The Effects of the EU-Ukraine FTA: An Inequality Analysis Using a CGE-Microsimulation Model for Ukraine

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Abstract

This paper analyzes the effects of the free trade agreement (FTA) between the European Union (EU) and Ukraine on inequality in the latter using a computable general equilibrium (CGE)-microsimulation model for Ukraine. The model follows a top-down approach, meaning that variables, such as prices and factor returns which change as a result of the simulation of trade liberalization in the CGE model are transferred to the microsimulation model where they are treated as exogenous variables.

JEL classification: C35; C68; D31; F15

Keywords: CGE; Microsimulation model; Trade liberalization; Income distribution; Ukraine

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1 Introduction

Ukraine's integration into the world economy has been widely evaluated. In most of the studies analyzing the effects of Ukraine's accession to the WTO[1] and the free trade agreement (FTA) between the European Union (EU) and Ukraine[2] computable general equilibrium (CGE) models are used. This implies that mainly the macroeconomic effects of trade liberalization (e.g changes in relative prices, production and trade flows) are considered. However, taking into account also microeconomic consequences is important as trade liberalization might also have an impact on income inequality. Those distributional effects can be analyzed in the context of a CGE-microsimulation model.

In general, three different approaches are distinguished (Colombo, 2010). The fully integrated approach is for instance used by Decaluwé et al. (1999). An example of the top-down or sequential approach can be found in Bourguignon et al. (2003) whereas Savard (2003) applies the top-down/bottom-up approach. The CGE-microsimulation model used in this paper follows the top-down approach, meaning that variables, such as prices and factor returns which change as a result of the simulation of trade liberalization in the CGE model are then transferred to the microsimulation model where they are treated as exogenous variables.

2 Modeling approach

Following Colombo (2008) we apply the top-down approach to analyze the effects of the EU-Ukraine FTA within a CGE-microsimulation model. This means that trade liberalization is first simulated in the CGE model to obtain information on changes in the relevant variables. Those variables include prices for goods and services, wages and returns on capital.[3] They are treated as exogenous variables in the microsimulation model. As they change as a result of the trade liberalization, the microsimulation model is used to simulate changes in the endogenous variables of the microsimulation model.

[1] Ukraine joined the WTO in 2008. For work on Ukraine's WTO accession see for example Jensen et al. (2005), Pavel et al. (2004) and Kosse (2002).

[2] The EU-Ukraine FTA is for instance discussed by Francois and Manchin (2009), Maliszewska et al. (2009) and Ecorys and CASE-Ukraine (2007).

[3] Note that changes in the employment level are not considered here as labor is assumed to be fully employed in the CGE model.

2.1 CGE Model

The CGE model used here is a static, small open economy, single-country model for Ukraine exhibiting perfect competition and constant returns to scale.[4] It incorporates 38 sectors of production. The consumption side is represented by public consumption, investment and intermediate consumption and by final consumption of households. The representative household of the model is disaggregated into four types according to the domestic poverty line and the place of residence (rural or urban). This level of disaggregation allows only for a very rough analysis of the distributional effects of the EU-Ukraine FTA. Labor is differentiated based on the level of education in skilled and unskilled labor and is assumed to be fully employed. A representative household derives utility from the consumption of goods and services and finances its total consumption by income from labor and capital endowments[5] and by received transfers.

As this paper focuses on trade policy it is important to distinguish between different trading partners. Ukraine's exports and imports were grouped into the following nine trading regions: EU15, EU12, other Europe, Asia, Africa, America, Commonwealth of Independent States (CIS), Russia and rest of the world (ROW). The first eight regions include countries representing the key trading partners of Ukraine with all other countries being summarized as rest of the world. Moreover, different trade regimes are incorporated. Commodity trade with Russia and other CIS countries is classified as free trade because of the existing FTA between Ukraine and the CIS countries. The most favored nation (MFN) status is applied to trade with all other regions as the included countries are either members of the WTO or have bilateral trade agreements with Ukraine to establish this trade regime.

2.2 Microsimulation Model

The microsimulation model consists of the following equations: a log-income estimation equation, a discrete choice labor supply equation, an equation to calculate household's income and two arithmetical computation equations for calculating the household specific consumer price index and household's real income.

For obtaining predicted income for those household members who are observed to be unemployed in the survey[6] the following equation is estimated:

$$log(Y_{hm}) = \alpha + \beta X_{hm} + \gamma \lambda_{hm} + \epsilon_{hm} \tag{1}$$

[4] For a detailed model description see Frey and Olekseyuk (2011).

