## How Accurate are Government Statistics? Developing New Measures using Official Trade Statistics<sup>\*</sup>

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#### Abstract

This study aims to quantify distortions due to the 'data update problem' in trade statistics that might cause biases in policy evaluation and econometric analyses. Using the UN Comtrade database over the period from 2007 to 2015, three main results are clarified. First, the study finds significant differences in trade values between pre-update and updated data. Second, the degree of distortion differs considerably among countries, even within OECD countries. Finally, estimation results indicate that the coefficient on independent variables may change in econometric analyses because of the data update problem. As a policy implication, it should be noted that the replication of previous studies' econometric results requires exactly the same data. Thus, it is required that the United Nations Comtrade and other official statistic offices provide real-time data on their websites.

#### JEL Classifications: F13, F14, F23

Key words: Official statistics, data updating, real-time data, trade data

#### **1. Introduction**

Recently, there has been a growing need for 'real-time data' (RTD) with a strong influence from evidence based policy making (EBPM). RTD is information that is promptly published after data collection and it plays an important role in EBPM as the timing of data access is crucial for policy evaluations (Komaki 2015). For instance, in the case of trade statistics, each country reports a 'quick estimation' and 'definite value'. Generally, the quick estimation is replaced by the definite value within two years by updating and revising the data. However, in some cases, even the definite value can be updated, which implies that the change could cause biases in policy discussions (see Table 1). This study calls this the data update problem. The data update problem refers to two issues. First, the value and the number of transactions can change considerably. Second, there is no access to pre-update data after the update. In other words, no one knows the difference between the original and updated data unless the provider continues to publish the pre-update data. Therefore, policy evaluations depend heavily on the date that the data was accessed.

In addition, the quality and availability of official statistics have been crucial for

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Target period	2010	2011	2012	2013	2014	2015	2016	2017	2018
Year of access									
2011	5								
2012	6	7							
2013	6	6	10						
2014	6	6	10	5					
2015	6	6	10	5	9				
2016	15	6	10	5	9	15			
2017	15	6	10	5	9	15	26		
2018	15	6	10	9	9	15	27	30	
2019	15	6	10	9	9	15	27	30	33

Table 1: Image of the real-time database of trade values and the data update problem

Note: The table is created by the author. The cells coloured by grey indicate our target in this study.

electoral constituencies, economists, and policy makers, especially in policy evaluation and econometric analyses (OECD 2012). In the early part of 2019, there was a scandal regarding improper collection of official data by the Ministry of Health, Labour and Welfare in Japan. Imprecise official statistics might mislead policy evaluation and arouse public mistrust (The Japan Times, 2019). Because of this situation, there is a need to understand more fully how accurate official statistics are.

Currently, trade statistics are published from a wide range of organisations and can be freely downloaded to evaluate trade policies. A variety of studies have argued that trade statistics reported by individual countries may be biased because of tariff evasion (Fisman and Wei 2004, Fisman and Wei 2007, Beja 2008, Buehn and Eichler 2011, Kellenberg and Levinson 2016) For instance, Buehn and Eichler (2011) state that 'Trade misinvoicing occurs if the true value of exports or imports deviates from the amount of exports or imports businesses report to authorities' (Buehn and Eichler 2011, p.1263). However, other studies basically use a 'snapshot' of trade statistics in their research. To fill this gap, this study intends to quantify the distortions in trade statistics by comparing pre-update and updated data from the United Nations (UN) Comtrade.

This study aims to quantify distortions in official trade data published by international organisations. In this research, trade data obtained from the UN Comtrade are employed to check the biases caused by the data update problem. The rest of this paper is organised as follows. Section 2 introduces the methodology for data manipulation. Section 3 summarises descriptive statistics of trade data and Section 4 conducts econometric analysis to quantify the biases caused by the data update issue. Finally, Section 5 concludes.

#### 2. Methodology

This section explains the methodology for constructing databases that can identify the biases in trade statistics due to the update problem. First, the following subsection

introduces the system of trade classification that we employed. Then, data coverage and definitions of updated data types are covered.

# 2-1 Explanation of the Harmonised Commodity Description and Coding System (HS)

In the case of the UN Comtrade, the trade data are reported from member countries to the UN according to the rule of the International Merchandise Trade Statistics: Concepts and Definitions (IMTSCD). However, the statistical reports submitted by certain countries should be modified because reporting systems in these countries tend to differ from those of the IMTSCD. To publish the trade statistics of these countries, the UN basically revises the reported data in accordance with their rule<sup>1</sup>.

Trade values are reported in two manners: Free On Board for export values and Cost, Insurance and Freight for import values. The former only includes the value of transactions while the latter additionally contains the cost of insurance and transportation. Trade data are published based on the Harmonised Commodity Description and Coding System (HS), Standard International Trade Classification (SITC), and Broad Economic Categories (BEC) classifications<sup>2</sup>. Because the HS has more than 5,000 product IDs, this study employed the HS classification for checking distortions<sup>3</sup>. The HS was developed by the World Custom Organisation. The classification has been updated every five years so far. It is organised by 4 levels, which are Section, Chapter, Heading, and Subheading. The 6-digit level HS is internationally common, while each country has its own schedule beyond the 6-digits.

#### 2-2 Data coverage

This study included 26 reporter countries and all partners. Because the period of data collection is from January 2017 to August 2019, this study only has a relatively small number of transactions (see Table 2). The research is based on the HS 6-digit level and all products are covered. As we only obtained the data for 26 countries, target periods

are limited to 2007-2015. Because the HS classification revises its codes every five years, this study covers the following versions: HS2007 in 6-digits and HS2012 in 6-digits.

