The Necessity of New Versions of Bilateral Trade Balances: The Nonlinear ARDL Approach for the USA and Japan

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Abstract: This study aims to demonstrate the need for new forms of Bilateral Trade Balances (BTBs) for countries rather than relying on the traditional BTB ratio. The traditional ratio, which is based on total exports, cannot quantify a BTB based on its economic impact content because countries do not export only domestic goods produced within the country but also export goods already imported from other countries (re-export). On the other hand, domestic goods undergo a value-added process within a country, whereas re-exported goods do not. Therefore, the study proposes two new forms of BTBs: the *production-related BTB* based on domestic export and the *non-production-related BTB* based on re-export, for the USA with Japan. Empirical findings support the need to reformulate US BTBs since the impacts of income, real exchange rate, trade policy uncertainty, and the COVID-19 pandemic on these two new forms of BTBs are entirely different. Furthermore, the proposed methodology allows a country to identify the nature of its deficits, which is economically more crucial than just knowing its single trade deficit volumes. Therefore, with this methodology, policymakers can implement more sustainable and manageable trade policies at a lower cost.

Keywords: *Production-related* bilateral trade balance, *non-production-related* bilateral trade balance, Nonlinear ARDL Approach, the USA, Japan.

JEL Classification: F10, F14.

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1- Introduction

The USA has been experiencing the most enormous and persistent trade deficits with other countries since 1992, reaching a total of $16 trillion. On the other hand, Japan, with a $1.99 trillion trade surplus to the USA, is one of these countries in the same period (CB, 2021). Accordingly, periodic trade conflicts between the USA and Japan were partly a consequence of Japan's high-level import penetration into the US markets (Sato, 1988; Marlin-Bennett et al. 1992; Cohen et al. 2002; Thorbecke, 2008; Wickes, 2021). Therefore, these large trade deficits periodically deteriorated the US-Japan economic relationships (Cimino-Isaacs and Williams,2020; Urata, 2020).

If a survey can be considered as one of the reasons for this conflict, according to a survey conducted by Harvard University, while 47% of Americans believe that free trade leads to lower goods prices for US consumers, 53% think that this causes job losses in the country (CAPS, 2018). These close percentages clearly show that bilateral trade deficits-surpluses resulting from free trade should eventually be based on economic impact contents for the countries concerned. This means that the economic impact of a negative or a positive Bilateral Trade Balance (henceforth, BTB) might become more important than solely a country's negative or positive BTB ratios. For instance, the final economic contribution of a *production-related BTB*, based on domestic export[1], might become lower for a country than the final economic contribution of *non-production-related BTB*, based on re-export[2]. In other words, for some goods, a non-production-related BTB might contribute to a country's economy more than a production-related BTB even though the former doesn't undergo any value-added process in this country. Therefore, this complex structure requires creating new forms of BTBs rather than using a traditional aggregated BTB ratio, based on total export only, since total export includes domestic export and re-export. However, lack of re-export data for many countries doesn't allow policymakers-scholars to make more accurate estimations in their trade policies-models. In this context, the USA is one of few countries that collect this data separately since the share of US re-exports to other

[1] Domestic Exports – Goods grown, produced, or manufactured in the United States and goods of foreign origin that have been changed, enhanced in value, or improved in condition by further processing or manufacturing in the United States (ITA, 2021).
[2]Re-exports – Previously imported goods that were grown, produced, or manufactured in a foreign country and which, at the time of export, have not undergone substantial transformation in form or condition, which adds a significant amount or percentage of value in comparison to its untransformed value) in the United States (ITA, 2021).

countries came to 19.7% of total export in 2020. As the fourth largest trade partner of the USA, Japan is one of the countries involved, with a share of 11.5% (CB, 2021).

Therefore, in this study, we, for the first time, propose to reformulate and re-investigate the bilateral trade balances of the USA with Japan in the forms of *production-related BTB* and *non-production-related BTB*, based, respectively, on domestic export and re-export separately. With these two forms of BTBs proposed, this methodology will be capable of quantifying bilateral trade balances based on economic impact content as opposed to *total-export BTB*. In this context, the main contribution of this study is to discover concealed but potentially existing, actual impacts of independent variables on the above-mentioned forms of BTBs since *total-export BTB* is not capable of detecting them. Hence, this methodology might allow policymakers to compare such impacts on negative-positive BTBs for the USA based on economic impact contents. This is so because a BTB can be positive (trade surplus) but in the form of *non-production-related BTB,* or a BTB can be negative (trade deficit) but in the form of *production-related BTB*. It is expected that the contribution of *production-related BTB* to the economy will be larger than *non-production-related BTB*. Hence, this methodology will answer a crucial question of what kind of trade deficit the USA has, rather than a trade deficit only as a single value. This information can provide more efficient and sustainable trade policies to USA policymakers. Therefore, this study, using the methodology mentioned above, differs from all previous empirical studies that use the concept of bilateral trade balance as a ratio of total export (x)/ total imports (m) or m/x (Magee, 1973; Bahmani-Oskooee and Alse, 1994; Arize, 1994; Gupta-Kapoor and Ramakrishnan, 1999; Hacker and Hatemi-J, 2003; Bahmani-Oskooee and Artatrana, 2004; Bahmani-Oskooee and Hegerty, 2009; Baek and Choi, 2020; Bahmani-Oskooee and Karamelikli, 2021; Ongan and Gocer, 2021).

2- Empirical Model

The empirical model of this study is presented in the following equation, including trade policy uncertainty (TPU) indexes for the US (TPU_{US}) and Japan (TPU_{JPN}) and the COVID-19 pandemic besides the traditional independent variables the US's income (Y_{US}) and Japan's income (Y_{JPN}) and real exchange rate (RER):

$$\frac{X_{US-JPN}}{M_{US-JPN}} = \beta_0 + \beta_1 LnY_{US_t} + \beta_2 LnY_{JPN_t} + \beta_3 RER_{YEN-USD_t} + \beta_4 TPU_{US_t} + \beta_5 TPU_{JPN_t} + +\beta_6 D_{Covid_t} + e_t \quad (1)$$

Following Eqn. (1), we re-construct the model above based on the methodology proposed in this study by adding the new version forms of bilateral trade balances (dependent variables) BTBs as *production-related BTB* and *non-production-related BTB*. To show this proposed methodological approach clearly, we present the following model in a non-logarithmic form; however, we estimate the model with logarithmic variables:

$$\left(\underbrace{\frac{X_{US-JPN}}{M_{US-JPN}}}_{A}\right) = \left(\underbrace{\frac{X^{p}_{US-JPN}}{M_{US-JPN}}}_{C}\right) + \left(\underbrace{\frac{X^{np}_{US-JPN}}{M_{US-JPN}}}_{D}\right) = \beta_0 + \beta_1 Y_{US_t} + \beta_2 Y_{JPN_t} + \beta_3 RER_{YEN-USD_t} + \beta_4 TPU_{US_t} + \beta_5 TPU_{JPN_t} + \beta_6 D_{Covid_t} + e_t \quad (2)$$

since X_{US-JPN} (*total-export*) = X^{p}_{US-JPN} (*production-related* export = domestic export) + X^{np}_{US-JPN} (*non-production-related* export = re-export). Hence, $\frac{X_{US-JPN}}{M_{US-JPN}}$, $\frac{X^{p}_{US-JPN}}{M_{US-JPN}}$, and $\frac{X^{np}_{US-JPN}}{M_{US-JPN}}$ are *total-export BTB* (denotes A in Eqn. 2*), production-related BTB (denotes C)*, and *non-production-related BTB (denotes D)*, respectively. X_{US-JPN} is US export to Japan and M_{US-JPN} is US imports from Japan. Y_{US_t} and Y_{JPN_t} are incomes of the USA and Japan. The industrial production index for monthly income is used as a proxy of income for both countries. $RER_{YEN-USD_t}$ is real exchange rate adjusted by CPIs. It is defined as $RER_{YEN-USD_t} = \frac{NEX_t * CPI^{JPN}_t}{CPI^{US}_t}$ since the NEX is nominal exchange rate as units of USD per YEN (Thorbecke, 2008). TPU_{JPN} and TPU_{US} are Japan's and US's trade policy uncertainty indexes (TPUs), respectively. D_{Covid_t} is the COVID-19 pandemic, defined as a dummy variable that takes the value of 1 from March 2020. The US and Japan's TPU indexes were created by Baker et al. (2016) and Arbatli et al. (2019), respectively. For the sake of brevity, the technical construction of the TPU index is explained in the Appendix. The rationale of using the TPU index as an additional independent variable in the model reflects our assumption that changes in uncertainties in trade policies of both countries may directly affect trade volumes and, thereby, the bilateral trade balances of the USA with Japan. It should also be noted that according to Hofstede et al. (1980) and Kim (2006), Japanese people are one of the highest uncertainty avoidance people. Therefore, this result will necessitate adding the TPU index in a trade model that includes Japan. The expected sign of β_1 is to be negative since a rise in US income will lead to an increase in USA's imports from Japan that will worsen the USA BTBs (A, C, and D). The expected sign of β_2 is to be positive since a rise in Japan's income will lead to an increase in USA's export to Japan that will improve the USA BTBs (A, C, and D) with Japan. We expect the sign of β_3 to be positive since a real depreciation (an increase in RER) in the USD will lead to an increase in USA's export to Japan that will improve the USA's BTBs (A, C, and D) with this country (Nakashima, 2008). The expected signs of β_4 and β_5 can be either positive or negative and thereby they may improve or worsen A, C, and D. Similarly, we expect the sign of β_6 to be either positive or negative since the COVID-19 pandemic can improve or worsen US BTBs. This study uses 44 leading *Harmonized System* (*HS*) coded goods between the USA and Japan. The monthly industry flows between 2002M1-2021M7 were obtained from the US Census Bureau. The nominal exchange rates, CPIs, and IPI indexes were obtained from the Federal Reserve Bank of St. Louis

3-Empirical Methodology

To reveal the separate impacts of increases (+) and decreases (-) in US's ($TPU^{+}_{US_t}$, $TPU^{-}_{US_t}$) and Japan's ($TPU^{+}_{JPN_t}, TPU^{-}_{JPN_t}$) TPU indexes on A, C, and D, we apply the Nonlinear Autoregressive Distributed Lag (NARDL) approach introduced by Shin et al. (2014). This approach allows for potential asymmetries concerning both increases and decreases in an independent variable (TPU index) since the impacts of $TPU^{+}_{JPN_t}, TPU^{-}_{JPN_t}, TPU^{+}_{US_t}$, and $TPU^{-}_{US_t}$ on A, C, and D can be asymmetric (nonlinear). Asymmetry is defined as the different magnitude or different sign (direction) effects of $TPU^{+}_{JPN_t}, TPU^{-}_{JPN_t}, TPU^{+}_{US_t}$, and $TPU^{-}_{US_t}$ on A, C, and D. Before applying the NARDL approach, we, first, decompose the TPU indexes of both countries into their increases (TPU^{+}) and decreases (TPU^{-}) using the following consecutive equations developed by Granger and Yoon (2002):

$$TPU_t = TPU_{t-1} + \varepsilon_t = TPU_0 + \sum_{j=1}^{t} \varepsilon_j \qquad (3)$$

where TPU_0 shows initial value of TPU. $\varepsilon_t \sim N(0, \sigma_{\varepsilon_t}^2)$ is white noise error term. Positive and negative shocks can be defined as:

$$\varepsilon_t^+ = max(\varepsilon_t, 0) \quad (4)$$

$$\varepsilon_t^- = min(\varepsilon_t, 0) \quad (5)$$

Since the error term can be defined as $\varepsilon_t = \varepsilon_t^+ + \varepsilon_t^-$, we can rewrite Eq. (3) as following:

$$TPU_t = TPU_{t-1} + \varepsilon_t = TPU_0 + \sum_{j=1}^{t} \varepsilon_t^+ + \sum_{j=1}^{t} \varepsilon_t^- \quad (6)$$

so, we can define the positive and negative shocks of TPU as:

$$TPU_t^+ = \sum_{j=1}^{t} \varepsilon_t^+ \quad (7)$$

$$TPU_t^- = \sum_{j=1}^{t} \varepsilon_t^- \quad (8)$$

if we set the equation based on ε_t in Eq. (3):

$$\varepsilon_t = TPU_t - TPU_{t-1} = \Delta TPU_t \quad (9)$$

we obtain the following equations when we add ΔTPU_t in Equations (7) and (8):

$$TPU_t^+ = \sum_{j=1}^{t} \Delta TPU_j^+ = \sum_{j=1}^{t} \max(\Delta TPU_j, 0) \quad (10)$$

$$TPU_t^- = \sum_{j=1}^{t} \Delta TPU_j^- = \sum_{j=1}^{t} \min(\Delta TPU_j, 0) \quad (11)$$

where TPU_t^+ and TPU_t^- are the partial sum process of positive (+) and negative (-) changes in the TPU index. After this decomposition process, we re-write the model in Eqn. (2) in the following NARDL approach to estimate the coefficients of the *total-export BTB* (denotes A), *production-related BTB* (denotes C), and *non-production-related BTB* (denotes D) models, separately.

