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WORKING PAPER

Are Product Standards diverting Indian Tea exports?

Panel Data Estimation Results

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Abstract

India's tea sector has witnessed a decline in exports during recent period, which can partly be explained by competition from lower cost competitors (e.g., Kenya, Sri Lanka). However, it has been observed that incidence of non-tariff barriers (NTBs) might also lower exports of many primary commodities. The current analysis strives to analyze the possible impact of product standards, e.g., Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) intercession, might have severely affected Indian tea exports over 1996-2020. The Poisson Pseudo Maximum Likelihood (PPML) estimation model, conducted for 36 major import partners of India over 1996-2020, confirm that the stringency of SPS barriers affect India's tea exports more severely in the developed country markets. A similar effect for TBT measures is however found to be missing in the empirical analysis. In addition, higher coefficient of TBT measure's stringency in countries characterized by higher tariff barriers is an interesting observation, as these countries fall to the developing country category. The paper concludes by noting that the policymakers need to explore the possibility of entering into mutual standard recognition agreements with appropriate trade partners.

Keywords: Tea Exports, WTO Notifications, Sanitary and Phytosanitary Measures, Technical Barriers to Trade, Non-Tariff Barriers, Panel Data, Poisson Pseudo Maximum Likelihood

JEL Classifications: C23, F13, F14, Q17

Acknowledgements

Introduction

Non-tariff barriers (NTBs) predate the progressive trade liberalization in the global market, followed by several successive rounds under the General Agreements on Trade (GATT), which eventually lead to the establishment of WTO in 1995. As traditional tariff rate was substantially reduced, countries resorted to alternative forms of protectionism to safeguard their domestic market (Agarwal et al., 2022). Some of these measures eventually evolved into significant non-tariff measures, affecting world trade (Mayeda, 2004). Countries started imposing non-tariff barriers on imports on many grounds, including plant and animal protection, environment protection, quality standards. However, over the period product standard related emerged as a barrier during 1970s and 1980s. To prevent misuse of such provisions on SPS and TBT were made integral part in 1995. However, despite that use of product standard remained a major barrier affecting merchandise trade in general and agricultural trade in particular (Johnson, 2021). The SPS-TBT provisions of WTO allowed the member countries to introduce newer product standards on imports for protecting human, animal or plant health in line with emerging and perceived threats through notifications, which can be scientifically justified (Agarwal et al., 2022). While these standards are implemented by the importing countries to ensure product quantity, product standards, human, animal and plant safety, it has often been argued that countries impose that to insulate local producers of primary products from international competition.

Despite rule-based framework and evidence-based measures, the SPS-TBT standards affecting primary products may continue to generate trade diversion for three reasons. First, the major exporters of agricultural products often happen to be developing economies including many least developed countries (LDCs), whose ability to comply with existing or new standard related notification imposed by a developed country might be limited in the short run owing to resource constraint (Henson and Loader, 2001). Second, while the SPS- TBT related agreements prompt countries to deepen mutual understanding of standards for smooth conduct of bilateral trade, the process is often slow (Mayeda, 2004). Finally, while the governmental agencies set and implement trade standards, international business decisions at ground-level are undertaken by private entities. Strict compliances demanded by importers, in anticipation of potential obstacles during random checks by implementing agencies at the time of imports, may therefore add to the concerns of the exporting firms (Henson and Humphrey, 2010).

Developed countries tend to impose more stringent SPS-TBT measures on imported products than developing countries, given the higher demand for cleaner environment and greater safety therein (El-Enbaby et al. 2015). Concerns have often been raised since early WTO years over the imposition of stringent SPS-TBT notifications by developed countries, which increase compliance costs for their lower-income counterparts considerably but leads to modest health and related benefits (Shepotylo 2016). The existing empirical literature confirms greater trade distortion from imposition of SPS-TBT measures by developed and developing countries (Dolabella 2020). For instance, SPS standard imposed by the European Union decline approximately 14 percent of the agricultural exports originating from their low-income counterparts (Murina and Nicita 2014).

India is historically a leading exporter of black tea in the world market, mostly dwelling in branded quality tea segments, focusing on bigger packets (pack weighing greater than 3 kg.). India has faced a number of NTBs on its exports, including SPS-TBT measures on the primary commodities, in line with the experience of other developing countries (Verma 2022). While the impact of NTBs on several Indian export commodities has been documented in the literature, the same on tea, one of the major traditional export products from the country (ADB 2020), has received limited attention so far. Four main types of tea are exported from India, namely: Green tea (both fermented and non-fermented varieties) and Black tea (fermented and non-fermented). However, black tea dominates India's export baskets, accounting for 97.65 and 95.94 percent of sectoral exports during 2012 and 2021 respectively. The sector continues to feature among major Indian exports, but in recent years Indian tea has grappled to maintain its position in the world market. Contenders such as China, Sri Lanka, and Kenya have emerged as leaders in the international market (Roy Pradhani et al., 2024). Over the past three decades, presence of India in the international market has declined in terms of value and volume (Majumdar and Kumar, 2017; Roy Pradhani et al., 2023). Although domestic production has increased substantially, this growth has corresponded with a concurrent rise in the demand for tea (Majumdar et al, 2012; Majumdar and Kumar, 2017). Studies attribute the decline in the export share primarily to a decrease in productivity within the tea sector. The proliferation of small tea growers with low productivity has further exacerbated the issue, and productivity levels have remained stagnant over the past few years, lagging behind those of top players (Das, 2012; Majumdar and Ray, 2017; Sethuranjan, 2019). Additionally, the availability of cheaper and higher- quality tea from other top growers such as Sri Lanka and Kenya have adversely impacted India's export performance (Srinivasan, 2018). As a result, India has been losing its market share to its competitors such as Kenya, China, and Sri Lanka (Vishwanathan and Shah, 2018).

Given this context, the current analysis tries to analyze the impact of NTBs, particularly SPS and TBT standards, on Indian tea exports to the major importing partners. It further intends to evaluate whether with rise in the stringency of notified SPS-TBT standards on tea reduces the exports. The paper adds value to the literature through an exhaustive investigation of the notifications on tea in partner countries to identify the potential impact on India's exports, as existing literature on this aspect is relatively scarce. The structure of current analysis is the following. The next section reviews the existing literature on the standard-related compliance requirement and their implications for exports, followed by a description of data sources and methodology. The empirical results following a Pseudo Poisson Maximum Likelihood (PPML) estimation are presented subsequently, based on which the conclusions and policy implications are noted.

Literature Review

The inclusion of the SPS-TBT provisions under WTO framework was intended to enable countries to undertake measures to secure their animal, plant and human, life through scientific evidence-based technical standards (Kang and Ramizo 2017). The WTO members are also allowed to adopt *precautionary principles,* for securing protection against unforeseen environmental,

biological or clinical threats. Moreover, the member nations are obliged to regularly communicate changes in their SPS-TBT framework to the WTO to ensure transparency and smooth compliance. Over the period, these measures have, however, emerged as major NTBs affecting trade flows. SPS-TBT notifications are related to food safety and human health, which significantly influence primary trade flows (de Almeida et al. 2012; Alaeibakhsh and Ardakani 2012). Many exporters from developing countries and LDCs generally find it challenging to stick to the SPS-TBT standards, owing to high compliance costs and resource constraints (Disdier et al. 2008; Kallummal et al. 2013). The extent of trade diversion from such notifications, however, depends on their level of stringency (Kallummal and Gurung 2017; Kallummal et al. 2018).

Several empirical literatures have attempted to test the negative impact of SPS-TBT related NTBs on trade in primary commodities. A major section of the literature employs the price gap method for examining the negative influence of NTBs on exports, e.g., for Canada (Papillion and Benoit 1994) and Iran (Ardakani et al. 2009). Another section of study has computed the trade-distorting effect of SPS-TBT standards using a computable general equilibrium (CGE) model, which confirms the negative influence of NTBs on trade, e.g., for New Zealand (Winchester 2009) and at the global level (Fugazza and Maur 2008). Considering the rejection of agricultural export consignments as a proxy for NTBs, Krishnan (2017) arrived at a similar result for India. Similarly, Maziku and Mashenene (2024) also noted a negative relation between the imposition of non-tariff barriers and primary commodity exports (Maize) in Tanzania.

A rich literature is emerging on quantification of the SPS-TBT measures. Based on a systematic survey of agricultural exporters from lower income countries, Henson and Loader (2001) concluded that many of the exporters lack enough resources to comply with the standards introduced by their developed counterparts. Through the construction of dummy variables for SPS-TBT notifications, Alaeibakhsh and Ardakani (2012) confirmed their negative impact on exports from Iran. Using a similar analysis, Kang and Ramizo (2017) noted that SPS measures negatively affect exports from Asian developing nations, while non-Asian developing nations are affected by TBT measures. Considering maximum residue limits (MRLs) on Chinese exports as proxy for SPS measures, Dong and Zhu (2015) observed that developed countries introduce more stringent technical measures compared to developing countries. Analyzing the case of Vietnam, Thuong (2018) noted a similar negative effect of SPS measures on rice exports from the country. Employing gravity model with two stage Heckman sample selection model, Nguyen (2024) noted, that SPS and TBT measures exert positive affect imports from developed nations while having a minimal impact on their developing counterparts.