Country	Year Publication	Latest Publication	Country	Year Publication	Latest Publication
Country	Note	Date	Country	Note	Date
Andorra	2014 Full revision	2019.04.22	Hungary	2012 Full revision	2018.01.12
Argentina	2014 Full revision	2019.07.29		2013 Full revision	2018.01.12
-	2015 Full revision	2019.07.29		2014 Full revision	2018.01.12
Austria	2013 Full revision	2019.06.26	Ireland	2012 Full revision	2018.03.16
	2014 Full revision	2019.06.23		2013 Full revision	2018.03.16
	2015 Full revision	2019.06.23		2014 Full revision	2018.03.16
Azerbaijan	2015 Full revision	2019.06.23		2015 Full revision	2018.03.16
Brazil	2007 Full revision	2017.05.23	Latvia	2014 Full revision	2019.07.24
	2008 Full revision	2017.05.23		2015 Full revision	2019.07.24
	2009 Full revision	2017.05.23	Malta	2015 Full revision	2017.05.15
	2010 Full revision	2017.05.16	Mexico	2015 Full revision	2017.10.06
	2011 Full revision	2017.05.23	Morocco	2015 Full revision	2019.08.27
	2012 Full revision	2017.05.23	Netherlands	2015 Full revision	2017.09.13
	2013 Full revision	2017.05.24	Paraguay	2012 Full revision	2018.07.24
	2014 Full revision	2017.05.24		2013 Full revision	2018.07.25
	2015 Full revision	2017.05.25		2014 Full revision	2018.07.24
Canada	2014 Full revision	2017.04.26		2015 Full revision	2018.07.24
	2015 Full revision	2017.06.27	Peru	2012 Full revision	2018.06.05
Chile	2014 Full revision	2018.05.25		2013 Full revision	2018.06.05
	2015 Full revision	2018.05.25		2014 Full revision	2018.06.05
China	2014 Full revision	2017.06.28		2015 Full revision	2018.06.05
	2015 Full revision	2017.06.29	Portugal	2015 Full revision	2019.06.28
Cyprus	2014 Full revision	2019.07.11	Rep. of Korea	2015 Full revision	2017.05.08
	2015 Full revision	2019.07.14	Singapore	2012 Full revision	2019.07.22
Estonia	2015 Full revision	2017.09.06		2013 Full revision	2019.07.19
Finland	2005 Full revision	2017.03.02		2014 Full revision	2019.07.21
Georgia	2014 Full revision	2019.07.21	Sweden	2015 Full revision	2017.05.09
Germany	2012 Full revision	2019.08.20			
	2015 Full revision	2019.08.20			

Table 2: Target countries and date of updates

Source: UN, Comtrade.

#### **2-3 Calculation method**

To investigate the distortions in trade reports due to the data update problem, the study calculates three types of variables (see Table 3). First, it defines transaction 3 as the **REVEALED transaction** because the trade value exists only in the updated data. Second, the study uses transaction 2 as the data for the **CONCEALED transaction** because it only appears in the pre-update data. Finally, transaction 4 is used as the

**REVISED transaction** as it is included in both the pre-update and updated data while trade values differ between them.

Transactions	Flow	Reporter	Partner	Period	HS code	Trade value (Old data)	Trade value (Updated data)
1	Export	Japan	UK	2014	871310	107,469	107,469
2	Export	Japan	UK	2014	871320	5,523	N/A
3	Import	Japan	UK	2014	831790	N/A	112,563
4	Import	Japan	UK	2014	871310	112,325	201,252

 Table 3: Definitions of each variable

Note: These are defined by the author.

#### 3. Stylised facts: Distortions in trade statistics

This section summarises the characteristics of our results using the UN Comtrade database. First, the descriptive statistics of REVEALED, CONCEALED, and REVISED trade are shown in the next subsection. Then, overall changes due to the updates are explained.

#### 3-1 Differences between pre-update and updated trade data

#### (1) **REVEALED** trade

Table 4 explains the values of REVEALED trade for targeted countries. REVEALED trade certainly increases the value of total trade and this means that the original trade data were underestimated. In terms of trade values, China has updated their trade statistics considerably (USD 83.59 billion for 2015), which might be because of the scale of their total trade. Furthermore, the change is mainly in import values. Regarding the ratio of original trade values to REVEALED trade, the largest value is 5.5% for Malta, 2015. Again, this could be because their total trade is relatively small and the REVEALED trade might have a greater effect on the updated total trade than those of other countries. Furthermore, as a special case, Brazil updated their trade

statistics for the period of 2008-2013, which was approximately a 1% change on average.

#### (2) CONCEALED trade

The values of CONCEALED trade for targeted countries are summarised in Table 5. If the updated data included CONCEALED trade, the changes led to decreases in trade values. Moreover, the existence of CONCEALED trade indicates that the original data was overestimated. Regarding the trade value, similar to REVEALED trade, Brazil and China underwent major updates. In addition, Hungary updated their trade statistics considerably (USD 4.8 billion for 2015). In terms of its percentage of original trade data, Azerbaijan (2.2%), Brazil (around 1%), China (1%) and Hungary show major changes in official trade statistics.

