

# Tariff Evasion and the Entrance into the European Union: Evidence from the East European Enlargement

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## **I. Introduction**

Corruption and particularly corruption at the customs is a well-known phenomenon in developing and transition countries. In many of them import tariffs present an important source of government revenue so a pronounced tariff evasion might lead to a significant loss of resources. Apart from the fiscal impact, a system allowing importers to evade tariffs would usually have also other negative effects on the home economy and governance of the country. The consequences can be of diverse nature. First, firms that are better connected with the customs officials would have unfair advantages compared to their competitors. Such a system violates the GATT/WTO principles since it imposes an implicit tax on the “honest” producers and importers. In this way, countries applying for a WTO membership with pronounced tariff evasion would face problems slowing down the accession process. Second, such a business environment might discourage foreign direct investors since they would have to deal with corrupt officials and might have to pay bribes in order to stay competitive in the market. Third, a key outcome is related to the government’s fear of revenue losses due to tariff liberalization. In the case of high tariff evasion the revenue losses due to tariff reduction might be offset or at least partially softened by decreasing evasion of import duties.

This study addresses empirically the issue of tariff evasion in the context of the ten Eastern European countries that became European Union (EU) members in the last decade (subsequently referred to as EU-10).<sup>1</sup> The approach follows Fisman and Wei (2004) and Javorcik and Narciso (2008) and estimates the responsiveness of the trade gap to changes in the tariff rates in the framework of the Eastern European EU enlargement for the time period 1995-2009. Compared to the existing literature the present study uses the complete process of trade liberalization between the EU-10 and the EU-15 and deals with possible issues of endogeneity by considering the actual entrance into the EU. The main aim of the study is to show how the relationship between trade gap and tariff rate evolves in the case of complete tariff liberalization as in the process of the EU-10 countries entering the EU.

First, the discrepancy between what is reported to be exported from each of the EU-15 countries to the Eastern European countries and what is actually being stated to be imported at the border, also referred to as the trade gap, will be analysed. It will be shown that the trade gap has been positively correlated with the level of the tariff rate in six out of the ten countries

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<sup>1</sup> Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia.

in the sample. Thereby the last reduction of the tariff rate due to the actual accession into the EU plays a key role in identifying the relationship between trade gap and tariff rate. Differentiating between different types of products, as a second step, demonstrates that the positive relationship is even more pronounced when restricting the sample only to manufacturing products. These results indicate that product-specific characteristics might have a significant influence on the ease of evasion of particular goods. Third, examining two additional channels of evasion - through misreporting of quantity and misclassification of high-tariff products as similar lower-tariff ones offers additional evidence for tariff evasion taking place. The channel of misclassification of goods proves to be significant only in the case of manufacturing products while there is little evidence for misreporting of quantity.

The case of the EU-10 is particularly interesting since in the last decades most of these states have been confronted with relatively high overall corruption rates with corruption at the customs being one of its major channels. The only study of the existing literature which deals partially with the EU-10 countries is the one by Javorcik and Narciso (2008). Thus, the first contribution of the present study will be to present the changes of tariff evasion and “missing” trade in all EU-10 countries on their way to EU membership and to point towards the progress of institutional quality in the field of customs corruption in the context of the EU enlargement. The annual reports of the EU Commission have persistently revealed corruption as one of the major issues in these countries undermining the progress on the way to full EU membership. In its regular monitoring report on the state of preparedness for EU membership from 2000 the EU Commission states that corruption was a serious concern in Bulgaria, the Czech Republic, Poland, Romania and Slovakia and a continuing problem in Hungary, Latvia and Lithuania (EU Commission 2000). The only two countries where it seemed that corruption was not a major issue were Slovenia and Estonia. Corruption remained one of the fields with “high priority for improvement” until the EU accession for all countries in the first enlargement wave except for Estonia and Slovenia (EU Commission 2003). For Bulgaria and Romania there was even a special mechanism introduced by the EU Commission monitoring the corruption in these countries.

Corruption at the customs is a special case. In the first round of the Business Environment and Enterprise Performance Study (BEEPS) in 1999, conducted jointly by the EBRD and The World Bank, the percentage of surveyed firms in the EU-10 that have made unofficial payments in order to deal with customs ranged from 19% (Hungary and Slovenia) to 45% in

Lithuania and 51% in Romania<sup>2</sup>. An explicit decrease can be seen when comparing those numbers with the ones from the last survey wave in 2008/2009. The percentage of firms that stated to have made any additional payments when dealing with customs and imports was the lowest in Slovenia (4%), Hungary (6%) and Lithuania (8%) and the highest in Bulgaria (26%) and Romania (27%). Despite this improvement, corruption as a whole still presents a major problem for firms doing business in these countries. Corruption was ranked as one of the top three most severe burdens for enterprises in five out of the ten countries in the last survey wave 2008/2009<sup>3</sup>. However, it should be noted that the BEEPS as any other firm-level survey might be presenting only a very narrow picture of the business environment in the surveyed countries, which is not generally applicable to all sectors and enterprises (Knack 2006).

Besides the issue of corruption at the customs these countries experienced high variation in the tariff rates before their EU accession, which offers the basis for the identification strategy of the present study. During the 1990s a trade liberalization process started in the EU-10 countries resulting in a significant variation in the tariffs across products and years. In some of the countries the initial tariffs ranged from up to more than 100% (the maximum tariff rate in Poland in 1996 was roughly 369% for certain alcoholic beverages) down to zero after the EU accession. Looking at the changes of the average tariff, it declined from around 8% in the mid-1990s in Poland, 4% in Lithuania and 11% in Slovenia to 0% after entering the EU.

One concern about the tariff data is the possible endogeneity of the reductions in the tariff rates before EU accession. All ten East European countries have signed in the mid-1990s accession agreements with the EU, the so-called “Europe Agreements”. These agreements included all steps regarding changes in the trade policy of the accession countries which are necessary conditions for a successful entrance into the EU. The issue of major concern is the difference across the EU-10 countries in the product lines, for which there were exceptions from the general tariff reduction rule. Based on these facts it is doubtful whether the variation in the tariffs in the years of preparation for EU membership can be regarded as completely exogenous. Dealing with the possible issue of endogeneity by including the actual entrance into the EU and with it the last reduction of the tariff rates down to zero is one of the major contributions of this study to the existing literature. The specific character of this setting is the

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<sup>2</sup> The figures represent the percentage of all firms that have answered the question “How often do firms like yours nowadays need to make extra, unofficial payments to public officials when dealing with customs/import?” with always, mostly, frequently, sometimes or seldom.

<sup>3</sup> The data come from the question “As I list some factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment.” from the BEEPS 2008/2009 survey.

fact that it was predetermined that no tariffs will remain once joining the EU so there was no scope for potentially endogenous tariff reductions in the last year before accession. The EU enlargement offers the unique possibility to investigate the relationship between tariffs and trade gap in the case of a complete tariff liberalization process lasting for over a decade.

This study builds upon several other studies that have undertaken a similar approach in order to investigate the relationship between tariff rates and trade gap but applying it to different country and policy settings. Bhagwati (1964) compared the discrepancy between export and import statistics in the case of Turkey and concluded that there is a pronounced under-invoicing of imports, in particular for manufacturing products. Pritchett and Sethi (1994) found that there is little systematic correlation between the official ad valorem tariff rate and the actually collected rate (ratio of tariff revenues to import volumes) in Jamaica, Pakistan and the Netherlands. According to Pritchett and Sethi, it is smuggling, under-invoicing of import values and misdeclaration that evoke the differences between the two rates.

Fisman and Wei (2004) were the first to examine the impact of tariff rates on trade gap applying the estimation method used also in this study on the example of trade flows from Hong Kong to China. Their results point towards a strong and significant correlation between the level of the tariff rate and the level of the trade gap, namely a one-percentage-point increase in the tariff is associated with a 3% increase in the trade gap which suggests significant evasion. Fisman and Wei explore in addition the channel of evasion and their conclusion is that besides the underreporting of the import value evasion takes place also through misclassification of high-tariff products as similar lower-tariff ones.

Partially using the same country sample as in this study, Javorcik and Narciso (2008) expand the initial work by Fisman and Wei by using a panel dataset and thus exploiting variation of tariff rates over time. The sample covers trade flows from Germany to ten East European countries, eight of which belong to the EU-10, for the time period 1992-2003. Javorcik and Narciso confirm the findings of Fisman and Wei that there is a positive correlation between the tariff rate and the trade gap, though the magnitude is much lower. Javorcik and Narciso also found support for the hypothesis that the relationship between tariffs and trade gap is more pronounced for differentiated than for homogenous goods.

The present study builds upon the work by Javorcik and Narciso and offers two new dimensions when examining the responsiveness of the trade gap to the tariff rate in Eastern Europe. First, it covers the complete process of the EU enlargement, which is unique in its character. The study provides in this way a more precise and consistent picture by including all Eastern European accession countries and all EU-15 states and taking into account the whole time period of preparation as well as the first years of EU membership. Second, the major difference lies in considering the actual accession into the EU and investigating the change of the trade gap in the case when tariffs are equal to zero, which limits potential issues of the estimation results due to endogenous tariff reductions before the EU accession. In this way this study will discuss the case of complete tariff liberalization, where the last drop down to zero presents the substantial part of the identification strategy. All estimations will be done separately for each EU-10 country and for the pooled sample of Eastern European states illustrating that the magnitude of the relationship varies across the countries.

An earlier study by Mishra, Subramanian and Topalova (2008) uses similar empirical strategy and applies it to the case of the Indian trade liberalization reform in 1991. Besides the confirmation of the positive and significant correlation between trade gap and tariffs the study provides insight into the impact of enforcement on the magnitude of evasion and suggests that an improvement of enforcement reduces the responsiveness of the trade gap to tariffs. Bouët and Roy (2012) apply the same estimation strategy for two years (2001 and 2004) for Kenya, Mauritius and Nigeria and conclude that a systematic underreporting of the imports' value exists but not of the quantity. Based on the magnitude of the correlation the authors infer that tariff evasion is more pronounced in Nigeria vis-à-vis Kenya and in Kenya vis-à-vis Mauritius, which matches the ranking of these countries with regard to their institutional quality. Van Dunem and Arndt (2012) estimate the relationship between trade gap and tariff in the case of Mozambique and South Africa in a cross-section setting similar to the initial work of Fisman and Wei (2004) and found a significant misreporting of imports' value and misclassification of products.

Recent work by Jean and Mitaritonna (2010) apply the same estimation strategy in a cross-country setting with 75 countries with data from 2004 and examine cross-country characteristics, which might affect the evasion gap. As a theoretical background Jean and Mitaritonna (2010) develop a model analysing the incentives and the interaction between the customs officer and the importer. One of the main predictions of the model is that the

incentive of importer to underreport the shipment value is higher when tariffs are higher since the benefit of evasion is increasing stronger than its cost. Similarly the incentive to misreport is higher when enforcement is weaker. Jean and Mitaritonna show also that in the case where sanctions and bonuses for the customs officer depend on tariffs, the customs officer has an incentive to control more strictly high-tariff products. This case might lead to a reversed relationship between tariffs and trade gap for high enough tariffs.

An OECD study on tackling corruption issues in customs service operation (Hors 2001) discusses three case studies from different programs aimed at reducing corruption among customs officials and improving customs procedures in Pakistan, Bolivia and the Philippines. In general, customs environments are more prone to corruption in places where a private and discrete interaction between the importer and the customs officials exists as well as in situations of lack of control and increased possibility for customs officials to build networks with accomplices. The case study of the Philippines shows in particular that a seemingly successful reform on customs corruption may backfire as it just shifts corruption to other channels (Yang 2008). Yang (2008) uses a quasi-experiment where an increased enforcement was applied to shipments only from certain countries to the Philippines and concludes that the reform did reduce duty avoidance of shipments from the targeted countries but simultaneously increased the use of another duty-avoidance method (shipping through duty-exempt export zones). While no particular reform of customs administration is considered in particular in this study, the evidence from the above mentioned studies still might be highly relevant in the context of tariff evasion in Eastern Europe.

