Trade Costs of India with European Union and Growth Accounting of Trade

Abhishek Gaurav and S. K. Mathur

***Abstract*—The present study aims to utilize the micro-founded measure of trade cost derived by Novy (2013) to estimate the relative bilateral trade costs of India with its European Union partners. The advantage of using such a model is that the trade costs can be derived entirely by using observable trade data. The results show that Indian tariff equivalent with its major European Union trading partners have declined on an average by 20 % between 1995-2010, with Malta and Latvia experiencing the greatest decline in their relative bilateral tariffs with India. The study then decomposes the growth of bilateral trade of India with these partners to ascertain whether it is an outcome of increased domestic production or reduction in bilateral and multilateral trade barriers across countries. Novy's model indicates that decline in relative bilateral trade costs with EU explain 109 % of this trade growth, which is partially offset by decline in multilateral resistance (-35%) terms that has diverted trade away from India and EU to other trading partners primarily in South and South east Asia and North America.**

***Index Terms*—Trade costs, Novy, India, Europe, EU.**

I. Introduction

All costs incurred in delivering a good from its place of production to its final consumer apart from the marginal cost of producing it, cumulatively add up to trade costs. They are influenced by several factors like – transportation costs, border barriers, common language effects, use of different currency, tariff and non-tariff barriers and other such related transaction costs related with collecting information and overcoming trade barriers. Trade costs significantly affect trade across countries and need to be taken into account to explain the rapid surge in bilateral and multilateral trade across nations in the past decades. However, arriving at a precise estimate of these trade costs is not easy because of the data limitations associated with capturing the aforementioned trade barriers. The problem becomes more acute when we are dealing with emerging economies where data of appropriate quality may not be available. Also, trade costs cannot be neglected in any current popular discourse of International Economics because of their significant negative impact on trade volumes [1]. With greater regional and global integration in the last few decades, trade costs have shown significant declining trend. Regional blocs like ASEAN, SAFTA, SAARC, G20, EU and global bodies like WTO aim to reduce trade barriers to promote efficient trade across countries[2]. The present study has tried to look at the dynamics of one such regional bloc European Union(EU) and how the trading relationship of India with EU has shaped over the past two decades.

European Union has emerged as a successful model of regional bloc in the last two decades since its inception in 1993. It is a union of 28 European countries which try to leverage the advantages of a single borderless market using standardized system of laws. Because of the nature of their political and economic union, the member countries of EU need to be looked at through the same lens of trade policies and design. This is especially important in the context of India, for which European Union was the largest trading partner in terms of trade volumes last year. The given study tries to capture the implicit and explicit trade costs of India with its European Union trading partners using the micro-founded measure of tariff equivalence, which measures relative bilateral trade costs using observable trade data [3]. The study then decomposes this relative bilateral trade volumes across the partners to conclude which factors have been largely responsible for this surge in trade volumes over the years.

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II. Literature Review

Samuelson (1954) modelled transportation costs in trade as iceberg costs wherein only a fraction of the goods shipped aboard from the exporter country reaches its destination, the rest of it melts away in transit [4]. Tinbergen (1962) used distance as an approximate proxy for trade costs in his famous gravity formulation [5]. Limao and Venables (2001) use the ratio [(cif/fob)-1] to capture transaction costs of trade across pair of countries [6]. Anderson and van Wincoop (2003) incorporated exogenous bilateral trade barriers in their gravity formulation [7]. Specifically, if p_i is the net supply price of the good originating in country *i*, then $p_{ij} = p_i t_{ij}$ is the price of this good faced by consumers in country *j*, where $t_{ij} \geq 1$ is the gross bilateral trade factor. They further assumed that bilateral trade costs are a function of two particular trade-cost proxies – a border barrier and geographical distance. The corresponding trade cost function hypothesized by them is: $t_{ij} = b_{ij} d_{ij}^k$ where b_{ij} is a border indicator variable, d_{ij} is the bilateral distance and *k* is the distance elasticity. Besides, they also assumed that trade costs for both the trading partners are symmetric i.e. $t_{ij}=t_{ji}$. Using these assumptions, they solve for multilateral resistance. Anderson and Van Wincoop (2004) model bilateral trade barriers as a log-linear function of observable proxies- distance, adjacency, preferential trade membership, common language and a host