There are numerous studies that have analyzed the impact of product standards, including SPS-TBT norms, on tea exports. Considering the influence of food safety norms on the Chinese tea exports in gravity model framework, Huang and Yang (2012) noted that stringency of MRL standards negatively affect China's tea exports. Ranjan and Edirisinghe (2020) observed a similar negative influence of MRL norms on Sri Lankan tea exports. Computing the coverage and frequency ratios of SPS and TBT measures, through a PPML estimation model Wood et al. (2017) confirmed their negative impact on Korean tea exports.

India, a major exporter of primary commodities, have faced a series of SPS-TBT related NTBs over the period (Chaturvedi and Nagpal 2003; Kumar, 2021). Using MRL standards on seafood as proxy for SPS measures, Somasekharan (2010) employed a gravity model and observed a negative impact on trade and supply chain system. Through a similar analysis on food and fruit exports, Agarwal et al. (2022) noted that India's trade decline when the stringency level of MRL increases and vice-versa. Indian horticultural commodities are also affected product standards imposed by the partner countries, given the difficulties associated with high compliance costs (Idris et al. 2015). Thomas and Shaijumon (2024) observed that impositions of TBT standards diversify the market for marine product exports from Kerela. However, despite tea being a major export product, the empirical literature on assessing the influences of SPS-TBT criteria on India's exports is relatively scarce.

In this context, the contribution of present analysis is the following. First, there exists no empirical study on influence of SPS-TBT standards on tea exports from India and the current paper focuses on this gap in the literature. Second, the existing literature concentrates on computation of the stringency of SPS-TBT measures through different routes, e.g., estimation of compliance cost through primary survey, construction of dummy variables, use of MRL as proxy, number of notifications as proxy, taking account of coverage and frequency ratios and so on. However, the literature on construction of a suitable dummy variable through an exhaustive analysis of country-wise SPS-TBT standards applying in empirical analysis is relatively scarce. By proposing a method for measuring stringency of SPS and TBT notifications of a country separately through construction of appropriate dummies, the paper proposes an alternate practical method for estimating the trade effects of the associated standards.

Model and Data

First, 36 major countries have been chosen for the empirical analysis, based on their importance in India's export basket, as they collectively account for around three-fourth of the total sectoral exports. On the basis of income levels, 20 and 16 of the selected countries fall under high-income (i.e., developed) and low-income (i.e., developing and emerging countries as well as LDC categories) respectively. The average shares of trade partners in India's tea export basket can be observed from Annexes 1-5. It is further noted that India's shares in the tea import basket of many of the partner countries have declined over the period (Roy Pradhani et al., 2024). It deserves mention that the decline of India's share in partner country's import basket is observed in countries from all development spectrums.

Second, given the dominance of the product group in the country's export basket, only Indian black tea exports to its partner countries are considered for the analysis.

Third, computation of a suitable dummy variable involving SPS-TBT notifications for empirical model is a challenging exercise, given their varying influence on compliance requirement, and in turn, exports. Assigning a dummy of 1 to indicate the presence of an applicable

SPS-TBT standard, regardless of compliance requirements of such measures, might lead to erroneous conclusions. The current analysis tries to overcome this inadequacy by assigning appropriate values to the constructed dummy variables, in line with the stringency of a particular notification by a WTO member country. The notifications issued by partner countries, as collected from CWS database (undated a, undated b), are meticulously studied first and then their potential trade restrictiveness are identified. The identified policies are then assigned weights from 1 to 5 (Fisher Scale), where a higher value indicates higher stringency. The principle adopted for construction of the dummies has been outlined in Figures 1 and 2. After construction of the dummies a number of tea exporters from the Indian cities of Guwahati (Assam) and Kolkata (West Bengal) are contacted and their views on the stringency level assigned to the notifications are sought. The contacted exporters, after being updated about the principles adopted in the exercise and the analysis, agreed with the assigned values. The current analysis considers the dummy variables generated in this manner as an independent variable, as a proxy for measuring compliance-related stringency.

Equation (1) is estimated to determine the link between SPS and TBT notifications on Indian tea exports to 36 partner countries over 1996-2020:

$$Export_{ijt} = \alpha + \beta_1 \, \text{Ln}(GDP_{it} * GDP_{jt}) + \beta_2 \, \text{Ln}\,(Population_{it} * Population_{jt}) + \beta_3 \, SPS_{ijt} + \beta_4 \, TBT_{ijt} + \beta_5 \, Tariff_{ijt} + \beta_6 \, \text{Ln}Wdistance_{ijt} + \beta_7 \, RTA_{ijt} + \beta_8 \, Common\ border_{ij} + \varepsilon_{it}$$

.. (1)

where,

α	depicts constant term
β's	depicts coefficients
ln	depicts natural logarithmic transformation of the variables
$Export_{ijt}$	depicts Indian (country i) tea exports to partner country (country j) in year t
GDP_{it}	depicts India's GDP in year t
GDP_{jt}	depicts GDP of the partner country j in year t
$Population_{it}$	depicts India's population in year t
$Population_{jt}$	depicts population of partner country j in year t
SPS_{ijt}	depicts notifications related to SPS measures issued on tea imports from India (i) by the partner country j in year t
TBT_{ijt}	depicts notifications related to TBT issued on tea imports from India (i) by the partner country j in year t
$Tariff_{ijt}$	depicts the level of tariff imposed on tea imports from India (i) by the partner country j in year t
$Wdistance_{ijt}$	depicts weighted distance between India (i) and partner country j in year t

RTA_{ijt}	depicts a constructed dummy variable for an existing regional trade agreement (RTA) between India (i) and partner country j in year t, which is 1 in case of a trade bloc and 0 otherwise
$Common\ border_{ij}$	depicts a constructed dummy, which is 1 if India (i) and the partner country j share border and 0 otherwise.
ε_{it}	is an error term

The gravity model literature acknowledges the crucial role of incomes (i.e., GDP) of both trade partners in determining the trade volume (Kea et al. 2019). Though the GDPs of the trade partners can be combined either in additive or multiplicative form, the latter transformation has been preferred over the former in a major branch of existing literature (Bhattacharyya and Banerjee, 2006). The current analysis considers an interaction term of India's GDP along with the same for partner countries. Following the convention, the combined populations of partners countries and the home country is also considered in the study (Frankel et al. 1997).

Figures 3-6 provide the total count of SPS (CWS undated a) and TBT (CWS undated b) notifications, communicated by developed and developing countries, as obtained from the CWS database. From the figures it clearly emerges that, in comparison to developing countries, developed countries have issued a notably higher number of TBT and SPS notifications on their tea imports. A deeper insight of CWS data reveals that the SPS notifications can be broadly divided into four broad categories, namely: plant health, animal health, food safety and labelling. It is observed that food safety standard is the most common form of SPS notification. Similarly, the TBT notifications can also be divided into four categories, namely: consumer safety, labelling, human health and others. Among the TBT-specific notifications, consumer safety related interventions are most common. Following the existing literature, the stringency index of the SPS and TBT notifications have been incorporated in the regression model (Kang and Ramizo 2017). However, instead of considering a binary dummy analysis using 0 and 1 for existence of potential trade barriers, the current paper gives weightage to existing SPS and TBT notifications, based on their stringency levels, as specified in Figures 1 and 2. In addition, in order to understand the developmental perspective of the SPS-TBT standards on India's tea exports, two interaction dummies (namely, $SPS_{ijt} * Dev$ and $TBT_{ijt} * Dev$) have been incorporated in the model, which indicate interaction between the respective stringency measures in partner countries and a dummy, considered as 1 for a developed country and 0 otherwise. Negative coefficient for these two dummies would confirm trade-distorting nature of the stringent compliance requirements introduced through SPS-TBT notifications in the higher-income trade partners of India.

The presence of tariff barriers can impede trade flows significantly in the gravity framework (Heid et al. 2021). The current analysis considers the effective applied tariff rates imposed by partner counties on India, so that the preferential tariff rates, if any, can be accordingly incorporated in the model instead of the corresponding Most Favored Nation (MFN) tariff rates. The average effective applied tariff rates imposed by both developed and developing countries on India's black tea exports over 1996-2020 are presented in Figures 7-11. It can be noted from the

figures that most of the high-income countries (e.g., USA, UAE, Canada, Japan) are imposing a zero tariff on tea imports from India, whereas several developing, emerging of least-developed countries (e.g., Thailand, Nepal) are imposing a relatively higher tariff on the same.

Usually in gravity models the geographical distance between the major cities or capitals of trade partners is considered, which is predicted to bear a negative relation with exports. However, distance between two countries calculated in this manner might remain invariant throughout the study period, and its inclusion may generate biased empirical results and potential erroneous conclusion. Following the existing literature (Aggarwal et al. 2023), *WDIST* between importing partners is instead taken into consideration, which can be calculated in the following manner:

$$WDIST_{ijt} = \frac{DIST_i * GDP_{jt}}{\sum_{i=1}^{36} GDP_{jt}}$$

Where, $DIST_{ij}$ represent the absolute distance between India (*i*) and respective partner countries (*j*) and GDP_{it} represents GDP of partner country *j* in year *t*.

