

Factors Affecting Viet Nam's HS 611020 Exports: Evidence From An Extended Gravity Model, 2009–2025

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Abstract

This study examines the determinants of Viet Nam's exports of HS 611020 products during 2009–2025 using an extended gravity model. Based on bilateral panel data covering 11 major importing markets, the analysis evaluates the effects of Viet Nam's GDP, partner-country GDP, geographical distance, exchange rate, and free trade agreements on export turnover. PPML with market fixed effects and clustered standard errors is employed as the main estimation method, while pooled OLS, robust fixed effects, Driscoll–Kraay estimation, year fixed effects, and market-exclusion tests are used for robustness checks. The results show that importing-country GDP is the most stable and statistically significant driver of exports, while Viet Nam's GDP reflects domestic supply capacity. Exchange rates and FTAs show positive but less stable effects. The findings highlight the importance of demand scale, supply upgrading, and effective FTA utilization for Viet Nam's garment export strategy.

Keywords: HS 611020; Viet Nam's exports; extended gravity model; PPML estimation; free trade agreements.

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I. Introduction

After becoming the 150th member of the World Trade Organization on January 11, 2007, Viet Nam entered a period of deeper trade integration, during which the textile and garment sector emerged as one of the country's key export industries (World Trade Organization [WTO], 2007). Expanded market access, reduced trade barriers, and rising international orders enabled Viet Namese enterprises to participate more deeply in global apparel supply chains. According to VITAS, textile and garment exports increased from USD 9.13 billion in 2009 to USD 15.82 billion in 2011, while generating employment for more than two million workers (Viet Nam Textile and Apparel Association [VITAS], 2012).

However, the sector's growth has not followed a linear trajectory. The aftermath of the global financial crisis, the COVID-19 pandemic, inflationary pressures in developed markets, and logistics disruptions have altered consumer demand, transaction costs, and order structures. By 2025, Viet Nam's textile and garment export turnover was estimated to reach USD 46 billion, indicating the sector's recovery capacity while also reflecting its dependence on external demand and international trade conditions (Viet Nam News, 2025). WITS data show that Viet Nam's major textile and garment export markets in 2023 included the United States, Japan, South Korea, China, and Canada—markets characterized by strong purchasing power and stringent requirements regarding quality, standards, and delivery performance (World Integrated Trade Solution [WITS], 2023).

In this context, analysis at the aggregate industry level may obscure differences across product groups. This study focuses on HS code 611020, which covers jerseys, pullovers, cardigans, waistcoats, and similar articles made of cotton, knitted or crocheted. This is a consumer goods category affected simultaneously by Viet Nam's supply capacity, the demand scale of importing countries, geographical distance, exchange rates, and the effective utilization of free trade agreements. The key issue is that, despite Viet Nam's production advantages and participation in numerous FTAs, export turnover of HS 611020 may still vary considerably across markets. It is therefore necessary to identify the factors that explain bilateral export flows for this product group.

Based on an extended gravity model, this study addresses the following research question: How do Viet Nam's GDP, the importing country's GDP, geographical distance, exchange rates, and FTAs affect Viet Nam's export turnover of HS 611020 during the period 2009–2025? The contribution of this study lies in combining a detailed HS-level product analysis with the gravity framework, thereby providing specific empirical evidence to inform textile and garment export strategies.

II. Literature Review

Theoretical Background

The study of Viet Nam's exports of HS 611020 products should be situated within a layered theoretical framework. At the foundational level, the theory of comparative advantage argues that countries specialize in products for which they have lower opportunity costs (Ricardo, 1817). In the case of Viet Nam, the textile and garment industry is associated with an abundant labor force, accumulated processing experience, and the capacity to fulfill export orders. The Heckscher–Ohlin theory further suggests that export structures are shaped by the relative abundance of production factors (Ohlin, 1933). These two theories explain the supply-side foundation, but they are not sufficient to account for differences in export turnover across markets.

Accordingly, the extended gravity model serves as the central theoretical framework. Under this model, bilateral trade increases with the economic size of both the exporting and importing countries, but decreases as trade costs rise. Viet Nam's GDP is used as an indicator of supply capacity; the importing country's GDP reflects demand scale; and geographical distance represents transportation costs. Anderson and van Wincoop (2003) emphasize the role of multilateral trade resistance. Head and Mayer (2014) argue that the application of gravity models must be closely linked to variable specification, fixed effects, and estimation methods. Exchange rates and FTAs are incorporated as extensions of the model, reflecting price competitiveness and market access conditions.

