THE WELFARE EFFECT OF EXPORT RESTRICTIONS: THE CASE OF UKRAINIAN MARKET FOR WHEAT

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Abstract

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On September 28, 2006, Ukrainian government introduced licensing of grain exports, which was afterwards replaced with a quota system.

A detailed investigation of the quotas on grain exports in Ukraine was made by the World Bank and IER. They have shown that a grain quota introduction is not justified. Also producers suffered losses and consumers gained much less from the grain quota introduction than it is predicted by the theory. And, alternative measures to secure the supply of domestic Ukrainian markets exist. Therefore, this paper is a continuation of the research World Bank and IER (2006), which focuses on the empirical evaluation of welfare effects for one of the grain markets – the market for wheat.

The paper adopts the partial equilibrium analysis for empirical evaluation of the effect of export quotas and taxes with 5%, 10%, 15% and 20% rates under the assumption of a "small" county case. For this purpose the paper provides the required domestic demand and supply, and import demand elasticities. On the basis of the estimated price elasticities a quantitative estimation is conducted on the welfare effects of wheat producers, consumers, the government and the country as a whole. The econometric results demonstrate that export quotas are not desirable for national welfare, and export taxes are sound alternatives.

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GLOSSARY

EXW is ex-works price. According to Incoterms – 2000 the price of the contract with this term of trade includes only the price of manufacturing plant.

FOB is free-on-board price. According to Incoterms – 2000 the price of the contract with this term of trade includes the price of manufacturing plant plus the cost of delivery to the shipment port, plus the cost of loading to the shipboard, plus the cost of custom clearance for export.

ARIMA (*p, d, q*) is an autoregressive integrated moving average estimation, frequently, of nonstationary time series data where *p* denotes the number of autoregressive terms, *d* the number of times the series must be differenced to reach stationarity, and *q* the number of moving average terms.

Chapter 1

INTRODUCTION

Ukrainian agricultural markets have been characterized as an occasionally unstable throughout the last decade. This fact has reinforced the belief that Ukrainian market mechanisms do not lead to satisfactory outcomes of agro-food sector production. But agriculture is a main source of relative resource endowments concentration that, through the relative resource efficiency, defines a country's comparative advantage which is the main determinant of economy competitiveness.

Ukrainian agriculture is only considered to show some signs of recovery from its "transition crisis". However, it is still weak and unstable, which is the main bottleneck to the foreign investment. Moreover, despite the significant progress made by a subset of the country's farms, agriculture's capital base continues to decline. Furthermore, management skills and know-how continue to remain far behind the necessary for tapping Ukrainian great potential in agricultural productivity and, therefore, its ability to compete on world markets levels. And, what is more vexing is the fact that government has not reacted to all of these concerns, and where it has, it has sometimes reacted with inappropriate tools. This was the case of recent developments on Ukrainian grain market.

On September 28, 2006, Ukrainian government introduced licensing of grain exports, which was afterwards replaced with a quota system. This measure was perceived by Ukrainian producers as a just another unexpected shock: exports have completely stopped. Producers suffered huge losses, they have to pay

$30 000 a day per each of 15 vessels during the idle time (Nivyevskiy and Strubenhoff, 2006). On the one hand, we can not blame the government for this, since export quotas sometimes appear to be beneficial for a country's economy. However, this time implementation of quotas was dictated not economically but only politically. The background of this measure relates to the rise of the world market price for grain at the time when a government asked grain-trading companies (including Cargill, ADM-Toepfer and Bunge) to sell 300 000 tons of wheat to the strategic reserve at a discount. Since government was refused, it introduced export quotas in the amount of 400 000 tons for wheat export (while actual wheat export in the preceding to quotas introduction month was 856 000 tons), 600 000 tons for barley export (with an actual preceding barley export value on the level of 1 200 000 tons), and 100 000 tons for the corn export (Nivyevskiy and Strubenhoff, 2006). That is, there is no justification of this measure, and therefore it has attracted a lot of attention to its analysis.

In particular, a detailed investigation of the quotas on grain exports in Ukraine was made by the World Bank and IER. They have shown that a grain quota introduction is not justified since the amount of domestic grain supply is enough to cover all domestic needs and allow higher grain export, than it was estimated by the government. As for welfare effects, producers suffered losses and consumers gained much less from the grain quota introduction than it is predicted by the theory, because with remaining constant wheat prices, prices for flour and bread have increased since quota's implementation. Additionally, quota system has hurt grain traders who invested significant funding to facilitate exports. Moreover, it has created opportunities for corruption (because companies who can cash in a profit of $25 per ton at present are able to secure an export quota). The main beneficiaries of this quota are flour millers and animal feed producers (because of domestic grain prices falling). Therefore, this export quota is "an ill-advised and poorly targeted measure to protect the poor in

Ukraine" (World Bank and IER, 2006). And, alternative measures for the protection of Ukrainian market exist, and they may serve better welfare effects than the grain export quota.

That is why, the main question of this research is to evaluate the welfare loss of Ukrainian economy after the recent imposition of an export quota on its grain market, and, to analyze an alternative scenario of domestic market protection, i.e. export tax. The estimation of welfare effects from the introduction of an export quota on the Ukrainian grain market and possible introduction of an export tax, as an alternative scenario will be made using partial equilibrium analysis (PE) for a "small" country case. Since the abovementioned research by the World Bank and IER does not contain any empirical calculations justifying the welfare losses of Ukrainian economy after a grain quota implementation, we will do such estimation in this paper, additionally, calculating the welfare effects of possible grain export tax introduction. Thus, Chapter 2 is devoted to the reviewing of the literature concerning evaluation of the partial equilibrium technique, discussion of all possible welfare effects of export restrictions like export tax and export quota, and also description of other insights which may influence our estimation results like a "theoretical" country case (large or small), exchange rate regime, time interval of investigated effects (long- or short-run), and the framework (static or dynamic). In Chapter 3 Ukrainian grain sector and its main players are described. In Chapter 4 we will present a theoretical framework assessing the main welfare effects in the grain sector caused by an imposition of the export quota, and possible imposition of an export tax. Particularly, "large" and "small" country cases for the economy protected by export quotas and export taxes are analyzed. Chapter 5 focuses on methodology of partial equilibrium model and data description. It also includes the discussion on obtained empirical results of the estimation. Chapter 6 concludes and gives policy recommendations.

Chapter 2

LITERATURE REVIEW

Agriculture is one of the core and most important industries in the initial country's development. It is well grounded by the fact that relative resource endowments, which are the main determinants of a country's comparative advantage, and therefore its competitiveness, are concentrated in agriculture. This pattern has attracted many scientists to the investigation of agricultural sector. Thus, Gollin et al. (2002) write that low agricultural productivity can appear to be a bottleneck in the process of industrialization. And, this low agricultural productivity can be determined not only by drawbacks in agricultural technologies, but also by poor governmental policies, which, in aggregate, result in the decline of a country's per capita income far below the country-leader. This was confirmed by the model of structural transformation which is basically a one-sector neoclassical growth model extended to include an explicit agricultural sector (Gollin et al., 2002). The key message that emerges from this model is that a better understanding of the determinants of agricultural productivity will enhance the world understanding about the development process for those economies that are currently poor. Since Ukraine's economy with its low performance characteristics can be attributed to those poor economies, thus, it is reasonable for Ukrainian policy makers to investigate each component of agricultural productivity. One of the main components is going to be studied in this paper. That is, export restrictions, set by the government, such as export quotas and taxes.

The potential contribution to global economic welfare of removing export quotas and taxes has been mainly estimated by partial equilibrium (PE) models. Economists have long recognized that the partial equilibrium measures used in applied researches are incomplete. That is why, some of them state that general equilibrium framework is needed in order to capture all the interactions that determine the net relative impact of a mix of policies on agricultural and non-agricultural sectors. However, till now there has been no systematic evaluation of the extent of agricultural bias of government interventions using general equilibrium framework (Bautista et al., 2001). That is why, I am going to apply partial equilibrium modeling for the estimation of welfare effects of such export restrictions as quotas and taxes.

Partial equilibrium models have faced a lot of criticism mainly due to their sometimes "unrealistic" assumptions. On the one hand, they are criticized because of their consideration of agricultural system as a closed system without linkages with the rest of the economy. On the other hand, these linkages can be included in a top-down fashion by altering parameters and exogenous variables. Thus, in principal, partial equilibrium models are able to provide details about multiple products (Tongeren et al., 2001).

For an instance, in the development of optimal competition policy, published in Economic Journal (1979)[1], authors estimated the influence of export taxes in the monopolized industries on the economic welfare using firstly partial equilibrium, and then general equilibrium framework. They show that the usage of general equilibrium is just "extends and qualifies" the results obtained by partial equilibrium estimation, but does not change them. In particular, partial equilibrium results show that in case of approximately equal elasticities of home

[1] The authors of the article are unknown: we will cite it further like EJ (1979), meaning its publication in the Economic Journal, vol. 89, 1979.

and foreign demand curves and a non-discriminating monopolist, a positive export tax usually maximizes welfare. Then, in case of more elastic foreign demand that the home one, non-discriminating monopolist and non-increasing marginal cost, the optimal export tax appears to be negative. Further, in case of discriminating monopolist[2] with increasing marginal cost, the optimal export tax should be positive, but if marginal cost doesn't change, no export tax must be introduced.

The above results are very important for our analysis since Ukrainian export grain market is shared among the limited number of large companies (like Cargill, ADM-Toepfer and Bunge), thus we have monopolistic competition on this market and, therefore, the cases for a producer-monopolist are very close to ours. Particularly, we are interested more in the last result, since (1) the listed companies prefer export to selling their grain on the domestic market, thus, they are of discriminating type, and (2) their marginal costs, on average, are of constant or, even, of decreasing type. Therefore, theoretically an optimal export tax should be zero for the Ukrainian grain market.

Extending the analysis from partial to general equilibrium, EJ (1979) investigated two instead of one industry simultaneously. They found that a country having two monopolized industries will lose in trade with a partner who has purely competitive industries in case of absence of a governmental policy which regulates its monopolies by setting an optimal export tariff. Since (1) we are not going to intensify our analysis by investigating the impact of export restrictions in other than "grain production" industry, and (2) to give "advices" about choosing a trade partner is not our primary task, using partial equilibrium analysis is sufficient for this investigation.

[2] A notion "discriminating monopolist" means when a producer-monopolist prefers trade on one of the markets: foreign or domestic.

It is necessary to mention that partial equilibrium model can also be of multi-product kind. Such types of models are able to capture supply and demand interrelationship among products. Since we are investigating grain market which includes wheat, barley, and corn, it firstly seems that multi-product partial equilibrium model will be better in this case. However, we want to show separate effect for wheat only, thus, we are going to use separate partial equilibrium model for wheat investigation. These models will be of log-linear type which allows the representation of supply and demand responses, prevailing in the market under study. We will also incorporate into the model some influential exogenous variables (see Methodology section).

It worth emphasizing that the results of estimation may differ not only across different models of estimation (like partial vs. general equilibrium models), but also across small and large country cases, different exchange rate regimes, in static and dynamic overview, and so forth, which will be discussed below. Therefore, firstly, we will describe some influential papers investigating the impact of export taxes (tariffs) and quotas on the economic welfare, and therefore we will end with a discussion of some important insights (such as stated above) which may influence our estimation results.

On this point, we come to the discussion of trade restrictions and its impact on economic welfare.

