

Article

Financial Constraints, Trade Mode Transition, and Global Value Chain Upgrading of Chinese Firms

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Abstract: China is facing the serious problem of ‘low-end locking’ in the global value chain as it becomes deeply integrated into world trade. Deciphering how to upgrade Chinese enterprises’ positions in the global value chain is crucial to China’s economic transformation and sustainable development. This study explores the feasibility of upgrading China’s global value chain from the perspective of financial constraints. Based on a theoretical framework, this study applies firm-level production data and trade data, using a documented method of measuring domestic value added at the firm level. Besides, we apply three methods to comprehensively measure the financial constraints faced by enterprises. In our study, we verify the findings of previous empirical studies that reducing financial constraints can significantly increase enterprises’ domestic value added, and this conclusion remains valid after considering various robustness tests. Our heterogeneity analysis indicates that easing financial constraints can significantly contribute to Chinese private enterprises’ upgrade in the global value chain, which could be related with “ownership discrimination” of Chinese banks. Finally, this study analyses the two mechanisms by which relaxing financial constraints could promote global value chain upgrading: (i) directly transfer enterprises’ trade mode from processing trade to general trade and (ii) allowing enterprises to climb up in the global value chain.

Keywords: financial constraints; value added at the enterprise level; trade mode transition; value chain upgrading

1. Introduction

The recent years witness the progress of incorporating corporate finance considerations into the study of international trade. Before that, trade theory was mainly interpreted the base of trade from the perspectives of factor endowment differences, transnational differences in productivity and economies of scale. The new new trade theory dives deep into the firms’ export behavior from macro scope and industrial level to firms heterogeneity, which lays a preliminary foundation for the study of the combination of corporate finance and firms’ export. As the external financial market is incomplete, the financing of enterprises will always be subject to various constraints. Considering that export enterprises have a greater demand for capital than those selling in domestic market, it is inevitable that when the financing of enterprises is restricted, it will affect the export volume [1–3].

Last few years, one of the fundamental changes in international trade is the rise of global value chains (GVCs), and the increasingly fragmentation of production. The enterprise only participates in one or several production ties of manufacturing. Through this process, the value of products exported also includes the value of intermediate imported from abroad, and the value created by the enterprise itself only accounts for a small part. Therefore, the measurement of a country’s trade interests and

division of labor status should shift from export volume to domestic value-added (DVAR). The WIOD (world input-output database) project launched the input and output data of countries and sectors in 2012. In this way, it is possible to calculate the added value trade. Thus, the research on global value chain has emerged including some representative studies e.g., [4–6].

Although the calculation of domestic value added is an ascendant research. Existing research on how financial conditions effect value-added trade is quite limited. Especially at the micro-firm level, the research on how a firm's financial constraint affects its DVAR is still not enough. Following this direction, this paper attempts to push forward the previous research on the combination of corporate finance and international trade to explore the relationship between financial constraints and an enterprise's value-added trade. So, this study consists of two kinds of literatures, one is the literatures on corporate finance and international trade. And the other is the literatures on GVCs (Global Value Chain) accounting. The following part summarizes these two literatures respectively.

The theoretical contribution of incorporating corporate finance to the study of international trade was mainly made by Chaney [7] and Manova [1], who introduce financial friction into Melitz [8] heterogeneous firms model. Through equilibrium analysis, it is concluded that the existence of financial friction will affect the export of enterprises, but they depict financial friction in different ways. Chaney [7] mainly demonstrates from the perspective of internal liquidity, namely cash flow, while Manova [1] mainly focuses on the perspective of external financing constraints. Based on the above theoretical research, scholars use national data to carry out empirical tests. Greenaway [9] used the data of British manufacturing enterprises, Muuls [10] used the data of Belgian enterprises, and Minetti and Zhu [2] studied Italian enterprises. They all find that enterprises subject to financing constraints were less likely to export, hence their exports decreased. With the increasing importance of China in the global export market, some scholars began to pay attention to the study of export and financing constraints of Chinese enterprises. Manova et al. [11] apply Chinese firm-level data and find that foreign-funded enterprises have better export performance due to less financing constraints. Feenstra et al. [12] conclude three main reasons why export enterprises are more vulnerable to financing constraints through constructing theoretical models. They used the database of China's industrial enterprises to confirm the conclusions of theoretical research. Based on further study in China, Manova and Yu [3] find that the capability of financing would also affect the choice of trade mode for enterprises. Generally speaking, enterprises with weaker financing capacity tend to integrate into GVCS by means of processing trade, which generates much lower profits and domestic added value than general trade. Although this study touches the issues of trade patterns and value chains, it does not account for the value added related to GVCS. Therefore, it is undoubted that this paper is a further step forward on the basis of their research.

Recently, the study on the calculations of value added in global value chain goes from macro perspective into micro-enterprise perspective. In terms of methods, it extends from the domestic input-output table to the transnational input-output table. For the specific case of China, recent studies have computed the value added of processing trade and general trade, respectively. Hummels et al. [13] propose the use of vertical specialization to measure the foreign components of exports. Based on a country's input-output table, exports can be divided into domestic value added and foreign value added. However, Hummels et al. [13]'s method doesn't distinguish processing trade, which could account for half of China's foreign trade exports. Imports under processing trade are used exclusively for the production of exports, companies could only earn modest processing fees. The value added in processing trade is quite limited. If the real value added in processing trade is considered to calculate China's trade surplus with the United States, this surplus would be reduced by 40% [1]. Given these shortcomings, Koopman et al. [4] revise the accounting method of Hummels et al. [13] to distinguish processing trade from non-processing trade and recalculate them using the input-output table, finding that the previously calculated vertical specialization rate was underestimated.

Although the input-output table can reflect the division of labour between countries and industries, it can only be used to calculate domestic value added in national or industry levels. The heterogeneity

of enterprises would be ignored. Since in the same industry, firms could have quite different sizes and competing abilities, the calculation results would be biased. Upward et al. [14] is the first to calculate the domestic value added at the firm level, they use the databases of China's Customs Import and Export Trade and of China's Industrial Enterprises, divide processing trade and general trade respectively, and find that the domestic value added of processing trade is much lower. Kee and Tang [5] also use micro-data to calculate the domestic value-added rate (DVAR) at the enterprise level and analyse the reasons for the increase in China's domestic value added in recent years, which has also shown that the DVAR of processing trade is much lower than that of general trade. Hence, whether value added at the industry level is calculated using a non-competitive input-output table [15,16] or micro-enterprise data [5,14], the results all show that the value added in processing trade is much lower than that in general trade.

This paper mainly studies the impact of financing constraints on firms' domestic value added trade, and further investigates how the easing of financing constraints promotes the Chinese enterprises' position in global value chain and what kind of mechanism to accomplish it. This paper push forward the previous literatures on the study of combination corporate finance and international trade theory. That is to say, we push the previous research on the effect of financial constraints on firms' export volume, to the research of the firms' domestic added value. The accounting of DVAR, especially the accounting of DVAR at the firm level, is recently ascending.