$$\Delta BTB_{US\_JPN_t} = \beta_0 + \beta_1 BTB_{US\_JPN_{t-1}} + \beta_2 Y_{US_{t-1}} + \beta_3 Y_{JPN_{t-1}} + \beta_4 RER_{YEN\_USD_{t-1}} + \beta_5 TPU^{+}_{US_{t-1}} + \beta_6 TPU^{-}_{US_{t-1}} + \beta_7 TPU^{+}_{JPN_{t-1}} + \beta_8 TPU^{-}_{JPN_{t-1}} + \sum_{j=1}^{m_1} \beta_{10j}\, \Delta BTB_{US\_JPN_{t-j}} + \sum_{j=0}^{m_2} \beta_{11j}\, \Delta Y_{US_{t-j}} + \sum_{j=0}^{m_3} \beta_{12j}\, \Delta Y_{JPN_{t-j}} + \sum_{j=0}^{m_4} \beta_{13j}\, \Delta RER_{YEN\_USD_{t-j}} + \sum_{j=0}^{m_5} \beta_{14j} TPU^{+}_{US_{t-j}} + \sum_{j=0}^{m_6} \beta_{15j} TPU^{-}_{US_{t-j}} + \sum_{j=0}^{m_7} + \beta_{16j} TPU^{+}_{JPN_{t-j}} + \sum_{j=0}^{m_8} \beta_{17j} TPU^{-}_{JPN_{t-j}} + \beta_{18} D_{Covid_{t-1}} + \epsilon_t \qquad (12)$$

In Eqn. (12), the long-run impacts of US and Japan's TPU_t^{+} and TPU_t^{-} indexes on US BTBs (A, C, and D) are determined by the signs and significances of normalized $\frac{-\beta_5}{\beta_1}$, $\frac{-\beta_6}{\beta_1}$, $\frac{-\beta_7}{\beta_1}$ and $\frac{-\beta_8}{\beta_1}$, respectively. Similarly, we determine the long-run impacts of the Y_{US_t}, $Y_{JPN_t}$and $RER_{YEN\_UDS_t}$ by the signs and significances of normalized $\frac{-\beta_2}{\beta_1}$, $\frac{-\beta_3}{\beta_1}$ and $\frac{-\beta_4}{\beta_1}$, respectively[3]. The short-run impacts of TPU_t^{+} and TPU_t^{-} indexes are determined by the signs and significances of $\sum_{j=0}^{m_5} \beta_{14j}$, $\sum_{j=0}^{m_6} \beta_{15j}$, $\sum_{j=0}^{m_7} \beta_{16j}$ and $\sum_{j=0}^{m_8} \beta_{17j}$. For formal decisions of short-run asymmetry (W_{SR}) and long-run asymmetry (W_{LR}), we apply the Wald test and determine $\sum_{j=0}^{m_5} \beta_{14j} = \sum_{j=0}^{m_6} \beta_{15j}$, $\sum_{j=0}^{m_7} \beta_{16j} = \sum_{j=0}^{m_8} \beta_{17j}$ and $\frac{-\beta_5}{\beta_1} = \frac{-\beta_6}{\beta_1}$ and $\frac{-\beta_7}{\beta_1} = \frac{-\beta_8}{\beta_1}$. The null hypothesis of the Wald test is symmetry.

4- Empirical Findings

Before estimating the ARDL model to examine the dynamics of BTB, the integration properties of the variables need to be tested using the conventional unit root tests of stationarity. In this context, Dickey and Fuller (1979, 1981) ADF and Phillips and Perron (1988) PP unit root tests were applied, and results are presented in Tables 1, 2, and 3.

[3] Following Shin et al. (2014), normalized results are presented in the tables in this study. Although unnormalized results were also available, we preferred to work with normalized results because we examined the results based on "sign" rather than "size," and working in this way avoids errors since the signs do not change in the normalized coefficients (since the β_1 coefficients are negative) and increases the significance levels of the coefficients.

Table 1: Unit Root Test Results

Variables	Constant				Constant + Trend			
	Level		First Difference		Level		First Difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
Y_{US}	-2.38	-2.52	-11.5***	-12.2***	-3.04	-2.48	-11.48***	-12.18***
Y_{JPN}	-3.14**	-3.02**	-13.07***	-13.02***	-3.57**	-3.33*	-13.05***	-13***
Y_{YEN_USD}	-1.23	-1.13	-11.87***	-11.84***	-2.27	-2.09	-11.92***	-12.01***
TPU_{US}^{+}	-0.84	-1.26	-21.12***	-21.5***	-2.44	-3.68**	-21.11***	-21.52***
TPU_{US}^{-}	-0.56	-0.57	-20.98***	-25.11***	-3.58**	-4.21***	-20.95***	-25.22***
TPU_{JPN}^{+}	-1.25	-0.95	-13.85***	-19.68***	0.27	-0.74	-13.93***	-19.74***
TPU_{JPN}^{-}	-0.59	-0.76	-13.64***	-19.28***	-2.54	-2.09	-13.63***	-19.28***
BTB_P_22	-1.17	-3.16**	-19.25***	-41.49***	-4.67***	-10.29***	-11.7***	-46.32***
BTB_P_28	-3.51***	-6.26***	-15.1***	-44.26***	-4.86***	-9.07***	-15.06***	-44.19***
BTB_P_29	-2.45	-5.22***	-10.87***	-116.94***	-4.29***	-10.21***	-10.85***	-124.38***
BTB_P_30	-2.35	-4.08***	-11.72***	-44.33***	-2.3	-4.33***	-11.76***	-68.86***
BTB_P_32	-3.1**	-11.2***	-9.99***	-61.44***	-3.38*	-11.53***	-10.13***	-70.23***
BTB_P_33	-1.1	-9.05***	-13.48***	-73.19***	-3.53**	-14.2***	-13.46***	-107.58***
BTB_P_35	-8.01***	-12.48***	-14.1***	-78.83***	-12.41***	-12.81***	-14.07***	-79.46***
BTB_P_37	-2.63*	-6.4***	-19.49***	-54.45***	-3.88**	-9.58***	-19.45***	-54.24***
BTB_P_38	-5.68***	-11.89***	-11.24***	-83.05***	-6.19***	-12.26***	-11.24***	-103.42***
BTB_P_39	-3.47***	-9.56***	-11.9***	-105.86***	-4.02***	-10.41***	-11.91***	-150.74***
BTB_P_40	-5.15***	-8.75***	-18.2***	-30.27***	-5.38***	-9.47***	-18.18***	-30.31***
BTB_P_42	-1.46	-5.32***	-12.48***	-41.26***	-2.59	-6.85***	-12.59***	-51.07***
BTB_P_44	-1.18	-6.38***	-14.6***	-51.16***	-1.86	-8.17***	-14.6***	-53.61***
BTB_P_48	-2.21	-7.97***	-15.71***	-37.72***	-3.67**	-11.81***	-15.68***	-37.58***
BTB_P_49	-4.34***	-10.44***	-13.44***	-50.44***	-4.52***	-10.32***	-13.41***	-50.55***
BTB_P_56	-2.84*	-7.64***	-14.1***	-38.68***	-4.41***	-10.36***	-14.09***	-38.91***
BTB_P_59	-4.52***	-12.19***	-12.04***	-83.86***	-5.15***	-12.83***	-12.01***	-85.94***
BTB_P_61	-2.03	-3.7***	-3.96***	-24.68***	-1.72	-3.66**	-6.43***	-25.09***
BTB_P_62	0.17	-9.87***	-17.5***	-35.34***	-1.43	-10.82***	-8.69***	-37.32***
BTB_P_63	-5.41***	-9.17***	-16.18***	-41.57***	-5.93***	-10.02***	-16.15***	-41.55***
BTB_P_64	-4.19***	-10.02***	-17.42***	-131.3***	-4.44***	-10.57***	-17.38***	-141.78***
BTB_P_65	-11.51***	-11.86***	-9.3***	-90.4***	-11.48***	-11.84***	-9.28***	-126.23***
BTB_P_68	-9.84***	-9.96***	-12.45***	-62.23***	-9.92***	-10.02***	-12.45***	-108.38***
BTB_P_69	-3.57***	-11.68***	-13.29***	-62.25***	-3.62**	-11.67***	-13.29***	-67.08***
BTB_P_70	-3.37**	-6***	-18.57***	-36.85***	-3.71**	-7.52***	-18.54***	-37.11***
BTB_P_71	-8.87***	-9.07***	-12.47***	-54.32***	-8.89***	-9.1***	-12.45***	-54.15***
BTB_P_72	-2.96**	-8.05***	-17.38***	-33.36***	-3.64**	-9.24***	-17.35***	-33.38***
BTB_P_73	-2.88**	-7.71***	-14.5***	-39.11***	-3.12	-9.02***	-14.48***	-38.96***
BTB_P_74	-4.4***	-6.89***	-16.1***	-27.54***	-4.51***	-7.2***	-16.06***	-27.49***

Table 1: Unit Root Test Results (Continue)

Variables	Constant				Constant + Trend			
	Level		First Difference		Level		First Difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
BTB_P_76	-2.22	-6.44***	-19.08***	-30.7***	-2.02	-6.49***	-19.12***	-31.7***
BTB_P_82	-8.2***	-8.17***	-10.76***	-68.28***	-9.38***	-9.4***	-10.75***	-81.27***
BTB_P_83	-4.57***	-5.45***	-14.58***	-35.34***	-4.63***	-5.73***	-14.6***	-42.21***
BTB_P_84	-3.51***	-6.93***	-18.31***	-30.57***	-3.52**	-7.18***	-5.11***	-30.54***
BTB_P_85	-2.38	-9.4***	-13.08***	-67.29***	-6.8***	-11.22***	-13.05***	-67.2***
BTB_P_86	-3.48***	-9.13***	-13.64***	-49.38***	-3.46**	-9.14***	-13.62***	-49.58***
BTB_P_87	-8.85***	-9.58***	-17.33***	-38.24***	-9.11***	-9.85***	-17.3***	-38.49***
BTB_P_88	-3.63***	-8.21***	-13.06***	-50.78***	-5.84***	-10.95***	-13.03***	-50.4***
BTB_P_90	-4.1***	-10.49***	-6.64***	-58.76***	-4.1***	-10.49***	-6.74***	-74.35***
BTB_P_91	-4.47***	-7.86***	-16.06***	-37.71***	-4.43***	-7.86***	-16.05***	-38.49***
BTB_P_92	-2.04	-5.02***	-13.7***	-51.82***	-3.08	-9.41***	-13.69***	-54.5***
BTB_P_94	-3.7***	-4.93***	-13.03***	-30.05***	-4.17***	-6.13***	-13.02***	-30.2***
BTB_P_95	-3.98***	-4.34***	-10.62***	-60.38***	-6.33***	-6.33***	-10.62***	-68.25***
BTB_P_96	-4.76***	-11.83***	-10.38***	-76.87***	-13.48***	-13.64***	-10.36***	-76.54***
BTB_P_97	-13.23***	-13.44***	-9.92***	-81.06***	-13.33***	-13.51***	-10.04***	-85.21***

Table 2: Unit Root Test Results (For BTB_NP)

