Impact of Heterogeneous FTA on Service Trade in the Context of Smart Economy

Hao Jiang

School of Economics Shanghai University, Jiading, Shanghai, China

*Corresponding author e-mail: johnny24@qq.com

Abstract: With the development of information technology, artificial intelligence is more and more closely involved in our lives. And its main industry is service industry. This paper uses value-added data to explore the impact of heterogeneous trade agreements on a country's export value-added. Using different measurement methods, with the help of Stata software. It is found that the establishment of free trade agreements in services among developing countries has a negative effect on the contracting countries, and the cooperation between the North-South type countries will significantly promote the value-added of service exports of the contracting countries.

Keywords: Intellectual economy; Service industry; Export domestic-value-added

1 Literature review

The traditional gravity model can not meet the needs of empirical research because its hypothesis is pure endowment economy. With the development of goods trade system, more and more countries and scholars pay attention to the opening and research of service industry. Grunfeld and Moxnes(2003) used cross-sectional data of bilateral service exports from 22 OECD countries in 1999 to find that the "average impact" of virtual variable "free trade area" on service trade flow is not significant. Kimura and Lee (2004) used cross-sectional data of service exports from 10 OECD countries in 1999 and 2000 to conduct regression analysis on the influencing factors of service trade. The conclusion is that regional trade arrangements can have a significant impact on both goods and service trade, and service trade is more affected. But they all use only section data for analysis, and there are some deficiencies in model construction[1-3].

Due to the large number of developing countries, they play an indispensable role in the development of the world economy, so "North South" trade cooperation accounts for the largest proportion in the world's FTA. However, most of the existing literature only focuses on the cooperative relationship between developing economies and countries, without a comprehensive and systematic analysis of the unified impact of "North South" trade agreements on member countries. Lu Xianxiang and Ma Lingyuan (2009) and Zhou Nianli (2010) conducted regression tests on panel data of developing economies, and the results showed that the virtual variable "regional trade arrangement" had no significant impact on it. The data they used were before 2006, and most of the developing countries focused on developing trade in services. Zhou Nianli (2012) took developing economies as the theme to
study the impact of signing trade agreements on their service trade, and found that signing service RTA with developed countries played a greater role in promoting service trade.

2 Model construction, data description and source

2.1 Model building

This paper combines Grunfeld & Moxnes (2003) gravity model analysis framework and nogguera (2012) developed a new gravity model to introduce intermediate product production and trade, and makes appropriate improvements to meet the needs of empirical research. The new gravity model is as follows:

\[ DVA_{ij} = \frac{Y_{i1} \cdot Y_{j1}}{Y_{i2} \cdot Y_{j2}} \left( \frac{\tau_{ij}}{\Pi P_j} \right)^{1-\sigma} \]

Among them, DVA_{ij} is the added value of service trade export from country I to country J, Y_{i1} and Y_{j1} represent the total income of country I and country j respectively, and Y_{i2} is the total income of the world. \( \sigma > 1 \) is the elasticity of substitution between service products. \( \Pi \) and \( P_j \) are multilateral resistance terms and functions of direct trade cost. In the existing literature, the cost of bilateral direct service trade, generally, is set as whether to sign regional service trade agreement (FTA) with country I and country j, nature of two countries (Ni), bilateral distance between two countries (DIS), whether the two countries share border, whether to share an official language (Lang), whether they have ever been colonial and colonized relations (Coloy), and whether they have ever belonged to the same country or region\(^{[4-6]} \). This paper mainly studies the issue of service trade, and the demand for services is largely affected by the population, so when considering the influencing factors, the population is introduced into the model. Finally, random error is introduced. When considering the issue of national nature, because of the heterogeneity of FTA signing, three models are established based on the national nature of both parties, respectively analyzing the specific situation of South-South, North-South and North-North FTA. At the same time, it is assumed that the DVA of a country’s service export is proportional to the total domestic service export, that is, \( DVA = aEXS \).