Thus, trade liberalization has been in the center of attention of many countries during the last couple of decades, which put reforms on trade restrictions at the center stage of economic policy reform in developing countries. In relation to the trade policy conditions, they have become a standard feature of the structural adjustment and stabilization policies of the IMF and the World Bank across a majority of developing countries. Although in many developing countries the

government has been less than enthusiastic in implementing the trade tax[3] reform because of fear of loss of tax revenue. In particular, as Emran (2005) shows, export tax could generate a significant share of country trade tax revenue; e.g.,. in Russia, the country with very similar to Ukraine trends, its dynamics was increasing throughout 1992-2000 (in 1992 the share was 54,66%, in 1995 - already 63,59%, and in 2000 it reached 71,91%). Furthermore, as Emran (2005) further shows, in a sample of 26 countries, revenue actually declined in 9 countries after trade and tax reform were implemented, where reductions in trade taxes appeared to be one of the main factors behind the decline in the revenue.

The Uruguay Round was an important point in trade liberalization process, especially in agriculture. Specifically, tariffication was a major accomplishment of the Uruguay Round in agriculture. It was admitted that high tariffs lead to welfare losses of a society, so URA's contribution was the requirement for a considerate reduction of export taxes, which is believed to improve social welfare promoted by a free trade (Gardner and Rausser, 2002).

Therefore, as Emran (2005) has shown, export taxes in some countries promote a considerable part of tax revenue for the government, but, simultaneously, they cause a diminution in producer surplus by adding extra costs, which are therefore partially shifted to consumers, reducing their surplus. Finally, this chain results in decrease of total welfare, which became a major argument of URA's advise towards the decrease of export taxes.

[3] Trade tax includes export and import taxes. The bulk of the trade taxes usually come from import tariffs, and the importance of export taxes as a source of revenue has been characterized by a declining tendency over the last few decades. However, as M. S. Emran (2005) shows, there are still a number of countries where export taxes constitute an important source of trade tax revenue.

Trade quotas, which are quantity restrictions, have the same effect as trade taxes – loss in welfare. A good example for this was shown by Jarvis (2005), who analyzed International Coffee Agreement (ICA) export quotas. The author emphasized the fact on how ICA quotas led to policy distortion and economic loss. Imposition of the quota created a sizeable domestic quota rent, which "stimulated rent seeking that wasted resources and reduced efforts to improve industry efficiency".

As described by Jarvis (2005), the ICA was an agreement between major coffee exporting and importing countries, which aimed to increase the prices at which exporters sold coffee to importers. The initiator of ICA was Brazil – the world's largest coffee exporter – which received the largest country quota. The ICA intended to benefit producing countries and their farmers, but it did not happen in Brazil. In fact, the winners were governmental bureaucrats, exporters participating in the lobbying process, and foreign importers. Therefore, despite scarcity of research on the actual effect of such commodity agreements on economic welfare, available evidence show that ICA, in particular, was harmful. Since ICA can be considered as quotas on the global scale, above arguments justify the mentioned statement that export quotas, as well as export taxes, might cause the loss in welfare.

The history of economic analysis of export restrictions begins in the early 1900s, as it becomes understandable from Yilmaz (1999), who refers to the Bickerdike (1906) who "was the first to show that a country with a non-negligible world market share could improve its welfare by imposing export taxes". However, export taxes are only one type of export restrictions. Export quotas are of no less importance. That is why, the choice between quotas and taxes imposition has induced a theoretical work comparing the difference of these two instruments. As Suranovic (1993) describes, firstly, Bhagwati (1965) proved the equivalence (in

terms of equivalent impact on prices when the quantity of imports/exports remains constant) of effects of tariffs and quotas for perfectly competitive markets; then Lizondo (1984) qualified Bhagwati's result by saying that rent and revenue obtained from quota and tariff respectively should be spent identically. The statement of quotas and tariffs equivalence will be discussed below in more detail, but here we would like to emphasize their non-equivalence. In particular, Suranovic (1993) shows that Bhagwati (1965) and Lizondo's (1984) results do not hold even for perfectly competitive markets. Using general equilibrium framework, he suggested[4] that by forcing an edge between domestic and foreign prices, tariffs can be a more protective long-run policy instrument in comparison with quotas, which should be used by government for temporary (short-run) protection. Moreover, quotas allow avoiding renegotiations, and, additionally, they can lead to the replication equilibrium[5] over time.As for export taxes, they are often dubious.

As for export taxes, their effects are often ambiguous. According to Warr (2002) when an exporting country has some degree of monopoly in a certain commodity on international market, then an application of an export tax is favorable. Here it is necessary to emphasize, that Ukraine has no monopolistic power on any kind of grain under investigation (wheat, barley, corn), thus, imposition of an export tax will be harmful for Ukrainian welfare.

Coming back to the theory, Warr (2002) states that an objective of an export tax is to use the difference between marginal cost and marginal revenue, which exists under market power but not under competitive equilibrium, by reducing

[4] We refer to only those of his conclusions which are relevant for our research.

[5] Replication equilibrium means that there is more than one world trade, production, and/or endowment configuration which are consistent with a similar set of equilibrium prices.

domestic price relatively to the world one. The optimal tax restricts exports to the level which equates marginal cost and marginal revenue.. It is achieved by setting the rate of an export tax equal to the inverse of an absolute value of the commodity export demand elasticity with respect to its international price, which we are going to carry out in empirical section.

Thus, Yilmaz (1999) attempted to develop optimal trade taxes for the global cocoa market and compare optimal partial equilibrium taxes with optimal general equilibrium taxes. The results appeared to be different due to (1) framework (partial equilibrium accounts only for government and the cocoa sector, while general equilibrium accounts for some fraction of GDP), (2) social welfare weight (which is smaller under general equilibrium estimation, and, therefore, exports should be taxed more here than in partial equilibrium in order to redistribute tax revenues to the whole society), and elasticity measurement (there is an inverse relationship of partial and general equilibrium measures of domestic supply elasticity of cocoa (in general equilibrium the optimal tax will decrease with a supply elasticity increase). Furthermore, Yilmaz (1999) compared Nash revenue maximizing and Nash optimum taxes under these two frameworks. Nash revenue maximizing general equilibrium taxes are lower than the partial equilibrium ones. The latter occurs because partial equilibrium tax rate is higher than the base one, and in the general equilibrium framework an increase in domestic supply elasticity will happen while moving from the base level towards the partial equilibrium revenue maximizing Nash equilibrium.

As was mentioned above (see also Neary 2001), the idea of the equivalence of welfare effects of tariffs and quotas used to be prevalent in the literature: it was believed that the equilibrium generated by, say, an export quota can also be generated by appropriately chosen level of an export tariff. However, this is true only if the economy does not experience any exogenous shocks. When such

shock happens, the response of the economy differs depending on whether tariffs or quotas are in the force. The difference between tariffs and quotas (and also voluntary export restraints) was shown by Neary (2001) in his general equilibrium analysis for a small competitive economy[6]. His first conclusion was that the welfare cost of an export quota is the higher the larger is the gap between world and domestic prices. Additionally, he showed that initially quota has smaller effect on income than on prices, but its further tightening increases its effect on income. Moreover, "welfare is a concave function of a quota level".

An important for our research conclusion of Neary (2001) was also that the presence of foreign-owned capital raises the welfare cost of export tariffs and quotas in case of exportables being relatively capital intensive. Since major Ukrainian grain exporters are companies with foreign capital, welfare losses of already imposed by the government export quotas and possible export taxes will be even higher than it was supposed. As Neary (2001) proceeds further, he states that if the domestic endowment of capital is increased, then the impact effect of quota on welfare equals the market rental rate, but is less than market rental rate when a tariff is in force (of course, it holds in case of relatively capital insensitivity of exportables - and this is the case of Ukrainian grain sector as evidence shows). But since implementation of quotas/tariffs reduces market rental, in the presence of existing foreign-owned capital, the welfare gains can be obtained in case of additional capital inflow, and these gains are higher with a presence of export quotas compared to export taxes, because the former induces changes in domestic prices of quantity-constrained exports. This phrase of Neary (2001) illustrates that implementation of quotas/taxes can induce not only welfare losses but gains as well. However, who exactly will benefit from these gains depends on

[6] Neary (2001) made his analysis for import restraints. However, his conclusions can logically be applied to the analysis of export restraints (thus, we will change his formulation, where needed) in appropriate way to apply for export taxes and quotas).

market conditions, type and structure of economic system, political interrelations, etc.

As recent development on the Ukrainian grain market shows, the winner from the implementation of quotas there became government and the loser is a producer. But, as previous to Jarvis (2005) literature[7] on evaluation of ICA export quotas show, producer can also benefit from the quota implementation. In this way, in Kenya ICA quota implementation led to the increase of existing producers' incomes, but, simultaneously, to the reduction of production efficiency. What is more, according to other studies, mentioned in Jarvis (2005), ICA quota increased the market power of Haitian exporters, as well as it allowed Papua New Guinea exporters "to capture most of the ICA domestic quota rents during the 1980s". Thus, taking this into account, we can not confirm that producers[8] are always losers in case of quantitative restrictions of exports introduced by the government. But quotas implementation can reduce the price and increase the uncertainty on the markets, as Indonesian coffee market proves, which is not in the interests of producers. Moreover, as Jarvis (2005) further shows the mechanisms, by which (according to the predictions of public choice theory) Brazil's home exporters got a large part of the rents, remain less clear, but it appears that they worked through government bureaucrats and officials. Therefore, the more complex the policy context is, the more difficult it is for actors to understand policy effects. Moreover, as studies mentioned in Jarvis (2005) show, the strength and activities of different rent-seeking actors may vary over time. What is more, changes in policies affect not only those who receives the rents, but also the resource allocation, market structure, and industry

[7] See literature review section in L. S. Jarvis (2005).

[8] In Ukrainian grain market, such powerful producers like Cargill, ADM-Toepfer, Bunge, etc. (who mainly (together with the government) define the trends of grain market development) can be considered to be not only producers, but also exporters and investors. Therefore, notions "producer", "exporter", "investor" are used interchangeably in this paper.

efficiency, which is of major importance for the study of welfare effects (of export restrictions such as export quotas or taxes), which I am going to make in this paper.

The above discussion of export restrictions demonstrates that export quotas and taxes are not equivalent, and which of them appeared to be more suitable in each particular case depends on the modeling framework (general vs. partial equilibrium) of investigation and its assumptions. Moreover, there exist no unique view on the separate effect of export quotas and taxes on producer and consumer surpluses, and on government revenue, which all together are the compounds of total economic welfare. On the one hand, both quotas and taxes are regarded as export restrictions, and they can not be profitable to either exporters or importers, because they make the latter suffer some costs, which afterwards can be shifted to consumers. On the other hand, elimination of all agricultural trade barriers within a free trade area will tend to reduce the level of protection in all member countries, and will bound the ability of governments to pursue their national agricultural policies. What is also important is that the consequences of export restrictions for the welfare depends not only on their "pure" effect but also on some important model assumptions such as a "theoretical" country case (large or small), exchange rate regime, time interval of investigated effects (long- or short-run), and the framework (static or dynamic). Now, we will stop on the discussion of those tips in more detail.