Finally, consistent with the existing literature, several dummy variables such as common border (Carrere 2006) and RTA partnership (Aggarwal et al. 2023) are considered in the study. Common border dummy is set to 1, if India shares its border with a trading partner in question, and 0 otherwise. Similarly, RTA dummy is set to 1, if India has entered into a preferential trade relationship with its partner countries, and 0 otherwise. Both the variables are expected to enhance India's exports to partners.

The data on India's country and year-wise black tea exports has been obtained from UNCOMTRADE database (UN undated). The GDP and Population data for countries have been taken from World Development Indicators (World Bank undated a). The distance between countries has been taken from CEPII (undated). The tariff data has been taken from World Integrated Trade Solution (WITS) database (World Bank undated b). The SPS and TBT notifications were collected from the Center for WTO Studies (CWS) database (CWS undated a CWS undated b). Logarithmic transformation of the variables has been considered here to allow the obtained coefficients to be interpreted as relevant elasticities. The description of the variables used in the current analysis and the data sources are summarized in Annex 6.

Empirical Findings

The stationarity scenario in all the variables of interest has been noted using Harris-Tzavalis Unit Root Test to remove any possible biases. The results presented in Table 1 confirm all the variables of interest are stationary at level. The summary statistics of all the variables have been provided in Table 2. The current study checks the data for presence of heteroscedasticity and multicollinearity. The estimated mean variance inflation factor (VIF) of 3.41 suggests that there is

no multicollinearity in the proposed model. Finally, the Breusch-Pagan / Cook-Weisberg test statistic of 4.58 indicates that there is a problem of heteroscedasticity in the data.

Given the consideration of data over two decades, there were some years characterized by zero trade values in between. Under this scenario, a static panel data model can lead to biased results. To address issues related to zero import values and heteroscedasticity, this current analysis employs Poisson Pseudo Maximum Likelihood (PPML) estimation technique used by Silva and Tenreyro (2006). The regression results obtained are summarized in Tables 3 and 4.

A few crucial findings can be drawn from the estimated results summarized in Table 3. First, the coefficient of the interaction term involving GDPs is positive and statistically significant in all the models. The result underline that the rise in income may cause a more than proportionate increase in India's tea exports. Second, the negative and significant coefficient of population can be explained by the increase and decrease in domestic demand for tea and exports respectively, caused by population growth in home country, i.e., exporter substitution effect (Sato 2020). Third, the coefficient of weighted distance is significant and negative, indicating the role of transport costs. Fourth, the negative and significant coefficient of tariff highlights the distortionary effect of trade frictions. A saving grace is that the coefficient is quite small, given the relatively low tariff barriers prevailing in several partner countries. Fifth, the negative coefficient of the SPS measure confirms that with growing stringency of the same, the tea exports are adversely affected. Sixth, while coefficient of the TBT index is similarly negative and significant, it is comparatively lower than the corresponding figure for SPS measures. The result is consistent with the evidence from existing literature, which notes diverging impacts of SPS and TBT standards on trade (N'Doua 2022; Nguyen 2024). Seventh, the coefficient of common border dummy is elastic and negative in all models, highlighting relatively higher exports from India towards geographically distant economies. This seemingly baffling result can be true for a country like India, which shares its border with two of the major producers and exporters of tea (e.g., China and Sri Lanka) and is surrounded by relatively low-income countries (i.e., the South Asian neighbors). Finally, the coefficient of the RTA dummy is negative and significant in the PPML specification, indicating that presence of an RTA relationship is not very conducive for India's export to the partner country. The result can be justified by inclusion of several non-RTA tea-importing partners of India (e.g., Germany, Russia, UAE, USA) among the current sample of countries.

The PPML model results, in presence of year dummies, are noted in Table 4. Despite their similarity with prior evidence reported in Table 3, some further points can be taken from the results. First, while the coefficients of the GDP interaction term remain elastic, highlighting the prominence of income factor on tea exports. Second, the coefficient of the population variable rises in the reported models. Third, the coefficient of weighted distance turns out to be elastic, indicating higher export of tea to relatively high-income countries located at a distance. Fourth, the coefficient of tariff remains at a comparable level, implying a relatively modest distorting effects of observed trade barriers on Indian tea exports. Fifth, while the signs of the coefficients of both SPS and TBT stringency indicators remain unchanged, the coefficients of TBT notifications are found to be lower than the corresponding figure for SPS under all model specifications. The

result underlines that the changes in stringency of SPS measures are not time-invariant, and the introduction of newer measures possibly entails compliance costs on the exporters, leading to a reduction in exports. The scenario remains unchanged when the interaction term involving the SPS and TBT barriers and the developed country dummies are introduced. Moreover, the TBT measures are significant only when developed country dummy is considered, underlining their country-specific but time-invariant natures. The lesser degree of trade diversion from TBT measures needs to be viewed in light of their implied time-invariance. This observation is also consistent with the existing literature, which documented differential impacts of the SPS and TBT measures on tea exports from Korea (Wood et al. 2017). Seventh, the coefficient of common border dummy remains negative but turns elastic. This adds further proof to the contention noted earlier on India's lower tea exports to neighbouring partners. Finally, while the coefficient of the RTA dummy remains negative, an increase in the same is observed. One underlying explanation for the last two results can be the absence of tariff preference to Indian tea exports in South Asian Free Trade Area (SAFTA) countries (e.g., Nepal, Bangladesh, Sri Lanka).

Conclusion

Given that the substantial share of population in India's tea producing regions (primarily northeast India, West Bengal and the Southern States) is engaged in the sector, the corresponding export earnings have significant development repercussions. The recent volatility in the export earnings, notwithstanding the continuous depreciation of the Indian Rupee against the US Dollar, therefore, requires the focus of the academic and policy research on the potential drivers. Over the years Indian players have highlighted the negative repercussions of the standard induced NTBs on their exports (ASL-CII 2016). In addition, given the absence of tariff preference accorded by partner countries on India's tea exports, demand for imposing higher tariff barriers on tea imports from SAFTA members (e.g., Nepal) keep surfacing on a regular basis (Saha 2023).

Given this background, the empirical results of current analyses indicate that Indian tea export is negatively influenced by both SPS and TBT measures, particularly to the developed countries. As Indian tea exports are targeting several high-income developed markets, imposition of stringent SPS-TBT compliance requirements on tea imports pose a considerable challenge for the sector. While in comparison to SPS measures, TBT specifications are found to exert a less stringent influence on exports, it might still be challenging for a country like India to meet the prevailing as well as newly introduced standards. The existing literature highlights the differential impacts of the product standards on export opportunities, depending on their operational sizes (Fontagne and Orefice 2018). In particular, the impact can be more pronounced for smaller firms or firms from developing countries exporting agricultural commodities, given the asymmetrically high compliance cost relative to their operational capacity. Given the lower volume of output produced and inherent scale disadvantages, a rise in compliance costs can eventually erode their profitability and in turn reduce exports (Fernandes et al. 2019). In recent past India has supported conversion of vegetable-growing fields to smaller tea gardens through various government programs, considering the associated operational advantages (Seddon and Schmidt 2017). However, the

continuous growth of the small growers in the tea segment might weaken their ability to comply with stringent product standard regulations in the long run (Langford, 2021).

An interesting policy conclusion emerges from the results of the analysis. India is currently involved in a number of RTA deals (e.g., EU, UK, US) and negotiations (e.g., Canada) with developed countries, all of whom have imposed stringent standards-related barriers on Indian primary exports in the past (Verma 2022). With the negative and elastic coefficient of the RTA dummy, it is apparent that Indian tea exports to the existing RTA partners is not enjoying any advantage. Moreover, it deserves mention that Indian tea sector standards are not mutually recognized in the partner countries yet (EIC undated). Given the fact that tariff barriers in most of the intended (i.e., Canada, EU, UK) as well as existing (i.e., Australia, Japan) developed trade partners are already zero of near zero level, India needs to enter into mutual recognition of standard agreements on tea with leading partner countries on urgent basis. Existing empirical research takes note of the fact that if the question of NTBs is not adequately addressed, tariff liberalization in itself may not result in any appreciable rise in Indian primary exports to the partner countries (Ray Chaudhuri and Chakraborty 2021).