		The value of trade (billion US dollar)			The value of REVEALED trade (billion US dollar)					
Country	Year	Export	Import	Total trade	Export	(%)	Import	(%)	Total	(%)
Andorra	2014	0.0	1.2	1.3	0.00	0.0%	0.00	0.0%	0.00	0.0%
Argentina	2014	47.7	12.9	60.6	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	51.1	4.1	55.2	0.00	0.0%	0.00	0.0%	0.00	0.0%
Austria	2013	116.0	173.0	289.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2014	150.0	114.0	264.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	111.0	108.0	219.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
Azerbaijan	2015	0.5	3.7	4.2	0.00	0.0%	0.00	0.0%	0.00	0.0%
Brazil	2007	160.6	120.6	281.3	0.00	0.0%	0.01	0.0%	0.01	0.0%
	2008	152.9	135.1	288.0	4.74	3.1%	0.00	0.0%	4.75	1.6%
	2009	153.0	127.7	280.7	2.69	1.8%	0.00	0.0%	2.69	1.0%
	2010	201.9	181.8	383.7	3.79	1.9%	0.02	0.0%	3.80	1.0%
	2011	256.0	226.2	482.3	4.88	1.9%	0.01	0.0%	4.88	1.0%
	2012	242.6	223.2	465.8	0.04	0.0%	0.37	0.2%	0.41	0.1%
	2013	242.0	239.7	481.8	4.20	1.7%	0.71	0.3%	4.91	1.0%
	2014	225.1	229.1	454.2	0.00	0.0%	0.00	0.0%	0.00	0.0%
G 1	2015	191.1	171.4	362.6	2.48	1.3%	0.68	0.4%	3.16	0.9%
Canada	2014	475.2	463.1	938.3	0.00	0.0%	0.00	0.0%	0.00	0.0%
<b>CT</b> 11	2015	408.8	419.7	828.5	0.01	0.0%	0.04	0.0%	0.05	0.0%
Chile	2014	0.1	24.5	24.6	0.00	0.1%	0.00	0.0%	0.00	0.0%
<b>a</b> t :	2015	37.9	48.5	86.4	0.00	0.0%	0.00	0.0%	0.00	0.0%
China	2014	2,342.3	1,959.2	4,301.5	0.00	0.0%	0.00	0.0%	0.00	0.0%
-	2015	2,273.5	1,679.6	3,953.0	2.11	0.1%	81.47	4.9%	83.59	2.1%
Cyprus	2014	1.3	3.5	4.8	0.00	0.3%	0.02	0.5%	0.02	0.5%
<b>D</b> ( )	2015	0.8	3.6	4.4	0.00	0.0%	0.18	5.1%	0.18	4.1%
Estonia	2015	13.9	15.7	29.6	0.00	0.0%	0.00	0.0%	0.00	0.0%
Finland	2005	65.2	58.5	123.7	0.00	0.0%	0.00	0.0%	0.00	0.0%
Georgia	2014	2.5	3.0	5.5	0.00	0.0%	0.00	0.0%	0.00	0.0%
Germany	2012	786.0	432.0	1,218.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	521.0	384.0	905.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
Hungary	2012	49.3	79.6	128.9	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2013	90.8	63.3	154.1	0.00	0.0%	0.00	0.0%	0.00	0.0%
T 1 1	2014	101.0	25.7	126.7	0.00	0.0%	0.00	0.0%	0.00	0.0%
Ireland	2012	18.2	19.2	37.4	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2013	47.5	39.3	86.8	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2014	60.8	40.6	101.4	0.00	0.0%	0.00	0.0%	0.00	0.0%
T / '	2015	107.0	55.5	162.5	0.00	0.0%	0.00	0.0%	0.00	0.0%
Latvia	2014	4.3	5.1	9.4	0.00	0.0%	0.00	0.0%	0.00	0.0%
Malta	2015	0.8	5.2	0.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
Mariaa	2015	280.5	0.8	10.7	0.00	9.2%	0.23	<b>3.3%</b>	0.59	<b>3.3%</b>
Maraaaa	2015	580.5	393.2	//3.8	0.01	0.0%	0.01	0.0%	0.01	0.0%
Motocco Natharlanda	2015	11.8	424.0	55.0 909.7	0.00	0.0%	0.00	0.0%	0.00	0.0%
Dereguer	2013	4/3.8	424.9	090./ 9.5	0.00	0.0%	0.00	0.0%	0.00	0.0%
Paraguay	2012	1.9	0.0	8.3 5.7	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	4.4	1.2	3./ 19.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2014	5.0	0.0	6.8	0.00	0.070	0.00	0.0%	0.00	0.070
Dam	2013	20.5	0.9	30.1	0.03	0.370	0.00	0.0%	0.05	0.470
reiu	2012	20.3	9.0	30.1	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2013	27.4 14 1	1.1	50.5 12 7	0.00	0.070	0.00	0.0%	0.00	0.0%
	2014	14.1	27.0 28.6	43.1 16.6	0.00	0.070	0.00	0.0%	0.00	0.0%
Portugal	2015	18.0	20.0 61.0	40.0	0.00	0.0%	0.00	0.0%	0.00	0.0%
Rep of Koree	2015	40.4 576 Q	126 5	062.2	0.00	0.070	0.00	0.0%	0.00	0.0%
Singanore	2015	108.0	183.0	201.0	0.00	0.070	0.00	0.0%	0.00	0.0%
Singapore	2012	72.1	220 0	291.0	0.00	0.070	0.00	0.0%	0.00	0.0%
	2013	171.0	150.0	301.1	0.00	0.070	0.00	0.0%	0.00	0.0%
Sweden	2014	140.0	138.0	278 4	0.00	0.0%	0.00	0.0%	0.03	0.0%
Sweden	2015	140.0	150.4	2/0.4	0.01	0.070	0.04	0.070	0.05	0.070

Table 4: Summary statistics of REVEALED trade

#### Source: UN Comtrade.

Note: The REVEALED trade is defined as transaction 3 in Table 3.