So far, the mixed OLS regression model 1 is obtained:

\[ \ln DVA_{ij} = a_0 + \beta_1 \ln (GDP_i) + \beta_2 \ln (GDP_j) + \beta_3 \ln (POP_i) + \beta_4 \ln (POP_j) + \beta_5 \ln (\text{dis}_{ij}) + \beta_6 FTA_{ij} + \beta_7 N_i + \beta_8 FTA_{ij} \cdot N_i + \beta_9 \text{LANG}_{ij} + \beta_{10} \text{Coloy}_{ij} + \beta_{11} \text{Border}_{ij} + \mu_i + \epsilon_{ij} \]  

(1)

The premise of mixed regression is to ignore the unobservable heterogeneity of individuals, which may be related to explanatory variables, leading to inconsistent estimates. Referring to the description of fixed effect by Woodridge and Gujarati, this paper uses the least square dummy variable method to control the fixed effect of national individuals in the regression of fixed effect, so as to obtain the LSDV model:

\[ \ln DVA_{ij} = a_0 + \beta_1 \ln (GDP_i) + \beta_2 \ln (GDP_j) + \beta_3 \ln (POP_i) + \beta_4 \ln (POP_j) + \beta_5 \ln (\text{dis}_{ij}) + \beta_6 FTA_{ij} + \beta_7 N_i + \beta_8 FTA_{ij} \cdot N_i + \beta_9 \text{LANG}_{ij} + \beta_{10} \text{Coloy}_{ij} + \beta_{11} \text{Border}_{ij} + \mu_i + \epsilon_{ij} \]  

(2)

But the above problems are caused by default variables, simultaneity and measurement errors, among which default variables may be the most important. Therefore, Baier and Bergstrand (2007) use tool variables, fixed effect of panel data, first-order difference model, and Heckman control function method to solve these problems, and find that panel data method is the most accurate\(^{[7-9]} \).

In the process of panel data processing, using Baier et al. (2014) for reference, the constant fixed effect of country pairing (\( \gamma_{ij} \)) is introduced to control the measurable and unmeasurable political and economic factors and cultural and historical links between countries, so as to obtain the following model:

\[ \ln DVA_{ij} = a_0 + \beta_1 \ln (GDP_i) + \beta_2 \ln (GDP_j) + \beta_3 \ln (POP_i) + \beta_4 \ln (POP_j) + \beta_5 \ln (\text{dis}_{ij}) + \beta_6 FTA_{ij} + \beta_7 N_i + \beta_8 FTA_{ij} \cdot N_i + \beta_9 \text{LANG}_{ij} + \beta_{10} \text{Coloy}_{ij} + \beta_{11} \text{Border}_{ij} + \gamma_{ij} + \mu_i + \epsilon_{ij} \]  

(3)

Furthermore, there are other time-varying factors such as infrastructure investment, factor endowment and education level that may affect the flow of bilateral trade in services that are not
controlled. We use fixed effects of exporting and importing countries that vary with time \((\gamma_i, \gamma_j)\) Control multilateral resistance of exporting and importing countries. Therefore, we further get the model of adding time-varying fixed effect and country group fixed effect:

\[
\ln DVA_{ijt} = \beta_1 FTA_{ijt} + \beta_2 NI_{ij} + \beta_3 FTA_{ijt} \cdot NI_{ij} + \gamma_{it} + \gamma_{jt} + \mu_i + \epsilon_{ijt} \tag{4}
\]

### 2.2 Data description and source

The definitions, data processing and sources of dependent variables and explanatory variables required in this paper are as follows:

1. \(DVA_{ijt}\) in 1995-2011 is from trade in value added database in TIVA database of OECD.
2. The data of GDP, population and per capita GDP are from the world bank.
3. The distance data between the import and export countries in this paper is from the CEPII database.
4. The data of FTA\(_{ij}\) is from RTA-IS developed by WTO.
5. Export country I and import country \(j\) are virtual variables of national nature of NI\(_{ij}\). When considering the nature of FTA countries, it is indicated that both countries are developing countries, one is developed country, the other is developing country, and both are developed countries. If it belongs to each category, the value is 1; if it does not belong to the category, it is 0.
6. The core explanatory variable of this paper, FTA\(_{ij}\) * NI\(_{ij}\), is that the two countries signed the South-South FTA, North-South FTA and North-North FTA.
7. Whether the virtual variable (LANG\(_{ij}\)) of common language judgment is used between exporting country I and importing country \(j\) whether the virtual variable (colonyij) has colonial dependency relationship: If yes, the variable value is 1; otherwise, it is 0. The above data is from CEPII database.