According to the analysis made by Hummels and Klenow (2004), larger economies export more than the smaller ones. Different theories analyzed in the paper predict export of a wider variety of goods (intensive margin), wider range of goods (extensive margin), or higher quality of goods (vertical differentiation). The author found (using 1995 trade data for many countries in many product categories) that extensive margin accounts for the biggest share, namely, 62% of

the greater exports of larger economies, and Krugman-style[9] models with products differentiated by firms come closer to fitting the facts on export margins. According to Hummels and Klenow (2004) these distinctions are extremely important in determining the welfare consequences of access to trade, since, first, they reflect fixed costs to exporting a variety to each foreign market, and, second, they match positive relationship between prices and quantities.

"Large" and "small" economies differ not only in the amount of exporting veriety, but also by the ability to influence the world price. Ukraine, however, is a small economy in relation to grain market, and currently it cannot influence other trade –partners' prices. But the situation might change in distant future. Judging by statistics, from the world wheat total net exports in 2005/2006 (which is projected to increase from 88158 thousand metric tons in 2005/2006 to 105733 thousand metric tons in 2015/2016) Ukraine accounts for only 5450 thousand metric tons in the period 2005/2006 and for 5853 in 2015/2016. In the corn net exports Ukraine's share was 2300 out of the world 75098 thousand metric tons during 2005/2006 and is expected to become 2996 out of 88760 in 2015/2016 (FAPRI, 2006). For other types of grain Ukraine even not included in the list of net exporters (there are data for the whole CIS only). Moreover, Ukraine is not a major exporter of grain on any of the regional markets. It proves our statement that Ukraine must be considered from the point of view of a small country while evaluating the welfare effects of export restrictions on the Ukrainian grain market. However, taking into account a "theoretical" prospective for Ukraine to become in future a "large" country, both cases, for small and large economy will be considered in the theory section.

[9]According to Krugman model, conditional on producing a variety (category), a country exports this variety (category) to all other markets, see Hummels and Klenow (2004).

Here we will not focus on consideration of "large" and "small" country cases. Besides, the above comparison (amount of export variety) of large and small economies reflected in general equilibrium modeling. For partial equilibrium, the mutual impact of the change in exchange rates (and, therefore, prices) between economies is more important. In particular, Mejean (2004) using disaggregated data on a large variety of industries and several exporting countries confirmed ones more empirically the existing arguments about the influence of the exchange rates on international trade prices. She showed that despite the kind of a country-exporter and after having controlled for the specific effects of importing countries and possible supply shocks, export prices respond by 40-50% of fluctuation of exchange rates in all industries. This result can not be interpreted as a macroeconomic phenomenon because of existence of high heterogeneity of coefficients within industries and exporters in a given industry. Such result was obtained by solving many industry (firm) profit-maximization problems with prices, demand and total production costs being the main determinants of the equation. In order to distinguish an effect of exchange rate on price, an optimal price in the model was represented as a function of production cost and the elasticity of demand with respect to the local price, in which a nominal exchange rate was expressed in terms of money per unit of the currency of a country-exporter.

As for exchange rate itself, fixed exchange rate regimes are believed to promote trade. In fact, judging by the results of Klein and Shambaugh (2006), employing gravity models for the theoretical justification of the impact of exchange rates on trade is less supportive than one might suspect of the policy argument that a country can promote its trade by establishing a fixed exchange rate. Authors adopted gravity model by regressing bilateral trade and some dummies that indicate (1) direct vs. indirect fixed exchange rates, (2) presence of a currency union with country's trading partner, and (3) volatility of the exchange rate

between the trading partners on a standard set of this model variables. Since authors are interesting in giving relevant policy lessons for the present time, the data included are for post-Bretton Woods period of 1973 to 1999. Thus, their results suggest that direct pegs make a statistically and economically significant impact on trade flows, and obtained results are consistent with previous studies (described in their paper) only in the fact of quantitatively small effect of exchange rate volatility on trade.

Authors also showed that simply declaring an exchange rate peg will not generate an increased trade flow, since the estimated effects of a de jure direct peg are not only smaller than the de facto pegs (which Ukraine has), but also the coefficients on the de jure direct pegs are not significant. As for other techniques used by Klein and Shambaugh (2006), IV estimation showed larger coefficients than OLS, fixed effects and pair fixed effects. Including random effects make the direct peg stronger and moves the indirect peg to a negative significant coefficient, but Hausman test stands for fixed effects usage. Moreover, results does not change with inclusion of each fifth year observation rather than each year, and AR (1) correction procedure still results in large and significant effects of fixed exchange rates on trade (but the coefficients are smaller than estimated by OLS).

Summing up, using different methods, Klein and Shambaugh (2006) showed that when one focuses on bilateral exchange rate regimes, there are statistically and economically significant impacts on trade from a fixed exchange rate. What is more, with few controls, only direct pegging appears to have a strong impacts on trade.

As for the impact of flexible exchange rates on trade and welfare, the main task of Bergin et al. (2006) was to show "the optimal degree of exchange rate variability for various types of open economies, and it appeared to be optimal to

stabilize inflation, while allowing the exchange rate to fluctuate in response to productivity shocks". This result is opposite to what was described above from the paper by Klein and Shambaugh (2006). However, one of these papers is empirical while the other one is strongly theoretical. Therefore, we cannot compare them directly, thus, we will just describe here important for our research insights. So, Bergin et al. (2006) came to this result in the context of a two-country general equilibrium model with sticky prices. This model represents a two country (home and foreign) model with agents consuming two final goods, where each country specializes in the production of one of them. Monopolistically competitive firms produce intermediates using capital and labor, and set prices sluggishly due to adjustment costs. Using these assumptions, authors draw the conclusions that with fixed exchange rates output, consumption and utility are lower in comparison with optimal policy which allows exchange rates to fluctuate in response to productivity shocks, and assumes inflation stabilization. Benchmark models, based on first-order Taylor approximations, show similar basic conclusions as a more richly specified (say, second-order Taylor), and more realistically calibrated model. But extension of the investigation environment, such as inclusion of habit formation into the model, leads to a slight increase of welfare gains from optimal stabilization policy, and speaks for the optimality of suppressing the exchange rate fluctuations.

That is, to stabilize the economy is easier with a flexible exchange rate regime, but this stabilization may appear to be short run, while fixed exchange rates, brining less welfare gains, give more long-lasting effect of economy stabilization. But we can not say exactly which regime is better, because it depends on the variety of other factors such as currency type, economy specificity, etc.

We draw so much attention to the discussion of exchange rates since they can greatly influence our future results, because they determine the prices which enter

our regression, as the main components of domestic demand and supply, and import demand equations. Thus, our results will implicitly depend on exchange rates. Moreover, exchange rates are one of the main determinants of exported volumes[10], which enter our equations as well. Furthermore, the state of the economy is very important for the investigation of any policy measure (as ours, export restrictions), thus, combining the facts of influence of fixed vs. flexible exchange rates on the state of the economy presenting in the discussed above literature and the fact that Ukraine has a "regulated" flexible exchange rate system, we can conclude that, judging by exchange rates, there is no ground on the duration of stability (in the long-run) of the Ukrainian economy (which is well proved by evidence).

Short-run and long-run framework is important not only for exchange rate effects studying but also for the investigation of the main question of this paper, i.e. estimation of welfare effects of export restrictions. That is why, we have included discussion for the short- and long-run effects of export restrictions above while discussing papers devoted to export taxes and quotas. Moreover, we are going to show short- and long-run effects theoretically in the theory section, and empirically in the empirical section.

The last, but very important issue, which may influence our future estimation results is static vs. dynamic overview. Marrewijk and Berden (2006) discussed such a framework for small developing economy, mainly using the results obtained by Romer (1994)[11], who stated that "in static framework the costs of unexpected increases in trade restrictions are smaller than the costs of expected

[10] Since we devoted much attention to the discussion of exchange rates importance, we will not stop on explaining this fact. For details see the article by M. Smith (2004) "Impact of the exchange rate on export volumes". Reserve Bank of New Zealand: Bulletin Vol. 67 No. 1.

[11] Marrewijk and Berden (2006) refer to Romer (1994) conclusions, and broaden them.

increases in trade restrictions", because the latter affect the range of goods available in the economy. However, this study was devoted to the R&D goods, but we are investigating agricultural products. Thus, in agricultural sphere, new selected varieties of grain can be considered like R&D products, and those which were obtained in the process of selection (production) of these new varieties can be referred to intermediaries. That is why, Marrewijk and Berden (2006) conclusions are of major importance for our analysis.

Thus, Marrewijk and Berden (2006) demonstrate, first, the presence of smaller estimated static than the dynamic costs of trade restrictions for the small developing economy if, and only if, the increase in trade restrictions reduces the share of invented intermediate goods introduced on the market, and, second, a slow-down economic growth as a result of an increase in the level of trade restrictions are very logical for grain market too (they coincide with statements and our point of view about export taxes and quotas, discussed above). Conducting a research, authors assume that a small developing economy under investigation can not influence the economic growth rate in the Rest of the World and, moreover, it does not engage in any R&D activity to develop new types of intermediate goods.

Using above stated implications and assumptions of Marrewijk and Berden (2006), we now present their conclusions, which are important for our research. First, income and welfare increase if the level of trade restrictions falls. Second, "if the new level of trade restrictions exceeds a critical value, the new growth rate will be zero and stagnation occurs, and dynamic costs of a rise in trade restrictions are generally much larger than the static costs as a result of the fall in the share of new goods introduced on the small developing economy market" (Marrewijk and Berden (2006)). Thus, we should take into account that dynamic

costs of trade restrictions are higher, because we will investigate a dynamic raw of data.

Summarizing the discussion, we can say that the literature on the subject concerning export restrictions is very diverse because in some periods of time they had become hot issues for selected countries, and, therefore, drew much attention of theorists to their proper investigation. Scientists concentrated on separate issues such as export tariffs or quotas, financial (like exchange rates, capital mobility, investment, etc.) or political issues (WTO, Euro Union accession). Therefore, it is difficult to conclude at this stage whether export restrictions are harmful or, may be, even beneficial for the welfare. From the political point of view, since Ukraine intends to become a full member of WTO and Euro Union, it must follow accepted by these organizations view on trade liberalization that any export restrictions are harmful for the economic welfare. From the economic point of view, we can conclude anything only after obtaining trustworthy empirical results, which we are going to do using partial equilibrium model.

Chapter 3

THE DEVELOPMENT OF UKRAINIAN MARKET FOR WHEAT

Agricultural production in Ukraine slumped following the dissolution of the Soviet Union in 1991. Mainly it happened because of the loss of heavy subsidies, which were estimated on 11 percent of GDP. Also, as Dohlman et al. (2003) state, it is not the only thing which account for the agricultural decline in early 1990s in Ukraine. The main problem, however, was a failure to fully implement institutional reforms like bankruptcy laws for agricultural enterprises and land codes which can establish well defined property rights. It is also stated in the paper that "without effective legislation and execution in agricultural production, investment incentives in the agricultural sector are limited, and, therefore, potential productivity growth is constrained".

Taking also into account that agricultural sector before the Soviet Union dissolution was inefficient, and many analysts projected that it would recover as soon as market-oriented farmers became more productive. Actually it did not take place.

