Can EU Enlargement lead to "Immiserizing Growth"?

An Empirical Investigation

Simla Tokgoz
Center for Agricultural and Rural Development
Iowa State University
Ames, IA 50011
stokgoz@iastate.edu

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Abstract: The possibility of "immiserizing growth" in the grain sectors of the acceding countries after the EU enlargement is explored. The impact of the enlargement on the EU, new member states, and world grains markets are projected with different technology transfer scenarios, and the net welfare changes in each scenario are computed.

Keywords: Immiserizing growth, technology transfer, EU enlargement

1. Introduction

At the end of 2003, the European Union (EU) concluded its negotiations with ten candidate countries[1], and in 2004 it accomplished its largest enlargement process in terms of the number of countries, area, and population. This development is significant for the world grains markets as not only the EU has been a major player both as an importer and an exporter, but also agricultural sector is critically important in the new member states.

The agricultural sector of the new member states generates a higher percentage of the GDP and employs a larger portion of the labor force relative to the EU. However, the structural inefficiency in the farms, a reminiscent of collectivization after the World War 2, has lead to low agricultural output levels in these countries, which were once considered the "bread basket" of Europe. Financial and capital constraints did not help, and lowered yields as they limited the purchase of inputs by farmers. For example, the wheat yield in the Czech Republic has been on average 24 percent lower than the average EU level in the last ten years. This ratio is 45 percent for Hungary and 64 percent for Poland. The average yield of corn in Czech Republic is 65 percent lower than the EU average; it is 76 percent lower in Hungary and 65 percent lower in Poland. The yield gaps are much higher for the remaining new member states. Although the yield levels have started converging towards the EU levels in the recent years, there is still much potential to be realized in the new member states.

Many instruments of the common agricultural policy (CAP) of the EU, such as direct payments to farmers, are expected to benefit the agricultural producers of the new member states, and increase their production and exports. With the accession to the EU, not only agricultural and trade policies of new member states will be uniformized with the EU, but also they will benefit from other externalities. These benefits are technology transfer from the EU-15 members, an increase in the flow of foreign direct investment (FDI) to their countries, and acceleration of the restructuring of their agricultural and food sectors. However, it should be noted that the net change in social welfare of new member states from the enlargement depends on multiple factors: the change in producer surplus, the change in consumer welfare,

[1] Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia

and the change in the export subsidy expenditures. The net change of social welfare for the new member states can either be positive or negative depending on the direction and the relative magnitudes of these changes. The changes in producer surplus, consumer welfare, and export subsidies in turn depend on the extent of the technology transfer and the supply response it generates. With a technology transfer-induced supply shift, producers will produce and export more, increasing the export subsidy expenditures. This in turn will decrease the net welfare gains for the new member states. Thus, when evaluating the impacts of the enlargement process on the new members' economy, a comprehensive calculation of the change in social welfare needs to be carried out.

That is why; we need to look at the literature on immiserizing growth while discussing the net welfare effects of the enlargement on the new member states. Bhagwati (1958) reintroduced the concept of immiserizing growth, i.e. technical progress may reduce social welfare through adverse effects on the terms of trade in an economy. Johnson (1967) showed that growth could be immiserizing due to trade policy distortions even when the terms of trade do not change. Alston and Martin (1995) showed how the size and the distribution of benefits from research-induced supply shift depend on the nature of the supply shift, the nature of any market-distorting policies, and the terms of trade effects arising from technology transfer.

In this context, the first objective of this study is to project the impacts of the enlargement on the EU, new member states, and world grains markets. In the next step, the welfare effects for the new member states under alternative technology transfer scenarios are calculated to test if immiserizing growth will occur.

To this end, the analysis provided in this work considers multiple technology transfer scenarios. In the first scenario that is used as a benchmark, no technology transfer is assumed and these new members maintain the yield growth rates before they joined the EU. This benchmark scenario incorporates the EU enlargement and the CAP reform. In the next scenario, technology transfer is included in the model that increases the yields to their potential level. There are different rates of technology transfer used in the study that gives rise to 3 scenarios: a low growth scenario, a modest growth scenario and a high growth scenario. The net welfare changes in each scenario is calculated and compared, to see whether there is a possibility of immiserizing growth.