of other factors. Hummels (2007) has proxied trade costs as the costs of ocean shipping and air transportation [8]. The problem with the above models of trade costs is that a particular trade cost function has been assumed which may not accurately cover all the relevant factors concerning trade barriers. Also, Anderson Wincoop (2003) assumes symmetric trade costs among the partner countrieswhich may not always be the case. Novy (2013) resolves these issues by deriving a micro-founded measure that can be obtained by using observable trade data of production and exports. Thus, there is no need to hypothesize a specific trade cost function. Also, the earlier studies use distance as a trade cost proxy, which does not change over time, which rules out the possibility of using time-series or panel data studies over such data [9]. Novy's model, however, can be used on both time series and panel data studies. Due to these significant advantages over the other models, we model the trade costs using Novy's model. An important point to note here is that Novy's model does not assume frictionless domestic trade, thus, tariff equivalent in this model, measures bilateral trade costs relative to the domestic trade costs. All such factors which increase the transaction costs of international trade over and above the domestic trade are captured in his measurement of tariff equivalence.

III. Data and Methodology

Novy (2013) uses the famous gravity equation of Anderson and Van Wincoop (2003) to derive the following expression for bilateral tariff equivalent τ_{ij}:

$$\tau_{ij} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \qquad (1)$$

where,

t_{ij} & t_{ji} are bilateral trade costs.

t_{ii} & t_{jj} are domestic trade costs.

σ > 1 is the elasticity of substitution across goods.

x_{ij} denotes nominal exports from country *i* to country *j*.

σ > 1 implies that the goods are imperfect substitutes. When the elasticity of substitution across goods is greater than 1, then an increase in the relative price of a good causes a decline in its share of total expenditure, in line with the law of demand. As we will see later the value has been assumed to be 8 (Anderson, 2004).

From Equation 1, we can see that if the bilateral trade flows $x_{ij}x_{ji}$ increase relative to domestic trade flows $x_{ii}x_{jj}$, then the value of tariff equivalent τ_{ij} would go down indicating that it has become easier to trade between the two countries *i* and *j*. τ_{ij} measures the geometric mean of the relative trade barriers in both the directions.

Novy (2013) decomposes the Anderson van Wincoop (2003) gravity model as below to provide an analytical framework of bilateral trade growth accounting. Equation 2 is obtained by taking natural logarithm of the basic gravity model of Anderson-van Wincoop and taking difference on both sides.

$$\Delta \ln(x_{ij}\, x_{ji}) = 2\Delta \ln\left(\frac{y_i y_j}{y^w}\right) + 2(1-\sigma)\Delta \ln(1+\tau_{ij}) - 2(1-\sigma)\Delta \ln(\Phi_i \Phi_j) \qquad (2)$$

Here, y_i is the nominal income of country *i*

y_w is the world income defined as $y_w \equiv \sum_j y_j$

Φ_i is a proxy for the country *i*'s multilateral resistance relative to the domestic trade costs, estimated as- $\Phi_i = \left(\frac{\prod_i P_i}{t_{ii}}\right)^{\frac{1}{2}}$ where $\prod_i$ and P_i are the price indices of country *i.*

$$100\% = \frac{2\Delta \ln\left(\frac{y_i y_j}{y^w}\right)}{\Delta \ln(x_{ij}x_{ji})} + \frac{2(1-\sigma)\Delta \ln(1+\tau_{ij})}{\Delta \ln(x_{ij}x_{ji})} - \frac{2(1-\sigma)\Delta \ln(\Phi_i \Phi_j)}{\Delta \ln(x_{ij}x_{ji})} \qquad (3)$$

Equation 2 is divided by the left hand side to arrive at the bilateral decomposition in terms of percentages as given in equation 3.This relates the growth of bilateral trade $\Delta \ln(x_{ij}\, x_{ji})$ to three distinct factors: the first term outlines the contribution of income growth, the second term is a contribution of the decline in the relative bilateral trade costs and the last term is the contribution of the decline in the multilateral resistance to bilateral trade expansion. The negative contribution of multilateral resistance term decline to trade costs can be interpreted in the manner that if trade barriers with the rest of the world falls then the bilateral trade between country *i* and country *j* decreases.