Developing the research further, Dohlman et al. (2003) pointed out that in fact, Ukrainian total factor productivity of agriculture continued to fall throughout the 1990s. Nevertheless during 1992 and 1998 years Ukraine shifted from being major importers of about 22 million tons of grain to net exporters of about 2 million tons. As Connell et al. (2004) emphasize improvement in country's status in the international trade came from the government's commitment given the

importance of agricultural sector to the general economy. Actually, Connel et al. (2004) describe Russian grain market, but Dohlman et al. (2003) speak about both countries simultaneously not making any distinction between them regarding their agricultural sector trends. So, according to Connel et al. (2004) improvement in Ukrainian agricultural foreign trade, as well as in the Russian one, appeared thanks to the support of both national and regional government of grain producers during 1990s "by providing domestic credit, subsidizing crop inputs and entering into machinery leasing arrangements". However, weak farm structure, land ownership and inefficient infrastructure development made the costs behind "farm gate" to remain high. These drawbacks are not the ones which prevent the development of the Ukrainian grain market. Another very recent example is wheat crisis of 2003.

The wheat crisis of 2003 was not the fault of bureaucrats, politicians, grain traders, consumers, or evil foreign powers. It happened due to unfavorable weather conditions during the winter of 2002-2003. There are two different considerations devoting the wheat crisis of 2003. On the one hand, according to Galushko et al. (2004) a serious problem took place because Ukrainian government did not try to import enough wheat at least to meet food demand and prevent an increase in wheat prices in order to make imports profitable (by compensating the poor this increase). Instead, Ukrainian government intervened directly "by setting price ceilings for staple foods, by regulating the profitability of food producing enterprises and providing subsidies to bread producers, and the mark-ups for retail stores". On the other hand, according to Cramon-Taubadel (2004), it is a question whether or not bad weather conditions amounted for a crisis, since in fact food security in Ukraine was not threatened in 2003. Therefore, the government should take into proper consideration that Ukrainian grain production was, is and will always be subject to fluctuations. And when

such situations happen, policy makers can help by their "steady hand" and not by unsetting markets further, as they actually made in 2003 crisis.

Coming slightly back, it can be seen that foreign private investment into grain market was just started after some "improving" market reforms in late 1999 and 2000. However, many actions by policy makers in response to the 2003 wheat crisis "unsettled traders considerably: they were subject to intense scrutiny and threats". The main of the government arguments about their interference into grain traders' policy were that too much grain was exported too quickly following the 2002 harvest. Traders were even threatened with a punitive tax of 10% on the previous year profits if they did not supply food wheat for a low unrealistic price for 2003.

An international impression of these Ukrainian grain market developments was that "Ukrainian agricultural policy making was as much in crisis as Ukrainian agriculture itself" (Cramon-Taubadel, 2004). It almost destroys an improving investment climate in Ukraine. And a plus to this is a constant indecisive land property problem.

According to German Consultancy Group (2006)[12] an absence of stimulating business environment and stable agrarian policy "with clear cut purposes and priorities" prevent structural reforms in Ukraine, which therefore impedes its investment attraction in order to increase the agricultural production effectiveness that will serve as a provision of its competitiveness on the world markets.

However, as stated in IER Policy Paper No.5 (2006), survey of agricultural business traders show that during their operation time in Ukraine they adjusted to

[12] http://www.ier.kiev.ua

"mistaken" legislation and almost no perfect action of its laws, but they prefer things to stay at that level, not permitting any shocks.

But their "life" without shocks due to sudden unthinkable actions of government in Ukraine was not so long after the wheat crisis of 2003. The latest shocked measure of 2006 was implementation of quotas on Ukrainian grain markets.

Quotas of grain exports were introduced to secure the supply of domestic markets. In practice, this measure led to a complete stop of grain exports, and, what is more, grain traders (suppliers, exporters) suffered huge losses. During a "protracted period of time" long before prepared for shipment ships accumulated charges at rate of about $30,000 per vessel a day for the idle time. In fact, this governmental measure was taken as the result of a refusal of powerful international traders like Cargill, ADM-Toepfer and Bunge to sell 300,000 tons of wheat to the strategic reserve at a discount of about $15 to the prevailing price. It brings some doubts whether there is any economic justification for quotas introduction?

This measure has been accepted by grain traders as a plus to the imperfect Ukrainian economic system, which in the sense of grain exports was before described by black custom markets, including bureaucratic procedure of custom clearing and two high export taxes.

In the long-run such measure of Ukrainian economy has a clear message to the rest of the world that Ukraine's commitment to market-oriented reform of its grain markets is wavering. As for the short-run, it tells us that Ukrainian system of export taxation and quotation is constantly increasing the uncertainty on its grain markets with making risk premium of traders higher, therefore, prices that farmers are to pay increase, and so, Ukraine pays for this by its welfare losses.

According to the investigation of World Bank and IER (2006), introduction of grain quota is not justified since the amount of domestic grain supply is enough to cover all domestic needs and allow higher grain export, than it was estimated by the government. Initially quota for wheat was set on the level of 0.4 MMT, but for the marketing year of 2006/2007 the government promised to increase its level till 0.73 MMT. However, this level is not enough to provide competitive exports. The latter can be justified by looking at welfare effects, which was theoretically described in the paper. Thus, producers suffered losses and consumers gained much less from the grain quota introduction than it is predicted by the theory, because with remaining constant wheat prices, prices for flour and bread have increased since quota's implementation[13]. Additionally, quota system has hurt grain traders who invested significant funding to facilitate exports. Moreover, it has created opportunities for corruption (because companies who can cash in a profit of $25 per ton at present are able to secure an export quota). The main beneficiaries of this quota are flour millers and animal feed producers (because of domestic grain prices falling). Therefore, this export quota is "an ill-advised and poorly targeted measure to protect the poor in Ukraine" (World Bank and IER, 2006). And, alternative measures for the protection of Ukrainian market exist, and they may serve better welfare effects than the grain export quota. Export taxes may serve as a good example of such alternative measures.

[13] Also we hope to prove negative change in producer surplus, and some positive in the consumer's one (but negative total surplus) by our estimation in this paper.

Chapter 4

THEORY

Since expansion or contraction of international trade has implications for income distribution, it is important to understand who the "winners" and "losers" are from trade inferences in order to assess the economic and political desirability of alternative trade policies.

There are three major groups (agents) of competitive market participants. These are consumers, producers and government, on whom competitive market analysis focuses. Participation of the first two groups – consumers and producers – in market operations forms market clearing condition, equilibrium point, where market supply equalizes with market demand. The third participant is government, who can intervene the market in different forms, including the set up of export quotas and taxes.

The simplest way of trade policies is export taxation in the form of specific tariffs and ad valorem tariffs. Thus, tariffs are imposed in the form of fixed charges for exported goods while ad valorem tariffs are determined as a fraction of the value of exported goods. However, in both cases the main effect of the tariff is to lift the cost of shipping goods outside the country.

Due to the fact that export tariffs are the oldest form of trade policy their usage have been known as a source of government income and protection of particular domestic sectors (Krugman and Obstfeld, 1997).

Nowadays the importance of tariffs has dropped, because modern governments usually prefer protecting domestic industries through a variety of nontariff barriers, such as export quotas.

Although, on the one hand the effects of export quota are analogous to the export tax but on the other hand the welfare effect of these two instruments differs since no government revenue is compulsorily collected. Due to the fact that the recipient of the export quota rent is unclear the main option for the government to obtain the revenue can be accomplished by selling it to those who offer the most money for export quotas. In order to get the beneficial rights to export in a competitive market exporter should be prepared to pay up to the difference in price in the importing and exporting countries that will help to make an income from the auction quota system and an export tax equal. Otherwise, exporters can act like a single seller to get the rent from the quota by charging the importing country the market-clearing price.

The final net welfare effect in quota-imposing country is based on the sum of deadweight losses and the distribution of the quota rent (Appleyard and Field, 2001).

In developing the theory of trade, general equilibrium models are often used. However, in many cases trade policies toward one sector can be sensibly and logically followed even without peculiar unpleasant backlashes of some policy in the rest of the economy. In such cases trade policy can be examined in a partial equilibrium modeling.

Thus, in 1952, M. W. Reder designed a general analysis of Marshallian demand and supply curves that not only was applied for the whole economy but also for all industries that was fairly unproductive in contrast to partial analysis of representative for a particular investigation industries. In partial equilibrium

models every industry is presented through a group of companies the behavior of which is being investigated by means of a typical firm. Hence, structure of industry supply and demand curves, which are based on average industry price, is effective in different particular situations. But it can illustrate only the general line of movement of such variables as price and quantity. Furthermore, the presence of pure competition is not needed for the construction of industry supply curve, while a large gap between supply and demand is of extreme importance for the welfare effects. For this reason (1) the measurement of welfare effects of export control by measuring the price-quantity effects is our prime object, and (2) other aspects of analysis are out of our particular interest, partial equilibrium method is very suitable for this paper.

However, general equilibrium method could be implemented here in case we were attracted by broader than welfare effects analysis. Since we are going to concentrate on agricultural industry and not to comment deeply the consequences and repercussions for the whole economy, we will use partial equilibrium model.

4.1 Export taxes in a "small" country case[14]

Due to the fact that producers widen domestic sales by means of reducing domestic price of products in order to refrain from paying export taxes, the levying of an export tax cause the decline of the domestic price (see Fig. 1).

[14] Subsections 4.1 – 4.3 are based mainly on Appleyard and Field (2001), Krugman and Obstfeld (1997), and Gardner (1989).

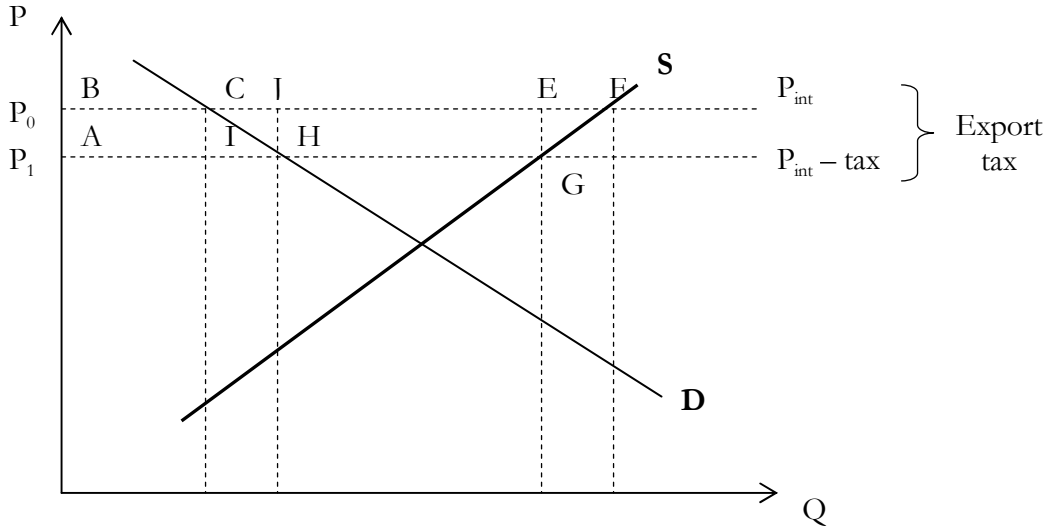


Figure 1. Imposition of an export tax in a small open economy

In case the domestic price (P_0) goes down until it gets the level of the international price (Pint) (which is above the crossing of the domestic demand and supply curves) that is calculated without the amount of the tax, then profits and losses can be determined by means of producer and consumer surplus.

