TANGLED WARFARE IN A VICIOUS CIRCLE: A QUANTITATIVE ANALYSIS ON THE WTO SAFETY VALVE MEASURES AND NETWORK

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ABSTRACT

It is approaching three decades since the establishment of the World Trade Organization (hereinafter "WTO"), whose founding aim, liberalization, has allowed it to successfully change the pattern of trading among its Members, exerting a profound impact on the global economic and political environment. Owing to the creation of the General Agreement on Tariffs and Trade (GATT) in 1948 and the inception of its successor, the WTO, in 1995, the world's merchandise exports and imports have experienced tremendous growth. Even so, during the course of lowering barriers and encouraging trade, this robust system has also provided a "safety valve" mechanism to its Members, so as to protect their national interests against any "unfair" competition or "unforeseen development" accompanying that trade liberalization. This "safety valve" (hereinafter "SV"), consisting of Anti-dumping, Anti-subsidy, and Safeguard measures, entitles Members to legitimately adopt protective remedies against the negative impact of foreign importation. Unfortunately, however, it has also become a problem itself. In particular, empirical evidence documenting the increasing use of "SV" measures (hereinafter "SVM") has resulted in a growing number of disputes being brought before the Dispute Settlement Body (DSB) of the WTO. Under this circumstance, WTO Members adopted different strategies to impose their own SVMs

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against the others or to cooperate/counterattack when facing investigations initiated by their counterparties. While academia has devoted decades of attention to this tangled warfare in terms of SVM, previous empirical analyses have primarily focused on a single type of SVM and have been limited to a case-by-case basis, failing to provide an overview of all SVMs from a longitudinal perspective. Furthermore, despite the widespread acknowledgement and application of quantitative research methods by scholars across various disciplines in the past decades, there have been limited quantitative studies in this area, with a few exceptions from purely economic perspectives. In light of these circumstances, this study intended to explore the overall situation of the global SVM application over the past twenty-five years and whether a deeper understanding of the SV mechanism can be obtained from a global/macro level through the application of quantitative approaches. To achieve this, this study initially collected all SVM investigations initiated by the WTO Members from 1995 to 2020, constructing a database that focuses on key components of a typical SVM investigation, such as players, products, duration, etc., so as to obtain a comprehensive understanding on the global application of SV measures from chronological and categorical angles. In addition, this study employed various quantitative research techniques to analyze the database extensively, identifying trends of the global SVM application during 1995-2020, and revealing the interrelationships between imposing members, targeted products, types of SVM, and days of measure in force. Furthermore, an SVM network was established, accompanied by an exploration of key players and essential features within the network. Based on these findings, this study offered perspectives on the related implications and proposed feasible ways to alleviate the current tangled SVM warfare in a vicious circle.

KEYWORDS: *anti-dumping, anti-subsidy, safeguard, safety valve, quantitative analysis, network analysis, WTO*

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Table of Contents

I. Literature Review on Empirical and Quantitative Research 387
A. Previous Empirical Research on SVM 387
B. Previous Application of Quantitative Research Method 389
C. Quantitative Research and Questions 390
II. Methodology 390
A. Sampling 391
B. Measures 392
1. Imposing Member Category 392
2. Targeted Products Category 392
3. Types of SVM 392
4. Days of Measure 393
C. Data Analysis Techniques 393
III. Findings 395
A. General Trends of Global SVM Application During 1995-2020 395
B. SVM of Different Member Groups 400
C. Targeted Products by Different Member Groups 402
D. SVM for Different Targeted Products 403
E. Duration of SVM Adopted by Different Member Groups 404
F. Lasting Period for Each SVM 405
G. Lasting Period for Different Targeted Products 406
H. Network of SVM Global Application 407
IV. Discussion 417
A. Trends of SVM 417
B. Key Features of the SVM Imposition 418
C. Structure of the SVM Network and the Key Players Thereof 420
V. Implications and Limitations 421
VI. Conclusion 424

I. LITERATURE REVIEW ON EMPIRICAL AND QUANTITATIVE RESEARCH

A. Previous Empirical Research on SVM

Understandings of the global application of safety valve measure can be gained from various research angles. In terms of empirical research, previous works analyze the economic or political aspects of an individual safety valve (hereinafter "SV") case or measure. Among numerous studies, the majority of them only focused on specific aspects of certain SV measures (hereinafter "SVM"). For instance, in the regime of anti-dumping area, Hyung Jin Kim

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focused on the economic cost of anti-dumping investigations in Korea.[1] Hyerim Kim and Dukgeun Ahn reviewed the United States (hereinafter "US") anti-dumping practices on surrogate country method for non-market economy.[2] For anti-subsidy research, Piyusha Chandra provided empirical evidence, supporting that tighter subsidy rules might lead to a decrease in the pace of tariff liberalization, using China's accession to the World Trade Organization (hereinafter "WTO") for a case study.[3] Sherzod Shadikhodjaev, used the dispute of *India — Export Related Measures* to examine the status of special economic zone incentive under the multilateral subsidy regime and discuss the relevant anti-subsidy practice.[4] When it came to safeguards, Benjamin H. Liebman used a US panel data set of product-level monthly price observations between 1997 and March 2005 to test the importance of the safeguards compared to other possible determinants and found that declining production capacity, improved macroeconomic conditions and a falling dollar helped return prices to healthier levels instead of safeguards measures.[5] Bown and McCulloch developed an approach for empirical analysis of discriminatory impact of safeguards measures, attempting to approximate dynamic specifications in the context of cross-sectional data.[6] Following the same approach, Volkan Sezgin further examined the trade impacts of sixteen safeguard duties implemented by Turkey between 2003 and 2013, demonstrated that these safeguard measures effectively exerted a discriminatory impact on imports from Turkey's major trading partners.[7]

As can be seen from the above works, previous empirical analysis largely focused on a single type of SVM, and especially on certain economic or political aspects. Such an approach is worthwhile, however, analysis on a case-by-case basis may make the discipline liable to miss changes that occur in the aggregate.[8] For this reason, this study acquired and used a database with more comprehensive information coving the lifespan of SV measures, from 1995—the foundation date of the WTO, to 2020—the year before the

[1] Hyung Jin Kim, *The Korean Anti-Dumping System*, 30(2) J. WORLD TRADE 101, 126-27 (1996).
[2] Hyerim Kim & Dukgeun Ahn, *Empirical Evidence on Surrogate Country Method for Non-Market Economy: US Anti-Dumping Policy Towards China*, 42(8) WORLD ECON. 2452, 2452 (2019).
[3] Piyush Chandra, *WTO Subsidy Rules and Tariff Liberalization: Evidence from Accession of China*, 23(8) J. INT'L TRADE & ECON. DEV. 1170, 1170 (2014).
[4] Sherzod Shadikhodjaev, *The WTO Agreement on Subsidies and Countervailing Measures and Unilateralism of Special Economic Zones*, 24(2) J. INT'L ECON. L. 381, 381 (2021).
[5] Benjamin H. Liebman, *Safeguards, China, and the Price of Steel*, 142(2) REV. WORLD ECON. 354, 381 (2006).
[6] *See generally* Chad P. Bown & Rachel McCulloch, *The WTO Agreement on Safeguards: An Empirical Analysis of Discriminatory Impact*, *in* EMPIRICAL METHODS IN INTERNATIONAL TRADE: ESSAYS IN HONOR OF MORDECHAI KREININ 145 (Michael G. Plummer ed., 2004).
[7] Volkan Sezgin, *Analysis of the Impacts of Safeguard Actions: Evidence from Turkey*, 22(1) CENT. BANK REV. 49, 49 (2022).
[8] Michal Ovádek & Akhil Raina, *The Evolution of EU Trade Law Through the Prism of Competence: A Quantitative, Longitudinal Perspective*, 53(3) J. WORLD TRADE 489, 489 (2019).

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world economy suffered a severe interruption by the Covid-19 pandemic, as to seek possible patterns from such chronological massive data set.

B. Previous Application of Quantitative Research Method

A proper data set provides a foundation for further data analysis. However, the selection of a quantitative research method is also important to figure out the best way to utilize such a data set. Besides the doctrinal methods, in the international trade law regime, scholars usually adopt various quantitative research methods that were prevalent in the economic studies.

Vandenbussche and Zanardi used the gravity model to reveal the chilling effects of anti-dumping duties on bilateral trade from 1980 to 2000.[9] Besedeš and Prusa estimated the import reduction effects of anti-dumping duties based on a random effects probit model, their work indicated that the effects of US anti-dumping duties on trade were greater during the stage before the final determination.[10] Wang, Wang and Feng applied the global simulation model (GSIM) developed by Francois and Hall, to predict the trade impact and welfare effects generated from the parallel anti-dumping (hereinafter "AD") and countervailing duties (hereinafter "CVD") imposition, showed that China has not formed a complete value chain of the Photovoltaic (PV) industry that is internationally competitive.[11] In another study on Japan's safeguards on agriculture products, Kazutaka Takechi employed both hedonic price model with a difference-in-difference framework and a discrete-choice model to investigate the impact of this safeguards measure, resulted that the safeguards measure only increased the transaction prices, not the profits of the domestic producers.[12]

It is obvious that, for SVM-related studies, the majority of the quantitative research methods employed by scholars were purely from economic perspectives. However, besides those economic aspects, an SV measure involves, by nature, other important elements, including the imposing member, the product, the counterparty and the duration—few works have ever applied quantitative research methods to investigate these key components and their interactions. Thus, what were the relationships

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[9] Hylke Vandenbussche & Maurizio Zanardi, *The Chilling Trade Effects of Antidumping Proliferation*, 54(6) EUR. ECON. REV. 760, 760 (2010).

