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# Value-added Tax Reform and Services Exports: Evidence from China

Yan Zhang, Zhuoran Bai and Christopher Findlay<sup>1</sup>

## Abstract

In 2012, a sales tax was replaced in China by a value-added tax (VAT). The effect of this change on services exports is evaluated in this paper. VAT reform was introduced across provinces and service sectors at different times, so we can identify the impacts of VAT reform on firms' export behavior by utilizing a difference-in-difference-in-difference (DDD) estimation methodology. We find that VAT reform significantly increases service exports, in both intensive and extensive margins. The export enhancing effects are larger for non-state-owned enterprises, and for firms of larger scale and higher productivity levels. VAT reform alleviates tax magnification and double taxation, and effectively promotes the competitiveness of China's services exports.

Key words: VAT, Service exports, Export tax rebate

JEL: H25, F14, L8.

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# 1 Introduction

Services are often largely overlooked in discussions on global trade, yet they are significant: they accounted for over 20% of total cross-border trade in the world in 2020<sup>2</sup>. On the other hand, this share is low compared to their share of output, which is often explained by the requirements for interaction of consumers and producers of services. However, with technological change and liberalization in services sectors, services exports have grown more rapidly, at an average annual rate of 5.4% since 2005, which is faster than that of trade in goods. Although developed countries account for about 60% of services trade, that in many developing economies is also growing rapidly. China, the top economy in world goods trade, shows rapid growth of services trade, at an annual average rate of 12.5% since the global financial crises. However, China's services exports only account for 2% of GDP and 4.9% of total trade. Furthermore, compared with its trade surplus in goods trade, China runs a deficit in trade in services, of \$US261 billion dollars in 2019. The small share of exports in total trade and the scale of the deficit has led to greater attention in China to the drivers of competitiveness in services trade. China's experience in this respect is also relevant to many other developing countries.

There is a substantial literature on how to promote the competitiveness of services in trade, which mainly focuses on the effects of trade liberalization (e.g., Francois and Hoekman, 2010; Nordås and Rouzet, 2017; Tang et al., 2013). There are other policy drivers of competitiveness and our focus in this paper is the impact of tax reform. Our attention is prompted by the observation that value added tax (VAT) systems have replaced sales taxes and become the focus of tax reform not only for developed countries, but also for developing countries (Hoseini and Briand, 2020), including in China. Our interest, therefore, is the impact of that reform on firm's exporting behavior. There is little research available on this topic.

China first applied a VAT to the manufacturing industry in the late twentieth century, and it was extended to services industries in 2012. VAT reform in services was firstly implemented in Shanghai and eight pilot provinces for a number (but not all) sectors. These changes offer a natural experiment that enables us to evaluate the extent to which the differences in VAT policy between reform and non-reform regions and sectors affect firms' exports of services. Based on data of listed services

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<sup>2</sup> Notes: The data reported is calculated by the authors and the original service trade and total trade data comes from World Bank Database. See <https://data.worldbank.org/>.

firms in China from 2007 to 2017, including export information, obtained manually from each firm's annual financial reports, this study provides the first micro-level empirical evidence on the effects of VAT reform on service firms' export behavior.

In this paper, we seek to establish a causal relationship between services export and VAT reform. One challenge in doing so is the potential endogeneity of the reform. Specifically, the reform regions and sectors may not have been randomly selected and those selected might be systematically different. To address this issue, we adopt a difference-in-difference-in-difference (DDD) estimation methodology. The first difference comes from the comparison of firms' services exports in pilot provinces ("1+8" provinces) and non-pilot provinces. The second difference compares the pilot services sectors ("1+6" sectors) with non-pilot services sectors. The last difference is the timing of the policy implementation in 2012, which divides the sample into pre- and post-treatment periods. The triple difference allows us to address the endogeneity issues by controlling for industry-province fixed effects, industry-year fixed effects, and province-year fixed effects, so that the potential omitted variables at the province and industry level have been properly considered.

Our main results show that VAT reform in services significantly increases services exports, in both export probability (extensive margin) and export value (intensive margin). VAT promotes the services exports of non-state-owned enterprises, while it has a muted effect on the services exports of state-owned enterprises. The effects of VAT reform on exports are more pronounced on larger firms and those with higher productivity levels.

The implications of our results are threefold. Firstly, VAT reform can avoid the problem of the accumulation and magnification of taxes along a value chain. With the replacement of the sales tax, services firms only pay tax on their own value-added, through the deduction of input taxes upon display of a value-added invoice. Under the sales tax system, the full amount of the sale tax would be added at each transaction in the value chain, and so the taxes would be accumulated. Therefore, the value added tax erases this tax-magnification problem, and lowers each firm's tax burden.

Secondly, VAT provides the basis for the implementation of an export tax rebate in services industries. The export tax rebate, allowed by the World Trade Organization (WTO), refers to the refund of the tax incurred on products which are eventually exported. The policy of the export rebate has been successfully implemented in almost all the developed countries and with respect to goods trade in China. The principle is that the VAT applies to consumption in the home economy. However,

the rebate was not applied in the services sectors due to the lack of the precise value of tax paid by exporters and the lack of some other necessary information under the sales tax system. VAT reform makes clear the arrangements for each service sector, including the setting of the export tax rebate rate. Therefore, after VAT reform, for the export competitiveness of services firms is improved.

As noted, China implemented VAT reform through a pilot policy then a staggered introduction to sectors and regions. Thus, there might exist the situation in which upstream service sectors have not been eligible for VAT reform and downstream exporters, who are eligible, cannot deduct the sales taxes incurred upstream. In this paper we develop a technique, using input-output data, which assesses the exposure of each firm to different degrees of VAT treatment of its inputs. Then depending on the size of the export tax rebate, we can assess the implications for the competitiveness of each services exporting firm. We then define an ideal case of the complete implementation of VAT reform in all the sectors and provinces, alongside the full refund of VAT on exported products. We find that China's services exports would increase by about two and a half times in a move to the ideal case.

Our study contributes in several ways to the literature. Firstly, we add to the growing literature on the economic consequences of the adoption of the VAT system. Existing studies have found that VAT reform has significant effects on fiscal revenue and social welfare (Keen and Lockwood, 2010; Dahlby and Ferede, 2012; Boeters et al., 2010; Samimi, 2011); resource allocation efficiency (Diamond and Mirrlees, 1971; Mirrlees et al., 2012); and distributional effects (Carbonnier, 2007; Kosonen, 2015; Gaarder, 2019). It can also promote tax enforcement and production efficiency (Smart and Bird, 2009; Hoseini and Briand, 2020; Pomeranz, 2015; Hoseini, 2019; Kopczuk and Slemrod, 2006; Kleven et al., 2011; Keen and Smith, 2006). Liu and Lu (2015) also study trade effects but via an indirect mechanism and in manufacturing: they study the relationship between investment and exports in goods by using the VAT pilot reform in 2004 for China's manufacturing industry in North-east China. They find that the reform of the VAT promotes firms' investment in machinery and equipment, which improves productivity, and promotes exports. Our interest, in comparison, is the adoption of VAT in services industries rather than in manufacturing. To the best of our knowledge, our paper is the first empirical study to provide the evidence of the effects of VAT reform on exports, in this case in services. We also contribute to the literature on the impacts of the export tax rebate in the course of VAT reform by focusing on trade in services, rather than trade in

goods (Chao et al., 2001; Chao et al., 2006; Chen et al., 2006; Mah, 2007; Chandra and Long, 2013; Gourdon et al., 2017).

