This is an Accepted Manuscript of an article published by ROUTLEDGE JOURNALS, TAYLOR & FRANCIS LTD in Europe-Asia Studies on 07/09/2020, available online: https://doi.org/10.1080/09668136.2020.1807468

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Does Abolishing Tariffs in Bilateral Trade Matter for a Country's Economic Growth? The Impact of the EU–Ukraine DCFTA

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Abstract

In the present study, a GTAP CGE model is used to assess three proposed scenarios for the DCFTA between the EU and Ukraine, one for unilateral trade liberalisation, another for bilateral trade liberalisation with exemptions from free trade and a third for bilateral trade liberalisation without exemptions from free trade. The main point of distinction of this study is the inclusion of exemptions from free trade in the first two simulated scenarios and the possibility of a quantitative evaluation of exemptions from free trade through the differences between scenarios 3 and 2.

A TRADE RELATIONSHIP BETWEEN THE EUROPEAN UNION (EU) AND UKRAINE started to develop in 1991 when the latter achieved its independence. In 1993, Ukraine was granted the Generalised System of Preferences (GSP)

for trade with the EU. Trade between the EU and Ukraine reached its historical maximum of €39.6 billion in 2008, which was followed by trade of €21.8 billion in 2009 due to the downturn following the economic crisis and the general shrinking of the Ukrainian economy. In 2015, trade recovered slightly, reaching a volume of €26.6 billion. The EU is Ukraine's most important trading partner, with a 40% share of all the country's trade, while representing a very large investor in the Ukrainian economy, with investments amounting to €16.4 billion in 2014.[1] Geographically, Ukraine is situated on the eastern border of the EU, and historically some parts of Ukraine have had close connections to central European countries, such as Poland, Lithuania, Hungary and Austria.[2] Thus, it is natural that both sides have aimed to buttress their relationship from economic and political perspectives, through the establishment of a regional free trade area in the form of the Deep and Comprehensive Free Trade Agreement (DCFTA)—in turn an important part of the wider Association Agreement (AA) between the parties.

Applying trade policy reforms to open up its economy, Ukraine became a World Trade Organization (WTO) member on 16 May 2008. After WTO accession, Ukraine began negotiations over the DCFTA with the EU. After 21 rounds of negotiations, an agreement was reached in November 2011, with its initiation signalled by the chief negotiators from each party in the spring of 2012. However, the official signing of the agreement was delayed, first, by the EU, citing 'politically motivated justice in Ukraine';[3] and then by then President Viktor Yanukovych, who under alleged economic Russian pressure, rejected the agreement. The DCFTA with the EU was widely perceived in Ukraine as an important roadmap for reforming and modernising the country and as a way of improving the country's quality of life (European Commission DG Trade 2009). Yanukovych's refusal to sign sparked popular protest across the country and in the capital Kyiv. After almost four months of confrontations, Yanukovych fled the country in February 2014. Between then and the election of a new president, Petro Poroshenko, on 25 May 2014, Crimea was occupied by Russia and separatist movements arose in Donetsk and Luhansk. The newly elected Poroshenko reverted to the post-Orange Revolution policy of EU

[1] 'Countries and Regions: Ukraine', European Commission, available at: http://ec.europa.eu/trade/policy/countries-and-regions/countries/ukraine/, accessed 19 July 2016.

[2] Significant areas of Ukrainian territory used to be a part of the Great Poland in the fourteenth to seventeenth centuries and part of the Austro–Hungarian Empire during the nineteenth century and the beginning of the twentieth century.

[3] 'EU–Ukraine Relations: A Geopolitical Test', *EurActive*, 16 December 2011, available at: www.euractiv.com/europes-east/eu-ukraine-relations-geopolitical-test-linksdossier-509764, accessed 14 December 2014. This referred to the trial and imprisonment of former Prime Minister of Ukraine Yulia Timoshenko by the direct but hidden order of President of Ukraine Viktor Yanukovych.

integration.[4] As a result, political chapters of the Association Agreement (AA) between Ukraine and the EU, which included the Deep and Comprehensive Free Trade Agreement, were signed by the interim Ukrainian prime minister, Arseniy Yatseniuk, in Brussels on 21 March 2014. The remaining sections of the agreement were signed at the EU summit on 27 June 2014. It was ratified simultaneously by the legislatures of both sides on 16 September 2014. However, to fully enter into force, the agreement needed to be ratified by the legislature of all EU member states.

The Russian government expressed concerns about possible damage to its economy as a collateral result of the implementation of the DCFTA (European Commission, 2015).. Considering those concerns, the EU and Ukraine agreed to open negotiations with Russia, putting on hold the implementation of the DCFTA until January 2016. As a substitute, Ukraine was offered the possibility of unilateral abolition of import tariffs by the EU until January 2016, equivalent to the first year of the DCFTA. With this offer, the EU opened its markets for Ukrainian producers to goods included in the DCFTA while Ukraine retained its tariffs. Although the concerns presented by Russia were not resolved,[5] a full DCFTA between the EU and Ukraine came into effect on 1 January 2016 (provisional application).

The main purpose of the current research is to compare and analyse the effects on the EU and Ukraine of the partial and full implementation of the DCFTA, considering the exemptions from free trade included in the DCFTA. The main original contribution of the article is the consideration of exemptions from free trade that have not been included in any previous research to date to the best of our knowledge. The baseline and three different scenarios are elaborated for this purpose. First, the EU abolishes its tariffs, as in the first year of the DCFTA (unilateral liberalisation, the actual situation from April 2014 to January 2016 named as provisional DCFTA implementation). Although this represent a real event, not hypothetical reality, we still call it a scenario because in CGE model we can focuses on the impact of the EU´s tariffs abolishment without being shocked by other real event happened at the same time. This focus allows to evaluate impacts of DCFTA exclusively. Second, the EU and Ukraine abolish tariffs, as in the first year of the DCFTA (the situation of bilateral liberalisation from January 2016 to January 2017). Third, the EU and Ukraine abolish all tariffs in trade between them without any exemptions from free trade. This third scenario represent a hypothetical situation of trade

[4] The development of Ukraine's EU integration policy began following the 2004 Orange Revolution, under the presidency Viktor Yushchenko.

