With support from

Federal Ministry of Food and Agriculture

by decision of the German Bundestag

German-Ukrainian Agricultural Policy Dialogue

Under the National Association of Agricultural Advisory Services of Ukraine ДОРАДА

Agricultural Policy Report APD/FPR/04/2020

„Market Implications of the Ukrainian Round Wood Export Moratorium"

Prof. Dr. Dieter Kirschke

Kyiv, September 2020

About the Project "German-Ukrainian Agricultural Policy Dialogue" (APD)

The project German-Ukrainian Agricultural Policy Dialogue (APD) started 2006 and is supported up to 2021 by the Federal Ministry of Food and Agriculture of Germany (BMEL). On behalf of BMEL, it is carried out by the mandatary, GFA Consulting Group GmbH, and a working group consisting of IAK AGRAR CONSULTING GmbH (IAK), Leibniz Institute of Agricultural Development in Transition Economies (IAMO) and AFC Consultants International GmbH. Project executing organization is the National Association of Agricultural Advisory Services of Ukraine in Kyiv. The APD cooperates with the German land use and management society (BVVG) on the implementation of key components related to the development of an effective and transparent land administration system in Ukraine. Beneficiary of the project is the Ministry of Agrarian Policy and Food of Ukraine.

In accordance with the principles of market economy and public regulation, taking into account the potentials, arising from the EU-Ukraine Association Agreement, the project aims at supporting Ukraine in the development of sustainable agriculture, efficient processing industries and enhancing its competitiveness on the world market. With regard to the above purpose, mainly German, but also East German and international, especially EU experience are provided by APD when designing the agricultural policy framework and establishing of relevant institutions in the agriculture sector of Ukraine.

www.apd-ukraine.de

Authors:

Dieter Kirschke

Disclaimer

This work is published under the responsibility of the German-Ukrainian Agricultural Policy Dialogue (APD). Any opinions and findings, conclusions, suggestions or recommendations expressed herein are those of the authors and do not necessarily reflect the views of APD.

Content

List of Figures

List of Abbreviations

APD	German-Ukrainian Agricultural Policy Dialogue
ATU	Agritrade project
BMEL	(German) Federal Ministry of Food and Agriculture
c	Constant of supply
cbm	Cubic meter
cif	Cost, insurance and freight
d	Constant of demand
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
fob	Free on board
$GB^{Production}$	Government´s budget due to its production tax policy
$GB^{Protection}$	Government´s budget due to its protection policy
GB^{Total}	Government´s total budget
GB^{VAT}	Government´s budget due to its VAT policy
GoU	Government of Ukraine
ITTO	International Tropical Timber Organization
m	Million
p	Domestic market price
p^d	Demand price (consumer price)
p^s	Supply price (producer price)
p^w	World market price
q^d	Demand quantity
q^s	Supply quantity
r	Protection rate
SSSU	State Statistics Service of Ukraine
t	Production tax rate
$T^{Consumer}$	Consumer taxation
$T^{Producer}$	Producer taxation
USD	United States Dollar
v	Value added tax (VAT) rate
VAT	Value added tax
ε^s	Elasticity of supply
ε^d	Elasticity of demand.

Executive Summary

There is an ongoing and controversial debate on the export moratorium for round wood in Ukraine as imposed from 1 January 2016 (for conifer wood from 1 January 2017). The study wants to contribute to the discussion providing a market modelling approach for analysing and quantifying key market effects of the export moratorium. The model developed can be used to carry out scenario calculations for further relevant policy options.

The key questions of the study are:

- How can a market model for the Ukrainian timber market be formulated?
- What are the market effects of the export moratorium?
- What are the market effects of policy alternatives?
- How can timber market specifics be considered in the analysis?
- What policy recommendations does the analysis suggest?

The study and the modelling approach are based on microeconomic theory and reflect the development of production and trade on the Ukrainian round wood market in recent years. The model focusses on industrial round wood (according to Ukrainian trade classification code 4403) to which the moratorium applies.