Variables	Constant				Constant + Trend			
	Level		First Difference		Level		First Difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
BTB_NP_22	-2.84*	-8.51***	-12.52***	-138.25***	-6.18***	-10.81***	-12.49***	-141.45***
BTB_NP_28	-4.91***	-9.79***	-12.08***	-81.22***	-5.3***	-10.53***	-12.06***	-85.82***
BTB_NP_29	-5.1***	-11.7***	-10.54***	-35.24***	-6.04***	-12.31***	-10.51***	-35.17***
BTB_NP_30	-1.6	-3.21**	-10.93***	-42.78***	-3.27*	-6.85***	-10.93***	-44.75***
BTB_NP_32	-4.26***	-11.1***	-17.37***	-81.73***	-4.23***	-11.13***	-17.34***	-91.31***
BTB_NP_33	-4.53***	-9.92***	-16.31***	-44.06***	-4.6***	-10.01***	-16.28***	-44.12***
BTB_NP_35	-10.06***	-10.41***	-12.07***	-109.88***	-10.37***	-10.69***	-12.05***	-118.77***
BTB_NP_37	-4.07***	-9.25***	-13.29***	-39.22***	-4.06***	-9.24***	-13.27***	-39.13***
BTB_NP_38	-4.51***	-11.7***	-12.56***	-76.43***	-6.8***	-11.69***	-12.53***	-76.04***
BTB_NP_39	-4.88***	-12.42***	-19.34***	-53.26***	-5.56***	-12.88***	-19.3***	-53.29***
BTB_NP_40	-2.9**	-9.64***	-10.26***	-41.06***	-6.77***	-12.57***	-10.27***	-40.95***
BTB_NP_42	-2.67*	-6.23***	-13.21***	-44.29***	-2.55	-6.24***	-13.21***	-44.7***
BTB_NP_44	-2.32	-5.76***	-17.46***	-69.44***	-4.38***	-10.69***	-17.43***	-75.56***
BTB_NP_48	-4.5***	-10.08***	-17.13***	-51.95***	-4.93***	-10.65***	-17.1***	-52.74***
BTB_NP_49	-3.26**	-10.85***	-14.45***	-50.67***	-3.7**	-11.85***	-14.42***	-50.58***
BTB_NP_56	-8.61***	-8.84***	-13.02***	-62.62***	-9.78***	-10.06***	-13.02***	-65.64***
BTB_NP_59	-3.08**	-11.67***	-13.74***	-64.35***	-7.06***	-12.36***	-13.7***	-64.82***
BTB_NP_61	-2.24	-2.76*	-5.92***	-26.83***	-1.03	-3.54**	-6.31***	-28.31***
BTB_NP_62	-1.47	-8.84***	-7.08***	-34.02***	-1.1	-8.79***	-7.23***	-35.42***
BTB_NP_63	-4.87***	-10.95***	-18.43***	-76.81***	-5.27***	-11.36***	-18.39***	-83.77***
BTB_NP_64	-2.12	-10.07***	-12.6***	-58.72***	-2.1	-10.09***	-12.57***	-60.2***
BTB_NP_65	-2.92**	-9.75***	-12.84***	-100.29***	-11.92***	-12.82***	-12.83***	-110.45***
BTB_NP_68	-3.4**	-8.02***	-12.25***	-82.45***	-4.66***	-9.84***	-12.23***	-81.34***
BTB_NP_69	-4.61***	-8.89***	-11.73***	-50.18***	-4.89***	-9.15***	-11.71***	-51.81***
BTB_NP_70	-10.01***	-10.59***	-10.27***	-47.97***	-11.7***	-11.68***	-10.24***	-47.84***
BTB_NP_71	-3.78***	-10.26***	-11.99***	-53.8***	-3.87**	-10.48***	-11.96***	-53.55***
BTB_NP_72	-3.46***	-11.28***	-14.77***	-64.35***	-3.54**	-11.77***	-14.75***	-64.19***
BTB_NP_73	-2.09	-6.46***	-19.2***	-34.09***	-3.84**	-10.16***	-19.17***	-34.06***
BTB_NP_74	-5.76***	-12.04***	-11.5***	-77.55***	-5.93***	-12.11***	-11.47***	-84.11***
BTB_NP_76	-4.35***	-11.85***	-12.08***	-59.02***	-4.38***	-11.9***	-12.06***	-59.23***
BTB_NP_82	-6.67***	-9.97***	-10.52***	-85.99***	-10.49***	-10.72***	-10.5***	-92.76***
BTB_NP_83	-2.84*	-5.81***	-10.63***	-52.76***	-11.23***	-11.78***	-10.6***	-53.22***
BTB_NP_84	-3.97***	-9.53***	-18.63***	-45.82***	-4.08***	-9.63***	-18.6***	-45.77***

Table 2: Unit Root Test Results (For BTB_NP, Continue)

Variables	Constant				Constant + Trend			
	Level		First Difference		Level		First Difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
BTB_NP_85	-3.16**	-7.94***	-11.54***	-84.46***	-7.72***	-12.3***	-11.52***	-83.3***
BTB_NP_86	-5.97***	-10.75***	-14***	-48.61***	-5.96***	-10.73***	-13.97***	-48.41***
BTB_NP_87	-5.45***	-8.63***	-16.1***	-30.01***	-5.91***	-8.97***	-16.08***	-30.8***
BTB_NP_88	-5.26***	-7.77***	-13.43***	-42.06***	-5.78***	-8.91***	-13.4***	-42.79***
BTB_NP_90	-2.08	-3.09**	-17.46***	-36.87***	-2.71	-6.01***	-17.47***	-41.5***
BTB_NP_91	-4.28***	-8.97***	-17.39***	-44.85***	-11.3***	-11.48***	-17.35***	-44.73***
BTB_NP_92	-2.79*	-4.91***	-11.23***	-100.87***	-11.5***	-11.71***	-11.2***	-130.85***
BTB_NP_94	-4.56***	-5.41***	-14.3***	-36.62***	-4.69***	-5.55***	-14.28***	-37.85***
BTB_NP_95	-2.08	-4.81***	-12.37***	-52.53***	-2.46	-8.51***	-12.4***	-56.34***
BTB_NP_96	-4.05***	-8.79***	-13.17***	-39.53***	-9.44***	-10.17***	-13.13***	-39.26***
BTB_NP_97	-11.28***	-11.32***	-9.63***	-69.47***	-11.26***	-11.3***	-9.67***	-70.04***

Table 3: Unit Root Test Results (For BTB_TOT)

Variables	Constant				Constant + Trend			
	Level		First Difference		Level		First Difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
BTB_TOT_22	-1.16	-3.04**	-11.76***	-41.24***	-4.84***	-10.27***	-11.81***	-45.91***
BTB_TOT_28	-3.49***	-6.15***	-15.17***	-44.43***	-4.89***	-9.03***	-15.14***	-44.36***
BTB_TOT_29	-2.46	-5.38***	-10.9***	-130***	-4.3***	-10.23***	-10.88***	-138.41***
BTB_TOT_30	-1.86	-3.86***	-11.75***	-48.42***	-1.59	-4.21***	-11.78***	-104.67***
BTB_TOT_32	-3.28**	-11.61***	-10.08***	-63.31***	-3.57**	-11.97***	-10.21***	-73.23***
BTB_TOT_33	-1.28	-9.28***	-13.32***	-77.25***	-13.38***	-14.07***	-13.3***	-131.59***
BTB_TOT_35	-7.88***	-12.36***	-13.83***	-79***	-8.26***	-12.65***	-13.8***	-79.71***
BTB_TOT_37	-2.83*	-6.72***	-19.59***	-61.86***	-4.18***	-9.8***	-19.55***	-61.78***
BTB_TOT_38	-5.72***	-12.13***	-11.26***	-103.17***	-6.23***	-12.78***	-11.26***	-150.94***
BTB_TOT_39	-1.95	-10.79***	-12.27***	-88.33***	-2.45	-11.48***	-12.28***	-116.69***
BTB_TOT_40	-5.3***	-9.02***	-18.26***	-29.05***	-5.42***	-9.56***	-18.25***	-29.08***
BTB_TOT_42	-2.51	-6.39***	-12.92***	-41.47***	-2.87	-6.69***	-12.98***	-44.92***
BTB_TOT_44	-1.18	-6.16***	-14.55***	-51.06***	-1.88	-8.21***	-14.55***	-53.24***
BTB_TOT_48	-2.18	-7.91***	-15.74***	-37.6***	-3.65**	-11.78***	-15.71***	-37.46***
BTB_TOT_49	-4.29***	-10.67***	-13.57***	-52.32***	-4.55***	-10.87***	-13.55***	-52.38***
BTB_TOT_56	-2.91**	-7.72***	-14.02***	-38.42***	-4.43***	-10.3***	-14.02***	-38.66***
BTB_TOT_59	-4.92***	-12.02***	-11.94***	-89.94***	-5.43***	-12.67***	-11.92***	-88.25***
BTB_TOT_61	-2.3	-3.41**	-5.77***	-23.87***	-1.71	-3.5**	-6.13***	-24.26***
BTB_TOT_62	-0.29	-10.46***	-8.16***	-33.81***	-1.28	-10.96***	-8.41***	-35.51***
BTB_TOT_63	-5.74***	-9.25***	-16.05***	-42.92***	-5.95***	-9.63***	-16.02***	-43***
BTB_TOT_64	-4.21***	-10.19***	-11.06***	-82.38***	-4.34***	-10.76***	-11.03***	-89.11***
BTB_TOT_65	-11.8***	-12.32***	-8.93***	-95.6***	-12.14***	-12.43***	-8.92***	-117.12***
BTB_TOT_68	-9.93***	-10.03***	-12.42***	-62.65***	-9.95***	-10.05***	-12.42***	-107.97***
BTB_TOT_69	-3.64***	-11.92***	-13.07***	-60.48***	-3.67**	-11.91***	-13.06***	-62.25***
BTB_TOT_70	-3.32**	-5.95***	-18.46***	-38.84***	-3.69**	-7.33***	-18.43***	-39.16***
BTB_TOT_71	-4.57***	-9.1***	-12.49***	-59.51***	-4.61***	-9.19***	-12.46***	-59.69***
BTB_TOT_72	-2.97**	-8.15***	-17.33***	-33.65***	-3.73**	-9.5***	-17.3***	-34.91***
BTB_TOT_73	-2.32	-6.83***	-12***	-43.7***	-3.02	-9.42***	-11.97***	-44.13***
BTB_TOT_74	-4.39***	-6.94***	-16.15***	-27.66***	-4.5***	-7.25***	-16.11***	-27.6***
BTB_TOT_76	-2.35	-6.84***	-18.99***	-31.69***	-2.18	-6.86***	-19.02***	-32.97***
BTB_TOT_82	-8.75***	-8.76***	-10.78***	-70.27***	-9.44***	-9.46***	-10.76***	-83.76***
BTB_TOT_83	-4.61***	-5.46***	-14.61***	-37.1***	-4.9***	-6.18***	-14.61***	-46.06***
BTB_TOT_84	-3.56***	-7.22***	-5.1***	-31.2***	-3.56**	-7.42***	-7.18***	-31.16***
BTB_TOT_85	-2.16	-10.93***	-5.62***	-63.08***	-2.15	-10.95***	-5.6***	-63.2***
BTB_TOT_86	-5.02***	-10.09***	-13.5***	-53.68***	-5.02***	-10.08***	-13.47***	-53.77***
BTB_TOT_87	-9.16***	-9.71***	-17.1***	-41.89***	-9.68***	-10.16***	-17.07***	-42.96***
BTB_TOT_88	-3.68***	-8.21***	-12.86***	-49.34***	-5.7***	-10.7***	-12.84***	-48.99***

Table 3: Unit Root Test Results (For BTB_TOT, Continue)

Variables	Constant				Constant + Trend			
	Level		First Difference		Level		First Difference	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
BTB_TOT_90	-3.52***	-8.99***	-9.37***	-59.47***	-3.74**	-9.81***	-9.53***	-104.5***
BTB_TOT_91	-5.16***	-8.27***	-10***	-41.46***	-5.89***	-9.43***	-10.01***	-41.51***
BTB_TOT_92	-1.95	-4.7***	-13.71***	-52.52***	-3.29*	-9.31***	-13.69***	-54.72***
BTB_TOT_94	-3.73***	-4.77***	-13.08***	-30***	-4.27***	-6.17***	-13.07***	-30.18***
BTB_TOT_95	-2.36	-4.41***	-10.78***	-40.48***	-6.39***	-6.22***	-10.79***	-42.59***
BTB_TOT_96	-11.56***	-12.11***	-10.24***	-71.01***	-12.82***	-12.91***	-12.23***	-70.88***
BTB_TOT_97	-12.14***	-12.2***	-9.84***	-77.06***	-12.21***	-12.25***	-9.95***	-80.46***

Note: ***, ** and * show the significance at the 1%, 5% and 10% respectively. BTB_P, BTB_NP and BTB_TOT show Production-related Bilateral Trade Balance, Non-Production-related Bilateral Trade Balance and Total Bilateral Trade Balance respectively.