This paper used a large micro firm-level production data compiled by China's National Bureau of Statistics, with import and export trade data collected by China's General Administration of Customs. Chinese industrial enterprises data covers more than 95% of China's total output in the manufacturing sectors. This is the most comprehensive and internationally recognized micro-database for the study of China's economy. The China Customs Import and Export Database, which records all import and export transactions of Chinese enterprises is widely used by Chen et al. [17] and so on. We devote a great amount of time in merging of these two micro-databases. By using the samples provided by these two databases for empirical research, our conclusions could more truly and accurately reflect China's economic reality. Secondly, this paper constructs the financing constraint indexes comprehensively. We use three kinds of different indexes to measure the financing constraint of enterprises. The multiple scoring method selects seven financial indicators, such as liquidity and liquidity ratio, and constructs them through scoring ranking. The SA index excludes all financial indicators that influence each other and only uses exogenous variables such as enterprise size and age to construct the index. The index of interest expenditure fully considered the "Chinese characteristics" of indirect financing of Chinese enterprises.

In addition, different from the previous methods of calculating the domestic added value at the national or industrial level, this paper endeavors to calculate the domestic added value from the firm level. The empirical study found that the easing of financing constraints significantly increased the domestic added value of Chinese enterprises, and played a more significant role in China's private enterprises. We also analyses the two mechanisms by which relaxing financial constraints could promote global value chain upgrading: one is directly transfer enterprises' trade mode from processing trade to general trade, the other is allowing enterprises to climb up in the global value chain. Generally speaking, this paper is of great value for understanding how the current global value chain distribute and what elements lead to this phenomenon, for understanding the mechanism and channels of upgrading enterprises' position in the global value chain, especially understanding and explaining the emerging global value chain phenomenon from a financial perspective.

The rest of this paper is structured as follows. The second section provides a theoretical analysis of the mechanism by which financial constraints could affect trade mode selection and value chain upgrading. The third section calculates domestic value added at the enterprise level and introduces the data and variables. The fourth section uses the micro-level enterprise data to conduct empirical tests and presents the robustness test and analysis of possible mechanisms. The last section concludes.

2. Theoretical Analysis

According to new trade theory that considers firms to be heterogeneous, financial constraints are an important factor affecting the exports of enterprises [1,7]. Export firms face higher entry costs than those in the domestic market. Long-term fixed costs such as those incurred in establishing distribution networks abroad and paying for advertising and marketing need to be paid in advance before companies can enter international markets. Further, compared with sales in the domestic market, transportation to other countries takes longer and is more capital-intensive, which requires higher liquidity. Therefore, regardless of the financial constraints of enterprises, whether the fixed costs and variable costs of international trade can be paid affects not only whether enterprises can export, but also the volume of trade exported.

Moreover, scholars have explained the relationship between financial constraints and enterprise exports from various perspectives. Manova and Yu [3] find in their research of China that the strength of enterprises' financing ability also affects their choice of trade mode. Compared with general trade, processing trade requires less capital. Therefore, those enterprises with weaker financing capacity tend to integrate into the GVC by choosing the processing trade mode. Processing trade generates lower firms' profits and domestic value added than general trade, which makes China locked into the lower end of the GVC for a long time. Therefore, the financial constraints of enterprises should first be eased to upgrade China's position in the GVC to transform enterprises' low value-added trade (e.g., processing trade).

The OECD's [18] research shows two mechanisms through which reducing financial constraints could upgrade Chinese enterprises' position in the GVC. First, from the perspective of trade mode, easing the financial constraints of enterprises could promote their transformation from processing trade to general trade, which can create more domestic value added but, at the same time, requires more capital investment. Second, from the perspective of the value chain position of enterprises, the enhancement of financing ability could transform Chinese enterprises from simple assemblers to suppliers of parts and capital goods (i.e., from processing and assembly at the bottom of the value chain to intermediate manufacturers in the middle and upper positions).

First, general trade involves more domestic production links and more domestic value added in export products. The raw materials, materials, and parts required for processing trade production all come from abroad, and only simple assembly or welding and other processing procedures are carried out in China. In processing trade, the domestic process and raw materials required for product production are less, which leads processing trade to have low domestic value added. In terms of capital demand, enterprises need to pay in advance for product design, raw materials, import tariffs, and product sales in general trade, meaning that they need more adequate capital in advance than under processing trade.

Processing trade is divided into two modes: processing with pure assemble and processing with imports. Pure assemble means that the raw materials are provided by foreign enterprises. Domestic enterprises do not need to pay for imports; rather, they only need to assemble based on the requirements of foreign enterprises, which then send the finished products. In this mode, domestic processing companies do not need to pay for raw materials or bear the risk of selling the finished products. Therefore, processing trade involves low cost, low risk, and low capital demand. In processing with imports, domestic enterprises pay for imported parts and then assemble and process them before exporting. In this mode, although domestic enterprises need to pay the import cost of raw materials in advance, the parts and raw materials they import are duty-free because of the favourable tax rebate policies provided by the Chinese government on processing trade. Moreover, the amount of capital they need to pay in advance is less than that under general trade. Hence, enterprises engaged in general trade need more investment than those engaged in processing trade. Therefore, firms that are financially constrained will be more inclined to engage in processing trade and only switch to general trade once their financial constraints ease because general trade has a higher profit margin and its DVAR is also significantly higher than that of processing trade [4,16].

The second mechanism is reducing financial constraints to promote the upgrading of the value chain. Ju and Yu [19] show that those enterprises in the upstream value chain have stronger production capacity and profitability as well as higher domestic value added. At the same time, the capital intensity of enterprises is also higher. Chen [20] also shows that most enterprises in the lower value chain position in China are engaged in processing trade such as assembly. Therefore, if enterprises could rise to the upstream value chain and produce more intermediate goods, it would be possible to upgrade the value chain. Compared with downstream assembly, if enterprises want to climb upstream and produce intermediate goods, they need to buy more machinery and equipment to organize production, and accordingly demand for capital increases. Therefore, easing financial constraints could also prompt a shift from downstream assembly to upstream parts producers.

Following Antràs et al. [21], we construct the so-called ‘upstream index’ to measure the positions of enterprises in the value chain. This index represents the distance between the production links of enterprises and final consumption. Specifically, we construct the upstream index in the following way. First, the upstream index of the industry is constructed. According to Leontief’s input-output table, in a closed economy, the total output of an industry is equal to the consumption of the final product of the industry and the intermediate products produced by other industries, which can be written as follows:

$$Y_p = F_p + \sum_{q=1}^N d_{pq}F_q + \sum_{q=1}^N \sum_{k=1}^N d_{pk}d_{kq}F_q + \sum_{q=1}^N \sum_{k=1}^N \sum_{l=1}^N d_{pl}d_{lk}d_{kq}F_q + \dots \tag{1}$$

where $q = 1, 2, 3 \dots \dots N$ represents the national economy, Y represents the final output of the industry, F represents the final product of the industry, and d_{pq} represents the consumption of intermediate products in the p industry by producing a unit of q industry products.