A possible area of future empirical research can be analyzing the potential effect of the standards-related interventions on exports of other tea exporting countries, through quantification of the barriers embodied in notifications. In addition, a similar analysis on other primary exportable from India, given observed export fluctuations, may be conducted.
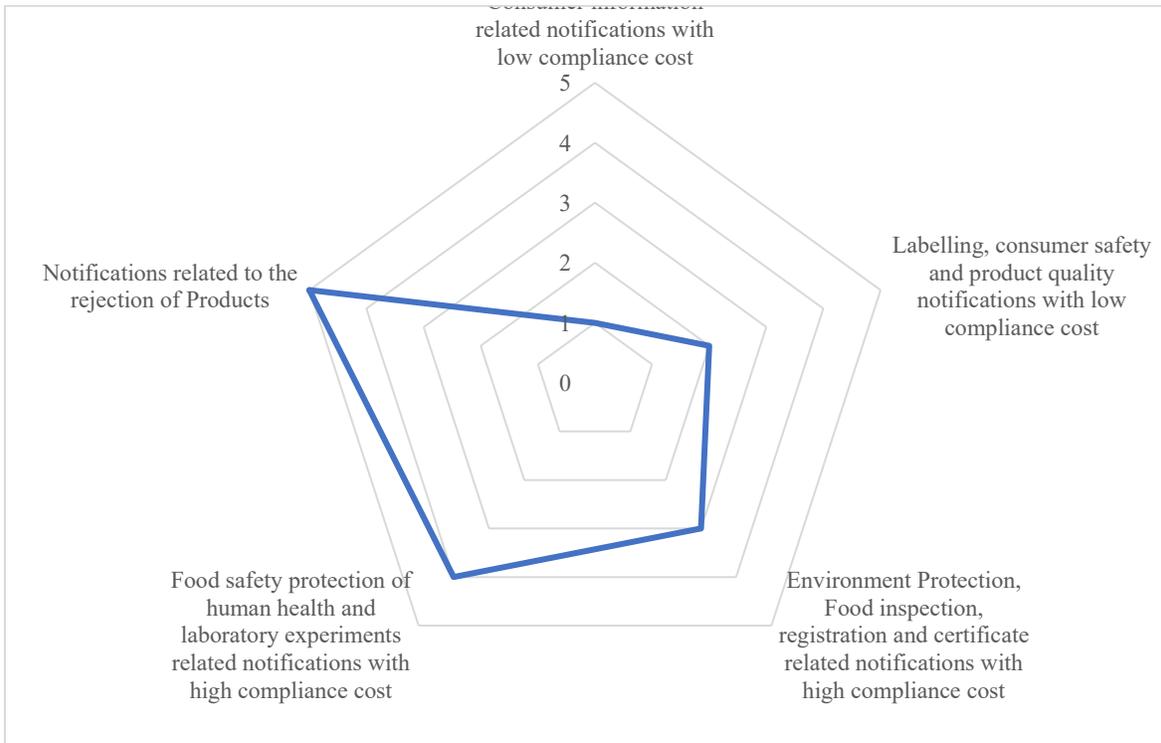
Figure 1: Construction of the SPS Stringency Index

Source: Author's own construction based on CWS (undated a)

**Figure 2: Construction of the TBT Stringency Index**

Consumer information
related notifications with
low compliance cost

Notifications related to the
rejection of Products

Labelling, consumer safety
and product quality
notifications with low
compliance cost

Food safety protection of
human health and
laboratory experiments
related notifications with
high compliance cost

Environment Protection,
Food inspection,
registration and certificate
related notifications with
high compliance cost

Source: Author's own construction based on CWS (undated b)

Figure 3: SPS Notifications issued by Developed Countries (1996-2020)
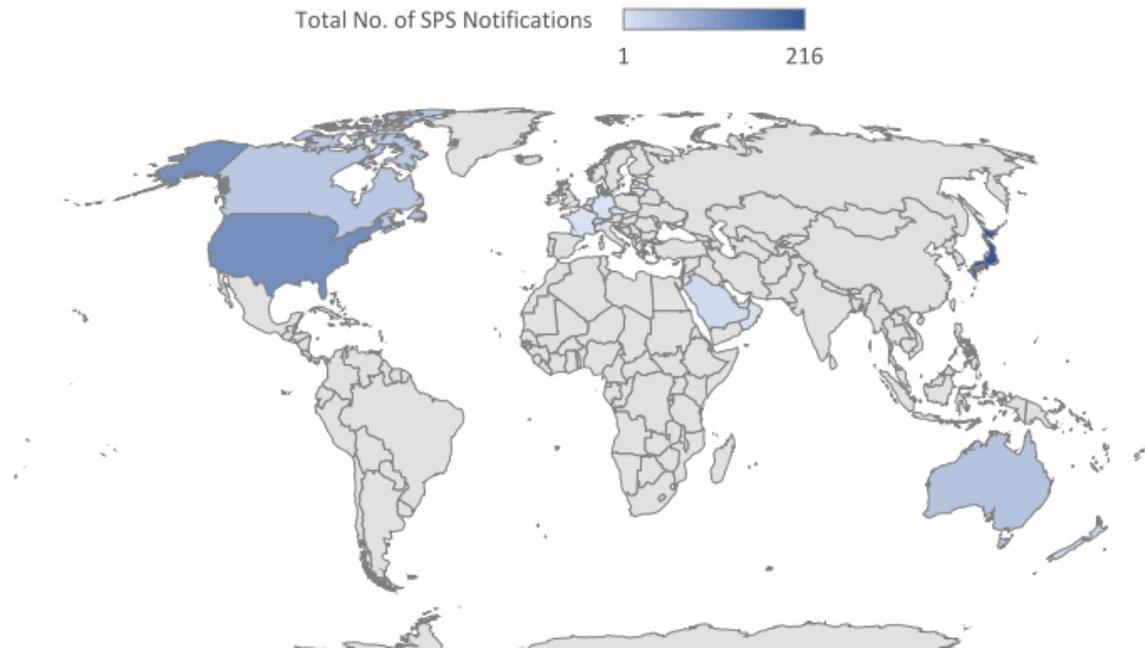
Source: Authors' construction from CWS (undated a)

Figure 4: TBT Notifications issued by Developed Countries (1996-2020)
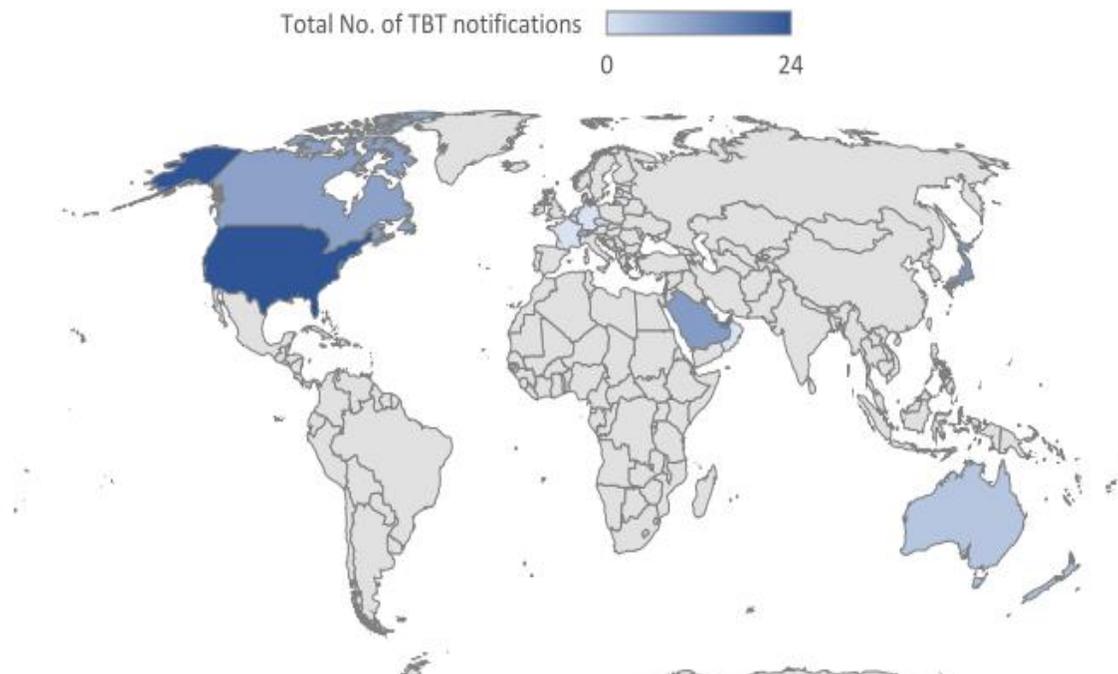
Source: Authors' construction from CWS (undated b)