### 3 Result analysis

The main purpose of this paper is to investigate the impact of trade agreements signed between countries with different development natures on domestic value added of exports. In Table 1, OLS regression with time fixed effect is reported, which is consistent with the new gravity model. Table 2 reports the regression estimates with the addition of other fixed effects: fixed effects for individual fixed countries and fixed effects for groups of countries\(^{[10-13]}\).

In the mixed regression results, first of all, the FTA variables are regressed, and a significant positive regression result is obtained, which shows that the signing of the service trade agreement is conducive to promoting the domestic added value of the service exports of the parties. In order to avoid missing variables, adding control variables to regression, the results are still significant, but smaller than without control variables. It shows that more accurate regression results can be obtained in the presence of control variables. Then, aiming at the problem of FTA heterogeneity, the core explanatory variable FTA * NI is added. Among them, the significant level of column (3) was lower, only at 10% significant level. It shows that the mixed regression can not accurately reflect the empirical research in this paper.

**Table 1:** mixed regression estimation results of the impact of heterogeneous service trade agreements on value added of service exports

|                | OLS       | South south | South north | North north |
|----------------|-----------|-------------|-------------|-------------|
| LnDVA          | (1)       | (2)         | (3)         | (4)         | (5)         |
| LnGDPi         | 1.130***  | 1.112***    | 1.011***    | 1.093***    | 1.021***    |
|                | (0.00657) | (0.00647)   | (0.00743)   | (0.00661)   | (0.00727)   |
| LnGDpj         | 1.074***  | 1.057***    | 0.956***    | 1.038***    | 0.965***    |
|                | (0.00656) | (0.00647)   | (0.00741)   | (0.00661)   | (0.00727)   |
| Lndis          | -0.966*** | -0.926***   | -0.870***   | -0.877***   | -0.875***   |
|                | (0.00704) | (0.00754)   | (0.00809)   | (0.00812)   | (0.00810)   |
| LnPOPi         | -0.0496***| -0.0461***  | 0.0485***   | -0.0288***  | 0.0384***   |
|                | (0.00627) | (0.00618)   | (0.00706)   | (0.00630)   | (0.00690)   |
| LnPOpj         | -0.0451***| -0.0416***  | 0.0480***   | -0.0245***  | 0.0431***   |

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Table 2 estimation results of fixed effects of heterogeneous service trade agreements on value added of service exports

|               | South south    | South north    | North north    |
|---------------|----------------|----------------|----------------|
| LnDVA         | (6)            | (9)            | (7)            | (10)           | (8)          | (11)         |
| FTA           | 0.229***       | 0.227***       | 0.162***       | 0.118***       | 0.465***     | 0.174***     |
| NI            | (0.0627)       | (0.0618)       | (0.0696)       | (0.0629)       | (0.0690)     |              |
| FTA*NI        | 0.251***       | 0.223***       | 0.332***       | 0.417***       | 0.320***     |              |
|              | (0.0316)       | (0.0311)       | (0.0226)       | (0.0270)       | (0.0299)     |              |
| Constant      | -30.66***      | -30.30***      | -28.50***      | -30.35***      | -28.95***    |              |
|               | (0.171)        | (0.169)        | (0.185)        | (0.169)        | (0.179)      |              |
| R-squared     | 0.696          | 0.706          | 0.710          | 0.707          | 0.709        |              |

(6), (7) and (8) in table (2) represent the individual fixed effect of controlling countries. The regression results show that the impact of FTA signed by different countries on the added value of service trade is: "south south", "North South", "north north north". The main reason for this result is that trade is two-way and determined by the common nature between the two countries. Therefore, controlling the fixed effect of a single individual country is still unable to get unbiased consistent regression results[14-15].