The multilateral resistance terms can be evaluated using observable trade data as:

$$2(1-\sigma)\Delta \ln(\Phi_i \Phi_j) = \Delta \ln\left(\frac{y_i / y^w}{x_{ii} / y_i}\right) + \Delta \ln\left(\frac{y_j / y^w}{x_{jj} / y_j}\right) \qquad (4)$$

The bilateral trade flow data has been extracted from IMF International Financial Statistics. Production data has been obtained from World Bank database. Greece has been excluded from the study for lack of requisite data in the study period. From equation 1 and 2, we note that both tariff equivalence calculation and trade growth accounting require proxies for national income. Novy (2013) mentions that GDP data is not suitable for trade calculations as trade volumes mostly include merchandise goods while GDP incorporates the service sector as well. Thus, the present study follows the methodology of Wei (1996) in constructing a proxy for national income using the production data of agriculture, manufacturing and mining sector [10]. x_{ii} is expressed as a difference of nominal GDP minus total exports of the i^{th} country to the rest of the world. The value of σ has been taken to be eight.

IV. Tariff Equivalent Measure of Bilateral Trade for India with EU Partners

Fig. 1 illustrates the percentage decline in the relative bilateral trade cost measure for India with all its EU trading partners. The tariff equivalent measure has significantly fallen for countries like – Poland, Malta, Latvia, France,

Estonia and Slovenia. Interestingly, tariff equivalent has increased for three European Zone countries – Slovakia, Denmark and Bulgaria. On an average the tariff equivalent has fallen by 20 percentage points for European Union Trading partners.

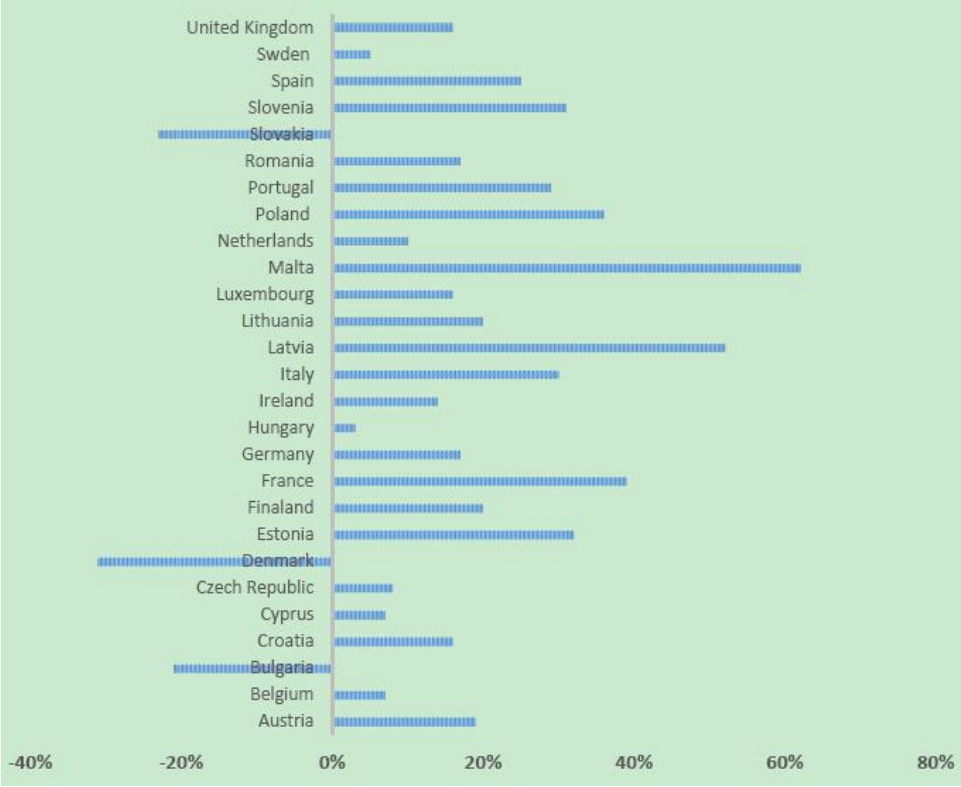

Fig. 1. Percentage points decline in average Novy tariff equivalent across all EU partners (1995-2010).