According to the results in Tables 1, 2, and 3, all series can be zero or first-order integrated, and there is no higher-order integrated series.

We provide the estimations of normalized long-run coefficients and diagnostics of the NARDL model in the following Tables 4, 5, and 6 for *production-related BTB, non-production-related BTB,* and *total-export BTB*, respectively. Additionally, we present a summary Table 7 (derived from Tables 4, 5, and 6) that clearly shows whether changes in independent variables worsen or improve BTBs above, separately. The letters "w" and "i", in Tables 4, 5 and 6. Furthermore, worsening and improvement numbers in Table 7 and their code numbers in Table 8 are only the BTBs of the industries that have long run cointegration by either the F test of Pesaran, Shin and Smith (2001) or ECT test[4]. We report the model estimations and diagnostic test results in the following tables only for the long-run since this study is a long-run analysis.

[4] In ARDL models, the F and ECM tests are used to test cointegrated relationships between the variables. While the F test determines whether the variables are cointegrated in the long run, the ECM test captures the short-run dynamics of the model and the speed of adjustment toward the long-run equilibrium. Pesaran et al. (2001: 304) state that ECT can be used for support, especially when the F statistic falls into the uncertainty zone.

Table 4: The Nonlinear ARDL Model Estimation Results (Normalized Long-Run Coefficient for ***Production-related BTB: X^p***)

	Const.	Y_{US}	Y_{JPN}	RER	TPU_{US}^{-}	TPU_{US}^{+}	TPU_{JPN}^{-}	TPU_{JPN}^{+}	D_{Covid}	$\bar{R}^2$	BG	RR	F_{PSS}	ECT_{t-1}	Cusum	$W_{SR}^{TPU\_US}$	$W_{SR}^{TPU\_JPN}$	$W_{LR}^{TPU\_US}$	$W_{LR}^{TPU\_JPN}$
22 Beverages, Spirits and Vinegar	-16.23^{**}	$7.44^{*,i}$	-2.64	0.71	0.24	0.09	-0.06	0.08	0.07	0.46	0.01	0.71	3.1	-0.36	S	$3.63^{*,as}$	0.76	2.46	1.59
28 Inorg Chem, Radioact Compd	23.40^{*}	$-5.44^{**,w}$	0.02	-0.43	$-0.41^{*,i}$	$-0.25^{*,w}$	-0.10	$-0.29^{***,w}$	$-0.47^{*,w}$	0.37	0.11	1.44	5.91^{***}	-0.44^{***}	S	0.008	0.84	$3.07^{*,as}$	$3.01^{*,as}$
29 Organic Chemicals	-5.42	-1.63	$2.76^{***,i}$	0.04	$0.16^{**,w}$	0.10	-0.16	-0.06	0.02	0.5	0.29	0.03	2.41	-0.39	S	0.08	$10.43^{***,as}$	0.72	1.36
30 Pharmaceutical Products	-23.73^{**}	$10.29^{*,i}$	-1.43	$3.74^{*,i}$	$-0.23^{***,i}$	$-0.36^{*,w}$	-0.23	-0.02	-0.08	0.36	0.02	0.09	2.73	-0.29	S	0.48	0.04	1.42	2.13
32 Tanning, Dye Ext, Paint, Putty, Inks	-13.94	-11.84	13.32	-1.33	0.02	-0.30	0.05	0.46	0.15	0.57	1.88	0.17	4.40^{**}	-0.19	S	1.98	$7.96^{***,as}$	1.05	1.12
33 Essential Oils, Perfumery, Cosmetic	-2.57	$4.64^{*,i}$	$-2.78^{*,w}$	$0.85^{*,i}$	-0.04	-0.05	0.02	0.01	0.15	0.53	1.52	0.38	4.05^{**}	-0.85^{***}	S	2.65	$3.67^{*,as}$	0.17	0.08
35 Albuminoidal Subst, Glue, Enzymes	6.62^{**}	-1.29	0.007	0.18	-0.01	0.03	$-0.11^{**,i}$	$-0.16^{*,w}$	-0.14	0.46	0.22	0.38	10.75^{***}	-0.79^{***}	S	0.06	$6.09^{**,as}$	2.42	2.14
37 Photographic or Cinematog. Goods	10.78	-3.31	0.24	-0.24	-0.03	0.07	-0.05	-0.17	-0.07	0.37	0.76	0.25	2.35	-0.31	S	1.32	2.2	1.93	2.25
38 Miscellaneous Chemical Products	-1.11	-0.29	0.31	-0.21	0.03	$-0.05^{**,w}$	-0.03	0.06	-0.09	0.47	0.69	3.34	8.51^{***}	-0.75^{***}	S	$2.81^{*,as}$	1.48	$12.17^{***,as}$	$12.24^{***,as}$
39 Plastics and Articles Thereof	5.56	$-5.21^{***,w}$	$4.04^{**,i}$	0.25	-0.01	0.01	-0.15	-0.16	-0.06	0.52	0.02	0.63	3.64^{*}	-0.22	S	0.18	1.27	0.22	0.03
40 Rubber and Articles Thereof	-11.33^{c}	-0.73	$2.33^{*,i}$	$-0.39^{*,w}$	$0.13^{*,w}$	$0.08^{*,i}$	-0.01	0.04	$0.31^{*,i}$	0.46	0.01	0.03	6.43^{***}	-1.05^{***}	S	$9.26^{***,as}$	0.92	$5.04^{**,as}$	$4.14^{**,as}$
42 Leather Art, Handbags, Gut Art	11.65^{***}	2.15	$-3.30^{**,w}$	$0.86^{*,i}$	-0.05	-0.09	-0.04	-0.006	$-0.59^{*,w}$	0.45	0.41	0.4	3.62^{*}	-0.50^{*}	S	0.04	1.21	0.32	0.22
44 Wood, Articles Wood	-15.73^{**}	4.30	0.71	0.45	-0.08	$-0.37^{*,w}$	0.25	$0.57^{*,i}$	0.04	0.41	0.37	0.44	3.37^{*}	-0.41^{**}	S	1.79	$2.94^{*,as}$	$12.20^{***,as}$	$10.96^{***,as}$
48 Paper, Paperboard	11.06^{**}	-1.39	-0.85	0.21	$-0.25^{**,i}$	$-0.10^{**,w}$	$0.49^{**,w}$	$0.30^{**,i}$	0.06	0.57	1.3	0.94	4.17^{**}	-0.45	S	$10.67^{***,as}$	$15.19^{***,as}$	$2.80^{*,as}$	2.58
49 Printed Books, Newspapers, Manusc.	14.82^{*}	$3.70^{**,i}$	$-5.11^{*,w}$	$1.58^{*,i}$	$0.21^{*,w}$	$0.23^{*,i}$	-0.15	-0.17	$-0.31^{**,w}$	0.58	0.04	0.6	5.23^{***}	-0.70	S	0.95	0.06	0.07	0.09
56 Wadding, Felt, Yarn, Twine, Ropes	7.12	-1.80	1.51	$1.38^{*,i}$	-0.01	-0.11	0.002	0.12	0.04	0.48	0.06	3.42	2.92	-0.48	S	$6.45^{**,as}$	0.00001	1.8	1.68
59 Impregnated, Text Fabrics	-10.43^{*}	$3.00^{*,i}$	$-1.75^{**,w}$	$-0.87^{*,w}$	0.05	-0.004	-0.10	-0.05	-0.19	0.46	0.02	5.1	5.06^{***}	-0.89^{***}	S	0.12	1.99	$2.82^{*,as}$	1.73
61 Apparel Articles, Accessories, Crochet	29.86	-4.67	7.96	$10.42^{**,i}$	-0.39	0.05	-0.86	-1.29	$-0.50^{**,w}$	0.33	4.98^{c}	0.64	2.19	-0.12	S	1.42	1.2	0.96	0.65
62 Apparel Articles	4.42	-0.41	2.15	$2.27^{**,i}$	0.18	-0.14	-0.25	0.14	0.13	0.57	0.19	1.21	2.39	-0.29	S	0.91	0.04	$2.94^{*,as}$	$2.95^{*,as}$
63 Textile Art Nesoi, Needlecraft Sets	9.94	-0.76	-1.51	-0.10	-0.20	0.10	-0.01	$-0.38^{**,w}$	$-0.44^{*,w}$	0.45	7.78^{a}	0.09	3.62^{*}	-0.38^{**}	S	0.38	0.36	$9.23^{***,as}$	$9.56^{***,as}$
64 Footwear, Gaiters Etc. And Parts Thereof	20.52	-1.51	0.38	$2.87^{*,i}$	-0.04	-0.06	-0.29	-0.24	$-0.69^{**,w}$	0.4	0.08	1.48	4.17^{**}	-0.49^{***}	S	1.68	1.01	0.02	0.08
65 Headgear and Parts Thereof	-1.74	3.97	-4.10	-0.51	0.002	-0.06	0.04	0.10	-0.33	0.51	0.02	0.09	1.38	-0.50	S	1.43	1.19	0.24	0.16

Table 4: The Nonlinear ARDL Model Estimation Results (Normalized Long-Run Coefficient for ***Production-related BTB*, Continue: X^p**)