[10] Tibor Besedeš & Thomas J. Prusa, *The Hazardous Effects of Antidumping*, 55(1) ECON. INQUIRY 9, 9 (2017).

[11] Hua Wang et al., *The Economic Effects of Anti-Dumping and Anti-Subsidy Policies Among China, the US and the EU: The Photovoltaic Industry*, 63(3) SING. ECON. REV. 513, 513 (2018); J.F. Joseph Francois & H.K Hall, *Global Simulation Analysis of Industry-Level Trade Policy*, WORLD INTEGRATED TRADE SOL. (2002), https://wits.worldbank.org/WITS/docs/GSIMMethodology.pdf.

[12] Kazutaka Takechi, *Do Domestic Producers Benefit from Safeguards? The Case of a Japanese Safeguard on Chinese Vegetable Imports in 2001*, 55(101024) JAPAN & WORLD ECON. 1, 1 (2020).

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between these key components and how they interacted are still uncharted territory that urges to be developed.

C. Quantitative Research and Questions

Having understood these gaps, this study intends to review the global application of SVM by tracking the historical applications of the SV measures implemented by the WTO members in the past twenty-five years (1995-2020). In addition, this study, in line with SV investigation components, introduced the elements of the imposing members, the targeted members, the products under consideration/measure, the type of SV measures and the duration of measures into the scope of review and further analysis. In particular, by introducing these key components, the following research questions were raised to evaluate the SVM investigations applied by the WTO members during the past twenty-five years:

1. RQ_1: What were the trends of the SVM investigations from 1995 to 2020?
2. RQ_2: Did different WTO Member groups take different measures when applying their SVM?
3. RQ_3: Did different WTO Member groups target different product groups when applying their SVM?
4. RQ_4: Were different product groups targeted differently by different SV measures?
5. RQ_5: Did different WTO Member groups impose their SVM for different periods of measure in force?
6. RQ_6: Did different types of SVM last for different periods of measure in force?
7. RQ_7: Were different product groups targeted differently in relation to the period of measure in force?
8. RQ_8: How did WTO Members interact in the SVM network?

II. METHODOLOGY

An official database, the Integrated Trade Intelligence Portal (hereinafter "I-TIP"), was established and maintained by the WTO to provide "a single entry point for information compiled by the WTO on trade policy measures".[13] One of its major features, the I-TIP Database on Goods

[13] The integrated Trade Intelligence Portal [hereinafter I-TIP] covers both tariff and non-tariff measures affecting trade in goods as well as information on trade in service, trade in government procurement markets, regional trade agreements and the accession commitment of WTO members. *See Integrated Trade Intelligence Portal (I-TIP) Improving the Transparency of Trade Policy Measures*, WORLD TRADE ORG. [hereinafter WTO], https://www.wto.org/english/res_e/statis_e/itip_e.htm.

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provides comprehensive information on non-tariff measures (hereinafter "NTM") applied by the WTO Members in merchandised trade based on data collected from various official sources, including the semi-annual reports on the SVM investigations submitted by the Members to the WTO committees of respective SV practices.[14] To answer the above research questions, a content analysis was conducted based on the data collected from the I-TIP Goods Database. The details of sampling, measures and data analysis techniques were presented in the following sections.

A. Sampling

By applying a detailed query function, and selecting five criteria related to SVM (type of NTM, dates, country imposing, country affected, and product), the I-TIP Goods Database generated a tabular listing of SVMs. The table was exported with detailed SVM information in Excel format as the raw database for further data cleaning. In the extracted database, any dumping, countervailing and safeguards notifications and measures (if any) initiated by any members against any other members between 1947 to 2020 on any products were recorded with details on dates of initiation, in force and withdrawal, as well as descriptions on products under investigation and the Harmonization System Code (HS Code).[15] The database covers 6907 measures. Table 1 provides a summary of the proportion of each type of SVM acquired from the I-TIP Goods Database.

TABLE 1: Sample Composition of SVM Investigation (N=6907)

Type of SVM	Number of Measures	Ratio
Anti-dumping	5851	84.71%
Anti-subsidy	608	8.80%
Safeguards	448	6.49%

[14] Members report their anti-dumping investigations to the Committee on Anti-Dumping Practices in their semi-annual reports under article 16.4 of the agreement on anti-dumping, report their anti-subsidy investigations to the Committee on Subsidies and Countervailing Measures in their semi-annual reports under article 25.11 of the agreement on countervailing, and report their safeguards investigations to the Committee on Safeguards in their notifications under article 12.1 (a) of the agreement on safeguards.

[15] The earliest data on the non-tariff measures [hereinafter NTM] in the I-TIP Goods Database starts from January 1, 1947. The inclusion of SVMs initiated before the establishment of the WTO (January 1, 1995) was because these SVMs did not terminated with the ear of the General Agreement on Tariffs and Trade [hereinafter GATT], instead, many of them were still in force after the foundation of the WTO.

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Total	6907	100.00%

It is important to note that the I-TIP Goods Database gathers information related to SVMs from semi-reports submitted by WTO Members. However, the information provided in these reports does not follow a fixed format or standard, and Members usually submit information based on their domestic SVM-related laws. Therefore, the raw data obtained from the I-TIP Goods Database needs to be cleaned before further analysis. Thus, based on the descriptions in the original reports, missing values and wrong entries were fixed. In addition, categorization on "imposing Member category", "product category", "type of SVM", and "days of measure in force" was done and assigned to each investigation to unify the granularity of the cases.

B. Measures

1. Imposing Member Category — Two attributes were assigned to the imposing members according to their levels of development (developed or developing) and geographic locations (Africa, Asia, Europe, North America, Oceania and South America).[16] The intention of such categorization was to investigate whether members of different levels of development or from different geographic locations acted differently when applying SVM.

2. Targeted Products Category — The products under investigation covered various types of merchandize, from chemicals and steel used as raw materials in manufacturing industries to footwear and bicycles that are ready to sell as finished products to mass consumers. Also, many of the listed products under investigation are usually deemed as intermediate products that although ready to circulate to mass consumers but mainly purchased as inputs for further industrial manufacturing (e.g., vehicle wheels and copy paper). Thus, to investigate whether different product categories were treated differently in the past SVM investigations, the products listed in the database were categorized into three groups: (1) raw materials; (2) consumer market finished products, and (3) intermediate products.

3. Types of SVM — Based on the nature of investigations, all measures were categorized into three groups, anti-dumping, anti-subsidy and safeguards. According to the data collection methodology of the I-TIP Goods Database, when one notification referred to more than one investigation, usually seen as parallel anti-dumping and anti-subsidy

[16] The majority of Members listed in the database are developing and developed countries/regions, with only one exception of Zambia, which accounts for one entry of measure in the database. To avoid outlier in the data analysis, Zambia and its measure were categorized under the "developing" member group.

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investigations, two entries were counted separately as two individual investigations.

4. Days of Measure — To evaluate the impact of an SVM, the lasting period of the measure could be used as a meaningful index. To be more specific, the period between "measure in force" and "measure withdrawn" quantifies the length of time span in which an SVM may exert its negative impact on the Members/markets affected. Thus, days of measures were calculated accordingly and assigned to the investigations which entered into force from 1995 to 2020. For those investigations initiated and entered into force prior to the foundation of the WTO, the starting point of calculating the days of measures is January 1, 1995—as to focus on their existence and impact under the WTO regime.

C. Data Analysis Techniques

Multiple data analysis techniques were applied to investigate the prepared database, as to maximize potential outcomes that may be generated from the raw data. Also, the selection of data analysis techniques and software related were based on (1) the need to answer specific research questions; (2) the nature of the data, and (3) the assumptions requirement of each analysis technique that needs to be fulfilled for the validation of the analysis.

Excel Pivot function was applied to investigate the general trends of SVM applications from 1995 to 2020. The pivot function provides a powerful tool to calculate, summarize and analyze data. The outcomes of Excel Pivot analysis can be shown as tables and figures that enable explicitly illustration of desired comparisons, potential patterns and trends. It is especially suitable for analysis of large datasets.

Chi-square test of homogeneity (R x 2) was applied to investigate whether different Member groups took different measures when applying their SVM and whether different Member groups targeted different product groups when applying their SVM. The chi-square test of homogeneity (R x 2) is used to determine whether two multinomial probability distributions are equal in the population, which means whether a statistically significant difference exists in the probabilities between two independent groups in terms of a multinomial dependent variable. If the test result is positive, a post hoc test could be applied to determine where the difference in proportions lies between the two groups of independent variables.[17] There are five assumptions of a chi-square test of homogeneity: (1) the dataset has one dependent variable that has three or more categories; (2) the dataset has two

[17] *Chi-Square Test of Homogeneity (R x 2 Table)*, LAERD STATISTICS, https://statistics.laerd.com/premium/spss/cstohrx2/chi-square-test-of-homogeneity-rx2-in-spss.php.

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independent groups; (3) independence of observations; (4) random assignment to groups; and (5) all cells or the r x 2 table should have an expected count greater than or equal to five.[18]

Chi-square test of independence (R x C) was applied to investigate whether different product groups were targeted differently by different SV measures. The chi-square test of independence (R x C) is used to test a variety of sizes of contingency tables and more than one type of null and alternative hypotheses. The test is also known as the chi-square test for association. [19] There are four assumptions of a chi-square test of independence: (1) two variables were measured at the categorical level; (2) independence of observations; (3) cross-sectional sampling was used; and (4) all cells should have expected counts greater than or equal to five.[20]

Kruskal-Wallis H test was applied to investigate whether different Member groups imposed their SVM for different periods of measure in force, whether different types of SVM lasted for different periods of measure in force and whether different product groups targeted differently in relation to the period of measure in force. Kruskal-Wallis H test (also known as the "one-way ANOVA on ranks") is a rank-based nonparametric test that is usually used to determine whether there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable.[21] There are four assumptions of a Kruskal-Wallis H test: (1) one dependent variable that is measured at the continuous or ordinal level; (2) one independent variable that consists of two or more categorical, independent groups; (3) independence of observations; and (4) determination on shapes of distribution of scores for each group of independent variable.[22]

To conduct the above three tests, the data analysis software SPSS was used to calculate various indexes and export relevant tables and graphs.

