Comprehensive Analysis of Tariff Barriers Worldwide: A Composite Assessment Approach

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ARTICLE DETAILS

ABSTRACT

International trade has fundamental importance for all the countries and the analysis concerning international trade particularly concerning tariff barriers is high on the agenda of researchers in the field of economics, business and politics. Aim of the study is to assess the world tariff barriers of 158 countries. Overall design of the study comprises of a crisp literature review, data extraction and analysis. It is a study of one hundred fifty-eight countries that uses secondary data taken from World Development Indicators (WDI) 2020. It uses Grey Relational Analysis (GRA) as research methodology. Results of GRA show that Macao SAR, China, Hong Kong, Singapore, Montenegro, Mauritius, Brunei Darussalam, Myanmar, Chile, Peru and Australia have relatively highest grey relational grades meaning thereby, low tariff trade barriers whereas Grenada, Antigua and Barbuda, Belize, Central African Republic, Nepal, Guinea-Bissau, Fiji, Gabon, Barbados, Djibouti, St. Kitts and Nevis have lowest grey relational grade meaning thereby, these countries have high level of tariff based barriers of international trade. Interestingly, all the member countries of European Union occupy the rank of 27 (i.e. all countries have the same rank) which can be explained in the perspective of their union of tariff. Since, they have uniformed tariff policy as against rest of the world, therefore, have same rank. It is a study based on reliable real time data set. The study has value for all stakeholders i.e. international community, local governments, society at large, policy makers, researchers and international institutions.

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1. Introduction

In the era of globalization, tariff and non-tariff barriers are being removed by most of the countries in general and at bloc level in particular. Certain groups of countries have been very successful in this regard e.g. European Union. Pinpointing and assessing the barriers in international trade at country levels is high on the agenda of mainstream economists. Country level comparisons are also fertile topics being investigated by contemporary researchers. It is important and research worthy for effectiveness of coordinated improvement to facilitate cross border trade. Avalanche of published literature is available in the area viz non-tariff barriers in Syria (Chemingui & Dessus, 2008), trade liberalization and competition in China (Deng et al., 2020), trade policy of Uruguay (Estrades & Flores, 2020), challenges of non-tariff barriers in Japanese Market (Maguire, 2001), tariff & non-tariff barriers and examine of inequality and trade policy of India (Ural Marchand, 2019), challenges of regulating water and sanitation tariff in Brazil (Sampaio & Sampaio, 2020), non-tariff barriers on chicken import in Russia (Soon & Thompson, 2020), income inequality and tariff reform in Indonesia (Vadila & Resosudarmo, 2020), China’s tariffs on U.S. hardware product (Zhang et al., 2020). From the context stated in the literature it can be learned that country level assessment of tariff related barriers is imperative to provide insights to the stakeholders. It is an evergreen issue for research. Particularly the composite assessment of tariff barriers is call of the day. Objective of the research is therefore to assess, rank and discuss position of 158 countries on tariff related trade barriers. The study has been built on mathematical methodology opted from wide array of methodological choices viz ANP, FANP, DEMATEL, AHP, PROMETHEE, TOPSIS, DEA, GRA, VIKOR, SWARA, ISM, TISM, MICMAC, FMICMAC, IPA, ELECTRE, NSGA-II, MADM, MAGDM, ARAS-F, FMEA-Model, ELECTRE-III, COPRAS-G, MULTI-MOORA, ARAS, WASPAS, MOORA, LP, IRP, SEM and Regression. To be more specific the study uses Grey Relational Analysis (GRA) as technique of data analysis. GRA is the most popular and applied part of grey systems theory. Rest of the paper is arranged as literature review, methodology, analysis & discussion and conclusion.