On this basis, Antràs et al. [21] propose a method of calculating the average distance (upstream) between the output and final consumption of an industry in the value chain. They multiply consumption in each stage in Equation (1) by the distance between it and final consumption, and then sum the output consumption of this stage as the weight:

$$U_p = 1 \times \frac{F_p}{Y_p} + 2 \times \frac{\sum_{q=1}^N d_{pq}F_q}{Y_p} + 3 \times \frac{\sum_{q=1}^N \sum_{k=1}^N d_{pk}d_{kq}F_q}{Y_p} + 4 \times \frac{\sum_{q=1}^N \sum_{k=1}^N \sum_{l=1}^N d_{pl}d_{lk}d_{kq}F_q}{Y_p} \dots \tag{2}$$

where U_p represents the average distance between the industry and final consumption; $U_p \geq 1$, and only if the industry’s output is all final consumption, $U_p = 1$. If U_p is larger, the output of the industry is mainly intermediate goods, far from final consumption; if U_p is smaller, the industry’s output is closer to the final consumer:

$$\hat{d}_{pq} = d_{pq} \frac{Y_p}{Y_p - X_p + M_p} \tag{3}$$

Considering the imports and exports in open economies and taking inventory into account, d_{ij} is updated as shown in Equation (3). Substituting Equation (3) into (2), the upstream degree of the domestic industry in an open economy can be obtained.

At the firm level, Chor et al. [22] and Ju and Yu [19] measure the upstream index of enterprises’ integration into the GVC through exports to reflect the position of an enterprise in the GVC. Specifically, the upstream index of each enterprise is obtained by mapping the upstream degree of the industry to a single enterprise with the exports of each enterprise’s sub-industry as the weight to measure the embedded position of the enterprise in the GVC. Since the industries in the World Input-Output Database are classified according to the ISIC 4.0 standard, whereas imported and exported products in the Chinese customs database are classified according to the HS8 standard code, this study match the two schemes according to the HS Combined to ISIC rev3 schemes provided by WITS (World Integrated Trade Solution) and the ISIC rev3–ISIC rev3.1/ISIC rev3.1–ISIC rev4 schemes provided by the United Nations Statistics Division. After the industry matching is completed, the upstream degree

of the enterprise can be expressed as the weighted average upstream degree of the export products of different industries:

$$exstream_{it} = \frac{1}{export_{it}} \times \sum_{j=1}^N U_{jt} \times export_{ijt} \quad (4)$$

where $exstream_{it}$ represents the upstream index of enterprise i embedded in the GVC through exports in year t , $export_{it}$ represents the total exports of enterprise i in year t , and $export_{ijt}$ represents the import volume of enterprise i in the j th industry in year t . U_{jt} represents the upstream index of the j th industry in year t . This indicator allows us to verify whether reducing financial constraints promotes enterprises into an upstream position of the value chain.

3. Econometric Models, Variables, and Data

3.1. Model Specification

To verify the above hypothesis, based on the research of Upward et al. [14], we use the following econometric models to estimate the impact of financial constraints on a firm's position in the GVC:

$$DVAR_{ijkt} = \beta_0 + \beta_1 fin_{ijkt} + \beta_2 X_{ijkt} + \gamma_j + \delta_k + \tau_t + \varepsilon_{ijkt} \quad (5)$$

where i represents the enterprises, j represents the industry in which the enterprise is located, k represents the area in which the enterprise is located, t represents the year, the DVAR of exports $DVAR_{ijkt}$ is adopted to represent the position of enterprises in the GVC, Fin_{ijkt} is used to represent the firm's financial constraints, and β_1 represents the impact of financial constraints on the DVAR of enterprises. X_{ijkt} is a control variable, including enterprise productivity, size, age, capital intensity, and industry-level variables such as industry competitiveness and the utilization rate of foreign capital. γ_j , δ_k , and τ_t represent the industry, region, and time fixed effects, respectively, ε_{ijkt} is a random error term.

3.2. Variable Construction

3.2.1. DVAR

According to Kee and Tang [5], the DVAR at the enterprise level is used to measure the status of the GVC. Firstly, an accounting equation is introduced:

$$PY_i = \pi_i + wL_i + rK_i + P^D M_i^D + P^I M_i^I \quad (6)$$

where the output value of enterprises (PY_i) is composed of enterprise profit (π_i), wages (wL_i), capital expenditure (rK_i), domestic purchase materials ($P^D M_i^D$), and imported materials ($P^I M_i^I$). Domestic materials purchased may contain foreign components, marked as δ_i^F . Imported materials may also contain domestic components, marked as δ_i^D . The national components contained in domestic materials are marked as q_i^D and the whole country's foreign components contained in foreign materials are marked as q_i^F . Therefore, domestic purchases of materials $P^D M_i^D$ and imported materials from abroad $P^I M_i^I$ can be written as follows:

$$P^D M_i^D = \delta_i^F + q_i^D P^I M_i^I = \delta_i^D + q_i^F$$

Similar to the method used to measure a country's GDP, we interpret the value added of a firm as the total domestic value contained in its total output. The domestic value added of the firm includes its profit (π_i), wages (wL_i), capital expenditure (rK_i), and direct/indirect domestic materials:

$$DVA_i = \pi_i + wL_i + rK_i + q_i^D + \delta_i^D \quad (7)$$

In China, processing trade accounts for a considerable proportion of exports. In view of the great differences between the production modes of processing trade and general trade, the DVAR is calculated for processing trade and general trade enterprises, respectively. Because the former export all the products they produce and consume all their imported products, their export value is equal to the gross products. That is, $EXP_i = PY_i$. Hence, all the imported foreign materials are also used in the production of export products $IMP_i = P^I M_i^I$. This means that for processing trade enterprises, Equation (8) can be derived from Equation (6) as follows:

$$EXP_i = \pi_i + wL_i + rK_i + P^D M_i^D + P^I M_i^I = \pi_i + wL_i + rK_i + \delta_i^F + q_i^D + \delta_i^D + q_i^F \quad (8)$$

According to Equation (7), Equation (8) can be transformed into:

$$EXP_i = DVA_i + IMP_i - \delta_i^D + \delta_i^F$$

Then,

$$DVA_i = EXP_i - IMP_i + \delta_i^D - \delta_i^F \quad (9)$$

In this case, δ_i^D approaches zero [4]. Hence, the domestic value added of the exports of processing trade enterprises is total exports minus total imports, and then the foreign components δ_i^F contained in domestic materials are adjusted. Based on the obtained domestic value added DVA_i , we further calculate the $DVAR_i$ of processing trade enterprises:

$$DVAR_i = \frac{DVA_i}{EXP_i} = \frac{EXP_i - IMP_i + \delta_i^D - \delta_i^F}{EXP_i} = 1 - \frac{IMP_i}{EXP_i} - \frac{\delta_i^F}{EXP_i} \quad (10)$$

However, data on the proportion of foreign components in domestic materials at the enterprise level $\frac{\delta_i^F}{EXP_i}$ are lacking. Following the calculation of Kee and Tang [5], this study thus matches the industry codes of the first two columns in China's industrial enterprise database to obtain the proportion of foreign components in domestic materials for each industry ($\frac{\delta_i^F}{EXP_i}$). The data are then applied to the corresponding enterprises in that industry.