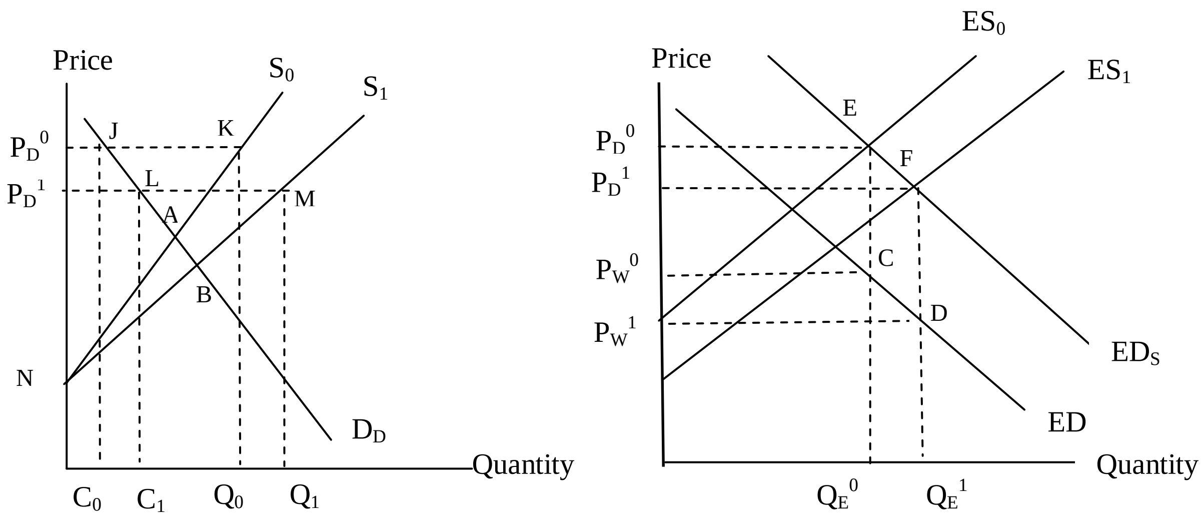
This study uses a multimarket non-spatial, partial-equilibrium model of world grains markets including wheat, corn, and barley markets for the EU, new member states, and other major countries and/or regions. Change in producer surplus is used to measure the welfare changes to producers resulting from technology transfer. The increase in export subsidy expenditures from higher exports is calculated as well. To obtain the change in consumer welfare, an incomplete demand system approach -LINQUAD- is used to compute equivalent variation of consumer price changes.

Many studies done before and during the enlargement negotiations estimated the potential impacts of the enlargement on the EU and on world agricultural markets. In contrast, this study will implement the actual agreed upon framework rather than making assumptions on the terms of the enlargement. It will also include the latest changes in the agricultural policy through the CAP reform.

This study proceeds as follows. Section 2 presents the impact of technology transfer on the grains markets in the new member states, describing the conditions under which immiserizing growth can occur. Section 3 discusses the modeling of technology transfer and its impact on yield, land, and supply of grains in the new member states. Section 4 discusses different channels through which technology transfer to new member states can take place. Section 5 describes the scenarios run under different technology transfer assumptions. Section 6 presents the results and Section 7 concludes.

2. Grains Markets

Figure 1 shows the impacts of technology transfer in the grains markets of the acceding countries. Panel (a) represents the domestic market, whereas panel (b) represents the export market. It shows the case for a large country exporter that has an export subsidy policy in place.[2]



(a) Domestic Market (b) Export Market

Figure 1. Effects of technology transfer on production, prices, and exports of grains in the acceding countries

In panel (a), point A denotes the autarky equilibrium. Point B represents the autarky equilibrium when supply shifts in the new member states with the technology transfer after accession to the EU. The domestic price that is denoted by P_D^0 decreases to P_D^1 with increased supply. Supply (S_0) shifts to S_1 with the technology transfer, which is shown here as a pivotal shift.

The export market is represented in panel (b) where ED denotes excess demand without export subsidy and ED_S denotes excess demand with export subsidy. The amount of export subsidy used before technology transfer is the rectangle ($P_D^0ECP_W^0$) where P_W^0 shows the world price before the supply shift. In the export market, the excess supply (ES_0) shifts to ES_1 after the technology transfer, changing the export subsidy amount to the rectangle shown by ($P_D^1FDP_W^1$). Although the supply shift in the domestic market is pivotal, the supply shift in the export market is nearly parallel.

