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Analyzing Trade Opening inUkraine: Effects of a Customs Union with the EU

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Analyzing Trade Opening in Ukraine: Effects of a Customs Union with the EU*

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This paper analyzes the possible a customs union between and the European Union. The GTAP multi-country simulation model of Purdue University's Center for Global Trade Analysis is applied. The welfare measure evaluated is the change in equivalent variation (EV). As all incomes in the model accrue to a representative household, EV fully assesses possible welfare benefits for Ukraine from a bilateral tariff elimination on trade with the EU. As the model includes Ukraine in the aggregated „Former Soviet Union" region (FSU), EV is estimated for the FSU and then disaggregated on the industry level proportionally to trade shares. The results of our simulations suggest that Ukraine's EV is particularly sensitive to the inclusion of the agricultural sector into a customs union. Due to the highly protected nature of this sector within the EU, Ukraine would be better off if agriculture were excluded from liberalization. If this scenario is assumed, Ukraine's monetary gain would be in the order of $40 million.

JEL classification: F02, F15, O19, O52

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1. INTRODUCTION

In the 20th century, Ukraine passed a tremendous period of its history. After collapse of the Soviet Empire, Ukraine recovered more slowly than did the Baltic States and still more slowly than what used to be called the Central and Eastern European Countries (CEECs). Only in the year 2000 did GDP begin to rise again after a decade of steady decline[1]. Strong state regulation of foreign trade was prevalent in 1994 and even in 1999, no time plan was set for Ukraine to join the World Trade Organization (WTO) (e.g., Michalopoulos 1999). In fact, from the point of view of the WTO, Ukraine could still not be considered to be a market economy[2]. However, in the year 2000, in the context of an anti-dumping investigation the European Union recognized Ukraine as a market economy; in the same year, the WTO announced Ukraine could be accepted as a member in the near future if its Parliament approved changes to about 60 laws and provisions as a precondition (*Postup*, 2000).

Already in 1994 the Partnership and Co-operation agreement with the EU was signed, which envisioned the creation of a customs union for 1998.[3] As economic conditions were not appropriate then, the customs union was postponed. Depending on how Ukraine will manage to further develop its political institutions and to improve its economic performance, a customs union with the EU will eventually be established. Anticipating the effects of such a union for Ukraine builds the main motivation for this work.

With the enlargement of the European Union, Ukraine faces the possibility that trade with its Western neighbors is diverted away into the EU.[4] One of Ukraine's major trade partners,

[1] In 2001, growth for the coming years was projected to be up to 6% yearly (*Postup*, 2001). See also EBRD (2001).

[2] This means in considering dumping cases by its partners, the costs of Ukrainian producers were not calculated from their actual costs but taken from comparable producer in other, market-economy country. The argument behind this is that non-market economy implicitly subsidises its producers, e.g. through supplying them with cheap energy. Such procedure of treating led to more judgements to detriment of Ukrainian producers.

[3] The basis for EU-Ukraine relations was laid down in the Partnership and Co-operation Agreement (PCA) on 14 June 1994. Ukraine was the first of the Newly Independent States (NIS) to sign this kind of document with the EU to replace former Agreement on Trade and Commercial and Economic Co-operation with the USSR. The aim of the Parties to the document was it to establish a free trade area by 1998 if appropriate (Article 4 of PCA). According to the Agreement, the Parties grant to each other most-favored-nation (MFN) treatment and the products of the other party should not be subject to discriminatory direct or indirect taxation (A10 and 15 respectively). However, textile and steel products are exempted from the latter clause. Further, the Agreement encourages "the approximation of Ukraine's existing and future legislation to that of the Community" (A51).

[4] Further, Chang and Winters (1999) demonstrate that if a country enters Preferential Trading Arrangements (PTA) "other contracting parties [who fail to enter it] may …. be affected adversely, because they are compelled to reduce their prices to meet competition from the suppliers within the PTA" (pp.33).