[5] Most of the Russian concerns were geopolitically motivated and thus impossible to settle. A lack of agreement with Russia triggered a trade war between Russia and Ukraine starting on 1 January 2016, which contributed to the trade war between Russia and Western countries.

without any kind of limitations between the EU and Ukraine. The first and second scenarios include exemptions from free trade as in the DCFTA (OJEU 2014).

The article is organised as follows. The first section provides background information on the current EU–Ukraine trade relationship and on the DCFTA negotiations and ratification. In the second section, a short literature review is provided. Next, the general modelling approach is presented and the specific adaptations of the database for the purpose of this study described. A summary of the simulation results is given in the following section. The final section concludes the article with a discussion and some conclusions.

Literature overview

Several studies have evaluated possible short- and long-term outcomes of an FTA between the EU and Ukraine, as they are geographical neighbours (Emerson et al. 2006; ECORYS and CASE 2007a, 2007b; Francois & Manchin 2009; Maliszewska *et al*. 2009; Von Cramon-Taubadel *et al*. 2010; Frey & Olekseyuk-Viber 2011; Frey & Olekseyuk 2014). Among the studies published to date on the current issue, the majority use computable general equilibrium (CGE) models to conduct a general economic impact analysis; gravity models of different types, as in the case of Shepotylo (2010); or a partial equilibrium model to conduct a separate sector analysis, as in the case of Nekhay *et al*. (2012), in which the impact of the FTA on the agricultural sector is analysed. The exception to this rule is the work of Von Cramon-Taubadel *et al*. (2010), who use the Global Trade Analysis Project 7 (GTAP) static comparative CGE model to analyse the effects of the FTA between the EU and Ukraine on the agricultural sector. To accomplish this, several scenarios are examined, and the general finding is that a 50% reduction in tariffs would bring moderate benefits for the EU and Ukraine that would vary from one agricultural sector to another. A comparison of the results from the different studies is difficult due to the varied nature and underlying assumptions of the different models. Furthermore, Harbuzyuk and Lutz (2008) use the GTAP model to evaluate the effects of a customs union between the EU and Ukraine. The findings of this work suggest a small general benefit of this union for Ukraine, with negative effects in the agricultural sector, possibly owing to the EU CAP policy. Moreover, Harbuzyuk and Lutz (2008) suggest excluding the agricultural sector from such an agreement increase benefits from a customs union. In another study, Maliszewska *et al*. (2009) use a standard CGE model to model tariffs and a gravity model approach that considers non-tariff barriers (NTBs) on trade to model an FTA between Russia, Armenia, Azerbaijan, Georgia, and Ukraine on one side and the EU on the other. They found that Ukraine would benefit from both simple and deep FTAs (1.73% and 5.83% increases in welfare, respectively). ECORYS and CASE (2007a, 2007b) also use a CGE model to

model the outcomes of Ukraine's accession to the WTO and the establishment of extended and limited FTAs with the EU. Both the short- and long-term impact of such FTAs are evaluated.

For all scenarios, the increase in welfare is found to range between 5.28%, in the case of an extended FTA in the long term, and 1.21%, in the case of a limited FTA in the short term. Francois and Manchin (2009) conduct a study using a GTAP-based CGE model while considering the NTB. The difference between their study and other studies is that their study found that an FTA between the EU and Ukraine would negatively affect Ukraine in terms of real income in all three scenarios and have a positive impact in terms of GDP growth only in the case of a full FTA scenario, with an increase in GDP of 0.68%, and the first partial FTA scenario, with an increase in GDP of 0.04%. In the case of the second partial FTA scenario, the GDP declines by 1.46%. Movchan and Shportyuk (2011) model two possible but opposing developments of Ukrainian trade integration policies. One involves an FTA with the European Union, and the other comprises Ukraine membership in the customs union of Russia, Belarus and Kazakhstan, with the CGE model being used. According to their findings, in the case of an FTA with the EU, the total welfare of Ukraine increases by 1.3% in the short term and 4.6% in the long term, whereas in the case of Ukraine's integration into the Eurasian Custom Union, the loss of aggregated welfare for Ukraine is 0.5% in the short term and 3.7% in the long term.

Frey and Olekseyuk (2014) provide another study using a CGE model. In contrast to previously mentioned studies, the effect of the elimination of income received from tariffs by Ukraine is analysed here assuming unilateral abolition of tariffs by Ukraine. The three proposed scenarios analyse different ways to compensate for the elimination of tariffs and its impact on the country's economy. The outcomes of this study indicate almost no effect on the real GDP in all scenarios, whereas the welfare effects vary significantly from one scenario to another, ranging from -0.09% to 0.69%, depending on the underlying assumptions of the scenario.