The modelling approach developed is a comparative-static, partial equilibrium market model. This is a standard modelling approach in market and policy analysis which we have adjusted to the specifics of the Ukrainian timber market. The constraints and assumptions of the analysis are explained and the implications of key assumptions for further analysis and policy-making are discussed. The model is fed with data based on the current market situation under the export moratorium. This is the baseline for the policy scenario calculations.

The modelling approach is then used to calculate the market effects of the moratorium and of alternative policy scenarios. The major effects of the export moratorium (as compared to a situation without export moratorium, i.e. free trade) are as follows:

- Domestic price decrease of ca. 20 USD/ton
- Export loss of ca. 1.4 m tons and foreign exchange loss of ca. 100 m USD
- Drop in producer revenue of ca. 170 m USD
- Drop in VAT revenue of ca. 14 m USD
- Producer taxation (ca. 125 m USD) and change from consumer taxation to consumer subsidisation (ca. 55 m USD)
- Redistribution of income from producers (ca. 130 m USD) and government/taxpayers (ca. 14 m USD) to consumers (ca. 140 m USD) (Processing industry (ownwers, managers, workers) and final consumers of wood products)
- Welfare loss for the economy of ca. 5 m USD.

The analysis suggests that these economic effects should not be neglected in policy-making. It is obvious, though, that there are other objectives pursued beyond economics

in the Ukrainian timber sector and market policy like sustainable forest use and development of the wood processing industry. Then, policy-making becomes more complex and the following questions have to be addressed and answered:

- What is the impact of the export moratorium on these policy objectives?
- If positive impacts can be identified, are they worth the costs (welfare loss and foreign exchange loss, unintended distributional effects)?
- Are there better policies (i.e. less costly) to achieve the goals pursued?

In fact, the modelling approach developed can be used to assess and quantify the market effects of alternative policies on the Ukrainian round wood market. This should ideally be done in a working group with experts using the modelling approach in an interactive way.

Given some key policy perspectives for the Ukrainian timber market (higher sustainable wood production, higher wood productivity in wood production and processing), we have formulated and analysed the following scenarios:

- Policy scenario 1: Free trade
  (by abolishing the export moratorium)
- Policy scenario 2: Free trade & production subsidy
  (by implementing a production subsidy rate of 25% under free trade)
- Policy scenario 3: Free trade & investment programme for the timber production industry
  (by implementing a supply shift factor of 10% under free trade)
- Policy scenario 4: Free trade & investment programme for the timber processing industry

(by implementing a demand shift factor of 10% under free trade).

As a general result, price policy interventions (export moratorium, production subsidy) suffer from market distortions, welfare losses and provide incentives for rent-seeking behaviour. Furthermore, there is little evidence in development economics that price incentives (as induced for the moratorium for the domestic wood processing industry) can foster economic development.

On the other hand, welfare effects of investment programmes and programmes to improve the institutional framework and good governance can be very high. This is a promising alternative for sustainable forest use and timber sector development. The design and evaluation of investment and governance programmes requires additional investment or cost-benefit analysis. The modelling approach presented can be extended into this direction in a straightforward way.

Some Ukrainian timber market specifics may require further information and analysis for policy-making support:

- Qualitative/quantitative estimates and sensitivity analysis to deal with uncertainty about price responses of producers and consumers

- Assessment of substitution effects in production and multi-market modelling to deal with market interdependencies, particularly, between industrial round wood and fuel wood
- Assessment of shadow market and rents, possibly, by extending the modelling approach to deal with illegal wood cutting and exports
- Assessment of market power, possibly, by using a Structure-Conduct-Performance-Approach
- Establish a proper institutional framework and good governance for the functioning of the market.

There is a widespread understanding in Ukraine that science-based policy support should be strengthened. The study and the proposed modelling approach could be the base for further discussions and analyses. The perspective is, based on the modelling approach and in cooperation with policy decision-makers and experts in Ukraine, to better support and improve policy decision-making for the timber sector and market in the country.