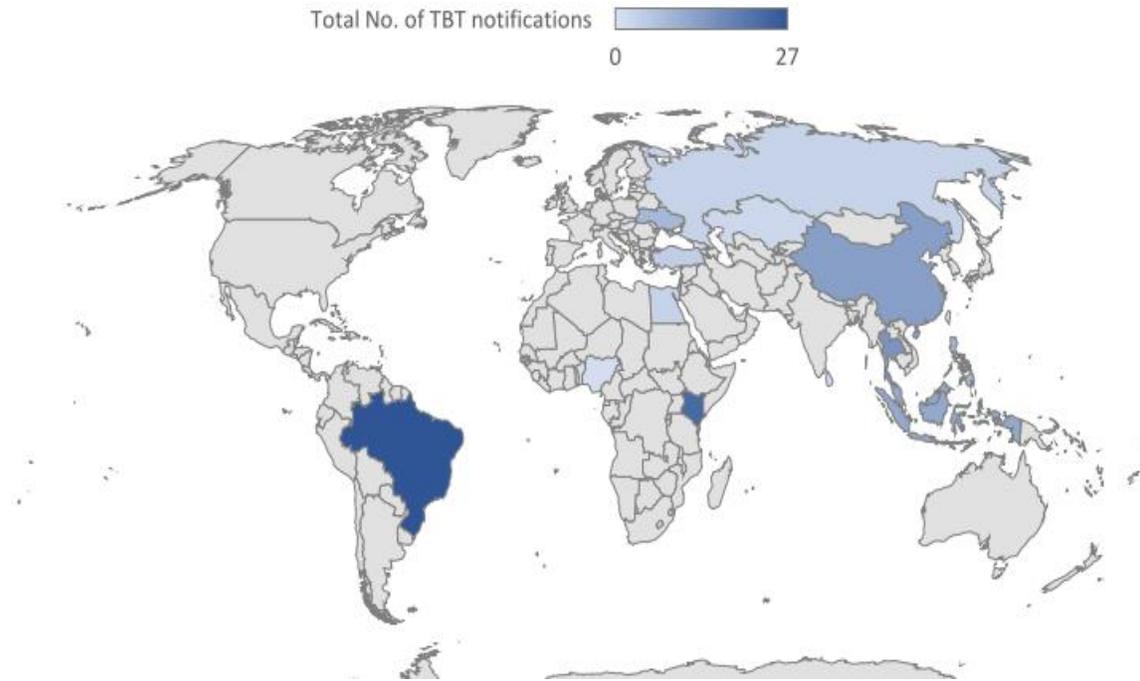**Figure 5: SPS Notifications issued by Developing Countries (1996-2020)**
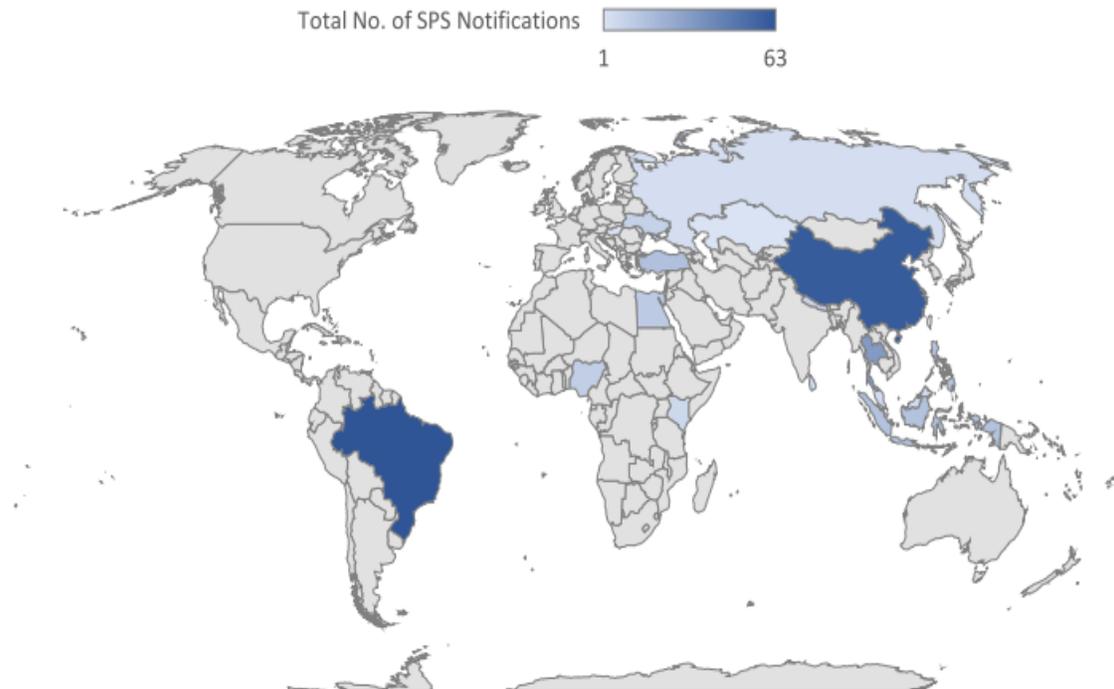
Source: Authors' construction from CWS (undated a)

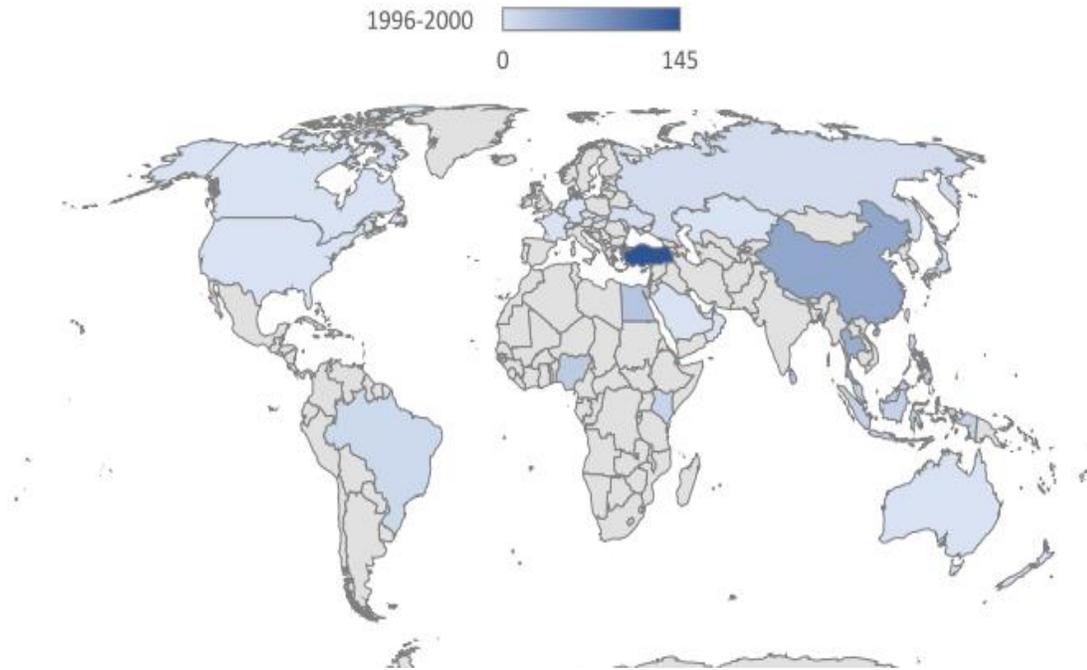**Figure 6: TBT Notifications issued by Developing Countries (1996-2020)**

Source: Authors' construction from CWS (undated b)

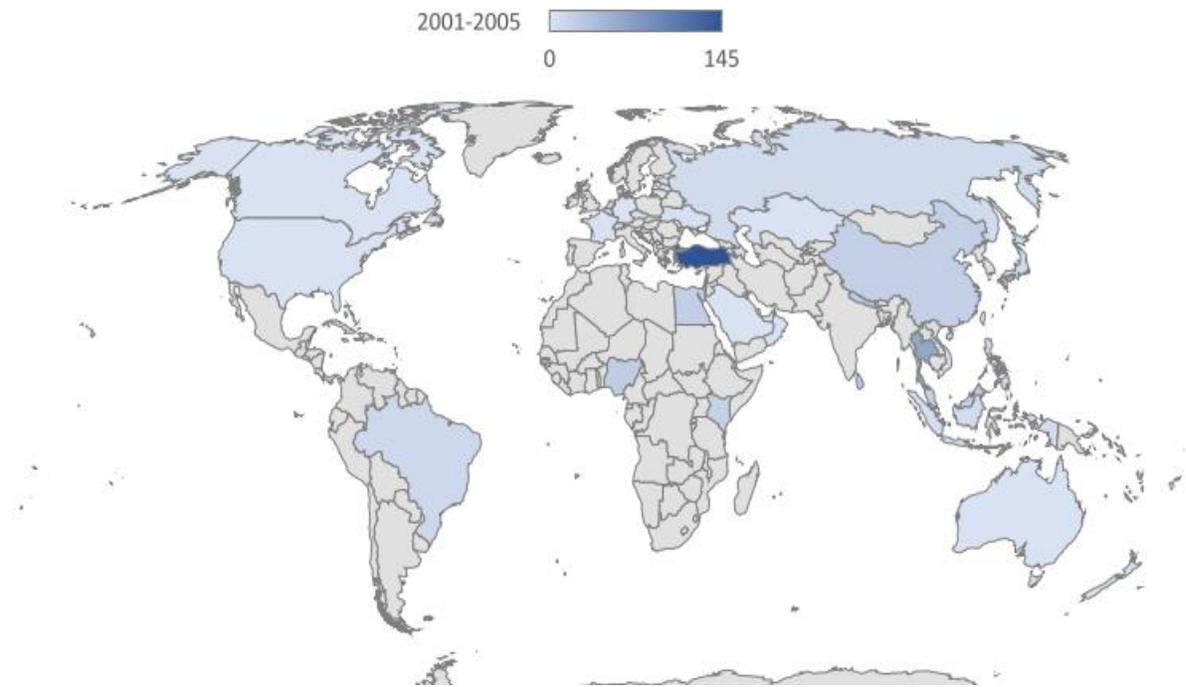**Figure 7: Average Tariff on Indian Tea Exports (1996-2000)**

Source: Authors' construction from WITS, World Bank (undated)

Figure 8: Average Tariff on Indian Tea Exports (2001-2005)