The idea of consumer surplus relates to the sector limited by the demand curve and market price which indicates that all buyers pay the same market price in spite of the sum they are ready to pay. Considering that market price moves upwards, consumer surplus moves quickly downwards; as price moves downwards, consumer surplus moves upwards.

The principle of producer surplus relates to the sector limited by the market price and by the supply curve. While all producers get the identical market price, a surplus takes place for all units whose marginal cost of production, illustrated by the supply curve, is less than the market price. In other words, when price goes up, producer surplus goes up, and when market price declines, producer surplus

declines. As a result, a transformation of market price causes a shift of surplus between producers and consumers. Hence, an upturn of price causes producer surplus rise and consumer surplus decline. For a price downturn, a surplus is moved slightly from producers to consumers.

The crucial interest in this section is concentrated on the changes in producer and consumer surplus that are based on the tariff-induced price change. As domestic price goes down and quantity supplied develops, there is a reduction, which is equal to the area ABFG. The area ABCH is a partial loss that is shifted to domestic consumers through the lower price, which upturns the consumer surplus. The area HJEG measures the revenue of the government. Therefore, the residual areas CJH and EFG symbolize deadweight efficiency losses that are caused by the price misrepresentation.

The sector HG interprets a smaller level of exports after tax in contrast to exports before the tax (area CF). For this reason governments will revalue the export tax income received without full accounting for the reduction in export quantity. As a result, the less elastic domestic supply and demand are, the smaller the effect of the tax on the quantity of exports and the greater the income got by the government. The less elastic producer and consumer reactions are, the smaller the deadweight efficiency losses.

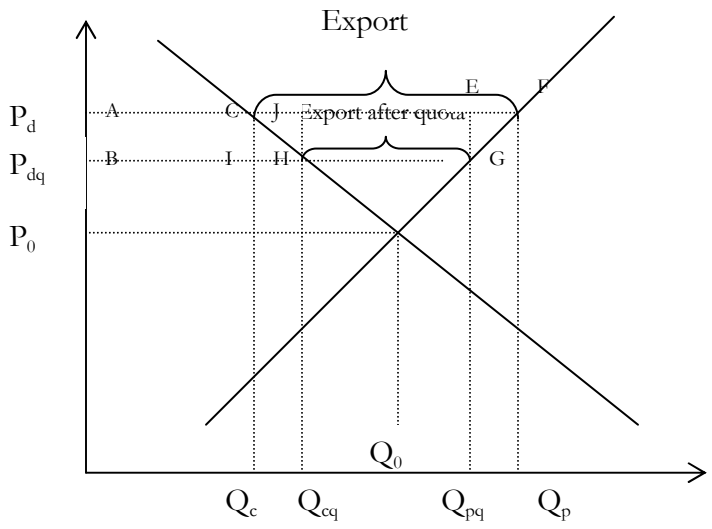
After summing up the effects of an imposition of export tax in the small open economy on the winners and losers, the net effect on the economy is negative.

4.2 Export quotas in a "small" country case

Although, on the one hand the effects of export quota are analogous to the export tax but on the other hand the beneficial impact of these two instruments

differs since no government revenue is compulsorily collected, which is the chief diversity of the welfare impact of these exports instruments.

In this particular situation the volume of supplied goods is controlled by means of giving a restricted amount of quotas to each exporter. As a result, an upper limit of the supply curve to the market fits in without levying of "rights for sale" (quota) that is shown in Fig. 2.



ΔCS = BACH
ΔPS = BAFG + HJEG
DW = HCJ + GEF

Figure 2. Imposition of an export quota in a small open economy

The export is limited by Q_{pq} that is less than without imposing quota Q_p, although producers now trade less at the lower price P_{dq}. For this reason the area BAFG is a (change in producers' surplus) loss when producers forced to trade by P_{dq} instead of P_d on the quantity Q_{pq}, which they may sell with no quota as well. Nevertheless, in case of the absence of the quota producers would have sold more. That is why such a policy "contributes" to their loss only, and, their net loss is BAFG - HJEG. However, since government introduced no licensing of

wheat exports in our case, producers got area HJEG (which is at least some compensation for their huge losses)

The area BACH is a consumers' gain because they, on the one hand, pay the lower price for quantity Q_{cq}, and, on the other hand, have an access to additional quantity $Q_{cq} - Q_c$. Therefore, the change in their surplus after quota implementation is an area BACH.

Consequently, when we count up a profit, we obtain $\Delta CS - \Delta PS$, which is in total a negative number. Also there are some deadweight losses in this case, which are represented by figures HCJ + GEF.

With this in mind we have used demand and supply curves in a small country case while now we will shift to the analysis of a large-country case, where an influence on world price takes place. Thus, we should present import demand curve and export supply curve, which are come from the domestic supply and demand curves. Import demand is a surplus of consumers demand over producers supply; export supply is a surplus of producers supply over consumers demand.

My means of above-mentioned concept, we come to the analysis of the impact of levying of export restrictions in the large-country setting.

4.3. Export taxes in a "large" country case

Graphically the effect of a tax levied by an exporting country is illustrated in Fig.3 on the example of two large countries that is very close to the above-mentioned cases of small country. Nevertheless, the principle of the export tax operation and

welfare effects on the two countries are relatively opposed. Under the influence of the export tax, producers of the export goods, called country B, are forced to let their domestic price down and sell more at home in order to be prevented from paying the tax which is a difference between the price of the good in country B and the world price. For this reason exports falls due to the improved local consumption and decreased quantity of the supplied export good. As a result, the diminished supply of exports increases the international price while an import price for country A grows from primary non-distorted price of P_{m0} to P_{m1}, and the price of the good in exporting country B drops from P_{m0} to P_{m2}. Therefore, the export tax equals the difference between P_{m1} and P_{m2} while desired exports Q_{x1} equal to desired imports Q_{m1}. The government revenue is introduced by the sum of rectangles c and n in Fig. 3 which are built when the exporting country equals the amount of the tax ($P_{m1} – P_{m2}$) * the quantity of exports_(Q_{x1}).

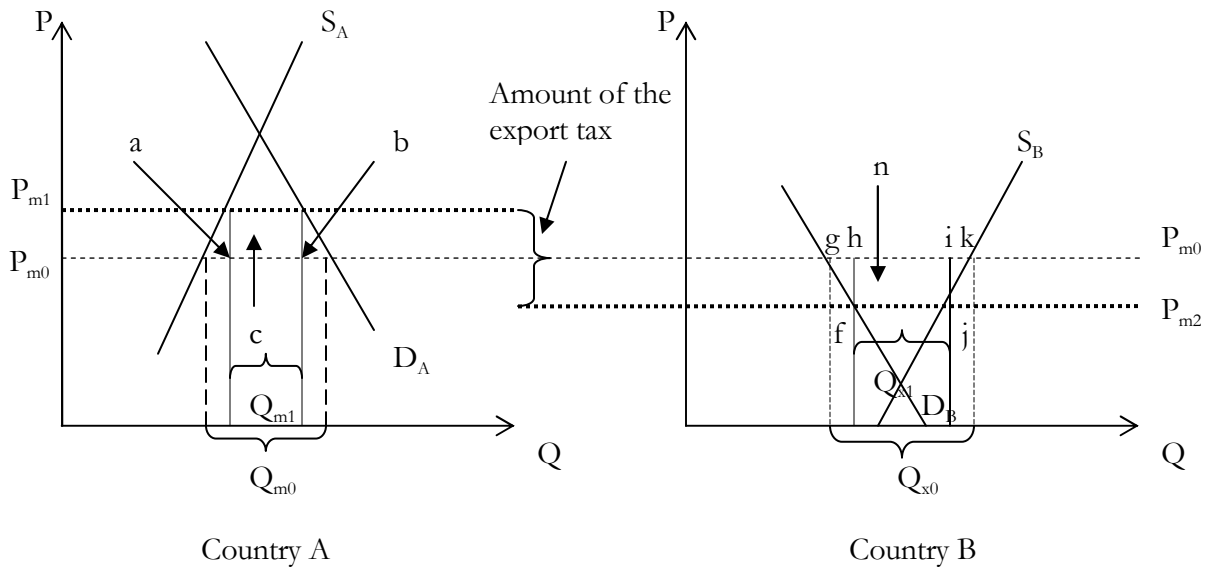


Figure 3. Imposition of an export tax in a large open economy

As an illustration of welfare perspective, the export tax culminates in deadweight losses of triangle ghf plus triangle ikj in the exporting country and an inward transfer of rectangle c from the importing country due to the higher world price.

Therefore, by means of the higher import price the importing country simultaneously "pays" a portion of the export tax, accordingly in case the incoming transfer from the importing country more than the deadweight losses from the tax at that time the exporting country can benefit (i.e. if sector c is bigger than the sum of triangles ghf and ikj). Moreover, for the importing country, the imposition of the export tax causes not just deadweight losses, assessed by sectors a and b, but also the transfer abroad of rectangle c. The possible incomes (losses) for the exporting (importing) country are greater with the decline of elasticity of the supply and demand in the importing country, and the more elastic are supply and demand in the exporting country.

Due to the fact that exports are favorable for a country by means of extra job placements, improvement of the balance of trade, and etc., there are some reasons which make country want to levy an export tax (particularly realizing their welfare losses, described above). In other words, in contrast to income or property taxation, the easiest form in developing countries is export taxation which provides government revenue. Another reason for the imposition of export taxes is to stop domestic inflationary pressures because export taxation is a generally fruitful anti-inflationary device: since the price of the good on the domestic market drops, it may dampen the upsurge in the hope price level. The next reason for the usage of export taxes is that they contribute to the redistribution of domestic income. In other words, in case the exported agricultural products grown by large and wealthy landowners and consumed by low-income urban dwellers, then the lowering of the domestic price by means of the export tax can change income distribution toward greater equality. Consequently, country's terms of trade will get better in case of an imposition of the export tax, while import prices are unchangeable.

The end result from the export quota in a large-country case is close to the export taxes: will not only the limitation of export goods influence deadweight losses in the exporting country but also will lead to a contradictory effect in the importing country.

Since Ukraine is a small exporting country on the world grain market, we will not pay too much attention to a thorough description of large-country cases. Estimating statistics, from the world wheat total net exports in 2005/2006 (which is projected to increase from 88158 thousand metric tons in 2005/2006 to 105733 thousand metric tons in 2015/2016) Ukraine accounts for only 5450 thousand metric tons in the period 2005/2006 and for 5853 in 2015/2016. In the corn net exports Ukraine's share was 2300 out of the world 75098 thousand metric tons during 2005/2006 and is expected to become 2996 out of 88760 in 2015/2016 (FAPRI, 2006). For other types of grain Ukraine even not included in the list of net exporters (there are data for the whole CIS only). Moreover, Ukraine is not a major exporter of grain on any of the world markets. It proves our statement that Ukraine must be considered from the point of view of a small country while evaluating the welfare effects of export restrictions on the Ukrainian grain market.

Chapter 5

EMPIRICAL ANALYSIS

5.1 Methodology

For the purpose of simplicity we undertake a partial equilibrium single-commodity analysis. The basic model will be used to evaluate the impact of reducing or eliminating the export quota and export tax on the welfare of the participants of the grain market, ignoring the effect that the tax and quota might have on the other sectors of Ukrainian economy.