The most up-to-date study, authored by Olekseyuk (2016), uses the CGE model to analyse FDI in business services following a simulation of the DCFTA. According to the findings of this study, Ukraine benefits from a welfare increase of over 8%, although a deindustrialisation effect in the country's economy is also found. Furthermore, in a study done in 2015 by the Institute for Economic Research and Policy Consulting, the impact of autonomous trade preferences on Ukraine is evaluated. This study could be used to compare the results of the first scenario in our study. However, a direct comparison is difficult since, in our simulation, the real uncertain economic and political situation could not be taken into account, whereas the Institute for

Economic Research and Policy Consulting used real economic data from the period of autonomous trade preferences action after the period of its application and when the official statistics became available.[6]

These studies underline the difficulty to draw a clear conclusion about benefits or losses of an FTA between the EU and Ukraine. Some authors find an FTA to be beneficial for both sides (Movchan & Shportyuk 2011); however, the size of benefits varies from one study to another. Others have determine that an FTA can bring losses, mainly for Ukraine in terms of real income (Francois & Manchin 2009) or a reduction in production of some sectors (Von Cramon-Taubadel *et al*. 2010) or in agriculture (Harbuzyuk & Lutz 2008). Additionally, there may be new studies that evaluate the positive and negative effects of the DCFTA in place and advices on how to address the latter effects (Adarov & Havlik 2016; Chychkalo-Kondratska *et al* 2017; Yatsenko *et al* 2017; Matuszak 2018; Olekseyuk & Balisreri 2018).

Methodology: specification of the modelling approach and the scenarios

The model

The A GTAP (Global Trade Analysis Project) Computable General Equilibrium (CGE) model has been used to run proposed scenarios. A GTAP was established in 1992 initially to allow a quantitative evaluation of the impact of the Uruguay Round negotiations on individual countries, which took place under the General Agreement on Tariffs and Trade (GATT) (Hertel 1997). Over time, a number of improvements and amendments have been introduced. The model is easily modified to suit to demands of the users and thus highly suitable for the evaluation of the impact of an FTA (Hertel 1997).

The modelling language of the GTAP model is GEMPACK. The model consists of two main parts and two important aspects. The first part is a database with input-output (IO), social accounting, tax and trade flow information matrices that provide necessary input information for the impact analysis. The second is a mathematical model that mimics the functioning of the world economy through a nested structure formed by microeconomic functions (producer cost minimisation, profit maximisation and consumer behaviour functions). The first aspect encompasses macroeconomic closure conditions, which allow for switching between endogenous and exogenous variables (the number of endogenous variables should be equal to the number of equations). The policy impact evaluation is performed through a 'shock' on the exogenous variables. Second

[6] 'Autonomous Trade Preferences: Impact on Ukrainian Exports', Institute For Economic Research And Policy Consulting, 2015 (Study has been developed as part of Implementation of Economic part of the EU–Ukraine Association Agreement project supported by the International Renaissance Foundation. Kyiv). The part highlighted in the parenthesis is a second low case title at the title page of the work.

aspect is that, the model includes elasticities of substitution for primary factors, between domestic and imported goods of the Armington structure and among imports from different sources.

In the present study, version 6.2 of the static comparative GTAP model was used, hence assuming perfect competition and constant returns to scale, with a standard closure rule. Other assumptions of the model are as follows: all markets are in equilibrium, all companies operate with zero profits, and all families are on budget constraints, which implies that global investment is equal to global savings, in agreement with Walras' law (Hertel 1997).

Leontief technology is used here for the production function, which implies zero substitutability between primary factors of production and intermediate inputs at the top of the three-level nested structure.

The utility function has a four-level structure and Cobb-Douglas functional form. At the highest level, the Cobb-Douglas utility function allocates income to private consumption, government spending and savings. At the second level, all spending is allocated among aggregated goods using a non-homothetic functional form with a constant difference elasticity. The remaining two levels of the utility function of the government and private sector are similar to the second and third level demand by firms for intermediate inputs with a constant elasticity of substitution.

Database and regional and sectoral aggregation used

This study uses the GTAP 9 database, which consists of 140 regions, 57 sectors and four types of endowments (land, natural resources, capital and workers). For workers, five labour skill categories are defined.[7] Bilateral trade data correspond to 2011 in this version of the GTAP database. However, for the purpose of the study, the 140 available regions were aggregated into eight regions: EU-28; Ukraine; Russia; Kazakhstan; Belarus; Armenia; Kyrgyzstan; and ROW (Rest of the World). The proposed aggregation includes the EU and Ukraine as main actors, as well as other members of the Commonwealth of Independent States (CIS) as important trade partners of Ukraine. However, the analysis of the results is focused on the EU and Ukraine, with other countries being outside of the scope of the present work. Sectors and endowments were used in their fully available lengths; thus, the resulting database has the dimensions of eight regions, 57 commodities and five endowments (the worker categories were aggregated into two groups: skilled and unskilled workers). We decided to use all

[7] Readers can view the web page for complete information, available at: https://www.gtap.agecon.purdue.edu/, accessed at July 10th 2018.

57 sectors and not to aggregate them in order to have the least-biased results as possible; according to Brockmeier and Bektasaglu (2014), the biases of data aggregation are much stronger than the model structure.

Scenarios

Three scenarios[8] and one baseline scenario are proposed to evaluate the impact of the FTA.

The baseline (counterfactual scenario) construction is necessary in order to describe thing without signature of any FTA between the EU and Ukraine as a situation that can be compared with other scenarios. The trade data in the GTAP model corresponds to the year 2011, and Ukraine's data contained in Social Accounting Matrices (SAMs) correspond to 2004. However, Ukraine's economy experienced considerable changes in terms of GDP, population and land endowments in that period. The Ukrainian land area was reduced by 7.27% following the loss of Crimea to Russia and a revolt in parts of the Donets and Luhansk regions. The country's population has declined by 9.22% and GDP has shrunk by 4.89% compared to 2004.[9] All of those changes were introduced into the database and as a result, a baseline scenario was generated. The results of scenarios 1 and 2 are presented in the results section, while also considering the baseline (counterfactual) scenario.

In scenario 1 (unilateral trade liberalisation), the EU lifts its import duties for Ukraine in accordance with the DCFTA (OJEU 2014), while Ukraine keeps its import duties unchanged. Exemptions from the FTA are explicitly considered. This scenario represents the real situation from April 2014 to January 2016. Table 1 presents the import duties imposed by the EU on Ukraine and *vice versa* before and after the DCFTA.[10] The tariff lines for all composed GTAP sectors were aggregated using simple averages rounded off to the first decimal place or the entire number. In the case of Tariff Rate Quotas (TRQ), expert knowledge was used to transform them into simple *ad valorum* tariffs.