In addition, to explore how the WTO Members interacted in the SVM network, the Network Analysis was conducted by using R and its environment.[23] Network Analysis focuses on the formulation and solution of

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[18] *Chi-Square Test of Homogeneity (R x 2 Table)*, LAERD STATISTICS, https://statistics.laerd.com/premium/spss/cstohrx2/chi-square-test-of-homogeneity-rx2-in-spss-10.php.

[19] *Chi-Square Test of Independence (R x C Table)*, LAERD STATISTICS, https://statistics.laerd.com/premium/spss/cstoirxc/chi-square-test-of-independence-rxc-in-spss.php.

[20] *Chi-square Test of Independence (R x C Table)*, LAERD STATISTICS, https://statistics.laerd.com/premium/spss/cstoirxc/chi-square-test-of-independence-rxc-in-spss-11.php.

[21] *Kruskal-Wallis H Test*, LAERD STATISTICS, https://statistics.laerd.com/premium/spss/kwht/kruskal-wallis-test-in-spss.php.

[22] *Kruskal-Wallis H Test*, LAERD STATISTICS, https://statistics.laerd.com/premium/spss/kwht/kruskal-wallis-test-in-spss-3.php#basic-requirements.

[23] The network analysis of this study was focusing on interactions between WTO Members, thus, given a safeguards measure is one member taking measure against all other trading partners of the world. It is by nature not suitable to be included in the network analysis which was based on a structure with each one node represent as one WTO member. Thus, only anti-dumping and anti-subsidy practices were included into the dataset for the network analysis.

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problems that have a network structure. It centers on relations between individuals, groups, or social institutions. R is a language and environment for statistical computing and graphics.[24] In terms of Network Analysis, R provides easy ways for measuring different centralities and their correlations, as well as the network density. Based on results from R, Gephi was used to plot relevant networks for better visualization of the network structure and the relationships between each node.[25]

By applying above the data analysis techniques, this study provided a full picture of the trends and patterns of the SVM investigations from 1995 to 2020, revealing relationships and associations between different Member groups, product groups, types of SVM and days of measure in force. In addition, interactions between Members were indexed with visualization of the networks. Detailed findings are discussed in the following section.

III. FINDINGS

In this section, the results for each analysis were reported following the sequence of proposed research questions listed in subsection 1.3.

A. General Trends of Global SVM Application During 1995-2020

Previous study showed that, from 1979 to the 15th year of operation of the WTO, the value of world exports had risen by an average of 7.1 per cent per annum (as of 2009), while the annual growth in global contingency measures was positively related to the growth of annual global export.[26] The data revealed a fact that—more trade means more frequent use of contingency measures. While tariff barriers and other instruments of protection were still playing substantially in the world trading system, the AD/CVD/SG measures gradually constituted the substitution of one set of instruments of flexibility, i.e., the SVMs. As a relatively developed instrument, the AD investigation has attracted attention from the very first years since the inception of the WTO, while the CVD and SG measures have also been resorted, but with less frequency.

When seeking a comprehensive understanding of the development of the SVMs, the revised I-TIP Goods Database, which provides detailed data on historical global SVM investigations (initiations, measures and terminations) on different categories of products under investigation enabled a further analysis for a comprehensive overview on the global SVM application during the WTO era with more data granularity. In particular,

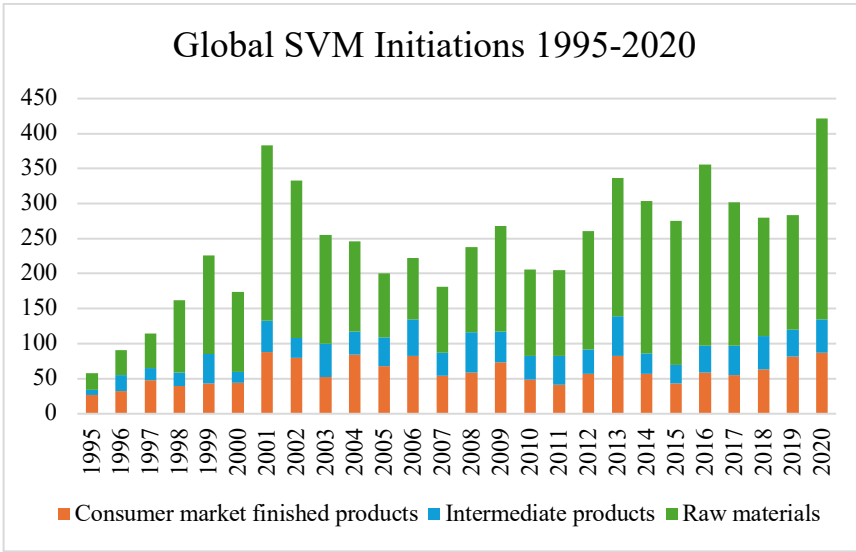
[24] *What is R?*, R, https://www.r-project.org/about.html.
[25] Gephi is a leading visualization and exploration software for graphs and networks.
[26] WTO, WORLD TRADE REPORT 2009: TRADE POLICY COMMITMENTS AND CONTINGENCY MEASURES 131 (2009).

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several trends of global SVM application from 1995 to 2020 were identified, as follows.

Starting with initiations, the trends of SVM initiations on Intermediate Products and Consumer market finished products were slightly and gradually increasing from 1995 to 2020, while the initiations on Raw Materials fluctuated sharply and accounted for the largest proportion among the total initiations in each year, see Figure 1.

FIGURE 1: Global SVM Initiations 1995-2020



In terms of each type of SVM, the AD initiations formed the general trend of the SVM application, while the CVD initiations experienced a different pattern, showing a rapid increase, especially since 2005. For the SG initiations, the general shape of the histogram is similar to the AD initiations. Nevertheless, it is noteworthy that "Consumer market finished products" account for a considerable proportion of the total products under the SG investigations and only a few "Intermediate products" were ever confronted with an SG investigation during the same period., see Figure 2, Figure 3 and Figure 4.

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FIGURE 2: Global AD Initiations 1995-2020

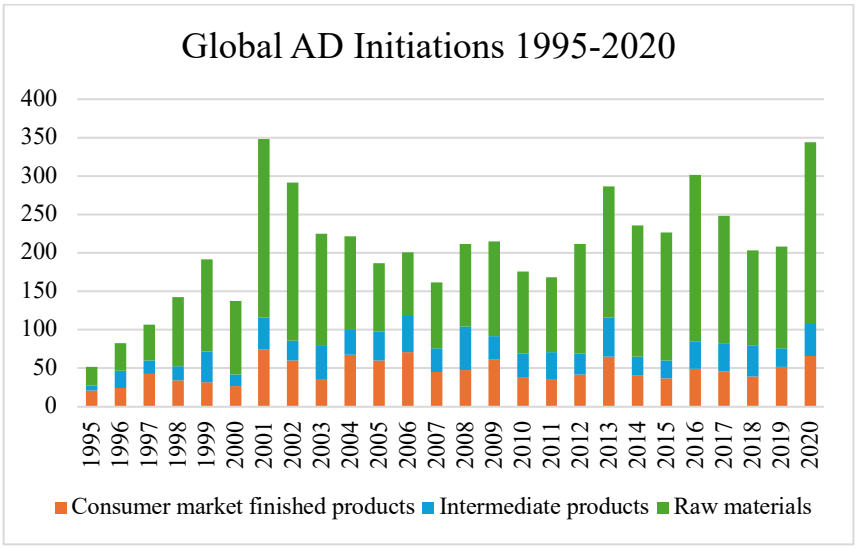
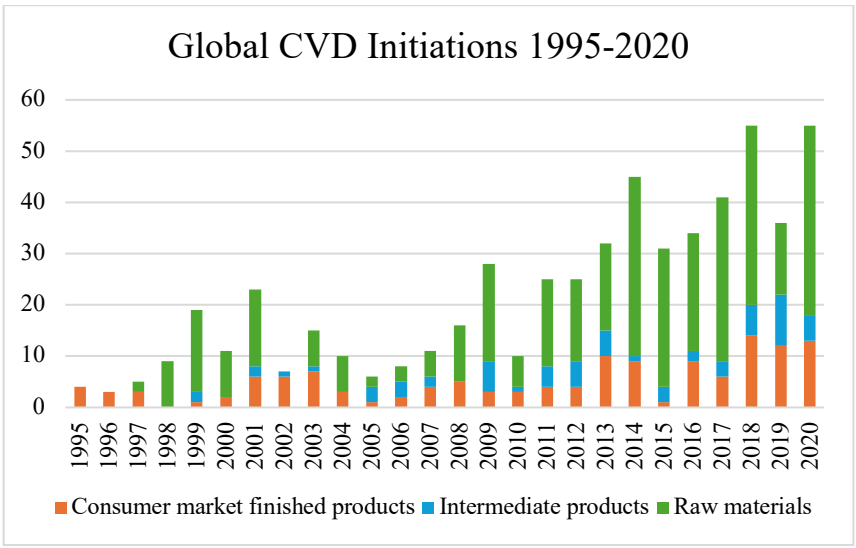
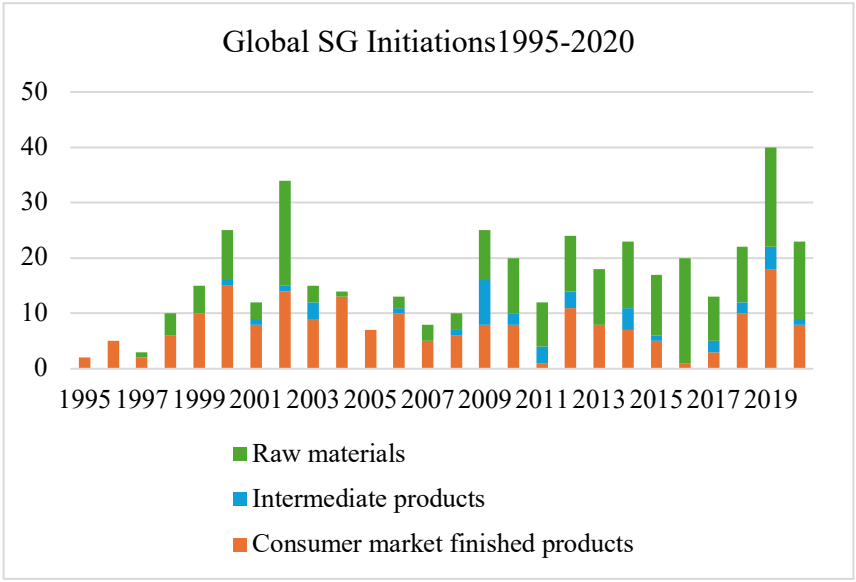


