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Ukraine's unconsidered losses from the annexation of Crimea: What should we account for in the DCFTA forecasts?

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Abstract

In March 2014 Crimea unilaterally declared its independence from Ukraine and joined the Russian Federation. The separation of a part of a state's territory and economy is an interesting matter to look into. Not only the economy of Ukraine has shrunk, it has also changed its structure as Crimea had a quite distinct production pattern compared to the rest of Ukraine. Moreover, policy measures that have been initialized before the separation may have different effects once applied only to a part of the former economy. This paper proposes a strategy to model the separation of part of an economy and its inclusion into another country and applies this strategy to the case of Crimea, Ukraine and Russia. After having constructed a model for the new geographical and economic situation we re-investigate the possible effects of a Deep and Comprehensive Free Trade Agreement (DCFTA) between Ukraine and the EU and compare the results for the situation with Crimea as part of Ukraine. We find that the annexation of Crimea leads to severe economic losses for Ukraine which are partly over-proportional compared to Crimea's economic size. These negative effects can be compensated by implementing the DCFTA with the EU as we also show in our model results.

JEL classification: C68, F12, F15, F51

Keywords: Ukraine, Crimea, annexation, territorial changes, Free Trade Agreement, CGE, Melitz, DCFTA, EU, Russia

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1 Introduction

In February 2014 the peninsula Crimea unilaterally declared its independence from Ukraine. In a referendum in March 2014 the Crimean people declared their will to join the Russian Federation. Though the declaration of independence and the referendum are not acknowledged by Ukraine and most of the international community, Crimea is de facto a Russian republic now and Russia has put measures in place to integrate it into the Russian Federation. Hence, as a matter of fact the economic capacity of Crimea is no longer available to the Ukrainian economy. As Crimea constituted 5.2% of the Ukrainian population and 3.7% of Ukrainian GDP in 2013[1], this is a non-negligible loss for the fragile economy of Ukraine.

The separation of a part of a state's territory and economy is an interesting matter to look into. Not only the economy of Ukraine has shrunk, it has also changed its structure as Crimea had a quite distinct production pattern compared to the rest of Ukraine. Moreover, policy measures that have been initialized before the separation may have different effects than expected, once applied only to a part of the former economy. The separation of the Crimean economy from Ukraine leads to a loss of resources (labor, capital, land, natural resources) but also to fallen FDI inflows, losses in efficiency and productivity, disrupted production chains and (temporarily) closed businesses. In addition, unexpected migration needs to be considered. It is not straightforward how one could include this into an economic model. As such incidents are scarce, there is also only a very small literature on the issue of territorial changes and their economic effects.

Ukraine's Deep and Comprehensive Free Trade Agreement (DCFTA) with the EU is broadly evaluated in the literature due to the scheduled implementation of the agreement in January 2016. Different studies[2] quantify the impact of this policy reform and suggest welfare gains for Ukraine ranging from 3% to 12%. However, all these studies are obsolete as they fail to consider the latest substantial changes of the country's economy associated to Crimea joining Russia as well as the separatist movement in Eastern Ukraine. Since the losses from the military conflict in Eastern Ukraine are still growing[3] and cannot be reliably measured, at least the annexation of the Ukrainian peninsula has to be taken into account while evaluating the DCFTA impact. This paper proposes a strategy to model the separation of part of an economy and its inclusion into another country and applies this strategy to the case of Crimea. After having constructed a model for the new geographical and economic situation, we re-investigate the possible effects of the deep integration between Ukraine and the EU and compare the results for the situation of Crimea being a part of Ukraine with the de facto case of belonging to Russia.

There is only a handful of incidences of territorial changes in the last years and hence, only a

[1] According to statistical publications of the State Statistics Service of Ukraine ("Regions of Ukraine" and "Gross Regional Product") available at `http://www.ukrstat.gov.ua/`.

[2] See, e.g., Emerson et al. (2006), ECORYS and CASE-Ukraine (2007), Maliszewska, Orlova, and Taran (2009), Movchan and Giucci (2011), Olekseyuk and Balistreri (2014) Olekseyuk (2016).

[3] See the reports by the UN Office for the Coordination of Humanitarian Affairs available at `http://reliefweb.int/country/ukr`.

very limited amount of papers proposing ways to model such incidences with modern economic frameworks. The only study also treating the case of Crimea is conducted by Barry (2014) and includes only a reduction of Ukraine's factor endowment induced by the separation of the Crimean economy from Ukraine. The results indicate that Ukraine's real GDP will fall by nearly 15% and the welfare will decline by seven billion USD. This is a surprisingly large effect, given that only a part of the losses for the Ukrainian economy are covered in the model.

There exist three studies on the effects of a possible, fictional re-unification of Korea: Chang (1997), Noland, Robinson, and Liu (1998), and Noland, Robinson, and Wang (2000). These papers, however, are not fully applicable to our research question as they treat the fusion of two formerly separated economies. The papers model, more or less, only the installation of a free-trade area with labor migration but still two distinct economies. Hence, these papers are not comparable with our use case, even though they give useful insights into the important aspects.

A situation slightly more comparable to the case of Crimea is the independence of South Sudan in 2011. Here we find - like for Crimea - the split of a former uniform economy into two parts with distinct production patterns. However, South Sudan is now an independent country and has not joined another third one. Siddig (2014) has published work on the effects of the separation of Sudan and explicitly on the implementation in a CGE model. Due to a lack of data on South Sudan, they are not able to have an explicit SAM for South Sudan. However, they deduct the population and the natural resources that now belong to South Sudan from Sudan's endowment and account for increased transaction costs due to the new border dividing the country. They find that the Sudanese economy as a whole has clearly suffered from the division. Our approach is much in line with this, but due to a rather good data availability we are partly able to account for sector-specific changes as well.

Other regions for which related questions occur comprise the split of former Yugoslavia, the Kosovo, the Kurdish territories in Iraq and the regions in Syria and Iraq under the control of the Islamic State. However, these regions have all gone through devastating wars in recent years and thus, many other aspects have to be taken into account in addition to the regional restructuring as for instance Ianchovichina and Ivanic (2014) show.

Using the GTAP 9 dataset with the base year 2011 as well as Ukrainian statistics from Derzhkomstat[4], we develop an innovative multi-regional general-equilibrium simulation model accounting for monopolistic competition and heterogeneous firms in manufacturing and services sectors.[5] Our preliminary results indicate that a redistribution of the Crimean endowments (natural resources, land, capital, skilled and unskilled labor) alone from Ukraine to Russia gen-

[4]State Statistics Service of Ukraine.

[5]Following the theory developed by Melitz (2003). Similar model structure was applied by Olekseyuk and Balistreri (2014).

erates welfare losses of more than 7% for Ukraine while Russia's benefit remains under 1%. The DCFTA however reverses most of the losses for Ukraine. Therefore, the negative effects associated to Crimea's annexation as well as the separatist movement in Eastern Ukraine should be accounted for while forecasting the impact of Ukraine's deep integration with the EU.

2 Conceptual preliminary considerations

As the economic literature on territorial changes is rather scarce, as pointed out in the introduction, we will describe some conceptual considerations on the (economic) effects of the separation of a part of a state's territory and population before moving to the description of the model and the simulation.

The split of a former unified economy into two parts involves quite a number of important changes. The first change, one might have in mind is - of course - the reduction of the country's population. Hence, an important number of workers but also consumers, tax payers and transfer recipients moves from one country to another. Thus, first of all, the population of Ukraine will be reduced in the model. Though, when it comes to modeling, the questions to ask in this context are: Are the workers in Crimea in general different from those remaining in Ukraine? Are there more or less skilled/unskilled workers compared to the rest of Ukraine? Do the consumers in this part of the country have different preferences? Do richer or poorer households live there, compared to the mean of Ukraine as a whole? Does this part of the population receive more/less transfers from the state? If this information would be completely and reliably available to the modelers, one could account for specific characteristics in the labor endowment, consumption and transfer pattern of the part of the population which is now Russian and has been Ukrainian before.

Apart from the population, the next point to be considered is the land lost to Ukraine and the resources linked to that part of the land. Hence, from a modeling perspective the land as resource is the important part to be included. Information is needed on the agriculturally used land which now belongs to another state as well as the natural resources, especially minerals, which are accessible in these parts of the country. In particular the access to water is crucial in the case of Crimea. Hence, the fish stock now lost to Ukraine must be accounted for as well as the water ways used for transportation and their influence on transport prices. As Crimea is a peninsula, water is a crucial production and transportation factor.