TABLE 1

THE EU'S IMPORT DUTIES WITH UKRAINE AND UKRAINE'S IMPORT DUTIES WITH THE EU BEFORE AND AFTER THE DCFTA, *AD VALORUM* BASIS

[8] To solve the model, a numerical method by Gragg was used (Hertel *et al*. 1992).

[9] Only a few studies evaluate the impact of the Crimea, Donetsk and Luhansk losses, among them, Barry (2014) and Olekseyuk and Schurenberg-Frosch (2016).

[10] The GTAP 9 database has all sectors and activities aggregated into 57 lines. Although only 42 of them have tariffs, the GTAP default code is used for all of them. A detailed description of each code item is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

	European Union, %		Ukraine, %	
Sectors	*Before FTA*	*After FTA*	*Before FTA*	*After FTA*
pdr	0.0	0.0	5.0	0.0
wht	19.8	5.0	5.3	2.5
gro	5.0	0.5	0.5	0.0
v_f	1.5	0.0	7.3	3.5
osd	0.0	0.0	3.7	0.0
c_b	0.0	0.0	0.0	0.0
pfb	0.0	0.0	0.0	0.0
ocr	0.5	0.0	5.2	2.5
ctl	1.3	0.0	0.4	0.2
oap	9.4	5.0	2.6	2.6
rmk	0.0	0.0	0.0	0.0
wol	0.0	0.0	0.0	0.0
frs	0.0	0.0	6.0	0.0
fsh	0.7	0.0	0.8	0.0
coa	0.0	0.0	0.0	0.0
oil	0.0	0.0	0.0	0.0
gas	0.0	0.0	0.0	0.0
omn	0.1	0.0	2.0	0.0
cmt	8.1	7.0	12.8	3.0
omt	12.8	10.0	10.1	5.0
vol	1.4	0.0	9.7	5.0
mil	3.7	3.7	9.7	5.0
pcr	9.3	0.0	4.2	0.0
sgr	7.2	5.0	39.2	1.0
ofd	12.7	8.0	7.2	3.0
b_t	5.4	1.5	8.1	1.0
tex	6.8	0.0	4.1	0.0
wap	9.0	3.0	10.6	3.0
lea	1.7	0.0	6.8	3.0
lum	0.5	0.0	0.2	0.0
ppp	0.0	0.0	0.0	0.0
p_c	0.0	0.0	2.3	0.0
crp	1.7	0.1	2.2	0.0
nmm	1.2	0.0	6.3	3.0
i_s	0.1	0.0	0.4	0.0
nfm	1.7	0.0	1.0	0.0
fmp	0.1	0.0	3.7	0.0
mvh	0.6	0.6	8.2	7.0
otn	0.0	0.0	2.3	0.0
ele	2.8	0.0	1.7	0.0
ome	0.0	0.0	2.1	1.0
omf	0.0	0.0	5.5	5.0

Note: A detailed description of each GTAP sector code is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

Source: GTAP 9 database for 'before FTA tariffs' and own elaboration from *Official Journal of the European Union* (2014) for 'after FTA tariffs'.

In scenario 2 (bilateral trade liberalisation with exemptions), the EU and Ukraine abolish tariffs, as in the DCFTA (OJEU 2014), considering exemptions from the free trade by both sides. This scenario represents the

real situation from January 2016 to January 2017. We only considered the first year of DCFTA adoption because the reduction of some tariff lines was planned to be done up to 10 years period after the agreement implementation. Ukraine's import duties before and after the first year implementation of the DCFTA are presented in Table 1.

Scenario 3 (bilateral trade liberalisation without exemptions) is prepared with the purpose of evaluating exemptions from free trade included in Scenario 2. The main assumption in this scenario is that the EU and Ukraine have no tariffs in any trade between them.

Description of exemptions from free trade and its inclusion into the model

The inclusion of exemptions from free trade is the most challenging part of this study. The main difficulty here is how bridging the gap between the tariffs published in the *Official Journal of the European Union* (OJEU 2014) and those used in the GTAP model. The GTAP model uses *ad valorem* equivalent (AVE) tariffs, which are simple to model and apply; in reality, there are specific tariffs expressed in monetary units per physical unit of product, Tariff Rate Quotas (TRQ), and mixed tariffs with *ad valorem* and a specific part. Furthermore, tariffs published in the *Official Journal of the European Union* (OJEU 2014) are on the product line level, whereas GTAP aggregates thousands of tariff lines in 57 sectors, with 42 of them being tradable. Thus, it was complex to aggregate individual tariff lines into GTAP sectors and transform specific tariffs, TRQ and mixed tariffs into AVE.

Several approaches have been proposed to solve this problem: a simple average, a weighted average that takes into account trade flows, and weighted averages calculated by reference groups of countries (Bouët *et al*. 2008). However, none of them is without problems, ranging from high time consumption to low accuracy resulting from the focus on the world data used (Lips & Rieder 2002; Guimbard *et al*. 2012).

The initial idea was to use the software TASTE,[11] developed by IFPRI to couple tariffs reduction scenarios with GTAP (Horridge & Laborde 2008). However, several important shortfalls forced us to disregard its use: first, data are presented at the HS6 level and, second, the applied tariffs in EU–Ukraine trade are too low in the TASTE DB (less than 1% for all sectors), which undermines any possibility of a tariff reduction scenario. Ultimately, the tariffs published in the *Official Journal of the European Union* (OJEU 2014) were integrated into the GTAP scenario through the following approach. First, all tariffs were assessed on a sector-by-sector

[11] The software TASTE 81 uses 2007 trade data and is based on the same tariff data as GTAP 81. TASTE reads the MAcMapHS6 database and allows us to calculate scenarios in applied and bound tariff rates.

basis;[12] second, simple averages were calculated for *ad valorem* tariffs where possible; and, third, expert knowledge based on a literature review (Ryzhenkov *et al*. 2013) was used for the aggregation of specific tariffs, TRQ and mixed tariffs into AVE as in GTAP. A review of past trade data was not of much help because trade between the EU and Ukraine is in expansion, especially Ukrainian exports of agricultural products to EU, where most TRQ are set.