The welfare changes in the new member states from the technology transfer scenario can be summarized as follows. The change in consumer surplus is equal to the area denoted by ($P_D^0JLP_D^1$),

[2] The 10 new member states are a part of the EU and observe EU prices, and EU-25 is a large country in the grains market. So, this is the case used for the technology transfer scenario.

which is positive. The change in producer surplus is equal to the difference in the areas, i.e. (P_D^1MN) – (P_D^0KN), which can be either positive or negative. The increase in export subsidy expenditure is equal to the area (CDFE), which is positive. The net welfare change is equal to the change in consumer surplus plus the change in producer surplus minus the change in export subsidy. This net change in welfare can be positive or negative, depending on the relative magnitude of its components. If it is negative, then immiserizing growth occurs, i.e. the country is worse off after a supply increase due to technological improvement. If it is positive, then the country benefits from the technology transfer. It should be noted that in the scenario analysis, the additional burden of tax costs for each country is not considered, as the budget allocated to the export subsidy is a part of the EU-25 budget, and it is not an easy task to differentiate how much each country contributes to the specific cost of export subsidy.

It is crucial to note that the nature of the supply shift and the size and the nature of the trade distortion will determine whether there will be “immiserizing growth” or not. Alston and Martin (1995) discuss a set of conditions under which technological change can be immiserizing. In panel (a), a pivotal supply shift is illustrated. In this case, there is a possibility of immiserizing growth even without trade distortion as the change in producer surplus can be either positive or negative. If the supply shift had been parallel, then producers would have benefited alongside the consumers, unless there is a trade distortion, such as export subsidies.[3]

The possibility of immiserizing growth further increases when we introduce the export market and the export subsidy into the analysis. In this case, there is a cost of export subsidy that needs to be considered in the calculation of net welfare of the society. As seen in panel (b), the export subsidy cost increases with a supply shift as the producers export more and receive higher subsidies. Thus, net benefits from technology transfer are lower when there are export subsidies, in some cases even negative, hence the “immiserizing growth”.

[3] See Bhagwati (1958) and Johnson (1958) for a discussion of immiserizing growth in the absence of distortions, when demand is inelastic.

3. Modeling the Technology Transfer

In order to model and evaluate the impact of technology transfer in the acceding countries, first a multi-market non-spatial, partial-equilibrium model of world grains markets is set up. The model includes wheat, corn, and barley markets for the EU, the new member states, and other major countries and/or regions.

In the next step, the impact of technology transfer on an agricultural production function of each commodity in each new member state is analyzed. The supply in the corn market of each acceding country, denoted by CS, is written as $CS = L_C \cdot y_C$, where L_C is land allocated to corn production, and y_C is production per hectare for corn (yield). The profit per hectare function is $\pi = \pi(P_C, P_I)$, where P_C is the price of corn and P_I is the price of an aggregate input. A normalized quadratic profit function is written as $\pi = \alpha + \gamma \cdot \left[\frac{P_C}{P_I}\right] + \frac{1}{2} \cdot \beta \cdot \left[\frac{P_C}{P_I}\right]^2$. The production per hectare is derived as

$$\frac{\partial \pi}{\partial P_C^*} = \gamma + \beta \cdot P_C^* = y_C \qquad (1)$$

where $P_C^* = \left[\frac{P_C}{P_I}\right]$.

In this framework, the new profit per hectare function after the technology transfer can be written as $\pi^T = \alpha + \phi + \gamma \cdot \mu(T) \cdot \left[\frac{P_C}{P_I}\right] + \frac{1}{2} \cdot \beta \cdot \theta(T) \cdot \left[\frac{P_C}{P_I}\right]^2$, where ϕ is the coefficient of unit profit increase due to technology transfer, $\mu(T)$ is the coefficient of unit yield increase due to technology transfer, and $\theta(T)$ is the coefficient of yield change due to technology transfer.[4] Thus, the new production per hectare for corn is

[4] In the above equation, an assumption that the optimal $\left[\frac{P_C}{P_I}\right]$ ratio did not change with the new technology is made.

$$\frac{\partial \pi^T}{\partial P_C^*} = \gamma \cdot \mu(T) + \beta \cdot \theta(T) \cdot P_C^* = y_C^T \quad (2)$$

where ${y_C}^T$ is the new yield for corn after the technology transfer.