As was shown above to qualify the effects one should have a clear idea about the demand and supply elasticities and about the demand and supply schedules. The basic model is formed similarly like the model developed by Galushko (2004)15 for evaluation of sunflower seed export tax, since it is the most suitable one for our analysis (further justification will be given in subsection on the discussion of results). Our model will be specified in the following way:

Domestic demand (constant elasticity function): $Q^D(P) = a \cdot P^{\varepsilon_D}$, where εD-elasticity of demand.

Domestic supply is perfectly inelastic in a short-run (in a given year), because once produced the quantity (supply) cannot be expanded no matter what the

price is. Thus, in the short-run the domestic supply is QS = Production. In the long run there are no boundaries for output and we assume a constant elasticity form, that is, $Q^S(P) = b \cdot P^{\varepsilon_S}$, where εS – long-run elasticity of supply.

Import demand is assumed to have constant elasticity as well: $Id(P) = c \cdot P^{\varepsilon_D^{IM}}$, where εDIM – elasticity of import demand.

Export supply curve (needed to evaluate the difference of scenarios with an export tax in place and free trade) is determined by an excess supply: in a short-run Es(P) = Production - aPεD and in the long run – $Es(P) = b \cdot P^{\varepsilon_S} - a \cdot P^{\varepsilon_D}$

To get the estimates of the elasticities, we are going to estimate the equations given below. The system of equations will look like that:

The equation for Domestic Demand estimation:

$$\ln(Demand)_t = \alpha_0 + \alpha_1 \ln(EXW)_t + \alpha_2 \ln(FOB)_t + \alpha_3 \ln(Demand)_{t-i} + \vartheta_t$$

where Demand – domestic demand for wheat (given for a marketing year).

EXW – the domestic (ex-works) price of wheat faced by processors.

FOB – the world (free-on-board) price for wheat.

t – stands for time period {1,… T}. Considering the behavior of Demand variable over time, the lagged values of demand are included to get rid of autocorrelation in residuals. The autoregressive structure is decided based upon

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[15] Notes of Galushko V. (2004) on evaluation the losers and winners of the introduction of export tax in sunflower seed industry.

the (partial) autocorrelation functions of the estimated residuals. The economic rationale for this is that consumers do not change their demand habits readily for technological, psychological or institutional reasons. Sometimes, when lagged terms of Demand are neglected, the resulting error term can reflect a systematic pattern because of the lagged demand on current demand influence. However, firstly it is necessary to look at economic justification of the lag inclusion, secondly, if its inclusion is appropriate for given data, etc. Thus, the final decision on whether to include it or not will be made during estimation procedure. Moreover, since we work with time series data, we need to check them for stationarity and autocorrelation, and in case of any of them presence use differenced or lagged values of variables. Thus, the form of the equation may change, and particular forms of the equation will be presented together with empirical results.

This equation will be estimated with ordinary least squares upon the assumption of the fact that all ten assumptions for the usage of this method are satisfied, or with autoregressive integrated moving average model if it will give better results. Other rationales will be given together with estimation results.

The equation for the Long-run Domestic Supply estimation:

$$\ln(Supply)_t = \beta_0 + \beta_1 \ln(area)_t + \beta_2 \ln(\Pr ice)_{t-1} + \xi_t$$

where Supply – annual production (gross harvest) of wheat;

area – harvested area in a year t for wheat;

Pricet-1 – one year lagged value of the price faced by producers of wheat.

Since for the estimation of long-run domestic supply we use panel data, thus, it is better to apply fixed (or random) effects rather than simple OLS. The concrete choice will be made upon testing procedure, and will be given in section on estimation results.

The equation for the Import Demand estimation:

$$\ln(Id_t) = \gamma_0 + \gamma_1 \ln(FOBw)_t + \gamma_2 \ln(FOBb)_t + \gamma_3 \ln(FOBc)_t + \gamma_4 AR(i) + \upsilon_t$$

where Id – monthly exports of wheat, barley and corn (thousand tons);

FOBw – world (free on board) price for wheat, (FOB, Odessa);

FOBb – the world price (FOB, Odessa) for barley.

FOBc – the world price (FOB, Odessa) for corn (a substitute/complement for wheat). Rationale for its usage is explained above. This variable (as well as FOBb variable) is included to allow for the change in the demand for Ukrainian exports of wheat in response to a change in the price of such important substitute as barley. However, wheat, barley and corn are not considered as perfect substitutes or complements, therefore, we may exclude substitute-variables from the regression in empirical section after final decision of the form of the equation. What is more, lagged prices can also be included basing on the results of (partial) autocorrelation functions, since economically it is rational to include them due to the absence of an immediate influence of prices change on exports. Besides, usually international contracts are drawn in advance, which creates some kind of rigidity on the world market, therefore inclusion of lagged prices is important since it takes some time for market participants to adjust to the new conditions. Moreover, as in the case of Domestic Demand investigation, if we neglect lagged terms (autoregressive Id patterns of order i) in the above regression, the resulting

error term may reflect a systematic pattern because of the lagged exports on current exports possible influence. Thus, autoregressive terms will be included. What is more, we check time-series variables for stationarity and autocorrelation, that is why the equation for import demand may transform into the first-differenced version, or include more lags of the variables. Final estimation technique (either log-likelihood or OLS) will be decided in empirical section.

Estimation of this system of equations gives us the values of elasticities, which are very important to completely characterize the demand for and supply of wheat. Having estimated the elasticities, we can replicate the base data through the calibration process. For this purpose we construct the demand and supply schedules for the whole period of investigation since we are interested in the long-run effects.

At the next stage we can estimate the free trade price, that is, the price that would have prevailed in Ukraine in 1998/99 through 2006/2007 if there had not been introduced export quota (or possible export tax) on wheat. The free trade price is found by equating the import demand and export supply curves. There is a caveat, however. If there were no transaction costs then under the free trade the PFOB would be equal to the domestic price. In the presence of transaction costs (transportation, obtaining quality certificates, etc.) the domestic price and the FOB price will differ by a number k such that k= PFOB/PEXW. Thus, we should equate Id(PFOB) and Es(P)=Es(PFOB/k).

Finally, we are going to draw graphs and measure welfare effects with quotas and_taxes.

5.2 Data description

The study uses weekly (which are therefore transformed to monthly), and yearly data from UkrAgroConsult and Derzhkomstat data bases.

In particular, for the internal demand analysis ex-works price for wheat is given in UkrAgroConsult weekly reports in USD and UAH per ton for each week of analysed period from 1998/1999 to 2006/2007March (we will use price in USD). The world, free-on-board price, Black Sea Ports (Odessa) is also given in UkrAgroConsult weekly reports in USD and UAH per ton for each week of analysed period (we take it in USD also). As for the Demand variable it is assumed that it is constant throughout the year, because it is given for the whole marketing year only.

Since the above described data for prices are given weekly, we transform their into the monthly form by taking an average of all month observations. Finally, it gives us a data set of 104 observations.

For the estimation of long-run supply equation annual district-level data on production and harvested area (crop) through 1998-2006 are used (taken from Derzhkomstat data base). Therefore, for the estimation it produces a panel of 200 observations. The price which producers face is the average of annual price for each Ukrainian oblast at which agricultural enterprises sold their produce (also taken from Derzhkomstat data base).

Estimation of the last, import demand, equation employs UkrAgroConsult export-import statistics, given monthly for the Id variable through the investigating period 1998-2006/07. The FOBw, FOBb and FOBc variables also employ UkrAgroConsult data but from its weekly reports (and we bring weekly

data to the monthly ones, which it total produces 104 observations as well as for the estimation of domestic demand equation).

5.3. Calculation of elasticity coefficients for domestic demand, domestic supply and import demand

As discussed in previous chapter, a welfare analysis of export restrictions in the wheat market will be conducted using the estimation of three equations: domestic demand, domestic supply and import demand. Frequently such estimation is made by applying simultaneous equation model. Since we have monthly data for the estimation of internal demand and import demand, but panel (by Ukrainian oblasts) yearly data for the estimation of domestic supply, it is only possible to estimate each equation separately.

Judging by Dickey-Fuller test for unit root and Durbin's alternative test for autocorrelation, we observe non-stationarity and autocorrelation in the (logarithms of) variables of prices, demand and export. These conclusions are justified by p-values. That is, for logarithms of variables of domestic demand for wheat, ex-works and free-on-board prices for wheat (as well as for its substitutes used, like barley and corn), and export of wheat, p-values are reported in the table below.

Table 5.1. Testing variables for stationarity and autocorrelation

Variables	p-values			
	Dickey-Fuller test for unit root		Durbin's alternative test for autocorrelation	
	True variables	First-differenced variables	True variables	First-differenced variables
lnDw	0.1209	0.0000	0.5581	0.9863
lnEXWw	0.4471	0.0000	0.0297	0.3928
lnFOBw	0.9791	0.0000	0.0226	0.8932
lnFOBb	0.5432	0.0000	0.0596	0.8680
lnFOBc	0.7846	0.0000	0.5196	0.9114
lnexpw	0.0437	0.0000	0.0986	0.8950

Source: own calculations

Since p-values prove non-stationarity and presence of serial correlation in our variables, we take their first differences to avoid spurious regression problems. Thus, we have no choice as to regress first differences of variables, instead of "true" variables for the estimation of domestic demand and import demand equations. Obtained elasticity coefficients in this case (which we will use for our further estimation of welfare effects) differ from what we could have obtained in case of inclusion of "true" variables into the regression. However, they appear to satisfy theoretical considerations (i.e. the elasticity of domestic and import demand for wheat should be low, since (1) domestic demand for wheat is inelastic because wheat will be used in feed and food production despite possible increase in its price, and will be rarely substituted with corn or barley, and (2) Ukraine is a small country, and cannot influence the world price). Obtained results are shown in the table 5.2.

Estimation of equations for domestic and import demand were accomplished using method of ordinary least squares (OLS), and for the long-run domestic supply – fixed effects method. The latter was chosen based on the results of Breusch and Pagan Lagrangian multiplier test, which has shown a very low p-value of 0.0000, thus, we have serial correlation in our variables. Therefore, it is better to use fixed or random effects estimation.

Theoretically, time-demeaned variables that are obtained by subtracting averages of variables from their "own" values give us the fixed effects estimator, which helps us to look at the variation within the observations for each Ukrainian oblast, after having got rid of the variation over oblasts (by getting rid of the oblast specific average). However, an error term here consists of two parts, and in case of correlation of averages of independent variables with an error part that reflects fixed over time but varying over oblasts unobservables, between estimator appears to be biased; or otherwise – inefficient. Therefore, one may

argue that it is better to use random effects estimator. What is more, in the case of using fixed effects we need an assumption, first, of strict exogeneity of the variables. Second, we can not estimate coefficients of variables that are fixed over time (but we do not have such variables in the equation). And, fixed effects estimator is not consistent for large number of observations (but we have just 200 observations) and fixed time period (which can be changed) (Coupe, 2006). Since we rely on the assumption of no correlation of independent variables and error terms, and on the results of Hausman test (which gives us a very small (0.0000) p-value, thus, we reject the null hypothesis of the test that the coefficients in two models are practically the same) we are to pick a fixed effects model for the estimation of wheat internal long-run supply, since random effects model provides inconsistent estimates.

Obtained by fixed effects estimation coefficients of long-run domestic supply are significant even at 1% level of significance, therefore they can be used for our further estimation with certainty. Moreover, small own price elasticity for supply, which we obtained, is in line with theory that speaks for not very broad opportunities for domestic traders to substitute barley's and corn's areas with wheat's in case of growing price, thus, increase in price for wheat by 1% will cause an increase in its supply (on average) only by 0,20%, holding all other variables unchanged.