FIGURE 3: Global CVD Initiations 1995-2020



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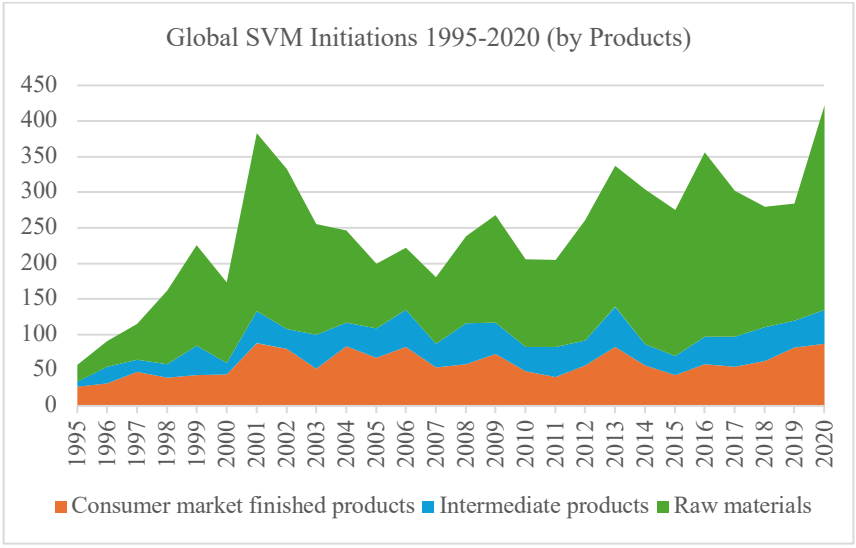
FIGURE 4: Global SG Initiations 1995-2020



However, the SVM investigations targeting different product categories were followed different trends. Figure 5 shows the shapes of the trend for each product category. While the trends of intermediate products and consumer market finished products followed similar shapes with slight differences in the numbers of respective annual initiations, the trend of raw materials experienced dramatic fluctuations and accounted for large proportions among the total annual initiations.

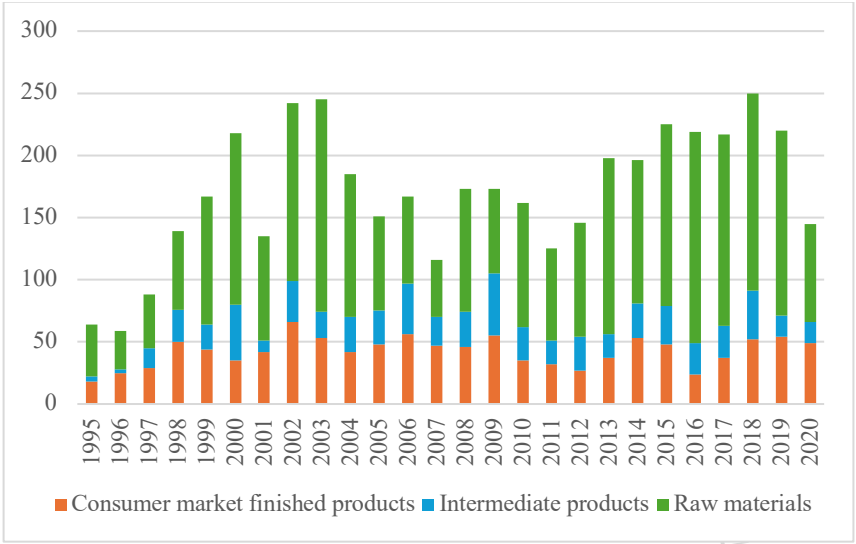
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FIGURE 5: Global SVM Initiations 1995-2020 (by Products)



The shape of Figure 6 illustrates that the trends of SVM enforcement were similar to the ones of the initiations, as well as the respective proportions of each category of product under investigation.

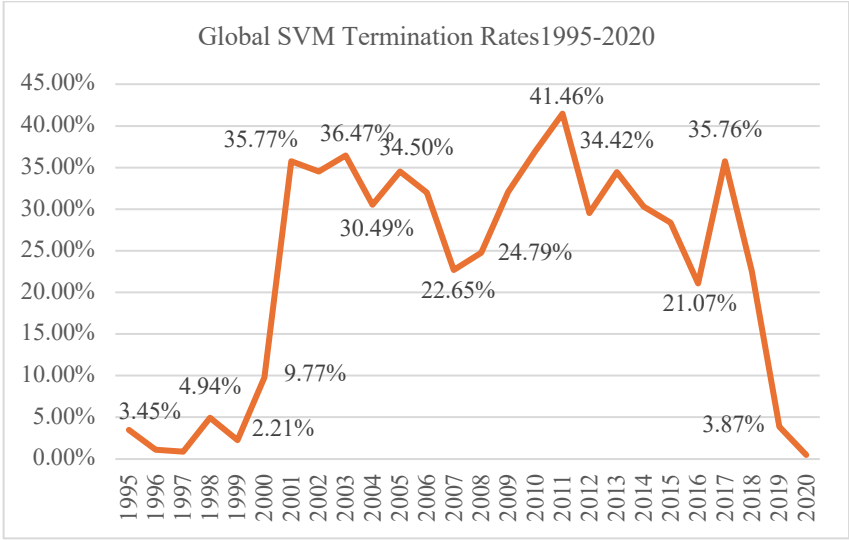
FIGURE 6: Global SVM Measures 1995-2020 (Total)



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In addition, one trend that is noteworthy is that, while many SVM investigations did not proceed with measures during the investigation periods, some of them ended up with the termination of the investigations. Figure 7 shows the global SVM termination rates from 1995 to 2020.

FIGURE 7: Global SVM Termination Rates 1995-2020



B. SVM of Different Member Groups

Did different Member groups take different measures when applying their SVM? To answer this question, this study applied a chi-square test of homogeneity (R x 2) to explore whether developed WTO Members take different SVM measures compared to the developing WTO Members.

A pre-test of chi-square of homogeneity was conducted between the imposing Member category and the types of SVM. All expected cell counts were greater than or equal to five with the lowest expected cell count equal to 90.8. Assumptions of the test were fulfilled (Table 2).

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TABLE 1: Types of SVM Measure * Imposing Member Category Crosstabulation (Expected Count)

Expected Count

		Imposing Member category		Total
		developed country	developing country	
Types of SVM measure	AD	1652.4	2442.6	4095.0
	CVD	144.9	214.1	359.0
	SG	90.8	134.2	225.0
Total		1888.0	2791.0	4679.0

Following the pre-test, a chi-square test of homogeneity was run, with an adequate sample size established according to Cochran.[27] The two multinomial probability distributions were not equal in the population, $\chi^2(2) = 395.015$, $p < .001$. There was a statistically significant difference in the multinomial probability distributions between the two groups ($p < .001$). See Table 3.

TABLE 2: Chi-Square Tests for Types of SVM Measure * Imposing Member Category Crosstabulation

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	395.015[a]	2	.000
Likelihood Ratio	423.070	2	.000
Linear-by-Linear Association	1.570	1	.210
N of Valid Cases	4679		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 90.79.

The above results of the chi-square tests showed that there were statistically significant differences between the imposition of different types of SVM by the developed WTO Members and the developing WTO Members.

To understand how three types of SVM contribute to the above overall difference, a post hoc analysis involved pairwise comparisons using multiple z-tests of two proportions with a Bonferroni correction was conducted. Statistical significance was accepted at $p < .016667$. The post hoc analysis showed that there were statistically significant differences in the proportion

[27] William G. Cochran, *Some Methods for Strengthening the Common χ2 Tests*, 10(4) BIOMETRICS 417, 418-21 (1954).

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of the developed WTO Members and the developing WTO Members when applying AD, CVD and SG measures respectively, $p < .001$ was found in all tests.

C. Targeted Products by Different Member Groups

Another chi-square test of homogeneity (R x 2) was conducted to explore whether different Member groups targeted different products groups when applying their SVM.

A pre-test of chi-square of homogeneity was conducted between the imposing Member category and the targeted product category. All expected cell counts were greater than or equal to five with the lowest expected cell count equal to 270.8. Assumptions of the test were fulfilled (Table 4).