There are three different types of supply shifts that might occur depending on the values of $\mu(T)$ and $\theta(T)$: the first case occurs when $\mu(T) > 1$ and $\theta(T) > 1$, where both the intercept and the slope of the yield function changes. The second case occurs when $\mu(T) > 1$ and $\theta(T) = 1$, where only the intercept of the yield function changes, and in this case the supply shift is parallel. The third case occurs when $\mu(T) = 1$ and $\theta(T) > 1$, where only the slope of the yield function changes, and in this case the supply shift is pivotal.[5]

In the technology transfer scenarios, the third case is considered for the supply shift. In this case, the new yield function becomes $y_C^T = \gamma + \beta \cdot \theta(T) \cdot P_C^*$. While implementing the technology transfer scenarios, the value of $\theta(T)$ is calculated for each scenario depending on the desired growth rate of yield for crops.

To determine the supply for corn, the next step is to identify the land equation. The equation for land allocated to corn is written as

$$L = L(\pi_C, \pi_B) = \lambda + \delta \cdot \pi_C + \rho \cdot \pi_B = \lambda + \delta \cdot P_C^* \cdot y_C + \rho \cdot P_B^* \cdot y_B \quad (3)$$

where P_B and y_B denote the price and yield of the complementary crops respectively. Technology transfer influences the land allocated to corn through its direct impact on yields and its indirect impact on prices.

Combining equations 1 and 3, the corn supply before technology transfer is derived as

$$CS = (\lambda + \delta \cdot P_C^* \cdot y_C + \rho \cdot P_B^* \cdot y_B) \cdot (\gamma + \beta \cdot P_C^*) \quad (4)$$

Using equations 2 and 3, the corn supply after technology transfer is derived as

[5] See below for a discussion of the impact of the nature of supply shifts on the possibility of immiserizing growth.

$$CS = (\lambda + \delta \cdot P_C^* \cdot y_C^T + \rho \cdot P_B^* \cdot y_B^T) \cdot (\gamma + \beta \cdot \theta(T) \cdot P_C^*) \qquad (5)$$

4. Sources of Technology Transfer and Yield Growth

In this study, the focus is on yield improvements in wheat, barley, and corn production in the acceding countries to the EU. The benchmark scenario against which the results of growth scenarios are compared also incorporates the EU enlargement and the CAP reform. The reason for incorporating the enlargement is to be able to isolate the impacts of technology transfer on production, prices and export subsidies in the acceding countries.

Different channels have been described in the literature in terms of the sources of technology transfer from EU to the Central and Eastern European countries that will increase the productivity of the farming systems, and therefore the yields. The first and the most often cited channel is the replacement of the technically obsolete machinery and equipment. The prices and the availability of machinery and equipment widely differ between the new member states and the EU countries. For example, Heinrich (2001) gives a comparison of Hungary and Germany in terms of the number of tractors and gross investments of machinery. He notes that, in terms of inputs, an average Hungarian farm roughly uses three-quarters of the tractors used by its German counterpart in 2000. Gross investments for machinery are more than three-fold for a German farm compared to a Hungarian farm in Euros per hectare units for 2000. These data show the potential for machinery use and investment for technical equipment in the new member states that has not been yet realized. This is especially true when productivities of machinery for wheat production are compared. In Hungary, the productivity of machinery is 8.9 (100 kg/hour) which is nearly half of that in Germany which is 16.4 (Heinrich 2001). Although a Hungarian farm can work with less machinery than the German farm because of different climate factors, the gap in the productivity shows the potential gains from new and improved machinery.

Purchases of new machinery and equipment will be possible as the financial situation of the farmers in the new member states will improve considerably with the enlargement. Through imports of newly built machinery from EU or other Western countries, not only the productivity of farms will increase, but also the costs of repair and maintenance will decrease. Pawlak and Muzalewski (2001) note that the share of imported new-built tractors from Western countries increased from 0.3 per cent in 1995 to 6.1 per cent in 2000 in Poland. Higher farm income combined with the increased trade relations with the other EU members will possibly increase this ratio.

The other possible channel of technology transfer is through the seed markets. Duczmal (2001) reports that the number of seed varieties in the "National List of Varieties" of countries in transition almost doubled in the last decade, and the proportion of domestic varieties in this list decreased. A similar trend was detected among cereals in the same period, where the proportion of domestic varieties decreased as well.