Existing production plants in Crimea are - of course - transferred to the Russian economy as they are located on territory now considered being Russian. Production capital and inventories need to be taken out of the Ukrainian production in the model as well. Here, measurement is rather complicated, especially if firms are operating plants in different parts of Ukraine. Ideally data on regional allocation of capital would be needed in order to account for this shift of productive resources from Ukraine to Russia. The same applies to public capital and infrastructure

which cannot be used separately from the territory it is build on.

There might also be structural differences between the country as a whole and the part which has left unity. Hence, ideally regional input-output-tables would be needed in order to account for the sectoral effects of part of the production of the country now being relocated to another country. An important point to be considered is tourism which is among the most important sectors in Crimea. We have some hints in our data that tourism faced a major drawback as a consequence of the annexation, however, we cannot translate this easily into our model. While it is quite clear that Ukrainians that have visited Crimea for touristic stays might now largely switch to other Ukrainian sea ports, it is unclear whether an increased amount of Russians is now coming to Crimea for holidays, especially as Crimea is a peninsula without a direct access via land to Russia but with one to Ukraine. Thus, visits by train must now be replaced by visits by ship and flight.

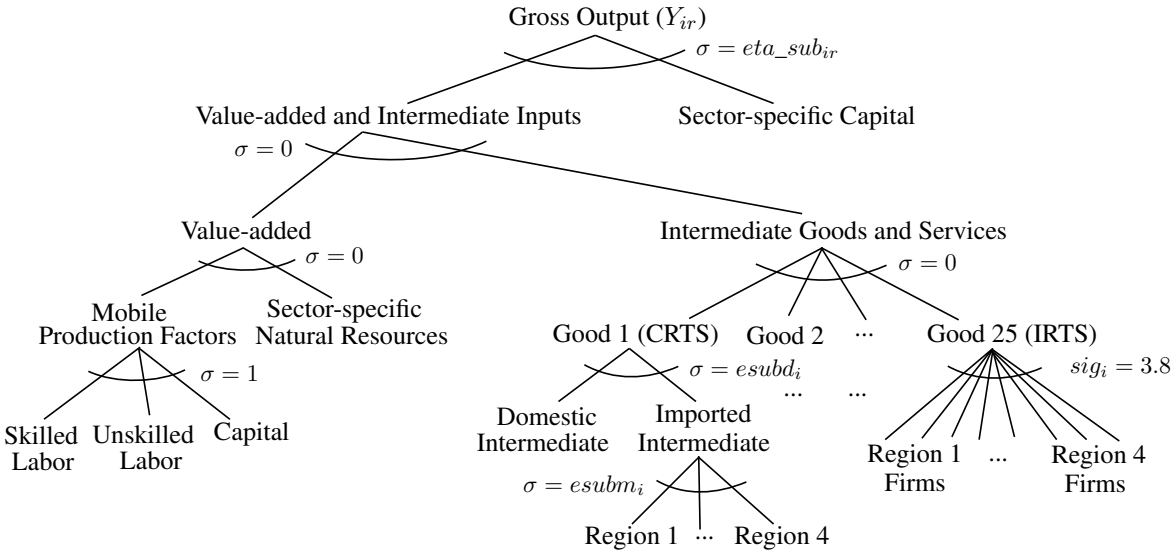
A last point to be taken into account is migration. As not 100% of the population of Crimea has voted for joining Russia, it might be that a part of the Crimean population will decide to move out of Crimea into the rest of Ukraine. On the other hand, some Russian citizens might now move to Crimea given that it is now part of Russia. Hence, data on these migration flows directly induced by the annexation need to be collected and the migration-induced change in the Ukrainian labor force needs to be integrated into the model.

The effects described so far are permanent changes in the size and structure of the economies. In addition to that, a period of transition is to be considered during which additional losses occur due to adaptive difficulties, disrupted production chains, legal changes and other sources of inefficiency. To give some examples: Many businesses in Crimea needed new licenses, in order to be allowed to work in Russia, especially banks. Many employees holding degrees such as teachers, professors, lawyers, prosecutors, judges and notaries needed their degrees certified by the Russian administration before being allowed to work. The change of passports from Ukrainian to Russian is still ongoing which might, in some cases, infer traveling. Theses processes require time and resources that could otherwise be used productively. Especially in the case of banks, the whole economy is affected if they are closed for some time until they have a new license and are able to work under a new legal system. Also the change of the law and the administrative regulation as well as the curriculum in schools are costly for the public administration. Hence, during the time of transition, the economy must be regarded as less efficient then it used to be.

3 Modelling Crimea's annexation

In an ideal world, one would model the change in Ukraine's territory based on regional input-output tables, exact statistics on labor force, capital, natural resources and land at the date of the referendum and exact migration statistics for the time thereafter. However, as modelers we

Figure 1: Production structure



are bound to the data available and hence have to make assumptions or simplifications where data is missing. We have taken into account data from various sources in order to make our model as well-tailored to the status quo as possible.

3.1 Model description

The general-equilibrium simulation model applied in this study is directly developed from the model presented by Olekseyuk and Balistreri (2014). The backbone of the modeling exercise consists of a typical multi-regional and multi-sectoral CGE model with standard assumptions of perfect competition, constant returns to scale (CRTS) and regional differentiation of goods (Armington (1969)). Though, we allow for imperfect competition and increasing returns to scale (IRTS) in some manufacturing sectors and services. In particular, we implement a competitive selection model of heterogeneous firms consistent with Melitz (2003). This allows us to capture two additional effects of trade liberalization, namely, trade growth in new varieties (i.e., extensive margin) and trade-policy induced productivity impacts.[6]

Figure 1 illustrates the production structure for all sectors and all regions of the model. It involves a combination of intermediate inputs and primary factors, which are grouped into mobile production factors and immobile natural resources.[7] This is one of the key differences to the model developed by Olekseyuk and Balistreri (2014). Furthermore, we assume a Cobb-Douglas function over the mobile primary factors (skilled, unskilled labor, and capital) and a Leontief function combining sector-specific natural resources with mobile factors. In the upper nest,we

[6] See Olekseyuk and Balistreri (2014) for a detailed model description.

[7] Natural resources are modeled as sector-specific inputs and include land, mineral resources, oil and gas, water living resources and forest areas.

also assume a Leontief function for a composite of intermediate goods and services on the one hand and production factors on the other hand. Sector-specific capital enters the top nest of the production function together with an aggregate of mobile production factors and intermediate inputs with an elasticity of substitution eta_sub_{ir}, which is calibrated according to the specific elasticity of supply used for modeling of Melitz goods and services.

Each region of the model has two representative agents: a government and a single household. Consumption of goods and services is given by a Cobb-Douglas utility function over sectoral commodity bundles. Both final and intermediate demand are composed of the same Armington aggregate of domestic and foreign goods. In the CRTS formulation, this Armington aggregate is given by a nested CES function where consumers first allocate their expenditures among domestic and imported goods and then decide between foreign varieties from different countries (see the illustration for good 1 in Figure 1). Allowing for imperfect competition and IRTS in selected sectors, we differentiate between domestic and foreign products at the firm level. This requires an assumption of the same substitution elasticity between firms and products.[8] Thus, the composite of the firm level goods is modeled by a single nest CES function with all domestic and imported varieties competing directly (see the illustration for good 25 in Figure 1). General equilibrium is then defined by competition for all producers, balanced budgets for representative households and government in each region, as well as market clearance for all goods and factor markets.

3.2 Simulation of the separation of Crimea and Ukraine

The simulations we conduct in our model of the now-separated territory of Ukraine are structured in two parts. First, we simulate the separation itself in three steps, afterwards we take the results of the last step of the annexation-simulation as new benchmark and simulate the DCFTA between Ukraine and the EU under the new circumstances of a smaller Ukraine. We then compare the results with those obtained for Ukraine as a whole.

We model the annexation of Crimea in three steps. We want to include the components already described in section 2: 1. Transfer of production factors (capital, labor, land, natural resources) from Ukraine to Russia (scenario *Crimea 1* in the following sections), 2. Losses in productivity and efficiency due to the transition and integration of Crimean production facilities into Russian production (scenario *Crimea 2* in the following sections), 3. Migration flows (scenario *Crimea 3* in the following sections). We include these components step-wise in order to account for the fact that we partly rely on assumptions or incomplete data and want to be able to identify the influence of our assumptions separately one from each other.

[8] The inter-variety elasticity of substitution sig_i is based on the the plant-level empirical analysis of Bernard et al. (2003).

3.2.1 Transfer of production factors

Based on regional statistics for Crimea before it left Ukraine, we were able to calculate the share of the Ukrainian workforce which is located in Crimea. We deduct this part of the labor force from the labor endowment of Ukrainian households. Based on our data we are able to make a distinction with respect to skill level.