Second, our study is relevant to the debate on how to improve the competitiveness of services exporters (Francois and Hoekman, 2010; World Trade Report, 2019). Existing studies have mostly focused on policy aspects such as decreasing services trade restrictions and barriers (Fink, 2009; Van der Marel and Shepherd, 2013; Nordås and Rouzet, 2017), domestic regulation (Kox and Lejour, 2005; Kox and Nordås, 2007; Schwellnus, 2007; Nordås, 2016; Crozet et al., 2016) and the application of subsidies (Grosso, 2008). There is little empirical work that uses micro-level data, as we do here, to conduct credible inferences on the determinants of services trade, and most literature utilizes aggregated trade data, such as that applied in gravity model estimating using cross country data (Nicoletti et al., 2003; Kox and Lejour, 2005; Kimura and Lee, 2006; Walsh, 2006; Francois et al., 2007; Kox and Nordås, 2007; Fink, 2009; Lennon, 2009; Marchetti, 2009; Van der Marel and Shepherd, 2013; Nordås and Rouzet, 2017), including work focusing on the services sector (Kox and Nordås, 2007; Fink, 2009; Van der Marel and Shepherd, 2013; Nordås and Rouzet, 2017; Nordås, 2020). Our paper therefore contributes to the recent literature on firm-level trade in services (Walter and Dell'mour, 2010; Breinlich and Criscuolo, 2011; Gaulier et al., 2011; Kelle et al., 2013; Temouri et al., 2013; Haller et al., 2014; Damijan et al., 2015; Ariu, 2016; Morikawa, 2019). These studies mainly describe the characteristics of firms exporting services, and mostly investigate the phenomena in the developed countries. In our work, we look at the impact of VAT incidence on the exporter performances, and give special attention on the case of a developing country.

In this paper, section 2 describes the background of China's VAT reform policy in 2012 and development of services exports, especially by China's listed firms. Section 3 describes the empirical models, variable settings and data. Section 4 reports the empirical results. Section 5 discusses the mechanisms involved in the results, and the final section concludes.

## **2 Background**

### **2.1 China's VAT Reform in Services**

China applied the sales tax system in services industries until 2012. Sales tax was levied on the full amount of turnover. Services industries, however, faced significant increments to their tax

burdens due to repeated collections of taxes at each stage of production along the value chain (Fang et. al, 2017; Fang et. al, 2019). Most Chinese service firms were also taxed at home before exporting and then again in the importing country (on the principle of the application of taxes at the point of consumption), which reduced their competitiveness in international markets. China introduced VAT reform in Shanghai's transportation industry and several other modern service sectors ("1+6" sector) in 2012, and then extended the change to other eight pilot provinces the same year. On January of 2012, the "1+6" industries in Shanghai were first to be piloted. "1" was the transportation industry including land, water, air and pipeline transportation, and the group of "6" included several other modern service sectors such as research and development, information technology, cultural and creativity, logistics assistance, leasing of tangible movable property, and consulting services. From September to December of 2012, the pilots were expanded from Shanghai to other eight provinces or cities, including Beijing, Jiangsu, Anhui, Fujian, Guangdong, Tianjin, Zhejiang, and Hubei. In 2016, after a 5-year pilot, VAT reform was applied to all services sectors and to the whole of China<sup>3</sup>.

## 2.2 Development of China's services exports

Research for this paper involved the collection of services export data, and it was necessary to collect these data at the firm level. In an innovative approach, services export data were collected for China's listed services firms from 2007 to 2017. The data is obtained manually from the annual financial report of each listed services firm in the WIND database<sup>4</sup>. These firm level data can also be used to provide indicators at the province and sector levels. We do this by aggregating the service exports to infer the trends in, and the overall relationship of VAT reform with, China's services exports. We begin with the latter topic and then return to a focus on micro-level data.

### 2.2.1 Overall trends

Based on the data of listed firms, China's services exports have grown from 306 billion yuan

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<sup>3</sup> The radio, film and television services industry were also included among pilot sectors in 2013. The railway transportation, the postal and the telecommunication sectors further implemented VAT reform in 2014. In 2016, the construction industry, real estate industry, financial industry and life service industry implemented VAT reform VAT reform, and so VAT reform was finally applied to all services sectors. This staggered approach may affect the application of our empirical methodology of DDD. We will consider this issue in the course of our robustness checks, where we find that our key results still hold.

<sup>4</sup> WIND is a service provider of financial data and analysis tools. The database includes relatively comprehensive financial information of listed firms in China. The database includes the firm's name, location, industry information, registered capital, employment information, revenue, the structure of the revenue and so on. See <https://www.wind.com.cn/en/edb.html> (accessed 25 October 2021).

in 2007 to 1,730 billion yuan in 2017: the measure used here is more extensive than Balance of Payments statistics and includes income from a number of modes of supply<sup>5</sup>. The growth rate of total service exports after VAT reform in 2012 is significantly higher than that before 2012 (see Figure 1). According to the WIND data base, the number of exporting firms (extensive margin) increased from 186 in 2007 to 371 in 2017, and the average export value of exporting firms (intensive margin) was also rising (Figure 2), as was its growth rate.

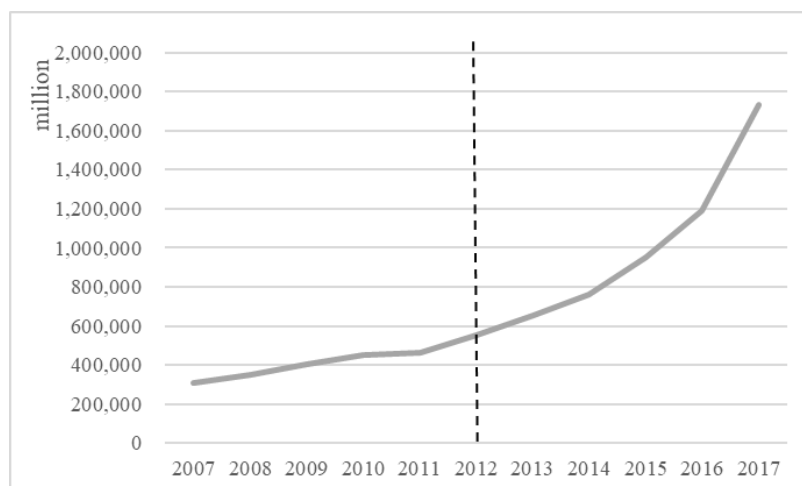


Figure 1 Total Export Value of China's Services Listed Firms

Source: WIND database.

Notes: The left axis shows the total export value (in million yuan) of services listed firms. The vertical dashed line shows the year 2012 when VAT reform was implemented.

<sup>5</sup> We regard the item "overseas revenue" as the value of services exports of listed services firms. The modes of services trade include not only cross-border trade, but also commercial presence, consumption abroad and movement of the personnel, and item of the overseas revenue of main income for services firms covers all of the modes. Based on statistics of BOP (Balance of payment), China's services export is 1540.7 billion yuan in 2017, and services exports for listed services firms in our database is about 1,730 billion yuan in 2017, which is even higher than BOP statistics for the whole country.



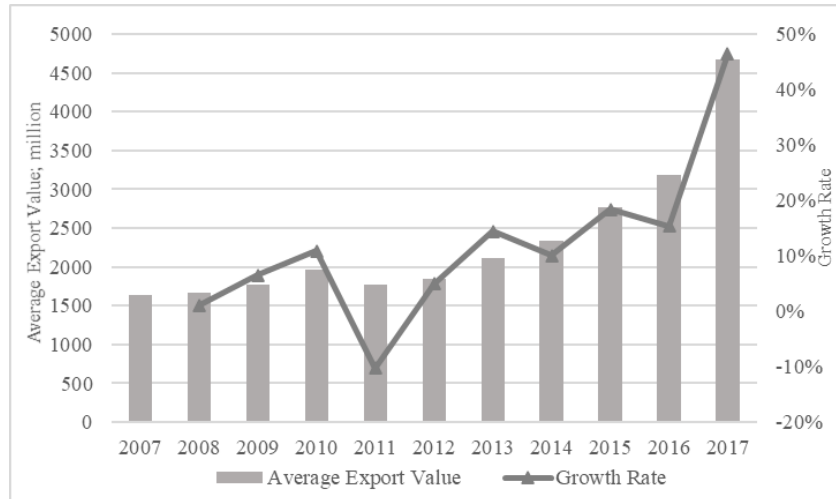


Figure 2 Average Export Value of China's Services Listed Firms

Source: WIND database and that reported here is calculated by the authors.

Notes: The left axis shows the average export value (in million yuan) of services listed firms, and the right axis shows its annual growth rate.

After VAT reform was implemented in 2012, the growth of services exports in the pilot provinces was significantly higher than that of the non-pilot provinces (Figure 3).