The study is structured in six main parts. The next section describes the data and reviews some data quality issues. The third section presents the estimation strategy and discusses the applied measure of evasion. The results of the main specification are explained in Section 4. Section 5 provides some robustness checks. Section 6 discusses the relationship between trade gap and tariff rate differentiated by product type. Section 7 includes the analysis of additional channels of tariff evasion. The last section contains the main conclusions.

## **II. Data**

The World Integrated Trade Solution (WITS) database provides access to the two main data sources for this study. The trade flow data are taken from the UN COMTRADE database,

collected by the United Nations Statistical Division. The UN COMTRADE database offers information on the value and quantity of exports from each of the EU-15 countries to each of the EU-10 states (hereafter referred to as “exports”) and on the value and quantity of imports in each of the EU-10 countries from each of the EU-15 countries (hereafter referred to as “imports”). Practically each pair of exports and imports within the same country pair and product code belong to one trade flow which is reported once when leaving the country of origin and for a second time when arriving at the destination border. In this sense there should not be any significant difference between the two figures except for the costs of insurance and freight; exports are reported as f.o.b. (free on board) and imports as c.i.f. (including costs of insurance and freight). The trade flows are reported according to the six-digit Harmonized Commodity Description and Coding System (HS), which is the highest available disaggregated level. The United Nations collect the data from national agencies and convert it, if necessary, into US dollars in order to be comparable across countries. Bilateral trade data at the six-digit HS level is available for each country in the sample for the whole time period (1995-2009). The data are used in the HS 1988/92 classification (the initial product classification of HS) in order to make product codes equivalent over time.

One issue regarding the reporting of trade flows is the implementation of different thresholds under which no exports or imports are reported. For example, a threshold of 1,000 US dollars exists in Hungary; import flows with value of smaller than 1,000 US dollars are not reported. According to the data similar thresholds of 500 US dollars or 1,000 US dollars were applied also in other importer countries (Romania, Latvia) and in some of the exporter countries. The timing of abolishing of these restrictions varies across the countries so in order to have always imports and exports in the same value range all trade flows (imports and exports) below 1,000 US dollars will not be considered in the analysis. The only remaining threshold is the one implemented in Poland for reporting imports only above 50,000 US dollars until Poland became an EU member. In this case also all exports to Poland below 50,000 US dollars will be dropped.

Data on bilateral tariff rates are taken from the UNCTAD’s Trade Analysis and Information System (TRAINS). The database provides information on bilateral tariff rates at the six-digit HS level. Since during the time period before EU accession all EU-10 countries had preferential trade agreements with the EU, data on applied tariff rates are used. Similar to the trade data, tariffs are converted into the HS 1988/92 classification in order to be equivalent

with the trade flows. The HS coding was updated three times after the 1988/92 classification leading to HS 1996, HS 2002 and HS 2007 with each time increasing number of six-digit product codes. In the cases where there was a split in a product code resulting in two or more product codes in the following HS classification, the average of the tariff rates is taken weighed by the trade volume in order to have only one tariff rate for each initial product code of the HS 1988/92 classification. It should be noted that tariff rates' availability varies across the EU-10 countries; data are not available for the entire time period and in-between there are missing years as well.<sup>4</sup> A possible way to deal with the missing years is the approach suggested by Javorcik and Narciso (2008) by filling in missing tariff rates for up to three years making the assumption that tariffs have remained constant during these years. Estimating all specifications using this method delivers similar results. After the EU accession in 2004 for the first enlargement and in 2007 for the second enlargement all tariff rates drop to zero since the EU represent a customs union and hence no tariffs exist between its member states.

### III. Estimation Strategy

In the following empirical analysis trade gap will be defined according to Fisman and Wei (2004) for each EU-10 country separately as:

$$Trade\ Gap_{cpt} = \ln Exports_{cpt} - \ln Imports_{cpt} \quad (1)$$

where  $c$  stands for the partner country (EU-15 countries),  $p$  for a six-digit HS product code and  $t$  for year. According to this approach the trade gap is equal to the discrepancy between the exports from an EU-15 country to an EU-10 country and the imports reported at the EU-10 country border. Since the export and import values are in logs the trade gap is measured only in the cases where imports and exports are non-missing. Another way of capturing evasion would be to assume complete smuggling, namely to consider also the cases where there are data on exports but imports are missing (Mishra, Subramanian and Topalova, 2008). Thus, one would treat the reported exports as completely smuggled into the destination country, which might lead to an overestimation of the real trade gap.

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<sup>4</sup> Data are available for the following years: Bulgaria 2001, 2003, 2004, 2005 and 2006; Czech Republic 1996, 1999, 2002 and 2003; Estonia 1995, 2000, 2001, 2002 and 2003; Hungary 1996, 1997 and 2002; Latvia 1996, 1997 and 2001; Lithuania 1995, 1997, 2002 and 2003; Poland 1995-2003; Romania 1999, 2001, 2004 and 2005; Slovak Republic 2002; Slovenia 1999, 2001, 2002 and 2003.

In the case of no evasion one would expect a slightly negative trade gap since additional to the trade value imports are reported including the costs of freight and insurance. De Wulf (1981) discusses various reasons other than smuggling, misreporting and misclassification of products that might explain the possible discrepancies between export and import data. The volumes of imports and exports might not match to each other because of incorrect identification of importers and exporters in the trade documents (especially in the case of transit trade) or exports which take place at the end of the year might be reported as imports in the following year. Aside from the difference due to the costs of freight and insurance the export and import values might vary also because of converting currencies into US dollars. In addition, imports are more prone to stricter control by the customs officials than exports (Javorcik and Narciso, 2008).

One issue regarding data quality arises when defining evasion as the simple difference between exports and imports, namely the case when a trade gap exists only because of random measurement error in the trade data. The question comes up whether measuring evasion in this way captures the real trade gap or only mis-measurement since there is no possibility to disentangle the two effects from each other. But even in this case the key point of the empirical analysis is whether a systematic correlation exists between the trade gap and the tariff rate, meaning that higher import duties are associated with higher loss in trade value. In the case of a trade gap existing only because of measurement error, there should not be any such systematic correlation between trade gap and tariff (the measurement error would be random with regard to the tariff rate).

Taking the measure for evasion as already defined the main specification in the empirical part is as follows:

$$\ln Exports_{cpt} - \ln Imports_{cpt} = Trade\ Gap_{cpt} = \beta_0 + \beta_1 Tariff_{cpt} + \alpha_t + \varepsilon_{cpt} \quad (2)$$

where  $c$  stands for each EU-15 partner country,  $p$  for each six-digit product code and  $t$  for each year. The model is estimated for each of the EU-10 countries separately and the identification comes from the variation of the tariff rate across partner country within products (at the six-digit level) over time. The year fixed effects control for changes occurring in a particular year such as introducing a reform in the customs administration or undertaking particular measures against corruption. In addition to the basic specification, the model is also estimated using country and/or product fixed effects in order to take into account any partner

country and product characteristics that are systematically correlated with the tariff rate. Since there seems to be correlation between the country and product characteristics with the import duty the specification including all three types of fixed effects (year, product and partner country) will be the preferred specification in the empirical analysis. In all specifications the standard errors are clustered at the six-digit product level to control for serial correlation of evasion of a specific product.

Using the above specification in order to identify the relationship between trade gap and tariff rates assumes that the government sets tariff rates exogenously. In general, tariff rates might be correlated with an unobserved part of the evasion which would lead to biased estimates. As already mentioned, each of the EU-10 countries negotiated a different schedule regarding timing of the liberalization of certain products with the EU-15. The fact that the data on tariff rates exploits the variation of tariffs within six-digit HS product groups over time and across trade partners implies that in order for the results of the applied estimation strategy to be biased because of endogeneity issues the governments of the EU-10 countries must have reduced their tariffs according to the trade gap of each product, which is rather unlikely (Fisman and Wei 2004; Mishra, Subramanian and Topalova, 2008).

Even assuming the case of governments setting tariff rates in response to the product trade gap and even deviating from the negotiated tariff liberalization process the inclusion of the actual EU accession and the last reduction of tariff rates down to zero offers a rather exogenous variation in the tariff rates since it is non-negotiable once becoming an EU member country. This fact provides confidence in the validity of the results and presents a crucial improvement in the identification strategy compared to similar studies. In order to illustrate the difference between using data with and without the actual EU accession, equation (2) will be estimated first only using the years before 2004 and 2007 respectively for the first and second enlargement wave and as a second step the time period will be extended until 2009 including the entrance into the EU. In this way one can observe the response of the trade gap to the complete abolishment of tariff rates due to EU membership.

#### **IV. Results**

The average tariff rate before EU accession ranges from roughly 1% to about 8.1% as Table 1 shows. The median values of the examined countries illustrate that many tariffs were already

equal to zero before the entrance into the EU, at the same time the high standard deviations point towards high variation in the tariff rates across products and years. The second and third panel of Table 1 describe the average trade gap before and after EU accession (until 2009). In order the summary statistics to be comparable the sample in Table 1 is limited to a balanced sample of product-partner country pairs for which data are available for all years. Before EU membership almost all countries (nine out of ten), had on average a positive trade gap indicating that the reported imports were lower than the exports reported by the partner countries. Aside from Estonia, the trade gaps reach up to 15% for the countries with a positive trade gap. Only for the Slovak Republic the trade gap behaves as expected in the absence of misreporting (being negative).

The most puzzling case presents the country of Estonia. The mean of the trade gap before the EU accession exceeds by far the figures from the other countries. Although the median value is much lower, it is still considerably higher than in the other countries (around 60%). What is even more striking is the fact that Estonia is the country with the lowest tariffs on average before its EU accession. One possible explanation could be measurement error in the trade data. Since most of the tariffs are equal to zero the customs officials are perhaps less strict when filling out import declarations. Anyways, the case of Estonia remains highly puzzling, at least when looking at the summary statistics.

The expectations about the development of the trade gap after the EU accession would predict a declining trend. Assuming that the trade gap is positively correlated with the tariff rate, with tariffs dropping down to zero the evasion should also decrease. In six out of the ten reporting countries this is also the case. As it can be seen, there is a clear decreasing trend as well in the mean as in the median values of the trade gap which goes in line with the assumption of a positive correlation between tariffs and trade gap. With tariff rates going down to zero the trade gap declines too (only in the case of the Slovak Republic there is a small increase and in Slovenia, Czech Republic and Poland it stays roughly the same). In the case of Estonia, which has by far the highest trade gap, the decrease is substantial, from 70% before EU membership to around 29% in the period after 2004. The Slovak Republic is an exception since there is a pronounced increase in the trade gap after becoming EU member. It should be noticed that for the Slovak Republic tariff data are available only for 2002 so all the figures of the period before accession in 2004 rely only on one year. Restricting the sample in addition to trade

flows with a value higher than 50,000 US dollars because of the threshold in the data for Poland does not have any influence on the average trade gap before and after EU accession.

Table 1: Summary Statistics

<i>Tariff Rate before EU Accession</i>					
Country	Mean	Median	Standard Deviation	Observations	Year of EU Accession
Bulgaria	7.210	4.600	8.816	36615	2007
Czech Republic	4.564	4.000	5.343	45064	2004
Estonia	0.829	0.000	4.472	18685	2004
Hungary	8.148	7.000	10.133	29181	2004
Latvia	3.947	0.500	6.433	10848	2004
Lithuania	1.917	0.000	5.593	14300	2004
Poland	4.181	0.000	15.680	48015	2004
Romania	3.908	0.000	7.685	28400	2007
Slovak Republic	5.214	4.600	5.313	7610	2004
Slovenia	6.011	2.000	7.259	34368	2004
<i>Trade Gap before EU Accession</i>					
Country	Mean	Median	Standard Deviation	Observations	Year of EU Accession
Bulgaria	0.018	-0.021	1.224	36615	2007
Czech Republic	0.022	0.006	1.179	45064	2004
Estonia	0.708	0.605	1.368	18685	2004
Hungary	0.075	0.035	1.323	29181	2004
Latvia	0.152	0.100	1.200	10848	2004
Lithuania	0.122	0.046	1.235	14300	2004
Poland	0.019	-0.001	0.796	48015	2004
Romania	0.025	-.0031	1.412	28400	2007
Slovak Republic	-.0191	-.0123	1.365	7610	2004
Slovenia	0.117	0.025	1.279	34368	2004
<i>Trade Gap after EU Accession</i>					
Country	Mean	Median	Standard Deviation	Observations	Year of EU Accession
Bulgaria	-0.024	-0.020	1.258	21969	2007
Czech Republic	0.059	0.019	1.242	67596	2004
Estonia	0.284	0.212	1.249	22422	2004
Hungary	0.029	0.038	1.193	58362	2004
Latvia	-0.069	-0.034	1.034	21696	2004
Lithuania	-0.183	-0.110	1.024	21450	2004
Poland	.0067	0.040	0.854	32010	2004
Romania	-.0306	-0.149	1.120	21300	2007
Slovak Republic	0.174	0.088	1.506	45660	2004
Slovenia	0.153	0.064	1.203	51552	2004

\* Trade gap measured according to the definition:  $\text{Trade Gap}_{\text{cpt}} = \ln \text{Exports}_{\text{cpt}} - \ln \text{Imports}_{\text{cpt}}$

\*\* Trade flows below 1,000 US dollars are dropped, for Poland below 50,000 US dollars.