1. Introduction

The Parliament of Ukraine has imposed an export moratorium for round wood (unprocessed round timber) by Law of Ukraine № 325-VIII (9 April 2015) as from 1 January 2016 (for conifer wood from 1 January 2017), for a period of ten years. More precisely, the moratorium refers to code 4403 (Industrial round wood) of the Ukrainian classification of goods in foreign trade (Law of Ukraine № 674-IX, 4 June 2020). Major objectives have been to reduce illegal wood cutting and to support the domestic wood processing industry. There is an ongoing and intensive debate on the implications of the moratorium and on policy alternatives to achieve political objectives in the forest sector. The German-Ukrainian Agricultural Policy Dialogue (APD) has initiated two papers to support the discussion on the moratorium (Bemmann and Pylaieva, 2018; Marchuk, 2019). Further analysis and discussion on the round wood export moratorium is provided by Angel and Butin (2018), Popkov (2016) and Yaroshchuk (2017, 2018).

It is obvious that the moratorium will affect markets and the economy. The export moratorium is a quantitative market intervention and the market effects of such a policy intervention can be analyzed in a rigorous analytical framework. Hence, the paper wants to contribute to the discussion on the Ukrainian round wood export moratorium by providing such analytical support.

The purpose of the paper is to formulate a market modelling approach for analyzing and quantifying key market effects of the export moratorium. We will look at the effects on prices, production, consumption, and trade; on tax revenue of the government as well as on taxation and income of producers and consumers; and on foreign exchange and welfare. The modelling approach is a partial equilibrium market model for the Ukrainian timber market. The model developed can also be used to carry out scenario calculations on further relevant policy options.

These are the key questions for the paper:

- How can a market model for the Ukrainian timber market be formulated?
- What are the market effects of the export moratorium?
- What are the market effects of policy alternatives?
- How can timber market specifics be considered in the analysis?
- What policy recommendations does the analysis suggest?

The structure of the paper is as follows.

Following the introductory chapter, we provide background information for analysing the Ukrainian round wood market in chapter 2. We describe some basic market statistics and present the theoretical background for the analysis.

Chapter 3 provides the modelling framework for the analysis. We describe the features of the model and the model specification. Data requirements and the data base are explained, and we show how the model can be implemented in Excel for interactive use and calculations. The chapter ends with the baseline formulation of the Ukrainian timber market model under the current export moratorium.

The model, then, is applied in chapter 4 for quantifying and discussing the implications of various policy scenarios for the Ukrainian round wood market. We start with the export moratorium and compare the current policy scenario with a free trade scenario. We then analyse the implications of other policy interventions. We discuss price policy support and investment programmes for the timber production industry and the timber processing industry, respectively. And we address the role of governance and institutions for policy-making.

Chapter 5 goes beyond the modelling analysis. We will address additional and relevant aspects for policy-making on the round wood market like uncertainty, market interdependencies, illegal wood cutting and exports, concentration and market power and institutional constraints. We will discuss how such timber market specifics can be considered in the analysis.

Based on the analysis we will give some recommendations for policy-making on the Ukrainian round wood market in chapter 6.

2. Analyzing the Ukrainian round wood market

2.1. Production and trade

The Ukrainian timber sector is a complex production sector. The primary product is (unprocessed) round timber or (unprocessed) round wood consisting of industrial round wood (Classification code 4403) and fuel wood (Classification code 4401). Round wood adds up with unmerchantable wood to total harvested wood following the notations of the State Statistics Service of Ukraine (2020). On the demand side, the timber sector is characterised by a heterogenous wood processing industry with a diversified output. There are various markets for specific wood products, including exports and imports. To

assess the complexity of the sector, relevant wood flows can be described and analysed as shown by Weimar (2011). This is helpful to understand interdependencies within a sector and the value chain, however, it is not sufficient to analyse market effects of policy interventions in this sector. To do this, a proper market modelling approach has to be formulated focusing on key market characteristics and the relevant policy framework to be analyzed. Furthermore, it is helpful to reduce complexity and to focus on key aspects for the analysis. This is a typical practice in market analysis e.g. analyzing agricultural commodity markets like wheat or sugar.