[5] Non-poor households are endowed with both capital and labor (skilled and unskilled) whereas poor households are only endowed with unskilled labor.

[6] Note that for household members who reported to be employed, observed instead of predicted income is used.

where $log(Y_{hm})$ is the logarithm of labor income of household member m of household h. Vector X_{hm} includes household member m's personal characteristics (such as gender, work experience and place of residence). λ_{hm} is the inverse Mills ratio and the residual term ϵ_{hm} accounts for unobserved characteristics having an effect on log-income. Using a Heckman two-step selection model equation 1 is estimated separately for unskilled and skilled household members as the Ukrainian labor market is assumed to be separated according to the skill level.

The choice of the labor market status is represented by the following equation:

$$A_{hm} = a + bZ_{hm} + u_{hm} \tag{2}$$

where A_{hm} is a dichotomous variable indicating the labor market status. This means that each household member can choose among two alternatives: being employed or being unemployed. Household member m's individual characteristics (like geneder, skill level and log-age) are included in the vector Z_{hm}. This vector also contains the variable income differential. It reflects the additional income a household member would get when moving from unemployment to employment. Equation 2 is estimated by the use of a binomial logit model, which assumes that the error terms (u_{hm}) are distributed according to the extreme value distribution[7]. This means that each household member m is assignd to the alternative with the highest probability. The utility of being unemployed is set to zero in order to be able to identify the model. For some household members the predicted labor market status does not coincide with the status observed in the survey. Therefore, following Creedy and Kalb (2005) a set of error terms is drawn from the extreme value distribution for each household member. Out of these values, 100 error terms are selected. An error term is chosen if the sum of the deterministic part of the model and the error term results in the correctly predicted labor market status of household member m. The deterministic part is recomputed after the simulations and added to the selected error terms in order to obtain a probability distribution over the two labor market alternatives.

Total income of household h consists of labor income of all household members, capital income (calculated on a household level) and other income (including for instance transfers from the government or other households), which is assumed to be exogenous. As a final step, household h's real income is calculated by dividing total household income by the household specific consumer price index.

[7]This distribution is also known as the Gumbel distribution.

3 Data

The backbone of the CGE model is formed by a social accounting matrix (SAM) for the year 2007. It was constructed with the data of the Ukrainian national accounts and input-output tables at basic and consumer prices (publications of the State Statistics Committee of Ukraine). Additional statistics from national sources include information on indirect taxes, labor remuneration and tariff lines. Furthermore, international trade statistics and a household expenditure survey for 2007 covering more than 10,000 Ukrainian households and more than 25,000 household members are used.

The latter is also the basis for the microsimulation model. Concerning the household level, information on expenditures, place of residence, characteristics of the household head and land ownership are the most important variables. With respect to the household members, information on sex, age, education, labor market status and income are crucial.

The analysis is restricted to the working age population (15-70) and does not include the following people: pensioners, students, pupils and housewives. This leaves us with 10,418 observations on the household members level. 18% of those people reported that they have been unemployed in 2007. Looking at skill levels one can see that the unemployment rate among the unskilled[8] people (26%) is almost three times as high as among the skilled part of the active working age population (9%). In addition, the household members dataset can be further characterized by looking at other socio-demographic indicators. The share of men (51%) and women (49%) is almost identical. Around 30% of all household members are living in a rural area and 70% indicated to be married.

4 Simulations and Results

Three scenarios are analyzed in the CGE model reflecting different possibilities for Ukraine to deal with the lost tariff revenues resulting from the FTA with the EU. All counterfactual experiments include the elimination of import tariffs in all commodity groups for the EU-15 and EU-12 regions, while for all other regions the calculated import tariffs remain valid. In scenario 1 (S1) there is no possibility for the Ukrainian government to compensate the loss in tariff revenues. Thus, government spending has to be reduced. But it can be hold constant in scenario 2 (S2) which involves an increase in the indirect tax rate. Scenario 3 (S3) accounts for compensation by means of addition foreign aid provided by the EU.

[8]Individuals are considered as unskilled if they obtain a secondary or lower education. Consequently, people with tertiary education are regarded as skilled.