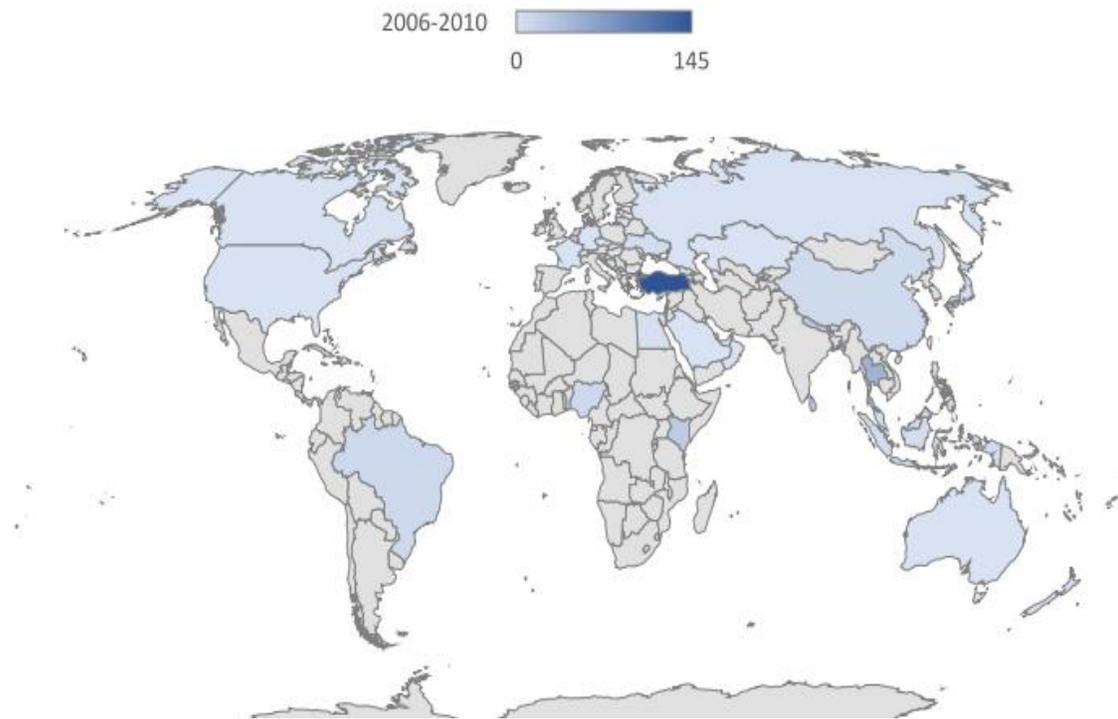**Figure 9: Average Tariff on Indian Tea Exports (2006-2010)**

Source: Authors' construction from WITS, World Bank (undated)

Figure 10: Average Tariff on Indian Tea Exports (2011-2015)

Source: Authors' construction from WITS, World Bank (undated)

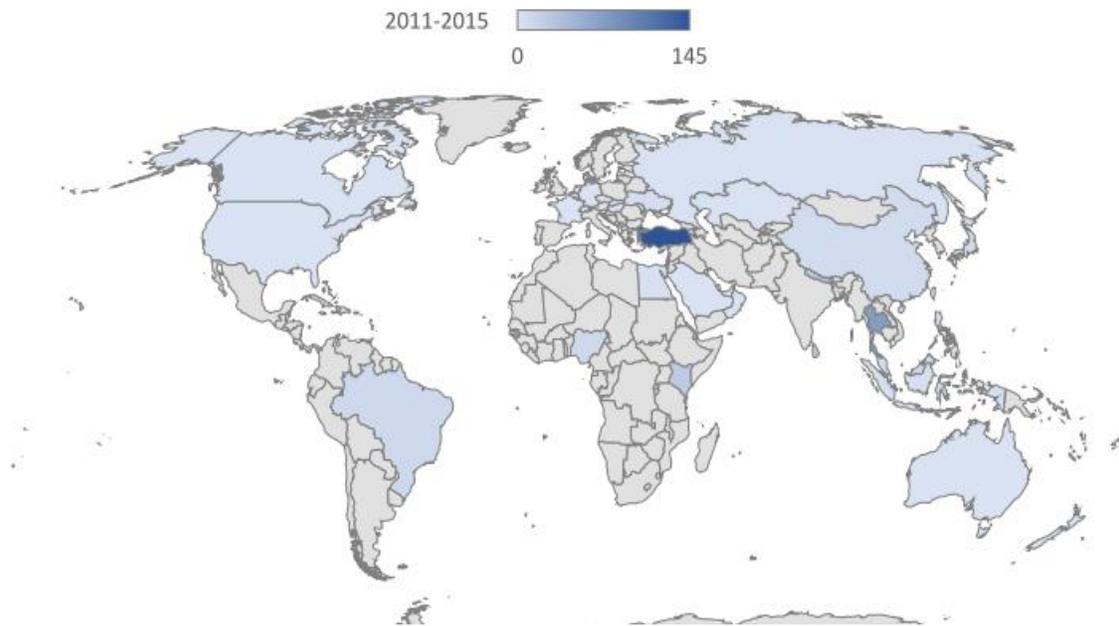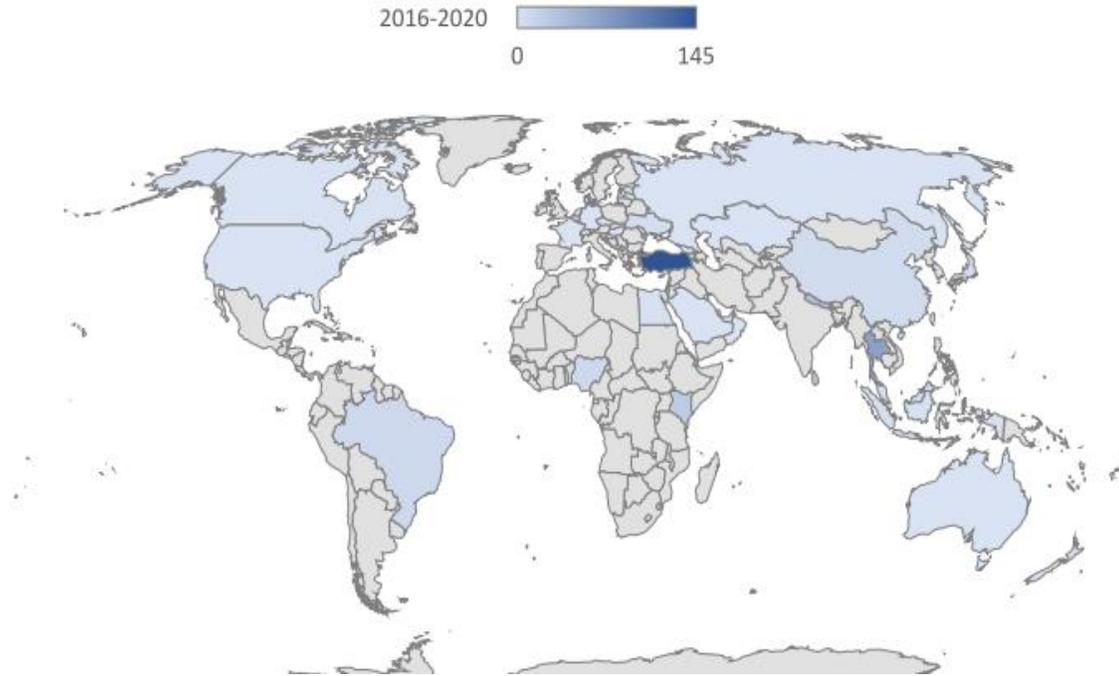**Figure 11: Average Tariff on Indian Tea Exports (2016-2020)**

2016-2020

0   145

Source: Authors' construction from WITS, World Bank (undated)

Table 1: Harris-Tzavalis Unit Root Test

Variables	Z Statistics
$Export_{ijt}$	-9.93***
$ln(GDP_{it}*GDP_{jt})$	-0.15**
$ln\,(pop_{it}*pop_{jt})$	-0.57**
$ln\,w.\,dist_{ij}$	-0.23***
$Tariff_{ij}$	-5.51***
SPS_{ij}	-10.01***
TBT_{ij}	-9.56***

Source: Authors' own estimation

Table 2: Summary Statistics

Variable	Observation	Mean	Standard Deviation	Min	Max
$Export_{ijt}$	900	9827941	20700000	0	186000000
$ln(GDP_{it}*lnGDP_{jt})$	900	54.97	1.58	51.10	59.36
$ln\,(pop_{it}*ln\,pop_{jt})$	900	37.89	1.66	33.87	42.11
$ln\,w.dist_{ijt}$	900	4.18	1.73	0.25	8.26
$Tariff_{ijt}$	900	10.48	26.22	0	145
SPS_{ijt}	900	1.68	1.44	0	4
TBT_{ijt}	900	1.04	1.28	0	4
RTA_{ijt}	900	0.09	0.29	0	1
$Common\,border_{ijt}$	900	0.08	0.27	0	1