The calculation for land can be made using statistics of agricultural land. We deduct the share of agricultural land which is located in Crimea and Sevastopol (4%) from the overall land endowment in the data set. For water resources the calculation is much more complicated. Crimea has both rivers and access to the Black Sea as well as fish production as an important activity. However, water access is not explicitly included in GTAP and we could hence not account for both the infrastructure and resources that are linked to access to water but only for fish resources.

The endowment with mineral resources has been calculated based on Ukrainian statistics of mining production. Crimea only produces hydrocarbons and other resources and its share in the respective productions has been deducted from the Ukrainian endowment with resources in GTAP.

For capital we could not find direct statistics on capital stock but on the number of firms active in Crimea as well as their size and the income from capital assets issued to Crimean entities. Based on the last data source we were able to calculate a share of Ukrainian capital located in Crimea and deduct this from total capital endowment in Ukraine.

3.2.2 Losses in efficiency and productivity

The integration of Crimea into the Russian economic and legal system and infrastructure has been a slow and still ongoing process. Banks, lawyers and other officially accredited institutions had to get new licenses in order to be allowed to operate under Russian law. The diplomas of lawyers, judges and teachers as well as civil servants had to be re-evaluated by Russian authorities. The fiscal authorities as well as registration authorities had to be given new orders and directions, passports needed to be printed for all Crimean civilians. Schools and Universities needed to adapt to new curricula. We see in our data, for instance, that all firms have been newly registered as new firms in Crimean regional statistics which leads to a one-time-increase in the number of Crimean firms by more than 1500%.[9] These adaptions take time and hinder the smooth working of the economy. The access to banking is crucial for a well-functioning economy as well as a smooth-working public sector. Hence, we suppose that these processes have temporarily impacted on the productivity of the Crimean peninsula. Our simulation is based on the assumption that for half a year most of Crimean economic activity stopped, which

[9] According to the officially reported number of the registered entities by Krimstat for the 1st of July 2015 (`http://crimea.gks.ru/wps/wcm/connect/rosstat_ts/crimea/ru/statistics/organizations/`), the number of firms increased by 1599.8% compared to July 2014, where probably no data exist due to the reorganization of Krimstat that now belongs to the Federal State Statistics Service of Russian Federation.

translates into a 10% loss in productivity if we suppose that the equilibrium in our CGE is a medium term equilibrium reached after 5 years.

3.2.3 Migration

Based on comparisons of the Ukrainian, Crimean and Russian regional population statistics, we come to the conclusion that from the initial Crimean population of 1958504 persons, approximately 74031 have moved to the Ukrainian main land after the annexation.[10] This is equal to 3.05% of the labor force. We hence deduct this share of the labor force from Crimea and add it to the Ukrainian labor force. We still have to assume that these migrants are comparable in skills and productivity to the whole Ukrainian population for lack of more precise data.

3.3 Simulation: The effects of the DCFTA with the EU

The results from scenario *Crimea3* in subsection 3.3.1. are used to calibrate a new benchmark for Ukraine without Crimea and subsequently the DCFTA is simulated (scenario *DCFTA 2* in the results section). Hence, we model Ukraine's integration with the EU given its new economic structure and size. We compare the results of this simulation with those obtained for Ukraine before the annexation of Crimea shown in simulation *DCFTA 1*.[11]

Both DCFTA scenarios include liberalization of all incorporated barriers, including elimination of import tariffs, reduction of NTBs and barriers to efficient trade facilitation. While NTBs are reduced by only 20% since these barriers cannot be eliminated completely; the bilateral trade facilitation barriers between Ukraine and the EU are assumed to reach the intra-EU level in order to explore the upper bound of trade liberalization. For this purpose we use the measured barriers between Greece and Germany which have approximately a similar distance as the average distance between Ukraine and the member countries of the EU.

3.4 Data

The model is based on the GTAP 9 database calibrated to 2011, which has been aggregated to five regions (Ukraine, Russia, EU, CIS and rest of the world) and 25 sectors. Following Olekseyuk and Balistreri (2014), nine sectors with a high share of intra-industry trade (over 60%) are assumed to produce under IRTS technology.[12] For these sectors we implement monopolistic competition with competitive selection of heterogeneous firms according to Melitz (2003). This allows to capture the trade-policy induced changes in aggregate productivity due to a within industry reallocation of factors from less to more productive plants (including exit of the lowest

[10] Due to Krimstat (`http://gosstat.crimea.ru/`), the population of Crimea declined between January 2014 and July 2014 from 1958504 to 1884473 people. This data, however, does not cover Sevastopol.

[11] The *DCFTA 1* results are computed following the Melitz specification from Olekseyuk and Balistreri (2014) and S3.MLZ.

[12] See Table 2 in the appendix. OMN (Minerals nec) is treated as a CRTS sector even though it has a high share of intra-industry trade. The reason is a diverse set of mineral products included in the sector which consequently leads to the high share of intra-industry trade.

productivity firms).

All distortions included in the GTAP dataset (import tariffs, export subsidies, and domestic taxes) are incorporated into the model. Focusing on Ukraine, however, we make adjustments in the distortions that directly impact Ukraine. We use import tariffs taken from the Law of Ukraine, "About the Customs Tariff of Ukraine," including all amendments associated with Ukraine's accession to the WTO. Hereby, the WTO, ITC, and UNCTAD (2007) methodology is used to calculate the ad valorem equivalents (AVEs) of specific and mixed tariffs.

The simulations of the Crimean annexation are based on a number of statistical publications from Ukrainian and Crimean statistical offices.[13] In general we tried to base our simulations on data from the year 2013 as this was the last year for which the statistical administration of Ukraine has complete data. For some statistics we had to base our simulations on earlier years if data for 2013 was not available or incomplete.

The area of agricultural land which is transferred from Ukrainian endowment to Russian endowment in the SAM has been calculated based on the statistical yearbook "Agriculture of Ukraine". Data is for 2013. The share of land under agricultural use belonging to enterprises and households in Crimea and Sevastopol constitutes 4.1% of Ukrainian agricultural land.

The share of capital endowment transferred from Ukraine to Russia is calculated based on income statistics (as capital endowments in SAMs are generally captured), more precisely on capital income reported by households and enterprises located in Crimea and Sevastopol. According to the Ukrainian publication "Income and expenses of the population for 2013 by regions of Ukraine", 4% of capital income in 2013 has flown to Crimea and Sevastopol.

The share of the labor force living in Crimea and Sevastopol has been calculated based on the publication "Labor of Ukraine in 2013". As the labor categories in Ukrainian data did not match the labor categories in GTAP, we aggregate the labor force to only skilled and unskilled labor. According to labor statistics, 4.3% of skilled and 4.4% of unskilled labor in Ukraine live in Crimea and Sevastopol.[14]

Natural resources constitute a distinct factor category in GTAP which subdivides into several resource categories. We calculate the share of Crimea and Sevastopol in the total endowment with natural resources based on the production of these resources from production statistics. Data for fossil resources stems from the statistical publication "Regions of Ukraine", data for the renewable resources from the publication "Environment of Ukraine" both are for the year

[13] All publications of the State Statistics Service of Ukraine are available at `http://www.ukrstat.gov.ua/`. These include Derzhkomstat (2014a), Derzhkomstat (2014b), Derzhkomstat (2014c), and Derzhkomstat (2014d) and Derzhkomstat (2015).

[14] As endowments in the SAM and model are based on income shares not on headcounts, we have weighted the respective number of workers with the average remuneration for the respective labor category.

2014. Based on these, Crimea and Sevastopol produce 5.7% of hydrocarbons and 4.2% of other minerals produced in Ukraine, 63% of fish and comprise 3.1% of Ukrainian forests. Crimea and Sevastopol do not have noteworthy endowments in coal, we therefore do not touch these endowments in the Ukrainian SAM.

Migration is based on a comparison of the population statistics before and after the referendum. We based our calculations on three sources: Ukrainian population statistics, the Crimean regional statistics office's population data and Russian statistics authorities. As the Ukrainian and Crimean data for the change between beginning of 2014 and mid 2014 is highly comparable, we adopt the change in the population of Crimea and Sevastopol as reported by Ukraine (which is an emigration of 3% of the population).