		The value of	The value of HIDDEN trade (billion US dollar)							
Country	Year	Export	Import	Total trade	Export	(%)	Import	(%)	Total	(%)
Andorra	2014	0.0	1.2	1.3	0.00	7.4%	0.01	0.7%	0.01	0.8%
Argentina	2014	47.7	12.9	60.6	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	51.1	4.1	55.2	0.00	0.0%	0.04	0.9%	0.04	0.1%
Austria	2013	116.0	173.0	289.0	0.03	0.0%	0.01	0.0%	0.04	0.0%
	2014	150.0	114.0	264.0	0.08	0.1%	0.01	0.0%	0.09	0.0%
	2015	111.0	108.0	219.0	0.13	0.1%	0.08	0.1%	0.21	0.1%
Azerbaijan	2015	0.5	3.7	4.2	0.00	0.1%	0.09	2.5%	0.09	2.2%
Brazil	2007	160.6	120.6	281.3	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2008	152.9	135.1	288.0	4.77	3.1%	0.00	0.0%	4.77	1.7%
	2009	153.0	127.7	280.7	2.75	1.8%	0.00	0.0%	2.75	1.0%
	2010	201.9	181.8	383.7	0.11	0.1%	0.07	0.0%	0.17	0.0%
	2011	256.0	226.2	482.3	4.95	1.9%	0.00	0.0%	4.95	1.0%
	2012	242.6	223.2	465.8	4.98	2.1%	0.37	0.2%	5.35	1.1%
	2013	242.0	239.7	481.8	4.24	1.8%	0.71	0.3%	4.96	1.0%
	2014	225.1	229.1	454.2	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	191.1	171.4	362.6	2.50	1.3%	0.68	0.4%	3.18	0.9%
Canada	2014	475.2	463.1	938.3	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	408.8	419.7	828.5	0.04	0.0%	0.02	0.0%	0.05	0.0%
Chile	2014	0.1	24.5	24.6	0.04	61.1%	0.01	0.0%	0.06	0.2%
	2015	37.9	48.5	86.4	0.03	0.1%	0.03	0.1%	0.06	0.1%
China	2014	2,342.3	1,959.2	4,301.5	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	2,273.5	1,679.6	3,953.0	0.17	0.0%	38.19	2.3%	38.37	1.0%
Cyprus	2014	1.3	3.5	4.8	0.00	0.0%	0.00	0.0%	0.00	0.0%
	2015	0.8	3.6	4.4	0.00	0.1%	0.00	0.0%	0.00	0.0%
Estonia	2015	13.9	15.7	29.6	0.00	0.0%	0.00	0.0%	0.00	0.0%
Finland	2005	65.2	58.5	123.7	0.00	0.0%	0.00	0.0%	0.00	0.0%
Georgia	2014	2.5	3.0	5.5	0.00	0.0%	0.00	0.0%	0.00	0.0%
Germany	2012	786.0	432.0	1,218.0	0.02	0.0%	1.35	0.3%	1.37	0.1%
	2015	521.0	384.0	905.0	2.69	0.5%	4.05	1.1%	6.74	0.7%
Hungary	2012	49.3	79.6	128.9	4.80	9.7%	0.01	0.0%	4.81	3.7%
	2013	90.8	63.3	154.1	0.04	0.0%	0.01	0.0%	0.05	0.0%
	2014	101.0	25.7	126.7	0.09	0.1%	0.00	0.0%	0.10	0.1%
Ireland	2012	18.2	19.2	37.4	0.02	0.1%	0.00	0.0%	0.03	0.1%
	2013	47.5	39.3	86.8	0.11	0.2%	0.00	0.0%	0.11	0.1%
	2014	60.8	40.6	101.4	0.14	0.2%	0.01	0.0%	0.15	0.1%
T / '	2015	107.0	55.5	162.5	0.00	0.0%	0.01	0.0%	0.01	0.0%
Latvia	2014	4.3	5.1	9.4	0.00	0.0%	0.00	0.0%	0.00	0.0%
Malta	2015	0.8	5.2	0.0 10.7	0.00	0.5%	0.00	0.1%	0.01	0.1%
Mariaa	2015	280.5	0.8	10.7	0.00	0.0%	0.05	0.3%	0.04	0.5%
Mercese	2015	580.5	393.2	//3.8	0.03	0.0%	0.01	0.0%	0.00	0.0%
Nothorlanda	2015	11.0	424.0	23.0 202 7	0.00	0.0%	0.00	0.0%	0.00	0.0%
Demonstration	2013	4/5.8	424.9	090./	0.00	0.0%	0.00	0.0%	0.00	0.0%
Palaguay	2012	1.9	0.0	8.3 5.7	0.00	0.1%	0.01	0.2%	0.01	0.2%
	2015	4.4	1.2	3.7	0.00	0.0%	0.03	2.8%	0.05	0.0%
	2014	7.9	11.0	10.9	0.00	0.070	0.00	0.070	0.00	0.070
Doru	2013	20.5	0.9	30.1	0.03	0.570	0.00	0.170	0.03	0.470
i ciu	2012	20.3	9.0	30.1	0.00	0.0%	0.00	0.070	0.00	0.0%
	2013	29.4	20.6	30.3 43.7	0.00	0.0%	0.00	0.470	0.00	0.0%
	2014	14.1	29.0	45.7	0.00	0.0%	0.01	0.0%	0.01	0.0%
Portugal	2015	10.0	20.0 61.0	102.2	0.00	0.070	0.01	0.070	0.01	0.070
Ren of Korea	2015	40.4 526 Q	/36.5	063.2	0.00	0.0%	0.00	0.0%	0.00	0.0%
Singanore	2015	108.0	183.0	201.0	0.00	0.070	0.01	0.0%	0.01	0.070
Singapore	2012	72.1	220 0	291.0	0.00	0.070	0.00	0.0%	0.00	0.070
	2013	171.0	150.0	301.1	0.00	0.070	0.00	0.0%	0.00	0.070
Sweden	2014	140.0	138.4	278.4	0.00	0.0%	0.00	0.0%	0.00	0.0%
~	-010	110.0	150.4	270.1	0.00	0.070	5.00	0.070	0.00	0.070

Table 5: Summary statistics of CONCEALED trade

Source: UN Comtrade.

Note: The CONCEALED trade is defined as transaction 2 in Table 3.