Figure 1 shows the development of the average trade gap in the EU-10 countries over the whole time period. The x-axis is rescaled in a way such that the accession year is equal to

zero, the years after accession are positive and those before negative. In this way it is possible to compare the change in the trade gap during the years of preparation, around the accession year and as EU member since the countries in the sample have different accession years (2004 and 2007). The figure illustrates the outlier case of Estonia where the mean trade gap is substantially higher than the rest of the countries throughout the time period of preparation. Looking at the year before accession and first year of EU membership demonstrates that the average trade gap has decreased in each of the EU-10 states with the exception of the Slovak Republic, where it increases slightly. Interestingly, there is a slight upward trend after the first year of being EU member country, which is observable in almost all countries and contradicts the expectations that the trade gap will continue to decline after accession. Nevertheless, as revealed by the summary statistics on average the trade gap is smaller after entering the EU than before for the majority of countries. It should be noted that even with tariff rates equal to zero importers still have an incentive to misreport trade flows in order to evade taxes in the country such as the value added tax.

Figure 1: Development of Trade Gap

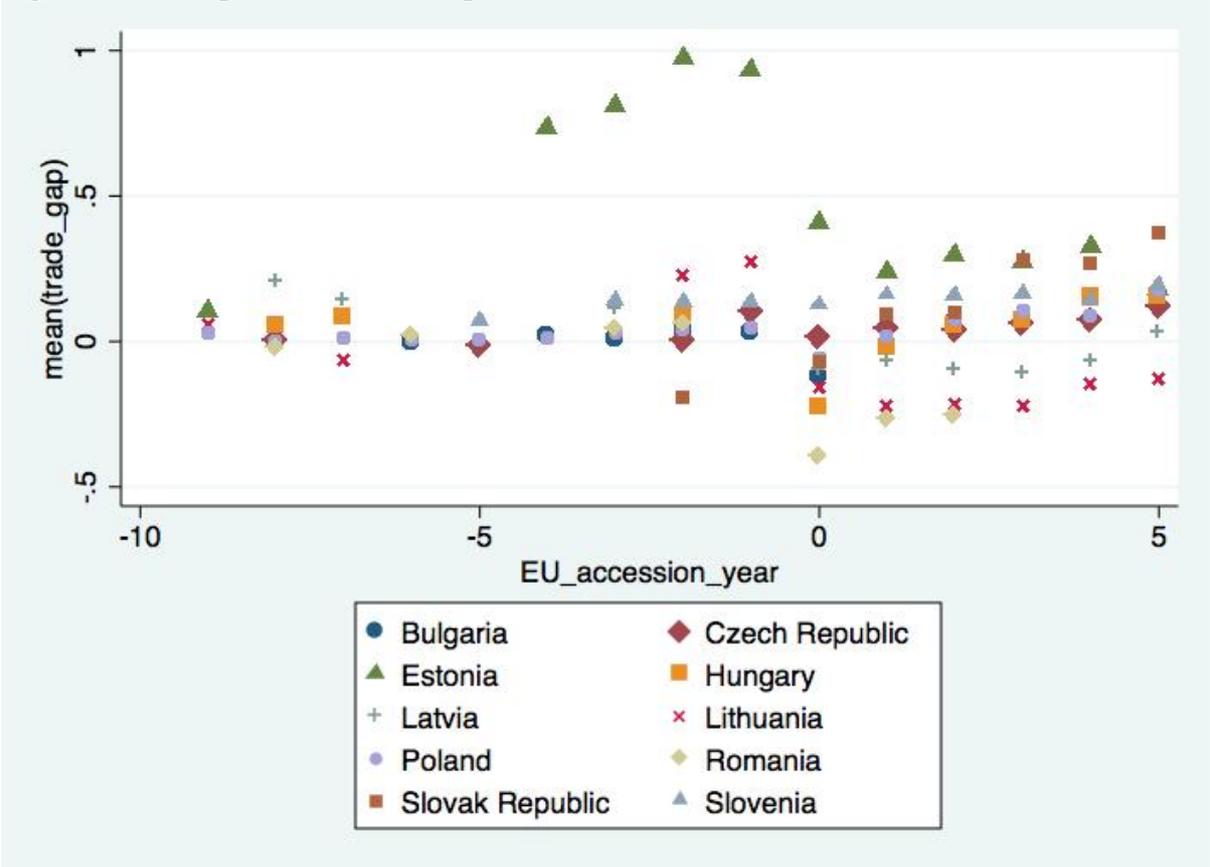


Figure A1. in the Annex pictures the distribution of the mean trade gap over all products with the same tariff rate for each EU-10 country and year. Poland seems to have the highest tariffs in the sample, overall most tariff rates range from 0% to 100%. The simple fitted lines point towards a possible positive correlation between the trade gap and the tariff rate in the majority of the years though there some exceptions exist also (Estonia and Slovenia).

The results of equation (2) are presented in Table 2. The relationship between tariff rate and trade gap is estimated for each EU-10 country separately as well for the pooled sample, both for the years only before EU accession and as a second step including the years of EU membership until 2009.

Table 2: Tariff Rate and Trade Gap before EU Accession

<i>Tariff Rate and Trade Gap (year fixed effects)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002** (0.001)	0.006*** (0.001)	-0.013*** (0.001)	0.007*** (0.001)	0.013*** (0.002)	0.011*** (0.002)	0.000* (0.000)	0.003* (0.001)	0.002 (0.002)	-0.001 (0.002)	0.002*** (0.000)
R <sup>2</sup>	76395	85614	51829	56205	25993	43587	108533	58967	13929	61832	582884
Obs.	0.000	0.001	0.021	0.002	0.005	0.006	0.000	0.000	0.000	0.000	0.013
<i>Tariff Rate and Trade Gap (year and partner country fixed effects)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002** (0.001)	0.007*** (0.001)	-0.014*** (0.002)	0.007*** (0.001)	0.013*** (0.002)	0.011*** (0.002)	0.000* (0.000)	0.002* (0.001)	0.001 (0.002)	-0.000 (0.002)	0.002*** (0.000)
R <sup>2</sup>	76395	85614	51829	56205	25993	43587	108533	58967	13929	61832	582884
Obs.	0.015	0.010	0.090	0.010	0.007	0.011	0.024	0.017	0.033	0.018	0.023
<i>Tariff Rate and Trade Gap (year, partner country and product fixed effects)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003** (0.001)	0.007** (0.003)	-0.015*** (0.004)	0.006*** (0.002)	0.002 (0.003)	0.010*** (0.003)	0.000 (0.000)	0.003 (0.002)	- (-)	-0.005*** (0.002)	0.001*** (0.000)
R <sup>2</sup>	76395	85614	51829	56205	25993	43587	108533	58967	-	61832	582884
Obs.	0.000	0.002	0.070	0.000	0.001	0.013	0.001	0.000	-	0.001	0.004

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>.

The first panel shows the results when including only year fixed effects. Panel two includes partner country (EU-15) fixed effects and in the lowest panel the estimation includes year, partner country and product fixed effects. Adding product fixed effects seems to influence in

some countries the significance of the tariff coefficient as well as its magnitude; in most cases the coefficient decreases slightly when including product fixed effects. This result suggests that there are product characteristics, which are systematically correlated with the tariff rate. Thus, only the results from the last panel (including year, partner country and product fixed effects) will be discussed in more detail.

In four of the ten reporting countries there is a positive and significant relationship between the level of the tariff and the trade gap. The coefficient ranges from 0.3%, a one-percentage-point increase in the tariff is associated with a 0.3% increase in the trade gap, for Bulgaria to 1.0% for Lithuania. The coefficients on tariff for Poland, Latvia and Romania are positive but insignificant in the regressions with product fixed effects. There is no specification estimated with product fixed effects for the Slovak Republic since data on tariffs are available only for 2002, meaning that the sample is just a cross-section before the EU accession. In the cases of Estonia and Slovenia a significant but negative correlation exists between tariffs and trade gap. When discussing the summary statistics Estonia was already somehow an outlier since it is the country with by far the highest trade gap of the sample. It appears that there the trade gap increases with lower tariffs. Perhaps, a possible explanation might be lower effort of customs officials to fill out carefully the customs declarations when there are no duties to be paid. The coefficient of Slovenia is negative in all specifications but becomes significant not until adding product fixed effects. Comparing the results with those of Javorcik and Narciso (2008) offers a similar picture, although one should bear in mind that the country and time sample is not exactly the same. The coefficient for Slovenia is also in their results negative and significant when product fixed effects are included (Estonia is not included in their sample).

It is interesting that the European Commission ranks Slovenia and Estonia as the countries with the least issues concerning corruption in its 2000 and 2003 reports and also in the BEEPS survey they are among the countries with the lowest percentage of firms that have paid bribes in order to deal with customs procedures. It is possible that the negative and significant correlation between tariff rate and trade gap can be explained by the model of Jean and Mitaritonna (2010) where the importer assumes that the customs officer would rather inspect high-tariff products and therefore evasion is higher in the case of lower-tariff products. Since in these two countries corruption is observed to be less of an issue this fact suggests to a certain extent the existence of a working punishment system for state officers,

which limits corruption and in this way can lead to a reverse relationship between tariff level and trade gap.

Coming to the question how the trade gap develops after the EU accession Table 3 offers the core results. Equation (2) is now estimated using also the years of being EU member country until 2009 (tariff rates vary only until the first year of EU membership and are afterwards equal to zero). Again the discussion refers to the last panel with year, partner country and product fixed effects included. The sign of all coefficients remains the same as in the previous regressions. But in the cases of Latvia and Poland the trade gap turns out now to be significantly correlated with the tariff rate. Also in half of the countries (Bulgaria, Hungary, Latvia, Lithuania and Poland) the magnitude of the coefficient increases slightly.

Table 3: Tariff Rate and Trade Gap, including EU membership

<i>Tariff Rate and Trade Gap (year fixed effects)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002** (0.001)	0.006*** (0.001)	-0.013*** (0.001)	0.007*** (0.001)	0.013*** (0.002)	0.011*** (0.002)	0.000* (0.000)	0.003* (0.001)	0.002 (0.002)	-0.001 (0.002)	0.002*** (0.000)
R <sup>2</sup>	127850	228277	133791	185232	107089	140601	204966	117910	101881	165711	1513308
Obs.	0.001	0.001	0.017	0.006	0.004	0.007	0.006	0.009	0.008	0.000	0.008
<i>Tariff Rate and Trade Gap (year and partner country fixed effects)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002* (0.001)	0.007*** (0.001)	-0.014*** (0.002)	0.007*** (0.001)	0.013*** (0.002)	0.011*** (0.002)	0.000* (0.000)	0.003* (0.001)	0.001 (0.002)	-0.001 (0.002)	0.002*** (0.000)
R <sup>2</sup>	127850	228277	133791	185232	107089	140601	204966	117910	101881	165711	1513308
Obs.	0.016	0.015	0.048	0.009	0.009	0.011	0.022	0.015	0.030	0.021	0.015
<i>Tariff Rate and Trade Gap (year, partner country and product fixed effects)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.005*** (0.001)	0.006*** (0.002)	-0.003 (0.002)	0.007*** (0.001)	0.013*** (0.002)	0.012*** (0.002)	0.001*** (0.000)	0.002 (0.001)	0.002 (0.003)	-0.007*** (0.002)	0.002*** (0.000)
R <sup>2</sup>	127850	228277	133791	185232	107089	140601	204966	117910	101881	165711	1513308
Obs.	0.002	0.002	0.029	0.010	0.008	0.012	0.008	0.018	0.022	0.001	0.002

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>.