	Const.	Y_{US}	Y_{JPN}	RER	TPU^-_{US}	TPU^+_{US}	TPU^-_{JPN}	TPU^+_{JPN}	D_{Covid}	$\bar{R}^2$	BG	RR	F_{PSS}	ECT_{t-1}	$Cusum$	$W^{TPU\_US}_{SR}$	$W^{TPU\_JPN}_{SR}$	$W^{TPU\_US}_{LR}$	$W^{TPU\_JPN}_{LR}$
68 Art of Stone, Plaster, Cement, Mica	-4.45	0.66	0.26	0.21	$-0.15^{*, i}$	$-0.09^{**, w}$	$0.17^{**, w}$	0.09	-0.17	0.38	0.04	0.58	10.06^{***}	-0.74^{***}	S	$3.46^{*, as}$	0.81	$2.94^{*, as}$	$3.13^{*, as}$
69 Ceramic Products	20.81^{***}	$-8.13^{***, w}$	3.54	0.52	$-0.29^{***, i}$	-0.10	0.26	0.05	-0.29	0.45	2.1	0.05	1.6	-0.35	S	0.03	0.05	1.7	1.44
70 Glass, Glassware	-15.90	1.77	0.77	-1.13	0.48	0.33	-0.34	-0.17	0.07	0.41	0.53	0.1	2.46	-0.13	S	$4.87^{**, as}$	0.21	0.48	0.47
71 Nat Pearls, Prec Stones, Met, Coin	-1.75	0.07	-0.75	$-1.31^{***, w}$	0.23	$0.35^{*, i}$	$-0.52^{**, i}$	$-0.65^{*, w}$	$-0.41^{***, w}$	0.4	0.12	0.16	2.89	-0.47	S	$2.93^{*, as}$	0.58	1.17	1.08
72 Iron and Steel	12.63	$-12.58^{**, w}$	7.77	-1.20	-0.42	-0.27	0.23	0.06	-0.11	0.42	0.2	0.76	1.73	-0.19	S	$5.12^{**, as}$	0.31	0.49	0.41
73 Articles of Iron Steel	-2.97	$-2.34^{*, w}$	$1.02^{***, i}$	$-1.51^{*, w}$	$0.07^{**, w}$	$0.10^{*, i}$	0.002	-0.03	0.06	0.53	0.03	2.34	4.94^{***}	-0.79^{***}	S	1.02	0.93	0.95	0.88
74 Copper and Articles Thereof	6.09	-1.01	1.36	$1.94^{*, i}$	0.0007	0.006	$-0.48^{**, i}$	$-0.4^{*, w}$	0.01	0.42	0.01	0.02	3.51^{*}	-0.36^{*}	S	1.31	0.14	0.004	0.08
76 Aluminum and Articles Thereof	7.73	1.26	-2.32	0.86	-0.17	0.10	-0.02	-0.34	$-0.27^{**, w}$	0.36	0.64	2.41	1.08	-0.13	S	$2.80^{*, as}$	1.13	1.76	1.66
82 Tools, Cutlery, Metal, Parts Thereof	0.60	-1.67	0.99	-0.004	$-0.14^{*, i}$	$-0.08^{**, w}$	0.01	-0.06	$-0.28^{**, w}$	0.28	0.03	0.89	10.84^{***}	-0.67^{***}	S	$2.75^{*, as}$	0.93	2.26	2.14
83 Miscellaneous Articles of Base Metal	-15.73	3.80	-1.52	-0.96	0.007	-0.11	-0.25	-0.10	-0.09	0.21	0.12	0.31	1.42	-0.18	S	2.38	0.01	0.56	0.6
84 Nuclear Reactors, Boilers, Machinery	-2.32^{***}	$-2.27^{*, w}$	$0.89^{**, i}$	$-1.60^{*, w}$	$0.12^{*, w}$	$0.04^{**, i}$	$-0.06^{*, i}$	0.03	$0.21^{*, i}$	0.54	3.34^{*}	2.65	9.76^{***}	-0.97^{***}	S	0.97	0.09	$30.64^{***, as}$	$27.27^{***, as}$
85 Electric Machinery, Sound Equip, Tv Eq.	-5.99^{***}	$3.55^{**, i}$	$-2.91^{**, w}$	$-0.51^{***, w}$	$0.10^{***, w}$	-0.02	-0.07	0.05	0.01	0.54	0.82	0.27	3.85^{**}	-0.39	S	1.11	0.38	$6.17^{**, as}$	$5.06^{**, as}$
86 Railway, Tramway, Traffic Signal Equip	15.58	-2.50	-2.20	-1.02	0.41	$0.59^{*, i}$	0.31	0.04	0.20	0.42	1.46	2.12	2.23	-0.30	S	1.33	1.77	0.62	0.95
87 Vehicles, Except Railway or Tramway	-4.18	0.87	-0.32	0.26	0.08	0.02	-0.02	0.04	$0.17^{***, i}$	0.49	0.03	0.82	4.65^{**}	-0.48^{***}	S	$3.38^{*, as}$	$4.14^{**, as}$	1.94	1.67
88 Aircraft, Spacecraft, Parts Thereof	4.35	-1.96	1.04	-0.30	0.05	$0.13^{**, i}$	$0.16^{***, w}$	0.03	$0.36^{***, i}$	0.46	0.78	1.17	6.63^{***}	-0.81^{***}	S	0.04	0.45	1.99	$3.85^{*, as}$
90 Optic, Medic, Surgical Instruments	1.10	0.31	0.02	0.62	-0.08	-0.04	0.11	0.06	-0.02	0.56	3.39	0.79	1.01	-0.15	S	0.35	0.18	0.24	0.27
91 Clocks, Watches and Parts Thereof	15.03	$-5.88^{***, w}$	$3.71^{***, i}$	$2.16^{*, i}$	0.07	0.02	$-0.49^{**, i}$	$-0.38^{***, w}$	$-0.49^{**, w}$	0.34	1.9	0.35	4.68^{**}	-0.43^{***}	S	0.23	0.06	0.23	0.82
92 Musical Instruments, Accessories Thereof	-14.93^{*}	$3.58^{**, i}$	0.49	$1.04^{**, i}$	$-0.12^{**, i}$	$-0.19^{*, w}$	0.01	$0.12^{***, i}$	0.11	0.47	0.29	5.71	4.47^{**}	-0.58	S	1.84	0.02	2.69	$4.77^{**, as}$
94 Furniture; Bedding Lamps Nesoi, Prefab	8.06	-0.33	-1.95	-0.86	$0.27^{**, w}$	0.10	0.08	0.25	0.10	0.34	2.08	0.02	2.47	-0.24	S	$3.62^{*, as}$	0.94	$2.78^{*, as}$	2.05
95 Toys, Games, Sport Equip., Accessories	-26.05^{**}	$12.69^{*, i}$	$-8.23^{**, w}$	$-1.46^{***, w}$	0.18	-0.06	0.12	0.40	-0.02	0.31	0.99	0.19	2.81	-0.36	S	1.17	1.02	$3.39^{*, as}$	$3.03^{*, as}$
96 Miscellaneous Manufactured Articles	-8.23^{*}	$2.55^{**, i}$	-1.02	0.16	0.06	$0.07^{**, i}$	$-0.1^{***, i}$	$-0.14^{**, w}$	-0.07	0.48	0.05	0.8	12.74^{***}	-0.99^{***}	S	0.19	0.32	0.15	0.59
97 Art, Collectors' Pieces and Antiques	10.90^{**}	$-12.39^{*, w}$	$7.08^{*, i}$	$-2.69^{*, w}$	$0.11^{***, w}$	$0.17^{*, i}$	0.15	0.07	$1.13^{**, i}$	0.6	0.83	1.71	5.44^{***}	-1.88^{***}	S	0.06	$3.26^{*, as}$	1.21	1.38

Table 5: The Nonlinear ARDL Model Estimation Results (Normalized Long-Run Coefficient for ***Non-production-related BTB: X^{np}***)

	$Const.$	Y_{US}	Y_{JPN}	RER	TPU_{US}^{-}	TPU_{US}^{+}	TPU_{JPN}^{-}	TPU_{JPN}^{+}	D_{Covid}	$\bar{R}^2$	BG	RR	F_{PSS}	ECT_{t-1}	$Cusum$	$W_{SR}^{TPU\_US}$	$W_{SR}^{TPU\_JPN}$	$W_{LR}^{TPU\_US}$	$W_{LR}^{TPU\_JPN}$
22 Beverages, Spirits and Vinegar	5.32	-0.90	-2.88	$-2.91^{***, w}$	$0.31^{*, w}$	0.02	0.46	$0.73^{**, i}$	0.56	0.46	2.13	1.29	8.21^{***}	-0.73^{***}	S	$8.78^{***, as}$	$5.33^{**, as}$	$3.73^{*, as}$	2.15
28 Inorg Chem, Radioact Compd	-22.27	-11.21	$12.36^{*, i}$	-3.50	0.33	-0.35	0.59	$1.37^{**, i}$	$1.23^{**, i}$	0.41	0.89	0.62	3.36^{*}	-0.36	S	$8.67^{***, as}$	$3.99^{**, as}$	$4.50^{**, as}$	$4.19^{**, as}$
29 Organic Chemicals	-12.93	-4.14	$4.86^{**, i}$	-0.93	-0.02	-0.12	-0.0007	0.15	$0.65^{*, i}$	0.49	0.09	0.44	3.84^{**}	-0.64^{***}	S	0.37	$3.10^{*, as}$	0.63	0.99
30 Pharmaceutical Products	-51.17^{***}	$22.47^{**, i}$	-6.98	$5.27^{***, i}$	-0.13	$-0.47^{***, w}$	-0.49	0.03	-0.28	0.35	0.14	0.36	3.88^{**}	-0.48^{**}	S	0.41	$4.22^{**, as}$	$3.83^{*, as}$	$5.93^{**, as}$
32 Tanning, Dye Ext, Paint, Putty, Inks	-15.65	3.32	-5.08	$-4.75^{***, w}$	0.29	0.20	-0.26	-0.21	0.32	0.5	0.42	2.53	2.51	-0.41	S	1.87	1.53	0.19	0.05
33 Essential Oils, Perfumery, Cosmetic	-2.85	-1.94	1.06	-1.25	0.13	-0.10	0.48	0.74	$0.63^{**, i}$	0.33	0.5	0.45	1.89	-0.28	S	0.19	0.98	1.23	1.04
35 Albuminoidal Subst, Glue, Enzymes	12.16	-4.10	2.61	$2.32^{**, i}$	0.11	0.14	-0.25	-0.24	-0.17	0.39	2.2	0.36	7.04^{***}	-0.60^{***}	S	0.02	0.16	0.06	0.0002
37 Photographic or Cinematog. Goods	-19.02	$9.93^{*, i}$	$-7.06^{**, w}$	-0.68	0.29	-0.22	-0.24	0.36	0.04	0.38	1.75	1.48	4.74^{***}	-0.44^{***}	S	0.27	0.26	$9.53^{***, as}$	$9.14^{***, as}$
38 Miscellaneous Chemical Products	46.35^{***}	$-18.72^{**, w}$	$5.20^{*, i}$	$-2.20^{**, w}$	0.12	0.18	-0.16	-0.19	$-0.64^{*, w}$	0.5	0.0003	0.09	5.50^{***}	-0.66^{***}	S	0.16	1.58	0.31	0.07
39 Plastics and Articles Thereof	-4.08	1.74	-1.44	0.08	-0.06	-0.01	$0.12^{*, w}$	0.05	-0.003	0.5	0.12	0.44	3.72^{*}	-0.60^{**}	S	0.95	2.33	1.54	1.8
40 Rubber and Articles Thereof	-7.32	1.78	-1.95	-0.60	0.16	-0.02	0.22	0.44	0.34	0.46	6.66^{***}	3.03^{*}	1.59	-0.39	S	0.09	0.15	1.69	1.86
42 Leather Art, Handbags, Gut Art	18.88^{**}	$7.15^{**, i}$	$-8.99^{***, w}$	$1.66^{**, i}$	-0.08	$-0.25^{***, w}$	$0.28^{*, w}$	$0.47^{**, i}$	0.15	0.43	0.46	0.1	6.93^{***}	-0.49^{***}	S	0.22	$5.49^{**, as}$	$3.29^{*, as}$	$2.86^{*, as}$
44 Wood, Articles Wood	-40.81^{**}	7.98	1.86	0.76	-0.21	$-0.45^{***, w}$	0.11	0.34	0.06	0.37	0.005	2.82^{*}	3.59^{*}	-0.50^{***}	S	0.25	1.01	2.01	1.3
48 Paper, Paperboard, Articles	15.78^{**}	3.00	$-6.35^{***, w}$	0.94	-0.009	$0.18^{**, i}$	0.19	-0.05	-0.12	0.42	0.39	4.02^{**}	4.91^{***}	-0.58^{***}	S	2.18	0.01	$6.69^{**, as}$	$7.48^{***, as}$
49 Printed Books, Newspapers, Manusc.	-20.14^{*}	$10.4^{***, i}$	$-4.86^{**, w}$	$1.52^{*, i}$	-0.12	$-0.27^{**, w}$	-0.27	-0.07	0.08	0.46	0.008	1.36	3.88^{**}	-0.53^{***}	S	0.57	$4.82^{**, as}$	1.49	1.78
56 Wadding, Felt, Yarn, Twine, Ropes	25.23^{*}	2.43	$-10.89^{**, w}$	$-1.87^{**, w}$	-0.005	$0.30^{*, i}$	-0.32	$-0.69^{**, w}$	-1.42	0.44	0.07	1.87	9.26^{***}	-0.63^{***}	S	$5.97^{**, as}$	0.75	$4.57^{**, as}$	$4.53^{**, as}$
59 Impregnated, Text Fabrics	0.84	-13.58	9.22	-2.49	$-0.73^{*, i}$	-0.36	0.97	0.54	-0.09	0.5	0.24	0.27	1.58	-0.28	S	0.12	0.06	1.18	1.03
61 Apparel Articles, Accessories, Crochet	-12.34	4.81	11.98	$15.16^{***, i}$	-0.43	-0.11	-0.75	-0.97	-0.34	0.32	5.26^{**}	0.95	2.43	-0.14	S	0.7	2.25	0.56	0.19
62 Apparel Articles	-0.34	1.11	4.89	$6.07^{***, i}$	0.15	-0.19	-0.28	0.18	0.25	0.59	0.07	4.58^{**}	4.76^{***}	-0.37	S	1.83	0.05	$5.43^{**, as}$	$6.61^{**, as}$
63 Textile Art Nesoi, Needlecraft Sets	-4.24	1.14	-0.46	-0.002	0.11	$0.17^{**, i}$	$-0.28^{**, i}$	$-0.33^{**, w}$	-0.14	0.42	0.005	0.78	4.33^{**}	-0.58^{***}	S	0.07	0.001	0.53	0.39
64 Footwear, Gaiters Etc. And Parts Thereof	45.35^{*}	-8.63	1.75	$2.98^{*, i}$	-0.14	-0.13	-0.004	0.03	-0.61	0.4	0.58	0.89	1.96	-0.36	S	0.72	0.11	0.004	0.01
65 Headgear and Parts Thereof	18.44^{**}	2.91	$-7.44^{***, w}$	0.04	0.05	0.01	$0.25^{*, w}$	$0.31^{*, i}$	0.03	0.51	0.007	0.04	11.71^{***}	-0.88^{***}	S	2.69	2.6	0.17	0.23