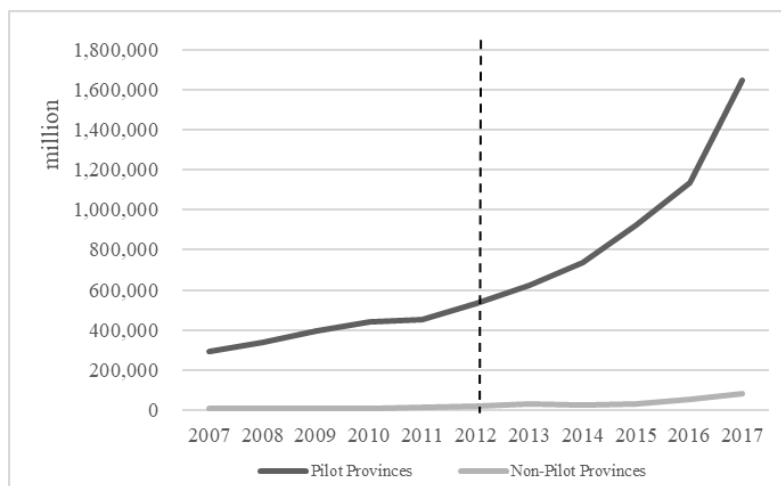


Figure 3 Service Export Value in Pilot Provinces and Non-pilot Provinces

Source: WIND database.

Notes: The left axis shows the export value (in million yuan) of pilot provinces or non-pilot provinces. The vertical dashed line marks the year 2012 when VAT reform was implemented.

### 3 The empirical methodology

#### 3.1 The specification of empirical model

The purpose of our empirical study is to estimate the impact of VAT reform on exports of

services. There are three key features of VAT reform. The policy was first implemented in nine provinces; secondly, the policy was piloted in seven services industries; VAT reform began in 2012. Based on these variations of VAT reform, this paper utilizes the DDD methodology in the following empirical specification:

$$Y_{i,j,k,t} = \alpha + \beta_1 Time_t \cdot industry_k \cdot Province_j + \beta_2 Control_{i,j,k,t} + \gamma_i + \delta_{kt} + \mu_{pt} + \varepsilon_{i,j,k,t} \quad (1)$$

where  $i$  denotes the firm,  $j$  denotes province,  $k$  denotes sector and  $t$  denotes year. The dependent variable  $Y_{i,j,k,t}$  can be either an indicator of the presence of exports, *export dummy*, or a measure of their value, *export value*. If the export income of the listed services firm  $i$  in industry (sector)  $j$  in year  $t$  is greater than 0, the value of *export dummy* is 1. If the export income is 0, it is a non-exporting firm, and the *export dummy* is 0. Alternatively, *export value* is value of the overseas sales of services firm  $i$  in industry (sector)  $j$  in year  $t$ .<sup>6</sup>

VAT reform in 2012 was piloted in the transportation industry and six other modern service industries in nine pilot provinces or municipalities. Therefore, firms of pilot sectors in pilot provinces can be regarded as the “treatment group”, and firms in non-pilot sectors and provinces can be regarded as the “control group”. The variable for VAT reform is the interactive item of the dummy variables of time, industry, and province. According to VAT reform, the time dummy variable equals 1 for 2013 and later years, otherwise it equals 0; the province dummy variable equals 1 for the nine pilot provinces, otherwise it equals 0; the industry dummy variable equals 1 for the “1+6” pilot industries, otherwise 0. The main policy variables of DDD on *Time*, *Province* and *Industry* are defined as follow:

$$\begin{aligned}
 Time_i & \begin{cases} =1, 2013 \text{ and after} \\ =0, \text{ before 2013} \end{cases} \\
 Province_j & \begin{cases} =1, \text{ nine pilot provinces} \\ =0, \text{ other provinces} \end{cases} \\
 Industry_i & \begin{cases} =1, \text{ “1+6” pilot service sectors} \\ =0, \text{ other industries} \end{cases}
 \end{aligned}$$

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<sup>6</sup> Export value takes the form of foreign sales plus 1, to facilitate the logarithmic transformation of the variable.

$Control_{i,j,k,t}$  refers to the control variables. Following previous work on the export behavior of export firms, such as Lin et al. (2011) and Jia et al. (2016), we add several such variables: (1) *productivity*: estimated by the share of the firm’s employees with the bachelor degree or above<sup>7</sup>; (2) *firm size*: measured by the firm’s registered capital multiplied by the time trend<sup>8</sup>; (3) *firm ownership (SOE)*: a dummy variable equal to 1 if the company is a state-owned enterprise, otherwise 0.

$\gamma_i$  is a dummy for firm fixed effects. Since few listed firms change their location and industry, firm fixed effects also control for the industry-province fixed effects.  $\delta_{kt}$  and  $\mu_{pt}$  control for industry-time and province-time fixed effects respectively. The triple difference allows us to control for full sets of industry-year fixed effects, and province-year fixed effects in which all potentially omitted variables varying at the province level and at the industry level have been properly managed.  $\varepsilon_{i,j,k,t}$  is the disturbance term. All the standard errors are clustered at firm level.

### 3.2 Data

To estimate the impact of China's VAT policy on service exports, we use unbalanced panel data of China's listed services firms from 2007 to 2017 from the Wind database. The sample period covers the entire process of China's VAT reform policy. The following observations are regarded as errors and excluded from the data: (i) outliers, which report changes in foreign revenue beyond reasonable expectations; (ii) revenue or foreign revenue which is reported as negative; (iii) an employee number which is reported as negative. We count the listed firms in the services and construction industries<sup>9</sup>. With these changes, there are 10,178 observations.

The industry classification of the firms in our sample is based on that of the China Securities Regulatory Commission (CSRC), which refers to 37 service sectors. We align the “1+6” service sectors of VAT reform with CSRC industries based on the concordance table shown in Appendix Table A-1.

The summary statistics for the dependent and explanatory variables used to estimate equation (1) are set out in Appendix Table A-2, for the whole sample and the pilot and non-pilot sample

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<sup>7</sup> Following Lin et al. (2011) and Jia et al. (2016), human capital in service firms plays an important role in their performance and sets a ceiling on the quality of services. So, considering the higher average productivity of skilled employees, we use the share of the firm’s employees who hold a bachelor degree or above to measure the firm’s productivity.

<sup>8</sup> Since the value of exports, measured as foreign revenue, is a part of the firm’s total revenue, we use the firm’s registered capital as the proxy variable for firm size. However, the registered capital is not a time-variant variable. Therefore, we introduce registered capital multiplied by the time trend to control for firm size.

<sup>9</sup> Since construction services account for a large part in construction industry, the construction industry is often included in the services industry. Therefore, the listed firms in construction industry are included in our sample.

separately.

## 4 Empirical results

### 4.1 Baseline results

In Table 1, results when the dependent variable is the export dummy are shown in columns (1) to (4), and the results with respect to the value of exports are shown in columns (5) to (8). Column (1) and (5) are the estimation results without control variables. In both sets of results, the coefficients of the *DDD* term are significantly positive at the 5% level, which indicates that the VAT policy increased the export tendency and value of exports. After controlling for productivity and firm size, the coefficient of the *DDD* terms remains significantly positive at the 5% level. Column (4) and (8) further control for the industry-time and province-time fixed effects, and the results remain consistent. Overall, the baseline results indicate that the VAT policy significantly increases services exports on both the intensive margin and extensive margins.

Table1 VAT Reform and Service Export: Baseline Result

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	export dummy				export value			
DDD	0.0576** (0.0226)	0.0559** (0.0226)	0.0559** (0.0226)	0.0822*** (0.0265)	0.481** (0.207)	0.461** (0.207)	0.461** (0.207)	0.623** (0.247)
productivity		0.0543** (0.0274)	0.0543** (0.0274)	0.0495* (0.0277)		0.634** (0.271)	0.634** (0.271)	0.580** (0.275)
firm size			0.0262*** (0.00813)	0.0311 (0.0192)			0.338*** (0.0776)	0.462*** (0.174)
firm FE	yes	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	yes	yes	yes
year-industry FE	no	no	no	yes	no	no	no	yes
year-province FE	no	no	no	yes	no	no	no	yes
Constant	0.254*** (0.0129)	0.244*** (0.0145)	0.185*** (0.0291)	0.164* (0.0865)	2.347*** (0.119)	2.220*** (0.137)	1.469*** (0.277)	0.947 (0.776)
Observations	10,178	10,178	10,178	10,178	10,178	10,178	10,178	10,178
R-squared	0.738	0.738	0.738	0.748	0.784	0.784	0.784	0.791

Notes: *export dummy* is the dummy variable of the firm's export behavior, with 1 if the firm exports, otherwise 0. *export value* is the logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend. Column (4) and (8) include a set of firm, year, industry-year and province-year fixed effects, and other columns include a set of firm and year fixed effects. Standard errors in parentheses are

clustered at the firm level. \*\*\*Significant at the 1% level, \*\*significant at the 5% level, \*significant at the 10% level.