The changes in the coefficients indicate that the trade gap seems to respond to the fact that the reporting countries enter into the EU and with it the tariff rates drop to zero. In the context of

the EU accession, a positive and significant coefficient of tariffs means that with decreasing tariff rates the trade gap will also decline. In Latvia and Lithuania (the cases with the highest coefficient) a one-percentage-point drop in the tariff rate is related with over a 1% decrease in the trade gap, which is a substantial reaction.

In the case of Estonia the coefficient is still negative but loses its significance when adding product fixed effects. For Romania there seems to be a positive correlation between the tariff rate and the trade gap but it is no longer significant once product fixed effects are included. For the Slovak Republic the relationship is never significant, neither before EU accession nor after including the first years of EU membership. The reason for this result might be the fact that there is little variation in the tariffs since only one year, 2002, before the EU accession is included in the sample. Also, when adding the first years of EU membership the estimate for Slovenia remains negative and becomes significant in the regression including product fixed effects. The relationship varies in its magnitude and significance across the states so considering only the pooled regression results would neglect the country heterogeneity in the relationship. Overall, the empirical findings suggest that the trade gap is positively correlated with the level of the tariff rate. Interpreting the trade gap as an evasion gap the results indicate that misrepresentation of the value is higher for higher tariff rates, meaning that more value is “missing” with higher import duties. In the case of the EU accession, the results predict a decrease in the “missing” value after the complete liberalization of tariffs with EU membership.

## **V. Robustness Checks**

In this section series of robustness checks will be presented in order to validate the previous findings. Trade flows in Poland are reported only if they have a value higher than 50,000 US dollars and therefore the above results for Poland show the relationship between trade gap and tariff rate for trade flows with a higher value. In order to control for a possible relationship between the size of the trade flows and the tariff rate Equation (2) is estimated with the threshold of 50,000 US dollars applied to all countries. The results are presented in Table 4. The estimated coefficients do not change significantly in most cases except for Slovenia where the relationship between trade gap and tariff is not significant anymore (though it is still negative). This result points towards a higher evasion of tariffs for trade flows with value smaller than 50,000 US dollars in Slovenia. In some of the countries the magnitude of the

coefficient is slightly smaller (Bulgaria, Hungary, Latvia and Lithuania) which indicates also that higher tariffs are associated with higher evasion gap for trade flows of smaller value.

Interesting to investigate is also the development of the relationship between tariffs and trade gap through including interaction effects between the tariff and year variable. Table A1 in the Annex presents the results. As expected with progressing towards the accession year the relationship between tariffs and trade gap decreases compared to its initial level. Since the countries were supposed to comply with various EU regulations and to improve the regulatory framework this development might be interpreted as showing progress in increasing the quality of institutions and border controls.

Table 4: Tariff Rate and Trade Gap (trade flows with value higher than 50,000 US dollars)

<i>Tariff Rate and Trade Gap before EU Accession</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.001)	0.005** (0.002)	-0.008* (0.005)	0.001 (0.002)	0.002 (0.004)	0.007** (0.003)	0.000 (0.000)	0.002 (0.002)	- (0.002)	-0.003* (0.001)	0.001** (0.000)
Obs.	30161	43092	14004	26169	6867	13905	108533	23864	-	25703	298013
R <sup>2</sup>	0.000	0.004	0.105	0.003	0.002	0.016	0.001	0.000	-	0.001	0.002
<i>Tariff Rate and Trade Gap, including EU membership</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003*** (0.001)	0.006*** (0.001)	-0.001 (0.002)	0.003*** (0.001)	0.011*** (0.002)	0.010*** (0.002)	0.001*** (0.000)	-0.000 (0.001)	0.003 (0.002)	-0.003 (0.002)	0.002*** (0.000)
Obs.	52966	123395	44011	97004	35122	51664	204966	53998	46967	74015	784108
R <sup>2</sup>	0.002	0.002	0.050	0.013	0.011	0.015	0.008	0.012	0.020	0.001	0.002

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Another issue that might possibly influence the estimation results is the fact that the panel used in the above regressions is unbalanced, meaning that from year to year the combinations of product code and partner country change. Although in the previous regressions product and partner fixed effects are included, the different composition of trade between each of the EU-10 states and each of the EU-15 countries still might play a role. In order to account for this issue equation (2) is re-estimated using a balanced panel. As Table 5 shows, the core results remain the same except that the tariff coefficient for Romania which becomes significant. This leads to a positive relationship between tariff rate and trade gap in seven out of the ten

countries in the sample with a one-percentage-point increase in the tariff rate being associated with a 0.2% to 1.5% increase in the trade gap. The evidence illustrates that the level of the import duty is significantly relevant for the level of tariff evasion in the majority of countries in the sample. The outlier case of Slovenia showing a significantly negative correlation between trade gap and tariff rates remains using a balanced panel.

Table 5: Tariff Rate and Trade Gap, Balanced Panel

<i>Tariff Rate and Trade Gap before EU Accession</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.001)	0.006* (0.004)	-0.011* (0.006)	0.005** (0.002)	-0.002 (0.003)	0.009** (0.004)	0.000 (0.000)	0.002 (0.003)	- (0.003)	-0.007*** (0.002)	0.001*** (0.000)
Obs.	36615	45064	18685	29181	10848	14300	48015	28400	-	34368	273086
R <sup>2</sup>	0.000	0.003	0.105	0.000	0.002	0.021	0.001	0.001	-	0.002	0.005
<i>Tariff Rate and Trade Gap, including EU membership</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003*** (0.001)	0.007*** (0.002)	-0.005 (0.003)	0.007*** (0.001)	0.015*** (0.003)	0.014*** (0.003)	0.001*** (0.000)	0.002* (0.001)	0.003 (0.003)	-0.007*** (0.002)	0.002*** (0.000)
Obs.	58584	112660	41107	87543	32544	35750	80025	49700	53270	85920	637103
R <sup>2</sup>	0.003	0.002	0.084	0.012	0.018	0.034	0.007	0.025	0.031	0.002	0.002

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

One way to partially account for measurement error in the trade data is through aggregating the bilateral trade data with each EU-15 state to the level of the EU-15 as one entity. In this way the variation in the model comes from two dimensions, product and year (without partner country). Aggregating the data to the trade at the EU-15 level may reduce the mismatch between exports and imports in the case of incorrect identification of the origin country. It should be also noticed that in this case the variation in the tariff rates is lower since some products have a tariff rate that differs across partner countries for a given year and product. The reason for this variation might be the use of mixed tariffs (combination of tariff and quota restrictions) or not successful proof of rules of origin. The accession agreements allow also for some variation and additional restrictions, especially in the case of agricultural products. In case where there is a variation across the partner countries in the tariff rate for the same product and year the weighted tariff rate by the trade value is taken into account. The results

of treating the EU-15 countries as one entity are presented in Table 6, both for the unbalanced and balanced panel, before and after EU accession.

Table 6: Tariff Rate and Trade Gap, EU-15 states as one country

<i>Tariff Rate and Trade Gap before EU Accession (unbalanced panel)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002 (0.002)	0.007*** (0.003)	-0.001 (0.004)	0.006** (0.003)	0.002 (0.004)	0.009** (0.004)	-0.000 (0.000)	0.003 (0.003)	- (0.004)	-0.003* (0.002)	0.001** (0.000)
Obs.	14942	16508	13406	11189	7799	10866	28356	11211	-	15218	132914
R <sup>2</sup>	0.001	0.006	0.032	0.002	0.002	0.018	-0.000	0.000	-	0.001	0.003
<i>Tariff Rate and Trade Gap, including EU membership (unbalanced panel)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.005*** (0.001)	0.006*** (0.002)	-0.004** (0.002)	0.003** (0.001)	0.014*** (0.002)	0.008*** (0.002)	0.000 (0.000)	-0.000 (0.002)	0.001 (0.004)	-0.004 (0.002)	0.001*** (0.000)
Obs.	25163	40659	31307	31988	25809	30203	48678	21898	23108	37703	316516
R <sup>2</sup>	0.004	0.003	0.034	0.014	0.017	0.019	0.008	0.023	0.015	0.001	0.004
<i>Tariff Rate and Trade Gap before EU Accession (balanced panel)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.002)	0.006* (0.003)	-0.000 (0.004)	0.006** (0.003)	-0.004 (0.005)	0.007 (0.005)	-0.001 (0.000)	0.003 (0.003)	- (0.004)	-0.002 (0.002)	0.001 (0.000)
Obs.	9965	12328	6450	7233	4356	9965	17037	6636	-	11468	83237
R <sup>2</sup>	0.001	0.006	0.061	0.001	0.001	0.001	0.001	0.000	-	0.000	0.003
<i>Tariff Rate and Trade Gap, including EU membership (balanced panel)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004*** (0.001)	0.008*** (0.002)	-0.007*** (0.002)	0.005*** (0.001)	0.012*** (0.003)	0.008*** (0.003)	0.000 (0.000)	0.000 (0.001)	0.002 (0.004)	-0.005*** (0.002)	0.001*** (0.000)
Obs.	15944	30820	14190	21699	13068	13290	28395	11613	17136	28670	194825
R <sup>2</sup>	0.004	0.004	0.089	0.021	0.029	0.029	0.011	0.017	0.023	0.001	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Comparing the estimates from the regressions at the bilateral level and those where all EU-15 countries are regarded as one entity demonstrates some slight differences in the results. Overall, the relationship between tariff and trade gap seems to be less significant and smaller in magnitude which was expected due to the smaller variation in the tariff rates. First, in the

regressions for the time period before EU accession the coefficient of tariff loses its significance for Bulgaria and Estonia when using all observations and restricting the sample to the balanced panel shows a not significant relationship for Lithuania. Including the EU accession and the years of EU membership leads to similar results as in the previous regression where the EU-15 was considered as 15 separate countries. Only in the case of Poland the tariff rate is not anymore significantly correlated with the trade gap but for Bulgaria, the Czech Republic, Hungary, Latvia and Lithuania the positive relationship remains. The results for Estonia and Slovenia still report a negative correlation though not always significant. Pooling the sample shows an overall positive relationship between tariff rate and trade gap.

## **VI. Trade Gap, Tariff Rate and the Type of Product**

Additional differentiation in the data can be made dividing the sample into different types of products. Broadly one can differentiate three types of goods according to the HS classification: agricultural (HS chapters 1-24), mineral (HS chapters 25-38) and manufacturing (39-97). The idea behind it is to investigate whether product characteristics affect the ease of evasion and with it the relationship between tariff rate and trade gap. In previous studies it has been shown that differentiated products are more prone to tariff evasion since it is more difficult for the customs officers to detect mis-representation of the value or misclassification of the products (Javorcik and Narciso, 2008; Mishra, Subramanian and Topalova 2008). In case this assumption holds it is expected that the relationship between tariff rate and trade gap is higher in magnitude for manufacturing products than for agricultural and mineral products which are rather homogenous goods in their nature.

The results of the estimation only for manufacturing products are presented in Table 7. Tables A2, A3, A4 and A5 in the Annex show the results for agricultural and mineral goods, however, there is almost in none of the cases significant outcomes. Only for Bulgaria, the Czech Republic, Latvia and Lithuania there is some evidence for a positive correlation between trade gap and tariff rate for agricultural products but its significance is not robust and depends on the specification. The results when restricting the sample only to manufacturing products illustrate an interesting case. The first two panels of Table 7 reveal the results before and after EU accession when the EU-15 are treated as 15 separate partner countries and the lower two panels when the EU-15 are treated as one entity. All regressions are based on the

unbalanced panel since using the balanced panel delivers similar results and in this way all available observations can be used. The results of the balanced panel are presented in Table A6 in the Annex.