Poland, has just joined the EU while others like Turkey prepare to do so[5]. Besides, the EU is the largest of Ukraine's trade partners outside the Newly Independent States (NIS); and the trade volume with it is growing from year to year at the expense of trade with the NIS. A customs union with the EU will potentially avoid much of trade diversion associated with EU enlargement otherwise.[6]

Using the GTAP multi-country simulation model of Purdue University's Center for Global Trade Analysis[7], we show that a customs union between Ukraine and the EU will not only help to avoid trade diversion with some partners, but also will foster trade creation and possibly a (modest) increase in Ukrainian welfare. The customs union is modeled through a bilateral tariff reduction. Since the the GTAP data set available to us had no disaggregated country data for Ukraine, the computation was done for the "Former Soviet Union" (FSU) region as a whole. Then reslting welfare effect for the FSU was then disaggregated proportionally to each Ukrainian industry's share in the total trade of FSU industries.

The rest of the paper is structured as follows. The next chapter gives a short overview of the GTAP model and the calculations performed. The results of modeling the customs union are presented and discussed in Chapter 3. This is followed by the conclusions in the last chapter. Input data and parameters for the GTAP calculations are presented in the appendices.

2. Modelling the Customs Union in GTAP[8]

We are applying the GTAP multi-country simulation model of Purdue University's Center for Global Trade Analysis to analyze the effects of a customs union between Ukraine and the EU. The customs union is modeled through a bilateral tariff reduction. The model available to us was Version 4 based on data up to 1995 and including 45 regions and 50 sectors.[9] Since the the GTAP data set available to us had no disaggregated country data for Ukraine, the

5 The top five of Ukraine's trade partners are ranked as follows (1998): Export – Russia, China (steel), Turkey, Germany, Belarus; Import – Russia, Germany, US, Poland, Italy.

6 Literature exploring the effects of trade liberalization and specifically aspects of trade diversion include Harrison et. al. (1996), Chang and Winters (1999), Kose and Riezman (2000). Kose/Riezaman analyze a three-country model and conclude that a small country will have a preference for builing a bilateral customs union with a larger country or region. Chang/Winters estimated trade diversion effects of MERCOSUR on the USA, Germany and Japan. Harrison et. al. estimate Turkey's benefits from a customs union with the EU.

7 See Hertel (1997) for a comprehensive documentation of the model.

8 This analysis is based on Harbuzyuk (2001).

9 Without further aggregation, this would result in more than 20 000 variables in more than 15 000 equations.

computation was done for the "Former Soviet Union" (FSU) region as a whole. The resulting welfare effect for the FSU measured as equivalent variation was then disaggregated proportionally to each Ukrainian industry's share in the total trade of FSU industries.

The model employs the following assumptions about producers, consumers and markets. Constant returns to scale in production and perfect competition is assumed in all sectors.[10] Consumer preferences are modeled as Armington-style product differentiation. This means, consumers differentiate among products of different origins and a country's aggregate import function has the following CES functional form:[11]

$$m'_r = \left[\sum_{i \neq r} a_{ir} x_{ir}^{(\sigma_r - 1)/\sigma_r} \right]^{\sigma_r/(\sigma_r - 1)} \quad \text{for r, i=1, 2, …, n}$$

where

m'_r = quantity index of total imports into r (prime indicates CES functional form);

x_{ir} = quantity of imports into country r from country i;

a_{ir} = weight multipliers;

σ_r = elasticity of substitution between any two imported products of different origins ($\sigma > 0$);

n = total number of countries.

The production process in GTAP has a nested structure and is modeled as follows. Final output of good j in region r (QO_{jr}) is produced using a Leontieff production technology, which implies that the value added composite (QVA_{jr}) and the intermediate composite (QF_{jr}) are perfect complements. There is a number of I intermediate composites (equal to the number of traded commodities), which can be chosen for the production of the final good; all intermediate composites are mutually substitutable with an elasticity of substitution $ESUBT_j$ among them. Production of the value added composite (QVA_{jr}) is carried out with a constant elasticity of substitution (CES) function, where $ESUBVA_j$ is the elasticity of substitution among the primary factors of production (QFE_{ijr}). Finally, the intermediate composite is produced from a domestic-good composite (QFD_{ijr}) and an import composite (QFM_{ijr} or m') with a CES production function and an elasticity of substitution $ESUBD_i$.