2. Literature Review

The problem under investigation is espoused in the domain of economics in general and in international trade in particular. The literature of economics in the context of international trade is filthy rich. It is pertinent to set out the context of the study to account for the relevant contemporary literature. In this context, we explored wide range of literature from within the renowned data bases such as ScienceDiret, Emerald, Wiley Blackwell, Taylor&Francis, JStor, Ebsco Host, etc. Apart from the general literature on international trade, while exploring the literature, researchers found numerous studies carried in the context of tariff and non-tariff barriers (Chemingui & Dessus, 2008; Cheong & Tang, 2018; Daly et al., 2000; DaSilva-Glasgow, 2020; Fugazza & Maur, 2008; Grundke & Moser, 2019; Imbruno, 2016; Jørgensen & Schröder, 2003; Juust et al., 2020; Knobel et al., 2019; Liu et al., 2019; Magee et al., 2019; Maguire, 2001; Manzoor et al., 2019; Niu et al., 2018; Okumura, 2015; Santeramo & Lamonaca, 2019; Schuenemann & Kerr, 2019; Soon & Thompson, 2020; Toshimitsu, 2008; Winchester, 2009). Aisbett and Silberberger (2020) found that countries where tariff liberalization is higher, producers can adopt a relatively cheaper standard and perform at top of the list. Cambini and Soroush (2019) proposed a grid tariffs to account for costs under mechanism of net metering and concluded that employing a multi-part tariffs (variable component that imitates net effect on operating cost together with fixed component that imitates cyclical grid-connection cost of distribution networks) there is possibility to mitigate the snags of optimize prosumption and net metering. Cary (2020) uncovered that tariffs implementation invoke inefficiency, furthermore it has no effect on carbon dioxide emissions but has direct positive relationship with carbon intensities. Giammetti (2020) bolstered that Brexit costs not only for UK but also for many Europeans countries, at worst, the 0.28 and 0.5 % of value added respectively and allowed countries and sectors to partially substitute the foreign products. Hayakawa et al. (2020) analyzed the relationship of import-tariff and export expansions and found a direct positive relationship between them. The study further reported that 1% decrease in importers’ tariff escalate 0.8% import freight rates; reduce around 1.1% export freight rates and increase export by 0.6% to 1%. He et al. (2019) affirmed that optimal
tariffs significantly decrease by 26% globally on average after trade imbalance which is advantageous to the global trade liberalization. Juust et al. (2020) documented that confiscation of non-tariff industry specific barrier played a pertinent role in expediting European automotive exports. Kang and Dagli (2018) argued that high tariff has significant negative direct and indirect impact on trade. It is further highlighted that indirect negative effect has bigger impact than direct impact. Knobel et al. (2019) carried a comprehensive empirical study and bolstered that decrease in non-tariff barriers and decrease in time in trade costs of goods result in significant improvement in welfare gains as % of consumption of 1.7% for Kazakhstan, 4.8% for Armenia, 7.2% for Belarus and 3.6% for Russia. Nawaz (2019) proposed a dynamic model that originates an optimal tariff for specific import to curtail the efficiency losses during adjustment procedure. Ortiz Valverde and Latorre (2020) stated that removal of UK’s tariff, advent of MFN tariffs and removal of restriction to migration broadly impacts on micro and macroeconomic of UK, China, US, EU and rest of the world. Slany (2019) revealed a significant negative impact of trade policies on foreign value added of charged tariff and positive correlated with telecommunication infrastructure. Tovar (2019) asserted that there is evident of tariff complementarity i) consumption rises, ii) greater reduction in import protection and iii) fall in imports from rest of the world. Vadila and Resosudarmo (2020) investigated that provinces having acquaintance to tariff liberalization experiencing relatively lesser income inequality, the study further highlighted that tariff cuts cause in decrease in poverty reduction. From the representation of the literature it is evident that there is enormous dispersed literature directly and indirectly related to the trade barriers. However, there is hardly any study that directly addresses the issue at global level. In order to specify the issue, it is not out of context to postulate the theoretical framework of the study.