For general trading enterprises, one part of their output is for exports and the other part is for domestic sales. In the imported materials, such enterprises also use a proportion of the materials to produce domestic products. Therefore, unlike processing trade enterprises, the output and imported materials of general trade enterprises leak into the domestic market.

To calculate general trade enterprises' $DVAR_i$, according to the assumption of Kee and Tang [5], the proportion of imports consumed in a firm's exports is proportional to its exports divided by total output. This means that the $DVAR_i$ of products manufactured by enterprises is the same for export and domestic sales. According to hypothetical conditions, the domestic value added of general trading enterprises DVA_i^O is:

$$DVA_i^O = EXP_i - (IMP_i + \delta_i^F) * \left(\frac{EXP_i}{PY_i} \right)$$

Based on the domestic value added obtained, we further calculate the DVAR of general trading enterprises $DVAR_i^O$:

$$DVAR_i^O = \frac{DVA_i^O}{EXP_i} = 1 - \frac{IMP_i + \delta_i^F}{PY_i} \quad (11)$$

Although the DVARS of both processing trade and general trade enterprises are calculated, some enterprises still engage in both trade modes, which we call mixed trade enterprises. According to the export shares of processing and general trade, this study weights the average DVARS of processing trade and general trade to calculate the DVAR of mixed trade enterprises.

3.2.2. Financial Constraints

How to accurately measure the financial constraints faced by enterprises has long been the subject of academic debate. This study uses three methods to measure financial constraints: the comprehensive index scoring method, SA index, and interest expense ratio of a single financial indicator. First, referring to Bellone et al. [23], we measure the financing ability of enterprises from the perspectives of external financing ability and commercial credit and profitability. We then select the following seven sub-indexes: enterprise size (logarithm of total assets), the ratio of net tangible assets (proportion of total fixed assets to total assets), the liquidation ratio (owner's equity divided by total liabilities), liquidity (current assets divided by current liabilities), commercial credit (accounts receivable divided by total assets), net interest rate of assets (income after interest and tax divided by total assets), and net interest rate of sales (income after interest and tax divided by sales revenue). Using these seven sub-indexes, we rank each enterprise index for all enterprises. The higher the value is, the stronger the financing ability of the enterprise is, and the higher the score is correspondingly. Specifically, the values of the seven sub-indicators are sorted from small to large and divided into five intervals (0–20%, 20–40%, 40–60%, 60–80%, and 80–100%). These are each assigned 1–5 points. After calculating the scores of the seven sub-indicators, we sum them. Finally, we standardize the total scores to the (0, 1) interval and mark them as *fin1*. The larger the value, the stronger is the financing capacity of enterprises and the lower are the financial constraints they face, making it more beneficial to promote the GVC upgrading of enterprises. Therefore, we expect the return of this index, the regression coefficient, to be positive.

Second, according to the research of Hadlock and Pierce [24], the SA index excludes all financial indicators that influence each other and only uses the exogenous enterprise size and age variables according to the ordered probit model. The higher the SA index, the greater are the financial constraints on enterprises. To be consistent with the other indicators of financial constraints in the regression results, this study uses the negative number of *fin2* of the SA index in the regression analysis. The larger the *fin2*, the lower are the financial constraints, which is conducive to improving enterprises' GVC status. Hence, the expected coefficient is also positive.

Finally, the interest expense ratio of a single financial indicator (*fin3*) is adopted to measure financial constraints. Feenstra et al. [12] study the financial constraints of enterprises caused by banks' inability to issue optimal loans because of asymmetric information. Since no loan data are obtained from banks' financial statements, they use interest expenses to measure financial constraints. In China, few enterprises are listed and financed through the securities market. The majority obtain external financing through bank loans. Moreover, owing to financial repression, there is 'ownership discrimination' in the loans available to enterprises. The higher the interest expenses, the higher the bank loans the enterprise obtains and the fewer financial constraints it is subject to. This study thus divides interest expenses by fixed assets to measure the financial constraints of enterprises. The larger the *fin3* value, the lower are the financial constraints faced by enterprises and the higher is the GVC. Hence, the coefficient is also expected to be positive.

3.2.3. Control Variables

In addition to the core variable of financial constraints, based on Upward et al. [6], we control for other firm characteristic and industry variables, including total factor productivity (TFP). We use the LP (Levinsohn & Petrin) method to calculate firm productivity from 2005 to 2007. Because data on Chinese enterprises in 2008 and 2009 do not provide information on intermediate inputs and industrial value added, TFP in these two years is estimated using the Solow residual method with fixed effects. Enterprise size is measured by the logarithm of the number of workers. Enterprise age refers to the length of time the enterprise has been established. Capital intensity measures fixed assets per capita. FDI inflow, which is calculated as annual FDI inflow divided by the GDP of each province, may also affect domestic value added. After FDI flows into China, to protect technology and seize the market, foreign enterprises collaborate with leading companies to manufacture key components

and enhance the domestic value added of exports. On the contrary, many enterprises in coastal areas engage in processing trade using cheap Chinese labour. This in turn reduces the domestic value added of products, making the role of FDI unclear. Industry concentration (HHI), which is calculated by the sum of the squares of the percentage of enterprise sales in the total sales of the industry, represents the industry concentration and also affects the value added that enterprises may obtain.

3.3. Data Sources and Data Processing

The data used in this study are micro firm-level production data compiled by China's National Bureau of Statistics, with import and export trade data collected by China's General Administration of Customs. The data we use ranges from 2005 to 2009. Data on China's industrial enterprises are collected for all state-owned enterprises (SOEs) and non-SOEs with a business income of more than 5 million yuan. This dataset contains basic and financial information on enterprises. To improve data quality, we exclude those samples missing important variables such as total assets, gross industrial output value, and net fixed assets as well as firms with fewer than 10 employees [12,25]. Similarly, the following samples that do not conform to general accounting standards are excluded: current assets exceed total assets, fixed assets exceed total assets, and current depreciation exceeds accumulated depreciation. We also eliminate companies with invalid founding dates and unknown regions and industries.

Although the Chinese industrial enterprise database provides a wealth of information at the enterprise level, the trade statistics are rough. It is thus necessary to match the Chinese customs import and export trade data with the Chinese industrial enterprise database. China's Customs Import and Export Trade Database mainly provides import and export data at the product level. Since these data are based on monthly data, we first sum them to obtain annual data. Further, using the methods of Upward et al. [14] and Yu [26], we match the database of Chinese industrial enterprises with the customs database using enterprise name, enterprise postcode plus telephone number, and enterprise postcode plus contact person. The complete database includes the basic financial status of the enterprise, import and export volume, trade mode, and other indicators.