10 See Hertel and Tsigas (1997). Some authors (Rutherford and Tarr, 1998) assume increasing returns to scale and monopolistic competition in the intermediate sector. The basic argument for this is the assumed presence of high fixed costs for starting business in this sector.

11 See Geraci and Prewo (1982).

The production process is performed under the assumption of separability, i.e. the optimal mix of land, labor, and capital (QFE_{ijr}) is independent of the prices of intermediates. Therefore, the solution can be obtained in two steps: first the optimal mix of primary factors of production and of domestic relative to foreign goods is chosen; then the optimal mix of intermediate composites for the production of the final good is determined.

Similarly, consumption is nested. A representative consumer derives utility from private expenditure (UP), savings (QSAVE/POP), and government expenditure (UG) according to a Cobb-Douglas utility function.[12] Government expenditure (UG) is also determined according to a Cobb-Douglas function.[13] Finally, the private expenditure function has a constant difference of elasticities (CDE) form, originally suggested by Hanoch (1975). The non-homothetic CDE form was chosen, because homothetic representations are inconsistent with real consumer data exhibiting expenditure shares that change with the level of income. The CDE function allows for both changes in expenditure shares and also changes in marginal expenditure (Huff, et. al., 1997).

A reduction of EU tariffs for several countries including Ukraine will result in trade creation and trade diversion effects. While trade creation unambiguously generates welfare gains, trade diversion may result in either gains or losses. In the GTAP model, the overall effect will be measured by equivalent variation (EV). Since in this model, all the income including taxes accrues to consumers, equivalent variation captures changes in consumer and producer surplus as well as changes in government revenues. Equivalent variation in region r EV(r) is calculated as the product of the percent change in per-capita utility u(r) and the regional income before the simulation INC(r).

Version 4 of the GTAP model, which we used, does not contain Ukraine as a separate region. Instead, Ukraine is part of the aggregated Former Soviet Union (FSU) region. Therefore, we ran simulations for the FSU and then disaggregated Ukraine's part of the static changes in welfare according to her share in FSU trade on an industry-by-industry basis.

[12] The inclusion of savings in static models like the GTAP model is based on results showing that an intertemporal expenditure system can be derived from a static maximization problem with savings (Howe, 1975, presented also in Hertel and Tsigas, 1997, p.46).

[13] Inclusion of government expenditure into households' utility is motivated by Keller (1980); see also Hertel and Tsigas (1997, p.47). Of course, using Cobb-Douglas implies constant expenditure shares for each good.

In a first step, the number of regions was reduced by aggregation from 45 to eight: Asia[14], USA, EU, European Free Trade Association (EFTA), Central European Associates (CEA)[15], FSU, Turkey, and the Rest of the World (ROW). Simarly, the number of sectors was reduced by aggregation from 50 to ten: agriculture, forest, coal, oil & gas, other minerals & chemicals, textiles & other clothes, ferrous & other metals, machinery, electricity, and services.

Next, two simulations are performed. As positive consideration of a Ukrainian application to the EU is virtually made conditional on the CEA's full membership in the EU (TSN, 2001), the first simulation is run in order to model the CEA joining the EU and Turkey forming a customs union with the EU. The Turkish agricultural sector is exempted from costumes union regulations in this simulation (Harrison *et al*, 1996). The economy is put out of equilibrium by a series of shocks that eliminate bilateral import and export tariffs among the EU, the CEA, and Turkey and adjust their tariffs with third countries to the EU level (see the appendix).

The second simulation includes all the elements of the first one described above and additionally models the FSU forming a customs union with the EU. The simulation constitutes a series of shocks performed to eliminate bilateral tariffs between the FSU on the one hand, and the EU, the CEECs, and Turkey on the other hand. It also adjusts bilateral tariffs of the FSU with third countries to EU levels and eliminates tariffs within the FSU itself. Since the EU is highly interested in maintaining the high protection of its agricultural sector, including agriculture into the customs union simulation would require increasing external agricultural tariffs for the FSU (and Ukraine). Therefore, the FSU's agricultural sector is exempted from the customs union in this base scenario.