3. Theoretical Framework
The study follows theoretical framework as used in World Development Indicators (WDI-2020) for representation of data set. Since, the study has adopted the data set from WDI, therefore, the variables specifications, unit of measurement and the definitions have also been adopted from WDI (Table 1). However, the variables as specified have been explored and aligned with the existing literature. A brief representation of literature concerning the variables is herein accounted for. Suwanprasert (2020) asserted that trade restrictiveness index of non-tariff barriers can be achieved weighted average mean of non-tariff barriers and it is further claimed that aggregated of non-tariff barriers can exactly be measured unlike other indexes having persistent measurement errors. Ino and Miyaoka (2020) affirmed that in case of homogenous products, higher domestic welfare is evident than import tariff to maximize profitability of domestic industry; and in case of differentiated products production control mechanism is fluctuated depending upon the variability of the products. The study further argued that government has control over domestic production of foreign firms particularly for homogenous products. Kuenzel (2020) found a significant inverse relationship between tariff overhangs and trade policy activity. Different share of tariff lines result in alternate outcome; like lower tariff overhangs compel countries to increase Most-Favored Nation (MFN) applied rates without consideration of past tariff independent changes and legal ramifications. Lichtenberg and Olson (2020) buttressed that tariff rates put insignificant effects on anticipated intrusive pest introductions facing presently positive tariffs. It is further proclaimed that different tariff lines share may result in lower consumer welfare and weaken United States trade policy.

<table>
<thead>
<tr>
<th>Code</th>
<th>Variable</th>
<th>Measure</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All Products Binding Coverage</td>
<td>% MRV</td>
<td>Smaller is Best</td>
</tr>
<tr>
<td>2</td>
<td>All Products Weighted Mean tariff</td>
<td>% MRV</td>
<td>Smaller is Best</td>
</tr>
<tr>
<td>3</td>
<td>All Products Share of Tariff lines with International Peaks</td>
<td>% MRV</td>
<td>Smaller is Best</td>
</tr>
<tr>
<td>4</td>
<td>All Products Share of Tariff lines with Specific Rates</td>
<td>% MRV</td>
<td>Smaller is Best</td>
</tr>
<tr>
<td>5</td>
<td>Primary Products Weighted Mean Tariff</td>
<td>% MRV</td>
<td>Smaller is Best</td>
</tr>
<tr>
<td>6</td>
<td>Manufactured Products Weighted Mean Tariff</td>
<td>% MRV</td>
<td>Smaller is Best</td>
</tr>
</tbody>
</table>

The variables have been selected from the website of WDI on the basis of availability of the data and relevance to the phenomenon under investigation. Total six variables (Table 1) qualify for inclusion in
investigation. All variables possess the characteristic “smaller is best”.

4. Methodology
This quantitative research study follows positivism as research philosophy and deduction as research approach. It is a study of 158 countries using the secondary data extracted from the website World Development Indicators (WDI) 2020. Overall design of the study entails on review of literature, data elicitation and analysis. Traditional procedure of Grey Relational Analysis (GRA) has been applied to the data as a technique of analysis. GRA is unique methodology that has the capability to accommodate wide range of alternatives with multitude of different criteria. The scheme of symbols and the procedure has been adopted from Ertugrul et al. (2016); Qazi et al. (2021) and Niazi et al. (2021).

4.1 Grey Relational Analysis
Step 1: Created a data set and established decision matrix

\[ x_i(k) = \begin{bmatrix} x_1(1) & x_1(2) & \cdots & x_1(m) \\ \vdots & \vdots & \ddots & \vdots \\ x_n(1) & x_n(2) & \cdots & x_n(m) \end{bmatrix} \]

Table 2: Tariff Data of Countries

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Country</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<td>5.5</td>
<td>4.5</td>
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</table>

Source of Data: (World Development Indicators (WDI), 2020)

Step 2: Created reference series and comparison matrix

\[ x_0 = [x_0(1) \cdots \cdots \cdots x_0(n)] \]