The results with AVE before the FTA and during the FTA are presented in Table 1. The reasoning behind the very complicated transformation to AVE is presented in Tables A2 and A3 in the Appendix.

Results

Macroeconomic variables, welfare effect and net exports

In the results of the scenario simulations, macroeconomic variables show important changes (see Table 2). GDP is a less affected variable, with an increase of 0.05%, or 77.95 million euro, for Ukraine in scenario 1; an increase of 0.09%, or 135 million euro, in scenario 2; and an increase of 0.14%, or 255 million euro, in scenario 3. The EU's GDP is barely affected in percentage terms; in absolute numbers, it increases by 56 M€, 216 M€ and 302 M€ in scenarios 1, 2 and 3 respectively. The welfare increases in scenarios 1, 2 and 3 for Ukraine are 703.03 million euro, 957.02 million euro and 1,607, million euro respectively. In the EU, scenario 1 has a welfare loss of 156.58 million euro in scenario 1, whereas scenarios 2 and 3 have gains of 348.54 million euro and 496 million euro, respectively.

TABLE 2

TOTAL VARIATIONS IN MACROECONOMIC VARIABLES: SCENARIOS 1, 2 AND 3

	Scenario 1 (unilateral liberalisation)		**Scenario 2 (bilateral with exemptions)**		**Scenario 3 (bilateral without exemptions)**	
Macroeconomic variables	**Ukraine**	**EU-28**	**Ukraine**	**EU-28**	**Ukraine**	**EU-28**
GDP (%)	0.05	0.00	0.09	0.00	0.14	0.00
GDP (Million euros)	77.95	56.00	135.30	216.00	215.06	302.00
Welfare (M€) Million euros	703.03	-156.58	957.02	348.64	1,607.80	496.01
Trade balance (Million euros)	-1,774.83	391.77	-3.935.09	652.64	-7,383.05	1,351.08
Total output (%)	0.11	-0.01	-0.29	0.00	-0.99	0.00
Cost of land (%)	4.44	-0.23	3.29	-0.16	4.90	-0.21
Cost of skilled work (%)	1.21	0.00	2.10	0.01	3.62	0.02
Cost of unskilled work (%)	1.44	0.00	2.44	0.01	4.17	0.01

Source: Authors.

[12] This refers to GTAP's 57 sectors.

Regarding trade balances, Ukraine reports negative results for all three scenarios, with losses of 1774.83 million euro, 3935.09 million euro and 7,383 million euro in scenarios 1, 2 and 3, respectively; in contrast, EU benefits from an improvement in its trade balance by 391.77 million euro, 652.64 million euro and 1,351 million euro, respectively. Total output increases in Ukraine in scenario 1 and declines in scenarios 2 and 3 by 0.11% -0.29%, -0.99%, respectively. In the EU, total output declines slightly in scenario 1 (-0.01%) and remains unchanged in percentage terms in scenarios 2 and 3. Regarding the price of land and the salaries of skilled and unskilled workers, the EU does not experience any major changes. Ukraine experiences positive dynamics in land prices in all scenarios. The salaries of skilled and unskilled workers in Ukraine are also projected to grow in all scenarios, with the largest increase in scenario 3 and lowest in scenario 1.

In light of the presented results, the DCFTA can be considered moderately beneficial for both sides. Ukraine benefits slightly more in terms of the increase in consumer welfare, salaries for skilled and unskilled workers, and land prices than the EU. However, the EU improves its trade balance and total output, whereas Ukraine's worsens.

Moreover, the results presented in Table 2 allow us to quantitatively evaluate the costs and benefits of bilateral trade liberalisation without exemptions compared to currently applied liberalisation with exemptions. In terms of Ukraine's GDP, the difference between gains in the third and second scenarios (215 –135 million euro) is 80 million euro. In terms of welfare gains, this difference is 650 million euro (1,607 –957 million euro). On the EU side, the difference in GDP between scenarios 3 and 2 is 86 million euro (302 –216 million euro), and the difference in welfare is 148 million euro (496 –348 million euro).

Domestic production

Table 1 shows a decline in the tariffs for trade between the EU and Ukraine. Consequently, it is logical to expect larger effects in the sectors where high tariffs were in place before the implementation of the DCFTA. The elasticities of substitution[13] used in the GTAP model also play important roles because where the change in tariffs is large and elasticity is high, the shock produced will be strongest.

An analysis of trade liberalisation for both scenarios in Ukraine and the EU is conducted for the five most positively affected sectors and for the five most negatively affected sectors. To assist in understanding the importance of gains after the DCFTA, Table A1 in the Appendix presents a ranking in terms of total output and

[13] A Table of the elasticities of substitution can be provided by the corresponding author upon request. The authors did not manipulate any elasticities; they are equal to GTAP's default option.

share of output for each sector in the EU-28 and Ukraine. The changes in sectoral output for the five best and five worst sectors are presented in Tables 3–8.