In our case we focus on the round wood export moratorium and, hence, we have to look at the round wood market and, even more specifically, at the industrial round wood market according to classification code 4403 where the moratorium applies. This is a simplification, but a good starting-point for the analysis. As a consequence, we develop a one-commodity market model for industrial round wood. There is no problem to assess industrial round wood production (on the supply side). On the consumption (demand) side, however, various processed wood commodities have to be aggregated to an (implicit) industrial round wood consumption.

In view of this perspective, we briefly present some basic features of round wood production and trade in Ukraine. Figure 1 shows the development of round wood production in Ukraine 2011-19. There has been a continuous increase over the years, with a cut following the export moratorium to 17.887 m cbm in 2019. The figure also shows the production development for industrial round wood and fuel wood. Production of both products have increased over the years until 2016, with a rather constant share in total round wood production, what could be expected. There have been turbulences following the export moratorium, though. In 2019 we have the highest production volume and share for industrial round wood, with a drop in fuel wood production. Probably, the development points to substitution effects and/or incorrect classifications for these commodities.

Figure 1 also shows the development of round wood exports and imports. Both industrial round wood and fuel wood are important export commodities for Ukraine whereas imports play a minor role. Exports have been going up over the years in terms of quantity and show the break and change under the moratorium in recent years. The export value development indicates a decline of world market prices as from 2014 and some substitution effect between industrial round wood and fuel wood in recent years under the moratorium.

Based on export and import values and quantities, trade unit values and export unit values have been calculated. They can be interpreted as relevant world market prices for Ukraine on the markets considered and help to feed the modelling approach with relevant data. Meaning and procedure are explained in chapter 3.2. The figures show international price levels and fluctuations on the international round wood markets from the point of view of Ukraine. Again, the figures for recent years point to some peculiar market development under the moratorium.

Figure 1: Round wood production and trade in Ukraine, 2011-19 (Data provided by Vitaliy Storozhuk, APD)