Table 3: Reference Sequence and Comparable Sequences

<table>
<thead>
<tr>
<th>Sr.</th>
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<tr>
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<td>5</td>
<td>18.9</td>
<td>6</td>
<td>5.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Step 3: Created a normalized matrix

\[ \text{Smaller the best } x_i(k) = \frac{\max x_i^{(0)}(k) - x_i^{(0)}(k)}{\max x_i^{(0)}(k) - \min x_i^{(0)}(k)} \]

Table 4: Normalized Comparable Sequences

<table>
<thead>
<tr>
<th>Sr.</th>
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<th>1</th>
<th>2</th>
<th>3</th>
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</tbody>
</table>
For example, calculation of Albania, ‘all products binding coverage’.

\[ x_1^*(1) = \frac{\max x^n_1(1) - x^0_1(1)}{\max x^n_1(1) - \min x^0_1(1)} = \frac{100 - 100}{100 - 0} = 0.0000 \]

Step 4: Obtained absolute values by calculating deviation sequence from desires value Equation 4.

\[ \Delta_0 (y) = |x_0(y) - x_1(y)| \quad \text{Equation 4} \]

Table 5: Deviation Sequences

<table>
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<th>Sr.</th>
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<td>157</td>
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</table>

Step 5: Established a co-efficient matrix of grey relation system Equation 5.

\[ \gamma[x^*_0(k), x^*_1(k)] = \frac{\Delta_{\min} + \xi \Delta_{\max}}{\Delta_{\max}}, \quad 0 < \gamma[x^*_0(k), x^*_1(k)] \leq 1 \quad \text{Equation 5} \]

Table 6: Grey Relational Co-efficient

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Country</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</table>

For example, grey relational co-efficient for ‘all products weighted mean tariff’.
Step 6: Calculated GRA grade *Equation 6 and Equation 7*

\[
\gamma(x_0, x_1) = \sum_{k=1}^{n} \beta_k \gamma [x_0^k(k), x_1^k(k)]
\]

\[
\sum_{k=1}^{n} \beta_k = 1
\]

**Table 7: Grey Relational Grades (GRGs)**

<table>
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<tr>
<th>Sr.</th>
<th>Country</th>
<th>GRGs</th>
</tr>
</thead>
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<tr>
<td>110</td>
<td>Panama</td>
<td>0.7006</td>
</tr>
<tr>
<td>...</td>
<td>...........</td>
<td>...</td>
</tr>
<tr>
<td>157</td>
<td>Zambia</td>
<td>0.7228</td>
</tr>
<tr>
<td>158</td>
<td>Zimbabwe</td>
<td>0.6449</td>
</tr>
</tbody>
</table>

For example, calculation of GRG for Angola:

\[
\gamma(x_0, x_1) = \sum_{k=1}^{n} \beta_k \gamma [x_0^k(k), x_1^k(k)]
\]

\[
= 0.1667 \times (0.3333 + 0.5276 + 0.6231 + 1.0000 + 0.5135 + 0.5848) = 0.5971
\]

5. Results & Discussion

The phenomenon of tariff barriers has of fundamental importance in international trade. It is an evergreen area investigated by economists. Therefore, the study in hand has also taken it as object of investigation. This study has approached the issue in different way. It used secondary data and applied mathematical methodology from gray system theory to analyze compositely a multitude of cross sections and criteria. Study used GRA, the results of which are given below (Table 8). In order to provide logical and structured understanding to the readers the study has evolved scheme of classifying the countries on the basis of their performance on removing, eliminating or minimizing the tariff barriers.