4. Regression Results and Analysis

This section adopts the DVAR of enterprises' exports as the explained variable to investigate the impact of financial constraints on their GVC status. In addition, we test the robustness of eliminating outliers, considering financial crisis, and distinguishing ownership type as well as examine the mechanism of how relaxing financial constraints affects the upgrading of enterprises' GVC.

4.1. Benchmark Regression Results

Table 1 shows the results of the benchmark regression, where columns (1–3) control the fixed effects of time and columns (4–6) control the fixed effects of time, industry, and region. The regression results in column (1) show that the *fin1* coefficient is positive and significant at the 1% level, indicating that the easing of financial constraints significantly improves the DVAR; that is also to say, the enhancement of financing ability can promote the enterprises' GVC position. Column (2) shows that the coefficient of the SA index (*fin2*) of financial constraints is also positive and significant at the 1% level. According to the construction of the SA index, the higher the value, the stronger the financial constraints. Because we take the opposite number for the SA index, the higher the opposite number of the SA index (*fin2*), the lower the enterprises' financial constraints. These regression results show that with an increase in *fin2*, the DVAR of enterprises rises; that is, relaxing financial constraints can promote the enterprise's position in the global value chain. The results in column (3) show that the coefficient of the interest expenses ratio (*fin3*) is also positive and significant at the 1% level, indicating that with an increase in the interest expense of enterprises, or equivalently the enhancement of financing capacity, the DVAR of enterprises significantly increases. Columns (4–6) control the fixed effect of time, industry, and region and show similar results. The results of this study are similar to those in Manova and Yu [3], and their findings are expanded. Manova and Yu [3] show that Chinese firms with more financial constraints

tend to participate in global value chains in the form of processing trade. Once the financial constrain is eased, they will participate in GVCS in a general trade manner. The domestic added value created by general trade is much higher than that of processing trade, which is confirmed in Upward et al. [14]; Kee and Tang [5]. Our paper show more directly that the easing of financing constraints improves firms domestic value added. Through subsequent mechanism analysis, it is further confirmed that the easing of financing constraints promotes the transformation of enterprises from processing trade to general trade mode, which is one of the mechanisms for their value chain upgrading (this is similar to Manova and Yu's research in 2016). Another mechanism is that easing financial constraints could also prompt a firm shift from downstream GVC position to upstream position (Manova and Yu's research in 2016 did not involve this).

Table 1. Benchmark regression results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	dvar	dvar	dvar	dvar	dvar	dvar
fin1	0.1281 *** (0.0048)	- -	- -	0.0928 *** (0.0047)	- -	- -
fin2	- -	0.6972 *** (0.0183)	- -	- -	0.3851 *** (0.0178)	- -
fin3	- -	- -	0.0516 *** (0.0024)	- -	- -	0.0395 *** (0.0024)
tfp	0.0081 *** (0.0005)	0.0010 ** (0.0004)	0.0062 *** (0.0005)	0.0050 *** (0.0004)	0.0003 (0.0004)	0.0038 *** (0.0005)
size	-0.0128 *** (0.0004)	-0.0109 *** (0.0003)	-0.0119 *** (0.0004)	-0.0079 *** (0.0004)	-0.0067 *** (0.0003)	-0.0073 *** (0.0003)
age	0.0074 *** (0.0013)	0.0015 (0.0013)	0.0073 *** (0.0013)	0.0047 *** (0.0012)	0.0009 (0.0012)	0.0049 *** (0.0012)
intensity	0.0069 *** (0.0003)	0.0028 *** (0.0003)	0.0056 *** (0.0003)	0.0084 *** (0.0004)	0.0050 *** (0.0003)	0.0075 *** (0.0003)
fdi	-0.738 *** (0.0146)	-0.719 *** (0.0147)	-0.741 *** (0.0146)	0.0949 *** (0.0261)	0.0926 *** (0.0262)	0.0971 *** (0.0261)
hhi	0.2063 *** (0.0582)	0.1716 *** (0.0579)	0.1813 *** (0.0582)	0.9427 (0.6315)	0.8201 (0.6306)	0.9039 (0.6318)
constant	0.8238 *** (0.0083)	0.9715 *** (0.0065)	0.8958 *** (0.0072)	0.8822 *** (0.0376)	0.9843 *** (0.0372)	0.9309 *** (0.0374)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Ind dummy	No	No	No	Yes	Yes	Yes
Pro dummy	No	No	No	Yes	Yes	Yes
R ²	0.0372	0.0438	0.0354	0.1255	0.1271	0.1248
N	128876	127928	128879	128876	127928	128879

Note: ** and *** are significant at the 5%, and 1% levels, respectively. Robust standard errors of the coefficients are in parentheses.

Among all of the other control variables, TFP and capital intensity have a significant positive impact on the DVAR, indicating that enterprises with high TFP and high capital intensity have a higher DVAR. It can be said that this result is similar to Ju and Yu's research on China. At the same time, the impact of enterprise age is positive, while the effect of firm size is negative. In addition, the level of FDI in this industry and the degree of monopoly power in this industry have uncertain impacts on the enterprises' global value chain positions.

4.2. Robustness Test

4.2.1. Excluding Outliers

Owing to the possible influence of extreme values on the estimated results, the values of the first 5% and last 5% of samples are removed and another regression analysis was run. Columns (1–3) in Table 2 show the results, which are roughly the same as those in Table 1. The three indexes used to measure the financing capacity of enterprises are still positive and significant at the 1% level.

Table 2. Robustness test 1.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	dvar	dvar	dvar	dvar	dvar	dvar
fin1	0.0710 *** (0.0037)	- -	- -	0.0910 *** (0.0060)	- -	- -
fin2	- -	0.2734 *** (0.0137)	- -	- -	0.460 *** (0.0256)	- -
fin3	- -	- -	0.0319 *** (0.0018)	- -	- -	0.0373 *** (0.0032)
tfp	0.0048 *** (0.0004)	0.0012 *** (0.0003)	0.0040 *** (0.0004)	0.0062 *** (0.0007)	0.0009 * (0.0005)	0.0047 *** (0.0006)
size	-0.0068 *** (0.0003)	-0.0059 *** (0.0003)	-0.0064 *** (0.0003)	-0.0127 *** (0.0005)	-0.0105 *** (0.0004)	-0.0118 *** (0.0005)
age	0.0034 *** (0.0009)	0.0005 (0.0010)	0.0037 *** (0.0009)	0.0023 (0.0017)	-0.0018 (0.0016)	0.0021 (0.0017)
intensity	0.0063 *** (0.0003)	0.0037 *** (0.0002)	0.0058 *** (0.0003)	0.0114 *** (0.0004)	0.0084 *** (0.0004)	0.0103 *** (0.0004)
fdi	0.0203 (0.0200)	0.0199 (0.0200)	0.0219 (0.0200)	0.0183 (0.0363)	0.0166 (0.0362)	0.0202 (0.0363)
hhi	0.7861 * (0.4617)	0.6912 (0.4611)	0.7595 (0.4619)	0.6959 (1.0271)	0.4062 (1.0263)	0.6091 (1.0272)
constant	0.887 *** (0.0276)	0.965 *** (0.0273)	0.922 *** (0.0274)	0.967 *** (0.0606)	1.078 *** (0.0603)	1.019 *** (0.0605)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Ind dummy	Yes	Yes	Yes	Yes	Yes	Yes
Pro dummy	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.1137	0.1149	0.1132	0.1426	0.1436	0.1415
N	116240	115357	116243	76254	76256	76256

Note: * and *** are significant at the 10% and 1% levels, respectively. Robust standard errors of the coefficients are in parentheses.