TABLE 3

TOTAL VARIATIONS IN SECTORAL OUTPUT—UKRAINE: SCENARIO 1

GTAP code	*Brief sector description*	*Output variation (%)*
28 wap	Wearing Apparel clothing, processed/dyed fur	14.21
2 wht	Wheat: wheat and meslin	12.11
27 tex	Textiles: textiles and man-made fibres	6.16
46 cns	Construction: building houses, factories, offices and roads	6.15
12 wol	Wool: wool, silk and other raw animal materials used in textiles	5.25
39 otn	Other Transport Equipment: Manufacture of other transport equipment	-2.26
37 fmp	Fabricated Metal Products: Sheet metal products but not machinery and equipment	-2.46
41 ome	Other Machinery & Equipment: electrical machinery and apparatus, medical precision and optical instruments, watches and clocks	-2.51
8 ocr	Other Crops: live plants, cut flowers and flower buds, flower seeds and fruit seeds, vegetable seeds, beverage and spice crops, etc.	-3.73
20 omt	Other Meat: pig meat and offal, preserves and preparations of meat, meat offal or blood, flour, meal and pellets of meat or inedible meat offal, greaves	-4.00

Note: A detailed description of each GTAP sector code is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

Source: Authors.

According to the results, the apparel sector in Ukraine is the top beneficiary of the unilateral abolition of EU tariffs, with a 14.2% increase in its output. Wheat producers are the second best-placed sector, with a 12.1% increase, followed by textile, construction and wool producers, which obtain increases of 6.2%, 6.2% and 5.3%, respectively. In contrast, five sectors face a decline in output as a result of scenario 1: other meat (-4%), other crops (-3.7%), other machinery and equipment (-2.5%), fabricated metal products (-2.5%) and other transport

equipment (-2.3%). In general, according to the scenario 1 simulation, trade liberalisation is beneficial for Ukraine's total output (+ 0.11%), which is presented in Table 6.

TABLE 4

TOTAL VARIATIONS IN SECTORAL OUTPUT—EU-28: SCENARIO 1

GTAP code	*Brief sector description*	*Output variation (%)*
12 wol	Wool: wool, silk and other raw animal materials used in textile	0.10
3 gro	Other Grains: maize (corn), barley, rye, oats, other cereals	0.07
35 i_s	Iron & Steel: basic production and casting	0.05
1 pdr	Paddy Rice: rice, husked and unhusked	0.05
7 pfb	Plant Fibres: cotton, flax, hemp, sisal and other raw vegetable materials used in textiles	0.04
27 tex	Textiles: textiles and man-made fibres	-0.02
24 sgr	Sugar	-0.02
21 vol	Vegetable Oils: crude and refined oils of soya-bean, maize (corn),olive, sesame, ground-nut, olive, sunflower-seed, safflower, cotton-seed, rape, etc.	-0.04
28 wap	Wearing Apparel: clothing, processed/dyed fur	-0.05
2 wht	Wheat: wheat and meslin	-0.89

Note: A detailed description of each GTAP sector code is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

Source: Authors.

On the EU side, the situation differs considerably for the five most positively affected sectors as well as for the five most negatively affected. In general, due to the size of the EU economy, the percentage changes in production are much more modest than in the case of Ukraine. The wool sector sees the largest increase in output (0.1%), followed by other grains (0.07%), iron and steel (0.5%), paddy rice (0.05%) and plant fibres (0.04%). According to these results, the wool sector is in the top five sectors for both the EU and Ukraine; therefore, this sector is the top winner of the conditions simulated in scenario 1.

The wheat sector shows the largest decline in output, -0.89%, which is reasonable given Ukraine's strong competitive advantage of Ukraine. The four other sectors that have reduced output are much less affected: apparel (-0.05%), vegetable oils (-0.04%), sugar (-0.02%) and textiles (-0.02%). The total EU output (see Table 6) as a result of scenario 1 declines by 0.01%.

TABLE 5

TOTAL VARIATIONS IN SECTORAL OUTPUT—UKRAINE: SCENARIO 2

Ukraine	*Sectors*	*Output variation (%)*
46 cns	Construction: houses, factories, offices and roads	14.11
28 wap	Wearing Apparel: clothing, processed/dyed fur	13.93
2 wht	Wheat: wheat and meslin	11.21
27 tex	Textiles: textiles and man-made fibres	5.75
12 wol	Wool: wool, silk, and other raw animal materials used in textiles	4.88
36 nfm	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver	-3.88
5 osd	Oil Seeds: oil seeds and oleaginous fruit; soy beans, copra	-4.41
8 ocr	Other Crops: live plants, cut flowers and flower buds, flower seeds and fruit seeds, vegetable seeds, beverage and spice crops, etc.	-5.09
37 fmp	Fabricated Metal Products: sheet metal products, but not machinery and equipment	-5.09
20 omt	Other Meat: pig meat and offal, preserves and preparations of meat, meat offal or blood, flour, meal and pellets of meat or inedible meat offal, greaves	-7.98

Note: A detailed description of each GTAP sector code is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

Source: Authors.

Simulating implementation of the DCFTA by both the EU and Ukraine (scenario 2) brings new outcomes, according to which the construction sector is raised to the top position of the increase in output (14.11%) in

Ukraine, compared to scenario 1, where it was fourth from the top. The apparel sector is second, with an increase in output of 13.43%, followed closely by the wheat sector (11.21%) and more distantly by the textiles sector (5.75%) and wool sector (4.88%). The expansion of the construction sector is a very interesting result of this scenario, taking into account that the sector ranks 9th, with an almost 3% share of the Ukrainian GDP.

The most negatively affected sector in terms of output in scenario 2 is other meat, with a decline of almost -8%, which is a continuation of the trend seen in scenario 1. Other sectors facing a decline in output are fabricated metal products (-5.09%), other crops (-5.09%), non-ferrous metals (-3.88%), and vegetable oils (-3.10%). The last one comes as a surprise, as Ukraine has a strong sunflower oil industry. One explanation could be an increase in the price of production factors, which would lead to an increase in the final product price, making it less attractive compared with EU producers. According to the simulation in scenario 2, Ukraine sees a decline in total output of -0.29%, indicating deindustrialisation of the economy.