Though countries like Germany and United Kingdom share high trade volume trade partnership with India, their tariff equivalent has not gone down significantly as compared to the overall average. This is one area which could be looked into by the policymakers, wherein we can try reducing trade barriers with countries which are already our big shot partners. I have created a unified index for European Union by summing the production and export levels to the rest of the world of 27 EU countries so that we have consolidated trade and production volumes for EU as a whole. EU can then be treated as a single country which engages in bilateral trade with India. Given that EU region has a high degree of economic integration and a common currency, our assumptions gain some ground and the analysis becomes far simpler. Fig. 2 illustrates the variation of tariff equivalent for euro zone as a whole over the years with India. Having shown a consistent decline till 2001, the tariff equivalent has stabilised at around 0.5, hence forth.

V. Decomposing Growth of Indian Bilateral Trade with EU Trading Partners

Table I below gives the country wise decompositionof bilateral trade growth for India in the period 1995-2010. The countries have been arranged in the decreasing order of their average bilateral trade volume with India in the aforementioned period. Germany was the biggest trade partner of India in this period, and understandably, has a low tariff equivalent. The same holds for countries like UK, Belgium, Italy and France. Apart from Germany, income growth in all these countries is able to explain more than half of the bilateral trade growth with India. For countries which feature lower down in the table, income growth's contribution to trade growth decreases significantly, with countries like Cyprus, Malta and Estonia showing negative trends. The interpretation of coefficients in the Column 5, 6 and 7 is fairly intuitive. Ideally, one would expect that the growth in income would give a positive stimulus to bilateral trade between countries and correspondingly, the terms appearing in column 5 should ideally have a positive sign. Likewise, decline in bilateral trade barriers relative to the domestic trade should also has a positive impact on percentage trade volume transacted between countries, as given in column 6. Column 7 contains contribution of the decline in multilateral resistance on the relative bilateral trade between countries, which should ideally be negativeas a negative term implies that easing of trading with the rest of the world (the other EU countries in this case) has diverted bilateral trade away from the trading partners under consideration.

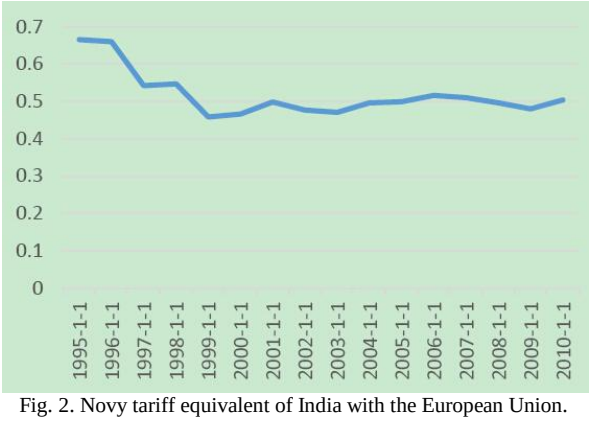

Fig. 2. Novy tariff equivalent of India with the European Union.

TABLE I: BILATERAL TRADE GROWTH ACCOUNTING OF INDIA WITH THE EU PARTNERS (1995-2010)