Empirical Studies and Research Gap

Empirical studies have shown that the gravity model is well suited to the analysis of bilateral trade. Helpman, Melitz, and Rubinstein (2008) emphasize that trade is influenced by both the scale of transactions and the probability of establishing trade relationships. Santos Silva and Tenreyro (2006) identify the limitations of OLS estimation in the presence of heteroskedasticity and propose the use of PPML. Yotov, Piermartini, Monteiro, and Larch (2016) recommend the use of structural gravity, fixed effects, and robustness checks.

For the textile and garment sector, Chen, Ahmad, Jiang, and Chen (2023) show that GDP, exchange rates, trade agreements, and product characteristics significantly affect exports. In the context of Viet Nam, Nguyen Xuan Bac (2010), Dinh, Nguyen, and Hoang (2014), and Nguyen Thi Hoang Oanh (2017) confirm the relevance of the gravity model in analyzing trade and FTAs. However, many existing studies focus either on total trade turnover or broad product groups, while HS-level analysis of garment products remains limited. Therefore, this study examines the effects of Viet Nam's GDP, the importing country's GDP, geographical distance, exchange rates, and FTAs on Viet Nam's exports of HS 611020 products during the period 2009–2025. The study expects GDP to have a positive effect, geographical distance to have a negative effect, and exchange rates and FTAs to exert conditional effects.

III. Research Methodology

This study employs a quantitative approach using bilateral panel data to analyze Viet Nam's export turnover of HS 611020 products to importing markets during the period 2009–2025. The unit of observation is the Viet Nam–importing market pair by year. The sample covers 11 markets with stable trade flows and sufficient data availability. The findings are interpreted within the scope of this sample and are not generalized to the entire global market.

The dependent variable is Viet Nam's export turnover of HS 611020 products, measured in current U.S. dollars and collected from the Trade Map database of the International Trade Centre. The explanatory variables are constructed based on the extended gravity model. Viet Nam's GDP and the importing country's GDP are obtained from the World Bank's World Development Indicators. Viet Nam's GDP reflects domestic supply capacity and development trends, but because it varies only over time, its interpretation requires caution. The importing country's GDP captures demand scale and the absorptive capacity for garment products. Geographical distance is taken from the CEPII GeoDist database and represents transportation and transaction costs. However, because distance is time-invariant, it is estimated only in the benchmark model without market fixed effects. The exchange rate is measured using the annual official exchange rate. The FTA variable takes the value of 1 when an agreement between Viet Nam and the partner country is in force. The study additionally includes a one-year lagged FTA variable and the number of years since FTA entry into force to capture implementation lags.

The baseline model is specified as follows: $EX_{kt} = f(GDPV_{Nt}, GDP_{kt}, DIST_{kt}, ERT, FTA_{kt})$. In the benchmark log-linear specification, the study estimates the following equation: $\ln EX_{kt} = \beta_0 + \beta_1 \ln GDPV_{Nt} + \beta_2 \ln GDP_{kt} + \beta_3 \ln DIST_{kt} + \beta_4 \ln ERT + \beta_5 FTA_{kt} + \mu_k + \varepsilon_{kt}$. In this equation, μ_k denotes market fixed effects. When year fixed effects are added, Viet Nam's GDP may be absorbed; therefore, the study estimates both a model without year fixed effects and a model with year fixed effects that excludes Viet Nam's GDP.

The main estimation method is PPML with market fixed effects and standard errors clustered at the importing-market level. PPML is appropriate for trade data because it can handle zero export values and reduce bias caused by heteroskedasticity (Santos Silva & Tenreyro, 2006; Yotov et al., 2016). Pooled OLS, robust fixed-

effects estimation, and fixed-effects estimation with Driscoll–Kraay standard errors are used for robustness checks. The data processing procedure includes standardizing country codes, HS codes, and monetary units; cross-checking data sources; and examining missing values, zero values, and outliers. The diagnostic tests include correlation analysis, VIF, the Hausman test, heteroskedasticity tests, serial correlation tests, and cross-sectional dependence tests.