## 4.2 Identification Checks

### 4.2.1 Common trend

A key assumption in the application of the DDD approach is that the average growth in services trade has a common trend in the reform and non-reform group before the implementation of VAT reform. Otherwise, the pre-treatment differences between the treatment and the control group lead to biased estimation of the coefficient on the reform dummy. In order to test the common trend assumption, we introduce a set of dummies for leading and lagging years, and estimate the coefficients of the interaction of the year dummies and those for provinces and sectors ( $Dummy\_year * industry_k * Province_j$ ) with the same controls in our baseline model. Figure 4 displays the estimated coefficients. In the years before VAT reform, the coefficients are not significantly different from 0, which means there is no significant difference between of the control and the treatment group before VAT reform. However, the coefficients become positive and significant after the implementation of VAT reform, indicating that the impacts on services exports become significantly different between the control and the treatment group. The results show the export behavior of firms in reform and non-reform provinces and sectors did not differ much before VAT reform, which meets the condition for the application of our DDD strategy.

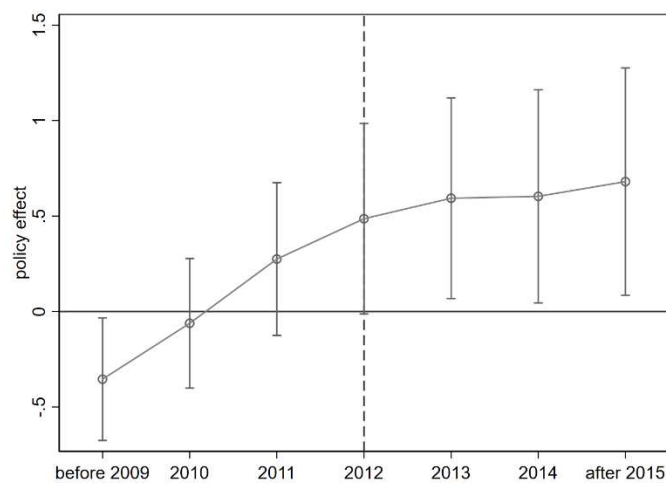


Figure 4 Common Trend Test

Notes: This figure shows the result of the common trend test of our model, with the estimated coefficients and 90 percent confidence intervals from a regression of the services export value on a set of VAT reform and time dummies controlling for firm, year,

industry-year and province-year fixed effects.

#### 4.2.2 Endogeneity of VAT reform

The main concern in the effort to identify the causal relationship between VAT reform and service export is the potential for non-random selection of reform provinces and sectors. If the determinants of the design of the VAT are correlated with firms' exports, the empirical estimates may be biased. It is likely that VAT reform was implemented in the provinces and sectors with better development and higher growth rates, thus firms may export more not because of VAT reform but rather because of a better competitive environment.

To address this endogeneity problem, we include firm fixed effects. China's central government decided whether and where to implement the reform according to pre-reform characteristics of those locations and of those sectors. If those pre-reform differences across province and service sectors are time invariant, then firm fixed effects control for all time-invariant determinants of VAT reform at the province and sector level, provided that firms did not change their location and industry.

Another problem is that the effects of some characteristics of services exports before reform might also vary across the years after reform. For example, the service sectors with higher initial economic growth may also export more over time. To account for this possibility, we further include the interaction terms involving pre-reform controls and year dummies. The pre-reform controls are several provincial and sectoral factors, such as the scale and productivity of services sectors, GDP growth, and government expenditure. Scale is measured by employment of service sectors at province level<sup>10</sup>. The value added per worker in each services sector measures the productivity in each sector<sup>11</sup>. GDP per capita and government fiscal expenditure per capita at province level measure the levels of economic development and government expenditure<sup>12</sup>.

Results are reported in Table 2. In columns (1) and (2), we include the *pre-reform differences*

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<sup>10</sup> Data Source: The Statistical Yearbook (2012) published by the China National Bureau of Statistics. And the index *employment* is at province-sector-level for the year of 2011. See <http://www.stats.gov.cn/> (accessed 20 December 2021).

<sup>11</sup> Data Source: Author's calculation using the data from the Statistical Yearbook (2012) published by the China National Bureau of Statistics. The *value added per worker* is derived from "value added" and "the number of "employed persons in urban units, private enterprises and self-employed individuals" of services sector level in 2011. See <http://www.stats.gov.cn/> (accessed 20 December 2021).

<sup>12</sup> Data Source: Author's calculation using the data based on the Statistical Yearbook (2012) published by the China National Bureau of Statistics. The index *GDP per capita* and *fiscal expenditure per capita* are both at province-level for the year of 2011. See <http://www.stats.gov.cn/> (accessed 20 December 2021).

along with a year dummy interaction. Each equation also includes a set of firm, year, industry-year and province-year fixed effects. In the case of each dependent variable, the coefficients of the VAT policy variable (*DDD*) are still significantly positive, meaning the baseline conclusions about the causal effect of VAT reform on services export are robust.

In addition, we also performed a placebo test to validate our identification strategy, details of which are in Part I of Appendix B.

#### 4.2.3 Confounding policies

To identify the effects of VAT reform on services trade, we also need to control the effects of confounding policies adopted by local and central governments that may also influence the development of services trade. Therefore, we add industry-year and province-year fixed effects. We also control for some contemporary policies in services sectors, such as service trade liberalization, market-oriented reform in services ('marketization') and some policies to promote service industry. China has accelerated the process of service liberalization by attracting more FDI in services, and the value of implemented FDI in each service sector are used to control for the extent of services liberalization<sup>13</sup>. Services marketization is measured by an index at provincial level (Fan et al., 2015)<sup>14</sup>. Services value added is used as a control for the extent of services sector development in each province<sup>15</sup>.

The results with these inclusions are shown in columns (3) and (4) of Table 2. In line with the baseline conclusion, we find again significant and positive impacts of VAT reform on export decisions and values.

Table 2 VAT reform and service export: Identification checks

VARIABLES	(1)	(2)	(3)	(4)
	export dummy	export value	export dummy	export value
DDD	0.0784*** (0.0266)	0.607** (0.247)	0.0691*** (0.0255)	0.508** (0.232)

<sup>13</sup> Data Source: The data comes from China National Bureau of Statistics, and we use the logarithmic form. See <http://www.stats.gov.cn/> (accessed 20 December 2021).

<sup>14</sup> The marketization index adopts five objective indicators to measure the depth and breadth of market-oriented reforms in provinces, including "the relationship between government and market", "the development of non-state economy", "the development of product market", "the development of factor market" and "the development of market intermediary organization and the environment of legal system". Each province is scored according to its performance every year. However, the marketization index is only available for 2007 to 2016.

<sup>15</sup> Data Source: The data comes from China Statistical Yearbook published by China National Bureau of Statistics, and we use the logarithm form. See <http://www.stats.gov.cn/> (accessed 20 December 2021).

productivity	0.0475*	0.572**	0.0451	0.523*
	(0.0276)	(0.275)	(0.0274)	(0.268)
firm size	-0.887	-22.17	2.319	71.06
	(29.00)	(204.9)	(4.349)	(44.31)
service liberalization			0.0168	0.272**
			(0.0124)	(0.120)
service value added			-4.829	-148.5
			(9.111)	(92.91)
marketization			2.039	48.71*
			(2.640)	(28.57)
pre-reform differences*year	yes	yes		
firm FE	yes	yes	yes	yes
year FE	yes	yes	yes	yes
year-industry FE	yes	yes	yes	yes
year-province FE	yes	yes	yes	yes
Constant	2.083	49.27	19.49	718.2
	(63.23)	(446.7)	(47.67)	(471.1)
Observations	10,178	10,178	9,104	9,104
R-squared	0.748	0.791	0.774	0.815

Notes: *export dummy* is the dummy variable of the firm's export behavior, with 1 if firm exports, otherwise 0. *export value* is the logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend. Other controls are province or services sector characteristics interacted with year dummies (*pre-reform differences\*year*). *service liberalization* is the logarithm of the value of FDI actually used in services sectors. *service value added* is the logarithm of services value added in provinces. *marketization* is the index to measure the marketization process of province (only available for 2007 to 2016). All columns include a set of firm, year, industry-year and province-year fixed effects. Standard errors in parentheses are clustered at the firm level. \*\*\*Significant at the 1% level, \*\*significant at the 5% level, \*significant at the 10% level.