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Partner Country	Average Bilateral Trade Volume (In million USD)	Percentage Growth in Bilateral Trade	Average Novy's Tariff Equivalent	Contribution of the growth in Income	Contribution of the decline in relative bilateral trade costs	Contribution of the decline in multilateral resistance	Total
Germany	22123085.893	248%	0.765	32%	-82%	150%	100%
United Kingdom	16403803.781	195%	0.679	89%	90%	-79%	100%
Belgium	15072182.617	256%	0.825	81%	72%	-53%	100%
Italy	5788532.936	286%	0.850	59%	105%	-63%	100%
France	4937667.515	326%	0.766	84%	9%	7%	100%
Netherlands	4115913.027	376%	1.076	-25%	174%	-50%	100%
Spain	905534.618	362%	1.227	50%	67%	-17%	100%
Sweden	329639.787	319%	1.103	55%	49%	-4%	100%
Denmark	106998.472	165%	1.160	21%	104%	-25%	100%
Austria	101082.612	390%	1.307	44%	-12%	68%	100%
Finland	60764.359	304%	1.000	42%	136%	-78%	100%
Poland	45158.352	357%	1.381	52%	-37%	84%	100%
Czech Republic	35877.076	437%	1.441	-16%	101%	15%	100%
Romania	31279.841	333%	1.557	30%	40%	30%	100%
Ireland	28768.510	366%	1.597	64%	68%	-32%	100%
Hungary	14468.488	501%	1.707	98%	11%	-8%	100%
Portugal	9483.872	276%	1.505	26%	154%	-80%	100%
Slovenia	5507.145	412%	1.694	88%	-31%	42%	100%
Lithuania	2136.857	684%	1.843	-135%	86%	149%	100%
Slovakia	1304.179	169%	1.874	22%	73%	5%	100%
Bulgaria	1167.995	292%	1.613	-50%	-78%	227%	100%
Malta	918.376	852%	1.857	-10%	389%	-279%	100%
Latvia	439.451	1023%	1.920	35%	-22%	86%	100%
Croatia	387.344	343%	2.217	0%	100%	0%	100%
Cyprus	354.052	326%	1.946	-10%	97%	13%	100%
Estonia	302.634	759%	2.117	-4%	66%	38%	100%
Luxembourg	229.819	422%	2.283	32%	29%	39%	100%

Equation 2 has been utilized to decompose the growth of Indian bilateral trade. Fig. 3 illustrates the contribution of each of the three factors which we discussed above towards the growth in bilateral trade for India with the entire EU region in the period from 1995-2010. The decline in relative bilateral trade costs have had the highest positive impact, 109%. Income growth proxied by GDP levels explain 26% of this growth. Decline in multilateral resistance term has had a negative impact on bilateral trade with EU. This indicates that reduction of multilateral barriers has diverted significant portion of trade from Indian and EU to other regions in the world.

VI. CONCLUSIONS

The results indicate thattrade liberalisation in the last two decades in India has had a significant impact on its bilateral trade with EU. This may also have to do with European Union countries gaining higher degree of political and economic integration in the same period. On an average, the Novy tariff equivalent has declined by 20% points in the period of the study (1995-2010). This relative bilateral trade growth has been fuelled mainly by the decrease of bilateral resistance values across the countries which explain 109% of the trade growth. This spurt in trade has been partially offset by the consequent decrease of multilateral resistance terms (-35%) in the same period. India, particularly, has forged ahead on various trade partnerships in South and South East Asia. India's trade with Middle East countries and U.S. has also picked up in this period which has diverted trade away from EU that is reflected by negative contribution of multilateral resistance term. Since 1994, WTO has started playing a major role in trade liberalisation worldwide which also explains the results of the study. In line with the gravity model framework, the increase in incomes is found to have a substantial impact (26%) on trade growth. Amongst the EU countries, Latvia and Malta have experienced the largest decline in their tariff equivalent for trade with India in the studyperiod. Data shows that this tariff equivalent measure is sensibly related to the average bilateral trading volumes of India with the EU countries so that countries which have traded larger volumes of

merchandise goods with India in the study period have lower average tariff equivalents.

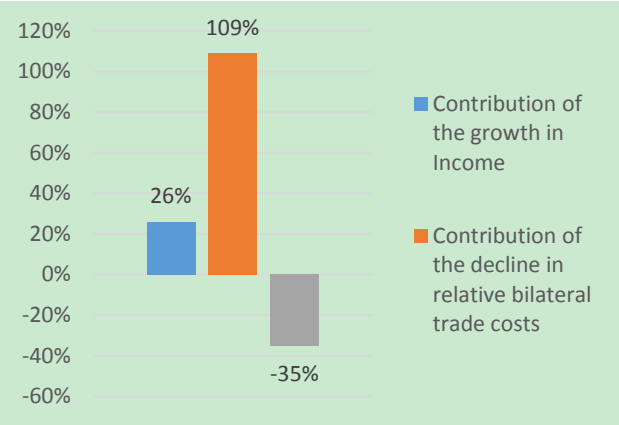

Fig. 3. Percentage decomposition of bilateral trade growth of India with the entire EU (cumulative figures).