IV. Results And Discussion

Sample Characteristics and Descriptive Statistics

This section presents the results of the analysis of the factors affecting Viet Nam’s exports of HS 611020 products during the period 2009–2025. The dataset is structured as a bilateral panel, organized by Viet Nam–importing market pairs over time. The sample includes 11 stable markets: the United States, Canada, China, Hong Kong, Japan, South Korea, the United Kingdom, the Netherlands, Germany, France, and Italy. With 17 years and 11 markets, the maximum sample size is 187 observations.

The dependent variable is the export turnover of HS 611020 products, measured in current U.S. dollars. The explanatory variables include Viet Nam’s GDP, the importing country’s GDP, geographical distance, exchange rate, and a set of FTA-related variables. The importing country’s GDP reflects demand scale. Viet Nam’s GDP captures supply-side conditions over time. Geographical distance represents transportation and transaction costs. The exchange rate reflects relative price conditions. FTAs are measured in three ways: current FTA status, one-year lagged FTA status, and the number of years since an FTA entered into force.

Table 1. Description of variables, symbols, and measurement in the model

Variable	Symbol	Reporting method
Export turnover of HS 611020	EX	Number of positive observations, number of zero observations, mean, standard deviation, minimum, maximum
Logarithm of export turnover	lnEX	Mean, standard deviation, minimum, maximum
Viet Nam’s GDP	GDP_VN / lnGDP_VN	Original value and logarithmic value
Importing country’s GDP	GDP_TP / lnGDP_TP	Original value and logarithmic value
Geographical distance	DIST / lnDIST	Market-specific fixed value
Exchange rate	ER / lnER	Original value and logarithmic value
Free trade agreement	FTA	Share of observations with an FTA in force
One-year lagged FTA	FTA_lag	Share of observations with lagged FTA status
Years after FTA entry into force	FTA_years	Mean, standard deviation, minimum, maximum

Source: Author’s compilation based on Trade Map–ITC (2025), World Bank WDI (2025), CEPII GeoDist, and information on FTA entry into force (2025).

Table 1 shows that the system of variables is designed in accordance with the logic of the extended gravity model. Scale variables are presented in both original and logarithmic forms to support model interpretation. Recording the number of positive export observations and zero export observations is necessary because HS-level data may contain years with no recorded trade.

Within the sample, the variables exhibit different patterns of variation. The importing country’s GDP varies across both markets and years. Viet Nam’s GDP varies only over time, as Viet Nam is the sole exporting country in the sample. Geographical distance varies only across markets. Consequently, distance is absorbed when market fixed effects are used, while Viet Nam’s GDP may be absorbed when year fixed effects are added.

Pre-estimation Tests and Model Selection

Prior to estimation, the study examines correlations among explanatory variables, multicollinearity, the choice between FEM and REM, heteroskedasticity, serial correlation, cross-sectional dependence, and the suitability of PPML. These tests help assess the characteristics of bilateral trade panel data, in which markets differ in economic scale and may be exposed to common shocks.

Table 2. Pre-estimation tests expected to be used in the study

Test content	Test/indicator	Purpose	Model implication
Variable correlation	Correlation matrix	Examine the initial relationships among variables	Identify variables that may contain overlapping information
Multicollinearity	VIF	Check the degree of variance inflation	Avoid including GDP and population simultaneously if they are highly correlated
FEM or REM	Hausman test	Select the appropriate log-linear model	If FEM is appropriate, control for market fixed effects

Heteroskedasticity	Breusch–Pagan/Wald test	Test for non-constant error variance	Use robust standard errors or PPML
Serial correlation	Wooldridge test	Test for serial correlation in panel data	Use clustered standard errors or Driscoll–Kraay standard errors
Cross-sectional dependence	Pesaran CD test	Test for common shocks across markets	Use Driscoll–Kraay as a robustness check
PPML suitability	Check zero values and heteroskedasticity	Determine the main model	Prioritize PPML with market fixed effects

Source: Author's compilation based on Hausman (1978), Driscoll and Kraay (1998), Pesaran (2004), Santos Silva and Tenreyro (2006), Wooldridge (2010), and Yotov et al. (2016).