TABLE 3: Products Category * Imposing Member Category Crosstabulation (Expected Count)

Expected Count

		Imposing Member category		Total
		developed country	developing country	
Products category	raw materials	1146.0	1694.0	2840.0
	consumer market finished products	471.3	696.7	1168.0
	intermediate products	270.8	400.2	671.0
Total		1888.0	2791.0	4679.0

Following the pre-test, a chi-square test of homogeneity was run, with an adequate sample size established according to Cochran. The two multinomial probability distributions were not equal in the population, $\chi^2(2) = 63.288$, $p < .001$. There was a statistically significant difference in the multinomial probability distributions between the two groups ($p < .001$). See Table 5.

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TABLE 4: Chi-Square Tests for Products Category * Imposing Member Category Crosstabulation

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	63.288[a]	2	.000
Likelihood Ratio	65.132	2	.000
Linear-by-Linear Association	62.265	1	.000
N of Valid Cases	4679		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 270.75.

The above results of the chi-square tests showed that there were statistically significant differences between the targeted products category when the developed WTO Members and the developing WTO Members applied their SVM.

To understand how individual product category was targeted under the overall differences, a post hoc analysis involved pairwise comparisons using multiple z-tests of two proportions with a Bonferroni correction was conducted. Statistical significance was accepted at $p < .016667$. The post hoc analysis showed that there were statistically significant differences in the proportion of the developed WTO Members that targeted raw materials when applied their SVM than the developing WTO Members (n = 1257, 66.6% versus n = 1583, 56.7%), as well as the proportion of the developed WTO Members that targeted intermediate products when applied their SVM than the developing WTO Members (n = 188, 10.0% versus n = 483, 17.3%), $p < .001$. There were no statistically significant differences in the proportion of the developed WTO Members that targeted consumer market finished products when applied their SVM than the developing WTO Members (n = 443, 23.5% versus n = 725, 26%), $p = .051$.

D. SVM for Different Targeted Products

According to the nature of variables, Chi-square test of independence (R x C) was applied to investigate whether different product groups were targeted differently by different SV measures. A pre-test of chi-square test of independence was conducted between the targeted products category and the types of SVM measure. All expected cell frequencies were greater than five, the minimum expected count was 32.27, thus assumptions of the test were fulfilled. The result showed that there was a statistically significant association between products category and the types of SVM measure, $\chi^2(4) = 66.27$, $p < .001$. See Table 6.

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TABLE 5: Chi-Square Test of Independence for Types of SVM Measure * Products Category Crosstabulation

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	66.265[a]	4	.000
Likelihood Ratio	60.618	4	.000
Linear-by-Linear Association	.203	1	.653
N of Valid Cases	4679		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 32.27.

The above results of the chi-square of independence illustrated that there was a statistically significant association between the targeted products category and the types of SVM measure. However, the test did not present the strength/magnitude of such an association. Thus, Cramer's V was investigated to further understand the nature of the association.[28] In the current test, Cramer's V = .084, presenting a small association, according to Cohen.[29]

E. Duration of SVM Adopted by Different Member Groups

To explore whether different Member groups imposed their SVM for different periods of measure in force, A Kruskal-Wallis H test was conducted to determine if there were differences in CWWS score between different categories of the WTO Members with different days of measure in force. Distributions of CWWS scores were similar for all groups, as assessed by visual inspection of a boxplot. Median CWWS scores were statistically significantly different between groups, $\chi^2(1) = 58.637$, $p < .001$. See Table 7.

[28] Cramer's V is a measure that does provide an estimate of the strength of the association between your two variables and the value of Cramer's V can be found in the Symmetric Measures table. Cramer's V ranges in value from 0 to +1 with a value of 0 indicating no association to a value of 1 indicating complete association. *See* JACOB COHEN, STATISTICAL POWER ANALYSIS FOR THE BEHAVIORAL SCIENCES 223 (2d ed. 1988).

[29] *Id*.

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TABLE 6: Kruskal-Wallis H Test for Days of Measure in Force Across Imposing Member Category

Independent-Samples Kruskal-Wallis Test Summary

Total N	4679
Test Statistic	58.637[a,b]
Degree of Freedom	1
Asymptotic Sig.(2-sided test)	.000

a. The test statistic is adjusted for ties.
b. Multiple comparisons are not performed because there are less than three test fields.

The results showed that there were statistically significant differences between different developed WTO Members and developing WTO Members in relation to the days of measure in force during their implementation of respective SVM.

F. Lasting Period for Each SVM

Another Kruskal-Wallis H test was conducted to determine if there were differences in CWWS score between different types of SVM in relation to the lasting period of days of measure in force. Distributions of CWWS scores were similar for AD and CVD groups (not similar for SG), as assessed by visual inspection of a boxplot. Median CWWS scores were statistically significantly different between groups, $\chi^2(2) = 355.428$, $p < .001$. See Table 8.

TABLE 7: Kruskal-Wallis H Test for Days of Measure in Force Across Types of SVM Measure

Independent-Samples Kruskal-Wallis Test Summary

Total N	4679
Test Statistic	355.428[a]
Degree of Freedom	2
Asymptotic Sig.(2-sided test)	.000

a. The test statistic is adjusted for ties.

The test confirmed that there were statistically significant differences between different types of SVM in relation to the lasting days of their implementation. Based on this finding, a *post hoc* test (medians) was conducted to further explore such differences. Pairwise comparisons were performed using Dunn's procedure with a Bonferroni correction for multiple

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comparisons.[30] Adjusted *p*-values are presented in Table 9. This post hoc analysis revealed statistically significant differences in CWWS scores between SG (*Mdn* = 924) and CVD (*Mdn* = 1900) ($p < .001$), SG and AD (*Mdn* = 2097) ($p < .001$) and CVD and AD ($p = .009$).

TABLE 8: Pairwise Comparisons of Types of SVM Measure

Pairwise Comparisons of Types of SVM Measure

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
SG-CVD	1516.510	114.849	13.204	.000	.000
SG-AD	1736.190	92.488	18.772	.000	.000
CVD-AD	219.681	74.347	2.955	.003	.009

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

G. Lasting Period for Different Targeted Products

In addition, whether different product groups were targeted differently in relation to the period of measure in force was also analyzed by applying a Kruskal-Wallis H test. The results of the test showed that distributions of CWWS scores were similar for all groups, as assessed by visual inspection of a boxplot. Median CWWS scores were statistically significantly different between groups, $\chi2(2) = 8.612$, $p = .013$. See Table 10.

TABLE 9: Kruskal-Wallis H Test for Days of Measure in Force Across Targeted Product Category

Independent-Samples Kruskal-Wallis Test Summary

Total N	4679
Test Statistic	8.612[a]
Degree of Freedom	2
Asymptotic Sig.(2-sided test)	.013

a. The test statistic is adjusted for ties.

The test confirmed that there were statistically significant differences between different categories of targeted products in relation to the lasting

[30] Olive Jean Dunn, *Multiple Comparisons Using Rank Sums*, 6(3) TECHNOMETRICS 241, 241-43 (1964).

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days of imposition. Based on this finding, a post hoc test (medians) was conducted to further explore such differences. Pairwise comparisons were performed using Dunn's procedure with a Bonferroni correction for multiple comparisons.[31] Adjusted p-values are presented in Table 11. The post hoc analysis showed CWWS scores between Consumer Market Finished Products (Mdn = 1906) and Intermediate Product (Mdn = 2084.00) (p = .814), Consumer Market Finished Products and Raw Materials (Mdn = 2008.50) (p = .011), and Intermediate Products and Raw Materials (p = .803). The adjusted p-values showed that the differences on the days of measure in force were statistically significant between Consumer Market Finished Products and Raw Materials. However, such differences were not found between other pairwise comparisons.

TABLE 10: Pairwise Comparisons of Targeted Products Category

Pairwise Comparisons of Targeted Products Category

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
consumer market finished products-intermediate products	-71.983	65.429	-1.100	.271	.814
consumer market finished products-raw materials	136.254	46.951	2.902	.004	.011
intermediate products-raw materials	64.271	57.977	1.109	.268	.803

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is .05.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

H. Network of SVM Global Application

A Network Analysis was conducted under the R environment to evaluate the interactions in relation to the impositions of SVM between the WTO Members during the past twenty-five years. In particular, the data on AD and CVD was used to structure an SVM network.[32] The WTO Members involved were categorized by development and geographic location. The network centralities were firstly measured. Table 12 listed the "Top 10" of Members

[31] *Id*.
[32] *See supra* note 23.

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with the highest degree centrality, eigenvector centrality and betweenness centrality.

TABLE 11: Centralities in the SVM Network (Top 10)

	Member	Degree Central	Member	Eigen vector	Member	Between ness
1	United States	102	China	1.000	United States	1527.937
2	India	86	India	0.795	Canada	774.990
3	Brazil	82	United States	0.766	European Union	574.310
4	Canada	74	European Union	0.481	Brazil	555.763
5	European Union	74	Korea	0.369	Turkey	529.488
6	China	66	Brazil	0.331	India	490.601
7	Turkey	66	Taiwan, China	0.250	Mexico	458.547
8	Argentina	54	Argentina	0.242	New Zealand	372.931
9	Australia	53	Turkey	0.235	South Africa	351.430
10	Korea	50	Canada	0.214	Pakistan	325.562

In addition, network densities were calculated to investigate the magnitude of SVM imposition at global and regional levels. The results of respective density are shown in Table 13.