### 4.3 Robustness Checks

In this part, we conduct three checks for robustness, one applying an alternative estimation methodology, and others involving changes in the sectoral coverage.

#### 4.3.1 Alternative methodology

The Logit model is utilized to test the effect of VAT on *export probability* as an alternative to OLS estimation. The results are shown in column (1) of Table 3. Also, as about 70% service firms in our sample do not export, a large number of dependent variable values, either *export probability* or *export value* will be 0, which will cause a heteroscedasticity problem with OLS estimation. Therefore, we undertake the estimation using the Pseudo Poisson Maximum Likelihood (PPML) method instead of OLS, which adequately deals with the zero-value observations (Silva and



Tenreyro, 2006). The results are shown in column (2) and (3) of Table 3. All the coefficients of *DDD* remain significantly positive, at the 1% level, in all these cases.

#### 4.3.2 Excluding the wholesale and retail sector

Wholesale and retail sectors export services and goods simultaneously. Therefore, the export value of sales in this sector may contain the value of those goods, making the services export value much larger than the actual value. So, we exclude the observations in these sectors and repeat the regressions. The empirical results are shown in column (4) and (5) of Table 3. The *DDD* coefficients are both significantly positive at the 10% level, which is also consistent with the baseline results.

#### 4.3.3 Excluding the new pilot sectors

China introduced VAT reform in the transportation industry and several other modern service sectors (“1+6” sector) in 2012. Then, in 2013, VAT reform was applied to the radio, film and television services industry. In 2014, VAT reform was extended to the railway transportation industry, and the postal and the telecommunication sectors. In our baseline estimation, we only marked the policy change as occurring in 2012, and ignored the timing of the changes in later years. However, there are only 22 firms belonging to these added sectors in our sample and their export value only accounts for 0.5% of the total, as shown in Appendix Table A-3. As a robustness check, we also excluded the sample of the added sectors in 2013 and 2014 and estimated the regression again.<sup>16</sup> The results are shown in column (6) and (7) of Table 3. Our baseline result still holds.

Table 3 VAT reform and service export: robustness check

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Logit	PPML		Excluding wholesale and retail service sectors		Excluding pilot sectors in later years	
	export dummy	export dummy	export value	export dummy	export value	export dummy	export value
DDD	1.294*** (0.455)	0.207*** (0.0725)	0.201*** (0.0727)	0.0891*** (0.0282)	0.737*** (0.262)	0.0872*** (0.0273)	0.645** (0.255)
productivity	0.600 (0.509)	0.126 (0.0897)	0.151 (0.0959)	0.0447 (0.0275)	0.453* (0.250)	0.0440 (0.0283)	0.565** (0.283)
firm size	0.823 (0.533)	0.110* (0.0642)	0.145*** (0.0518)	0.0350 (0.0221)	0.525*** (0.198)	0.0275 (0.0203)	0.431** (0.185)

<sup>16</sup> The sample covers the years from 2007 to 2017, and due to the time-lag effect of tax reform on firm’s export, the disturbance of new pilot sectors in 2016 can be ignored.

firm FE	yes	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	yes	yes
year-industry FE	yes	yes	yes	yes	yes	yes	yes
year-province FE	yes	yes	yes	yes	yes	yes	yes
Constant	-4.574*** (1.668)	-0.800*** (0.301)	1.372*** (0.251)	0.148 (0.100)	0.595 (0.890)	0.176* (0.0907)	1.058 (0.820)
Observations	2,902	4,639	4,639	8,530	8,530	9,722	9,722
R-squared				0.746	0.793	0.744	0.790

Notes: *export dummy* is the dummy variable of the firm's export behavior, with 1 if firm exports, otherwise 0. *export value* is the logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend. All columns include a set of firm, year, industry-year and province-year fixed effects. Standard errors in parentheses are clustered at the firm level. \*\*\*Significant at the 1% level, \*\*significant at the 5% level, \*significant at the 10% level.

#### 4.4 Heterogeneous effects

In this part, we examine whether the effects of VAT reform vary by the ownership structure of firms, their scale and their productivity.

##### 4.4.1 Heterogeneous effects by ownership

State owned enterprises (SOEs) in China have preferential access to government subsidies and financial support (Zhang et. al 2002; Le et.al ,2019; Ren et.al, 2019), but they are less productive and less likely to export than non-SOEs (Cui and Jiang, 2012; Witt and Lewin, 2007; Rugman et al., 2016)<sup>17</sup>. The ownership structure of listed firms from the WIND database includes central state-owned firms, local state-owned firms, private firms, foreign-invested firms, collective firms and others. We define firms with the ownership of central state owned or local state owned as SOEs. And there are 409 state-owned services firms. Other firms are classified as non-SOEs, of which there are 666 in our sample.

We estimate equation (1) with the subsamples of SOEs and non-SOEs respectively. The results for SOEs are reported in columns (2) and (5) of Table 4, in which the coefficient of *DDD* is not significant, indicating that the VAT policy has limited impact on the service exports of state-owned firms. However, the result of non-SOEs in column (3) and (6) show significantly positive coefficients of *DDD* at the 1% level, so that VAT reform does promote the service exports for non-SOEs firms. Our interpretation is that non-SOEs are more responsive to events in markets and are

<sup>17</sup> Non-SOEs are more flexible to the market and are more motivated to adjust to improve their productivity.

more motivated to adjust to improve their productivity and innovation after the implementation of VAT reform. SOEs either possess monopoly resources or have other social responsibilities, so are less likely to adjust following VAT reform.

Table 4 Heterogeneous effects by ownership

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	export dummy			export value		
	Full sample	State-owned	Non-state-owned	Full sample	State-owned	Non-state-owned
DDD	0.0822*** (0.0265)	-0.0232 (0.0469)	0.121*** (0.0347)	0.623** (0.247)	-0.321 (0.445)	1.019*** (0.322)
productivity	0.0495* (0.0277)	0.0706 (0.0471)	0.0230 (0.0352)	0.580** (0.275)	0.825* (0.458)	0.334 (0.352)
firm size	0.0311 (0.0192)	-0.0159 (0.0153)	0.0718** (0.0361)	0.462*** (0.174)	0.0889 (0.163)	0.755** (0.310)
firm FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	yes
year-industry FE	yes	yes	yes	yes	yes	yes
year-province FE	yes	yes	yes	yes	yes	yes
Constant	0.164* (0.0865)	0.343*** (0.0737)	0.0137 (0.155)	0.947 (0.776)	2.571*** (0.785)	-0.280 (1.319)
Observations	10,178	4,117	6,061	10,178	4,117	6,061
R-squared	0.748	0.798	0.729	0.791	0.842	0.756

Notes: *export dummy* is the dummy variable of the firm's export behavior, with 1 if firm exports, otherwise 0. *export value* is the logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend. All columns include a set of firm, year, industry-year and province-year fixed effects. Column (1) and (4) use the full sample. Column (2) and (5) use the sample of state-owned firms, while column (3) and (6) use the sample of non-state-owned firms. Standard errors in parentheses are clustered at the firm level. \*\*\*Significant at the 1% level, \*\*significant at the 5% level, \*significant at the 10% level.

#### 4.4.2 Heterogeneous effects with the scale and productivity

Larger firms and firms with higher productivity are more likely to export (Krugman, 1985; Melitz, 2003). Thus, we will investigate whether the impact of VAT reform on service exports depends on scale and productivity. We use firm's total revenue as a proxy for scale and add an interaction term of firm scale and VAT policy. The empirical results are shown in Table 5. The coefficients of the interaction terms of DDD with scale and productivity in column (1) and (2) are

both significantly positive at the 1% level. VAT reform will have larger effects on export behavior for larger firms.

The coefficient of the interaction term of DDD and productivity as shown in column (3) and (4) are significantly positive at the level of 1%, indicating that firms with higher productivity level are more likely to be influenced by VAT reform and improve their export probability and export value.

