Analyzing the Economic Liberalization of 1991 : A Gravity Model approach

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***Abstract*—Economic liberalisation in India occurred in 1991 in response to a protracted economic crisis characterised by rising inflation, stalled growth, and an unsustainable balance of payments. The liberalisation that occurred in 1991 resulted in the opening of the market to foreign competition, which enhanced efficiency and innovation. The liberalisation led to an increase in India's exports and imports as well as a diversity of its trade partners. Using the popular gravity with gravitas model of Anderson and van Wincoop (2003), we test this claim in the Indian context. The results suggest that India's exports and imports increased significantly, and there was a diversification in trade partners. Distance, GDP, and population size continue to influence bilateral commerce between India and its trading partners, both before and after the liberalisation programme, according to the study.**

***Index Terms*—Liberalization, Trade, Gravity model**

I. Introduction

PRIOR to 1991, India's restrictive trade policies and regulations had resulted in a closed and protected market which hindered the growth of economy and development in the industrial sector, as Indian manufacturers were almost monopolistic in their respective sectors. The liberalization of 1991 opened the markets to foreign competition and dismantled the aforementioned restrictions and reduced tariffs. This led to increased efficiency and innovation as a result of the improved access to technology, capital and markets. The post 1991 period was marked by the following :

Increase in trade : Bhattacharya and Bhattacharya (2015) found that the liberalization was marked by a significant increase in exports and imports, as well as an increase in foreign direct investment.

Increase in competitiveness : Kaur and Kumar (2017) found that liberalization led to increase in competitiveness of Indian firms, as they were forced to adapt to the changing market conditions and compete with foreign firms. The study found that the liberalization policy led to an increase in the productivity and efficiency of Indian firms, as well as an improvement in their technological capabilities.

Non-uniform proliferation : Adam and Bevan (2003) note that economic liberalization has had a positive impact on economic growth, but the effect is not uniform across all sectors. It also notes that there is a need for further reforms to sustain and deepen India's growth.

Of these, we seek to quantitatively verify the first; i.e., has the trade in India increased with introduction of the 1991 reforms.

II. Literature Review

Although there have been a multitude of papers in the general sense of exploring the trade and growth impacts of the Liberalization policy, they few rely on the gravity model to do so. Bhagwati and Pangariya (2002) and Ahluwalia (2001) use descriptive methods and secondary sources to analyze the impacts of the reforms and give conceptual frameworks to illustrate and confirm their arguments.
Adam and Bevan (2003) use econometric techniques to estimate the relationship between economic liberalization and economic growth, using a time-series data set spanning the period from 1950 to 1997. However, their model is far from the gravity model we propose, instead, they use a growth accounting framework to estimate the contributions of capital, labor, and total factor productivity to economic growth, and then assess the impact of economic liberalization on each of these factors. Raj and Sen (2001) use panel data methods to estimate the effect of economic reforms on productivity growth and profitability in the Indian manufacturing sector.

In recent years, however, there has been an inclination to use one of the many varieties of the gravity model, proposed originally by Tinbergen(1962), who first proposed the model to explain the bilateral trade flows between countries. The gravity model Baldwin and Harrigan (2011), derived the model from basic economic theory and showed how it can be used to analyze the determinants of bilateral trade flows. Head and Meyer (2014) proposed a new estimation method that accounts for the frequent occurrence of zero trade flows in bilateral trade data, as the traditional gravity model fails when the trade flow between nations is zero.
Anderson and van Wincoop (2003) propose a new approach to estimating the gravity model, which addresses the ”border puzzle” - the fact that many bilateral trade flows are zero or near-zero despite the absence of physical or policy barriers to trade. In their work, they introduce multilateral resistance, where the authors suggest that trade costs between two countries not only directly affect their bilateral trade flows but also indirectly affect their trade with other countries. This is because trade costs affect the relative prices of goods and services, which in turn affect demand and supply for these goods and services in other countries.

Guiso, Sapienza and Zingales (2008) use the gravity with gravitas model to analyse the effect of culture and economic behavior and argue that cultural differences can significantly affect economic outcomes. Jacks and Pendakur argue that the maritime revolution that introduced steamships and decreased the cost of trade along with an increase in reliability in shipping facilitated global trade in the past two centuries tremendously. Giovanni and Levchenko (2009) explore trade openness and volatility using Anderson and van Wincoop's model. They use a combination of theoretical models and empirical data to explore this link and hypothesize that increased trade openness can lead to both higher and lower levels of macroeconomic volatility, depending on the specific characteristics of a country's economy and its trade relationships.

III. Objective

Through the use of Anderson and van Wincoop's (2003) gravity with gravitas model, we seek to develop a quantitative equation to describe the effects of the liberalization policy of 1991 in the context of India's trade. Other effects of the policy as discussed in the first section, such as non-uniform growth and increased competitiveness could be work for future research.

IV. Methodology

We will essentially use the gravity with gravitas equation proposed by Anderson and van Wincoop, but it is important to document the route through which we get there. In this section, we will first look at the intuitive gravity model given by Tinbergen (1962), and then move on to Anderson's model, concluding with our modified model and the specifications of each variable.