To simulate the establishment of the DCFTA between Ukraine and the EU we need to apply the AVEs for non-tariff barriers (NTBs) to trade and for barriers to efficient trade facilitation. Concerning NTBs, we aggregate the AVEs estimated by LooiKee, Nicita, and Olarreaga (2009). For the trade-facilitation AVEs, we use the values based on the research of Hummels (2007), Hummels, Minor, et al. (2007) and Hummels and Schaur (2013). They estimate the value of one day saved in transit for more than 600 HS 4-digit level products. Using these estimates Minor and Hummels (2010) provides country and product specific AVEs for trade time costs as a separate package of the GTAP database.[15]. Combining these estimates with the number of days needed to export or import goods from the World Bank's Doing Business dataset for 2012, we get the bilateral overall trade time costs by country and sector.

4 Results

We describe the results following the same structure as shown in the previous section. We first present the effects of the Crimean annexation separately and subsequently describe the effects of an integration with the EU based on the new, smaller Ukrainian economy. The results on macroeconomic aggregates are shown in table 4.1 for all scenarios.

4.1 Crimean annexation

The effect of the reduction of Ukraine's factor endowment by the Crimean part as shown in scenario *Crimea 1* has - as one would expect - a strong negative impact on the Ukrainian GDP and welfare. Welfare drops by 7.36% and real GDP by 4.56%. Hence, welfare losses are even larger than GDP losses indicating lower consumption possibilities for the Ukrainian population and a stronger effect on consumer prices compared to overall prices.

[15] See `http://mygtap.org/resources/#Estimates`

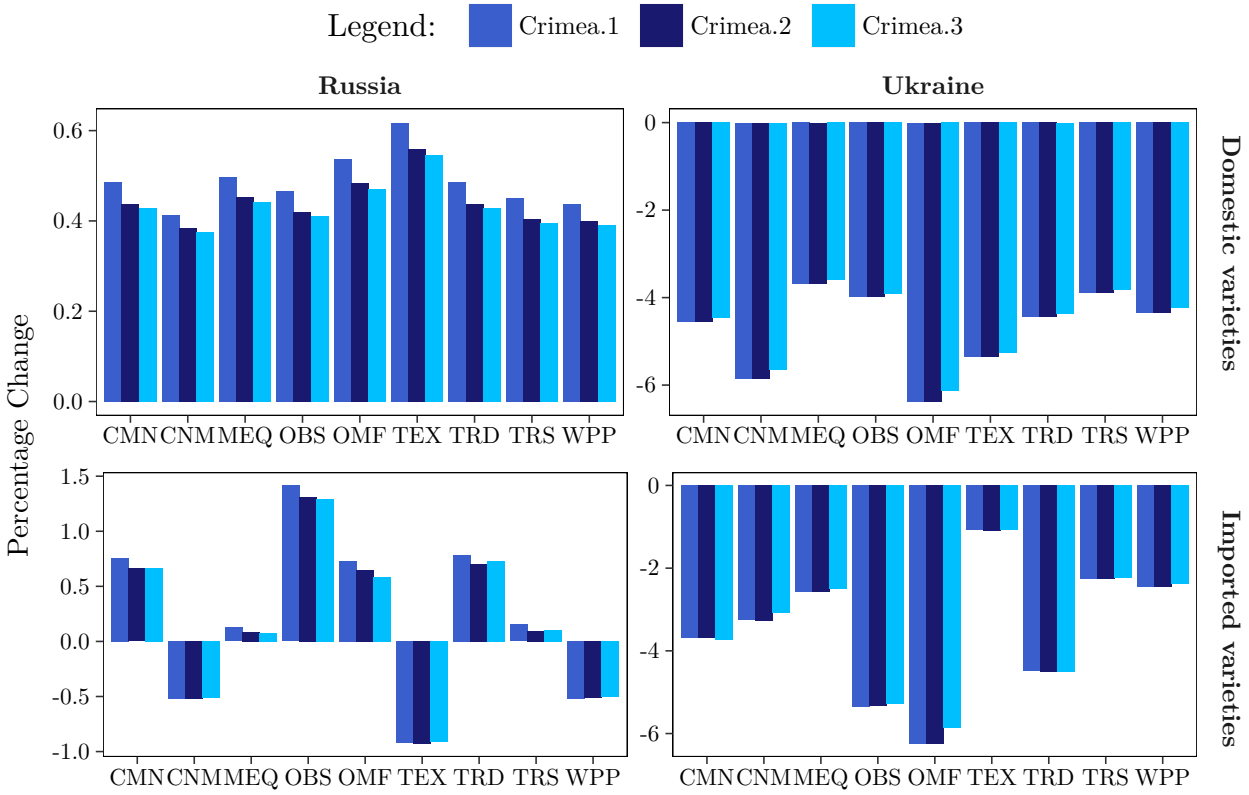
Table 1: Results for macroeconomic aggregates, change in %

	Crimea 1	Crimea 2	Crimea 3	DCFTA 1	DCFTA 2
Welfare (Hicks welfare index)					
UKR	−7.36	−7.36	−7.22	8.63	7.45
RUS	0.89	0.80	0.78	−0.11	−0.11
EU	−0.01	−0.01	−0.01	0.09	0.10
CIS	0.01	0.00	0.00	−0.16	−0.18
ROW	0.00	0.00	0.00	0.00	0.00
Real GDP*					
UKR	−4.56	−4.56	−4.48	5.39	4.75
RUS	0.42	0.37	0.37	−0.05	−0.05
EU	−0.01	−0.01	−0.01	0.07	0.08
CIS	0.00	0.00	0.00	−0.08	−0.09
ROW	0.00	0.00	0.00	−0.01	0.00
Exports					
UKR	−4.14	−4.14	−4.07	15.34	15.08
RUS	0.24	0.20	0.20	−0.58	−0.63
EU	0.00	−0.01	−0.01	0.61	0.59
CIS	−0.09	−0.09	−0.09	−0.51	−0.54
ROW	0.00	−0.01	−0.01	−0.29	−0.29
Imports					
UKR	−3.73	−3.74	−3.67	13.38	13.19
RUS	0.19	0.17	0.16	−0.65	−0.69
EU	0.00	0.00	0.00	0.53	0.52
CIS	−0.08	−0.09	−0.09	−0.60	−0.64
ROW	−0.01	−0.01	−0.01	−0.26	−0.27
Capital*					
UKR	−5.60	−5.60	−5.49	4.61	4.77
RUS	0.50	0.46	0.45	−0.09	−0.07
EU	−0.01	−0.01	−0.01	0.09	0.10
CIS	−0.02	−0.01	−0.01	−0.07	−0.05
ROW	0.00	0.00	0.00	0.02	0.03
Skilled labor*					
UKR	−1.80	−1.80	−1.76	5.55	3.88
RUS	0.05	0.05	0.05	−0.06	−0.06
EU	−0.01	−0.01	−0.01	0.09	0.09
CIS	−0.01	−0.01	−0.01	−0.02	−0.03
ROW	0.00	0.00	0.00	0.02	0.02
Unskilled labor*					
UKR	−3.37	−3.37	−3.30	11.10	9.36
RUS	0.25	0.23	0.23	−0.11	−0.11
EU	−0.01	−0.01	−0.01	0.05	0.06
CIS	−0.01	−0.01	−0.01	−0.13	−0.15
ROW	0.00	0.00	0.00	0.01	0.01

*All nominal measures for region r (e.g., nominal GDP and factor earnings for capital, skilled and unskilled labor) are scaled by the true-cost-of-living index for region r, where the true-cost-of-living index is given by the unit expenditure function. Percentage change in this table is then reported for the real GDP and real factor earnings.

Looking at the number of domestic and imported varieties in Ukraine (see Figure 2), we observe a reduction in all IRTS sectors by approximately up to 6% for other manufacturing (OMF). This consequently leads to a lower number of total varieties consumed in Ukraine (see Table 4). However, counting up the varieties to explain the welfare changes along the extensive margin can be misleading as varieties enter the expenditure system under different prices. Thus, we calculate the so-called Feenstra ratio to take this into account (bottom panel of Table 4).[16] The negative percentage change of Feenstra ratio in all IRTS sectors indicates losses along the extensive margin for Ukrainian consumers.