Firm's technological innovation will increase productivity and exports (Bustos, 2011; Liu and Lu, 2015). VAT reform can motivate firm to innovate by providing tax deductions related to R&D expenditures and investment. In order to test the hypothesis of this channel, we use R&D expenditure as the proxy variable of firm's technological innovation behavior, indicated by Bustos (2011) and Tang et al. (2021). The results are shown in Table 5, where the coefficient of the interaction term of DDD and innovation in column (5) and (6) is significantly positive at the 1% level.

Table 5 Heterogeneous effects by the firm's size and productivity

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	export dummy	export value	export dummy	export value	export dummy	export value
DDD_scale	0.00398*** (0.00127)	0.0315*** (0.0120)				
DDD_productivity			0.123*** (0.0409)	0.966** (0.381)		
DDD_innovation					0.00512*** (0.00145)	0.0423*** (0.0135)
productivity	0.0496* (0.0277)	0.579** (0.274)	0.0274 (0.0300)	0.406 (0.297)	0.0478* (0.0276)	0.561** (0.274)
firm size	0.0305 (0.0193)	0.453*** (0.174)	0.0325* (0.0191)	0.470*** (0.174)	0.0296 (0.0192)	0.442** (0.174)
firm FE	yes	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes	yes
year-industry FE	yes	yes	yes	yes	yes	yes
year-province FE	yes	yes	yes	yes	yes	yes
Constant	0.167* (0.0865)	0.975 (0.776)	0.171** (0.0865)	1.009 (0.776)	0.170** (0.0862)	1.018 (0.772)
Observations	10,178	10,178	10,178	10,178	10,178	10,178
R-squared	0.748	0.791	0.747	0.791	0.748	0.791

Notes: *export dummy* is the dummy variable of the firm's export behavior, with 1 if firm exports, otherwise 0. *export value* is the

logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *DDD\_scale* is the interaction term of *DDD* and scale. *DDD\_productivity* is the interaction term of *DDD* and productivity. *DDD\_innovation* is the interaction term of *DDD* and innovation. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend. All columns include a set of firm, year, industry-year and province-year fixed effects. Standard errors in parentheses are clustered at the firm level. \*\*\*Significant at the 1% level, \*\*significant at the 5% level, \*significant at the 10% level.

## 5 VAT reform and export rebate policy

In this section we will discuss how VAT reform promotes services exports through its tax reduction effect, and how implementation of the export tax rebate improves the competitiveness of firms in services industries.

### 5.1 Tax reduction effects

Under the sales tax system, a tax is levied on firms' total sales. When an item is bought by another firm, that firm will add the tax into their own costs and therefore their own sale price. Along a supply chain, sales taxes will be applied at each transaction, leading to a magnification effect. However, under the value-added tax system, firms can deduct taxes paid on inputs upon display of a value-added invoice. Therefore, VAT reform erases the tax magnification problems associated with the purchase of inputs. It will also increase the competitiveness of services exports (Samimi, 2011; Chandra et al., 2013; Cai and Harrison, 2011; Fang et al., 2017). The detail is illustrated by an example in Part II of Appendix B.

In order to verify the direct effect of tax reduction, we test the impact of VAT reform on a firm's tax burden. Tax burden is measured by the firm's tax-payable divided by the total revenue<sup>18</sup>. The results are shown in column (1) of Table 7. The coefficient of the *DDD* is significantly negative, illustrating that the implementation of VAT reform will bring about a "tax reduction effect", which is expected to increase the competitiveness of a firm's services exports.

### 5.2 Implementation of export tax rebate

"Export tax rebate" refers to the refund of the VAT actually paid during domestic production and circulation on items which are eventually exported. Without an export tax rebate, goods or services entering the international market at a tax-included price will be double-taxed, because the

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<sup>18</sup> Due to the lack of tax information in the WIND database, we use the information of tax-payable of listed firms in the China Stock Market & Accounting Research Database (CSMAR) database. See <https://cn.gtadata.com/> (accessed 20 December 2021). However, the ID of the firms in the two databases are not exactly the same, so after matching, there are 6735 observations remaining.

importing country will follow the principle of “national treatment” and levy the same taxes as are applied to their own domestic goods. If the exporters receive a full refund on the domestic VAT they have paid on their inputs, the VAT system is neutral and there is no double taxation. However, there have been problems in the implementation of the export tax rebate in China’s services sectors. Firstly, China implemented VAT reform by staggering its introduction across services sectors between 2012 and 2016. When upstream service sectors are not included in the pilot reform, the taxes paid on these inputs cannot be refunded since these service upstream sectors cannot issue a VAT invoice. Secondly, VAT rates varied among sectors. China’s VAT reform, while it provided for a tax rebate for service exports, involved different arrangements for each service sector, including the setting of the tax rebate rate<sup>19</sup>. The rebate rate arrangements of pilot services sectors are shown in Table 6. Even if the upstream sectors have implemented VAT reform, when the VAT rate is higher<sup>20</sup> on the upstream input sectors, and the export rebate is based on the lower VAT rate of downstream service sector, the latter sector continues to be taxed if exporting.

Table 6 VAT rate and export tax rebate

Services	VAT rate/ Export tax rebate rate	Implementation modes
R&D services provided overseas	6%	VAT exemption and rebate
Design services provided overseas	6%	VAT exemption and rebate
International transportation services	11%	VAT exemption and rebate
Engineering survey and exploration services for overseas engineering and mineral resources	6%	VAT exemption
Conference and exhibition services where the venue is overseas	6%	VAT exemption

<sup>19</sup> There are two modes of export tax rebate in China, one of which is tax “exemption” and the other is tax “rebate”. In tax “exemption”, which applies to many sectors, the services exporting firms with VAT reform will be exempted from the VAT when exporting. However, the input tax already paid in the previous transactions cannot be refunded, so the exporters still have to bear the input tax burden. There are three remaining sectors, transportation, R&D and design services, where exporters can receive a tax “rebate”, meaning they can also get the input tax refunded based on the VAT rate of their own services sectors”.

<sup>20</sup> Here, we consider all industries, including manufacturing industries. The value-added tax system in China does not have a uniform tax rate for all industries, according to the document “Interim regulations on value-added tax of China”, and the tax rates in manufacturing sectors are higher than tax rates in service sectors. In 2012, the two sets of value-added tax rates in manufacturing sectors were 17% and 13%, while the two sets of value-added tax rate in service sectors were 11% and 6%. For example, the value-added tax rate of transport equipment industry was 17% in 2012, and the tax rate of transportation services sector was 11%. When a transportation services firm buys a train from the upstream transport equipment seller at the price of 100, the transportation services firm should pay the input tax of 17 (=100\*17%). However, this service firm can only get the export tax rebate of 11 (=100\*11%), because the export rebate is based on the VAT rate of downstream service sector. Therefore, the downstream firm does not receive a complete refund and the problem of double taxation is not eliminated.

Warehousing services with storage locations overseas	6%	VAT exemption
Tangible movable property leasing services provided overseas	17%	VAT exemption
Technology transfer services provided overseas	6%	VAT exemption
Technology consulting services provided overseas	6%	VAT exemption
Contract energy management services provided overseas	6%	VAT exemption
Software services provided overseas	6%	VAT exemption
Circuit design and testing services provided overseas	6%	VAT exemption
Information system services provided overseas	6%	VAT exemption
Business process management services provided overseas	6%	VAT exemption
Trademark copyright transfer services provided overseas	6%	VAT exemption
Intellectual property services provided to overseas	6%	VAT exemption
Logistics auxiliary services (except warehousing services) provided overseas	6%	VAT exemption
Certification services provided overseas	6%	VAT exemption
Authentication services provided overseas	6%	VAT exemption
Consulting services provided overseas	6%	VAT exemption
Advertising services placed overseas	6%	VAT exemption

Source: Caishui [2011] No. 111 and Caishui [2011] No. 131.