TABLE 6

TOTAL VARIATIONS IN SECTORAL OUTPUT—EU-28: SCENARIO 2

EU-28	*Sectors*	*Output variation (%)*
5 osd	Oil Seeds: oil seeds and oleaginous fruit; soy beans, copra	0.18
3 gro	Other Grains: maize (corn), barley, rye, oats, other cereals	0.08
12 wol	Wool: wool, silk, and other raw animal materials used in textiles	0.06
35 i_s	Iron & Steel: basic production and casting	0.05
19 cmt	Cattle Meat: fresh or chilled meat and edible offal from cattle, sheep, goats, horses, asses, mules, and hinnies, raw fats or grease from any animal or bird.	0.04
30 lum	Lumber: wood and products of wood and cork, except furniture, articles of straw and plaiting materials	-0.02
23 pcr	Processed Rice: rice, semi- or wholly milled	-0.02
17 gas	Gas: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)	-0.03
36 nfm	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver	-0.03
2 wht	Wheat: wheat and meslin	-0.89

Note: A detailed description of each GTAP sector code is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

Source: Authors.

As can be seen from Table 6, oil seeds, other grains, wool, and iron and steel show increases in output of 0.18%, 0.08%, 0.06% and 0.05%, respectively. The last sector in the top five of increased output is a category of cattle meat (0.04%) The composition of the top five compared with that of scenario 1 is different in terms of two sectors.

The sectors with decreased output in scenario 2 are wheat, which maintains its position in scenario 1 (-0.89%), followed distantly by non-ferrous metals (-0.03%), gas extraction (-0.03%), processed rice (-0.02%) and lumber (-0.02%). The last four sectors differ from scenario 1. The general output level of the EU is not affected in scenario 2 or 3.

TABLE 7

TOTAL VARIATIONS IN SECTORAL OUTPUT—UKRAINE: SCENARIO 3

Sector code	*Sectors*	*Output variation (%)*
46 cns	Construction: houses, factories, offices, and roads	26.52
28 wap	Wearing Apparel: clothing, processed/dyed fur	22.70
2 wht	Wheat: wheat and meslin	16.83
27 tex	Textiles: textiles and man-made fibres	5.75
12 wol	Wool: wool, silk, and other raw animal materials used in textiles	3.79
37 fmp	Fabricated Metal Products: Sheet metal products, but not machinery and equipment.	-7.49
5 ocd	Oil Seeds: oil seeds and oleaginous fruit; soy beans, copra	-7.55
8 ocr	Other Crops: live plants, cut flowers and flower buds, flower seeds and fruit seeds, vegetable seeds, beverage and spice crops, etc.	-8.57
36 nfm	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver	-8.76

20 omt	Other Meat: pig meat and offal, preserves and preparations of meat, meat offal or blood, flour, meal and pellets of meat or inedible meat offal, greaves	-14.32

Note: A detailed description of each GTAP sector code is available at:

https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

Because Scenario 3 is provided for the purpose of quantitatively evaluating exemptions from trade, the results of Table 7 and 8 are in reference to Scenario 2. Analysing the results of Table 7, the ranking of the top five gaining sectors in scenario 3 does not change, but the magnitudes of increase are different. For example, the gains in the construction sector in terms of output in scenario 3 are 26.52%, whereas in scenario 2, they are 14.11%. The increase in scenario 3 compared to scenario 2 is 12% in terms of the baseline scenario. In addition, the three top sectors would benefit more from trade liberalisation without exemptions. The textile and wool sectors would gain slightly less in the same scenario.

In the case of the five most negatively affected sectors in Table 7, the order is preserved with one exemption, the non-ferrous metals sector, compared to scenario 2. The decline in the five most negatively affected sectors is higher in scenario 3 than in scenario 2.

A negative trend observed in Ukraine, particularly under scenario 2 and even more pronounced in scenario 3, is a decline in the output of some key industrial sectors, such as fabricated metal products, non-ferrous metals and some food-producing sectors such as other meat and vegetable oils. This phenomenon of deindustrialisation in Ukraine in DCFTA simulations has also been observed by other authors (Olekseyuk 2016).

TABLE 8

TOTAL VARIATIONS IN SECTORAL OUTPUT—EU-28: SCENARIO 3

EU-28	*Sectors*	*Output variation (%)*
5 osd	Oil Seeds: oil seeds and oleaginous fruit; soy beans, copra	0.31
21 vol	Vegetable Oils	0.13
3 gro	Other Grains: maize (corn), barley, rye, oats, other cereals	0.11
35 i_s	Iron & Steel: basic production and casting	0.10

29 lea	Leather: tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear	0.10
40 ele	Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus	-0.03
46 cns	Construction: houses, factories, offices, and roads	-0.03
17 gas	Gas: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)	-0.04
36 nfm	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver	-0.05
2 wht	Wheat: wheat and meslin	-1.30

Note: A detailed description of each GTAP sector code is available at: https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp, accessed 15 January 2020.

On the EU side, the composition of the five most positively affected sectors in Table 8 changes compared to Table 6. Under liberalisation without exemptions, the oil seeds and vegetable oil sectors are projected to gain in output. Although these changes are relatively small in percentage terms, their importance is considerable in absolute numbers, given the size of the oil seeds and vegetable oil sectors in the EU. This increase in the EU is mirrored by a decline in the same industries in Ukraine (see Table 7). The situation is similar to scenario 2 but with a difference in the size of impact, with the size of the change being stronger in scenario 3. This fact is explained by the high protection put in place for the sunflower industry. After liberalisation, part of the protected industry in Ukraine would become uncompetitive and possibly go out of business.