4.2.2. Impact of Financial Crisis

The subprime mortgage crisis that broke out in 2008 had a huge impact on China's exports, and the country's participation in the GVC dropped sharply. Considering the possible interference of such shocks on the regression results, this study excludes the samples of 2008 and 2009 and runs a regression on the pre-crisis samples only. Columns (4–6) in Table 2 present the regression results, showing that reducing financial constraints still significantly promotes an increase in the DVAR of enterprises at the 1% level.

4.2.3. Endogeneity Problems

There may be endogeneity problems between financial constraints and domestic value added. On the one hand, easing financial constraints promotes the position of the enterprise in the value chain. On the other hand, if enterprises have climbed the value chain from processing and assembly, thereby creating more domestic value added and profits, enterprises' internal cash flow will increase and financial constraints could be mitigated. At the same time, firms with upgraded value chains are more likely to signal to banks that they are high-quality enterprises and may be more likely to obtain financial support, thus alleviating financial constraints. To exclude this endogeneity problem, we use the first-order lagged variable of financial constraints as the instrumental variable for the regression analysis. The regression results in columns (1–3) in Table 3 show that easing financial constraints can significantly upgrade the GVC after considering endogeneity problems. In addition, the Kleibergen–Paap rk LM statistic p value is less than 0.01, strongly rejecting the original hypothesis of non-identifiability and thus indicating that the instrumental variables and interpretation variables are related. The Kleibergen–Paap Wald rk F test shows that there is no weak instrumental variable. Hence, our instrumental variables are reasonable and effective, and the estimated results are reliable.

Table 3. Robustness test 2.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	dvar	dvar	dvar	dvar	dvar	dvar
fin1	0.0614 *** (0.0115)	- -	- -	0.0450 *** (0.0047)	- -	- -
fin2	- -	0.930 *** (0.0845)	- -	- -	0.3685 *** (0.0178)	- -
fin3	- -	- -	0.0240 *** (0.0056)	- -	- -	0.0198 *** (0.0024)
tfp	0.0042 *** (0.0009)	0.0004 (0.0007)	0.0032 *** (0.0008)	0.0060 *** (0.0005)	0.0041 *** (0.0005)	0.0056 *** (0.0005)
size	-0.0086 *** (0.0006)	-0.0085 *** (0.0006)	-0.0082 *** (0.0006)	-0.0082 *** (0.0004)	-0.0090 *** (0.0003)	-0.0084 *** (0.0004)
age	0.0051 *** (0.0017)	0.0014 (0.0017)	0.0050 *** (0.0017)	0.0046 *** (0.0012)	0.0036 *** (0.0012)	0.0051 *** (0.0012)
intensity	0.0064 *** (0.0007)	0.0044 *** (0.0005)	0.0056 *** (0.0007)	0.0009 ** (0.0004)	0.0009 ** (0.0004)	-0.0005 (0.0004)
fdi	0.0658 (0.0458)	0.0514 (0.0464)	0.0679 (0.0458)	0.0942 *** (0.0261)	0.0880 *** (0.0261)	0.0952 *** (0.0261)
hhi	1.5452 ** (0.7139)	1.2580 * (0.7371)	1.5347 ** (0.7022)	0.9360 (0.6314)	0.8249 (0.6297)	0.9007 (0.6314)
constant	0.8826 *** (0.0578)	0.9655 *** (0.0621)	0.9170 *** (0.0563)	0.9177 *** (0.0376)	0.9736 *** (0.0371)	0.9420 *** (0.0374)
Kleibergn-Pa LM	9780 (0.000)	197.07 [0.000]	9453 [0.000]	-	-	-
Kleibergn-Paap Wald F	16000 (0.000)	31.823 [0.000]	18000 [0.000]	-	-	-
Yeardummy	Yes	Yes	Yes	Yes	Yes	Yes
Ind dummy	Yes	Yes	Yes	Yes	Yes	Yes
Pro dummy	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.115	0.110	0.115	0.126	0.129	0.126
N	53736	52902	53738	128876	127928	128879

Note: *, **, and *** are significant at the 10%, 5%, and 1% levels, respectively. Robust standard errors of the coefficients are in parentheses.

4.2.4. Alternative Firm Size Measures

In the empirical corporate finance field, firm size is a very important index to measure the characteristics of enterprises [27,28], which will affect the coefficient of independent and dependent

variables simultaneously. Different methods to measure firm size may bring different regression results. In the previous parts, we use the number of employees to measure firm size. Referring to the important research of Dang et al. [27], now we use logarithm of total assets to measure the firm size (Dang et al. [27] summarize more than 100 corporate finance literatures published in finance economics and accounting top journal, they find that total assets is one of the most commonly used indexes to measure firm size), and robustness test is carried out. When we use total assets to measure firm sizes and do the regression, the results could be seen in the 4–6th column in Table 3. Compare to Table 1 column (4–6) with the employee as the proxy variable to measure firm size, there is no significant difference between the two regression results. Thus, we can say the regression result is robust for the dependent variable: domestic added value. As the core variable, the sign direction and significance level of the coefficients of the three financing constraint indicators have not changed. In addition, the R2 of the regression equation of column (4–6) in Table 3 and column (4–6) in table are similar, which all add fixed effects of industry and region at the same time. This means that, as far as this topic is concerned, it is robust when choosing different indicators to measure firm size.

4.3. Expansion Analysis: Heterogeneity of Enterprise Ownership

In China, enterprises with different ownership types have different production modes, meaning that the DVAR of their exports may be significantly different. Hence, a group regression is carried out for SOEs, private-owned enterprises (POEs), and foreign-owned enterprises (FOEs). According to Chinese law, enterprises with over 25% of paid-in capital from Hong Kong, Macao, and Taiwan are FOEs and enterprises with over 50% of state-owned capital are SOEs. Table 4 shows the regression results; columns (1–3) present the results for SOEs, while columns (4–6) and (7–9) show the results for POEs and FOEs, respectively. Financial constraints have no impact on upgrading the value chain of SOEs, but reducing financial constraints can significantly promote the upgrading of the value chains of POEs and FOEs in China. Generally speaking, the impact on the upgrading of POEs' value chains is stronger. One possible reason is that Chinese banks show ownership discrimination when providing credit and tend to prioritize loans for SOEs. Therefore, China's SOEs generally do not have financing difficulties and thus no barrier to upgrading to their value chain. On the contrary, many POEs are faced with difficult and expensive financing, which becomes an important factor restricting their upgrading of the value chain. In other words, easing financial constraints significantly promotes their rise to the upstream value chain. The coefficient of the impact of financing on the value chain upgrading of FOEs is also significantly positive.