**Table 8: Results of Grey Relational Analysis**

<table>
<thead>
<tr>
<th>Country</th>
<th>GRG*</th>
<th>Rank</th>
<th>Country</th>
<th>GRG*</th>
<th>Rank</th>
<th>Country</th>
<th>GRG*</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Sequence</td>
<td>1.0000</td>
<td>0</td>
<td>United Kingdom</td>
<td>0.7770</td>
<td>27</td>
<td>Ecuador</td>
<td>0.6575</td>
<td>106</td>
</tr>
<tr>
<td>Macao SAR, China</td>
<td>0.9402</td>
<td>1</td>
<td>El Salvador</td>
<td>0.7728</td>
<td>54</td>
<td>Argentina</td>
<td>0.6569</td>
<td>107</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>0.9167</td>
<td>2</td>
<td>Indonesia</td>
<td>0.7708</td>
<td>55</td>
<td>Uruguay</td>
<td>0.6555</td>
<td>108</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.8972</td>
<td>3</td>
<td>North Macedonia</td>
<td>0.7697</td>
<td>56</td>
<td>Bangladesh</td>
<td>0.6458</td>
<td>109</td>
</tr>
<tr>
<td>Montenegro</td>
<td>0.8890</td>
<td>4</td>
<td>United States</td>
<td>0.7670</td>
<td>57</td>
<td>Zimbabwe</td>
<td>0.6449</td>
<td>110</td>
</tr>
<tr>
<td>Mauritius</td>
<td>0.8856</td>
<td>5</td>
<td>Mozambique</td>
<td>0.7666</td>
<td>58</td>
<td>Brazil</td>
<td>0.6353</td>
<td>111</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td>0.8823</td>
<td>6</td>
<td>Kyrgyz Republic</td>
<td>0.7616</td>
<td>59</td>
<td>Guyana</td>
<td>0.6322</td>
<td>112</td>
</tr>
<tr>
<td>Myanmar</td>
<td>0.8717</td>
<td>7</td>
<td>Nicaragua</td>
<td>0.7603</td>
<td>60</td>
<td>Ghana</td>
<td>0.6312</td>
<td>113</td>
</tr>
<tr>
<td>Chile</td>
<td>0.8683</td>
<td>8</td>
<td>Armenia</td>
<td>0.7602</td>
<td>61</td>
<td>Tonga</td>
<td>0.6278</td>
<td>114</td>
</tr>
<tr>
<td>Peru</td>
<td>0.8611</td>
<td>9</td>
<td>Kazakhstan</td>
<td>0.7557</td>
<td>62</td>
<td>Mauritania</td>
<td>0.6271</td>
<td>115</td>
</tr>
<tr>
<td>Australia</td>
<td>0.8564</td>
<td>10</td>
<td>Georgia</td>
<td>0.7517</td>
<td>63</td>
<td>Kenya</td>
<td>0.6224</td>
<td>116</td>
</tr>
</tbody>
</table>
Results of GRA show that Macao SAR China, Hong Kong, Singapore, Montenegro, Mauritius, Brunei Darussalam, Myanmar, Chile, Peru and Australia have relatively highest GRGs, therefore have relatively low tariff trade barriers, whereas, Grenada, Antigua and Barbuda, Belize, Central African Republic, Nepal, Guinea-Bissau, Fiji, Gabon, Barbados, Djibouti, St. Kitts and Nevis have lowest GRGs, therefore have high level of tariff based barriers of international trade. All the member countries of European Union occupy rank 27 (i.e. all countries have the same rank) which can be explained in the perspective of their union on tariff. Since, they have uniformed tariff policy as against rest of the world, therefore, and have same GRG as for as the tariff barriers are concerned, therefore, occupy the same rank.

With an aim of assessment of world tariff barriers and analysis of secondary data is performed in order to rank the countries. It is vital to evaluate countries’ performance qua each other. Applying the procedure of GRA the data was normalized, compared with reference series, deviation were calculated, GRA coefficient was worked out and the coefficient were computed. On the basis of GRG, grades have
been computed and arranged in descending order. This methodology is different and unique and less applied in the area of economics. Hence, this study is different from contemporary studies; however its results are aligned with contemporary literature. The results of this study can be contrasted with that of some studies from existing literature (Table 9).