Table 5: The Nonlinear ARDL Model Estimation Results (Normalized Long-Run Coefficient for ***Non-production-related BTB*****, Continue:** $\boldsymbol{X^{np}}$)

	Const.	Y_{US}	Y_{JPN}	RER	TPU_{US}^{-}	TPU_{US}^{+}	TPU_{JPN}^{-}	TPU_{JPN}^{+}	D_{Covid}	$\bar{R}^2$	BG	RR	F_{PSS}	ECT_{t-1}	**Cusum**	$W_{SR}^{TPU\_US}$	$W_{SR}^{TPU\_JPN}$	$W_{LR}^{TPU\_US}$	$W_{LR}^{TPU\_JPN}$
68 Art of Stone, Plaster, Cement, Mica	29.14***	-9.27$^{***, w}$	2.27	0.73	-0.08	-0.23$^{***, w}$	0.24	0.47$^{**, i}$	0.29	0.49	0.52	0.84	7.85***	-0.84***	S	0.01	2.14	2.80$^{*, as}$	4.90$^{**, as}$
69 Ceramic Products	-8.03	-1.26	-0.53	-3.00$^{***, w}$	0.51$^{***, w}$	0.18$^{*, i}$	-0.30$^{*, i}$	0.10	0.35	0.37	0.63	0.44	9.07***	-0.61***	S	0.72	0.002	11.73$^{***, as}$	11.60$^{***, as}$
70 Glass, Glassware	2.63	-0.76	-0.25	0.67	-0.17$^{*, i}$	0.0005	0.06	-0.13	-0.37	0.41	0.3	0.76	2.95	-0.77	S	0.06	0.48	3.77$^{*, as}$	2.95$^{*, as}$
71 Nat Pearls, Prec Stones, Met, Coin	-24.81*	-5.73	8.13$^{**, i}$	-2.82$^{***, w}$	0.14	0.13	-0.24	-0.21	-0.12	0.52	0.004	0.01	2.47	-0.48	S	0.12	0.03	0.007	0.04
72 Iron and Steel	-26.21	-1.84	2.03	-4.75$^{***, w}$	0.8$^{***, w}$	0.35	-0.45	0.04	0.86	0.43	0.02	0.001	3.15	-0.47**	S	0.003	1.47	3.56$^{*, as}$	2.95$^{*, as}$
73 Articles of Iron/Steel	-4.71	2.39	-3.52	-1.44	-0.05	-0.04	-0.21	-0.22	0.13	0.45	0.26	0.11	1.56	-0.29	S	0.00002	0.43	0.009	0.001
74 Copper and Articles Thereof	-16.13***	4.31$^{**, i}$	-3.39	-1.88$^{***, w}$	0.10	-0.13$^{**, w}$	-0.10	0.16	0.48$^{*, i}$	0.46	0.06	5.54**	11.27***	-0.89***	S	1.13	0.26	15.28$^{***, as}$	14.08$^{***, as}$
76 Aluminum and Articles Thereof	-4.79	5.94	-4.76$^{**, w}$	0.47	-0.04	-0.12	0.66$^{**, w}$	0.70$^{***, i}$	0.50	0.43	0.74	1.05	3.60*	-0.50**	S	1.34	0.002	0.42	0.11
82 Tools, Cutlery, Metal, Parts Thereof	-8.07	0.37	0.44	0.22	-0.28$^{***, i}$	-0.14$^{*, w}$	0.11	-0.04	0.03	0.36	1.38	0.61	4.07**	-0.68***	S	0.68	0.48	2.98$^{*, as}$	2.47
83 Miscellaneous Articles of Base Metal	4.19	0.64	-1.54	1.15$^{***, i}$	0.13$^{*, w}$	0.20$^{***, i}$	-0.06	-0.12	-0.07	0.47	0.3	2.55	13.54***	-0.85***	S	1.74	0.93	1.65	0.53
84 Nuclear Reactors, Boilers, Machinery	7.81**	-3.99$^{***, w}$	1.34$^{*, i}$	-0.03	-0.02	0.03	0.008	-0.05	-0.06	0.4	0.25	6.38**	3.95**	-0.49**	S	0.89	2.73	1.94	1.38
85 Electric Machinery, Sound Equip, Tv Eq.	-9.09***	0.81	0.30	-0.21	-0.1$^{***, i}$	-0.1$^{***, w}$	0.13$^{*, w}$	0.14$^{**, i}$	-0.06	0.56	1	12.15***	3.97**	-0.96	S	0.001	0.17	0.01	0.03
86 Railway, Tramway, Traffic Signal Equip	-17.48	14.85$^{**, i}$	-10.22$^{**, w}$	0.77	0.32	0.30$^{*, i}$	0.59$^{*, w}$	0.53	0.70*$^{, i}$	0.44	1.78	0.75	4.46**	-0.42*	S	0.009	0.01	0.01	0.09
87 Vehicles, Except Railway or Tramway	-3.61	4.55	-3.70$^{*, w}$	1.37$^{**, i}$	-0.09	0.11	0.03	-0.23	-0.28	0.29	1.46	2.76*	5.17***	-0.42***	S	0.47	0.03	5.07$^{**, as}$	5.75$^{**, as}$
88 Aircraft, Spacecraft, Parts Thereof	2.37	-4.55	3.05	-0.12	-0.04	0.19	-0.07	-0.33	-0.14	0.34	0.7	1.18	2.78	-0.38	S	0.06	0.004	1.75	1.57
90 Optic, Medic, Surgical Instruments	1.31	-2.94	2.95$^{*, i}$	0.96$^{*, i}$	-0.11	-0.13	-0.0004	0.07	0.03	0.4	0.04	3.72*	2.87	-0.24	S	2.48	0.76	0.06	0.42
91 Clocks, Watches and Parts Thereof	-1.96	-1.24	1.47	0.83$^{***, i}$	0.03	0.06	-0.08	-0.10	0.21	0.45	1.05	0.008	9.23***	-1.01***	S	1.62	5.99$^{**, as}$	0.6	0.05
92 Musical Instruments, Accessories Thereof	-6.20	1.94	-0.15	1.41$^{***, i}$	-0.05	-0.13$^{**, w}$	-0.05	0.11	0.55$^{**, i}$	0.4	0.15	2.94*	11.25***	-0.82***	S	0.006	0.22	1.88	4.58$^{**, as}$
94 Furniture; Bedding Lamps Nesoi, Prefab	-23.08	2.26	-0.40	-2.73$^{**, w}$	0.15	0.17	0.03	-0.03	0.15	0.2	0.01	0.04	3.66*	-0.32***	S	9.85$^{***, as}$	0.28	0.007	0.09
95 Toys, Games, Sport Equip., Accessories	-32.74***	3.32	2.06	-1.17	0.008	-0.37$^{***, w}$	0.84$^{**, w}$	1.31$^{***, i}$	0.64$^{**, i}$	0.45	1.16	1.24	4.17**	-0.46	S	2.12	6.04$^{**, as}$	6.55$^{**, as}$	7.34$^{***, as}$
96 Miscellaneous Manufactured Articles	6.32	-8.36$^{**, w}$	4.39$^{*, i}$	-1.20	-0.20	-0.002	0.19	-0.01	-0.39	0.38	0.3	2.21	4.58**	-0.46***	S	0.16	1.15	2.55	1.77
97 Art, Collectors' Pieces and Antiques	65.16*	-9.80	-9.24	-4.82$^{**, w}$	0.19	0.40$^{*, i}$	0.10	-0.20	-0.32	0.45	0.05	1.67	2.85	-0.53	S	0.11	0.64	0.62	0.83

Table 6: The Nonlinear ARDL Model Estimation Results (Normalized Long-Run Coefficient for ***Total-export BTB: X***)