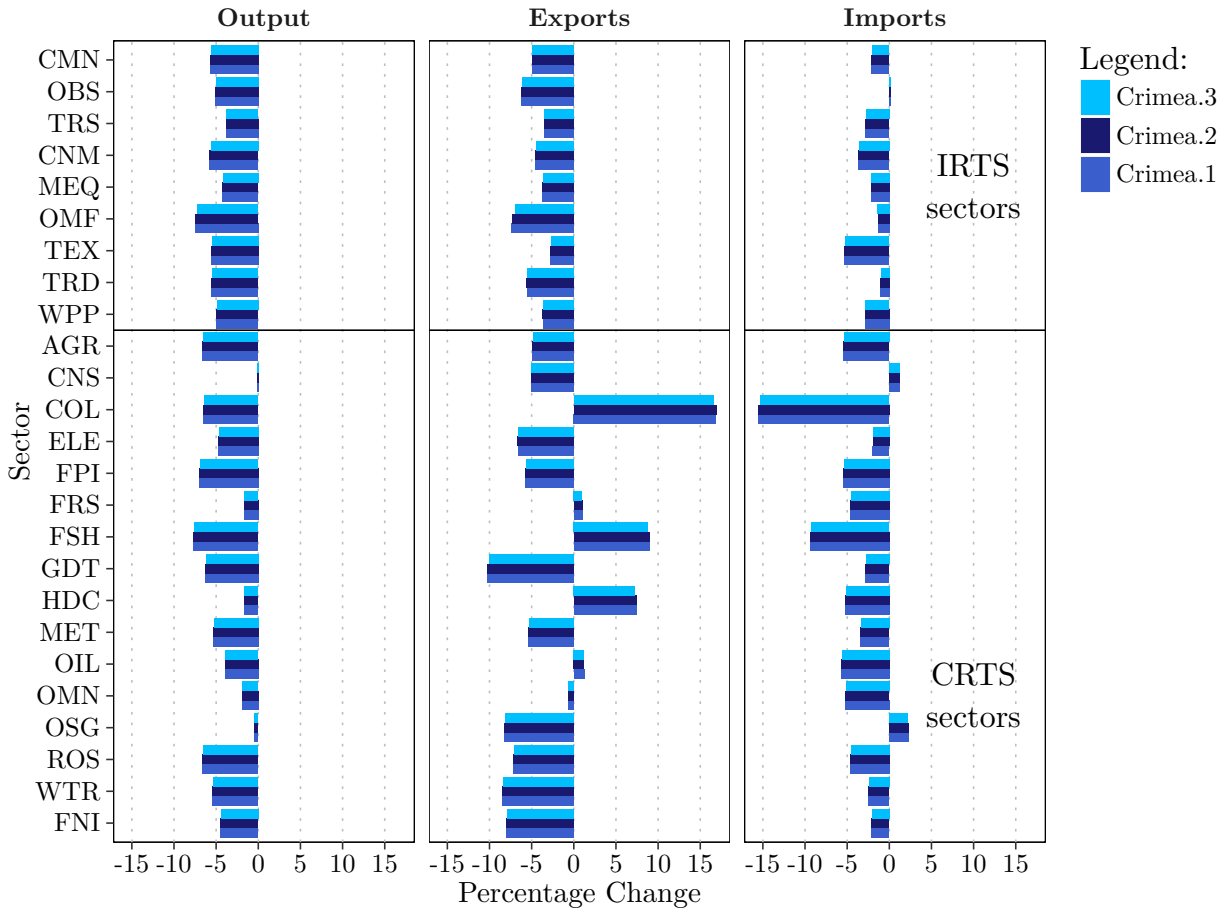
Figure 2: Crimea: Domestic and imported varieties in Ukraine and Russia, change in %



The sectoral effects of Crimean annexation on production are shown in Figure 3. None of the production sectors in Ukraine shows a growing production, however, losses are spread unevenly across sectors. While all IRTS sectors lose strongly from -4.17% in machinery and equipment (MEQ) sector to -7.48% in other manufacturing (OMF), many of CRTS sectors experience a lower reduction of their output and exports indicating a reallocation of resources towards the

[16] Comparing equilibria t versus $t-1$, Feenstra (2010) shows that the variety gains can be measured by deviations in the following ratio from unity: $\left(\lambda_{hr}^{t}/\lambda_{hr}^{t-1}\right)^{-1/(\sigma_h-1)}$, where λ_{hr}^{z} is region-r's share of expenditures at equilibrium z on good-h varieties available in both equilibria to the total expenditures on good-h varieties at z.

Figure 3: Crimea: Disaggregate results for Ukraine, change in %



CRTS sectors. However, the highest or over-proportional losses are found for sectors such as agriculture (AGR), food processing (FPI), fishing (FSH), coal (COL) and gas (GDT) as well as other manufacturing (OMF) and recreational and other services (ROS). Most of these sectors produce under constant returns with intensive use of unskilled labor.

The welfare loss for Ukraine comes along with a much smaller but still noteworthy gain in welfare (0.89%) and GDP (0.42%) for Russia due to the increased availability of production factors. It should, however, be noted that we have not included the - probably - negative effect of the European and US sanctions against Russia that came as a result of the Russian intervention in Ukraine. Given that the Russian gains in our simulations lie well below 1%, these might be overcompensated by the negative effects of the sanctions.

The welfare effect for the EU is negative but very small (-0.01%) and for the CIS region it is positive and very small (0.01%), the rest of the world is not affected.

Assuming, that the productivity of Crimean production factors is - temporarily - reduced due to transition costs (*Crimea 2*), leaves the economic effects for Ukraine untouched as the deduction of the Ukrainian endowment stays the same, but reduces the gain from the Crimean

annexation for Russia as the newly acquired resources and workforce are less productive during a period of transition. The gain in GDP for Russia is reduced to 0.37% and the gain in welfare to 0.80%. The increase in the number of domestic varieties is also smaller compared to the *Crimea 1* scenario, which results in slightly smaller welfare gains along the extensive margin.[17] Hence, the overall small positive effect for Russia is reduced if we account for transition costs.

Additionally accounting for outward migration from Crimea (*Crimea 3*) slightly reduces Ukraine's losses in welfare (-7.22%) and GDP (-4.48%) and the Russian gains in welfare (0.78%) while leaving Russian GDP almost unchanged compared to *Crimea 2*. However, the additional effects in the scenarios *Crimea 2* and *Crimea 3* are very small compared to the initial effect of Crimea separating from united Ukraine. The results for economic aggregates clearly indicate a severe loss for Ukraine from Crimea joining Russia.

We also find a strong reduction in trade both inwards and outwards of Ukraine as a result of the reduced production and consumption. Hereby, exports (-4.14%) are more affected than imports (-3.73%) turning the trade balance to the negative. Again, the additional effects in the second and third scenario are of minor importance, but especially the amplifying effect of migration is noteworthy with exports and imports falling less by 4.07% and 3.67% respectively. Russian trade is slightly positively affected while EU and rest of the world are nearly unaffected. Interestingly, there is some trade diversion from the CIS due to the slightly negative trade effect which has no direct GDP and welfare impact, but arises because of strong trade links to Ukraine.

Given the large reduction in production and welfare of Ukraine in reaction to the Crimean annexation, it is interesting to have a look at factor earnings in order to see who bears the costs of Crimea joining Russia. The results show that capital is most affected with a decrease in its real factor income by 5.60% in Ukraine, which is slightly reduced to 5.49% if migration from Crimea to Ukraine is taken into account. The Ukrainian capital stock is reduced by 4% with the Crimean annexation but the decline in capital income is even higher. This over-proportional decline in capital earnings is driven not only by the reallocation effects within Ukraine, but also by a slight relative change in the factor endowments. As Crimea has slightly more labor compared to capital and arable land, its separation from Ukraine leads to a relatively stronger decline in labor endowment making labor scarcer than capital and land, and consequently leaving capital (and land) owners slightly worse off.[18] Russian capital owners slightly benefit in the same scenarios with their remuneration increasing by 0.50 and 0.45% respectively.

The second largest effect on factor remuneration is found for unskilled labor. The earnings of unskilled labor fall by 3.37% in the *Crimea 1*-scenario and by 3.30% in the *Crimea 3*-scenario. However, the endowment of unskilled labor has fallen by 4.3%. Hence, although Ukraine as a whole loses income from this source, the workers are better off as their remuneration in real

[17] See Table 4, comparison of Feenstra ratio for *Crimea 1* and *Crimea 2*.
[18] Real income of land owners falls by more than 6% (see Table 7 in the appendix).

terms has increased. The same is true for skilled labor. Skilled labor income falls only slightly even though skilled labor endowment declines by 4.2%, thus the reduced availability of workers, both unskilled and skilled, leads to increasing real wages.

We find a very strong decline in the income from natural resources (see table 7 in the appendix). In particular, Ukrainian real income from coal, other mineral resources and water living resources declines by more than 30% even after the inclusion of migration. Income from forest resources declines by 28% and income from land declines by 6%. Especially for coal, other mineral resources and forest resources, this effect is much higher than the initial shift of the resource endowment from Ukraine to Russia. There is no reduction in the endowment of coal, hence, the reduction in income is completely induced by a shift in the production structure, as shown above. For land, the effect is over-proportional with a 6% decline in land income in reaction to a 3.7% decrease in land endowment. For fish, in contrast, the effect is less pronounced than the resource endowment reduction (63% of Ukrainian fish production was located in Crimea, but the income is reduced only by 39%) indicating a much higher price for fish and a shift to other competing agricultural sectors. Nonetheless, Ukraine loses an important income source with the strong decline in fishing grounds.