#### (3) **REVISED** trade

The REVISED trade statistics, which is the most important variable in the study, are explained in Table 6. The existence of REVISED trade could cause either an increase or decrease in official trade statistics. Thus, we need to investigate the changes precisely. Surprisingly, many countries changed their official statistics by more than 10% in absolute values (Azerbaijan 2015, Chile 2014, Ireland 2012 and 2013, and Malta 2015). This implies that policy evaluations for these countries should be conducted carefully, especially concerning the timing of data access. Furthermore, China and Singapore have updated their trade data considerably, although its share of original value is relatively smaller than those of countries explained above. Finally, the study calculates the overall change in their official trade statistics that are caused by the updates in the next subsection.

#### 3-2 Overall changes

This subsection explains the overall changes in government trade statistics. The results are summarised in Table 7. The overall changes are calculated according to the following method:

$$Overall \ changes = REVEALED \ trade + REVISED \ trade$$
$$- CONCEALED \ trade \tag{1}$$

Similar to the REVISED trade, the update can lead to either an increase or decrease in the data. Again, Azerbaijan, Ireland, and Malta updated their trade data by more than 10% (-65.4% for Azerbaijan in 2015, around 10 % for Ireland in 2013 and 2014, and 21.8% for Malta in 2015). In addition to these countries, there are other members who changed their government statistics by more than 5% (Chile, Latvia, and Singapore). For instance, Chile originally published their official export statics for 2014 as USD 0.1 billion. However, they updated the figure 4 years later and it became evident that the

		The value of trade (billion US dollar)			The absolute value of REVISED trade (billion US dollar)					
Country	Year	Export	Import	Total trade	Export	(%)	Import	(%)	Total	(%)
Andorra	2014	0.0	1.2	1.3	0.00	0.73%	0.00	0.00%	0.00	0.01%
Argentina	2014	47.7	12.9	60.6	0.01	0.03%	0.54	4.15%	0.55	0.91%
	2015	51.1	4.1	55.2	0.05	0.10%	0.11	2.59%	0.16	0.28%
Austria	2013	116.0	173.0	289.0	0.00	0.00%	0.01	0.00%	0.01	0.00%
	2014	150.0	114.0	264.0	0.00	0.00%	0.00	0.00%	0.00	0.00%
	2015	111.0	108.0	219.0	0.00	0.00%	0.00	0.00%	0.00	0.00%
Azerbaijan	2015	0.5	3.7	4.2	4.25	833.33%	0.02	0.52%	4.27	101.65%
Brazil	2007	160.6	120.6	281.3	0.12	0.08%	0.17	0.14%	0.29	0.10%
	2008	152.9	135.1	288.0	0.44	0.29%	0.47	0.35%	0.91	0.32%
	2009	153.0	127.7	280.7	1.81	1.18%	0.18	0.14%	1.99	0.71%
	2010	201.9	181.8	383.7	0.70	0.35%	0.09	0.05%	0.79	0.20%
	2011	256.0	226.2	482.3	0.32	0.12%	0.26	0.12%	0.58	0.12%
	2012	242.6	223.2	465.8	5.18	2.13%	0.25	0.11%	5.43	1.17%
	2013	242.0	239.7	481.8	0.43	0.18%	0.35	0.15%	0.78	0.16%
	2014	225.1	229.1	454.2	0.24	0.11%	0.18	0.08%	0.42	0.09%
	2015	191.1	171.4	362.6	0.18	0.09%	0.12	0.07%	0.30	0.08%
Canada	2014	475.2	463.1	938.3	2.01	0.42%	0.91	0.20%	2.91	0.31%
	2015	408.8	419.7	828.5	0.55	0.13%	1.35	0.32%	1.90	0.23%
Chile	2014	0.1	24.5	24.6	2.09	2882.76%	1.39	5.67%	3.48	14.16%
	2015	37.9	48.5	86.4	0.66	1.73%	1.59	3.28%	2.25	2.60%
China	2014	2,342.3	1,959.2	4,301.5	2.26	0.10%	4.28	0.22%	6.54	0.15%
	2015	2,273.5	1,679.6	3,953.0	14.52	0.64%	60.95	3.63%	75.47	1.91%
Cyprus	2014	1.3	3.5	4.8	0.00	0.16%	0.00	0.05%	0.00	0.08%
	2015	0.8	3.6	4.4	0.03	3.08%	0.07	1.89%	0.09	2.11%
Estonia	2015	13.9	15.7	29.6	0.05	0.37%	0.05	0.30%	0.10	0.33%
Finland	2005	65.2	58.5	123.7	0.05	0.08%	0.04	0.07%	0.09	0.07%
Georgia	2014	2.5	3.0	5.5	0.00	0.00%	0.00	0.00%	0.00	0.00%
Germany	2012	786.0	432.0	1,218.0	3.08	0.39%	0.94	0.22%	4.02	0.33%
	2015	521.0	384.0	905.0	2.51	0.48%	0.14	0.04%	2.65	0.29%
Hungary	2012	49.3	79.6	128.9	1.01	2.05%	0.86	1.08%	1.87	1.45%
	2013	90.8	63.3	154.1	0.24	0.26%	0.06	0.10%	0.30	0.19%
	2014	101.0	25.7	126.7	0.18	0.17%	0.28	1.09%	0.46	0.36%
Ireland	2012	18.2	19.2	37.4	2.76	15.16%	6.45	33.59%	9.21	24.63%
	2013	47.5	39.3	86.8	6.12	12.88%	8.19	20.84%	14.31	16.49%
	2014	60.8	40.6	101.4	1.39	2.29%	0.83	2.05%	2.22	2.19%
	2015	107.0	55.5	162.5	1.42	1.33%	0.92	1.66%	2.34	1.44%
Latvia	2014	4.3	5.1	9.4	0.20	4.72%	0.26	5.14%	0.47	4.95%
	2015	0.8	5.2	6.0	0.00	0.45%	0.18	3.53%	0.19	3.11%
Malta	2015	3.9	6.8	10.7	1.03	26.42%	0.91	13.35%	1.94	18.13%
Mexico	2015	380.5	395.2	7/5.8	0.53	0.14%	0.39	0.10%	0.91	0.12%
Morocco	2015	11.8	21.2	33.0	0.00	0.00%	0.00	0.00%	0.00	0.00%
Netherlands	2015	4/3.8	424.9	898.7	0.47	0.10%	0.37	0.09%	0.84	0.09%
Paraguay	2012	1.9	6.6	8.5	0.00	0.00%	0.70	10.48%	0.70	8.19%
	2013	4.4	1.2	5.7	0.00	0.00%	0.07	5.42%	0.07	1.16%
	2014	7.9	11.0	18.9	0.00	0.06%	0.05	0.45%	0.05	0.29%
D	2015	5.9	0.9	6.8	0.01	0.20%	0.13	15.00%	0.14	2.07%
Peru	2012	20.5	9.6	30.1	0.00	0.00%	0.00	0.01%	0.00	0.01%
	2013	29.4	1.1	30.5	0.00	0.00%	0.00	0.01%	0.00	0.00%
	2014	14.1	29.6	43.7	0.22	1.55%	0.04	0.13%	0.26	0.59%
D ( 1	2015	18.0	28.6	46.6	0.19	1.05%	0.06	0.23%	0.25	0.54%
Portugal	2015	40.4	61.9	102.3	0.35	0.86%	0.48	0.77%	0.82	0.80%
Kep. of Korea	2015	526.8	436.5	963.2	0.75	0.14%	0.69	0.10%	1.44	0.15%
Singapore	2012	108.0	183.0	291.0	10.00	0./5%	5.20	2.84%	12.49	4.29%
	2013	/2.1	229.0	301.1	10.60	14./0%	3.80	1.00%	14.40	4./8%
Suradan	2014	1/1.0	150.0	321.0	7.91	4.05%	1.00	4.0/%	14.91	4.04%
Sweden	2013	140.0	138.4	2/8.4	0.77	0.33%	1.50	1.13%	2.33	0.84%