	Const.	Y_{US}	Y_{JPN}	RER	TPU^{-}_{US}	TPU^{+}_{US}	TPU^{-}_{JPN}	TPU^{+}_{JPN}	D_{Covid}	$\bar{R}^2$	BG	RR	F_{PSS}	ECT_{t-1}	$Cusum$	$W^{TPU\_US}_{SR}$	$W^{TPU\_JPN}_{SR}$	$W^{TPU\_US}_{LR}$	$W^{TPU\_JPN}_{LR}$
22 Beverages, Spirits and Vinegar	-15.09**	6.99$^{***, i}$	-2.59$^{*, i}$	0.55	0.24	0.09	-0.05	0.09	0.08	0.47	0.002	0.97	3.35*	-0.40	S	4.45$^{**, as}$	0.72	3.09$^{*, as}$	1.93
28 Inorg Chem, Radioact Compd	23.16***	-5.81$^{**, w}$	0.49	-0.39	-0.4$^{***, i}$	-0.25$^{***, w}$	-0.08	-0.25$^{*, w}$	-0.46$^{***, w}$	0.38	0.32	0.73	7.62***	-0.46***	S	0.004	1.05	3.29$^{*, as}$	3.18$^{*, as}$
29 Organic Chemicals	-5.47	-1.69	2.82$^{*, i}$	0.03	0.16$^{**, w}$	0.10	-0.16	-0.06	0.03	0.5	0.34	0.0002	2.43	-0.39	S	0.09	10.33$^{***, as}$	0.7	1.34
30 Pharmaceutical Products	-21.17*	8.88$^{**, i}$	-0.87	3.46$^{***, i}$	-0.23$^{*, i}$	-0.38$^{***, w}$	-0.24	-0.007	-0.09	0.35	0.11	0.45	2.6	-0.29	S	0.47	0.04	1.85	2.79$^{*, as}$
32 Tanning, Dye Ext, Paint, Putty, Inks	-5.34	-8.01$^{*, w}$	8.40	-0.59	0.008	-0.19	0.04	0.30	0.12	0.57	1.24	0.04	4.35**	-0.30	S	2.58	8.50$^{***, as}$	2.09	2.3
33 Essential Oils, Perfumery, Cosmetic	0.58	2.02$^{*, i}$	-1.30$^{**, w}$	0.44$^{*, i}$	-0.04	-0.07$^{*, w}$	0.03	0.03	0.17	0.52	0.37	0.46	2.86	-0.75*	S	2.54	1.22	0.46	0.02
35 Albuminoidal Subst, Glue, Enzymes	7.20**	-1.44	0.07	0.23	-0.01	0.04	-0.1$^{*, i}$	-0.16$^{***, w}$	-0.14	0.46	0.25	0.25	10.26***	-0.76***	S	0.04	5.59$^{**, as}$	2.51	2.17
37 Photographic or Cinematog. Goods	9.91	-1.76	-1.06	-0.13	0.010	0.14$^{*, i}$	-0.20	-0.36$^{**, w}$	-0.14	0.39	0.02	0.3	2.84	-0.33	S	3.08$^{*, as}$	0.91	2.46	2.67
38 Miscellaneous Chemical Products	-0.03	-0.48	0.26	-0.22	0.04	-0.04$^{*, w}$	-0.04	0.05	-0.11	0.48	0.15	3.28*	8.63***	-0.77***	S	2.3	1.49	12.37$^{***, as}$	12.5$^{***, as}$
39 Plastics and Articles Thereof	5.54	-4.6$^{*, w}$	3.46$^{*, i}$	0.20	-0.03	0.002	-0.10	-0.13	-0.05	0.53	0.01	0.66	3.02	-0.22	S	0.001	0.89	0.42	0.17
40 Rubber and Articles Thereof	-10.75***	-0.20	1.67$^{***, i}$	-0.43$^{***, w}$	0.13$^{***, w}$	0.09$^{***, i}$	-0.009	0.04	0.24$^{**, i}$	0.46	0.12	0.09	7.25***	-0.95***	S	6.94$^{***, as}$	0.75	4.09$^{**, as}$	3.18$^{*, as}$
42 Leather Art, Handbags, Gut Art	11.77^{c}	4.78$^{***, i}$	-5.59$^{***, w}$	1.04$^{**, i}$	-0.08	-0.15$^{***, w}$	0.08	0.14	-0.29$^{*, w}$	0.49	0.01	0.12	5.30***	-0.57***	S	0.19	0.42	1.62	1.15
44 Wood, Articles' Wood	-16.01	4.34$^{*, i}$	0.72	0.43	-0.09	-0.37$^{***, w}$	0.25	0.57$^{***, i}$	0.04	0.41	0.4	0.36	3.36*	-0.41**	S	1.78	3.02$^{*, as}$	12.03$^{***, as}$	10.76$^{***, as}$
48 Paper, Paperboard, Articles	11.66**	-1.44	-0.94	0.21	-0.25$^{**, i}$	-0.09$^{*, w}$	0.50$^{**, w}$	0.30$^{**, i}$	0.05	0.57	1.35	0.88	4.11**	-0.43	S	10.57$^{***, as}$	14.77$^{***, as}$	2.74$^{*, as}$	2.54
49 Printed Books, Newspapers, Manusc.	11.03**	4.99$^{***, i}$	-5.61$^{***, w}$	1.49$^{***, i}$	0.21$^{***, w}$	0.2$^{***, i}$	-0.18$^{*, i}$	-0.17$^{*, w}$	-0.25$^{*, w}$	0.6	0.05	0.34	5.56***	-0.76*	S	1.08	0.01	0.15	0.1
56 Wadding, Felt, Yarn, Twine, Ropes	13.26	-3.77	1.85	1.08$^{**, i}$	0.01	-0.07	0.0007	0.11	-0.03	0.48	0.09	2.34	2.77	-0.43	S	0.06	0.45	1.15	1.11
59 Impregnated, Text Fabrics	-7.89^{a}	2.64$^{**, i}$	-1.99$^{***, w}$	-0.9$^{***, w}$	0.02	0.003	-0.06	-0.05	-0.19	0.47	1.3	3.58*	5.25***	-0.88***	S	0.01	0.42	0.31	0.03
61 Apparel Articles, Accessories, Crochet	30.02	-4.03	8.43	11.54$^{***, i}$	-0.35	0.10	-0.85	-1.28	-0.45$^{*, w}$	0.3	4.29**	2.14	2.35	-0.12	S	1.18	1.77	1.01	0.65
62 Apparel Articles	-6.63	0.81	5.14	4.08$^{***, w}$	0.21	-0.17	-0.29	0.19	0.24	0.62	0.13	5.91**	3.70*	-0.27	S	0.79	0.77	3.51$^{*, as}$	3.65$^{*, as}$
63 Textile Art Nesoi, Needlecraft Sets	5.38	0.40	-1.41	0.10	-0.09	0.17$^{*, i}$	-0.10	-0.41$^{**, w}$	-0.42$^{***, w}$	0.42	3.07^{c}	0.01	4.18**	-0.39**	S	0.22	0.34	7.91$^{***, as}$	8.11$^{***, as}$
64 Footwear, Gaiters Etc. And Parts Thereof	18.03	-0.37	-0.03	2.96$^{***, i}$	-0.02	-0.09	-0.26	-0.15	-0.60$^{*, w}$	0.4	0.0002	0.83	4.28^{b}	-0.52***	S	1.6	0.97	0.27	0.46
65 Headgear and Parts Thereof	4.32	3.47	-4.66$^{*, w}$	-0.16	0.04	0.0007	-0.03	0.006	-0.26	0.52	0.67	0.08	2.47	-0.65	S	0.16	1.9	0.16	0.13

Table 6: The Nonlinear ARDL Model Estimation Results (Normalized Long-Run Coefficient for ***Total-export BTB*****, Continue: X**)

	Const.	Y_{US}	Y_{JPN}	RER	TPU_{US}^{-}	TPU_{US}^{+}	TPU_{JPN}^{-}	TPU_{JPN}^{+}	D_{Covid}	$\bar{R}^2$	BG	RR	F_{PSS}	ECT_{t-1}	$Cusum$	$W_{SR}^{TPU\_US}$	$W_{SR}^{TPU\_JPN}$	$W_{LR}^{TPU\_US}$	$W_{LR}^{TPU\_JPN}$
68 Art of Stone, Plaster, Cement, Mica	-1.53	0.23	0.11	0.28	$-0.17^{***, i}$	$-0.08^{**, w}$	$0.16^{**, w}$	0.06	$-0.24^{*, w}$	0.37	0.33	0.35	10.68^{***}	-0.75^{***}	S	$5.85^{**, as}$	0.5	$6.04^{**, as}$	$6.03^{**, as}$
69 Ceramic Products	19.42^{**}	$-7.10^{**, w}$	2.93	0.55	-0.17	-0.08	0.11	0.02	-0.27	0.44	1.87	0.4	1.92	-0.48	S	0.01	0.27	1.08	0.73
70 Glass, Glassware	-17.65	3.09	0.03	-0.88	0.26	0.19	-0.19	-0.11	0.06	0.38	0.27	0.35	2.07	-0.17	S	$3.01^{*, as}$	0.05	0.28	0.25
71 Nat Pearls, Prec Stones, Met, Coin	-3.42	-1.04	0.55	$-1.5^{***, w}$	$0.17^{*, w}$	$0.29^{***, i}$	$-0.38^{**, i}$	$-0.52^{***, w}$	$-0.49^{**, w}$	0.4	1.06	0.28	8.26^{***}	-0.61^{***}	S	2.1	0.25	2.51	2.27
72 Iron and Steel	13.80	$-13.74^{*, w}$	$8.62^{*, i}$	-1.20	-0.49	-0.29	0.42	0.20	-0.12	0.42	1.1	1.16	1.92	-0.19	S	$5.37^{**, as}$	0.18	0.82	0.72
73 Articles of Iron or Steel	-0.27	$-2.56^{***, w}$	0.66	$-1.52^{***, w}$	0.03	$0.07^{***, i}$	-0.002	-0.04	0.04	0.56	0.41	2.29	5.97^{***}	-0.89^{***}	S	0.86	1.09	$2.89^{*, as}$	2.42
74 Copper and Articles Thereof	6.11	-1.02	1.33	$1.90^{***, i}$	0.004	0.006	$-0.48^{**, i}$	$-0.45^{**, w}$	0.01	0.42	0.03	0.004	3.53^{*}	-0.36^{*}	S	1.4	0.14	0.001	0.1
76 Aluminum and Articles Thereof	7.49	1.30	-2.30	0.83	-0.15	0.08	0.009	-0.28	$-0.26^{**, w}$	0.37	1.28	2.22	1.12	-0.14	S	$2.93^{*, as}$	1.11	1.73	1.65
82 Tools, Cutlery, Metal, Parts Thereof	-0.05	-1.46	0.91	-0.04	$-0.16^{***, i}$	$-0.09^{**, w}$	0.03	-0.05	-0.20	0.28	0.04	1.48	10.98^{***}	-0.67^{***}	S	2.36	0.84	$2.76^{*, as}$	2.59
83 Miscellaneous Articles of Base Metal	-13.98	3.56	-1.23	-0.49	-0.01	-0.09	-0.22	-0.12	-0.09	0.21	0.23	0.08	1.5	-0.20	S	2.42	0.05	0.35	0.41
84 Nuclear Reactors, Boilers, Machinery	1.35	$-3.12^{***, w}$	$1.09^{**, i}$	$-1.44^{***, w}$	$0.08^{***, w}$	0.02	$-0.06^{*, i}$	0.004	0.07	0.52	0.38	2.69	5.47^{***}	-0.60^{***}	S	0.07	0.07	$7.06^{***, as}$	$6.77^{**, as}$
85 Electric Machinery, Sound Equip, Tv Eq.	-9.86^{***}	$3.74^{**, i}$	$-2.17^{**, w}$	$-0.46^{**, w}$	0.07	-0.03	-0.01	0.10	-0.001	0.63	0.05	1.46	3.57^{*}	-0.47	S	0.35	0.08	$7.60^{***, as}$	$6.46^{**, as}$
86 Railway, Tramway, Traffic Signal Equip	17.54	2.50	$-5.87^{**, w}$	0.70	0.17	$0.48^{***, i}$	0.28	-0.13	0.09	0.41	1.06	4.**	4.55^{**}	-0.48^{**}	S	1.38	1.04	$6.80^{***, as}$	$8.26^{*, as}$
87 Vehicles, Except Railway or Tramway	-3.76	1.22	-0.67	0.36	0.06	0.04	-0.003	0.02	0.14	0.5	0.005	0.91	5.62^{***}	-0.59^{***}	S	1.89	$4.1^{**, as}$	0.52	0.29
88 Aircraft, Spacecraft, Parts Thereof	4.30	-1.96	1.03	-0.32	0.05	$0.13^{**, i}$	0.16	0.02	0.35	0.44	0.28	0.82	6.42^{***}	-0.78^{***}	S	0.03	0.48	2.06	$3.84^{*, as}$
90 Optic, Medic, Surgical Instruments	2.73	-2.97	$3.11^{*, i}$	$0.89^{**, i}$	-0.009	-0.007	0.01	0.03	0.01	0.59	1.13	2.25	2.93	-0.23	S	$3.25^{*, as}$	0.04	0.02	0.13
91 Clocks, Watches and Parts Thereof	7.33	$-11.58^{**, w}$	$9.76^{***, i}$	0.84	-0.03	$-0.11^{*, w}$	$-0.22^{*, i}$	-0.06	0.03	0.46	1.42	0.001	4.72^{***}	-0.55^{*}	S	2.06	0.16	1.43	$3.57^{*, as}$
92 Musical Instruments, Accessories Thereof	-13.51^{***}	$3.20^{**, i}$	0.51	$0.98^{**, i}$	$-0.11^{**, i}$	$-0.18^{***, w}$	0.01	$0.12^{*, i}$	0.15	0.46	0.33	4.76^{*}	4.28^{**}	-0.61	S	1.58	0.03	$2.81^{*, as}$	$5.17^{**, as}$
94 Furniture; Bedding Lamps Nesoi, Prefab	-2.87	2.04	-2.14	$-1.09^{*, w}$	0.16	-0.02	0.19	$0.37^{**, i}$	0.19	0.3	2.27	0.65	2.62	-0.27	S	0.02	0.8	$4.22^{**, as}$	$2.87^{*, as}$
95 Toys, Games, Sport Equip., Accessories	-25.80^{**}	$12.45^{***, i}$	$-7.86^{**, w}$	-1.28	0.18	-0.08	0.13	0.43	0.03	0.32	1.34	0.49	2.75	-0.35	S	1.39	1.14	$3.61^{*, as}$	$3.34^{*, as}$
96 Miscellaneous Manufactured Articles	-9.28^{***}	$1.81^{*, i}$	-0.30	-0.07	0.02	0.04	-0.05	-0.08	-0.09	0.49	1.25	3.41^{*}	13.94^{***}	-1.02^{***}	S	0.88	0.45	0.54	0.95
97 Art, Collectors' Pieces and Antiques	18.89^{**}	$-11.27^{**, w}$	$4.03^{*, i}$	$-3.14^{***, w}$	0.12	$0.16^{*, i}$	0.17	0.11	0.76	0.53	7.13^{***}	1.59	2.89	-1.05	S	$4.45^{**, as}$	0.72	$3.09^{*, as}$	1.93

Notes: $***$, $**$ and $*$ show the significance at the 1%, 5% and 10% respectively. w and i indicate that related independent variable "worsens" and "improves" bilateral trade balances of the USA with Japan for the related goods. BG: Breusch-Godfrey Serial Correlation LM test and its critical value at 1%, 5% and 10% level is 6.63, 3.84 and 2.71. W_{SR} and W_{LR} are short-run and long-run Wald test, respectively. as; Denotes asymmetry. RR; Ramsey-RESET model misspecification test, F_{PSS} ; F cointegration test of Pesaran, Shin and Smith (2001), ECT_{t-1}; Error correction term. S; Stable.