Alternative scenarios include the agricultural sector into the customs union for Turkey in the first simulation and for the FSU (Ukraine), in the second simulation. The next chapter presents the results of the base scenario as a benchmark and contrasts them to the alternative scenario for comparison and to derive policy implications.

3. RESULTS AND DISCUSSION

[14] "Asia" contains a number of Asian high-growth countries, China, and Japan. For a detailed mapping of regions and sectors see the appendix.

[15] CEA includes 7 countries: Poland, Hungary, Czech Republic, Slovakia, Slovenia, Romania, and Bulgaria.

The results of both simulations – Simulation 1: EU customs union with CEA and Turkey; Simmulation 2: EU customs union with CEA, Turkey and FSU - are presented together in Table 1 below. Not surprisingly, the world as a whole gains under both szenarios, but there is some redistribution of wealth. The EU countries (Germany, Italy, and the rest of the EU) as well as the Candidate Countries (Poland, the rest of the CEA, and Turkey) gain in both simulations, while all the other regions (except Asia) lose.

Table 1. Equivalent variation, in millions of US$

Region	Simulation 1	Simulation 2
China	-568	-52
Asia	-1692	64
USA	-893	-110
Germany	482	629
Italy	123	339
Rest of EU	253	840
EFTA	-76	-147
Poland	3016	248
CEA	4675	279
FSU	**-571**	**-123**
Turkey	1802	192
ROW	-2517	-802
World total	4034	1355

The FSU as a whole loses in both simulations. In the remainder of this chapter, the FSU's equivalent variation from Simulation 2 – i.e. from the full customs union between EU, CEECs, Turkey and the FSU (excluding agriculture) - is disaggregated with the purpose of quantifying Ukraine's share in equivalent variation. This will be our approximate measure of the trade liberalization's net welfare effect for Ukraine.

The next table presents the decomposition of the simulation 2 results into allocation, terms-of-trade (TOT) and capital-goods effects. Allocation effects are the results of relative price changes due to changes in taxes, while capital-goods effects stem from changes in capital-goods prices.

Table 2. Decomposition of EV, in millions of US$

Region	Allocation	TOT	Capital goods	Total
China	-88	27	9	-52

Asia	-14	89	-12	64
USA	-16	-61	-34	-110
Germany	213	450	-33	629
Italy	124	255	-41	339
EU	505	358	-24	840
EFTA	-25	-114	-8	-147
Poland	68	123	57	248
CEA	40	198	41	279
FSU	**749**	**-903**	**31**	**-123**
Turkey	30	129	33	192
ROW	-230	-552	-20	-802
World total	1355	-1	0	1355

While the FSU gains mainly from a more efficient allocation of resources, this is overcompensated for by an adverse terms-of-trade shock. The terms of trade shock is mainly due to decreases in export prices (see Table 3). Note the significantly negative figures for exports in the forestry, oil & gas, and metals industry sectors and the highly positive number for transport services. Ukraine does not have much mineral fuels while services of pipeline transport constitute more then half of its export of transport services.

Table 3. Decomposition of the TOT component for the FSU, in millions of US$

Sector	**World price**	**Price of export**	**Price of import**	**Total**
1 Agriculture	-4	75	-35	37
2 Forestry	0	-101	-1	-102
3 Oil & gas	-88	-372	-2	-462
4 Minerals	0	-5	4	-1
5 Cloths	-1	-66	-136	-204
6 Chemicals	0	-62	10	-52
7 Metals	-2	-111	13	-99
8 Machinery	-6	-59	2	-62
9 Miscellaneous	0	-6	0	-7
10 Transport	2	110	-3	109
11 Services	-2	-37	-21	-60
Total	-100	-635	-168	-903

The decomposition of the allocation effect by tax type is presented in **Error! Not a valid bookmark self-reference.**. The results suggest that the distortions from almost all taxes (except the consumption tax) decline.