International seed companies entered Central and Eastern European markets, and have well-organized 'transfer of technology' systems. Turi (2001) reports the increased activities of multinational corporations in Hungary, and the increased usage of foreign varieties. He also notes that Hungary's hybrid corn seed improvement comes from multinational corporations' investments. Although Hungary already had well-established links with the Western countries through seed production and seed trading activities, these links have been renewed and strengthened in the past decade. Another channel for yield improvement has been biotechnology that has been introduced into Central and Eastern Europe for some time. Field trials of transgenic crops started in multiple countries such as in Czech Republic for corn (Heffer 2001).

The next channel, Foreign Direct Investment (FDI), such as Pioneer's in Hungary, is critical in the transfer of modern technology. However, not all Central and Eastern European countries are equally attractive to FDI. Although concentration has been mostly in Hungary, Czech Republic and Poland (Josling et al. 1997), acceding to the EU will increase the attractiveness of the new member states, and may increase FDI and the resulting technology transfer from it.

In this context, it is beneficial to refer to Pouliquen's (2001) extensive study on the relative competitiveness and farm incomes in the Central and Eastern European agri-food sectors. He claims that the relative low yields in these countries are the result of low use of bought inputs. He notes that with the exception of Slovenia, the main inputs bought for production of crops are utilized 2 to 3 times fewer per agricultural hectare compared to the EU. He also shows that the level of capital invested per worker is lower in these countries than the French level, which is an acceptable approximation for the EU. In terms of implications of the enlargement, he claims that the overall productivity in agri-food sectors will probably increase more from technological progress than from price rises, with the exception of rye. However, he also points out that the structures of small- and medium-sized semi-subsistence holdings may prevent farmers from realizing these productivity gains. He also notes that farmers in new member states will receive higher incomes as a result of direct payments from EU, which in turn will increase productivity and production. However, this is on the condition that these higher incomes are used for investment rather than consumption or absorbed in land price increases.

5. Technology Transfer Scenarios

The average grain yields in the EU define the potential for the grain yields in the new member states. In terms of historical perspective, Eastern Europe and Commonwealth of Independent States (CIS) were net food exporters early in this century. In the pre-socialist period, average yields in the Eastern Europe were only slightly lower than those in the Western Europe. Tyers (1993) gives example of Poland where the average yield of wheat was equal to its counterpart in Western Europe, whereas yield of barley was slightly below it.

There are a couple of reasons for the lower yields in the new member states. One of them is the transition to market economy which started in 1989, and included de-subsidization, de-collectivization, privatization, and price liberalization in the agricultural sector. These structural changes are accounted for the low yield levels in the grains sector as they have contributed to the lack of finance in the agricultural sector, as well as less use of inputs such as fertilizers, pesticides etc. Thus, when estimating the yield growth after the enlargement, the growth in yields from technology transfer needs to be separated from the increase in yields that is expected to originate from input use due to higher income of farmers.

To correctly assess the yield growth for the grains is critical in determining the impact of technology transfer on production, prices, and exports. To this end, previous literature provides guidance.

Tyers (1993) utilizes 3 growth and productivity scenarios for post-socialist economies. The first one is a benchmark against which other scenarios can be compared. The other two scenarios are "low growth" and "high growth". In the "low growth scenario", there is no technology catch-up and the growth rates settle down to their pre-reform values after a decline. In the "high growth" scenario, wheat yields increase 10 per cent over the benchmark, and coarse grain yields increase 5 per cent over the benchmark. However, Tyers' work does not incorporate a possible EU enlargement, and underestimates the potential for technology transfer that might be brought on by it.

In this study, 3 different technology transfer scenarios are run. The first one is a "low growth" scenario, in which wheat, corn, and barley yields increase by 5 per cent in 3 years (2004-2006) for all countries. In the "modest growth" scenario, all 3 commodities' yields increase by 10 per cent over 3 years, and in the "high growth" scenario, the increase is 15 per cent. In all 3 scenarios, stocks are kept constant at their benchmark levels, as an increase in stocks might be reduced by an increase in export subsidies and exports. Wheat and coarse grain markets are modeled separately for the 3 biggest players, Hungary, Poland, and Czech Republic. The other 7 new member states are grouped together.

It should also be noted that the potential for each country depends on its climate conditions, soil conditions etc. Thus, the yield growth that can be brought upon by technology transfer may not be unique but may differ from country to country, and also from commodity to commodity. The differences are hard to predict and to model. Thus, a constant growth rate among countries and crops has been assumed.