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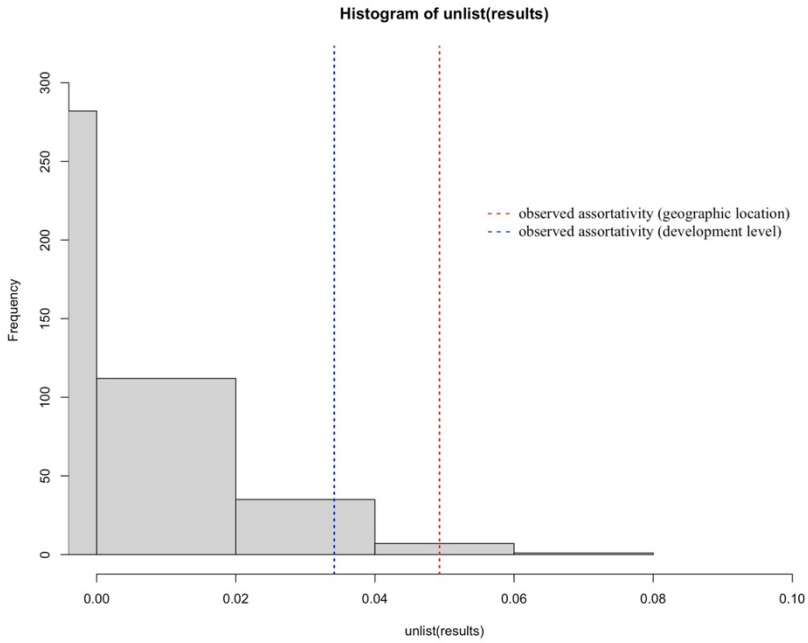
TABLE 12: Network Density

Geographic Locations	Network Density
Asia	0.2297297
North America	0.3076923
South America	0.6
Europe	0.06219512
Africa	0.09090909
Global	0.1408085

Moreover, the analysis also resulted in the observed assortativity (based on geographic location) of the network at 0.04928197, and the observed assortativity (based on development level) of the network at 0.03415493, showing a diversified pattern of assortativity within the SVM network, see Figure 8.

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FIGURE 8: Observed Assortativity of the SVM Network



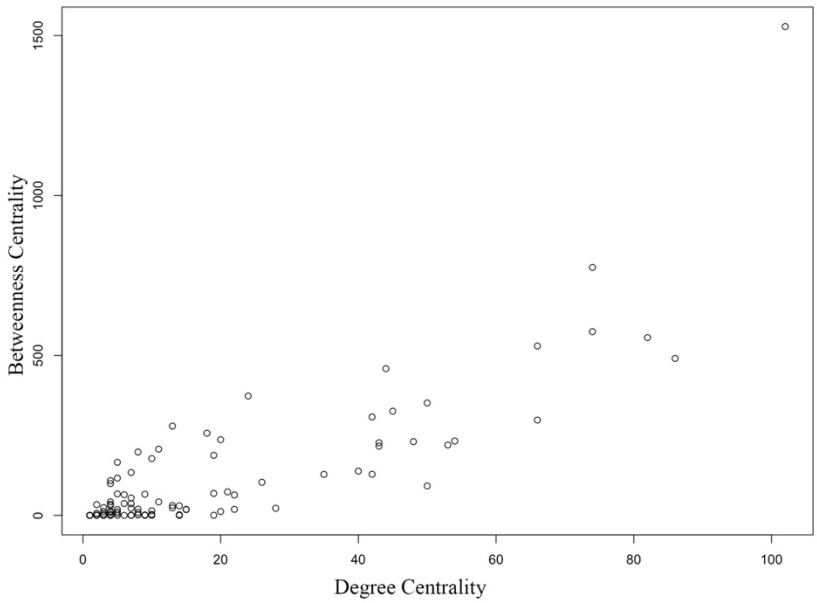
As it can be seen from the histogram, compared to a randomly created network, the real dataset has higher scores based on classifications of both geographic locations and development levels, however, the differences were not significant according to the visual inspection and the absolute figures.[33]

Further, the correlation between degree and betweenness centrality, and the correlation between degree and eigenvector centrality were also calculated. The scores resulted at 0.8363 and 0.8456 respectively, indicating strong correlations between these centralities. (Figure 9 and Figure 10)

[33] Assortativity ranges from -1 to 1. Once all edges are connected between the same type of vertices, assortativity score is 1.

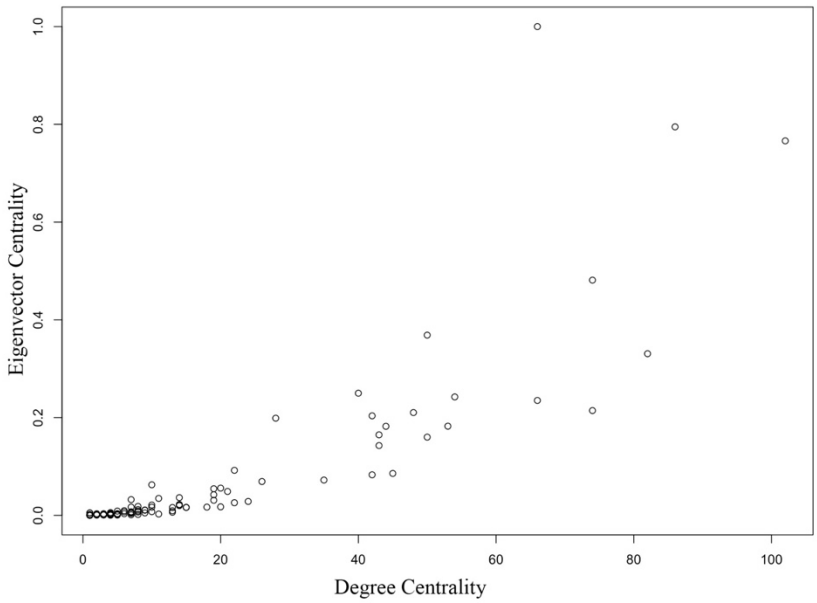
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FIGURE 9: Correlation Between Degree and Betweenness Centrality in the SVM Network



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FIGURE 10: Correlation Between Degree and Eigenvector Centrality in the SVM Network

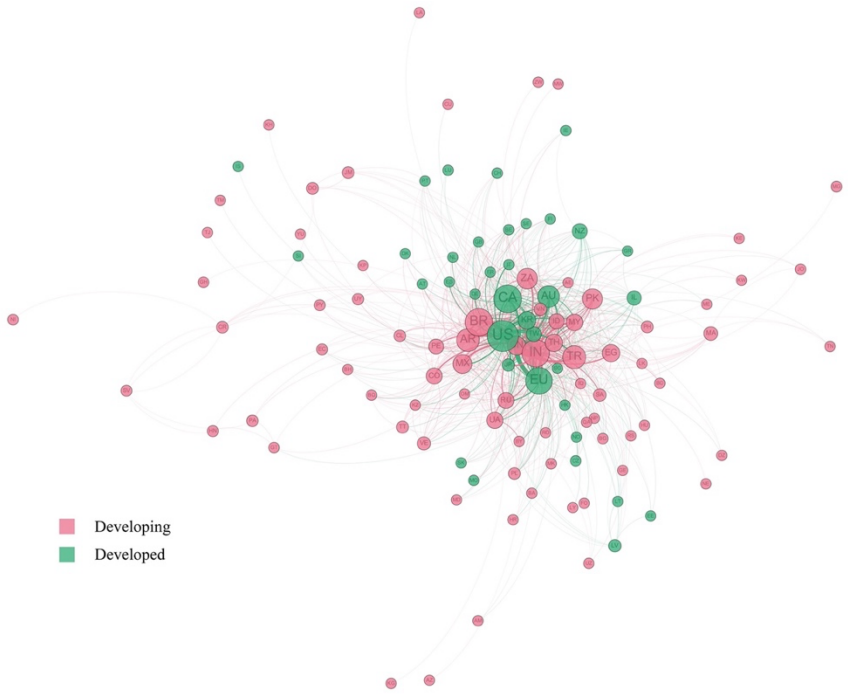


Finally, two types of visual networks with the degree centrality were plotted by Gephi based on the same dataset, so as to illustrate the structures and interactions of the SVM network with different focus points. (Figure 11, Figure 12, Figure 13 and Figure 14)

In Figure 19, an SVM network is shown in "ForceAtlas 2" mode, which demonstrates a network centered around the main players. The vertexes in the figure represent the WTO Member countries or regions (see the abbreviations) and are divided into two different colors based on their level of development (i.e., developing country and developed country). The size of each vertex corresponds to the number of cases it has been involved in (both as an imposing Member or targeted Member). Additionally, each line connecting two vertexes represents the connection between two WTO Members, with the depth of color of the line indicating the degree of connection.

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FIGURE 11: SVM Network (Main Player Focused)



Based on Figure 11, Figures 12 and 13 further illustrate an SVM network by separating degree centrality into "in-degree" and "out-degree" using the "ForceAtlas 2" mode. In Figure 12, the size of each vertex corresponds to the number of investigations the WTO Member encountered while each line connecting two vertexes with an arrow represents the direction of the measures (who imposed the SVM to whom) with the weight of the line and arrow indicating the frequency of the measures.

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FIGURE 12: SVM Network (In-Degree)



By comparison, in Figure 13, the size of each vertex corresponds to the number of investigations the WTO Member initiated against others while each line connecting two vertexes with an arrow represents the direction of the measures (who imposed the SVM to whom) with the weight of the line and arrow indicating the frequency of the measures.