Table 4. Decomposing the allocation effect for the FSU, in millions of US$

Type of tax	Contribution to EV
1. Tax on production	2
2. Tax on inputs	35
3. Consumption tax	-17
4. Export tariff	52
5. Import tariff	678
Total	749

Table 5. Decomposing the trade tariff effects for the FSU, in millions of US$

Sector	EV due to export tariff	EV due to import tariff
1 Agriculture	-5	29
2 Forestry	4	61
3 Oil & gas	43	6
4 Minerals	0	46
5 Cloths	3	89
6 Chemicals	1	34
7 Metals	1	74
8 Machinery	3	306
9 Miscellaneous	0	23
10 Transport	0	2
11 Services	2	9
Total	52	678

The shares of Ukraine's trade in the FSU's trade are displayed in Table 6. They are used as weights to calculate Ukraine's share in equivalent variation from the term-of-trade effect and the allocation effect, respectively. Data from the World Bank and the State Statistical Committee of Ukraine were used for these calculations. Ukraine's small share in negatively affected export industries – 4% in forestry and 1% in oil & gas – is noteworthy. So is Ukraine's large share in exports of transport services.

Table 6. Share of Ukraine's trade in FSU's trade

Sector	Export and import	Export	Import
1 Agriculture	0.08	0.17	0.04
2 Forestry	0.06	0.04	0.09

3 Oil & gas	0.14	0.01	0.50
4 Minerals	0.14	0.19	0.10
5 Cloths	0.09	0.16	0.07
6 Chemicals	0.19	0.23	0.17
7 Metals	0.18	0.21	0.09
8 Machinery	0.14	0.23	0.12
9 Miscellaneous	0.38	0.27	0.51
10 Transport	0.21	0.34	0.05
11 Services	0.06	0.05	0.06

Disaggregating Ukraine's welfare change

Ukraine's equivalent variation EV is separated into three elements: EV_1 due to changes in the terms of trade; EV_2 due to changes in the distortions from export and import tariffs; EV_3 due to changes in production, input, and consumption taxes and changes in the price of capital goods.

Table 7. Ukraine's EV due to TOT, millions of US$

Sector	World price	Export price	Import price	Total
1 Agriculture	-0.3	12.8	-1.4	11.1
2 Forestry	0.0	-3.7	-0.1	-3.7
3 Oil & gas	-12.6	-4.4	-0.8	-17.9
4 Minerals	0.0	-1.0	0.4	-0.5
5 Cloths	-0.1	-10.8	-8.9	-19.8
6 Chemicals	0.1	-14.0	1.6	-12.2
7 Metals	-0.3	-23.2	1.2	-22.2
8 Machinery	-0.8	-13.2	0.3	-13.8
9 Miscellaneous	0.0	-1.8	-0.2	-2.0
10 Transport	0.3	37.1	-0.1	37.3
11 Services	-0.1	-2.0	-1.2	-3.3
Total	-13.9	-24.0	-9.1	**-47.0**

EV_1 for each sector in Ukraine is received by multiplying the respective columns of Tables 3 and 6 and summing up. As Table 7 shows, equivalent variation due to changes in in the terms of trade sum up to -$47.0 million for Ukraine, despite the mauch larger negative figure for the FSU (-$903 million). The relatively small magnitude of the negative TOT effect is mainly due to the different composition of Ukraine's trade flows.

EV_2 for Ukraine is calculated by multiplying the respective columns of Tables 5 and 6 and summing up. The results are presented in Table 8. Ukraine receives an overproportional share of the FSU's positive trade tariffs effects.