4.2 Effects of the DCFTA

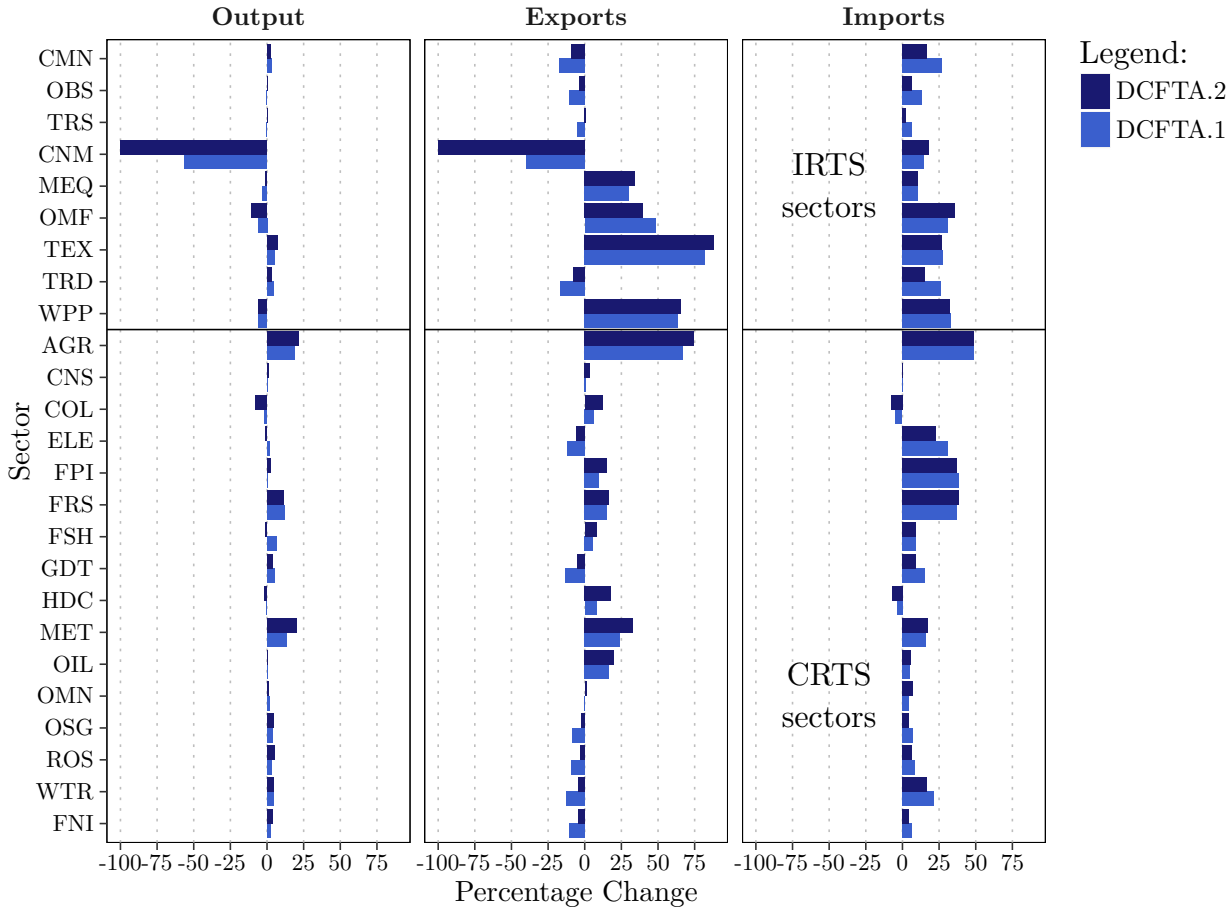
Similarly to the previous findings in the literature,[19] the DCFTA between Ukraine (with Crimea as a part of its territory, i.e., scenario *DCFTA 1*) and the EU is welfare increasing for the both partners (8.63% and 0.09%, respectively), with corresponding improvements in aggregate income measured by real GDP. Hereby, the EU gains are relatively small given that the embodied liberalization applies to a very small part of the EU economy.

Following Olekseyuk and Balistreri (2014) and Olekseyuk (2016), there is a little danger of deindustrialization dominating the overall welfare gains. Similarly to the aforementioned studies, we find a reallocation of resources and production into Ukraine's traditional export sectors producing under constant returns (see Figure 4). Thus, trade liberalization intensifies the production and exports of agriculture (AGR), metallurgy (MET) and other sectors in which Ukraine has a traditional comparative advantage, while the IRTS sectors shrink in the face of EU-based import competition. While the total number of available varieties increases for all IRTS sectors in the EU, the results for Ukraine are negative in almost all IRTS sectors due to reduction of both domestic and imported varieties (see Figure 5).[20] However, considering the percentage change of Feenstra ratio (Table 4), the results indicate no losses along the extensive margin meaning

[19] See, e.g., Emerson et al. (2006), ECORYS and CASE-Ukraine (2007), Maliszewska, Orlova, and Taran (2009), Movchan and Giucci (2011), Olekseyuk and Balistreri (2014) and Olekseyuk (2016).

[20] Manufacture of machinery and equipment (MEQ), other manufacturing (OMF), textiles (TEX) and wood and paper industry (WPP) demonstrate an increase of imported varieties in Ukraine. However, for all these sectors except other manufacturing (OMF), it is not enough to compensate for the losses of Ukrainian domestic varieties.

Figure 4: DCFTA: Disaggregate results for Ukraine, change in %



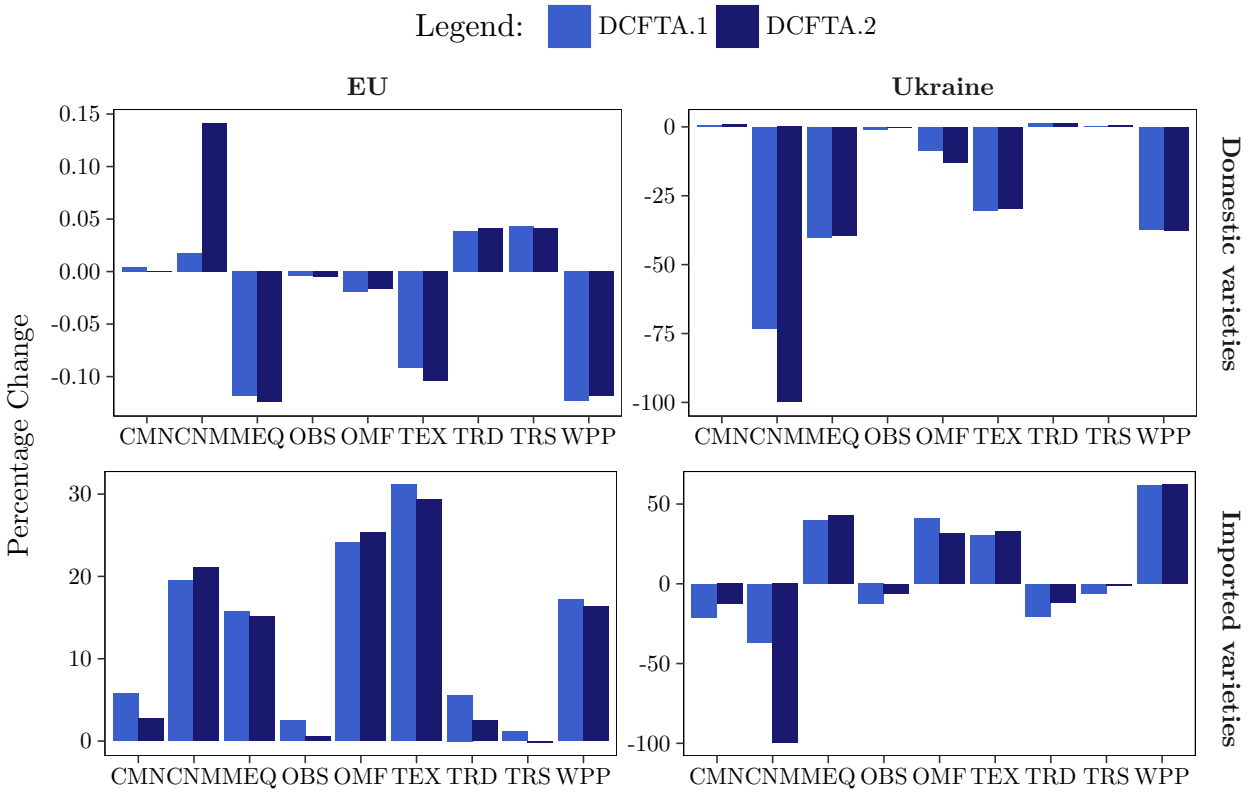
that lost varieties in Ukraine represent low productivity goods with relatively high prices and low quantities, so that net impact is positive.