Table 4. Heterogeneity: Differentiation by ownership type.

Variables	SOEs			POEs			FOEs		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	dvar	dvar	dvar	dvar	dvar	dvar	dvar	dvar	dvar
fin1	0.0358 (0.0219)	-	-	0.0897 *** (0.0054)	-	-	0.0762 *** (0.0084)	-	-
fin2	-	-0.1249 (0.1118)	-	-	0.1795 *** (0.0175)	-	-	0.5899 *** (0.0412)	-
fin3	-	-	0.0109 (0.0114)	-	-	0.0367 *** (0.0026)	-	-	0.0330 *** (0.0044)
tfp	-0.0027 (0.0021)	-0.0042 ** (0.0019)	-0.0034 (0.0021)	0.0041 *** (0.0005)	-0.0001 (0.0005)	0.0029 *** (0.0005)	0.0048 *** (0.0008)	0.0003 (0.0007)	0.0037 *** (0.0008)
size	-0.0038 ** (0.0015)	-0.0032 ** (0.0015)	-0.0034 ** (0.0015)	-0.0054 *** (0.0004)	-0.0050 *** (0.0004)	-0.0049 *** (0.0004)	-0.0099 *** (0.0006)	-0.0083 *** (0.0006)	-0.0092 *** (0.0006)
age	0.0102 *** (0.0039)	0.0101 *** (0.0039)	0.0101 *** (0.0039)	0.0071 *** (0.0013)	0.0041 *** (0.0013)	0.0072 *** (0.0013)	-0.0238 *** (0.0026)	-0.0266 *** (0.0026)	-0.0237 *** (0.0026)
intensity	0.0048 *** (0.0017)	0.0034 ** (0.0014)	0.0041 ** (0.0017)	0.0067 *** (0.0004)	0.0035 *** (0.0004)	0.0059 *** (0.0004)	0.0073 *** (0.0006)	0.0048 *** (0.0005)	0.0066 *** (0.0006)
fdi	-0.1957 (0.1402)	-0.2140 (0.1403)	-0.1948 (0.1402)	-0.0907 *** (0.0315)	-0.0991 *** (0.0314)	-0.0861 *** (0.0315)	0.0910 * (0.0487)	0.0972 ** (0.0487)	0.0924 * (0.0488)
hhi	0.1911 (1.1647)	0.1588 (1.1637)	0.1836 (1.1650)	0.6917 (0.7155)	0.6144 (0.7119)	0.6854 (0.7159)	1.1914 (2.6734)	1.0957 (2.6704)	1.0557 (2.6740)
constant	0.9878 *** (0.0718)	1.0210 *** (0.0692)	1.0097 *** (0.0699)	0.8885 *** (0.0384)	0.9866 *** (0.0379)	0.9366 *** (0.0382)	0.9798 *** (0.2208)	1.0580 *** (0.2204)	1.0254 *** (0.2207)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pro dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.120	0.119	0.119	0.131	0.131	0.130	0.113	0.115	0.112
N	3388	3377	3388	69290	68364	69292	56907	56885	56908

Note: *, **, and *** are significant at the 10%, 5% and 1% levels, respectively. Robust standard errors of the coefficients are in parentheses.

5. Possible Mechanisms

Although the empirical analysis shows that reducing financial constraints significantly improves the DVAR of enterprises, the possible mechanisms are underexplored. This study argues that there are two ways to ease financial constraints and increase the DVAR. First, easing financial constraints allows enterprises to shift from processing trade to general trade, which is more capital-intensive. Second, it allows enterprises to shift from the processing and assembly of final products to the production of intermediate products, which also requires more investment. To test these two mechanisms, this study constructs the following mediating effect model:

$$share_{ijkt} = \beta_0 + \beta_1 fin_{it} + \beta_2 X_{ijkt} + \gamma_{ijkt} + \delta_{ijkt} + \tau_{ijkt} + \varepsilon_{ijkt} \quad (12)$$

$$exstream_{ijkt} = \beta_0 + \beta_1 fin_{it} + \beta_2 X_{ijkt} + \gamma_{ijkt} + \delta_{ijkt} + \tau_{ijkt} + \varepsilon_{ijkt} \quad (13)$$

$$DVAR_{ijkt} = \beta_0 + \beta_1 fin_{it} + \beta_2 share_{ijkt} + \beta_3 exstream_{ijkt} + \beta_4 X_{ijkt} + \gamma_{ijkt} + \delta_{ijkt} + \tau_{ijkt} + \varepsilon_{ijkt} \quad (14)$$

where $share_{ijkt}$ represents the proportion of general trade exports in total exports and $exstream_{ijkt}$ represents the upstream index of the enterprise in the value chain. Columns (1–6) of Table 5 present the regression results, showing that easing financial constraints, on the one hand, can increase the proportion of enterprises engaged in general trade and, on the other hand, can significantly promote enterprises' ascent up the value chain. This finding shows that reducing financial constraints allows enterprises to engage in more general trade, thereby enhancing their domestic value added and upgrading the GVC. According to Ju and Yu [19], the upstream value chain provides increases profits and value added to enterprises. Moreover, columns (1), (3), and (5) of Table 6 add two mediating variables before regressing the DVAR; columns (2), (4), and (6) show the regression results without these intermediary variables. The coefficient value of financial constraints decreases after the addition

of the mediating variables, indicating that these channels are the main mechanisms for alleviating financial constraints and promoting GVC upgrading for firms.