However, we can not rely with such a certainty on OLS estimators of domestic and import demand, since they are jointly significant only at 15% level, and for the import demand we have insignificant FOB price elasticity, which will be used in our further calculations.

Let's discuss domestic demand equation first. As it was written in previous section, the variables to include into it (as well as of equations for domestic

supply and import demand) were chosen using notes of V.Galushko (2004) on evaluation of the losers and winners after an export tax in sunflower seed industry introduction, since (1) sunflower is an agricultural product as well as wheat, and (2) we investigate not only export quota but also a possible introduction of an export tax on wheat as she did. However, we got rid of autoregressive terms of demand for wheat because they reduce degrees of freedom a lot, and, therefore, it is unwise to do so in case of such "low" number of observations (104 only).

Another change from the original model for domestic demand that we made is inclusion of first differences of variables (the rationale for it is discussed above). When we do so, our estimates become stationary and without serial correlation judging by Dickey-Fuller test for unit root and Durbin's alternative test for autocorrelation. Also Durbin-Watson d-statistics indicate that there is no autocorrelation in the model (d-statistic (3,104) = 2.160798, which is inside the interval between the upper limit and 4 – upper limit, i.e. [1.736; 2.264]).

The problem of autocorrelation in time series is the most serious, and we have completely coped with it by estimating the domestic demand for wheat with the model of the form (1). However, obtained coefficients are still insignificant despite their satisfaction to the theoretical considerations. It happens because there are problems of (1) omitted variables, and (2) reverse causality.

The existence of a problem of omitted variables in the equation for domestic demand is confirmed with low R^2 = 0.0244 (and its adjusted for degrees of freedom value = 0.0051). But it is difficult to solve this problem since we have low number of observations, and inclusion of each additional variable reduces number of degrees of freedom. Moreover, it is very difficult to collect the appropriate data for each additional variable.

The existence of reverse causality problem is centered on the fact of mutual dependence of prices and quantity on each other, therefore simultaneous equation models are used. Since the equation for the supply of wheat made up of panel data rather than simple time series, we can not apply any simultaneous equation model as it has been already discussed above. Coming back to the demand for wheat equation, we can state that exogeneity/endogeneity problems can often be solved by applying, say, vector autoregression models (VAR), but such models are rarely used for policy analysis (Gujarati, 1995).

Another way that we propose to apply is to use autoregressive integrated moving average model (ARIMA) that estimates by log-likelihood function which gives different from ordinary least squares results for not-large number of observations as in our case. What is more, as an alternative, in ARIMA fractional differences (d) instead of ordinary ones are used (Beran, 1995). In our case it helps to save some degrees of freedom (since "true" logarithm of demand for wheat variable according to partial autocorrelation function has just 1st lag, but differenced – 12th), and, what is more important, to get significant at 5% level coefficient for own price elasticity of wheat, which appears to be equal to -0.24. All other coefficients are jointly significant at 10% level (p-value equals 0.0940). Therefore, for the estimation of welfare effects of export restrictions we will use own wheat price elasticity obtained by specification ARIMA (1,1,0).

Now, we are going to discuss the last equation – import demand equation, from which we need own FOB wheat price elasticity to determine free-trade price. Note that this equation includes prices of barley and corn as substitutes for wheat since they influence import demand. In terms of estimation this equation is the most problematic since no specification gives significant results, thus we will choose the model by the results of (1) postestimation tests such as Breusch-Pagan

/ Cook-Weisberg test for heteroskedasticity and Durbin-Watson d-statistic, and (2) better correspondence of results to the theoretical justifications.

Thus, final model specification is based on first differences for the variables because of non-stationary and with serial correlation their "true" values, and it includes first lags of each variable that was decided upon (partial) autocorrelation functions, and economic rationale that there is no immediate response of export to price changes. An estimation technique applied is OLS since it gives consistent with the theory results (i.e. proves inelastic import demand). Moreover, postestimation shows (1) there is no heteroskedasticity since high p-value = 0.5929 in Breusch-Pagan / Cook-Weisberg test for heteroskedasticity makes it impossible to reject the null of constant variance, and (2) no autocorrelation since obtained Durbin-Watson d-statistic (8, 88) = 2.039 is inside the interval [1.714; 2.286]. Thus, the major reason for insignificant coefficients are omitted variables (R2 is just 0.1226 (and adjusted 0.0459)), not enough number of observations, exogeneity/endogeneity, etc. But since this specification and estimation gave us consistent to the theory result we are going to use an obtained FOB price elasticity for wheat of -0.23 in our further calculations. The form of the model is given by (3).

Finally for better visual performance we summarize all obtained results into the table 5.2., and visually present all of the applied equations.

Table 5.2. Empirical results for the market of wheat

Domestic demand equation			**Domestic supply equation**			**Import demand equation**		
Variable	Coeffic.	p-value	Variable	Coeffic.	p-value	Variable	Coeffic.	p-value
(1):			*(2):*			*(3):*		
d.lnEXWw	**-0.180293**	**0.115**	ln_price_wheat	**0.1961115**	**0.000**	d.lnFOBw	**-0.22953**	**0.927**
d.lnFOBw	0.123614	0.657	ln_area_wheat	1.615927	0.000	d.lnFOBc	-1.69902	0.360
constant	-0.001779	0.887	constant	-3.45464	0.000	d.lnFOBb	3.005809	0.083
						l.d.lnFOBw	-3.41010	0.180
ARIMA (1,1,0)						l.d.lnFOBc	0.154995	0.935
						l.d.lnFOBb	-3.18654	0.056
d.lnEXWw	**-0.237226**	**0.013**				l.d.ln_expw	0.107828	0.315
d.lnFOBw	0.157457	0.837				constant	0.024821	0.833
constant	-0.001652	0.907						
AR (1)	-0.103756	0.632						

Domestic demand: (1)

$$\Delta \ln Dw_t = \varphi_0 + \varphi_1 \Delta \ln EXWw_t + \varphi_3 \Delta \ln FOBw_t + \varepsilon_t$$

Long-run domestic supply equation: (2)

$$\ln\_\sup\_wheat = \delta_0 + \delta_1 \ln\_price\_wheat_{t-1} + \delta_2 \ln\_area\_wheat + \varepsilon_t$$

Import demand equation:(3)

$$\Delta \ln\_\exp w = \gamma_0 + \gamma_1 \Delta \ln FOBw_t + \gamma_2 \Delta \ln FOBb_t + \gamma_3 \Delta \ln FOBc + \gamma_4 \Delta \ln FOBw_{t-1} + \gamma_5 \Delta \ln FOBb_{t-1} + \gamma_6 \Delta \ln FOBc_{t-1} + \gamma_7 \Delta \ln\_\exp w_{t-1} + \varepsilon_t$$

Where:

$\Delta \ln Dw_t$ - first difference of the domestic demand for wheat between months t;

$\Delta \ln EXWw_t$ - first difference of the ex-works price for wheat between months t;

$\Delta \ln FOBw_t$ - first difference of the free-on-board price for wheat between months t;

$\ln\_\sup\_wheat$ - gross harvest (supply) of wheat in a year t;

$\ln\_price\_wheat_{t-1}$ - one year lagged value of the price faced by wheat producers;

$\ln\_area\_wheat$ - harvested area in a year t;

$\Delta \ln\_\exp w$ - monthly exports of wheat;

$\Delta \ln\_\exp w_{t-1}$ - exports of wheat one month back;

$\Delta \ln FOBw_t$ - free-on-board price for wheat;

$\Delta \ln FOBw_{t-1}$ - free-on-board price for wheat a month ago;

$\Delta \ln FOBb_t$ - free-on-board price for barley;

$\gamma_5 \Delta \ln FOBb_{t-1}$ - free-on-board price for barley a month ago;

$\Delta \ln FOBc$ - free-on-board price for corn;

$\Delta \ln FOBc_{t-1}$ - free-on-board price for corn a month ago;

$\varepsilon_t, \nu_t, \omega_t$ - error terms.

Source: own calculations and composition (for STATA output see Appendix 1)

5.4. Calibration of parameters

Having estimated the elasticities we can replicate the base data through the calibration process. We construct the demand and supply schedules for the whole analysed period (not for each year or each month), since we are interested in the long-run estimation.

We know from the real data that the domestic demand curve passes through the point denoting annual demand and average annual domestic price. We also know that the domestic demand equation is of the form $Q^D(P) = a \cdot P^{\varepsilon_D}$. Thus, the magnitude of a can be calculated by dividing summarized domestic demand by summarized price.

Since domestic supply is perfectly inelastic in a short-run, it is equal to production. In the long run there are no boundaries for output and we assume a constant elasticity form, that is, $Q^S(P) = b \cdot P^{\varepsilon_S}$, where εS – long-run elasticity of supply. Therefore, to get the long-run result we will estimate for the whole

period from 1998 till 2006, and find parameter b by dividing gross harvest on correspondent price.

The same procedure is applied for import demand, assuming its constant elasticity form: $Id(P) = c \cdot P^{\varepsilon_D^{IM}}$, where εDIM – elasticity of import demand. Therefore, parameter c is determined by dividing total average exports for the analyzed period by total average FOB price.

Finally, we determine export supply curve (an excess supply). In the short-run Es(P) = Production - aPεD , but since we are interested in the long-run estimation, we determine export supply as $Es(P) = b \cdot P^{\varepsilon_S} - a \cdot P^{\varepsilon_D}$.

Corresponding equations are summarized in the Table 5.3.

Table 5.3. Estimated equations for wheat

Name	Formula
Domestic demand equation	$Q^D(P) = 12.39*P^{-0.24}$
Domestic supply equation	$Q^S(P) = 2.01*P^{0.20}$
Import demand equation	$Id(P) = 3.077*P^{-0.23}$
Export supply equation	$Es(P) = 12.39*P^{-0.24} - 2.01*P^{0.20}$

Source: own calculations

At the next stage we can estimate the free trade price, which can be found by equating the import demand and export supply curves. There is a caveat, however. If there were no transaction costs then under the free trade the PFOB would be equal to the domestic price. In the presence of transaction costs (transportation, obtaining quality certificates, etc.) the domestic price and the

FOB price will differ by a number k such that k= PFOB/PEXW. Thus, we should equate Id(PFOB) and Es(P)=Es(PFOB/k). In such a way we obtain a free trade price which (according to EXCEL calculations) should lie in the interval [104.3557; 104.2670], therefore, taking average of upper and lower bounds of this interval we obtain 104.31.