Notes: According to the provisions of Article Twelve (1) to (3) of the document of Caishui [2011] No. 111, the VAT rate for “tangible movable property leasing services” is 17%, for “transportation” is 11%, for modern services (except tangible movable property leasing services) is 6%. Caishui [2011] No. 131 stipulates that the zero VAT rate is applicable to international transportation services, R&D services and design services for overseas units provided by units and individuals in the pilot areas. Therefore, for services with zero VAT rate, firms do not pay tax when exporting.<sup>21</sup>

Thus, we have to consider a number of factors when assessing the implementation of the export rebate policy including: 1) whether the upstream sectors have implemented VAT reform; and 2) the extent of the linkages between sectors, measured by the intensity of upstream input used by

<sup>21</sup> According to Caishui [2011] No. 131, under the general calculation method, the tax deduction and rebate should be implemented and the tax rebate rate is equal to the VAT rate. That means, firm’s taxes paid for the upstream inputs can be deducted, and the amount of tax deduction equals to the input amount of the purchased intermediates multiplied by the tax rebate rate, which also equals the input tax. This amount of tax deduction can be used to deduct firm’s other payable taxes during the current period, and if there is a surplus after the deduction, the surplus will be refunded to firm. Therefore, for services with zero VAT rate, not only the VAT when exporting is zero, but the input tax paid in the circulation can also be deducted. Otherwise, according to Caishui [2011] No. 131, a tax exemption is applicable to some other services. Tax exemption means firm is exempted from the obligation to pay tax when exporting, that is, no tax is required to be paid when exporting, which is same as the zero VAT rate. However, unlike the zero VAT rate, the input tax of the services applicable to tax exemption cannot be deducted, so firms still have the burden of input tax.

downstream service firms, based on China's Input-Output table of 2012.

To consider whether the upstream sectors have implemented VAT reform, we form the variable  $composite\_export\_rebate\_dummy_{k,t}$  (for downstream industry  $k$  at time  $t$ ) as shown in equation (2). The time dummy variable  $D_t$  equals 1 for 2013 and later years, otherwise it equals 0; the industry dummy variable  $D_m$  equals 1 for the "1+6" pilot industries, otherwise 0<sup>22</sup>, and the interaction of these two dummies  $D_t D_m$  measures whether VAT reform has been implemented upstream in sector  $m$ . Also, in equation (2) we weight the interaction of these two dummies by the extent of the linkages between sectors;  $ss_{km}$  is the share of input of the upstream intermediate industry  $m$  used in the downstream industry  $k$ .<sup>23</sup>

We then take into account the actual export rebate rate of the downstream services sector and form the variable  $composite\_export\_rebate\_actual_{k,t}$  as shown in equation (3), where the  $downstream\_VAT\_rate_k$  measures the effective export rebate rate, according to the downstream VAT rate and whether tax reform is applied upstream (weighted by the linkages involved). This variable is then used in equation (4).

$$composite\_export\_rebate\_dummy_{k,t} = \sum_m ss_{km} * D_t D_m \quad (2)$$

$$composite\_export\_rebate\_actual_{k,t} = \sum_m ss_{km} * D_t D_m * downstream\_VAT\_rate_k \quad (3)$$

$$Y_{i,j,k,t} = \alpha + \beta_1 composite\_export\_rebate\_dummy_{k,t} + \beta_2 Control_{i,j,k,t} + \gamma_i + \delta_{kt} + \mu_{pt} + \varepsilon_{i,j,k,t}$$

or

$$Y_{i,j,k,t} = \alpha + \beta_1 composite\_export\_rebate\_actual_{k,t} + \beta_2 Control_{i,j,k,t} + \gamma_i + \delta_{kt} + \mu_{pt} + \varepsilon_{i,j,k,t} \quad (4)$$

The estimation results based on the empirical specification of equation (4) are shown in columns (2) to (5) of Table 7. The coefficients of  $composite\_export\_rebate\_dummy_{k,t}$  on the decision to export and on export value are both significantly positive at the 5% level, as shown in columns (2) and (3). Then, as shown in columns (4) and (5), adding the consideration of the downstream VAT rate, the coefficients remain significantly positive at the 5% level. The result indicates that the export rebate policy in upstream services sectors will promote services exports

<sup>22</sup> Here, according to the proximity of services providing, we assume that service firms only use the upstream services locally.

<sup>23</sup> Data Source: China's Input-Output table of 2012. And the upstream manufacturing industries also are included.



and the presence of these industrial linkages will accelerate the effects of VAT reform.

However, a further complication is that VAT rates vary by sector. When the export tax rebate rate is greater than the downstream industry's VAT rate, the refund will not cover the actual input tax the downstream firm has already paid, due to the different VAT rates. Thus, the rebate on exports will not be fully realized. In the ideal circumstance, a complete export rebate rate would guarantee that all the industries completed VAT reform in 2012 and the export tax rebate rate would equal the VAT rate of each upstream input industry. Table 8 shows both the mean actual composite export rebate rate (from equation 3) and what is called the ideal rate, in which case VAT reform applies to all sectors from 2012, and the rebates are available at the actual VAT rate of each sector. The mean ideal rate is much higher than the actual rate: in 2016, the ideal rate is 10.72, while the actual rate is only 4.55. Also, the ideal rate increases from 6.16 before VAT reform to 10.72 in 2016. While the current incomplete export rebate rate increases by only 2, the complete rate with full implementation increases by almost 5. We can then calculate the impact of the complete implementation of VAT reform in all the service sectors and provinces, also with the full export tax refund, using the coefficients from Table 7. According to this calculation, services exports will increase about 5 times ( $e^{0.33*5}$ ), while under the current incomplete VAT reform they increase about 2 times ( $e^{0.33*2}$ ). Thus, in a transition from incomplete to complete VAT reform, service exports would be about 2.5 times higher. We infer that, in order to promote export competitiveness, VAT reform should be fully adopted in all sectors and regions, and an export rebate should also be implemented with the full amount refunded.

Table 7 Mechanisms of VAT reform on Service Export

VARIABLES	(1)	(2)	(3)	(4)	(5)
	tax	export dummy	export value	export dummy	export value
DDD	-0.0545*** (0.0199)				
composite_export_rebate_dummy		0.233** (0.0947)	1.980** (0.878)		
composite_export_rebate_actual				0.0388** (0.0158)	0.330** (0.146)
productivity	0.0421 (0.0441)	0.0535* (0.0276)	0.608** (0.272)	0.0535* (0.0276)	0.608** (0.272)

firm size	0.0240*	0.0156	0.319	0.0156	0.319
	(0.0133)	(0.0224)	(0.203)	(0.0224)	(0.203)
firm FE	yes	yes	yes	yes	yes
year FE	yes	yes	yes	yes	yes
year-industry FE	yes	yes	yes	yes	yes
year-province FE	yes	yes	yes	yes	yes
Constant	0.0499	0.0983	0.413	0.0894	0.338
	(0.0636)	(0.0886)	(0.798)	(0.0892)	(0.804)
Observations	6,735	10,178	10,178	10,178	10,178
R-squared	0.528	0.747	0.791	0.747	0.791

Notes: *tax* is the logarithm of the firm's intensity-form-taxes, measured by the firm's taxes divide its revenue. *Export dummy* is the dummy variable of the firm's export behavior, with 1 if firm exports, otherwise 0. *export value* is the logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *composite\_export\_rebate\_dummy* describes the industry linkage by using the input intensity and the dummy variable for whether the input industry has implemented VAT reform. *composite\_export\_rebate\_actual* describes the industry linkage by using the input intensity, the dummy variable for whether the input industry has implemented VAT reform and the tax rate of the downstream service sector. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend. All columns include a set of firm, year, industry-year and province-year fixed effects. Standard errors in parentheses are clustered at the firm level. \*\*\*Significant at the 1% level, \*\*significant at the 5% level, \*significant at the 10% level.

Table 8 Composite export rebate rates

	2007	2012	2016
The actual rate of <i>composite_export_rebate</i>	2.52	2.70	4.55
The ideal rate of <i>composite_export_rebate</i>	6.16	6.74	10.72

Notes: The actual rate of *composite\_export\_rebate* describes the industrial linkage by using the input intensity and the tax rate of the downstream service sector, according to equation (3). The ideal rate of *composite\_export\_rebate* describes an ideal circumstance in which all industries complete VAT reform in 2012, so it uses the input intensity and the actual VAT rate of each input industry. The data in the table represent the mean of these above variables across all sectors.

## 6 Conclusion

VAT replaced sales tax in some developed countries in the world and China implemented a staggered VAT reform in services sector in 2012. By using this quasi-natural experiment and a DDD estimation methodology, based on China's service firm-level data, we examine the casual effects of VAT reform on China's export behavior in service firms. The paper finds that VAT reform promotes service export in both intensive and extensive margins. The results are robust for the identification checks and alternative estimation methodologies. The effects of VAT reform on export are more pronounced for the firms with larger scale and higher productivity level and in non-stated-owned firms.