Table 8. Ukraine' EV due to trade tariffs effect, in millions of US$

Sector	Export tax	Import tax	Total
1 Agriculture	-0.9	1.2	0.3
2 Forestry	0.1	5.4	5.5
3 Oil & gas	0.5	3.0	3.5
4 Minerals	0.1	4.6	4.6
5 Cloths	0.5	5.8	6.3
6 Chemicals	0.2	5.8	5.9
7 Metals	0.2	6.8	7.0
8 Machinery	0.6	36.6	37.2
9 Miscellaneous	0.0	11.7	11.7
10 Transport	0.0	0.1	0.0
11 Services	0.1	0.5	0.6
Total	1.5	81.3	**82.8**

The third constituent, EV_3, is computed using the share of Ukraine's GDP in the FSU's GDP of 9.2% (according to World Bank Data) and is reported in Table 9 below.

Table 9. Ukraine's EV due to capital-goods price and non-trade tax effects, in millions of US$

Type of tax	FSU	Weighing. %	Ukraine
Capital goods	30.9	9.20	2.8
Production tax	1.8	9.20	0.2
Input tax	34.8	9.20	3.2
Consumption tax	-16.9	9.20	-1.6
Total	50.6		**4.7**

Finally, Table 10 summarizes total equivalent variation for Ukraine; the total net effect will amount to +US$40.5 million including a positive allocation effect of about $83 million and a negative TOT effect of 47 million.

Table 10. Summing up EV for Ukraine, in millions of US$

TOT	-47.0

Allocation, trade tariffs	82.8
The rest, proportional to GDP	4.7
Total	**40.5**

Comparing base and alternative scenarios

Calculations for the alternative scenario are performed under the same methodology as for base scenario. Equivalent variation for Ukraine under the alternative scenario amounts to +$22.2 millions and for the FSU as a whole the result is -$618.3 millions. The received numbers suggest that Ukraine's gain from joining into a customs union with the EU would be less than half that expected from the base scenario, if the agricultural sector was included. The large negative figure for the FSU results mainly from a deterioration in the terms of trade for imported agricultural products (-$754m.). As Ukraine's share in the FSU's total agricultural imports is only 4 percent, the resulting negative welfare effects are still small for Ukraine.

4. CONCLUSIONS

As the model predicts, Ukraine stands to gain from joining into a customs union with the European Union under any scenario, although would fare better with the agricultural sector excluded from the agreement. The respective gain – $40.5 millions – is to accrue yearly in terms of smaller distortions from taxes and an appreciation in the value of investment goods. Ukraine's gain accrues despite the negative aggregated welfare effect for the FSU as a whole. This means Ukraine would gain while some other FSU countries would lose from a customs union between the EU and Ukraine.

The alternative scenario suggests that imitating EU's highly protective agricultural policy would be undesirable for Ukraine. It would worsen Ukraine's terms of trade for agricultural products and lead to a sizable negative welfare effect. Import prices would increase because of the elimination of the 20% subsidy on exports of agricultural products from EU (on average) and higher common external tariffs in the EU on imports from third countries. Export prices would decrease due to higher import taxes of third countries on agricultural products from the EU (and its customs union partners) as response to EU's protectionism.

Therefore, the final result is sensitive to shocks performed on tariffs to agricultural products. However, the EU considers reducing its agricultural export subsidies, followed by bilateral

agricultural tariff reductions with third countries, in order to avoid difficulties with its common agricultural policy after enlargement. This would make a customs union including the agricultural sector more attractive for Ukraine.

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APPENDIX

AGGREGATION OF REGIONS

Definition of new (aggregated) regions

ase	Quickly growing Asian economies (including China) and Japan
usa	USA
eun	European Union
eft	EFTA
cea	Central European Associates
fsu	Former Soviet Union
tur	Turkey
row	Rest of the world

Regions mapping

Previous	**Previous region definition**	**New**
AUS	Australia	row
NZL	New Zealand	row
JPN	Japan	ase
KOR	Republic of Korea	ase
IDN	Indonesia	ase
MYS	Malaysia	ase
PHL	Philippines	ase
SGP	Singapore	ase
THA	Thailand	ase
VNM	Viet Nam	row
CHN	China	ase
HKG	Hong Kong	ase
TWN	Taiwan	ase
IND	India	row
LKA	Sri Lanka	row
RAS	Rest of South Asia	row
CAN	Canada	row
USA	United States of America	usa
MEX	Mexico	row