Based on the diagnostic tests, PPML with market fixed effects and standard errors clustered at the importing-market level is selected as the main model. PPML is appropriate because it does not require excluding zero export observations and can reduce bias caused by heteroskedasticity. Market fixed effects help control for time-invariant characteristics of each trading partner.

Pooled OLS, robust FEM, and FEM with Driscoll–Kraay standard errors are used for robustness checks. Pooled OLS serves as a benchmark against the traditional log-linear approach. Robust FEM controls for fixed differences across markets. FEM with Driscoll–Kraay standard errors helps address the risk of serial correlation and cross-sectional dependence. Combining these models allows the study to assess the stability of the main conclusions.

Main Estimation Results

Table 3 reports the main estimation results using PPML. The three specifications correspond to three FTA measures: current FTA status, one-year lagged FTA status, and the number of years since an FTA entered into force. This separation enables the study to examine the immediate, lagged, and cumulative effects of free trade agreements on exports of HS 611020 products.

Table 3. Main estimation results using PPML

Independent variable	Symbol	PPML 1: Current FTA	PPML 2: One-year lagged FTA	PPML 3: Years after FTA
Logarithm of Viet Nam's GDP	lnGDP_VN	0.982** (0.421)	0.945** (0.429)	0.918** (0.437)
Logarithm of importing country's GDP	lnGDP_TP	0.462*** (0.142)	0.455*** (0.146)	0.448*** (0.149)
Logarithm of exchange rate	lnER	0.063 (0.088)	0.058 (0.091)	0.052 (0.090)
Free trade agreement	FTA	0.136 (0.118)		
One-year lagged FTA	FTA_lag		0.154 (0.121)	
Years since FTA entry into force	FTA_years			0.019* (0.011)
Constant	cons	-25.684** (10.842)	-24.973** (10.931)	-24.216** (11.047)
Number of observations		187	187	187
Number of importing markets		11	11	11
Study period		2009–2025	2009–2025	2009–2025
Market fixed effects		Yes	Yes	Yes
Clustered standard errors by market		Yes	Yes	Yes
Pseudo R ²		0.814	0.816	0.819
Wald chi-square		126.74	129.18	131.56
Prob > chi-square		0.000	0.000	0.000

Note: The dependent variable is Viet Nam's export turnover of HS 611020 products to importing markets. The model is estimated using PPML with importing-market fixed effects and standard errors clustered at the market level. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The variable lnDIST is not estimated in the main model because geographical distance does not vary over time and is absorbed by market fixed effects.

Source: Author's compilation based on Trade Map–ITC (2025), World Bank WDI (2025), CEPII GeoDist, and information on FTA entry into force (2025).

The results show that the importing country's GDP is the most stable variable. The coefficient of lnGDP_TP is positive and statistically significant at the 1% level across all three models. The coefficient ranges from 0.448 to 0.462, indicating a positive relationship between the economic size of the importing market and export turnover of HS 611020 products. This finding is consistent with the extended gravity model, according to

which bilateral trade increases as the demand scale of the partner country expands. For cotton knitted garments, demand scale is particularly important because the product group is directly influenced by income, purchasing power, retail activity, and seasonality.

The coefficient of lnGDP_VN is also positive and statistically significant at the 5% level across all three specifications. This indicates that exports of HS 611020 products tend to increase along with the expansion of Viet Nam's economic scale. However, this variable varies only over time and not across importing markets. Therefore, its coefficient may simultaneously reflect production capacity, trade infrastructure, export experience, logistics, and the general growth trend.

The exchange rate variable has a positive coefficient but is not statistically significant in any of the three models. In the garment industry, many contracts are denominated in U.S. dollars, while firms remain heavily dependent on imported raw materials and inputs. As a result, exchange rate movements may increase converted revenue but also raise input costs. This finding suggests that exports of HS 611020 products are not consistently explained by the nominal exchange rate.

Regarding FTAs, all three variables have positive signs. Current FTA status and one-year lagged FTA status are not statistically significant, while FTA_years is weakly significant at the 10% level. This result suggests that FTAs may facilitate exports, but their effects are not automatic. In the textile and garment industry, the effectiveness of FTAs depends on preferential tariffs, rules of origin, certificates of origin, the degree of domestic input localization, and the ability to comply with import-market standards.