Table 7: Total Numbers of Improvement and Worsening Impacts on BTBs and Industry Codes

	Y_{US}			Y_{JPN}			$RER_{YEN-USD}$			TPU^-_{US}			TPU^+_{US}			TPU^-_{JPN}			TPU^+_{JPN}			D_{Covid}		
	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X
Worsen	6	4	5	5	9	6	6	7	7	6	4	4	7	10	10	3	7	2	6	2	6	8	1	7
Improve	6	6	9	6	5	4	8	9	6	5	2	5	7	6	7	5	2	6	3	8	3	5	6	1

BTB: Bilateral Trade Balance. X^p: *Production-related BTB (based on the US domestic goods)*. X^{np}: *Non-production-related BTB (based on the US re-exported goods)*. X: *Total-export BTB (based on the US total export). RER denotes depreciation in USD.*

Table 8: Industry Codes

	Y_{US}			Y_{JPN}			RER			TPU^-_{US}			TPU^+_{US}			TPU^-_{JPN}			TPU^+_{JPN}			$Covid$		
	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X	X^p	X^{np}	X
Worsens	28; 39; 73; 84; 91; 97	38; 68; 84; 96	28; 32; 73; 84; 91	33; 42; 49; 59; 85	37; 42; 48; 49; 56; 65; 76; 86; 87	33; 42; 49; 59; 85; 86	40; 59; 73; 84; 85; 97	22; 38; 56; 69; 72; 74; 94	40; 59; 62; 71; 73; 84; 85	40; 49; 73; 84; 85; 97	22; 69; 72; 83	40; 49; 71; 84	28; 38; 44; 48; 68; 82; 92	30; 42; 44; 49; 68; 74; 82; 85; 92; 95	28; 33; 38; 42; 44; 48; 68; 82; 91; 92	48; 68; 88	39; 42; 65; 76; 85; 86; 95	48; 68	28; 35; 63; 74; 91; 96	56; 63	28; 35; 49; 63; 71; 74;	28; 42; 49; 61; 63; 64; 82; 91	38	28; 42; 49; 63; 64; 68; 71
Improves	33; 49; 59; 85; 92; 96	30; 37; 42; 49; 74; 86	22; 33; 42; 44; 49; 59; 85; 92; 96	39; 40; 73; 84; 91; 97	28; 29; 38; 84; 96	22; 40; 84; 91	33; 42; 49; 61; 64; 74; 91; 92	30; 35; 42; 49; 62; 83; 87; 91; 92	33; 42; 49; 64; 74; 92	28; 48; 68; 82; 92	82; 85	28; 48; 68; 82; 92	40; 49; 73; 84; 88; 96; 97	48; 56; 63; 69; 83; 86	40; 49; 63; 71; 73; 86; 88	35; 74; 84; 91; 96	63; 69	35; 49; 71; 74; 84; 91	44; 48; 92	22; 28; 42; 65; 68; 76; 85; 95	44; 48; 92	40; 84; 87; 88; 97	28; 29; 74; 86; 92; 95	40

Before examining the impacts of independent variables on different forms of US BTBs with Japan, we re-explain the definitions of the abbreviations used in Tables 4-5-6-7-8 and the paragraphs below for easy reading. X^p*: production-related BTB* (*based on US domestic goods*), X^{np}*: non-production-related BTB* (*based on US re-exported goods*), and X: t*otal-export BTB (based on US total export).* Test results in the tables above clearly reveal that a bilateral trade model of the USA with Japan should be constructed and analyzed on the proposed forms of bilateral trade balances (BTBs) separately rather than a traditional BTB, constructed on total export/total import. Because the impacts of independent variables on *production-related BTB* (X^p), *non-production-related BTB* (X^{np}), and *total-export BTB* (X) are entirely different. For example, while a rise in Japan's TPU index (TPU^+_{JPN}) worsens the US *production-related BTB* for 6 industries, the same rise worsens the US *non-production-related BTB* only for 2 industries. This means that the worsening impact of Japan's increasing trade policy uncertainty is less on the *non-production-related BTB* than on the *production-related BTB*. This may be interpreted to mean that Japanese consumers, under rising uncertainty in Japan, purchase (import) more re-exported goods (X^{np}) from the USA than domestic goods (X^p**)** produced/processed within the USA. This may be due to the fact that the USA imports from abroad for consumption purposes but cannot consume and re-exports to Japan at below world prices.

However, while a fall in Japan's TPU index (TPU_{JPN}^{-}) worsens the *production-related BTB* only for 3 industries, the same fall worsens the *non-production-related BTB* for 7 industries. This can also be interpreted to mean that Japanese consumers, under falling uncertainty in Japan, purchase (import) fewer re-exported goods (X^{np}) than US domestic goods (X^{p}). This may stem from the markups on imported goods (due to potential duties, taxes, and storage costs), and, thereby, fewer US re-exports to Japan. Hence, we may conclude that Japanese consumers, under falling uncertainty in Japan, are more sensitive to US exported goods (X^{np}) than domestic goods (X^{p}).

On the other hand, rises and falls in total in the US TPU index have more impacts on X^{p} and X^{np} than the impacts of rises and falls of Japan's TPU index. This may stem from the fact that the US economy is much larger than Japan's; thereby, US imports from Japan are more than Japan's imports from the USA. Therefore, changes in trade policy uncertainty in the USA play a more determining role than changes in Japan on bilateral trade volumes between two countries. This result can also be explained from the Japanese consumers' side only since Hofstede et al. (1980) states that the Japanese are one of the highest uncertainty avoidance people.

Furthermore, Japanese consumers purchase (import) fewer re-exported goods (X^{np}) from the USA than US domestic goods (X^{p}) when their income rises (9 and 5). Regarding the impact of the exchange rate, the improvement impact of real depreciated USD on X^{p} and X^{np} is more than its worsening impact. Japanese consumers with stronger YEN purchase (import) slightly more US re-exported goods (X^{np}) than US domestic product goods (X^{p}). Lastly, test results in the tables above indicate that the worsening impact of the COVID-19 pandemic on US domestic product goods (X^{p}) is much higher than on re-exported goods (X^{np}). This can be interpreted to mean that the COVID-19 pandemic negatively affects US domestic goods more than re-exported goods. If we relied only on traditional trade balance (X), we would not see that the COVID-19 pandemic improved *production-related BTB* for 5 industries and *non-production-related BTB* for 6 industries.

Additionally, Table 8 reports the bilateral trade balances based on industries (with their codes) and how they are affected (improved or worsened) by changes in both countries' exchange rates, incomes, and trade policy uncertainty indexes. For instance, a rise in Japan's TPU index (TPU_{JPN}^{+}) improves the *non-production-related BTBs* (X^{np}) of the industries in the shaded cell. Additionally, we determined cumulative short-run asymmetric effects of

TPU_{US} in industries 22, 38, 40, 48, 56, 68, 70, 71, 72, 76, 82, 87, 94, and for TPU_{JPN} in industries 29, 32, 33, 35, 44, 48, 87, 97 in the production-related bilateral trade balance between US and Japan based on short-run Wald test, which depends on cumulative asymmetries. However, there are asymmetric effects of TPU_{US} in industries 22, 28, 56, 94 and TPU_{JPN} in industries 22, 28, 29, 30, 42, 49, 91, and 95 in non-production related bilateral trade balance of US between Japan in the short run analysis. While the asymmetric effects are greater in the production-related bilateral trade balance, it is observed that the asymmetric effects significantly decrease in the non-production-related bilateral trade balance

Regarding the expected and estimated signs of the obtained coefficients, while we expected Y_{US} to have significantly negative signs for X^{p} and X^{np} for all industries, we found significantly positive signs for 11 industries as 30, 33, 37, 42, 59, 74, 85, 86, 92, and 96. Similarly, while we expected the sign of Y_{JPN} to be positive, we found negative signs for 10 industries 33, 37, 48, 56, 59, 65, 76, 85, 86, and 87. Finally, we expected RER to be positive for all industries; however, we found negative signs for 13 industries as 22, 38, 40, 56,59, 69,72, 73, 74,84, 85, 94, and 97. While we had no expectations for the signs of TPU_{US}^{-}, TPU_{US}^{+}, TPU_{JPN}^{-}, TPU_{JPN}^{+} and $Covid$, we found both positive and negative signs for different industries.

5- Conclusion

This study's main aim is to reveal the need to analyze bilateral trade balance (BTB) models with new forms of BTBs for two reasons. The first reason is that the traditional form of BTB, based on a total export/total import ratio, assumes that countries export only their domestic goods produced within their countries (denotes domestic export). However, countries also export some goods already imported from other countries (denotes re-export). Therefore, we should redefine and reformulate new forms of BTBs constructed on domestic goods and re-exported goods separately to achieve more accurate results. In this context, we, for the first time, attempted to reformulate two new forms of BTBs as *the production-related BTB and non-production-related BTB*. The second reason is that the economic impacts of these two new forms of BTBs will be in different magnitudes because, while *the production-related BTB* undergoes a value-added process in a country (domestic export), *the non-production-related BTB* doesn't (re-exported). Therefore, the methodology proposed in this study will enable policymakers to examine bilateral trade balances of countries based on economic impact contents. Hence, the USA seems to be a unique sample country requiring this methodological analysis since the country re-exports to Japan and collects its export data separately, as domestic export and re-export. Although many countries re-export, they cannot/do not collect such data separately. The main empirical finding supports the need to redefine/reformulate US BTBs since the impacts of income, real exchange rate, trade policy uncertainty, and the COVID-19 pandemic on these two new forms of BTBs are entirely different. We strongly believe that the future new forms of BTBs, defined on the basis of different related macroeconomic variables, will enable policymakers to implement more sustainable and manageable trade policies at a lower cost. Today, hundreds of countries have been experiencing large trade deficits. However, with the methodology proposed in this study, these countries will, to some degree, be able to identify what kind of deficits they have, rather than knowing their trade deficit volumes only as single values. What it means for these countries is that a trade deficit in domestic goods will be economically more crucial than a trade deficit in re-exported goods.

Appendix:

1. The technical construction of the TPU index:

The TPU index[5], as a news-based index, is constructed on the frequency of articles on leading US[6] and Japanese[7] newspapers. It counts some terms which may reflect the uncertainties in trade policies such as *import tariffs, import duty, import barrier, government subsidies, government subsidy, WTO, World Trade Organization, trade treaty, trade agreement, trade policy, trade act, Doha round, Uruguay round, GATT, dumping, Federal Reserve, legislation,* and *White House.* The construction of this index can be presented in the following summary steps and formulas (Baker et al. 2016; Čižmešija et al. 2017; Davis et al. 2019):

i. Counting the (aforementioned) words and get the series of scaled TPU frequency (X_{it}) for a newspaper $i = 1, 2, \dots, N$ in month t. N is a number of newspapers.
ii. Calculating the times-series variance (σ_i) of X_{it} for the interval from the first to the last year for each newspaper.

[5] For further detailed information, visit https://www.policyuncertainty.com/methodology.html
[6] The USA Today, Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, New York Times, and Wall Street.
[7] Yomiuri, Asahi, Mainichi and Nikkei.

iii. Getting the relative frequencies with $Y_{it} = \frac{X_{it}}{\sigma_i}$ and dividing them by the number of newspapers (N) to get the averages $Z_t = \frac{1}{N}\sum_{i=1}^{N} Y_{it}$.

iv. Finally, calculating the mean (M) of Z_t in the interval, multiply Z_t by ($100/M$) for all t as ($TPU_t = \frac{Z_t}{M} * 100$) and get the normalized TPU time-series index.

2. Correlation Matrix

Probability	COVID-19	TPU_{US}	TPU_{JPN}
COVID-19	1		
TPU_{US}	0.104 (0.110)	1	
TPU_{JPN}	-0.069 (0.290	0.612 (0.000)	1

As can be seen from this table, there is a positive but statistically insignificant relationship between Covid 19 and trade policy uncertainty in the US and a negative, weak, and statistically insignificant relationship between Covid 19 and trade policy uncertainty in Japan. Therefore, there is no "highly impactful" relationship between Covid 19 and TPU that could cause multicollinearity problems.

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