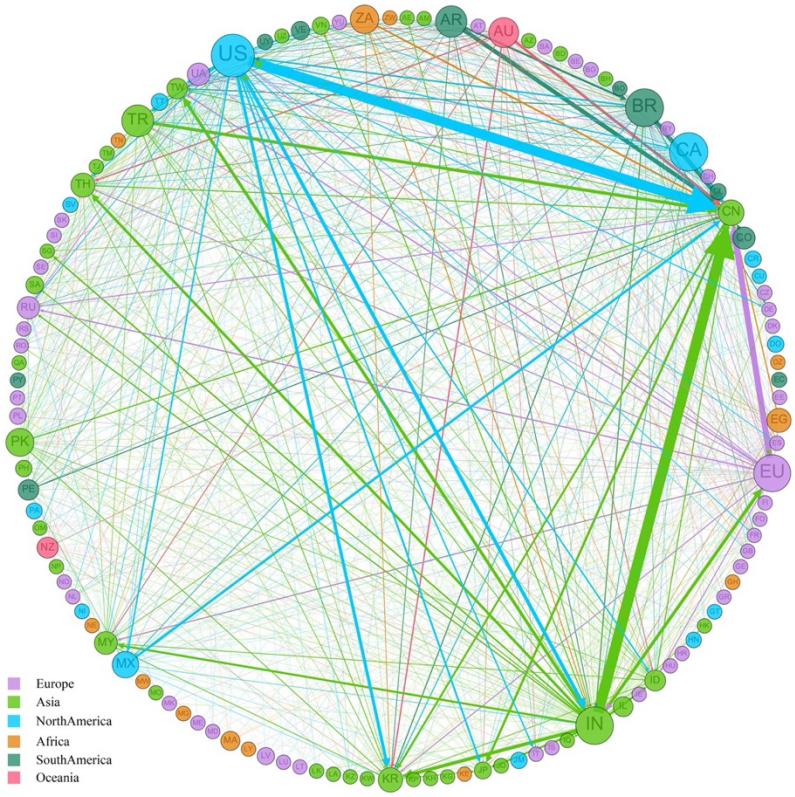
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FIGURE 13: SVM Network (Out-Degree)



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FIGURE 14: SVM Network (Direction Focused)



Compared to Figures 11, 12 and 13, Figure 14 illustrates the SVM network in "Circulation" mode. The vertexes in the figure represent the WTO Member countries or regions (see the abbreviations) and are divided into six different colors based on their geographic location (i.e. Europe, Asia, North America, Africa, South America and Oceania). The size of each vertex corresponds to the number of outward connections (SV investigation against others), while the thickness of the line connecting two vertexes indicates the degree of such outward connections (frequencies of the measures) with arrows showing the directions (who imposed the SVM to whom).

Based on the above network modes, this study further conducted a cluster analysis using the "Louvain" function in the R environment. This function is usually used in Network Science to find community structure by multi-level optimization of modularity. However, according to the visual inspection of the layout of the cluster analysis result, no obvious clusters (communities of WTO Members) were identified.

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IV. DISCUSSION

In this study, a thorough review and analysis were conducted based on a comprehensive official database—I-TIP Goods—followed by the application of several quantitative research approaches. The analysis began with an exploration of trends in global SVM between 1995 and 2020, in general, and by item. Based on this macro overview, key interrelationships were measured among imposing Member category, products category, types of SVM and the days of measure in force. Moreover, by applying network analysis techniques, the structure and key features of the SVM network were formulated and analyzed, to provide, for the first time, a global perspective on the dynamic interactions within the SVM network.

A. Trends of SVM

The general trends of global SVM initiations and of measures were largely similar, showing a stable "conversion rate" of the SVM investigations from 1995 to 2020, from initiations of the SVM investigation to final determinations and impositions of measures. Such "conversion rate", along with the proliferation of the applications of the SVM during the past decades, demonstrated the prevailing status of the SVM as a mature and leading international trade remedy among other instruments. Nevertheless, the popularity of the SVM among the WTO Members was not only because of the imposition of definitive duties after the investigations. High termination rates (annual) were recorded, especially from 2001 to 2017 (ranging between 21.07% to 41.46%), reaching 24.48% on average. That is to say, during the past 25 years (1995-2020) of the SVM applications almost one-fourth of the SVM investigations were terminated by the investigating authorities without imposition of final measures. This finding, from an empirical perspective, confirmed the "harassment" purpose of the SVM investigations. This occurs because, when an SV investigation is initiated (sometimes even prior to official notification), exporters of the product in question often seek alternative markets to avoid unexpected SVM-related tariffs and ensure a stable supply chain. Meanwhile, importers begin searching for products from other sources. As a result, the importation of the goods under investigation slows down, and the protective objective of the SV investigation is achieved without necessarily implementing a formal measure. As such, investigating authorities tend to terminate the investigation if doing so brings other benefits after engaging in negotiations with the exporting countries. Such a "harassment" function constitutes one of the important features that enable the SVM as a prevailing trade protection instrument.

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In terms of the trends of different types of SVM, it can be seen from the findings that the initiations of AD, CVD and SG investigations represented in different shapes. While SG's trend was not as obvious as the ones of AD and CVD, the AD initiations contributed a large proportion of the total initiations and formed the basis of the general trend of the overall SVM applications. Unlike the general SVM trend and the AD trend, CVD initiations represented a different shape, showing a gradual increase in general and a surge from 2005 onwards.

Moreover, analysis based on the SVM investigations against different product categories found that "raw materials" were the most vulnerable goods compared to others under the SVM investigations. This echoes the finding that contingent trade remedies prefer raw materials as the suitable selection of "product under investigation", as to provide "cascading protection" to downstream industries that suffer the transmission of injury.[34] Nevertheless, it is also noteworthy that according to the SG initiations trend, "consumer market finished products" account for a considerable proportion of the total products under the SG investigations (similar to "raw materials") and only a few "intermediate products" were ever confronted with an SG investigation during the same period. This fact reveals the downstream industries' preference for the selection of types of SVM.

B. Key Features of the SVM Imposition

After an overview of trends of global SVM investigation, in general and by itemized means, an in-depth quantitative analysis was conducted to reveal the interrelationships between key components of the investigations, inter alia, the WTO Members, three types of SVM, targeted products categories and the days of measure in force in individual investigations.

The findings of the current study showed that, the developed WTO Members and the developing WTO Members acted differently when they adopted AD, CVD, and SG investigations, collectively or separately. This may be attributed to the domestic industrial settings of each WTO Member. While the developments of respective industries vary, Members with different development levels tend to use different instruments for proper protection against "unfair trade" or "unforeseen development". This may also explain the findings that when applying SVM, the developed WTO Members usually apply different SVM investigations targeting different product categories compared to the ones by the developing WTO Members. Such differences regarding targeted product categories were significant, especially for raw materials and intermediate products, demonstrating

[34] Bernard M. Hoekman & Michael P. Leidy, *Cascading Contingent Protection*, 36(4) EUR. ECON. REV. 883, 891 (1992).

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different considerations and rationales between the developed and the developing WTO Members when choosing their strategies of "to defend" or "to attack".

In relation to the days of measure in force, while the WTO agreements on SVM stipulate the legitimate duration of each measure, the findings of the current study indicated that different imposing Member groups tend to adopt SVM for different periods of time. Moreover, the days of measure in force were different according to different types of SVM. To be more specific, the analysis confirmed the following relations regarding the days of measure in force for each type of SVM:

$$AD > CVD > SG$$

The result of the above comparisons may refer to two reasons: (1) both AD and CVD measures could be reevaluated every five years (which means indefinite) while a Member shall provide compensation if it intends to prolong its SG measure for over three years; (2) the legal basis for the application of a CVD measure must be built on the allocation of subsidies/financial contribution by a government/public body to the specified recipient(s). Such allocation shall be time-limited and used to be terminated according to the end of policies or depletion of funds. Thus, a CVD measure shall not be renewed after the removal of the subsidies and such removals are usually predictable and follow certain schedules. However, compared to the recurrence test for a CVD measure, the calculation and the evaluation of dumping margins are based on individual producers/exporters' data of production/exportation, which is more likely to continue or resume even after several rounds of "sunset review".

Moreover, the findings showed that, different product groups were targeted differently in relation to the period of measure in force. In particular, the days of measure in force for raw materials and consumer market finished products represented significant differences. SVM on raw materials used to last longer than consumer market finished products. This phenomenon may be explained from two aspects: (1) longer days of measure in force for raw materials are more conducive for Members who intend to use SVM investigations on raw materials to provide longer protection for their domestic industry and downstream industries while impeding or attacking the ones of their counterparts; (2) domestic industry for consumer market finished products usually represents smaller industrial volume with simpler supply chain network comparing to the ones of raw materials, by nature, it demands a shorter period of time to get recovered from the "injury" or the "unforeseen development".

As it can be seen from the analysis, these key features of SVM imposition, revealed the pattern of the SVM imposition adopted by Members. The triad of SVM instruments, i.e., AD, CVD and SG were

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adopted strategically, following Members' aims and purposes, according to the characteristics of the industries that intended to protect or attack.

C. Structure of the SVM Network and the Key Players Thereof

Having understood the strategies of the WTO Members on their SVM investigations and impositions, since any measure adopted by one Member will consequently affect, largely negatively the interests of other(s), therefore a SVM network eventually emerged and got increasingly complex based on Members' SVM activities against each other. Thus, a follow-up question raised inevitably, that is, how did Members interact in this SVM network?

A network analysis was conducted to understand the pattern of connection and interaction. Although some information has not been taken into account in such a method, for instance, economic and political impact, the network analysis method still provided a high level of abstraction based on large scale and efficient calculation of the network structure. As it can be seen from Table 12, the United States, India, Brazil, Canada and EU took the "Top 5" on the degree centrality scores, indicating that these Members were the most important players within the SVM network, based on respective degrees of, either imposing SVM against the others or being targeted by their counterparts. However, such reciprocal interactions did not present a symmetry relationship, although only took the sixth place of the SVM "key player", China, won the championship with an absolute advantage on the score of eigenvector centrality. That is to say, in this SVM network, China was the most targeted Member and such targeting was done mostly by other "key players" within the SVM network. On the contrary, the United States took the gold medal on betweenness centrality with a score twice higher than the silver medalist—Canada, demonstrating its status as the dominant influencer in the SVM network.