Table 7: Tariff Rate and Trade Gap (manufacturing products)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.002)	0.017*** (0.004)	0.057* (0.031)	0.004 (0.003)	0.003 (0.004)	0.005 (0.003)	0.005*** (0.001)	0.005 (0.004)	- (0.005)	-0.007*** (0.002)	0.003*** (0.001)
Obs.	62050	67712	42365	45216	21138	35516	87694	47766	-	48210	468981
R <sup>2</sup>	0.000	0.003	0.073	0.000	0.001	0.015	0.002	0.000	-	0.001	0.005
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002 (0.002)	0.004 (0.003)	0.032 (0.024)	0.013*** (0.003)	0.015*** (0.003)	0.014*** (0.003)	0.005*** (0.001)	0.013*** (0.004)	-0.011** (0.005)	-0.021*** (0.003)	0.001* (0.001)
Obs.	102722	177127	109231	144296	86830	114151	162193	93863	81127	127318	1198858
R <sup>2</sup>	0.002	0.002	0.029	0.011	0.008	0.014	0.010	0.019	0.027	0.002	0.002
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.003 (0.003)	0.017*** (0.005)	0.005 (0.074)	0.009** (0.004)	0.001 (0.005)	0.002 (0.004)	0.006*** (0.001)	0.013** (0.005)	- (0.007)	-0.004 (0.003)	0.003*** (0.001)
Obs.	10480	11692	10108	8104	5904	8100	21102	7884	-	10790	96716
R <sup>2</sup>	0.002	0.009	0.033	0.002	0.001	0.018	0.001	0.002	-	0.001	0.004
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002 (0.003)	0.014*** (0.004)	0.013 (0.054)	0.020*** (0.004)	0.017*** (0.003)	0.008** (0.003)	0.004*** (0.002)	0.019*** (0.005)	-0.006 (0.007)	-0.012*** (0.004)	0.002*** (0.001)
Obs.	17662	28269	23353	22158	18795	22033	35352	15187	16701	26188	225698
R <sup>2</sup>	0.005	0.005	0.037	0.017	0.020	0.021	0.012	0.031	0.020	0.003	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

First, it is obvious that manufacturing goods present by far the majority of traded products between the EU-10 and the EU-15. Second, there is again an observable difference in the significance level of the coefficients between the regression before EU accession and including EU membership. The entrance into the EU seems to play a relevant role in the

relationship between trade gap and tariff rate. Third, the significant coefficients are on average of a higher magnitude than the previous results including all products (in Table 3). The estimates of the regression with EU-15 as one entity including all years point towards a relationship between the trade gap and the tariff rate of up to 2% (in the cases of Hungary and Romania).

There are significant differences concerning several countries. The estimates for Romania were until now always positive but never significant. Restricting the sample only to manufacturing products increases the magnitude of the coefficient by far and is almost always highly significant. In the case of Estonia the sign of the coefficient changes, being always positive for manufacturing products. Since there is almost no systematic correlation between trade gap and tariff rate in the results for agricultural and mineral goods it seems that the manufacturing products are the main reason for the positive correlation when all product groups are included. These results are in line with the findings of previous studies where the trade gap of differentiated products revealed its responsiveness to the tariff level to be greater compared to homogenous products. Manufacturing goods appear to be more prone to tariff evasion due to their product characteristics and a one-percentage-point-increase of the tariff rate for manufacturing products is associated with a 0.4% to 2% increase in the trade gap depending on the specification and country.

## **VII. The Channel of Tariff Evasion**

The previous estimations presented the responsiveness of the trade gap, measured as the “missing” value of traded goods, to changes in the tariff rate. There are two other possible channels for tariff evasion to take place: to underreport the quantity of the imports and to misclassify high-tariff products as similar lower-tariff ones.

In order to investigate whether mis-reporting of quantity occurs the quantity gap is defined as:

$$Quantity\_Gap_{cpt} = \ln Exports_{Quantity_{cpt}} - \ln Imports_{Quantity_{cpt}} \quad (3)$$

Similar to the trade gap in values it measures the quantity gap as the difference between the quantity of exports and the quantity of imports at the partner country and product level over time. One should bear in mind that the statistics about the quantities of trade flows are prone

to more missing observations and are assumed to be more exposed to measurement error. The regressions include only observations for which the export and import quantity unit can be matched. As before, all estimations include year, product and partner country fixed effects.

Table 8 presents the core results with dependent variable being the quantity gap. Again, only the results of the unbalanced sample for the EU-15 as separate countries and one entity will be discussed since the balanced samples lead to similar findings (Table A7 in the Annex).

Table 8: Tariff Rate and Quantity Gap

<i>Tariff Rate and Quantity Gap, before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.001)	0.008** (0.003)	-0.017*** (0.005)	0.009*** (0.002)	-0.006* (0.004)	0.004 (0.004)	0.001* (0.000)	0.003 (0.003)	- (0.004)	-0.015*** (0.002)	-0.000 (0.000)
Obs.	61553	80216	43403	52621	22397	38619	101709	45708	-	57238	516387
R <sup>2</sup>	0.000	0.009	0.051	0.003	0.001	0.017	0.007	0.007	-	0.006	0.008
<i>Tariff Rate and Quantity Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.000 (0.001)	0.003* (0.002)	-0.003 (0.002)	0.004*** (0.001)	0.004* (0.002)	0.004* (0.002)	0.000 (0.000)	-0.001 (0.002)	-0.001 (0.004)	-0.011*** (0.002)	0.000 (0.000)
Obs.	107170	210784	116797	164545	92670	125660	188778	97648	92731	151345	1348128
R <sup>2</sup>	0.002	0.004	0.019	0.007	0.005	0.010	0.005	0.010	0.015	0.003	0.002
<i>Tariff Rate and Quantity Gap, before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.000 (0.002)	0.012*** (0.003)	-0.000 (0.005)	0.013*** (0.003)	-0.001 (0.004)	-0.001 (0.005)	0.000 (0.000)	0.002 (0.003)	- (0.005)	-0.014*** (0.003)	-0.000 (0.000)
Obs.	14942	16508	13406	11189	7799	10866	28356	11211	-	15218	83237
R <sup>2</sup>	0.001	0.008	0.043	0.011	0.000	0.031	0.016	0.011	-	0.009	0.011
<i>Tariff Rate and Quantity Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.001 (0.002)	0.005** (0.002)	-0.005*** (0.002)	0.001 (0.001)	0.009*** (0.003)	0.002 (0.003)	0.000 (0.000)	-0.004** (0.002)	0.001 (0.005)	-0.009*** (0.003)	-0.000 (0.000)
Obs.	25163	40659	31307	31988	25809	30203	48678	21898	23108	37703	194825
R <sup>2</sup>	0.004	0.005	0.028	0.008	0.006	0.015	0.012	0.016	0.007	0.003	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

The evidence of evasion taking place through misrepresentation of quantity is not as pronounced as via underreporting of value. The majority of the country coefficients are not significant and the pooled regression results do not point towards underreporting of quantity. The only countries where there seems to be some positive correlation between the tariff rate and the quantity gap are the Czech Republic and Hungary; for Slovenia the relationship still remains significantly negative. Possible explanation for the insignificant results for the quantity gap is the low quality of the data regarding quantities of trade flows.

Table 9: Tariff Rate and Quantity Gap (manufacturing products)

<i>Tariff Rate and Quantity Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.001 (0.002)	0.021*** (0.005)	-0.002 (0.093)	0.008** (0.003)	-0.006 (0.005)	-0.007 (0.005)	0.007*** (0.001)	-0.002 (0.006)	-	-0.018*** (0.003)	-0.000 (0.001)
Obs.	47837	62702	34294	41867	17702	30711	81173	35466	-	43819	405915
R <sup>2</sup>	0.000	0.011	0.052	0.003	0.000	0.019	0.010	0.007	-	0.008	0.008
<i>Tariff Rate and Quantity Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.007*** (0.003)	-0.003 (0.005)	0.025 (0.072)	0.011*** (0.003)	0.004 (0.003)	0.002 (0.003)	0.006*** (0.002)	0.002 (0.005)	-0.016** (0.008)	-0.031*** (0.004)	-0.004*** (0.001)
Obs.	82798	160505	92852	124436	72911	99672	146833	74765	72260	113517	1040549
R <sup>2</sup>	0.003	0.005	0.019	0.008	0.006	0.012	0.007	0.010	0.017	0.006	0.003
<i>Tariff Rate and Quantity Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.005 (0.003)	0.030*** (0.006)	0.012 (0.095)	0.015*** (0.005)	0.001 (0.006)	-0.010** (0.005)	0.008*** (0.002)	-0.003 (0.007)	-	-0.016*** (0.004)	-0.001 (0.001)
Obs.	10480	11692	10108	8104	5904	8100	21102	7884	-	10790	96716
R <sup>2</sup>	0.003	0.012	0.042	0.011	0.000	0.037	0.028	0.014	-	0.015	0.015
<i>Tariff Rate and Quantity Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.007** (0.003)	0.013*** (0.005)	0.019 (0.073)	0.019*** (0.004)	0.010*** (0.004)	-0.002 (0.004)	0.005*** (0.002)	-0.006 (0.007)	-0.003 (0.010)	-0.021*** (0.004)	-0.002* (0.001)
Obs.	17662	28269	23353	22158	18795	22033	35352	15187	16701	26188	225698
R <sup>2</sup>	0.006	0.008	0.031	0.011	0.009	0.017	0.019	0.018	0.009	0.006	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>. Year, product and partner country fixed effects included.

Table 9 shows the results for the unbalanced panel when restricting the sample only to manufacturing products, for the balanced panel the findings are in Table A8 in the Annex. Table 9, again, does not show consistent results to support the hypothesis that tariff evasion of manufacturing products takes place through underreporting the quantities of trade flows. Robust evidence, independent of the sample selection, is found only for Poland and Hungary (positive correlation) and for Slovenia (negative). It seems that misrepresentation of quantity is not the main channel of tariff evasion except for a couple of countries.

Another possible channel for tariff evasion is through misclassification of products. Importers might have an incentive to misreport the correct product code as similar one within the same four-digit HS product group but with a lower tariff. In order to account for this channel Fisman and Wei (2004) propose to include in the baseline Equation (2) an additional variable capturing the average tariff of the other products in the same four-digit HS product category weighted by the value of exports. Equation (2) will then look like this:

$$Trade\ Gap_{cpt} = \beta_0 + \beta_1 Tariff_{cpt} + \beta_2 TariffHS4_{cpt} + \alpha_t + \gamma_c + \theta_p + \varepsilon_{cpt} \quad (4)$$

The assumption is, in case of misclassification of goods, that the coefficient of the similar products will have a negative relationship with the trade gap, meaning the higher the average tariff rate of similar products the smaller is the incentive of the importer to misreport the correct product code. Tables 10 and 11 present the results for this channel of evasion. Table 10 includes the regressions for the unbalanced sample for all products and Table 11 the findings for manufacturing products, the results from the balanced samples are in Tables A9 and A10 in the Annex.

Including the variable measuring the average tariff on similar products does not seem to have an influence on the trade gap when all product groups are included (Table 10). The coefficient of *tariffHS4* is indeed negative in most of the regressions but insignificant. There is no significant difference as a result of the EU accession; it makes just the tariff variable significant in more cases. Also, there is no observable substantial difference between the samples. In this case there is only a difference between the unbalanced and balanced sample with separate EU-15 countries. Regarding the balanced sample some evidence seems to appear pointing towards misclassification of products. However, it is the only specification which provides some confirmation for the hypothesis of misclassification.