Source: Authors' own estimation

Table 3: OLS and PPML Estimation results

	Dependent variable: Indian Tea Exports to Partner Countries					
	OLS Results			**PPML Results**		
Independent Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Constant	-31.69***	-43.57***	-46.58***	-20.51***	-31.70***	-31.99***
	(4.54)	(4.77)	(5.03)	(4.41)	(0.04)	(4.09)
$ln(GDP_{it}*GDP_{jt})$	1.14***	1.42***	1.49***	0.69***	1.02***	1.02***
	(0.09)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)
$ln\,(pop_{it}*pop_{jt})$	-0.41***	-0.49***	-0.50*	-0.01	-0.17**	-0.17**
	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)	(.089)
$ln\,w.dist_{ijt}$	-0.24***	-0.34***	-0.38***	-0.22***	-0.27***	-0.27***
	(0.08)	(0.08)	(0.08)	(0.06)	(0.07)	(0.06)
$Tariff_{ijt}$	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$SPS_{ij}t$		-0.35***	-0.33***		-0.39***	-0.38***
		(0.05)	(0.05)		(0.04)	(0.04)
TBT_{ijt}			-0.11**			-0.00
			(0.06)			(0.04)
$Common\ border_{ijt}$	0.84***	0.82***	0.74***	-0.89***	-0.81***	-0.81***
	(0.31)	(0.30)	(0.30)	(0.23)	(0.21)	(0.21)
RTA_{ijt}	-0.08	0.12	0.12	-0.59***	-0.32**	-0.32**
	(0.26)	(0.25)	(0.25)	(0.13)	(0.14)	(0.14)
R^2	0.22	0.25	0.26	0.20	0.30	0.30
No. of observation	900	900	900	900	900	900

Source: Authors' own estimation

Note: Standard Errors are Reported in the parenthesis

Table 4: PPML results with Year Dummy

		Dependent variable: Indian Tea Exports to Partner Countries				
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	-97.48***	-94.66**	-95.03***	-127.34***	-96.50***	-134.61***
	(7.08)	(7.08)	(7.03)	(10.34)	(6.84)	(10.31)
$ln(GDP_{it}*GDP_{jt})$	2.47***	2.46***	2.47***	2.92***	2.57***	3.13***
	(0.16)	(0.15)	(0.15)	(0.18)	(0.15)	(0.18)
$ln\ (pop_{it}*pop_{jt})$	-0.38***	-0.46***	-0.46***	-0.17*	-0.57***	-0.29**
	(0.08)	(0.08)	(0.08)	(0.09)	(0.10)	(0.11)
$ln\ w.dist_{ijt}$	-1.40***	-1.24***	-1.25***	-1.82***	-1.30***	-1.93***
	(0.11)	(0.11)	(0.11)	(0.17)	(0.10)	(0.17)
$Tariff_{ijt}$	-0.02	-0.02***	-0.02***	-0.01***	-0.24***	-0.21***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SPS_{ijt}		-0.29***	-0.29***	-0.23***		
		(0.04)	(0.04)	(0.03)		
TBT_{ijt}			-0.00	-0.01		
			(0.46)	(0.03)		
$SPS_{ijt}*Dev$					-0.13***	-0.13***
					(0.03)	(0.03)
$TBT_{ijt}*Dev$					-0.05	-0.08*
					(0.04)	(0.04)
$Common\ border_{ijt}$				-1.90***		-2.15***
				(0.29)		(0.30)
RTA_{ijt}				-0.40***		-0.53***
				(0.13)		(0.14)
R^2	0.25	0.34	0.34	0.49	0.27	0.46
No of observations	900	900	900	900	900	900
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' own estimation

Note: Standard Errors are Reported in the parenthesis

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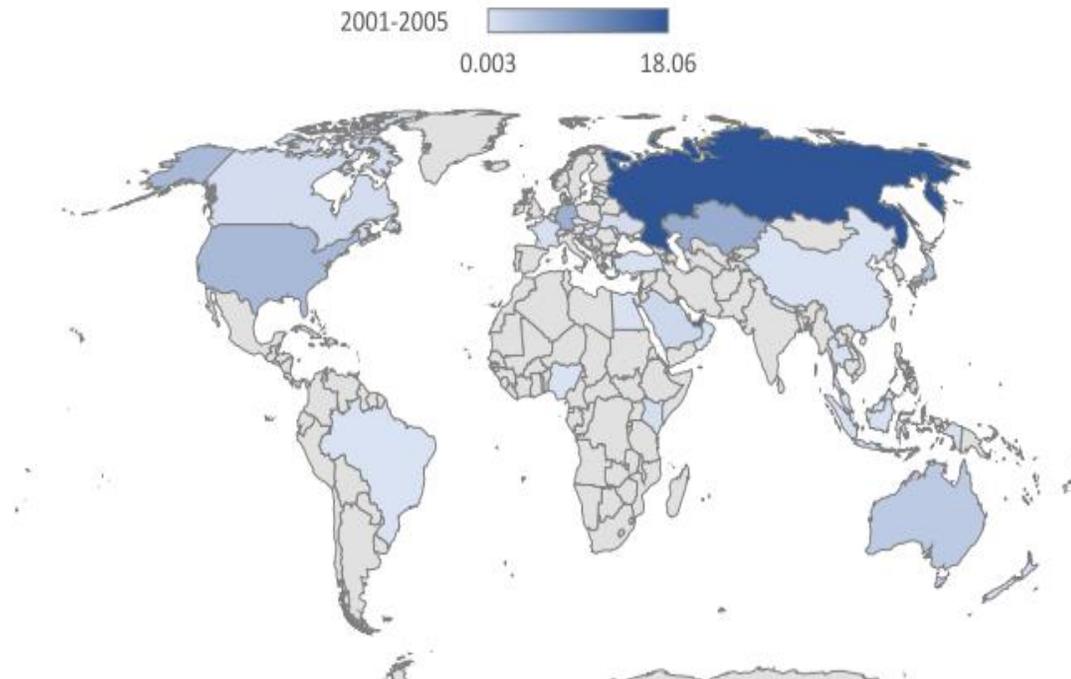World Bank. undated b. "World Integrated Trade Solution (WITS) database". Available at: https://wits.worldbank.org/ (accessed May 1, 2023).

Annex 1. Shares of Major Partners in India's Tea Export Basket (1996-2000)
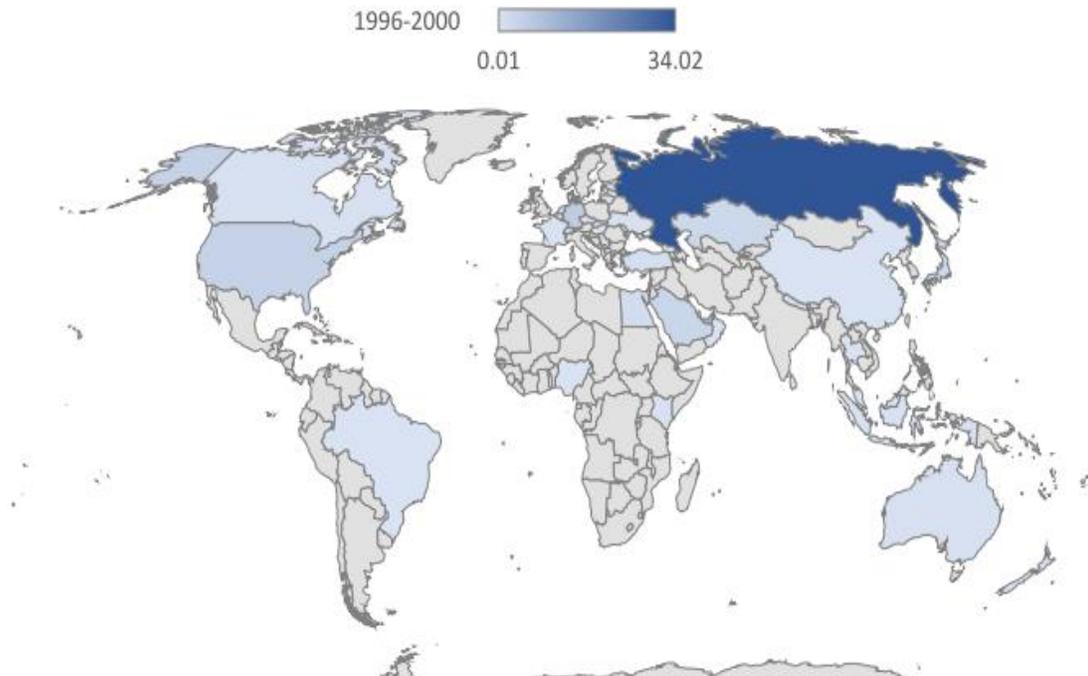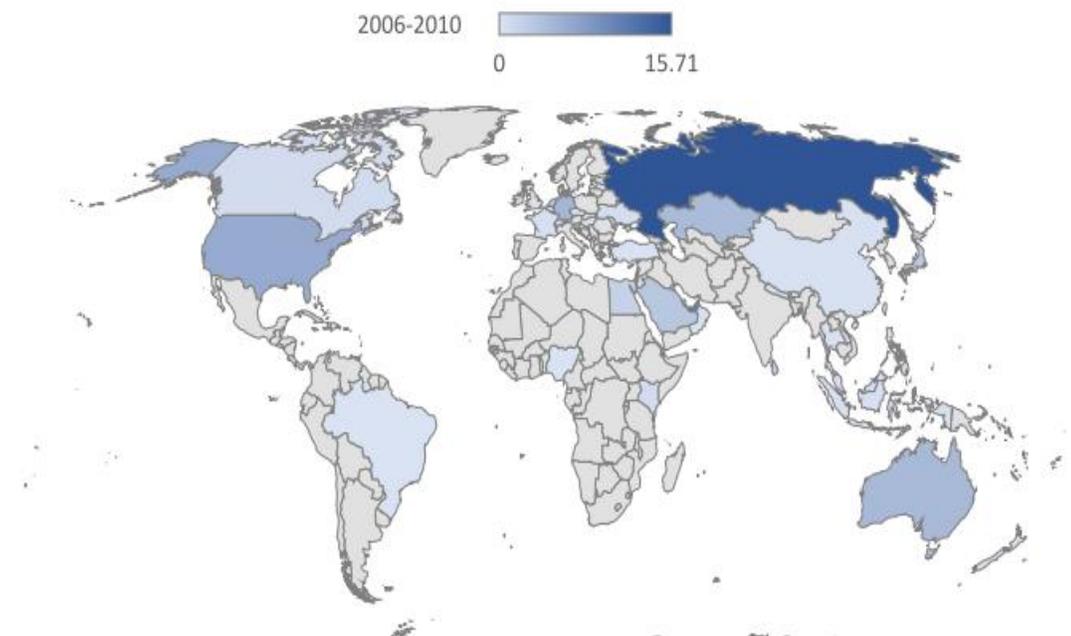