The results of the DCFTA after the annexation of Crimea (*DCFTA 2*) show that the negative effects from the loss of the peninsula can be compensated by the positive effect of Ukraine's integration with EU. The DCFTA leads to a strong positive effect on Ukrainian GDP (+4.75%) also if the Crimean annexation is taken into account. We also find a highly positive welfare effect of the free trade agreement of 7.45% after the split of Crimea from Ukraine. A comparison of the initial losses in *Crimea 3* and the gains in *DCFTA 2* shows that for all aggregate variables except from capital income, the free trade agreement more than compensates the initial losses from Crimean annexation. However, for GDP and welfare, the remaining total positive effect of both shocks combined is small (below 1 percentage point). For trade and labor remuneration in contrast, a large positive total effect prevails.

Comparing the results for Russia with Crimea as a part of its economy, we find a qualitative switch in the overall welfare effect which is also noteworthy in size (0.67 percentage points).[21]

[21] This difference is calculated using the positive effect from Crimea joining Russia of 0.78% (*Crimea 3*) and Russia's losses from the DCFTA of -0.11%.

Figure 5: DCFTA: Domestic and imported varieties in Ukraine and the EU, change in %



This can be explained by the welfare gain from annexation of Crimea which compensates Russia for the partial loss of Ukrainian import demand. However, this positive effect on Russia, again, does not account for the sanctions that have been implemented as a reaction to its intervention in Ukraine and that have hit the economy of Russia on a considerable scale.[22]

Concerning trade effects, they are still highly positive for Ukraine also after Crimea's annexation and comparable in size (for exports +15%, imports +13%) with a slightly less high but still considerably positive effect on the Ukrainian trade balance. The small trade creating effect for the EU remains almost unchanged with changes in exports and imports of 0.6% and 0.5%, respectively. Interestingly, with Crimea belonging to Russia, the trade reduction for Russia in reaction to Ukraine's integration with the EU is increased. Moreover, a reduced number of imported varieties leads to a decline of available varieties in the majority of IRTS sectors, and slightly negative changes in Feenstra ratio indicate losses along the extensive margin (see Table 4).

Considering other regions of the model, the welfare and GDP effect for the EU and the rest of the world is nearly unchanged compared to *DCFTA 1.* The effect for the CIS becomes slightly

[22]See *Sanctions after Crimea: Have they worked?* (2016) for a discussion of the effect the EU and US sanctions had on the Russian economy.

more negative if Crimea is not a part of the trade agreement.

Taking a look at factor remuneration we see that especially for capital and unskilled labor, the DCFTA helps to reverse the negative effect from Crimea's annexation as all factors benefit in terms of factor income from the trade liberalization. Even though the effect is lower compared to the simulation with Crimea belonging to Ukraine, the benefits are still quite high. The relative distribution of the gains from free trade with the EU changes compared to the situation with Crimea as part of Ukraine: unskilled labor gains the most, but now capital has the second largest benefit and not skilled labor as before. Still, the total income effect for capital from both shocks (Crimean annexation and DCFTA) is negative while labor income shows a positive overall effect.

For most resources this is also true with earnings from fish production, forest resources and land growing by 140%, 96% and 29%, respectively. However, earnings from coal, oil and gas as well as other mineral resources fall even further after the free trade agreement is implemented due to reduced production in corresponding sectors (see Figure 4). Especially coal production and real income from coal endowment is strongly affected with earnings from coal declining by 44.5%.

5 Limitations

The results presented here give an idea of the large losses Ukraine faces due to the Crimean annexation, but also shed some light on the positive effect of further integration with the EU. A more precise analysis would require detailed regional SAMs such that the economic structure of Crimea could be fully represented and the changes in Ukraine's production structure could be shown. Furthermore, we had to use production or income as a proxy for endowment in some cases, which could also be improved if regional data was available.

Tourism used to be among the top income sources for Crimea, and tourism to Crimea was an important part of Ukraine's internal recreational travel. We suspect that Crimea's tourism sector must have suffered strongly from leaving Ukraine as the number of Ukrainian visitors will have fallen sharply.[23] However, including this into the model would be highly speculative. We have simply no reliable information on the number of internal tourists compared to external ones, on the number of Russian tourist who now travel to Crimea and the number of Ukrainian tourists that now spend their vacation at other Black Sea destinations. Hence, we cannot include that point. We are, however, sure that overall Crimea's tourist sector has lost as traveling to Crimea from Russia is more complicated and expensive than from Ukraine due to non-existent

[23] According to the data provided by the Crimean Ministry of Tourism (`http://mtur.rk.gov.ru/`), 20% of all tourists were coming from abroad in 2014, with only 3.2% from other countries than the CIS. For January - July 2015 the Ministry reports a share of Russian tourists of approximately 80%. Moreover, the structure of tourist flows has changed in 2015 as the majority of tourists (83%) came to Crimea either by air or water (through the Kerch Strait). In comparison, 66% of tourists came to Crimea by train in 2013, and only 34% by air or road (including the ferry through the Kerch Strait).

land public transport. Hence, including the tourism effect would probably reduce Russia's gains from the annexation.

We also could not account for the losses in public infrastructure and public capital for Ukraine as data on public capital is scarce in general and simply not available on a regional basis. Ukraine - of course - have lost all public buildings, streets, universities and other infrastructure on Crimean territory. In addition, Crimea has a number of Black Sea ports that are lost for Ukraine as well as the respective water ways.

A further point to be considered is the effect on internal and external capital transfers. Public as well as private transfers will be affected by the Crimean annexation but we were not able to find reliable data. For FDI flows, data might become available after some time. For public flows the effects would in general show up in the budgets, however, as the conflict in Eastern Ukraine is still ongoing, the Ukrainian government has made massive changes in taxation and transfers with huge cuts in transfers to households and pensions that obfuscate these effects in the budget.

The results presented here can only be understood as the lower bound of the overall effects of the ongoing conflict in Ukraine. We have only included the most obvious effects of the Crimean annexation into our simulations. Moreover, the geographic situation of the peninsula leads to strong economic problems for Crimea as it is now separated from supply of many important imports especially food and energy which were brought to Crimea by land before the annexation and have now to be imported from Russia by air or sea. Hence, the price of living in Crimea has strongly increased since the annexation.

From the perspective of Ukraine, these economic problems in Crimea are of minor importance, however, Ukraine's political situation is far from being settled with the ongoing violent conflict in Eastern territories as well as an unstable government. An important part of Ukraine's infrastructure especially in the East has been destroyed. The important mining production in Eastern Ukraine is not reliable any longer. The permanent threat of further Russian military actions leads to high costs for the military that reduce the government's economic freedom crucially. Future work should address this conflict and its economic effect.

So far, we have not included the effect of the EU- and US-sanctions against Russia into our simulations. Russia suffers from a severe economic crisis since 2014, which is partly attributed to the sanctions which have led to reduced Russian exports to the EU. However, the sanctions have coincided with the sharp fall in oil prices which also strongly affect the Russian trade balance. These two effects lead to the fact that the small gain for Russia, we find in our model, is more than outruled by strong negative impacts on the Russian economy ((*Sanctions after Crimea: Have they worked?* 2016, see)).

6 Conclusion and outlook

In this paper we investigate the implications of Crimea's annexation from Ukraine and revise the impact of Ukraine's integration with the EU, given the new geographical and economic situation. Therefore, we develop a strategy how the split of a formerly unified country can be included in a CGE model also if data is rather scarce. The inclusion of Crimea's annexation in models for Ukraine is crucial as it has a strong economic impact and thus affects the results for other policy simulations which are not directly linked to the conflict between Ukraine and Russia or to the one in Eastern Ukraine.

The annexation of Crimea is highly harmful for Ukraine which suffers from a reduction in real GDP by more than 4% and welfare by more than 7%. Moreover, the number of available varieties declines indicating losses along the extensive margin for Ukrainian consumers. It also has an over-proportionally negative impact on capital income, whereas skilled and unskilled labor experience a decline in factor earnings smaller than changes in their endowments. Russia, on the other hand, ends up with a small gain from the acquisition of Crimea, however, the effect is much below Ukraine's losses and is likely by far outruled by the severe economic downturn induced by the falling oil price and the international sanctions against Russia.