APPENDIX

Since, the three contributing factors do not show a consistent behaviour above across all countries, we use regression analysis to estimate the desired relationship. It may be possible that there are other factors, apart from income growth and bilateral and multilateral terms which could explain growth in bilateral trade. For this, the logarithm of trade volume is regressed upon the log values of income growth, tariff equivalent and multilateral resistance term. We would expect that, income growth should be statistically significant with a positive sign which means that higher incomes among the trading partners leads to greater trade between them. The tariff equivalence term should enter the estimated equation with a negative sign, implying that greater the tariff barriers, lesser is the trade between the countries. The multilateral resistance term has a counter intuitive explanation. Higher multilateral resistance term should actually lead to higher bilateral trade between the trading partners because it diverts trade away from the rest of the world to these two trading partners. The regression equation used is:

$$\ln(x_{ijt}x_{jit}) = \alpha_{it} + A\ln(\frac{y_{it}y_{jt}}{y_{wt}}) + B\ln(1+\tau_{ijt}) + C\ln(\Phi_{it}\Phi_{jt}) + \varepsilon_{ijt} \quad (5)$$

TABLE II: FIXED EFFECT ANALYSIS ON TRADE FLOWS

Dependent Variable: Log Trade Volume		
IndependentVariables	**CoefficientValues**	***P*-values**
Constant	5.61*	0.00
Income Growth	1.54*	0.00
Bilateral Resistance Term	-13.54*	0.00
Multilateral Resistance Term	-0.96*	0.00
R^2 **overall = 0.9918** **No. of Observations =1296**		
Note:* representsthe coefficientis significantat 1 percent Levelofsignificancerespectively.		

To make a choice between the different panel data estimation techniques, Hausman test and Breusch-Pagan Lagrange Multiplier (LM) tests are done and these tests favoured the application of fixed effects model.

Table II reports the results obtained by estimating the fixed effects model.

The regression testifies the Anderson-Wincoop gravity model, that income growth, bilateral resistance terms and multilateral resistance values are found to have statistically significant impact on bilateral trade growth. Increase in income has a positive sign which testifies the gravity theoretical framework that similar economic sized countries tend to trade more witheach other. With rising incomes, demand for merchandise goods would rise which would lead to increasing bilateral trade between the countries. Bilateral resistance term has a negative sign which implies that increasing tariff equivalent leads to declining bilateral trade growth, as expected from theory. Multilateral resistance term enters the regression equation with a negative sign which implies that higher multilateral resistance term leads to lower trade with EU countries though theory predicts the opposite that with larger multilateral trade barriers, trade should be diverted away from the rest of the world to between India and EU countries. Multilateral resistance term is significant at 1% probability significance level. The coefficient of determination (R-square) of the regression is very high at around 0.9918. This may be happening because of the functional specification of our regression equation which closely resembles the identity described above in equation 2. Listed below is the bilateral trade growthaccounting of the top 3 trading partners of India in EU.

- Germany

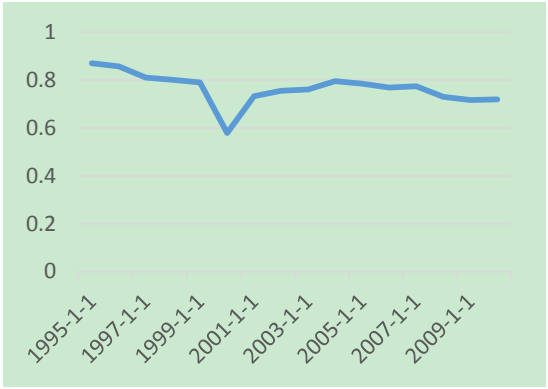

Fig. 4. Novy's tariff equivalent.