6. Measuring Welfare Changes

To calculate welfare changes, a benchmark is established by solving the model with no technology transfer assumption. Then each scenario is evaluated under different assumptions of technology transfer relative to this benchmark using producer surplus (PS), equivalent variation (EV), and export subsidy expenditure (ES).[6]

[6] All 3 welfare calculations are computed at the year 2013 which is the marketing year that starts in 2013 and ends in 2014.

Producer Surplus

The formula used for computation of the producer surplus is

$$\Delta PS = \int_{\bar{\pi}}^{\hat{\pi}} L_x(x)dx \tag{6}$$

where $\hat{\pi}$ represents the profits after the technology transfer and $\bar{\pi}$ represents the benchmark profits before the technology transfer for each country and commodity. L_x is the land allocated to the specific commodity.

Consumer Welfare

Equivalent variation (EV) is used to measure the change in consumer welfare. An incomplete demand system approach (LINQUAD) (LaFrance (1998), LaFrance et al. (2002), Agnew (1998), Beghin et al. (2003) and Beghin et al. (2004)) is used as it allows an exact welfare measure to be derived from it.

First, a representative consumer with an expenditure function $e = f(P,U)$ is assumed where P is a vector of consumer prices, $P = (P_C, P_B, P_{OG})$, and U denotes utility. In the example below, the focus is on a two-good case of the utility function, corn and barley. Each country has a different consumption equation for each commodity, and the EV calculation has been adjusted for each case. P_C is the price of corn, P_B is the price of barley, P_{OG} is the price of all other goods that is included for completeness, and M denotes income.

The Marshallian demands for corn and barley, denoted by CD and BD respectively, are derived as follows:

$$CD(P_C, P_B, M) = \xi_C + \nu_C \cdot P_C + x_C \cdot (M - \xi_C \cdot P_C - \xi_B \cdot P_B - 0.5 \cdot \nu_C \cdot P_C{}^2 - 0.5 \cdot \nu_B \cdot P_B{}^2) \tag{7}$$

and

$$BD(P_C, P_B, M) = \xi_B + \nu_B \cdot P_B + x_B \cdot (M - \xi_C \cdot P_C - \xi_B \cdot P_B - 0.5 \cdot \nu_C \cdot P_C{}^2 - 0.5 \cdot \nu_B \cdot P_B{}^2) \tag{8}$$

for all countries.

In the next step, the following system of equations is solved with the above two equations to obtain the parameters $\xi_B, \nu_B, x_B, \xi_C, \nu_C, x_C$.

$$\frac{\partial BD}{\partial P_B} = \nu_B - x_B \cdot (\xi_B + \nu_B \cdot P_B) \tag{9}$$

$$\frac{\partial BD}{\partial M} = x_B \tag{10}$$

$$\frac{\partial CD}{\partial P_C} = \nu_C - x_C \cdot (\xi_C + \nu_C \cdot P_C) \tag{11}$$

$$\frac{\partial CD}{\partial M} = x_C \tag{12}$$

The solution allows to exactly identify all cross-price responses to the system as ξ, ν and x are then known parameters. Based on equations 7 and 8, the EV is derived as

$$EV = \left\{ \left[M - \xi_C \cdot P_C{}^1 - \xi_B \cdot P_B{}^1 - 0.5 \cdot \nu_C \cdot (P_C{}^1)^2 - 0.5 \cdot \nu_B \cdot (P_B{}^1)^2 \right] * \exp\left(-\left(x_C \cdot P_C^1 + x_B \cdot P_B^1 \right) + \left(x_C \cdot P_C^0 + x_B \cdot P_B^0 \right) \right) \right\}$$

$$- \left[M - \xi_C \cdot P_C{}^0 - \xi_B \cdot P_B{}^0 - 0.5 \cdot \nu_C \cdot (P_C{}^0)^2 - 0.5 \cdot \nu_B \cdot (P_B{}^0)^2 \right] \tag{13}$$

where 0 and 1 denote the initial and the final prices respectively.