CAM	Central America and Caribbean	row
VEN	Venezuela	row
COL	Colombia	row
RAP	Rest of Andean Pact	row
ARG	Argentina	row
BRA	Brazil	row
CHL	Chile	row
URY	Uruguay	row
RSM	Rest of South America	row
GBR	United Kingdom	eun
DEU	Germany	eun
DNK	Denmark	eun
SWE	Sweden	eun
FIN	Finland	eun
REU	Rest of European Union	eun
EFT	European Free Trade Area	eft
CEA	Central European Associates	cea
FSU	Former Soviet Union	fsu
TUR	Turkey	tur
RME	Rest of Middle East	row
MAR	Morocco	row
RNF	Rest of North Africa	row
SAF	South African Customs Union	row
RSA	Rest of Southern Africa	row
RSS	Rest of Sub Saharan Africa	row
ROW	Rest of World	row

AGGREGATION OF INDUSTRIES

Definition of new (aggregated) sectors

1.	agr	Food products, plant-based fibers, fishery, beverages and tobacco
2.	for	Forestry, wood and paper products
3.	col	Coal
4.	o_g	Oil, gas, petroleum and coal products
5.	min	Minerals and chemicals
6.	tex	Textiles, wearing apparels, and leather products
7.	fer	Metals and metal products
8.	mac	Motor vehicles, transport and electronic equipment, machinery
9.	ele	Electricity
10.	ser	Utilities, trade, transport, construction, financial services

Industries mapping

Previous		**Previous industry definition**	**New**
1.	pdr	Paddy rice	agr
2.	wht	Wheat	agr
3.	gro	Other cereal grains	agr
4.	v_f	Vegetables, fruit, nuts	agr
5.	osd	Oil seeds	agr
6.	c_b	Sugar cane, sugar beet	agr
7.	pfb	Plant-based fibers	agr
8.	ocr	Other crops	agr

9.	ctl	Bovine cattle, sheep and goats, horses	agr
10.	oap	Other animal products	agr
11.	rmk	Raw milk	agr
12.	wol	Wool silk-worm cocoons	agr
13.	for	Forestry	for
14.	fsh	Fishing	agr
15.	col	Coal	col
16.	oil	Oil	o_g
17.	gas	Gas	o_g
18.	omn	Other minerals	min
19.	cmt	Bovine cattle, sheep and goat, horse meat prods	agr
20.	omt	Other meat products	agr
21.	vol	Vegetable oils and fats	agr
22.	mil	Dairy products	agr
23.	pcr	Processed rice	agr
24.	sgr	Sugar	agr
25.	ofd	Other food products	agr
26.	b_t	Beverages and tobacco products	agr
27.	tex	Textiles	tex
28.	wap	Wearing apparel	tex
29.	lea	Leather products	tex
30.	lum	Wood products	for
31.	ppp	Paper products, publishing	for
32.	p_c	Petroleum, coal products	o_g
33.	crp	Chemical, rubber, plastic products	min
34.	nmm	Other mineral products	min
35.	i_s	Ferrous metals	fer
36.	nfm	Other metals	fer
37.	fmp	Metal products	fer
38.	mvh	Motor vehicles and parts	mac
39.	otn	Other transport equipment	mac
40.	ele	Electronic equipment	mac
41.	ome	Other machinery and equipment	mac
42.	omf	Other manufactures	mac
43.	ely	Electricity	ele
44.	gdt	Gas manufacture, distribution	ser
45.	wtr	Water	ser
46.	cns	Construction	ser
47.	t_t	Trade, transport	ser
48.	osp	Financial, business, recreational services	ser
49.	osg	Public admin and defense, education, health	ser
50.	dwe	Dwellings	ser

TRADE DATA USED FOR CALCULATIONS

Two sources of trade data used in this work are IMF (1998) and Pakhomov *et al* (1997). IMF data (Table A1) is used to calculate Ukraine's share in FSU's exports and imports.