Table 6: Summary statistics of REVISED trade

Source: UN Comtrade.

Note: The REVISED trade is defined as transaction 4 in Table 3.

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		The value of trade (billion US dollar)			Total changes in the value of trade (billion US dollar)					
Country	Year	Export	Import	Total trade	Export	(%)	Import	(%)	Total trade	(%)
Andorra	2014	0.0	1.2	1.3	0.0	-5.6%	0.0	-0.7%	0.0	-0.8%
Argentina	2014	47.7	12.9	60.6	0.0	0.0%	0.5	0.8%	0.5	0.8%
	2015	51.1	4.1	55.2	0.0	0.0%	0.4	0.8%	0.4	0.8%
Austria	2013	116.0	173.0	289.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
	2014	150.0	114.0	264.0	-0.1	-0.1%	0.0	0.0%	-0.1	0.0%
	2015	111.0	108.0	219.0	-0.1	-0.1%	-0.1	0.0%	-0.2	-0.1%
Azerbaijan	2015	0.5	3.7	4.2	-2.7	-521.7%	-0.1	-2.1%	-2.7	-65.4%
Brazil	2007	160.6	120.6	281.3	0.0	0.0%	0.0	0.0%	0.0	0.0%
	2008	152.9	135.1	288.0	4.8	3.1%	-0.2	-0.1%	4.6	1.6%
	2009	153.0	127.7	280.7	0.0	0.0%	0.0	0.0%	0.0	0.0%
	2010	201.9	181.8	383.7	4.5	2.2%	1.2	0.7%	5.8	1.5%
	2011	256.0	226.2	482.3	-0.1	0.0%	0.0	0.0%	0.0	0.0%
	2012	242.6	223.2	465.8	0.0	0.0%	0.4	0.2%	0.4	0.1%
	2013	242.0	239.7	481.8	4.1	1.7%	0.9	0.4%	5.0	1.0%
	2014	225.1	229.1	454.2	0.1	0.0%	0.0	0.0%	0.1	0.0%
	2015	191.1	171.4	362.6	2.5	1.3%	0.7	0.4%	3.1	0.9%
Canada	2014	475.2	463.1	938.3	1.6	0.3%	0.1	0.0%	1.7	0.2%
	2015	408.8	419.7	828.5	0.1	0.0%	0.6	0.1%	0.7	0.1%
Chile	2014	0.1	24.5	24.6	-1.9	-2557.5%	0.4	1.5%	-1.5	-6.0%
	2015	37.9	48.5	86.4	-1.4	-3.6%	-0.6	-0.7%	-2.0	-2.3%
China	2014	2,342.3	1,959.2	4,301.5	0.0	0.0%	1.1	0.1%	1.1	0.0%
	2015	2,273.5	1,679.6	3,953.0	-8.4	-0.4%	-2.2	-0.1%	-10.6	-0.3%
Cyprus	2014	1.3	3.5	4.8	0.0	0.5%	0.0	0.6%	0.0	0.7%
	2015	0.8	3.6	4.4	0.0	0.6%	0.2	4.6%	0.2	4.7%
Estonia	2015	13.9	15.7	29.6	0.0	0.0%	0.0	0.0%	0.0	0.0%
Finland	2005	65.2	58.5	123.7	0.0	0.0%	0.0	0.0%	0.0	0.0%
Georgia	2014	2.5	3.0	5.5	0.0	0.0%	0.0	0.0%	0.0	0.0%
Germany	2012	786.0	432.0	1,218.0	3.6	0.5%	1.9	0.2%	5.5	0.5%
	2015	521.0	384.0	905.0	-3.7	-0.7%	-2.3	-0.3%	-6.0	-0.7%
Hungary	2012	49.3	79.6	128.9	-0.4	-0.8%	8.4	6.5%	8.0	6.2%
	2013	90.8	63.3	154.1	0.2	0.3%	0.6	0.4%	0.9	0.6%
	2014	101.0	25.7	126.7	0.2	0.2%	1.1	0.8%	1.3	1.0%
Ireland	2012	18.2	19.2	37.4	0.2	1.2%	2.8	7.5%	3.0	8.1%
	2013	47.5	39.3	86.8	1.5	3.1%	7.2	8.3%	8.7	10.0%
	2014	60.8	40.6	101.4	1.5	2.5%	9.7	9.6%	11.2	11.1%
	2015	107.0	55.5	162.5	-1.4	-1.3%	-0.9	-0.6%	-2.3	-1.4%
Latvia	2014	4.3	5.1	9.4	0.2	4.2%	0.2	2.6%	0.4	4.5%
	2015	0.8	5.2	6.0	0.2	19.1%	0.2	3.0%	0.3	5.6%
Malta	2015	3.9	6.8	10.7	1.3	34.1%	1.0	14.7%	2.3	21.8%
Mexico	2015	380.5	395.2	775.8	-0.1	0.0%	0.0	0.0%	-0.1	0.0%
Morocco	2015	11.8	21.2	33.0	0.0	0.0%	0.0	0.0%	0.0	0.0%
Netherlands	2015	473.8	424.9	898.7	0.0	0.0%	0.0	0.0%	0.0	0.0%
Paraguay	2012	1.9	6.6	8.5	0.0	0.0%	0.1	0.6%	0.1	0.6%
	2013	4.4	1.2	5.7	0.0	0.0%	0.0	0.7%	0.0	0.7%
	2014	7.9	11.0	18.9	0.0	0.0%	0.0	0.2%	0.0	0.2%
	2015	5.9	0.9	6.8	0.0	0.0%	0.0	0.4%	0.0	0.4%
Peru	2012	20.5	9.6	30.1	0.0	0.0%	0.0	-0.1%	0.0	-0.1%
	2013	29.4	1.1	30.5	0.0	0.0%	0.0	0.0%	0.0	0.0%
	2014	14.1	29.6	43.7	0.2	1.3%	0.0	-0.1%	0.2	0.4%
	2015	18.0	28.6	46.6	0.4	2.3%	-0.1	-0.2%	0.3	0.7%
Portugal	2015	40.4	61.9	102.3	-0.2	-0.6%	0.0	0.0%	-0.2	-0.2%
Rep. of Korea	2015	526.8	436.5	963.2	-0.1	0.0%	0.0	0.0%	-0.1	0.0%
Singapore	2012	108.0	183.0	291.0	7.2	6.7%	6.0	2.1%	13.3	4.6%
	2013	72.1	229.0	301.1	4.2	5.9%	14.3	4.7%	18.5	6.2%
	2014	171.0	150.0	321.0	3.2	1.9%	10.7	3.3%	13.9	4.3%
Sweden	2015	140.0	138.4	278.4	-0.1	-0.1%	0.3	0.2%	0.1	0.0%