When panel data is used to consider the fixed effect of national groups, the theoretical concept is supported, which is consistent with the research of Baier and Bergstrand (2007). The main reason is that the data are faced with default variables, simultaneity and measurement errors, which will lead to endogenous errors.(9), (10) and (11) in table (2) are the results obtained by controlling the fixed effect of country groups under the condition of panel data regression.

In the regression results (9), the variable coefficient of FTA * Ni is significantly negative, which indicates that the conclusion of service trade agreements between developing countries has a negative effect on the value-added of their own service exports. Therefore, the establishment of free trade in services agreement between developing countries can not increase the domestic value-added of service exports of the two countries to a large extent. The regression results of FTA * Ni in (10) and (11) are greater than zero, and the coefficient of (10) is 0.119 greater than that of (11) is 0.0325, but (11) is not significant. That is to say, FTA signed by developed countries and developing countries can significantly promote the domestic value-added of service exports of exporting countries, while FTA signed between developed countries has no significant impact on the domestic value-added of service exports. The main reason is that under the global value chain trade system, developing countries are in the low-end position of the value chain, and their export trade is dominated by manufacturing industry, so the development of service trade is slow; for developed countries, the service industry of developed countries is relatively developed, and the domestic added value of service export from one country to another country after the two countries sign FTA plays a smaller role. The signing of "North South" FTA will promote the increase of service trade exports of developed countries, which are mainly composed of domestic value-added.
Considering other time-varying factors, such as infrastructure investment, factor endowment and education level, which may affect the flow of bilateral trade in services, the multilateral resistance conditions of "changing with time" are added. The results are consistent with those of control country group and time fixation effect. The regression coefficient of "south south type" in Table 3 is greater than that of country group control effect in Table 2; the coefficient of "North South type" in Table 3 is less than that of country group control effect in Table 2; the regression result of "North North type" is not significant. The main reason is that: in the past 20 years, the expression of development changes in developing countries, so the band of time-varying variables can be more accurate after being controlled. Compared with developing countries, the service trade between developed countries started earlier, and the time-varying factors such as education level and factor endowment in developed countries have not changed much.

Table 3 estimation results of time-varying fixed effect

|          | (12)              | (13)              | (14)              |
|----------|------------------|------------------|------------------|
| Lndva    |                  |                  |                  |
| FTA      | 0.135***         | 0.0696***        | 0.133***         |
|          | (0.0203)         | (0.0257)         | (0.0221)         |
| FTA*Ni   | -0.112***        | 0.0880***        | -0.0465          |
|          | (0.0421)         | (0.0301)         | (0.0371)         |
| Constant | 18.11***         | 18.12***         | 18.12***         |
|          | (0.0145)         | (0.0145)         | (0.0146)         |
| time     | YES              | YES              | YES              |
| individual | NO              | NO               | NO               |
| Country group | YES           | YES              | YES              |
| Time varying (it, JT) | YES    | YES              | YES              |
| Observations | 64,294        | 64,294           | 64,294           |
| R-squared | 0.453            | 0.453            | 0.453            |
| Number of id | 3,782         | 3,782            | 3,782            |

4 Conclusion
This paper uses the data of value-added in trade of countries in oecd-tiva database from 1995 to 2011 to study the impact of FTA heterogeneity on domestic value-added of service exports of countries, and expand the analysis of market access commitments in trade agreements. The conclusions are as follows:

1. The conclusion of service trade agreement can promote the value-added trade of service export, and strengthen the value-added trade among member countries;

2. For the heterogeneous trade agreements, the FTA between developing countries has a significant negative effect on the value-added of service exports, the FTA between developing countries and developed countries has a significant role in promoting, and the FTA between developed countries has no significant role.

Based on the above conclusions, this paper puts forward the following policy suggestions from the perspective of the parties of RTAs: in view of the significant role of "North South" RTAs in promoting bilateral service exports, it is suggested that developing economies should pay more attention to signing regional service trade arrangements with developed economies, so as to adjust the structure of domestic service trade and strengthen the innovative development of service industry. To increase the domestic added value of service industry exports and move forward to the strong end of service value chain.

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