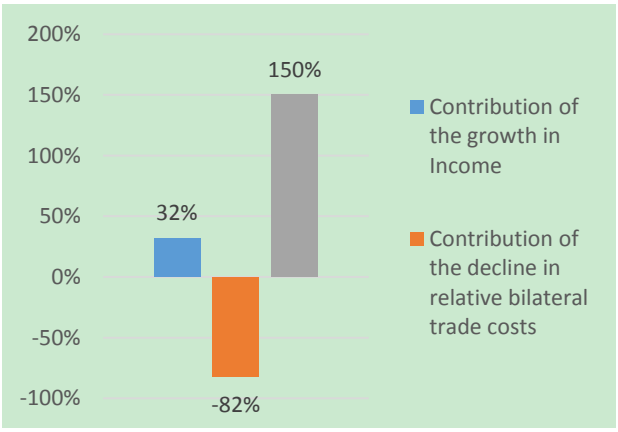

Fig. 5. Percentage-wise decomposition.

- United Kingdom

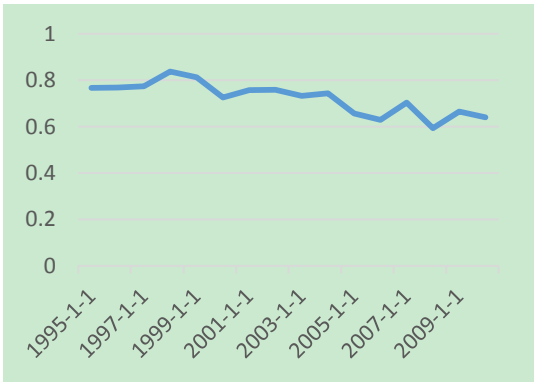

Fig. 6. Novy's tariff equivalent.

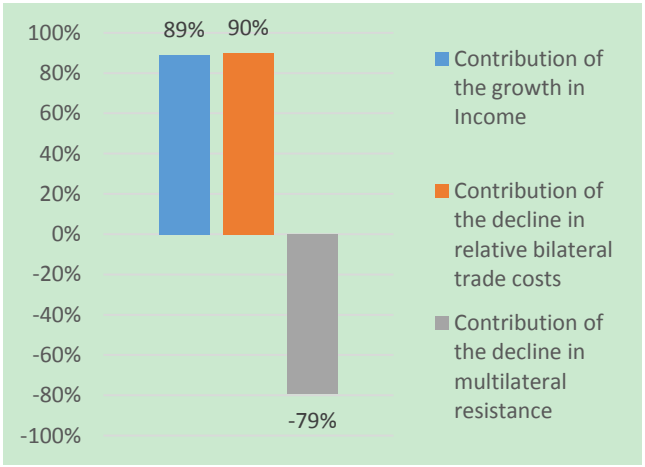

Fig. 7. Percentage-wise decomposition.

- Belgium

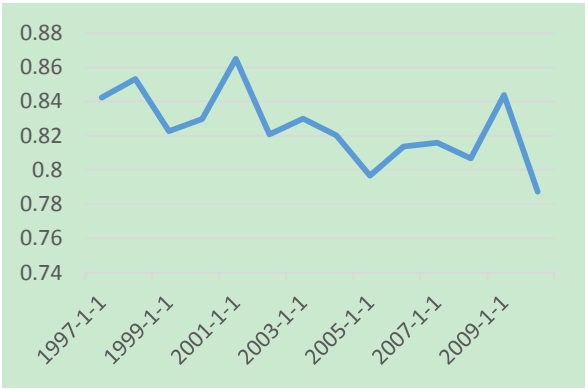

Fig. 8. Novy's tariff equivalent.

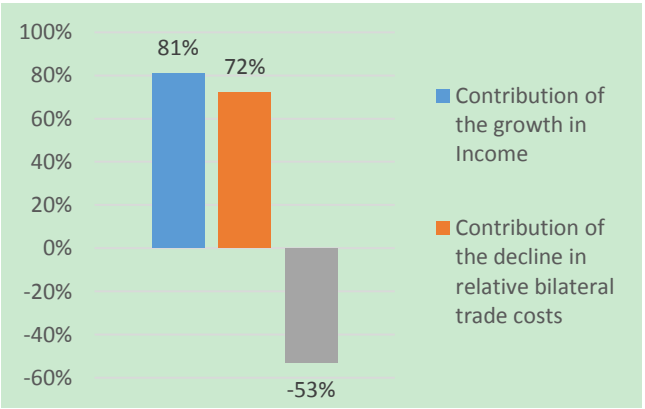

Fig. 9. Percentage-wise dcomposition.

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