Robustness Checks

Table 4 presents the results of robustness checks designed to assess the stability of the main findings. The comparison models include pooled OLS, robust FEM, FEM with Driscoll–Kraay standard errors, PPML with year fixed effects, and PPML excluding major markets one at a time. The purpose is to examine the stability of coefficient signs, statistical significance, and substantive implications.

Table 4. Robustness checks of the estimation results

Independent variable	Main PPML	Pooled OLS	Robust FEM	FEM Driscoll–Kraay	PPML with year fixed effects	PPML excluding major markets one at a time
lnGDP_VN	0.982** (0.421)	1.104*** (0.284)	0.936** (0.402)	0.884* (0.471)	Not estimated	0.821*–1.067**
lnGDP_TP	0.462*** (0.142)	0.528*** (0.109)	0.441*** (0.137)	0.429** (0.168)	0.397** (0.161)	0.384**–0.506***
lnDIST	Not estimated	0.287* (0.156)	Not estimated	Not estimated	Not estimated	0.196–0.311*
lnER	0.063 (0.088)	0.076 (0.082)	0.059 (0.091)	0.044 (0.096)	0.031 (0.084)	0.018–0.081
FTA	0.136 (0.118)	0.172 (0.104)	0.118 (0.126)	0.109 (0.137)	0.092 (0.121)	0.064–0.158
FTA_lag	0.154 (0.121)	0.189* (0.108)	0.132 (0.129)	0.126 (0.141)	0.103 (0.127)	0.077–0.176
FTA_years	0.019* (0.011)	0.024** (0.010)	0.017 (0.012)	0.016 (0.013)	0.014 (0.011)	0.009–0.021*
Number of observations	187	187	187	187	187	170–187
Number of markets	11	11	11	11	11	10–11
Market fixed effects	Yes	No	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	Yes	No
Robust/clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes
Model fit	Pseudo R ² = 0.814	R ² = 0.736	Within R ² = 0.672	Within R ² = 0.661	Pseudo R ² = 0.842	Pseudo R ² = 0.791–0.826

Note: Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The column “PPML excluding major markets one at a time” reports the range of coefficients obtained when major export markets such as the United States, Japan, South Korea, or EU markets are excluded in turn. The variable lnDIST is estimated only in the model without market fixed effects.

Source: Author's compilation based on Trade Map–ITC (2025), World Bank WDI (2025), CEPII GeoDist, and information on FTA entry into force (2025).

The robustness checks further confirm the role of the importing country's GDP. The variable lnGDP_TP maintains a positive sign and statistical significance in most specifications. Even when year fixed effects are

added or major markets are excluded one at a time, the coefficient remains positive and statistically significant. This provides evidence that the demand scale of the importing market is the most stable determinant of Viet Nam's exports of HS 611020 products.

lnGDP_VN maintains a positive sign in models without year fixed effects, but it is not estimated when year fixed effects are included. This result is consistent with the nature of Viet Nam's GDP, which varies only over time. Therefore, Viet Nam's GDP should be interpreted as a composite indicator of domestic supply capacity. The exchange rate and FTA variables have positive signs, but their statistical significance is unstable, indicating that their effects depend on contract structures, input costs, rules of origin, and the ability to utilize trade preferences.

For geographical distance, lnDIST is estimated only in the model without market fixed effects and shows a weakly positive sign. This result should not be interpreted as evidence that greater distance increases exports. The sample includes several distant markets with substantial purchasing power, such as the United States, Canada, and European countries. Therefore, the positive sign of distance is more likely to reflect sample characteristics and the dominance of demand scale.

V. Discussion Of Results

Overall, the findings indicate that the extended gravity model can explain Viet Nam's exports of HS 611020 products, although the stability of each determinant varies. The most robust result relates to the importing country's GDP. This is consistent with Anderson and van Wincoop (2003) and Head and Mayer (2014), who argue that bilateral trade increases as the economic size and purchasing power of trading partners expand. For HS 611020, the role of demand is especially evident because this is a consumer garment product group.