Table A1. Exports and imports of FSU countries, millions of US$

Country	Exports, fob	Imports, cif
Armenia	357	696
Azerbaijan	544	666

Belarus	4641	5505
Estonia	1840	2546
Georgia	151	392
Kazakhstan	5250	3807
Kyrgyz Rep.	483	392
Latvia	1284	1646
Lithuania	2706	3649
Moldova	739	841
Russia	81096	60945
Tajikistan	749	810
Turkmenistan	1881	1364
Ukraine	13317	16052
Uzbekistan	2708	3030
FSU	117746	102341
Ukraine, share of FSU	0.11	0.16

Source: IMF (1998) and calculations of the author.
Pakhomov *et al* (1997) data is used to calculate percentage structure of Ukrainian exports and imports. The original data and calculations are presented in Table C2.

Table A2. The structure of Ukrainian exports and imports, millions of US$

Sector	Export, value	Export, share	Import, value	Import, share
1 Agriculture	2823	0.18	1190	0.07
2 Forestry	150	0.01	490	0.03
3 Coal	72	0.00	560	0.03
4 Oil & gas	176	0.01	6731	0.41
5 Minerals	2125	0.14	1600	0.10
6 Textiles	389	0.03	572	0.03
7 Metals	4620	0.30	777	0.05
8 Machinery	2285	0.15	3394	0.21
9 Electricity	91	0.01	0	0.00
10 Services	2559	0.17	1179	0.07
Total	15289	1	16492	1

The next table shows the calculation of adjusted trade flows for Ukraine. It uses only relative relationships among different sectors. The table contains exports and imports at market prices and the figures for the FSU are taken from GTAP.

Table A3. Calculating adjusted trade flows for Ukraine, millions of US$

Sector	GTAP, FSU		Ukraine, GTAP adjusted	
	Export	Import	Export	Import
1 Agriculture	7543	16735	1852	958
2 Forestry	4918	3650	98	394
3 Coal	955	438	47	451
4 Oil & gas	16621	1190	116	5417
5 Minerals	12716	8108	1394	1288
6 Textiles	2688	7290	255	460

7 Metals	23715	2728	3031	625
8 Machinery	3795	22851	1499	2732
9 Electricity	279	130	60	0
10 Services	15451	21507	1679	949
Total	88682	84628	10030	13274

Then the numbers for total adjusted export and import for Ukraine are calculated using shares from Table A1. Finally, the value of each sector's export and import is computed by applying weights from Table A2 to previously calculated total values. Further, Ukrainian adjusted exports are divided by FSU exports from Table A3 and the same is done for imports. Also, the sum of Ukraine's exports and imports is divided by sum of FSU's exports and imports to get weighting coefficients for EV due to the change in world prices. Computed weights are put down into Table A4 (compare Table 6 in the main text above).

Table A4. Share of Ukraine's trade in FSU's trade

Sector	Export and Import	Export	Import
1 Agriculture	0.12	0.25	0.06
2 Forestry	0.06	0.02	0.11
3 Coal	0.35	0.05	1.00
4 Oil & gas	0.07	0.01	1.00
5 Minerals	0.13	0.11	0.16
6 Textiles	0.07	0.09	0.06
7 Metals	0.14	0.13	0.23
8 Machinery	0.16	0.39	0.12
9 Electricity	0.15	0.21	0.00
10 Services	0.07	0.11	0.04

GDP DATA USED FOR CALCULATIONS

For disaggregating non-trade allocation effects the weighting coefficients computed from the table below are used. Input data are from the World Bank (2001).

GDP at market prices (current $US millions), 1995	
Armenia	2887
Azerbaijan	2894
Belarus	20071
Estonia	4789
Georgia	1900

Kazakhstan	19925
Kyrgyz Rep.	3325
Latvia	4904
Lithuania	6445
Moldova	3093
Russia	337902
Tajikistan	1827
Turkmenistan	4505
Ukraine	49061
Uzbekistan	16294
FSU	479822
Ukraine, share	0.1022

Source: World Bank (2001) and author's calculations.

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