When we investigate the case with a possible export tax, then parameter k= PFOB/[(1+tax)*PEXW]. We look at 4 scenarios with an export tax on the level of 5%, 10%, 15% and 20%. Welfare effects for this case are calculated according to the Fig.1 in Theory section (ch.3) by measuring squares of figures for consumer/producer surpluses, and government revenue. After that total welfare loss and deadweight losses are obtained. All calculations are made with usage of EXCEL and general economic knowledge. The results are reported in the table below:

Table 5.4. Estimation of welfare effects after possible introduction of export taxes for wheat

Value of possible tax	k	New P[16]	Welfare effects				
			Change in Consumer Surplus (CS)	Change in Producer Surplus (PS)	Government Revenue (G)	Total Surplus (TS = CS + PS + G)	Deadweight Losses (DW)
5%	0.91	101.32	12.18578	-15.18015	2.907262	-0.0871	-0.100887
10%	0.87	99.81	18.37253	-22.81256	4.240728	-0.1993	-0.220109
15%	0.83	97.23	28.99557	-35.79986	6.302177	-0.50211	-0.535015
20%	0.80	96.61	31.55843	-38.91064	6.755767	-0.59645	-0.632285

Source: own calculations

Now, let's look at the case of wheat export quotas. The welfare effects here will be calculated using Fig.2 from Chapter 3 by measuring squares of two curvilinear trapezoids indicated CS and PS, since government does not obtain revenue in case of quotas in a small country case. However, it should be taken into account

[16] New P is calculated analogically as a free-trade price by changing parameter k as discussed above. Finally obtained number is taken as an average of upper and lower bound of the interval.

that since government introduced no licensing, therefore a square above the intersection of demand and supply curves will be referred to producers, thus decreasing their loss.

To determine a price before quotas implementation here we will solve the next equation:

QS(P) – QD(P) = average of total exports, which were more than a quota level equal to 0.4

This average equals 0.685, thus, the price is about 115[17]. After quota was introduced, it became impossible to export more than 0.400, therefore, looking again at demand and supply curves we find that new price appears to be 87,26[18]. At this point we can calculate consumer and producer surpluses, which are presented in table below.

Table 5.5. Estimation of welfare effects after wheat export quota introduction

Quota for wheat	Welfare effects	Value
0.400	CS	113.6094
	PS	-121.6033
	TS	-7.9939
	DW	-8.1228

Source: own calculations

Therefore, we see that total welfare loss from export quota implementation (-7.9939) is much higher than from export taxes introduction even for the maximum assumed of them on the level of 20% (- 0.5965). Thus, export quotas on the wheat market in the long-run bring much more larger welfare losses than export taxes.

[17] It is approximately determined by subtracting demand from supply for different price levels.

[18] We again look at difference between supply and demand, but now at where this difference <=0,400, and then find average price for these levels.

Chapter 6

CONCLUSIONS

Estimation of welfare effects of different governmental policies was frequently made by different countries in different times. And in developing countries the net welfare gain often became negative in the long-run because of governmental interventions which impeded free development of competitive business environment. But it is possible that welfare losses would be much more higher in case if the government stayed aside. However, it is not the case of Ukraine.

Since Ukrainian economy is unstable, it cannot develop without governmental interventions. When some unstable situations happen, policy makers can help by their "steady hand" and not by unsetting markets further, as they actually made during wheat crisis in 2003. In fact, this was not the only situation when government's intervention had negative impact on total welfare. And the most recent example of similar situation is grain quota introduction in October of 2006.

Grain quota introduction attracted a lot of attention, and some time ago became a hot issue in the Ukrainian press. In general, this governmental measure was evaluated negatively, and the most complete evaluation of it was given in the joint research of the World Bank and IER (2006). However, this research has not presented any empirical calculations concerning the Ukrainian problem of grain quotas implementation. Therefore, the novelty of our paper is that we give an empirical evaluation of export quotas' implementation for the wheat market.

What is more, taking into account the conclusion of the World Bank's and IER's paper that there are alternative measures which may serve better welfare effects for Ukrainian market for wheat, we make an empirical evaluation of such alternative measure as export tax.

Our empirical evaluation was made with the help of usage of econometric methods for the estimation of equations of domestic demand and supply, and import demand and export supply to further calculate producers' and consumers' surpluses, government revenue (if any) and deadweight losses.

The results show:

i) the elasticity of domestic demand is -0.24 that means that a 1% increase in the domestic price for wheat will lead on average to just 0.24% decrease in its domestic consumption, holding all other variables constant; which confirms theoretical fact about non-elastic demand for wheat;

ii) the elasticity of domestic supply is 0.20 that means that a 1% increase in the domestic price for wheat will lead on average to just 0.20% increase in its domestic production, holding all other variables constant; which confirms theoretical fact about impossibility of growth of Ukrainian gross harvest of wheat;

iii) the elasticity of import demand is -0.23 that means that a 1% increase in the foreign price for wheat will lead on average to just 0.23% decrease in its import demand, holding all other variables constant; which serves as a justification of the fact that Ukraine is a small country on the world wheat market, and it cannot influence foreign wheat price.

iv) in the long-run the welfare effects of imaginary export taxes on the level of 5%, 10%, 15% and 20% are much more better than of export quota. In

particular, in case with export quota we have total welfare loss on the level of 7.9939, while in case with export taxes it lies in the interval of [0.0871; 0.59645] depending on the tax rate. Also separate welfare effects for producers, consumers and government are better with export taxes that with export quotas, i.e.:

a) the loss for producers in the long-run is 121.6033 for the case with wheat export quota, and from 15.1802 till 38.9106 with an export tax scenario;

b) the win for consumers is 113.6094 for the case with wheat export quota, and from 12.1858 till 31.5584 with an export tax scenario. But it is necessary to mention that consumers gained much less from the grain quota introduction than it is predicted by the theory, because with remaining constant wheat prices, prices for flour and bread have increased since quota's implementation (World Bank and IER, 2006);

c) the win for the government lies in the interval [2.9073; 6.7558] depending on tax rate level for the scenario with possible export taxes, and makes 0 for the export quotas scenario in the long run;

d) also there are deadweight losses for each scenario, and they differ a lot for each of the cases, i.e. they are in the interval of [0.1009; 0.6323] for imaginary export taxes, and make 8.1228 for the case with existing export quotas for wheat.

Therefore, our empirical estimation proved the conclusion of the paper of World Bank and IER (2006) that an alternative measure, such as export taxation, could bring less welfare losses than existing export quota for wheat in the long run, that is why, it is necessary for the Ukrainian government to revise its policy concerning the protection of the supply on domestic market for wheat, which

was the main justification of introduction of export quota for the Ukrainian grain in October of 2006.

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APPENDIX 1

1. STATA Estimation of Domestic Demand Equation for wheat

```
. use "D:\IER\intern_demand.dta", clear
.  reg d.lnDw d.lnEXWw d.lnFOBw
      Source |       SS       df       MS              Number of obs =     104
-------------+------------------------------           F(  2,   101) =    1.27
       Model |  .039379501     2  .019689751           Prob > F      =  0.2866
    Residual |  1.57194341   101  .015563796           R-squared     =  0.0244
-------------+------------------------------           Adj R-squared =  0.0051
       Total |  1.61132291   103  .015643912           Root MSE      =  .12475

------------------------------------------------------------------------------
      D.lnDw |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnEXWw |
         D1. |  -.1802926   .1133843    -1.59   0.115    -.4052165    .0446313
      lnFOBw |
         D1. |    .123614   .2779341     0.44   0.657    -.4277326    .6749605
       _cons |  -.0017793   .0124368    -0.14   0.887    -.0264505     .022892
------------------------------------------------------------------------------
. arima lnDw lnEXWw lnFOBw, arima(1,1,0)
(setting optimization to BHHH)
Iteration 0:   log likelihood =   70.75061
Iteration 1:   log likelihood =  70.785675
Iteration 2:   log likelihood =  70.797916
Iteration 3:   log likelihood =   70.80653
Iteration 4:   log likelihood =  70.835206
(switching optimization to BFGS)
Iteration 5:   log likelihood =   70.83723
Iteration 6:   log likelihood =  70.848809
Iteration 7:   log likelihood =  70.851202
Iteration 8:   log likelihood =  70.853428
Iteration 9:   log likelihood =  70.855492
Iteration 10:  log likelihood =  70.855866
Iteration 11:  log likelihood =  70.856998
Iteration 12:  log likelihood =  70.857028
Iteration 13:  log likelihood =  70.857028
ARIMA regression
Sample:  2 to 105                               Number of obs      =       104
                                                Wald chi2(3)       =      6.39
Log likelihood =  70.85703                      Prob > chi2        =    0.0940
------------------------------------------------------------------------------
             |                 OPG
      D.lnDw |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lnDw         |
      lnEXWw |
         D1. |  -.2372256   .0956177    -2.48   0.013    -.4246328   -.0498183
      lnFOBw |
         D1. |   .1574566   .7675921     0.21   0.837    -1.346996     1.66191
       _cons |  -.0016517   .0141997    -0.12   0.907    -.0294825    .0261792
-------------+----------------------------------------------------------------
ARMA         |
          ar |
         L1. |  -.1037597   .2166149    -0.48   0.632     -.528317    .3207977
-------------+----------------------------------------------------------------
      /sigma |   .1224187    .003435    35.64   0.000     .1156863    .1291511
------------------------------------------------------------------------------
```

2. STATA Estimation of Domestic Supply Equation for Wheat

```
. use "H:\thesis\estimation results\supply reg.dta", clear
. xtreg  ln_sup_wheat ln_area_wheat ln_price_wheat, fe

Fixed-effects (within) regression               Number of obs      =       200
Group variable (i): obl_i                       Number of groups   =        25

R-sq:  within  = 0.9287                         Obs per group: min =         8
       between = 0.9723                                        avg =       8.0
       overall = 0.8951                                        max =         8

                                                F(2,173)           =   1126.94
corr(u_i, Xb)  = -0.8044                        Prob > F           =    0.0000

------------------------------------------------------------------------------
ln_sup_wheat |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
ln_area_wh~t |   1.615927   .0349904    46.18   0.000     1.546864     1.68499
ln_price_w~t |   .1961115   .0330031     5.94   0.000      .130971     .261252
       _cons |   -3.45464   .2483644   -13.91   0.000    -3.944855   -2.964426
-------------+----------------------------------------------------------------
     sigma_u |  .42190863
     sigma_e |  .20459759
         rho |  .80961144   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(24, 173) =    11.26             Prob > F = 0.0000
```

3. STATA Estimation of Import Demand Equation for Wheat

```
. reg  d.ln_expw d.lnFOBw d.lnFOBc d.lnFOBb l.d.lnFOBw l.d.lnFOBc l.d.lnFOBb
l.d.ln_expw

      Source |       SS       df       MS              Number of obs =      88
-------------+------------------------------           F(  7,    80) =    1.60
       Model |  12.1744872     7  1.73921245           Prob > F      =  0.1482
    Residual |  87.0995984    80  1.08874498           R-squared     =  0.1226
-------------+------------------------------           Adj R-squared =  0.0459
       Total |  99.2740856    87  1.14108144           Root MSE      =  1.0434

------------------------------------------------------------------------------
   D.ln_expw |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnFOBw |
         D1. |  -.2295239   2.487542    -0.09   0.927     -5.17989    4.720842
      lnFOBc |
         D1. |  -1.699023    1.84371    -0.92   0.360    -5.368123    1.970076
      lnFOBb |
         D1. |   3.005809   1.712172     1.76   0.083     -.401522    6.413139
      lnFOBw |
         LD. |  -3.410196   2.519969    -1.35   0.180    -8.425095    1.604703
      lnFOBc |
         LD. |   .1549954   1.891303     0.08   0.935    -3.608817    3.918808
      lnFOBb |
         LD. |  -3.186543   1.644395    -1.94   0.056    -6.458994    .0859087
     ln_expw |
         LD. |   .1078283    .106741     1.01   0.315    -.1045931    .3202497
       _cons |    .024821   .1174552     0.21   0.833    -.2089223    .2585643
------------------------------------------------------------------------------
```