The negative effects from the loss of Crimea can be reversed by implementing the DCFTA with the EU. The GDP and trade effects of the DCFTA are highly positive exceeding 4% in case of real GDP. Factor earnings turn also from negative to positive in reaction to Ukraine's European integration. The welfare gains reach 7.45% indicating no losses along the extensive margin as the lost varieties in Ukraine represent low productivity goods with relatively high prices and low quantities. The reduced number of available varieties, however, suggest a little danger of deindustrialization as also found by Olekseyuk and Balistreri (2014) and Olekseyuk (2016). Nevertheless, working in favor of a deep and comprehensive integration with EU is the right strategy for Ukraine to cope with the effects of the ongoing internal conflict and those of the loss of the Crimean peninsula as the welfare loss is overcompensated by the positive impact of European integration.

7 Appendix

Table 2: Mapping of GTAP sectors

Model specific sectors		GTAP 8.1 sectors	
CRTS Sectors			
AGR	Agriculture and hunting	PDR	Paddy rice
		WHT	Wheat
		GRO	Cereal grains nec
		V_F	Vegetables fruit nuts
		OSD	Oil seeds
		C_B	Sugar cane sugar beet
		PFB	Plantbased fibers
		OCR	Crops nec
		CTL	Bovine cattle sheep and goats horses
		OAP	Animal products nec
		RMK	Raw milk
		WOL	Wool silk worm cocoons
FRS	Forestry	FRS	Forestry
FSH	Fishing	FSH	Fishing
COL	Coal	COA	Coal
HDC	Production of hydrocarbons	OIL	Oil
		GAS	Gas
OMN	Minerals nec	OMN	Minerals nec
FPI	Food-processing	CMT	Bovine meat products
		OMT	Meat products nec
		VOL	Vegetable oils and fats
		MIL	Dairy products
		PCR	Processed rice
		SGR	Sugar
		OFD	Food products nec
		B_T	Beverages and tobacco products
OIL	Petroleum, coal products	P_C	Petroleum, coal products
MET	Metallurgy and metal processing	I_S	Ferrous metals
		NFM	Metals nec
		FMP	Metal products
ELE	Electricity	ELY	Electricity
GDT	Gas manufacture, distribution	GDT	Gas manufacture distribution
WTR	Water	WTR	Water
CNS	Construction	CNS	Construction
FNI	Financial services, insurance	OFI	Financial services nec
		ISR	Insurance
ROS	Recreational and other services	ROS	Recreational and other services
OSG	Public services	OSG	Public administration, defense, education, health
IRTS Sectors			
TEX	Textiles and leather	TEX	Textiles
		WAP	Wearing apparel
		LEA	Leather products
CNM	Chemical and mineral products	CRP	Chemical rubber plastic products
		NMM	Mineral products nec
OMF	Manufactures nec	OMF	Manufactures nec
WPP	Wood, paper products, publishing	LUM	Wood products
		PPP	Paper products, publishing
MEQ	Manufacture of machinery and equipment	MVH	Motor vehicles and parts
		OTN	Transport equipment nec
		ELE	Electronic equipment
		OME	Machinery and equipment nec
OBS	Business services nec	OBS	Business services nec
TRD	Trade	TRD	Trade
CMN	Communication	CMN	Communication
TRS	Transport	OTP	Transport nec
		WTP	Water transport
		ATP	Air transport

Table 3: Factor earnings for natural resources, change in %

		Crimea 1	Crimea 2	Crimea 3	DCFTA 1	DCFTA 2
			Ukraine			
COL	Coal resources	-31.77	-31.80	-31.16	-14.05	-44.48
HDC	Oil and gas resources	-8.84	-8.92	-8.80	-9.90	-9.73
OMN	Other mineral resources	-32.31	-32.33	-31.83	-0.29	-3.94
FSH	Water living resources	-38.99	-38.98	-38.26	26.56	140.51
FRS	Forest resources	-27.99	-28.15	-27.57	95.04	97.55
AGR	Land resources	-6.35	-6.35	-6.23	26.56	29.00
			Russia			
COL	Coal resources	-5.84	-5.97	-5.86	-0.95	-8.48
HDC	Oil and gas resources	1.75	1.55	1.53	0.43	1.65
OMN	Other mineral resources	9.87	8.93	8.75	-8.27	0.50
FSH	Water living resources	5.20	4.68	4.58	0.32	1.46
FRS	Forest resources	11.60	10.49	10.25	-2.96	7.24
AGR	Land resources	0.89	0.80	0.78	0.03	0.01
			EU			
COL	Coal resources	-5.44	-5.44	-5.34	-1.41	-7.91
HDC	Oil and gas resources	0.58	0.50	0.49	-0.56	-0.18
OMN	Other mineral resources	0.40	0.40	0.39	-11.86	-10.06
FSH	Water living resources	-0.08	-0.06	-0.06	0.81	0.74
FRS	Forest resources	0.99	0.86	0.84	-8.19	-7.38
AGR	Land resources	0.00	0.01	0.01	-0.55	-0.59

Table 4: Consumed varieties and Feenstra ratio, change in %

Reported variable	IRTS sector	Crimea			DCFTA		Crimea			DCFTA		Crimea			DCFTA	
		1	2	3	1	2	1	2	3	1	2	1	2	3	1	2
		Ukraine					Russia					EU				
Total varieties consumed	CMN	-4.29	-4.29	-4.25	-5.96	-3.17	0.57	0.51	0.50	2.45	1.51	-0.09	-0.09	-0.08	1.78	0.84
	CNM	-5.05	-5.05	-4.86	-61.96	-99.85	0.12	0.11	0.10	-2.33	-1.82	-0.17	-0.17	-0.17	6.01	6.55
	MEQ	-3.34	-3.34	-3.26	-15.43	-13.76	0.38	0.34	0.33	-3.09	-3.08	-0.06	-0.06	-0.06	4.77	4.57
	OBS	-4.41	-4.41	-4.34	-4.66	-2.03	0.76	0.69	0.68	1.41	0.83	0.07	0.07	0.07	0.76	0.18
	OMF	-6.34	-6.33	-6.05	6.86	0.75	0.60	0.53	0.51	-1.70	-1.56	-0.02	-0.02	-0.03	7.42	7.77
	TEX	-4.04	-4.05	-3.97	-11.63	-9.77	0.14	0.10	0.10	-2.23	-2.21	-0.28	-0.29	-0.28	9.54	8.91
	TRD	-4.46	-4.46	-4.41	-5.50	-2.64	0.58	0.52	0.52	2.42	1.46	-0.01	-0.01	0.00	1.75	0.80
	TRS	-3.39	-3.39	-3.34	-1.85	-0.04	0.36	0.31	0.31	0.76	0.34	-0.18	-0.17	-0.17	0.38	-0.04
	WPP	-3.76	-3.77	-3.67	-6.76	-6.49	0.14	0.12	0.12	-3.59	-3.57	-0.05	-0.06	-0.06	5.19	4.93
Feenstra ratio	CMN	-1.62	-1.62	-1.59	0.50	0.52	0.15	0.13	0.13	-0.01	-0.01	0.00	0.00	0.00	0.01	0.01
	CNM	-1.26	-1.26	-1.23	7.57	7.27	0.12	0.11	0.11	0.03	0.05	0.00	0.00	0.00	0.03	0.03
	MEQ	-0.69	-0.69	-0.67	8.68	8.65	0.09	0.08	0.08	0.00	-0.01	0.00	0.00	0.00	0.01	0.01
	OBS	-1.21	-1.21	-1.19	0.21	0.14	0.13	0.12	0.12	-0.02	-0.02	0.00	0.00	0.00	0.01	0.01
	OMF	-1.62	-1.62	-1.58	5.21	4.93	0.14	0.13	0.13	-0.02	-0.02	0.00	0.00	0.00	0.02	0.02
	TEX	-1.69	-1.69	-1.65	7.44	7.22	0.20	0.18	0.17	-0.04	-0.05	0.00	0.00	0.00	0.05	0.05
	TRD	-1.56	-1.56	-1.53	0.64	0.61	0.17	0.15	0.15	-0.01	-0.01	0.00	0.00	0.00	0.02	0.02
	TRS	-1.26	-1.26	-1.23	0.46	0.19	0.14	0.13	0.13	-0.03	-0.02	0.00	0.00	0.00	0.02	0.02
	WPP	-1.19	-1.19	-1.16	7.18	7.09	0.15	0.14	0.13	0.01	0.01	0.00	0.00	0.00	0.03	0.03

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