Table 5. Mechanism of relaxing financial constraints.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Share	Share	Share	Exstream	Exstream	Exstream
fin1	0.1005 *** (0.0129)	-	-	1.0095 *** (0.0417)	-	-
fin2	-	1.0668 *** (0.0483)	-	-	1.0486 *** (0.1574)	-
fin3	-	-	0.0453 *** (0.0064)	-	-	0.3766 *** (0.0208)
tfp	0.0290 *** (0.0013)	0.0234 *** (0.0011)	0.0279 *** (0.0013)	0.0064 (0.0042)	0.0560 *** (0.0037)	0.0238 *** (0.0040)
size	-0.0378 *** (0.0009)	-0.0376 *** (0.0009)	-0.0372 *** (0.0010)	-0.0200 *** (0.0031)	-0.0371 *** (0.0030)	-0.0283 *** (0.0031)
age	0.0111 *** (0.0033)	0.0158 *** (0.0033)	0.0108 *** (0.0033)	0.0970 *** (0.0108)	0.0612 *** (0.0107)	0.0943 *** (0.0108)
intensity	0.0199 *** (0.0010)	0.0224 *** (0.0008)	0.0206 *** (0.0009)	0.1268 *** (0.0032)	0.0858 *** (0.0027)	0.1136 *** (0.0031)
fdi	0.3734 *** (0.0709)	0.3546 *** (0.0709)	0.3755 *** (0.0709)	-0.6412 *** (0.2298)	-0.5992 *** (0.2308)	-0.6117 *** (0.2299)
hhi	-0.8749 (1.7138)	-1.0262 (1.7073)	-0.9129 (1.7138)	-8.9578 (5.5554)	-10.2054 * (5.5609)	-9.4722 * (5.5608)
constant	0.8519 *** (0.1019)	0.9758 *** (0.1007)	0.9017 *** (0.1014)	1.9461 *** (0.3304)	3.0056 *** (0.3281)	2.5383 *** (0.3289)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Ind dummy	Yes	Yes	Yes	Yes	Yes	Yes
Pro dummy	Yes	Yes	Yes	Yes	Yes	Yes
	0.2130	0.2172	0.2130	0.1778	0.1749	0.1762
N	128876	127928	128879	128876	127928	128879

Note: The data in parentheses are the t values of the coefficients, and * and *** are significant at the levels of 10% and 1%, respectively.

Table 6. Mechanism of relaxing financial constraints with mediating variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	dvar	dvar	dvar	dvar	dvar	dvar
fin1	0.0631 *** (0.0037)	0.0928 *** (0.0047)	-	-	-	-
fin2	-	-	0.1311 *** (0.0140)	0.3851 *** (0.0178)	-	-
fin3	-	-	-	-	0.0266 *** (0.0019)	0.0395 *** (0.0024)
share	0.2309 *** (0.0008)	-	0.2310 *** (0.0008)	-	0.2310 *** (0.0008)	-
exstream	0.0065 *** (0.0002)	-	0.0068 *** (0.0003)	-	0.0067 *** (0.0002)	-
tfp	0.0016 *** (0.0004)	0.0050 *** (0.0004)	0.0048 *** (0.0003)	0.0003 (0.0004)	0.0025 *** (0.0004)	0.0038 *** (0.0005)

Table 6. Cont.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	dvar	dvar	dvar	dvar	dvar	dvar
size	0.0007 ** (0.0003)	−0.0079 *** (0.0004)	0.0018 *** (0.0003)	−0.0067 *** (0.0003)	0.0011 *** (0.0002)	−0.0073 *** (0.0003)
age	0.0067 *** (0.0009)	0.0047 *** (0.0012)	0.0042 *** (0.0010)	0.0009 (0.0012)	0.0067 *** (0.0010)	0.0049 *** (0.0012)
intensity	0.0121 *** (0.0003)	0.0084 *** (0.0004)	0.0096 *** (0.0002)	0.0050 *** (0.0003)	0.0115 *** (0.0003)	0.0075 *** (0.0003)
fdi	0.0128 (0.0204)	0.0949 *** (0.0261)	0.0147 (0.0205)	0.0926 *** (0.0262)	0.0144 (0.0204)	0.0971 *** (0.0261)
hhi	1.2027 ** (0.4938)	0.9427 (0.6315)	1.1260 ** (0.4936)	0.8201 (0.6306)	1.1771 ** (0.4940)	0.9039 (0.6318)
constant	0.6730 *** (0.0294)	0.8822 *** (0.0376)	0.7386 *** (0.0291)	0.9843 *** (0.0372)	0.7059 *** (0.0292)	0.9309 *** (0.0374)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Ind dummy	Yes	Yes	Yes	Yes	Yes	Yes
Pro dummy	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.4653	0.1255	0.4651	0.1271	0.4650	0.1248
N	128876	128876	127928	127928	128879	128879

Note: The data in parentheses are the t values of the coefficients and **, and *** are significant at the levels of 5%, and 1%, respectively.

6. Conclusions

Our research shows that financial constraint is the key element in the upgrading of Chinese enterprises' global value chain position. This study adopts Chinese Industrial Enterprises Database and China Customs Import and Export Database to calculate the DVAR at the micro-enterprise level, while taking the heterogeneity of enterprises into full consideration and distinguishing processing trade enterprises from general trade enterprises. In terms of constructing the variables for financial constraints, we adopt three methods (comprehensive scoring method, SA index method and single financial indicator method) to measure firm's financial constraints.

The study find that reducing financial constraints can significantly promote the position of Chinese enterprises in the GVC. Since Chinese banks show 'ownership discrimination' hence state-owned enterprises have priority in gaining loans from banks, while private-owned enterprises usually suffer from severe financing difficulties and high financing costs. We choose to divide our samples into state-owned enterprises (SOE), private-owned enterprises (POE) and foreign-owned enterprises (FOE) in order to study the effect of ownership. Our results show that financial constraints have no effect on SOEs, but it's a crucial factor that restricts the upgrading of POEs' positions in the global value chain.

We also investigate the channels through which financial constraints affect the GVC upgrading of Chinese enterprises. We find that an increase in financing capacity can shift enterprises from processing trade to general trade, which demands more capital. It also helps enterprises shift from simple processing and assembly to intermediate product production, which again requires more capital to purchase the necessary machinery and equipment. The transformation from processing trade to general trade and from processing and assembly to intermediate goods production improves both the profit and the DVAR of enterprises, thus promoting China's position in the GVC.

Well, we mainly study financial constraints from the static perspective rather than dynamic M&A. As Kopecky et al. [29] shows, in short term, enterprises could optimize their firm values through modifying debt structure if there is no takeover market. However, when we consider dynamic firm takeover, the modification of debt structure only has minor effect on firm value. Similarly, if we

consider M&A, firm with less financial constraints could acquire those firms with severe financial constraints. In this case, the financial constraint problem could also be solved. However, whether this long-term, dynamic solution works the same way and has the same effect on firms DVAR as the debt structure adjustment, is a topic worth studying by future researches.

In view of the conclusions of this study, we have the following policy implications: firstly, Government should realize that if they want to upgrade domestic enterprises' positions in the global value chain when opening up, they would have to improve domestic level of financial development and mitigate domestic firms' financial constraints. For developing countries, it is particularly necessary to encourage the development of private financial institutions, introduce foreign financial institutions, promote competition in financial markets, and break the monopoly of funds by state-owned commercial banks. Limited financial resources can only be allocated to the most efficient enterprises through competition among various financial institutions. Second, China's financial institutions and the Chinese government should fundamentally reverse the credit discrimination against private enterprises and avoid the continuous flow of capital to the "zombie enterprises", but to the most efficient enterprises. Only in this way can we alleviate the financing constraints of enterprises, especially the financing constraints of private enterprises, and provide financial support for Chinese enterprises to push their way up the global value chain.

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