Export Subsidy

An effective export subsidy rate is calculated for each commodity for the EU by using the latest available value of export subsidy expenditure and the FOB values of exports for that year.

$$\text{Per unit export subsidy rate} = \frac{(ER)}{(EX)} \tag{14}$$

where ER denotes value of export refunds (export subsidy expenditures), and EX denotes value of exports (FOB price times total exports). This subsidy rate is used for each new member state to calculate their respective export subsidy expenditures and the change after each scenario. Thus, the total export subsidy expenditure gets evenly distributed with respect to the export shares of each country for each commodity. The export subsidy expenditure for each country and commodity is calculated by multiplying the export subsidy rate with the FOB price of the commodity and the third-country[7] exports.

7. Results

The preliminary results for the 3 technology transfer scenarios are presented in Tables 1-3. Tables 1A through 1C show the welfare effects from the first scenario that incorporates a growth rate of 5 per cent for wheat, corn, and barley yields over the benchmark scenario. For all 3 commodities, the benefits of technology transfer outweigh the costs from it, as the sum of producer surplus and equivalent variation exceeds the change in export subsidy. Thus, all countries benefit from the yield growth of all commodities considered in this scenario. Tables 2A through 2C show the welfare impacts of a 10 per cent growth in yields of wheat, corn, and barley. Tables 3A through 3C present the welfare impacts of a 15 per cent growth in yields of wheat, corn, and barley. In these scenarios, as well, the benefits of technology transfer and yield growth outweigh the costs incurred from it. Therefore, it can be concluded that no matter which rate of technology transfer is assumed in this study, the acceding countries' welfare increases because of technology transfer and yield growth, in the grains sector. However, it should also be noted that the increase in export subsidies is positive in most cases, and therefore the burden of higher export subsidies must be taken into consideration while evaluating the welfare effects of technology transfer in acceding countries.

These results also show that the magnitudes of the producer surplus in the acceding countries depend on the country's potential. For example, Hungary benefits the most from an increase in the yield of corn, a commodity in which it has a large production capacity and has been a traditional net exporter. This is also true for the Czech Republic and Poland for the case of wheat, for which the producer surpluses were the highest with respect to other commodities.

As the producer surplus in all commodities for all countries in each scenario is positive, the only remaining option available for the immiserizing growth to happen was to have a large enough negative impact through a large increase in export subsidies. However, the increases in export subsidies of all

[7] Third-country exports include exports to all countries except EU-15 and the 10 new member states.

commodities were below the sum of producer surplus and equivalent variation. One of the reasons for this result was that, although the increases in production and exports were considerable, not all exports were subsidized. The export subsidy rates for the EU was used to compute the export subsidy expenditures in the acceding countries, and these rates are less than 1, specifically 4.5% for wheat, 22.8% for corn, and 44.1% for barley.

8. Conclusions

The objective of this study is to explore the possibility of immiserizing growth in the grain sectors of the acceding countries to the EU. To this end, a multi-market non-spatial, partial-equilibrium model of world grains markets for the EU, new member states, and other major countries and/or regions is used. First, a benchmark scenario is set up that incorporates the EU enlargement and the CAP reform with no technology transfer. Then, multiple scenarios that include different rates of technology transfer to the acceding countries from the EU are run. Technology transfer is incorporated into the model in the form of an increase in yields of wheat, corn and barley over the benchmark scenario. The resulting welfare effects in the acceding countries from this technology transfer in the grains sector are computed.

The preliminary results show that the net welfare effects of technology transfer is positive for all the acceding countries in all commodities. Although the increase in export subsidy expenditures of the acceding countries is positive in most cases, it is not large enough to obtain a negative welfare effect. The sum of producer surplus and equivalent variation exceeds the increase in export subsidy expenditure in all cases.

It should be noted that the gain of producers in the form of producer surplus depends on the relative potential of each commodity, in other words producers gained the most in commodities they already produced the most although the growth rate of yields were kept constant across commodities in each scenario.

There are two points that need to be discussed while interpreting the above results. The first one is the usage of an export subsidy rate while calculating the export subsidy expenditures of the acceding countries. The subsidy rate for each commodity in EU is calculated based on the latest available data, and used across all the acceding countries to be consistent, which in turn resulted in an even distribution of export subsidies to acceding countries with respect to their export shares. However, some of the acceding countries had export subsidies prior to the enlargement, and ambiguity about their future utilization has prompted the above methodology. Thus, the utilization of export subsidies by the new member states after joining the EU may differ from the one described in this study. In future research, a more recent description of the export subsidy policies in the new member states will be incorporated into the technology transfer scenarios.