Table 10: Tariff Rate and Trade Gap

<i>Tariff Rate and Trade Gap, before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003 (0.002)	0.006 (0.004)	-0.014* (0.007)	0.009* (0.005)	0.006 (0.006)	0.011 (0.010)	0.001 (0.001)	0.005 (0.004)	- (0.004)	-0.006** (0.003)	0.002*** (0.001)
Tariff	-0.002 (0.002)	0.003 (0.004)	0.009 (0.007)	-0.004 (0.005)	-0.007 (0.006)	-0.000 (0.009)	-0.001 (0.001)	-0.003 (0.004)	- (0.004)	0.001 (0.003)	-0.001 (0.001)
HS4	61504	71947	40693	47056	20139	34286	85800	47838	-	50494	470892
R <sup>2</sup>	0.000	0.003	0.079	0.000	0.001	0.016	0.001	-0.000	-	0.002	0.005
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.002)	0.007** (0.003)	-0.000 (0.004)	0.010** (0.004)	0.015*** (0.005)	0.017*** (0.006)	0.001 (0.001)	0.002 (0.003)	-0.001 (0.004)	-0.005* (0.003)	0.003*** (0.001)
Tariff	0.003* (0.002)	-0.002 (0.003)	-0.001 (0.004)	-0.003 (0.004)	0.001 (0.005)	-0.003 (0.006)	0.001 (0.001)	0.001 (0.003)	-0.003 (0.004)	-0.003 (0.003)	-0.001 (0.001)
HS4	103585	192772	107143	156057	85987	113464	163735	97283	81839	136432	1238297
R <sup>2</sup>	0.002	0.003	0.033	0.010	0.009	0.015	0.009	0.019	0.025	0.001	0.002
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.002)	0.009*** (0.003)	-0.000 (0.009)	0.007** (0.003)	0.005 (0.007)	0.016** (0.007)	-0.000 (0.001)	0.004 (0.003)	- (0.003)	-0.003 (0.002)	0.001 (0.000)
Tariff	0.000 (0.000)	-0.000** (0.000)	-0.001 (0.009)	-0.001 (0.000)	-0.003 (0.007)	-0.007 (0.007)	-0.000 (0.001)	-0.000** (0.000)	- (0.000)	0.000 (0.001)	-0.000* (0.000)
HS4	13218	15283	11787	10331	6846	9568	25557	9911	-	13899	75385
R <sup>2</sup>	0.001	0.007	0.034	0.002	0.002	0.020	-0.000	-0.000	-	0.001	0.003
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003** (0.002)	0.007*** (0.002)	-0.003 (0.003)	0.003** (0.001)	0.011* (0.006)	0.015*** (0.005)	0.000 (0.001)	-0.000 (0.001)	0.003 (0.004)	-0.004* (0.002)	0.001*** (0.000)
Tariff	0.001 (0.001)	-0.000 (0.000)	0.000 (0.003)	-0.000 (0.000)	0.006 (0.006)	-0.009* (0.005)	0.000 (0.001)	-0.000 (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000 (0.000)
HS4	22428	37587	27681	29348	22826	26834	44076	19627	20710	34368	177417
R <sup>2</sup>	0.005	0.003	0.036	0.015	0.020	0.021	0.009	0.024	0.018	0.001	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

In contrast, Table 11 offers more evidence for this channel of evasion taking place in the context of manufacturing products. The findings show a negative and significant coefficient of the tariff on similar products for the pooled sample and separately for four countries when considering the second panel (EU-15 as separate countries and including EU membership). It is interesting to see that adding the variable `tariffHS4` drives the coefficient of the tariff variable in a positive way. The responsiveness of the trade gap to the own tariff rate reaches a remarkable 3% in the case of Latvia. Also for the Czech Republic, Hungary and Poland, as well as the pooled sample, the results exceed by far the previous findings. When treating the EU-15 as one entity the magnitude of the estimates is again lower, in-line with the previous results. There are no results presented for Estonia because there are very few non-zero observations for the own tariff and the average tariff of the HS 4-digit group when restricting the sample only to manufacturing products.

In conclusion, the results show evidence for tariff evasion through underreporting of the imports' value though misrepresentation of the quantity seems not to be a significant channel of tariff evasion. Analysing the full sample including all product types provides also no robust confirmation of the hypothesis that high-tariff goods are classified as similar lower-tariff ones. Restricting the sample only to manufacturing products indicates even stronger responsiveness of the trade gap to the tariff rate in the case of underreporting of value. In addition, it appears that misclassification of products is a significant channel of tariff evasion in a couple of the EU-10 countries. Apparently, manufacturing goods, which are in their nature rather differentiated products, are more prone to tariff evasion than agricultural and mineral products.

Table 11: Tariff Rate and Trade Gap (manufacturing products)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.001 (0.004)	0.020*** (0.006)	-	0.004 (0.006)	0.027** (0.011)	0.001 (0.013)	0.012*** (0.003)	0.013 (0.010)	-	-0.004 (0.004)	0.007*** (0.002)
Tariff	-0.002 (0.004)	-0.005 (0.006)	-	-0.000 (0.006)	-0.026** (0.011)	0.006 (0.013)	-0.007* (0.004)	-0.006 (0.010)	-	-0.003 (0.005)	-0.004** (0.002)
HS4											
Obs.	52275	58914	-	39257	17104	29155	72849	40575	-	40683	395030
R <sup>2</sup>	0.000	0.004	-	0.000	0.001	0.016	0.002	0.000	-	0.002	0.005
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.001 (0.004)	0.014*** (0.005)	-	0.014** (0.006)	0.033*** (0.009)	0.016* (0.009)	0.013*** (0.004)	0.011 (0.009)	0.001 (0.009)	-0.011** (0.005)	0.009*** (0.002)
Tariff	0.001 (0.004)	-0.016*** (0.005)	-	-0.001 (0.006)	-0.016* (0.009)	-0.000 (0.009)	-0.009** (0.004)	0.003 (0.009)	-0.015 (0.010)	-0.013** (0.005)	-0.008*** (0.002)
HS4											
Obs.	86870	154441	-	125734	72507	95879	135624	80728	67794	108228	1018934
R <sup>2</sup>	0.002	0.003	-	0.011	0.009	0.017	0.011	0.019	0.027	0.003	0.002
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.003 (0.004)	0.018*** (0.005)	-	0.010** (0.005)	0.015 (0.018)	0.010 (0.013)	0.011*** (0.003)	0.015 (0.012)	-	-0.005 (0.003)	0.002*** (0.001)
Tariff	-0.002 (0.004)	-0.000*** (0.000)	-	-0.002 (0.003)	-0.014 (0.018)	-0.009 (0.013)	-0.006** (0.003)	-0.004 (0.012)	-	0.001 (0.001)	-0.000** (0.000)
HS4											
Obs.	9449	11014	-	7619	5379	7376	19517	7120	-	10046	89029
R <sup>2</sup>	0.002	0.010	-	0.002	0.001	0.018	0.002	0.002	-	0.001	0.003
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.003)	0.013*** (0.004)	-	0.018*** (0.004)	0.025** (0.010)	0.024** (0.011)	0.010*** (0.003)	0.018* (0.009)	0.002 (0.011)	-0.014*** (0.004)	0.002*** (0.001)
Tariff	0.002*** (0.001)	-0.000 (0.000)	-	0.003 (0.002)	-0.006 (0.010)	-0.017 (0.012)	-0.006** (0.003)	0.002 (0.009)	-0.003 (0.012)	-0.000 (0.001)	-0.000 (0.000)
HS4											
Obs.	16024	26500	-	20604	17103	20145	32726	13852	15334	24246	207774
R <sup>2</sup>	0.005	0.005	-	0.019	0.022	0.023	0.013	0.031	0.022	0.003	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.  
Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

## VIII. Conclusion

The topic of corruption in customs administration is a highly interesting subject for policy makers and government officials since import duties might represent an important source of revenue which in the case of tariff evasion is lost. Especially in transition countries, as the EU-10, this issue might be very relevant since many of these countries are fighting with corruption issues within their own administration. Although no particular program or intervention is analysed the results still are of relevance for policy makers in order to gain more detailed picture of the pattern of tariff evasion, possible ways to combat it and the way it develops in the particular case when tariff rates are abolished. In the case where higher tariffs are associated with higher evasion gap the effect of revenue losses due to tariff liberalization might be even partially softened.

This study contributes to the recent empirical studies on the relationship between tariffs and trade gap by investigating the influence of the EU accession of the EU-10 countries on the development of the “missing” trade. It does so by using product-level data and exploiting the variation of tariff rates due to the entrance into the EU and the foregone preparation period before that. The results indicate that there is a positive responsiveness of the trade gap with respect to changes in the tariff rate; including the accession year in the regression sample enhances this correlation. The relationship is even stronger in the case of manufacturing products. A one-percentage-point higher tariff rate is associated with up to a 1.3% increase in the trade gap for all products and up to 1.5% increase for manufacturing products treating the EU-15 as 15 separate countries. Besides, underreporting of value manufacturing products seem to be more prone also to misclassification, labelling high-tariff products as lower-tariff ones within the same HS 4-digit product group. The findings support the hypothesis that additional effort should be put in combating tariff evasion in the case of manufacturing products.

The study also shows that the magnitude of the relationship varies across the EU-10 countries although they are in a similar position regarding their progress towards EU membership. This result reveals the fact that there are still significant differences in the political and institutional environment inside the countries, as also discussed in the reports by the EU commission, which play an important role in the extent of tariff evasion.

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## Annex

Figure A1: Trade Gap and Tariff Rate

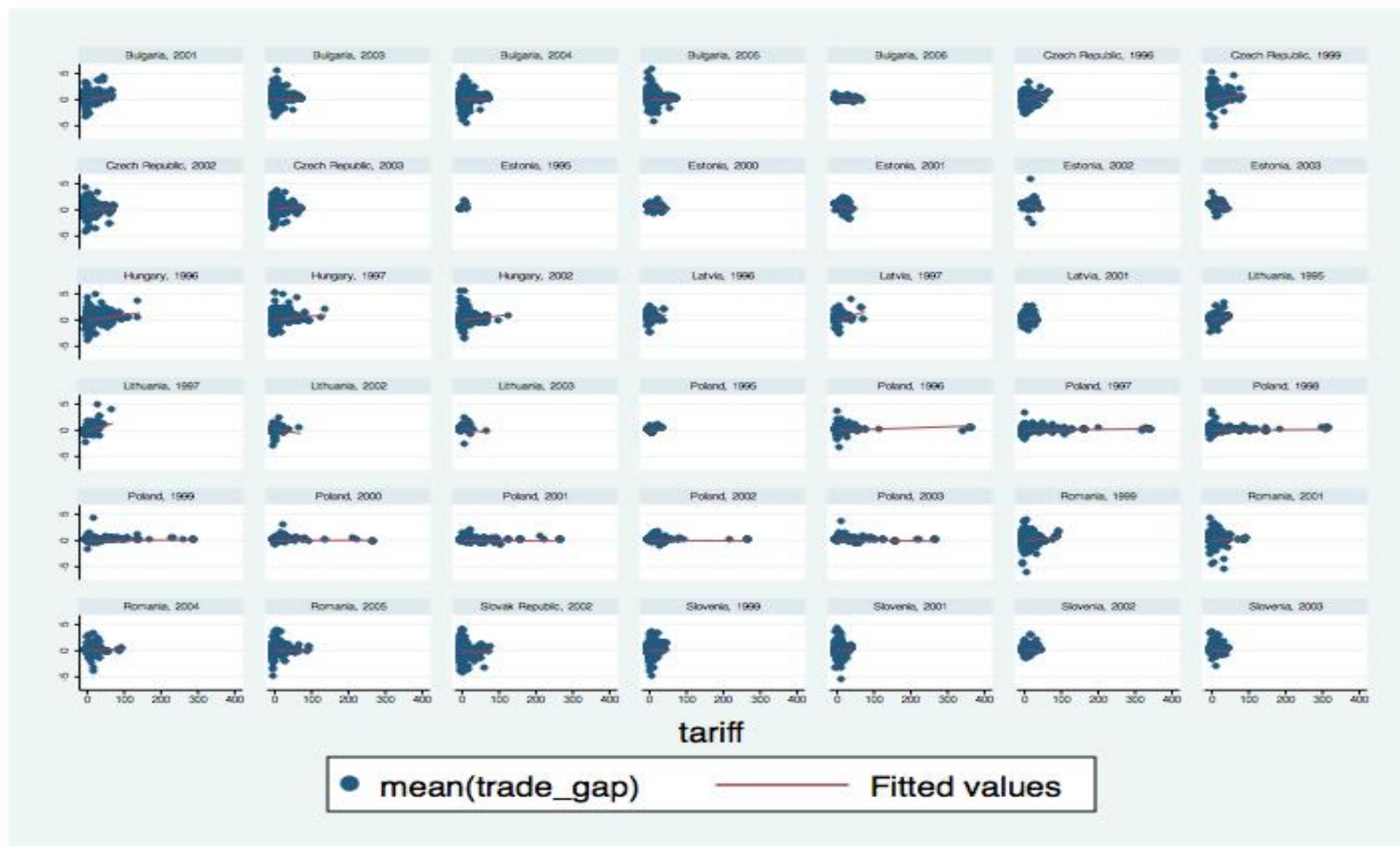


Table A1: Tariff Rate and Trade Gap (interaction effects with year)