VAT reform promotes the export in services through alleviating the problem of repeated and magnified taxation. The implementation of services VAT reform combined with export tax rebate policy can lower the export prices and enhance export competitiveness for services firms. When the industrial linkages are considered, the full implementation of VAT reform and the complete rebate of export tax will further increase services export competitiveness.

VAT tax reform and export rebate policy will be important for understanding trade pattern and global value chain in developing countries. Some further studies could also been investigated. Firstly, with the tax reform, productivity could be endogenously determined and linked to the participation in services export. The second is the interaction of VAT tax reform and services trade liberalization and their overlapping effects on services trade. With the coordination of global tax policy, what is the policy agenda for the tax and trade policy reform in the developing countries? Third, how could VAT reform in services enhance the industrial linkage and the upstream effects on exports.

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## Appendix A

Table A-1 Services industry concordance in 2012

VAT reform industries		Industries in China Securities Regulatory Commission
transportation industry		road transportation, air transportation, water transportation
Modern service industries	research and development	research and experiment development, professional technical services industry; technology promotion and application services industry
	information technology	Internet and related services, software and information technology service industry
	cultural and creativity	culture and art, news and publishing industry
	logistics assistance	loading and delivery agency
	leasing of tangible movable property	leasing
	authentication consulting	business service
	radio, film and television service industry	film and television recording production

Source: The documents of Caishui [2011] No. 111 and the WIND Database.

Table A-2 Summary statistics

Variable	Full sample			Pilot firms			Non-pilot firms		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
export probability	10,178	0.298	0.458	3,230	0.363	0.481	6,948	0.269	0.443
export value	10,178	2.810	4.566	3,230	3.224	4.536	6,948	2.618	4.568
DDD	10,178	0.177	0.381	3,230	0.557	0.497	6,948	0	0
productivity	10,178	0.329	0.275	3,230	0.385	0.299	6,948	0.303	0.259
firm size	10,178	3.929	1.344	3,230	3.661	1.155	6,948	4.054	1.406

Notes: *export probability* is the dummy variable of the firm's export behavior, with 1 if firm exports, otherwise 0. *export value* is the logarithm of the firm's foreign sales. *DDD* is the interaction term of province dummy, industry dummy and time dummy. *productivity* is firm's productivity, measured by the share of high-level employees with above college degrees. *firm size* is the logarithm of firm's registered capital multiply the time trend.

Table A-3 The distribution of service sectors in sample of listed firms in 2007-2017

The year implementing the VAT pilot	firm number		export value (billion yuan)	
	annual average	share	annual average	share
2012	388	42%	155.52	24%
2013	21	2%	1.38	0%
2014	21	2%	2.28	0%
2016	496	54%	500.52	76%

Notes: The sectors implementing VAT reform in 2012 include the land, water, air and pipeline transportation, the research and development, the information technology, the cultural and creativity, the logistics assistance, the leasing of tangible movable property, and the consulting services. The sector implementing VAT reform in 2013 includes the radio, film and television services industry. The sectors implementing VAT reform in 2014 include the railway transportation, the postal and the telecommunication sectors. The sectors implementing VAT reform in 2016 include the construction industry, the real estate industry, the financial industry and the life service industry. The *firm number* describes the number of firms in the pilot sectors of each stage. The *export value* describes the value of pilot sectors exporting in each stage.

## Appendix B

### • Part I Placebo Test

We also perform a placebo test to validate our identification strategy. We generate a random pilot reform that is different from the actual pilot reform, and we construct a placebo policy variable based on the random pilot reform. Specifically, following Liu and Lu (2015), we randomly generate a year of the VAT pilot reform between 2009 and 2016, and randomly select 7 out of 16 sectors and 9 out of 31 provinces to be the reform pilot. We then estimate equation (1) using the false policy variable and repeat the exercise 1000 times. The distribution of the simulated coefficients is shown in Figure B-1. As expected, the simulated coefficients are centered on zero and the estimated coefficient of our true policy variable of baseline results lies at the very end of the distribution on the right.

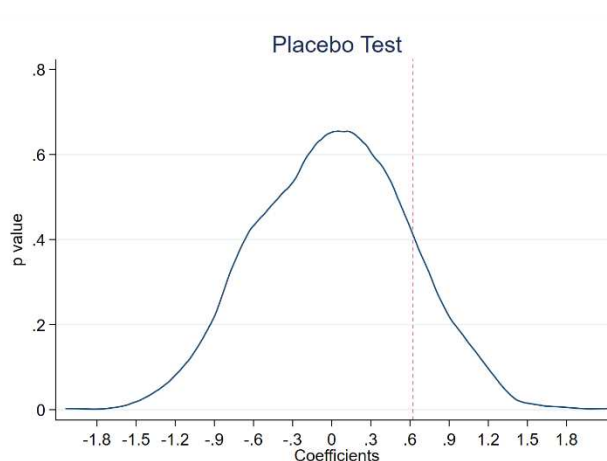


Figure B-1 Density of the estimated coefficients with random reform pilots

Notes: This figure shows the density function of 1000 estimated coefficients from regressions of the services export value on a placebo policy variable controlling for firm, year, industry-year and province-year fixed effects. The X axis represents the estimated coefficient of the "pseudo-policy dummy variable", the Y axis represents the density value. The curve is the kernel density distribution of the estimated coefficient, and the vertical dashed line is the true estimate of the DDD in our model, which is 0.623.

## • Part II The case of sale tax system and the value-added tax system

There is a case that, firm A, B and C set up a supply chain as shown in Figure B-2. To simplify, we have several assumptions: 1) There are three firms A, B and C in this value chain. They buy the inputs from their upstream firm and sell exactly the same product to their downstream firm without adding any value added. 2) Firm A sells the product to firm B as B's input, and firm B sells the product to firm C as C's input, and firm C finally export this product to the foreign importer. 3) Firm A sell the product at the price of  $X$ . Under the sale tax system, there is a uniform sale tax rate as  $r$ ; under the value-added tax system, there is a uniform value-added tax rate as  $t$ .

Firstly, under the sale tax system, the firms will add the tax into the price, as "tax included in price". From the above assumptions, firm B buys the product at the price of  $X$  from A, and sell the product to firm C. If firm B also set its price as  $X$ , there is a tax  $X*r$  needs to be paid. Considering its profit, firm B will put the tax into its price and sell the product at the price  $X(1+r)$  to firm C. Then, if firm C sells the product at the price of  $X(1+r)$ , C still needs to pay a tax of  $X(1+r)*r$  under the sale tax system, although firm B has already paid a tax for this input product before. So, firm C will also put this tax into the price and sell it at the price of  $X(1+r)(1+r)$ . In this supply chain, the same input will be taxed repeatedly. Therefore, the longer this value chain is, the more tax will be paid on this input product and the higher the price of this final product will be. Under the sale tax system, there is a tax magnification effect, making the cost of input like a "snowball".

While, under the value-added tax system, the input tax will be deducted and firms only need to pay the tax according to their own valued added. So firm B will sell this product to firm C at the original price  $X$ . Similarly, firm C will also make the price of  $X$ . Therefore, the input price distortion generated by the sale tax will be alleviated when the implementation of the VAT with the tax excluded prices of inputs. Thus, value-added tax can effectively avoid the problem of repeated taxation with the sales tax.

If firm C export the product, the export price with sale tax is  $X(1+r)(1+r)$ . Under the VAT system, if the VAT tax rate is  $t$ , the final export price is  $X(1+t)$ , because firm C can't transfer its tax burden to the foreign importer when exporting.

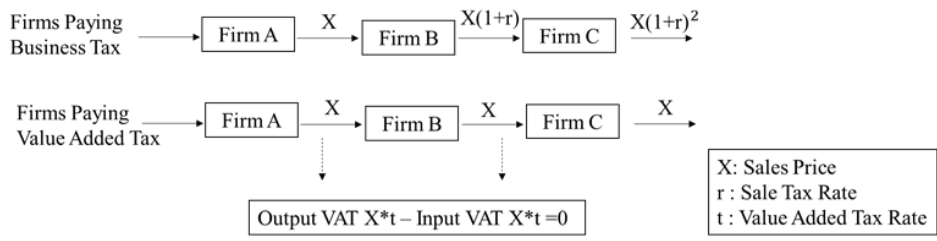


Figure B-2 Differences between Sale tax and VAT on prices