Source: Authors' construction from WITS, World Bank (undated)

Annex 2. Shares of Major Partners in India's Tea Export Basket (2001-2005)

Source: Authors' construction from WITS, World Bank (undated)

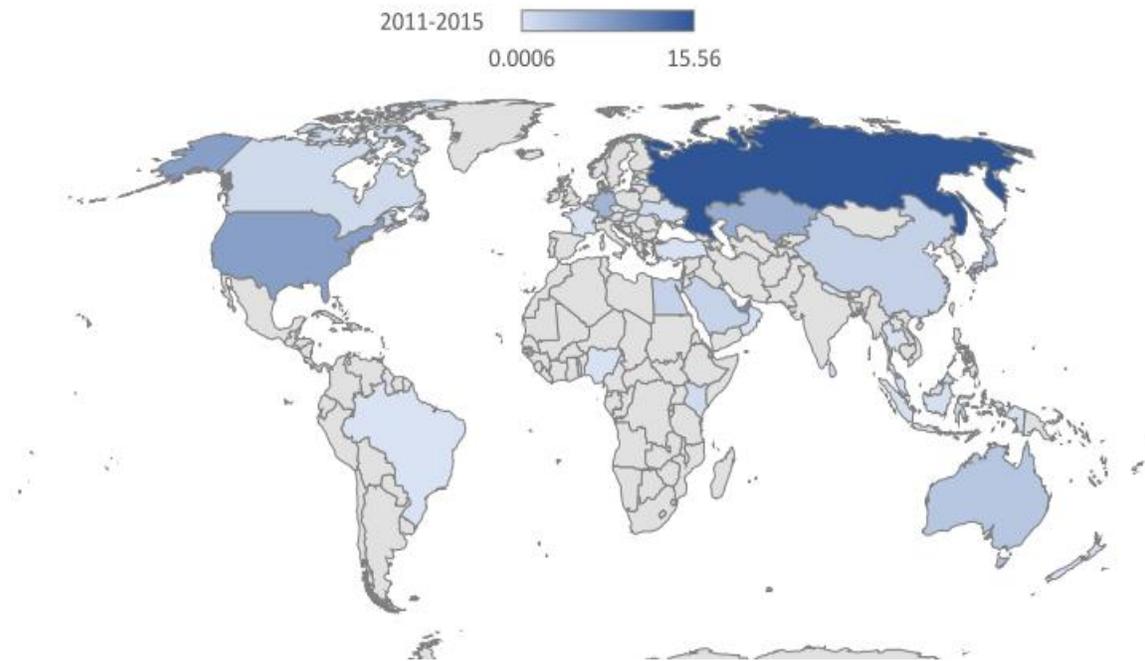**Annex 3. Shares of Major Partners in India's Tea Export Basket (2006-2010)**

Source: Authors' construction from WITS, World Bank (undated)

Annex 4. Shares of Major Partners in India's Tea Export Basket (2011-2015)

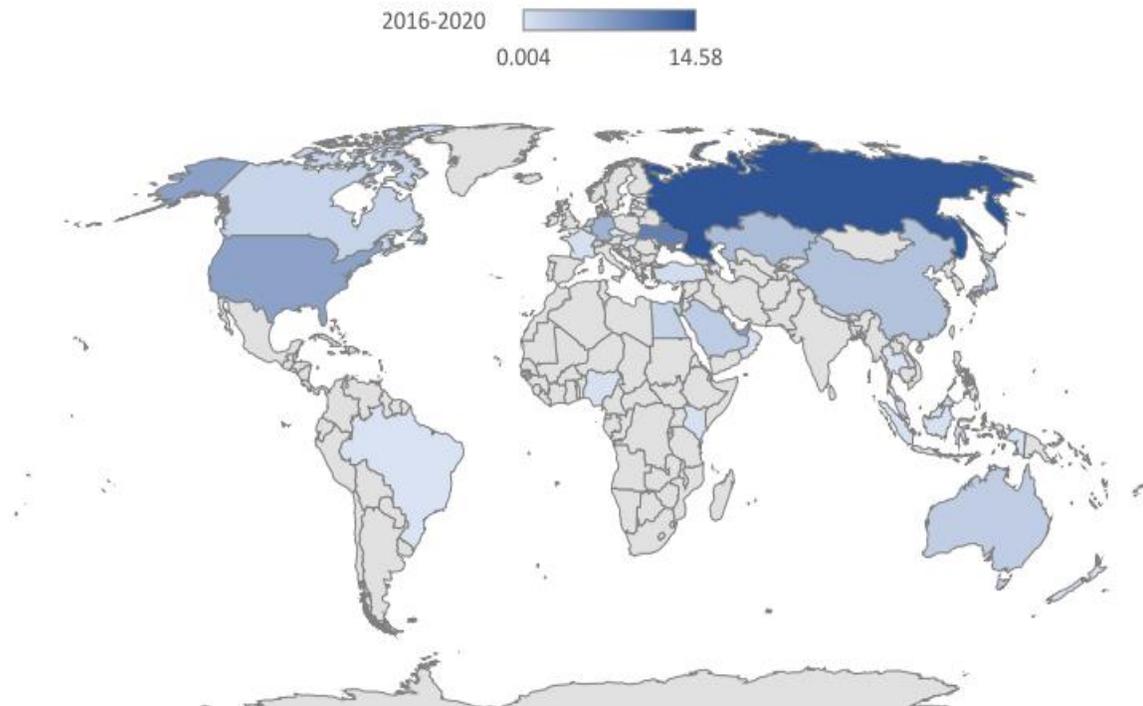
Source: Authors' construction from WITS, World Bank (undated)

Annex 5. Shares of Major Partners in India's Tea Export Basket (2016-2020)

Source: Authors' construction from WITS, World Bank (undated)

Annex 6: Data Source and Variables

Variable Name	Description	Data source	Expected Sign
$Export_{ijt}$	India's bilateral black tea exports to partner countries.	UNCOMTRADE (undated)	Dependent Variable
$GDP_{it}*GDP_{jt}$	Interaction of real GDP of India and partner countries.	World Development Indicators, World Bank (undated a)	(+ve)
$pop_{it}*pop_{jt}$	Interaction of population of India and partner countries.	World Development Indicators, World Bank (undated a)	Mixed
$w.dist_{ijt}$	Income weighted distance between India and Partner countries.	CEPII (undated)	(-ve)
$Tariff_{ijt}$	MFN tariff imposed by partner countries on India's black tea exports	World Integrated Trade system, World Bank (undated b)	(-ve)
SPS_{ijt}	Constructed Stringency measure from SPS notifications in partner countries.	Center for WTO Studies (undated a)	Mixed
TBT_{ijt}	Constructed stringency measure from TBT notifications by partner countries.	Center for WTO Studies (undated b)	Mixed
$SPS_{ijt}*Dev$	Interaction term between the constructed stringency in SPS norms in partner countries and a developed country dummy.	Center for WTO Studies and World Bank Country Classifications	Mixed
$TBT_{ijt}*Dev$	Interaction term between the constructed stringency in TBT norms in partner countries and a developed country dummy.	Center for WTO Studies (undated) and World Bank Country Classifications	Mixed
RTA_{ijt}	Dummy variable constructed as 1 for India's RTA partners and 0 otherwise.	Constructed from ADB ARIC (undated)	Mixed
$Common\ border_{ijt}$	Dummy variable constructed as 1 for India's immediate neighbours and 0 otherwise.	Constructed from CEPII (undated)	Mixed

Source: Author's compilation

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