<i>Tariff Rate and Trade Gap, including EU membership</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.014*** (0.002)	0.013*** (0.003)	0.029 (0.024)	0.009*** (0.001)	0.016*** (0.003)	0.014*** (0.003)	0.001 (0.001)	0.004** (0.002)	0.002 (0.003)	-0.013*** (0.003)	0.015*** (0.001)
Tariff*1996							0.001 (0.001)				-0.010*** (0.002)
Tariff*1997				-0.002 (0.001)	-0.002 (0.003)	0.005 (0.003)	-0.000 (0.001)				-0.011*** (0.001)
Tariff*1998							-0.000 (0.001)				-0.014*** (0.001)
Tariff*1999		-0.001 (0.003)					-0.000 (0.001)				-0.013*** (0.001)
Tariff*2000			-0.030 (0.024)				0.001 (0.001)				-0.014*** (0.001)
Tariff*2001			-0.033 (0.024)		-0.006 (0.004)		0.000 (0.001)	-0.002 (0.002)		0.005** (0.002)	-0.014*** (0.001)
Tariff*2002		-0.012*** (0.003)	-0.033 (0.024)	-0.006*** (0.002)		-0.027*** (0.005)	0.001 (0.001)			0.014*** (0.003)	-0.018*** (0.002)
Tariff*2003	-0.010*** (0.002)	-0.010*** (0.003)	-0.034 (0.024)			-0.025*** (0.004)	-0.000 (0.001)			0.013*** (0.003)	-0.016*** (0.001)
Tariff*2004	-0.010*** (0.002)							-0.005** (0.002)			-0.007*** (0.002)
Tariff*2005	-0.012*** (0.002)							-0.005** (0.002)			-0.009*** (0.001)
Tariff*2006	-0.012*** (0.002)							0.004** (0.002)	0.002 (0.003)	-0.013*** (0.003)	-0.012*** (0.002)
Obs.	127850	228277	133791	185232	107089	140601	204966	117910	101881	165711	1513308
Adj. R <sup>2</sup>	0.003	0.002	0.029	0.010	0.008	0.013	0.008	0.018	0.022	0.001	0.002

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Omitted category is always the first year with available data for tariffs: Bulgaria-2001, Czech Republic-1996, Estonia-1995, Hungary-1996, Latvia-1996, Lithuania-1995, Poland-1995, Romania-1999, Slovak Republic-2002, Slovenia-1999.

Table A2: Tariff Rate and Trade Gap (agricultural products, unbalanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004** (0.002)	-0.004 (0.003)	-0.012** (0.005)	0.020*** (0.005)	0.002 (0.004)	0.026*** (0.006)	-0.000 (0.000)	0.000 (0.002)	- (0.003)	-0.004 (0.003)	-0.000 (0.000)
Obs.	5288	7493	4643	3958	2099	3713	7532	4252	-	5410	18782
R <sup>2</sup>	0.014	0.007	0.042	0.010	0.005	0.015	0.001	0.002	-	0.000	0.004
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003** (0.002)	0.008*** (0.002)	-0.001 (0.003)	0.003* (0.001)	0.012*** (0.003)	0.008*** (0.003)	0.000 (0.000)	-0.001 (0.002)	0.003 (0.003)	0.004 (0.003)	0.002*** (0.000)
Obs.	10044	22876	12022	17426	9537	12590	17093	10073	9136	16676	44633
R <sup>2</sup>	0.020	0.004	0.022	0.014	0.016	0.012	0.005	0.022	0.003	0.001	0.010
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003 (0.002)	-0.001 (0.004)	0.002 (0.006)	0.015** (0.006)	0.004 (0.005)	0.026*** (0.008)	-0.001* (0.000)	-0.004 (0.003)	- (0.003)	0.002 (0.004)	-0.000 (0.000)
Obs.	1818	2050	1705	1188	896	1365	2862	1361	-	1876	15475
R <sup>2</sup>	0.022	0.016	0.025	0.011	0.006	0.038	0.004	0.001	-	0.002	0.004
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003* (0.002)	0.006** (0.003)	0.002 (0.003)	0.001 (0.002)	0.017*** (0.004)	0.004 (0.004)	-0.000 (0.000)	-0.002 (0.002)	0.004 (0.005)	0.004 (0.004)	0.001*** (0.000)
Obs.	3222	5441	4092	4177	3477	4075	5531	2877	2833	5070	40795
R <sup>2</sup>	0.015	0.008	0.014	0.022	0.019	0.032	0.001	0.024	0.007	0.001	0.003

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A3: Tariff Rate and Trade Gap (agricultural products, balanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004** (0.002)	-0.005 (0.003)	-0.001 (0.007)	0.019*** (0.006)	-0.000 (0.006)	0.017*** (0.006)	-0.000 (0.000)	-0.000 (0.002)	-	-0.004 (0.004)	-0.000 (0.000)
Obs.	2330	3612	1455	1683	726	1132	2700	1684	-	2900	18782
R <sup>2</sup>	0.030	0.006	0.049	0.008	0.002	0.009	0.002	0.001	-	0.001	0.004
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002 (0.002)	0.008*** (0.003)	-0.001 (0.005)	0.003 (0.002)	0.015*** (0.005)	0.008* (0.005)	-0.000 (0.000)	0.001 (0.002)	0.000 (0.003)	0.004 (0.004)	0.002*** (0.000)
Obs.	3728	9030	3201	5049	2178	2830	4500	2947	3920	7250	44633
R <sup>2</sup>	0.042	0.008	0.065	0.032	0.049	0.051	0.012	0.032	0.004	0.000	0.010
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003 (0.002)	-0.010** (0.005)	0.007 (0.006)	0.015** (0.007)	0.002 (0.006)	0.025*** (0.009)	-0.001 (0.000)	-0.003 (0.003)	-	0.001 (0.004)	0.000 (0.000)
Obs.	1160	1548	1015	834	540	804	1674	864	-	1512	10216
R <sup>2</sup>	0.030	0.019	0.036	0.006	0.019	0.039	0.021	-0.000	-	-0.002	0.002
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004** (0.002)	0.010*** (0.003)	0.000 (0.003)	0.002 (0.002)	0.016*** (0.005)	0.008** (0.004)	-0.000 (0.000)	-0.004** (0.002)	0.005 (0.004)	0.001 (0.003)	0.002*** (0.000)
Obs.	1856	3870	2233	2502	1620	2010	2790	1512	1855	3780	24028
R <sup>2</sup>	0.033	0.020	0.037	0.044	0.039	0.057	0.015	0.034	0.010	-0.001	0.007

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A4: Tariff Rate and Trade Gap (mineral products, unbalanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.004 (0.005)	-0.008 (0.005)	- -	0.004 (0.006)	-0.000 (0.011)	0.034** (0.014)	0.002 (0.002)	0.016 (0.010)	- -	-0.000 (0.006)	0.001 (0.002)
Obs.	9057	10409	-	7031	2756	4358	13307	6949	-	8212	30445
R <sup>2</sup>	0.001	0.008	-	0.005	0.000	0.014	0.000	0.001	-	0.001	0.003
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.001 (0.005)	-0.009** (0.004)	- -	0.005 (0.005)	0.007 (0.009)	0.025** (0.011)	-0.000 (0.003)	0.011 (0.008)	0.003 (0.008)	-0.001 (0.006)	-0.001 (0.002)
Obs.	15084	28274	-	23510	10722	13860	25680	13974	11618	21717	70375
R <sup>2</sup>	0.002	0.004	-	0.005	0.003	0.004	0.002	0.011	0.015	0.001	0.001
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.005 (0.007)	-0.005 (0.007)	- -	-0.003 (0.008)	0.015 (0.016)	0.038 (0.024)	0.004 (0.003)	0.030** (0.013)	- -	-0.002 (0.006)	0.002 (0.002)
Obs.	2644	2766	-	1897	999	1401	4392	1966	-	2552	13052
R <sup>2</sup>	-0.001	0.010	-	0.009	0.002	0.015	0.001	0.014	-	-0.001	0.002
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.008 (0.006)	-0.016** (0.008)	- -	0.011 (0.008)	0.009 (0.013)	0.028 (0.019)	0.002 (0.004)	0.017* (0.009)	0.006 (0.009)	0.002 (0.008)	0.001 (0.002)
Obs.	4279	6949	-	5653	3537	4095	7795	3834	3574	6445	50023
R <sup>2</sup>	-0.000	0.004	-	0.007	0.007	0.008	0.004	0.010	0.004	0.000	0.001

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A5: Tariff Rate and Trade Gap (mineral products, balanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.002 (0.005)	-0.007 (0.006)	-	-0.004 (0.006)	0.007 (0.013)	0.041*** (0.015)	0.000 (0.003)	0.019 (0.013)	-	-0.004 (0.007)	0.001 (0.002)
Obs.	4225	4788	-	3216	1053	1480	5805	3204	-	4188	30445
R <sup>2</sup>	0.001	0.009	-	-0.000	0.002	0.022	0.000	0.000	-	0.003	0.003
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003 (0.006)	-0.006 (0.005)	-	0.007 (0.007)	0.003 (0.013)	0.023* (0.014)	0.001 (0.003)	0.016 (0.012)	-0.003 (0.012)	-0.005 (0.007)	-0.001 (0.002)
Obs.	6760	11970	-	9648	3159	3700	9675	5607	5712	10470	70375
R <sup>2</sup>	0.004	0.004	-	0.007	0.002	0.013	0.002	0.010	0.018	0.001	0.001
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.001 (0.007)	-0.002 (0.008)	-	-0.002 (0.008)	0.017 (0.016)	0.058*** (0.020)	0.003 (0.003)	0.026** (0.012)	-	-0.000 (0.006)	0.002 (0.002)
Obs.	1750	2036	-	1317	534	736	2403	1200	-	1876	13052
R <sup>2</sup>	-0.002	0.017	-	0.013	0.007	0.020	-0.001	0.008	-	-0.001	0.002
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003 (0.007)	-0.012* (0.007)	-	0.017** (0.008)	-0.001 (0.017)	0.037* (0.022)	0.004 (0.003)	0.014 (0.010)	0.007 (0.009)	0.002 (0.007)	-0.000 (0.002)
Obs.	2800	5090	-	3951	1602	1840	4005	2100	2485	4690	30422
R <sup>2</sup>	-0.002	0.008	-	0.013	0.010	0.009	0.002	0.011	0.011	0.001	0.001

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A6: Tariff Rate and Trade Gap (manufacturing products, balanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.003 (0.002)	0.016*** (0.004)	0.063 (0.042)	0.006** (0.003)	-0.003 (0.004)	0.004 (0.005)	0.006*** (0.001)	0.004 (0.005)	- (0.006)	-0.008*** (0.002)	0.003*** (0.001)
Obs.	30060	36664	15560	24282	9069	11688	39510	23512	-	27280	223859
R <sup>2</sup>	0.001	0.005	0.115	0.000	0.002	0.024	0.002	0.001	-	0.003	0.006
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.001 (0.002)	0.003 (0.004)	0.049* (0.026)	0.013*** (0.003)	0.015*** (0.003)	0.015*** (0.004)	0.007*** (0.001)	0.012*** (0.004)	-0.007 (0.006)	-0.021*** (0.003)	-0.000 (0.001)
Obs.	48096	91660	34232	72846	27207	29220	65850	41146	43638	68200	522095
R <sup>2</sup>	0.003	0.003	0.087	0.012	0.017	0.038	0.009	0.027	0.037	0.003	0.003
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.006* (0.003)	0.018*** (0.005)	-0.046 (0.079)	0.008* (0.005)	-0.010 (0.007)	-0.005 (0.006)	0.004*** (0.001)	0.011* (0.006)	- (0.007)	-0.004 (0.003)	0.002** (0.001)
Obs.	7055	8744	4590	5082	3282	3776	12960	4572	-	8080	59969
R <sup>2</sup>	0.002	0.010	0.072	0.002	0.002	0.015	0.002	0.001	-	0.001	0.004
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.003)	0.015*** (0.004)	-0.029 (0.053)	0.021*** (0.004)	0.013*** (0.004)	0.002 (0.005)	0.004*** (0.002)	0.015*** (0.006)	-0.011 (0.007)	-0.015*** (0.004)	0.001 (0.001)
Obs.	11288	21860	10098	15246	9846	9440	21600	8001	12796	20200	140375
R <sup>2</sup>	0.004	0.006	0.103	0.024	0.031	0.032	0.015	0.019	0.030	0.004	0.006