Table 7: Summary statistics of overall changes

Source: UN Comtrade.

Note: Total change in the value of trade is defined as follows: The sum of the REVEALED trade values - the sum of the CONCEALED trade values + the sum of the REVISED trade values.

real value was USD 2 billion. Understandably, the change might contribute to a sense of mistrust from their people as well as from other countries. The next section reports the econometric analyses conducted to quantify the biases caused by the data update problems.

#### 4. Econometric analysis

To achieve its purpose, this study uses two types of dependent variables in the empirical analysis. The first is the value of exports and imports in the pre-update data and the other is those from the updated data.

There are two steps in this section. First, the study estimates the gravity equation of international trade by ordinary least square (OLS) with robust standard errors. Second, it checks the similarity of the coefficients from the different OLS regressions for the pre-update and updated data, using the Chi-squared test.

In the first stage of the empirical section, the baseline specification is:

$$lnTrade_{ijklt} = \beta_1 \ lnGDP_{jt} + \beta_2 \ lnDISTANCE_{ij} + \beta_3 \ Contiguity_{ij} + \beta_4 \ LANGUAGE_{ij} + \beta_5 \ COLONY_{ij} + \varepsilon_{ijt}$$
(2)

where *i*, *j*, *k*, *l*, and t denote reporter, partner, trade flow, product, and year respectively. In addition, *Trade* and *DISTANCE* are defined as values of trade as well as physical distance between two countries. *Contiguity* is a dummy variable for country-pairs that have a common border. *LANGUAGE* is equal to 1 if a country-pair shares the same language and 0 otherwise. *Colony* is a dummy variable for country-pairs which have a colonial relationship. Finally,  $\varepsilon$  is the error term. Our data sources are *World Development Indicators* for GDP and the *CEPII distance database* for the rest of the variables. As we explained above, one of our aims is to test the difference between preupdate and updated trade data. To examine the similarity (or difference) of coefficients, the study uses the suest command and Chi-squared test in STATA. This study checks the similarity using REVEALED, CONCEALED, and REVISED transactions for each reporter country to quantify the bias caused by the data update problem. The results are summarised in Table 8 for exports and Table 9 for imports.

As the tables show, the results indicate that the data update problem might cause biases in empirical analysis because the difference in the coefficients on variables are statistically significant. In other words, policy evaluation could be changed due to the issue. In addition, the degree of bias varies across countries, sectors, and targeted years. For instance, if we conducted an analysis on determinants of trade flow using Canadian official statistics, we may need to reconsider the empirical results for exports because the coefficients on distance, contiguity and colony may be changed while the results for imports should be same as those using the pre-update official data. Thus, it should be noted that we need to consider the date that the data was accessed very carefully.