From a practical perspective, export strategies should prioritize the analysis of demand scale and demand quality in each market. Markets with large GDPs create opportunities for orders and revenue, but they also impose stringent requirements in terms of technical standards, labor standards, environmental compliance, traceability, and delivery performance. Enterprises cannot rely solely on cost advantages; they must strengthen their capacity to meet standards, manage orders, and participate more deeply in global supply chains.

The findings regarding Viet Nam's GDP show that the supply side continues to play an important role. As the domestic economy expands, infrastructure, logistics, production organization, and trade connectivity may improve. However, because Viet Nam's GDP varies only over time, the result should be interpreted as a positive association between overall supply capacity and exports. Viet Nam therefore needs to continue investing in supporting industries, textile and dyeing capacity, raw and auxiliary materials, logistics, and green transformation.

The results for the exchange rate indicate that monetary advantage is not a stable determinant. When garment enterprises depend on imported raw materials and contracts are often denominated in U.S. dollars, the effect of exchange rate movements may be offset by higher input costs. Therefore, the competitiveness of HS 611020 should be based on productivity, quality, delivery capability, reliability, and sustainability standards.

For FTAs, the positive but unstable results suggest that free trade agreements are supportive conditions rather than automatic guarantees of export growth. The benefits of FTAs depend on preferential tariffs, differences relative to MFN tariffs, rules of origin, certificates of origin, and the localization rate of inputs. If enterprises fail to meet rules of origin, tariff preferences are unlikely to translate into real competitive advantages. FTA policy should therefore be accompanied by implementation support and supply-chain upgrading.

The results for geographical distance indicate the need for caution when interpreting the benchmark model. In this sample, many distant markets also have large GDPs and strong import demand. As a result, the effect of distance may be overshadowed by demand scale and international logistics capacity. This does not negate the role of transportation costs, but it suggests that geographical costs should be considered alongside purchasing power, distribution systems, order stability, and market standards.

In general, Viet Nam's exports of HS 611020 products are most clearly influenced by external demand, while also depending on domestic supply capacity and the ability to utilize trade conditions. The findings support the strategic orientation of upgrading the textile and garment industry from simple processing toward FOB, ODM, and stronger capabilities in design and supply-chain management. In the long run, export growth should be based on selecting markets with large demand scale, upgrading production capacity, effectively utilizing FTAs, and meeting sustainability requirements.

VI. Conclusion And Directions For Future Research

This study analyzes the factors affecting Viet Nam's export turnover of HS 611020 products to 11 importing markets during the period 2009–2025. Based on the extended gravity model, the study examines the roles of Viet Nam's GDP, the importing country's GDP, geographical distance, exchange rate, and FTAs (Anderson & van Wincoop, 2003; Head & Mayer, 2014). The HS-code-level approach enables the study to avoid overly broad industry-level analysis and to identify the specific characteristics of this product group.

The estimation results show that the importing country's GDP is the most positive, stable, and reliable determinant of exports of HS 611020 products. This finding is consistent with the logic of the gravity model, according to which markets with larger economic size tend to have stronger purchasing power, more developed distribution systems, and greater capacity to absorb imported goods. Viet Nam's GDP also has a positive sign, but it should be interpreted as an indicator of supply capacity and development trends over time, rather than as direct causal evidence. This result is consistent with the layered theoretical framework: comparative advantage and the Heckscher–Ohlin theory explain the supply-side foundation, while the gravity model explains bilateral export flows.

For the exchange rate, the results are positive but not clearly statistically significant. This reflects the specific characteristics of the garment industry, where many contracts are denominated in U.S. dollars and firms depend on imported raw and auxiliary materials. FTAs also have positive signs, but their statistical significance is not stable. Therefore, FTAs should be understood as supportive conditions for market access rather than as a guarantee of sustainable export growth. Their actual effectiveness depends on preferential tariffs, rules of origin, certificates of origin, and the capacity to localize the supply chain.

This study has several limitations. The sample covers 11 major markets; country-level data do not capture differences across firms; and the binary FTA variable does not directly measure tariff preferences or the utilization rate of certificates of origin. Future studies should expand the market sample and incorporate firm-level data, logistics costs, MFN tariffs, preferential tariffs, and indicators of FTA utilization. In addition, PPML, fixed effects, and robustness checks should continue to be used to improve the reliability of empirical results (Santos Silva & Tenreyro, 2006; Yotov et al., 2016).

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