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A7: Tariff Rate and Quantity Gap (balanced panel)

<i>Tariff Rate and Quantity Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.000 (0.002)	0.010** (0.004)	-0.013* (0.007)	0.007*** (0.003)	-0.010** (0.004)	0.000 (0.006)	0.001 (0.000)	0.001 (0.003)	- (0.004)	-0.016*** (0.002)	-0.000 (0.000)
Obs.	29515	42643	15512	27938	9758	12423	45441	22259	-	31991	244574
R <sup>2</sup>	0.001	0.009	0.088	0.004	0.002	0.028	0.008	0.008	-	0.009	0.009
<i>Tariff Rate and Quantity Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.002)	0.002 (0.002)	-0.006 (0.004)	0.004*** (0.001)	0.005 (0.003)	0.005 (0.004)	-0.000 (0.000)	0.012*** (0.004)	0.000 (0.004)	-0.014*** (0.003)	-0.000 (0.000)
Obs.	48937	103834	35536	78240	28537	31393	73820	40646	48525	78518	567986
R <sup>2</sup>	0.004	0.004	0.060	0.009	0.006	0.022	0.007	0.018	0.016	0.004	0.010
<i>Tariff Rate and Quantity Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.002)	0.012*** (0.004)	0.000 (0.006)	0.008** (0.004)	-0.011** (0.005)	0.004 (0.006)	-0.000 (0.000)	0.000 (0.003)	- (0.004)	-0.013*** (0.003)	-0.000 (0.000)
Obs.	9965	12328	6450	7233	4356	5316	17037	6636	-	11468	83237
R <sup>2</sup>	0.002	0.011	0.079	0.005	0.002	0.022	0.010	0.005	-	0.008	0.011
<i>Tariff Rate and Quantity Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.002)	0.007** (0.003)	-0.009*** (0.003)	0.003* (0.002)	0.006* (0.003)	0.002 (0.003)	-0.000 (0.000)	-0.004** (0.002)	-0.001 (0.004)	-0.010*** (0.002)	-0.000 (0.000)
Obs.	15944	30820	14190	21699	13068	13290	28395	11613	17136	28670	194825
R <sup>2</sup>	0.005	0.006	0.078	0.011	0.012	0.017	0.012	0.013	0.008	0.004	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A8: Tariff Rate and Quantity Gap (manufacturing products, balanced panel)

<i>Tariff Rate and Quantity Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.002)	0.024*** (0.005)	- -	0.007** (0.004)	-0.010* (0.006)	-0.013** (0.006)	0.007*** (0.002)	-0.002 (0.006)	- -	-0.019*** (0.003)	0.000 (0.001)
Obs.	23219	34373	-	23087	8004	9841	37000	17682	-	24979	196402
R <sup>2</sup>	0.002	0.012	-	0.004	0.001	0.037	0.012	0.009	-	0.011	0.011
<i>Tariff Rate and Quantity Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.010*** (0.003)	-0.006 (0.005)	- -	0.010*** (0.003)	0.003 (0.004)	-0.002 (0.005)	0.006*** (0.002)	0.004 (0.006)	-0.011 (0.009)	-0.032*** (0.004)	-0.005*** (0.001)
Obs.	38748	83142	-	63762	23260	24913	59816	32425	38986	61010	454860
R <sup>2</sup>	0.005	0.005	-	0.009	0.006	0.027	0.009	0.019	0.018	0.007	0.004
<i>Tariff Rate and Quantity Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.009** (0.004)	0.027*** (0.006)	- -	0.007 (0.005)	-0.019** (0.008)	-0.008 (0.007)	0.006*** (0.002)	-0.005 (0.008)	- -	-0.017*** (0.004)	0.000 (0.001)
Obs.	7055	8744	-	5082	3282	3776	12960	4572	-	8080	59969
R <sup>2</sup>	0.005	0.019	-	0.002	0.004	0.027	0.018	0.004	-	0.012	0.014
<i>Tariff Rate and Quantity Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.012*** (0.004)	0.012** (0.005)	- -	0.017*** (0.005)	0.005 (0.005)	-0.003 (0.006)	0.004** (0.002)	-0.004 (0.008)	-0.012 (0.010)	-0.024*** (0.005)	-0.002** (0.001)
Obs.	11288	21860	-	15246	9846	9440	21600	8001	12796	20200	140375
R <sup>2</sup>	0.007	0.010	-	0.015	0.015	0.019	0.018	0.012	0.010	0.007	0.007

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A9: Tariff Rate and Trade Gap (misclassification of products, balanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004 (0.003)	0.005 (0.004)	-0.003 (0.011)	0.018*** (0.006)	-0.001 (0.006)	0.011 (0.012)	0.003** (0.001)	0.002 (0.005)	- (0.005)	-0.007** (0.003)	0.003*** (0.001)
Tariff	-0.004* (0.002)	0.005 (0.004)	-0.007 (0.010)	-0.016*** (0.006)	-0.003 (0.006)	-0.002 (0.012)	-0.002** (0.001)	0.001 (0.005)	- (0.005)	0.000 (0.003)	-0.002** (0.001)
HS4											
Obs.	31872	40353	16357	26163	9287	12351	41693	24919	-	30215	239795
R <sup>2</sup>	0.000	0.004	0.111	0.001	0.002	0.023	0.001	0.001	-	0.003	0.006
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004 (0.003)	0.007** (0.003)	-0.002 (0.008)	0.012*** (0.004)	0.012* (0.007)	0.019** (0.008)	0.002* (0.001)	0.004 (0.003)	0.001 (0.004)	-0.007** (0.004)	0.003*** (0.001)
Tariff	-0.001 (0.003)	0.000 (0.003)	-0.005 (0.007)	-0.005 (0.004)	0.005 (0.007)	-0.005 (0.008)	-0.001 (0.001)	-0.000 (0.004)	-0.000 (0.005)	-0.002 (0.003)	-0.002* (0.001)
HS4											
Obs.	51274	101376	36386	79078	28514	31544	70186	44130	46342	75999	564829
R <sup>2</sup>	0.003	0.003	0.087	0.012	0.019	0.036	0.009	0.026	0.033	0.002	0.003
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.000 (0.002)	0.007** (0.003)	0.001 (0.008)	0.007** (0.003)	-0.002 (0.008)	0.018** (0.009)	-0.001 (0.001)	0.003 (0.003)	- (0.003)	-0.002 (0.002)	0.001 (0.000)
Tariff	-0.000 (0.000)	-0.000** (0.000)	-0.003 (0.008)	-0.000* (0.000)	0.000 (0.007)	-0.011 (0.009)	0.000 (0.001)	-0.000* (0.000)	- (0.000)	0.001 (0.001)	-0.000* (0.000)
HS4											
Obs.	8800	11492	5730	6704	3891	4701	15426	5870	-	10535	75385
R <sup>2</sup>	0.001	0.007	0.065	0.001	-0.000	0.014	0.001	0.000	-	0.000	0.003
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003** (0.002)	0.009*** (0.002)	-0.002 (0.004)	0.005*** (0.002)	0.010* (0.006)	0.017** (0.007)	0.000 (0.001)	0.000 (0.002)	0.001 (0.004)	-0.006*** (0.002)	0.001*** (0.000)
Tariff	0.000 (0.000)	-0.000 (0.000)	-0.003 (0.004)	-0.000 (0.000)	0.005 (0.006)	-0.012 (0.007)	0.000 (0.000)	-0.000 (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000 (0.000)
HS4											
Obs.	14154	28762	12618	20069	11738	11891	25902	10381	15580	26322	177417
R <sup>2</sup>	0.005	0.005	0.094	0.020	0.029	0.032	0.012	0.017	0.024	0.002	0.005

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level.

Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.

Table A10: Tariff Rate and Trade Gap (misclassification of products, manufacturing products, balanced panel)

<i>Tariff Rate and Trade Gap before EU Accession (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.004 (0.004)	0.022*** (0.007)	-	0.017** (0.007)	0.027** (0.011)	0.000 (0.018)	0.012*** (0.004)	0.004 (0.011)	-	-0.005 (0.004)	0.010*** (0.002)
Tariff	-0.008* (0.004)	-0.006 (0.007)	-	-0.014** (0.007)	-0.031*** (0.011)	0.005 (0.017)	-0.006 (0.004)	0.002 (0.011)	-	-0.005 (0.005)	-0.007*** (0.002)
HS4											
Obs.	27226	33704	-	22382	8020	10413	35592	21385	-	24678	203001
R <sup>2</sup>	0.001	0.005	-	0.000	0.004	0.026	0.002	0.002	-	0.003	0.007
<i>Tariff Rate and Trade Gap, including EU membership (15 EU partner countries)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	0.003 (0.005)	0.014** (0.006)	-	0.017*** (0.006)	0.032*** (0.012)	0.020 (0.013)	0.016*** (0.005)	0.002 (0.010)	0.010 (0.010)	-0.010* (0.005)	0.010*** (0.002)
Tariff	-0.004 (0.005)	-0.016*** (0.005)	-	-0.004 (0.007)	-0.015 (0.012)	-0.004 (0.013)	-0.011** (0.006)	0.013 (0.010)	-0.021** (0.010)	-0.014*** (0.006)	-0.010*** (0.002)
HS4											
Obs.	43704	84417	-	67335	24512	26527	59679	37738	39222	61970	476160
R <sup>2</sup>	0.003	0.003	-	0.012	0.019	0.039	0.010	0.028	0.037	0.004	0.003
<i>Tariff Rate and Trade Gap before EU Accession (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.002 (0.004)	0.019*** (0.005)	-	0.003 (0.010)	-0.013 (0.020)	0.004 (0.016)	0.006*** (0.002)	0.009 (0.014)	-	-0.005 (0.003)	0.002*** (0.001)
Tariff	-0.005* (0.003)	-0.000*** (0.000)	-	0.005 (0.010)	0.008 (0.019)	-0.011 (0.017)	-0.002 (0.002)	0.001 (0.014)	-	0.001 (0.001)	-0.000*** (0.000)
HS4											
Obs.	6342	8286	-	4779	3037	3425	12026	4137	-	7586	55511
R <sup>2</sup>	0.002	0.011	-	0.002	-0.000	0.014	0.002	0.001	-	0.001	0.004
<i>Tariff Rate and Trade Gap, including EU membership (EU-15 as a partner country)</i>											
	Bulgaria	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovak Republic	Slovenia	Pooled
Tariff	-0.004 (0.003)	0.015*** (0.004)	-	0.018*** (0.005)	0.019* (0.012)	0.020 (0.015)	0.008*** (0.002)	0.015 (0.011)	-0.007 (0.010)	-0.016*** (0.004)	0.001 (0.001)
Tariff	0.002** *	-0.000 (0.000)	-	0.003 (0.003)	-0.005 (0.012)	-0.019 (0.015)	-0.003 (0.002)	0.000 (0.012)	-0.001 (0.011)	0.000 (0.000)	-0.000 (0.000)
HS4											
Obs.	10202	20680	-	14262	9105	8631	20093	7298	11883	18885	130200
R <sup>2</sup>	0.004	0.007	-	0.025	0.032	0.034	0.016	0.017	0.031	0.003	0.006

\*\*\* Denotes significance at 1% level; \*\* denotes significance at 5% level; \* denotes significance at 10% level. Standard errors are clustered at the six-digit product level; t-statistics reported in parentheses; R<sup>2</sup> presents the adjusted R<sup>2</sup>; Year, product and partner country fixed effects included.