A. *The Intuitive Gravity Model*

The traditional gravity model assumes that the volume of trade between two nations is directly related to the size of their respective economies and inversely proportionate to the distance between them.

According to the physical principles, the force of attraction between two things is directly proportional to their mass and inversely proportional to their distance. In economics, it is hypothesized that larger economies exert a stronger pull on commerce, whereas bigger distances operate as a disincentive to trade.

The traditional gravity model can be written in the mathematical form as follows :

$$T_{ij} = k * (GDP_i)^{b_1} * {GDP_j}^{b_2} / (D_{ij})^{b_3}$$

where
$T_{ij} =$ Trade volume between the two countries i and j
$k =$ a constant
$GDP_i =$ GDP of country i
$D_{ij} =$ Distance between country i and j

In the log linearized form, this can be written as follows :

$$\ln T_{ij} = b_0 + b_1 * \ln GDP_i + b_2 * \ln GDP_j - b_3 * \ln D_{ij} + e_{ij}$$

, where e_{ij} is the stochastic error term.

The purpose of this econometric task is to estimate the unknown b parameters. Ordinary least squares (OLS) is the econometric counterpart of lines of best fit, which are used to demonstrate the relationship between trade and GDP or trade and distance.

However, on further analysis, it is clear that some spects of this equation are flawed. For instance, suppose countries I and k sign a preferential trade agreement that reduces tariffs on their respective goods. Even though country j is not a signatory to the agreement, economic theory predicts that such a move could have an effect on its commerce. Indeed, these are evident in real world examples of trade creation and diversification. However, this does not appear in the intuitive model. Hence there is a need for a better model.

B. *Anderson and van Wincoop's model*

Issues with the traditional gravity model calls for structural changes in the model to account for these issues. Perhaps the most famous work in this direction has been that by Anderson and van Wincoop (2003), whose model is given as follows :

$$\ln T_{ij} = \ln Y_i + \ln Y_j + \ln Y + (1-\sigma) * (\ln \tau_{ij} - \ln \Pi_i - \ln P_j)$$

$$\Pi_i = \Sigma (\tau_{ij}/P_j)^{1-\sigma} * Y_j/Y$$

$$P_j = \Sigma (\tau_{ij}/\Pi_i)^{1-\sigma} * Y_i/Y$$

$$\ln \tau_{ij} = b_1 * \ln D_{ij} + b_2 * lang + b_3 * bor$$

$$Y = \Sigma Y_i$$

Where
Y_i represents GDP of country i
σ is the elasticity of substitution, and
τ_{ij} represents the trade costs, which include the distance (D_{ij}) variable and the dummies *lang* and *bord*, which are 1 if the countries share a common language and border, and 0 otherwise.

A modified version of this can be obtained by grouping together the i and j terms together. The resultant equation is as follows :

$$\ln T_{ij} = C + F_i + F_j + (1-\sigma) * (\ln \tau_{ij})$$

$$C = -logY$$

$$F_i = \ln Y_i - \ln \Pi_i$$

$$F_j = \ln Y_j - \ln P_j$$

$$\ln \tau_{ij} = b_1 * \ln D_{ij} + b_2 * lang + b_3 * bor$$

We will use a similar model for the purpose of our estimation.

C. *Our Model*

We retain the basics of the above model in our estimation. Specifically, since we are considering only the top 10 trading partnets of India, namely USA, China, Saudi Arabia, UAE, Iraq, Singapore, Hong Kong, Indonesia, Korea and Australia, we create the GDP, distance, common language, common border and country fixed effects variables for each of these and define the following model :

$$\ln T_{jt} = b_0 + b_1 * \ln D_{ij} + b_2 * lang + b_3 * bor + b_4 * \ln GDP_i + b_5 * \ln GDP_j + b_6 * libn + b_7 * \alpha_j + e_{ijt} \quad (1)$$

where

T_{jt} is the trade volume of India with country with country j
(D_{ij}) is the distance variable and the dummies *lang* and *bor* are 1 if the countries share a common language and border, and 0 otherwise.
$GDP_i =$ GDP of country i
α_j is the multilateral resistance with the jth country, calculated as

$$\alpha_j = \Sigma GDP_j{}^{\sigma} * D_{ij}$$

$libn$ is the dummy variable for liberalization (0 before 1991 and 1 afterwards).

We will use the data from 1970 to 2010 for the purpose of this paper. The 'plm' library in R will be used for empirical analysis.

V. HYPOTHESIS

The obvious hypothesis from our discussion about the reforms and the gravity equation of total trade would be a positive and significant coefficient for the dummy **libn**, which would indicate that the reforms of 1991 did actually impact trade in India. I would like to reserve my judgements for the multilateral resistance variable of each country for the empirical analysis. The coefficients of GDP and distance are both expected to be significant, although differing in signs. I would also expect a positive coefficient for the variable lang and bor. I'm hopeful that the empirical results of the model will yield insightful and supportive evidences to the references made earlier.

VI. DATASET

We will use data from the World Trade Organisation (WTO) (stats.wto.org) and the World Bank's World Integrated Trade Solution website (https://wits.worldbank.org/), which have extensive databasing of category-wise import and export data of over 180 countries. The data on distance, border data will be obtained through Centre for Prospective Studies and International Information database.

VII. REFERENCES

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