Moreover, the findings also suggested that, in different geographic locations, Members treated their trading partners within that region differently when applying SVM (Table 13). While Members in Europe and Africa showed little interest in taking SVM against other Members within respective regions, interactions between Members in South America were more active than in other parts of the world—manifested as measures and countermeasures among the neighborhoods.

Each Member had its own pattern of SVM interaction with others (Figure 8). However, high scores on correlation between (1) degree and betweenness centrality and (2) degree and eigenvector centrality demonstrated that: (a) the more SVM activities (either imposing SVM against others or being targeted by others), the higher the chance of being targeted by other "key players"; (b) the more SVM activities (either

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imposing SVM against others or being targeted by others), the higher chance of obtaining power of influence in the SVM network (Figure 9 and Figure 10). These findings also proved the SVM's nature of "tit-for-tat" and further explained the reasons of Members on manipulating the applications of SVM.

To sum, as it can be seen from the SVM network graphs, during the past twenty-five years, the global SVM applications adopted by Members has structured a network of density and complexity (Figures 11, 12, 13 and 14). In such a network, some Members evolved into "key players" (US, India, Brazil, Canada, EU and China), and some of them were also facing fierce attacks by their counterparts (China, India, US and EU). While different Members were following their own strategies, the US has occupied the dominant position in the center of the network and influence largely the overall connection and interaction within the network.

V. IMPLICATIONS AND LIMITATIONS

Retrieving from the most comprehensive official information portal of the WTO, a database with adjustments and cleaning on the raw data was established. By applying different quantitative research techniques, the current study analyzed the database in depth, identified the trends of the global SVM application during 1995-2020, and revealed the interrelationships between imposing Members, targeted products, types of SVM and days of measure in force. Moreover, an SVM network was also structured based on this database, accompanied by an exploration of key players and essential features of the network. With the findings being reported and discussed in previous sections, this study also intended to contribute its perspectives on the related implications.

Firstly, the proliferation of SVM sees no end in the near future, according to the findings of trends of SVM investigations/measures. Domestic industries and investigating authorities will be more willing to resort to SVM protections/attacks due to its stable "conversion rate" (from initiation to final measure). From a cost-efficiency point of view, for domestic producers, such a stable "conversion rate" ensures a high level of expectations on additional SV duties against their foreign counterparts. Even when the investigations end up with no measures, the historically high level of the "termination rate" also suggested the continuous popularity of the "harassment effect" pursued by domestic protectionism.

Secondly, among the triad of SVM, anti-dumping will continue to be the most popular instrument compared to the other two SV measures. Such superiority will be presented in both the quantity of investigations and measures as well as density and complexity within the SVM network. Members will increasingly strengthen their anti-dumping investigations

臺灣大學學術期刊資料庫

against others and at the same time, get more troubled by being targeted by others' counterattacks.

Thirdly, raw materials will continue to draw fire in the SVM investigations compared to other categories of products. The "cascading protection" principle proved its effectiveness and thus, will keep guiding Members on their selection of targeted products when applying SVM. Moreover, as more SVM investigations on raw materials are being conducted, with frequent exchange and maintenance of business information, especially data on costs and prices pertaining to raw materials production and sales, information that is needed to evaluate petitions or initiate *ex officio* investigations is increasingly easy to be tracked and obtained by the investigating authorities, which equips them with higher successful rates on establishing prima facie cases and subsequent measure determinations.

Fourth, the density and complexity of the SVM network will continue to deepen, given the increasingly inundated SVM investigations following the differentiated patterns of SVM application of the WTO Members. In this network, the existing advantages achieved (as scores showed) will allow the United States to continue its dominative position in terms of SVM imposition and further influence other Members' SVM activities, while China, to a large extent, will continue to be the most targeted country by other WTO Members, according to the current structure of the SVM network. For any Member within the network, the more SVM activities it involved, the higher the chance to both influence the others or be attacked by the others. Thus, such a vicious circle emerged will continue to deteriorate. On the one hand, Members intend to apply SVM to protect their domestic industries and weaken the ones of their counterparts. During this process, their global influence increases among other trading partners; however, on the other hand, active SVM players are more likely to be revenged by the others' counterattacks, in the same way that using one's spear to attack one's own shield. Thus, resorting to SVM turns to drinking from a poisoned chalice, and the one will eventually suffer from his own behaviors.

Fifth, one potential solution for breaking such a vicious circle can be seen from the analysis of the SVM network. Although the trend of global SVM proliferation seems inevitable, data also showed that in most continents, Members had little interest in taking SVM against other Members within their respective regions. This may benefit from geographical political considerations and regional economic arrangements, for instance, the conclusion of political friendship, as well as bilateral trade agreements (hereinafter "BTA") and regional trade agreements (hereinafter "RTA"). For instance, Ahn and Shin found that WTO Members tended to trigger fewer AD petitions against their Free Trade Agreement (hereinafter

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"FTA") membership, regardless of facing more imports from the FTA partners.[35] In particular, many BTAs and RTAs contain SVM-related provisions that regulate their own bilateral/multilateral SVM remedies.[36] These SVM-related provisions tightened discipline or reduced the incentives on the application of the SVMs on the Members of the BTA or RTA networks.[37] Nevertheless, such a phenomenon was not prevalent in every BTA or RTA. In some RTAs, SVM-related rules are "very sketchy" and have "hardly made any impact" on the intra-RTA trade. Thus, under these circumstances, this study maintains that a "spaghetti bowl" with deepened BTAs and RTAs network which regulates inter-members SVM activities with optimized arrangements (WTO + provisions) may offer a solution for a better SVM mechanism, although such an alternative mechanism may deviate from the course of the WTO system.[38]

Despite best efforts, the current study also encountered some limitations. Firstly, since the I-TIP Goods database collected and maintained the information from the semi-annual reports of the WTO Members on their SVM activities, such self-reporting may cause missing data if a Member fails to report all of its SVM activities in such reports. For instance, the official WTO statistics indicate that only 206 anti-dumping investigations were initiated by South Africa during 1995-2010; however, in practice, South Africa's official record shows that 211 anti-dumping investigations were initiated.[39] Such discrepancies can be seen on other occasions, mainly due to differences in statistical recording at domestic and international levels. Second, the current study categorized all targeted products into three groups. However, a more detailed categorization of targeted products according to the industries they belong to may provide additional understanding of the research subject. Lastly, current quantitative research mainly focused on the interrelationships between key components of SVM and did not take into account economic data or political indexes. Admittedly, the SVM activities of WTO Members may not be easily evaluated by simple economic data or

[35] Ahn Dukgeun & Shin Wonkyu, *Analysis of Anti-Dumping Use in Free Trade Agreements*, 45(2) J. WORLD TRADE 431, 431 (2011).

[36] For instance, Chapter 10 of United States–Mexico–Canada Agreement (USMCA) includes an entire section on 'cooperation on preventing duty evasion of trade remedy laws', which regulates that 'recognize their shared concerns regarding duty evasion of antidumping, countervailing, and safeguard duties, and the importance of cooperation, including through information sharing, to combat duty evasion'; see also the Free Trade and Investment Protection Agreement signed between the European Union and Vietnam (dated August 1, 2020), Article 3.2, 3.3 and 3.7 stipulate transparency requirement and public interest evaluation when imposing anti-dumping or countervailing duties.

[37] Robert Teh et al., *Trade Remedy Provisions in Regional Trade Agreements* 32 (Econ. Rsch. & Stat. Div., WTO, Staff Working Paper ERSD-2007-03, 2007).

[38] Zakir Hafez, *Weak Discipline: GATT Article XXIV and the Emerging WTO Jurisprudence on RTAs*, 79(4) N. DAKOTA L. REV. 879, 910 (2003).

[39] Brink Gustav, *Anti-Dumping in South Africa* 9 (Tralac Trade L. Ctr, Working Paper No. D12WP07/2012, 2012).

臺灣大學學術期刊資料庫

political indexes. In most occasions, the outcomes of the SVM activities were the results of compromises between different interested parties. However, incorporating the economic data and political indexes is still of importance to enhance the understanding of the SVM mechanism. Thus, this study proposes to incorporate these two elements as variables after proper re-indexing according to sophisticated models and recognized theories, to provide a more comprehensive database for a further thorough analysis.

VI. CONCLUSION

It is not difficult to see from the above analysis and findings that the development of SVM has already deviated from its original intention at the beginning of the legislation. On the one hand, WTO Members have been more and more proficient in using SVMs to control the import of specific products and/or crack down on related domestic industries in the target countries. At the same time, they have been also suffering from the same measures by rivals. The complex SVM network showed the vicious cycle of chaos, and the quantitative analysis of all SVM investigation data in the past twenty-five years also revealed the rationale behind such tangled warfare. Based on the analysis, findings and discussions above, this study not only revealed the nature behind the proliferation of SVM and predicted the future development direction of SVM, but also proposed one of the feasible methods to alleviate the current tangled warfare based on quantitative models, namely, by concluding more high-level bilateral and regional trade agreements (BTAs and RTAs), a "spaghetti bowl" with deepened BTAs and RTAs networks which regulate inter-members SVM activities with optimized arrangements (WTO + provisions) offers a solution for a better SVM mechanism under the WTO regime.

臺灣大學學術期刊資料庫

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