### Table 9: Contrast of Results of the Study with Contemporary Literature

<table>
<thead>
<tr>
<th>Studies</th>
<th>Focus</th>
<th>Variables/Factors</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>Tariff barriers</td>
<td>Weighted average mean of tariff, products, tariff, share of tariff, tariff rates.</td>
<td>Grey relational analysis</td>
<td>China, Hong Kong, Singapore rank on top of the 158 countries having low tariff barriers. EU occupy at rank 27. Gabon, Barbados, Djibouti and Kitts &amp; Nevis occupy bottom, hence, have high levels of tariff trade barriers.</td>
</tr>
<tr>
<td>Kuenzel (2020)</td>
<td>WTO tariff commitments and temporary protection</td>
<td>Trade policy, political economy motives, macroeconomic factors, import surges and terms-of-trade effects, retaliation</td>
<td>Fixed effects logit model, linear probability model</td>
<td>It is found a significant inverse relationship between tariff overhangs and trade policy activity.</td>
</tr>
<tr>
<td>Lichtenberg and Olson (2020)</td>
<td>Government-induced production commitment vs. import tariff Trade</td>
<td>Production control policy, domestic social welfare, import tariff</td>
<td>Empirical analysis</td>
<td>Different tariff lines share may result in lower consumer welfare and weaken United States trade policy.</td>
</tr>
<tr>
<td>Suwanprasert (2020)</td>
<td>Restrictiveness Index of Non-Tariff Barriers</td>
<td>Preference, production, non-tariff barriers, equilibrium</td>
<td>Simulation, statistics equation</td>
<td>Aggregated of non-tariff barriers can exactly be measured by using proposed model.</td>
</tr>
</tbody>
</table>

The studies: Kuenzel (2020), Lichtenberg and Olson (2020) and Suwanprasert (2020) are comparable with the study in hand and are in general aligned with it. However, our study is different in number of countries under study, variables under study, methodology used, results and information contributed towards the body of knowledge.

6. Conclusion

International trade is a reality and the tariff barriers are intertwined with international trade. Rationalization, changes, elimination and reduction in tariff barriers is a continuous process having fundamental importance. It remained high on agenda of research in every regime. Comparing countries on basis of tariff is natural. This study also has same agenda but it approaches it in novel way. It uses GRA to compare countries and contributes valuable information in form of grey coefficients and grey relational grades. Study compares selected 158 countries on basis of six variables (Table 1). Results show that Macao SAR China, Hong Kong, Singapore, Montenegro, Mauritius, Brunei Darussalam, Myanmar, Chile, Peru and Australia are the countries that have high Grey Relational Grades (GRGs) rank on top among 158 countries meaning thereby low levels of tariff trade barriers. The member countries of EU (viz Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom) have 0.7770 GRG and occupy rank 27 (i.e. the same rank). Since, EU is a union of European countries on tariff, therefore, they are graded identical qua rest of the world. Whereas, Grenada, Antigua and Barbuda, Belize, Central African Republic, Nepal, Guinea-Bissau, Fiji, Gabon, Barbados, Djibouti, St. Kitts and Nevis have low GRGs and occupy bottom ranks meaning thereby having high levels of tariff trade barriers. The study has theoretical and practical contributions towards body of knowledge that include grey relational coefficients and grades calculated for each country. It is useful for political governments for redressing policies, businessmen for rethinking and reframing the trade priorities, for researchers to refine the research frameworks. This study has some limitations as well. Firstly, it is based
on cross sectional secondary data taken from WDI 2020 therefore the contextual limitation exists. Future studies may use some other dataset to verify the results qua reality. Secondly, it uses GRA as methodology the results should be confirmed through equivalent methods. Thirdly all variables have been given equal weights by dividing 1 by six (number of variables) this scheme can be rationalized by using Entropy method or expert opinion method.

References
Eurasian Economic Union: what are the benefits of successful implementation or wider liberalization?. *Eurasian Geography and Economics, 60*(2), 177-210.