Discussion

A Computable General Equilibrium (CGE) GTAP model was used in this work to evaluate the possible outcomes of trade liberalisation between the EU and Ukraine under the Association Agreement (AA), which includes the DCFTA. With that aim, four scenarios were simulated,[14] and the results of three of them are presented in the results section. A unique aspect of the study is the inclusion of exemptions from free trade, as in

[14] One of them is a baseline scenario that brings Ukraine's GDP, population and land area to its current size as of the year 2015. The results of the baseline scenario are not presented in the study but are used as background information. The results of the baseline scenario can be provided upon request.

the DCFTA (OJEU 2014). However, the aggregation of information on exemptions in agreement with the 57 aggregated sectors of the GTAP database was quite a challenging issue, and in many cases, arbitrary simplifications were necessary to fit the data.

Of the two scenarios presented, the first considered unilateral tariff abolishment by the EU, the situation that crystallised between April 2014 and 1 January 2016. The second scenario simulated bilateral trade liberalisation with both the EU and Ukraine eliminating their tariffs in accordance with the DCFTA, which is the current situation. The third hypothetical scenario is where bilateral trade is completely liberalised without exemptions. The inclusion of the third scenario allows us to shed light on the quantitative evaluation of exemptions from trade.

The results show that the DCFTA simulated in the three scenarios has a very limited impact on the GDP growth of the EU and Ukraine, which is in line with other studies presented in the literature review. The inclusion of exemptions from trade is estimated to create a loss in GDP in the first year of DCFTA application of 80 M€ in Ukraine and 84 M€ in the EU. However, the latter benefits in its trade balances, whereas the former worsens. This is related to an observed outcome of the scenarios two and three: the de-industrialisation of the Ukrainian economy. These findings were confirmed by Olekseyuk and Balistreri (2014) and Olekseyuk (2016). This fact brings into question the benefits of the DCFTA for Ukraine. A switch of developed economies from production to services is widely observed (Oliva & Kallenberg 2003); however, Ukraine is classified as a transition economy with huge room for growth, and de-industrialisation could be harmful to the country's economic prospects. Therefore, the implementation of all chapters of the Association Agreement, including the DCFTA, is vital to Ukraine. This comprehensive implementation would foster the implementation of reforms, modernisation, increased labour productivity and economic competitiveness as well as improved energy efficiency and a better investment climate. Only after taking such actions could a country expect to achieve sustainable growth and increase its living standard to the EU level. Although trade liberalisation could also produce a restructuring of the Ukrainian economy with redirections in trade and investment flows and, as a result, a change in the shares of the contributions of each sector to GDP, such effects can only be captured in the long run.

Future research could include the elimination of non-tariff barriers (NTDs) to trade in the model, which is particularly important for Ukrainian producers who need to adapt production capacities to EU norms, which would require considerable investment. Similarly, Ryzhenkov *et al*. (2013) highlight the necessity for specific policies to be put in place to help Ukrainian agricultural producers adapt to the EU's sanitary and phytosanitary

standards. Rau and Verma (2015) proposed one possible modelling approach to address that. Consideration of long-term effects should include investment inflow and capital accumulation, technological improvement and possible demographic changes. A major portion of the issues addressed in this last paragraph could be solved using a Dynamic CGE approach, which would allow us to evaluate the long-term impact of the DCFTA.

Conclusions

In the present study, a Computable General Equilibrium model is used to assess three proposed scenarios of the DCFTA between the EU and Ukraine. Although the topic of evaluating the DCFTA between the EU and Ukraine is not new, the implementation of exemptions from free trade was not considered in previous studies.

From the point of view of production output, the results show a slight increase in total output in Ukraine in the first scenario (0.11%) and a moderate decline in the second scenario (-0.29%). On the EU side, the output decline is very small in the first scenario (-0.01%) and is almost unchanged in the second scenario.

Regarding sectoral performance in Ukraine, the wheat sector increases output in both scenarios, as do the textile, apparel and construction sectors. The last expands the most of all sectors under scenario 2 (14.11%) and has the highest share of GDP in terms of benefiting from the DCFTA. On the EU side, the wool, other grains, iron and steel, and cattle meat sectors are the main beneficiaries.

The analysis of GDP growth shows that in absolute numbers, Ukraine has a larger increase in GDP in the first scenario (77.95 M€) than the EU (56 M€), whereas the EU benefits more in scenario 2 (216 M€) than Ukraine (135.3 M€) and three (EU 302 M€, Ukraine 215 M€). However, both experience higher GDP growth in scenario 3 than in scenario 1 and 2.

The welfare assessment based on an allocative efficiency analysis shows that Ukraine benefits the most in all three scenarios (703.03 M€, 957.02 M€ and 1,607 M€, respectively), whereas the EU experiences a decrease in its welfare in scenario 1 (-156.58 M€) and an improvement in scenario 2 and 3 (348.64 M€ and 496 M€).

The dynamics for land prices and salaries for skilled and unskilled workers are positive for Ukraine in all scenarios. On the EU side, a small decline in land prices is observed, and salaries for both categories of workers are practically unaffected in all scenarios.

Scenario 3 considered the evaluation of exemptions from the trade liberalisation. Calculating differences between the impact of scenario 2 and 3, we obtained a quantitative evaluation of exemptions from trade. In terms of GPD in Ukraine, exemptions from trade cost 80 M€. Likewise, the cost in terms of welfare for

Ukraine is 650 M€. On the EU side, the cost of the exemptions in terms of GDP is 86 M€ and in terms of welfare, 148 M€. Moreover, considering the impact on sectoral output, scenario 3 amplifies the impact of scenario 2 in terms of increases or decreases in the production in the main sectors affected by the exemptions from trade.

The conclusions of the present study refers only to trade liberalisation through the elimination of tariffs. The implementation of other chapters of the Association Agreement, including DCFTA, would probably bring other effects not considered in the present study.

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