			Ехро	ort			
		Variable					
Country	Year	GDP	Distance	Contiguity	Common language	Colony	
Andorra	2014	***	***	***	***	***	
Argentina	2014	***		***		***	
0	2015			*			
Austria	2013	***			**	*	
	2014	***					
	2015	***	***	***	**	***	
Azerbaijan	2015	*	**	*		**	
Brazil	2007						
	2008						
	2009				***		
	2010	***	***				
	2011	***	***	***	***	***	
	2012				***		
	2013				***		
	2014						
	2015				***		
Canada	2014		***	***		**	
	2015		*				
Chile	2014	***	***				
	2015	***	***	***		**	
China	2014		***		***		
China	2015	***	***	**	***		
Cyprus	2013				*	*	
Cyprus	2015	***	***			**	
Estonia	2015						
Finland	2015						
Georgia	2005		**			**	
Germany	2014	***	***	***	**		
Germany	2012	***	***	*	***	***	
Hungary	2013	***	***	**		***	
Trungary	2012	***					
	2013	***	*	***			
Ireland	2014	***	***	***			
Itelallu	2012		***	***			
	2013	**	***	***	***		
	2014	***	***	***	***	***	
Latria	2013	***	***	***		***	
Latvia	2014	***	***	***		***	
Malta	2015		**			***	
Maxiao	2015					**	
Managaga	2015	***	***	***	***	***	
NIOFOCCO	2015		**	*			
Demonstration	2015						
Paraguay	2012	**					
	2013	**					
	2014	**			**	***	
Dama	2015	***	<u></u>				
Peru	2012	***	***			**	
	2013	***	***		بالدران بل	**	
	2014	***			***		
<b>n</b>	2015	***			**		
Portugal	2015	***	***	***	***		
Rep. of Korea	2015		**				
Singapore	2012		*			***	
	2013					**	
	2014		**			**	
Sweden	2015	***		***	**	**	

#### Table 8: Results from the chi-squared test for exports

Note: \*\*\*, \*\*, and \* denote that the equality of coefficients is rejected by the Chi-squared test at the 1%, 5%, and 10% levels of significance, respectively.

<b>C</b> (		CDD		variable								
Country	Year	GDP	Distance	Contiguity	Common language	Colony						
Andorra	2014	***	***	+	***							
Argentina	2014	***	**	^	**							
	2015	***	***		**	*						
Austria	2013	***	***	***	***	***						
	2014	**	***	***	*	***						
A1	2015	***			<b>~</b>							
Azerbaijan	2015	***	**		***	***						
Brazii	2007		***	***								
	2008	**	**	***	***							
	2009	***	***	***	***	***						
	2010	***	*	*	*							
	2011	**		-	-							
	2012	***										
	2013											
	2014											
Canada	2015											
Canada	2014											
Chile	2013	***	***	***	***	*						
Chile	2014	***	***	***	***	***						
China	2015	***				***						
China	2014	+										
C	2015	***										
Cyprus	2014	***										
F ( '	2015					***						
Estonia	2015											
Finland	2005	***										
Georgia	2014	***	***	***	***	***						
Germany	2012	***	***		+++	++						
TT	2015	++	+++	***		++						
Hungary	2012	***	**	***								
	2013	***		***								
Tustand	2014			***	***							
Ireland	2012		***	***	***							
	2013		***	***	***							
	2014	***	***	***	***	***						
Tataia	2015											
Latvia	2014	***										
Malta	2015	***	***		***	***						
Mariaa	2015											
Mexico	2015	***	***	***	***	***						
Morocco Natharlanda	2015	***				***						
Demonitori	2013											
Paraguay	2012											
	2013											
	2014											
Dom	2013	*										
i ciu	2012		***		**							
	2013	*	**	**		**						
	2014	***			**	***						
Doutracel	2015	*	***	***	***							
Portugal	2015											
Kep. of Korea	2015	**			***	**						
Singapore	2012	***			***							
	2013	*	<b>.</b>		***							
0 1	2014	<u> </u>	^		44 44	**						
Sweden	2015				**	**						

#### Table 9: Results from the chi-squared test for imports

Note: \*\*\*, \*\*, and \* denote that the equality of coefficients is rejected by the Chi-squared test at the 1%, 5%, and 10% levels of significance, respectively.

#### 5. Concluding remarks

The importance of RTD has been growing and it plays a significant role in EBPM. In addition, the quality of official statistics including the transparency and credibility of data collection affects the trust of voters. This study finds that the data update problem exists, even for OECD countries. Furthermore, the problem can cause biases in quantitative analyses.

As a policy implication, it should be noted that the replication of previous studies results can only be achieved with exactly the same data. Moreover, to provide trusted official data to electoral constituencies and policy makers, the government needs to discuss the RTD system carefully. Thus, it might be required that UN Comtrade and other statistic centres keep the pre-update data on their websites for comparison with updated data. Furthermore, it is necessary to consider the international harmonisation of data collection and revision methods to facilitate precise policy evaluation. Further studies can target other economic variables such as FDI, income, employment, etc. In addition, the ranking of each country's statistical accuracy may be important for future research.

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- 1 The UN does not substantially modify reported data from member countries. This fact implies that the bias in raw data can be reflected in official statistics in UN Comtrade database (Kumakura 2011).
- 2 The BEC is a classification that divides product IDs into each production stage, e.g. capital products, consumer products, intermediate products, etc.
- 3 A large number of economists may believe that the HS is more appropriate for econometric analyses because the HS has more disaggregate product IDs than the SITC as well as each ID having an economic meaning, e.g. tariff.

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