The second point is the assumption of same yield increases across commodities and across countries in each scenario. The rate of increase in yields may not be the same across commodities, as the level of investment by domestic producers and by multinational corporations may differ for each commodity as the profitability of each commodity may differ. The agro-ecological conditions of the new member states differ from each other, as well. This may not only introduce different rates of yield increase across countries for the same crop, but also across commodities in the same country. Although projections of technology transfer in acceding countries is difficult as it depends on multiple factors, in the future research more attention will be paid to different potential of each commodity and country in terms of ability to benefit from technology transfer from the EU.

This study explores the possibility of immiserizing growth in the grain sectors of the new member states after acceding to the EU. The possibility of technology transfer and the use of export subsidies, hence trade distortion, create the conditions which may lead to immiserizing growth, i.e. a negative net welfare change after technological improvement. The results show that this is not the case, and that all acceding countries benefit from technology transfer and yield increases in all grain sectors.

TABLE 1.A. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013/14) for Wheat

	Scenario 1		
Country	**Change in PS**	**EV**	**Change in ES**
Czech Republic	450.78	4.26	7.42
Hungary	247.60	2.83	3.32
Poland	629.76	7.02	1.49
Other NMS*	347.66	4.41	8.54

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 1 incorporates 5% growth rate in yields by 2006.

TABLE 1.B. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013/14) for Corn

	Scenario 1		
Country	**Change in PS**	**EV**	**Change in ES**
Czech Republic	116.54	0.09	0
Hungary	455.66	0.36	22.5
Poland	282.94	0.07	0
Other NMS*	125.48	0.35	10.29

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 1 incorporates 5% growth rate in yields by 2006.

TABLE 1.C. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013/14) for Barley

	Scenario 1		
Country	**Change in PS**	**EV**	**Change in ES**
Czech Republic	239.28	3.85	45.74
Hungary	56.06	1.06	4.25
Poland	173.51	2.48	0
Other NMS*	208.73	3.15	40.03

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 1 incorporates 5% growth rate in yields by 2006.

TABLE 2.A. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013) for Wheat

	Scenario 2		
Country	Change in PS	EV	Change in ES
Czech Republic	913.31	10.08	14.73
Hungary	499.94	6.70	6.64
Poland	1269.18	16.60	1.49
Other NMS*	707.41	10.42	17.22

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 2 incorporates 10% growth rate in yields by 2006.

TABLE 2.B. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013) for Corn

	Scenario 2		
Country	Change in PS	EV	Change in ES
Czech Republic	235.41	0.23	0
Hungary	911.99	0.88	45.07
Poland	572.11	0.18	0
Other NMS*	255.27	0.86	10.27

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 2 incorporates 10% growth rate in yields by 2006.

TABLE 2.C. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013) for Barley

	Scenario 2		
Country	Change in PS	EV	Change in ES
Czech Republic	480.37	7.81	90.71
Hungary	112.01	2.16	8.44
Poland	347.05	5.04	0
Other NMS*	420.55	6.40	79.95

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 2 incorporates 10% growth rate in yields by 2006.

TABLE 3.A. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013) for Wheat

	Scenario 3		
Country	**Change in PS**	**EV**	**Change in ES**
Czech Republic	1378.86	15.41	26.33
Hungary	752.68	10.24	9.97
Poland	1916.75	25.38	1.48
Other NMS*	1069.92	15.93	26.02

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 3 incorporates 15% growth rate in yield by 2006.

TABLE 3.B. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013) for Corn

	Scenario 3		
Country	**Change in PS**	**EV**	**Change in ES**
Czech Republic	234.29	0.36	7.85
Hungary	1361.51	5.91	65.36
Poland	864.21	0.29	0
Other NMS*	386.07	1.32	10.16

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 3 incorporates 15% growth rate in yield by 2006.

TABLE 3.C. Welfare effects of technology transfer scenarios in 1000 US dollars at 1995 prices (2013) for Barley

	Scenario 3		
Country	**Change in PS**	**EV**	**Change in ES**
Czech Republic	719.37	12.01	151.45
Hungary	167.18	8.39	12.51
Poland	518.61	7.76	0
Other NMS*	630.27	9.84	119.40

* Other NMS are Estonia, Latvia, Lithuania, Cyprus, Malta, Slovakia, Slovenia.

Note: Scenario 3 incorporates 15% growth rate in yield by 2006.

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