After running the simulations in the CGE model, some of the resulting outcome is transferred to the microsimulation model. In particular, the variables that are coming from the CGE model and that are conisdered to be exogenous in the microsimulation model are prices, wages and return on capital.[9] Table 1 contains information on changes in real factor returns resulting after the simulations S1-S3.

variable	S1	S2	S3
real factor return (change in %):			
- return to capital	0.23	-0.08	0.10
- wage rate for unskilled labor	0.22	0.07	0.17
- wage rate for skilled labor	-0.17	0.08	0.19

Table 1: Relevant CGE model results

The results of the income estimation for unskilled and skilled household members can be found in table 3 and tabel 4 in the Appendix. Table 5 in the Appendix reports the results of the estimation of the binomial logit model. Resulting changes in income distribution are very small as table 2 shows.

	benchmark	S1	S2	S3
Gini index	0.388	0.075%	0.008%	-0.003%

Table 2: Income distribution changes

[9]Note that changes in the employment level are not considered here as labor is assumed to be fully employed in the CGE model.

5 Conclusion

The simulation of trade liberalization in a CGE-microsimulation model for Ukraine shows that the distributional effects of the EU-Ukraine FTA are rather small. However, the results seem to be reasonable given the small changes coming from the simulations in the CGE model. This might be explained by the fact that the biggest reduction of Ukraine's import tariffs was done when the country joined the WTO, resulting in an already low level of protection even before the establishment of the EU-Ukraine FTA.

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Appendix

	(1)	(2)	(3)
VARIABLES	logarithm of income	select	mills
rural location	-0.288***	-0.657***	
	(0.0514)	(0.0401)	
work experience	0.0124***	0.0273***	
	(0.00427)	(0.00632)	
work experience * work experience	-0.000530***	-0.000216	
	(8.76e-05)	(0.000166)	
man	0.373***	-0.182***	
	(0.0226)	(0.0402)	
Zakarpattia	0.142***	0.207**	
	(0.0500)	(0.0897)	
West Ukraine	-0.00316	-0.102**	
	(0.0299)	(0.0517)	
South Ukraine	-0.0597	-0.0826	
	(0.0400)	(0.0711)	
Autonomous Republic of Crimea	0.114**	0.106	
	(0.0502)	(0.0942)	
East Ukraine	0.118***	0.192***	
	(0.0288)	(0.0534)	
married		0.283***	
		(0.0440)	
number of household members		0.00955	
		(0.0221)	
chronic disease		-0.102**	
		(0.0469)	
lambda			-0.454***
			(0.157)
constant	9.004***	0.512***	
	(0.0851)	(0.0890)	
Observations	5,470	5,470	5,470

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Unskilled labor income, Heckman selection model

VARIABLES	(1) logarithm of income	(2) select	(3) mills
rural location	-0.253***	-0.574***	
	(0.0526)	(0.0581)	
work experience	0.0191***	0.0229***	
	(0.00372)	(0.00849)	
work experience * work experience	-0.000599***	-0.000196	
	(7.73e-05)	(0.000220)	
man	0.379***	-0.248***	
	(0.0234)	(0.0526)	
Zakarpattia	0.0353	0.0134	
	(0.0547)	(0.142)	
West Ukraine	-0.134***	-0.00729	
	(0.0267)	(0.0735)	
South Ukraine	-0.0544	0.0601	
	(0.0335)	(0.0948)	
Autonomous Republic of Crimea	-0.0162	0.0848	
	(0.0416)	(0.123)	
East Ukraine	-0.000681	0.109*	
	(0.0232)	(0.0656)	
married		0.197***	
		(0.0586)	
number of household members		-0.00141	
		(0.0329)	
chronic disease		-0.115*	
		(0.0597)	
lambda			-0.450
			(0.278)
constant	9.151***	1.135***	
	(0.0727)	(0.116)	
Observations	4,948	4,948	4,948

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Skilled labor income, Heckman selection model

	(1)	(2)
VARIABLES	unemployed is base outcome	employed
man	0	-0.456***
	(0)	(0.0585)
income differential	0	4.16e-05***
	(0)	(5.91e-06)
rural location	0	-0.938***
	(0)	(0.0585)
logarithm of age	0	0.566***
	(0)	(0.100)
number of household members	0	-0.101***
	(0)	(0.0315)
Zakarpattia	0	0.121
	(0)	(0.130)
West Ukraine	0	-0.125*
	(0)	(0.0726)
South Ukraine	0	-0.0533
	(0)	(0.0993)
Autonomous Republic of Crimea	0	0.0630
	(0)	(0.132)
East Ukraine	0	0.201***
	(0)	(0.0755)
skilled	0	0.787***
	(0)	(0.0620)
constant	0	-0.443
	(0)	(0.407)
Observations	10,418	10,418

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Labor market status, binomial logit model