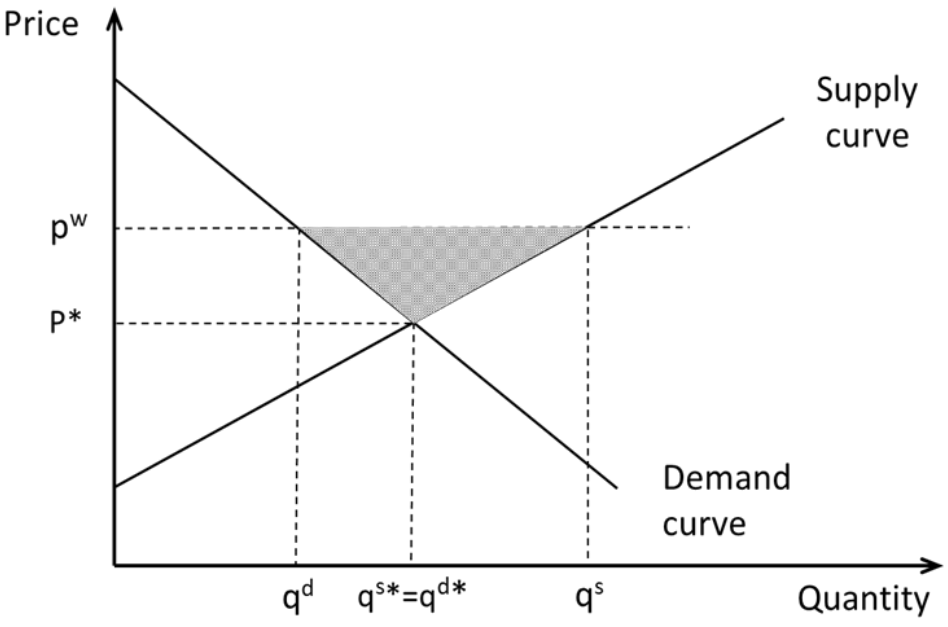
		2011	2012	2013	2014[1)]	2015[1)]	2016[1)]	2017[1)]	2018[1)]	2019[1)]
Round wood production	m cbm	17.510	17.507	18.022	18.333	19.268	19.606	18.914	19.696	17.887
Industrial round wood (Code 4403)	m cbm	7.989	7.851	8.102	8.159	8.303	8.311	7.297	8.976	9.303
	%	45.6	44.8	45.0	44.5	43.1	42.4	38.6	45.6	52.0
Fuel wood (Code 4401)	m cbm	9.521	9.656	9.920	10.174	10.965	11.294	11.617	10.720	8.583
	%	54.4	55.2	55.0	55.5	56.9	57.6	61.4	54.4	48.0
Round wood export	m USD	321.263	300.690	344.686	367.029	273.387	207.788	115.174	146.868	105.799
	m tons	3.562	3.612	4.309	4.637	4.538	3.772	1.982	1.887	1.089
Industrial round wood (Code 4403)	m USD	234.868	212.672	237.544	254.486	173.021	106.094	0.880	0.197	0.008
	m tons	2.397	2.384	2.788	2.879	2.497	1.732	0.011	0.003	0.000
Fuel wood (Code 4401)	m USD	86.395	88.018	107.142	112.543	100.366	101.694	114.294	146.671	105.791
	m tons	1.165	1.228	1.522	1.757	2.041	2.040	1.972	1.884	1.089
Round wood import	m USD	3.109	1.915	1.682	1.136	0.537	0.496	1.090	3.302	1.009
	m tons	0.022	0.017	0.013	0.007	0.007	0.006	0.010	0.026	0.004
Industrial round wood (Code 4403)	m USD	2.769	1.629	1.363	0.852	0.416	0.409	1.019	3.232	0.889
	m tons	0.021	0.017	0.012	0.007	0.006	0.005	0.010	0.025	0.004
Fuel wood (Code 4401)	m USD	0.340	0.286	0.319	0.284	0.121	0.087	0.071	0.070	0.120
	m tons	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000
Trade unit value[2)]										
Industrial round wood (Code 4403)	USD/ton	98.29	89.27	85.33	88.48	69.29	61.29	91.91	121.11	223.08
Fuel wood (Code 4401)	USD/ton	74.41	71.86	70.59	64.19	49.21	49.88	57.99	77.86	97.19
Export unit value[3)]										
Industrial rund wood (Code 4403)	USD/ton	98.00	89.21	85.21	88.39	69.29	61.25	82.57	69.27	347.83
Fuel wood (Code 4401)	USD/ton	74.16	71.66	70.41	64.04	49.18	49.85	57.97	77.83	97.11
1) Data exclude the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and a part of temporarily occupied territories in the Donetsk and Luhansk regions.										
2) Trade value (export value plus import value) divided by trade volume (export quantity plus import quantity).										
3) Export value divided by export quantity.										

Source: Own compilation based on State Fiscal Service of Ukraine (2020).

2.2. Theoretical background

The export moratorium on (industrial) round wood is a classical ban on exports and the market effects can be analysed in a simple one-commodity partial equilibrium framework. Figure 2 visualizes main effects.

Figure 2: Implications of an export moratorium on a market



Source: Own presentation based on Jechlitschka, Kirschke and Schwarz (2007), chapter 1-3.

For starting, let us assume that we consider an open economy with free trade and no government intervention on markets. Then, the domestic price on markets would be determined by the world market price; in fact, the domestic market price and, thus, the price for producers and consumers would be equal to the world market price if we neglect transport cost (what we do for simplification and following standard economic market analysis). The free trade situation as illustrated in figure 2 shows an export market (reflecting our round wood case study). The figure shows the quantities supplied, consumed and exported under free trade; producer revenue, consumer expenditure, and foreign exchange earnings can be easily calculated. Applied welfare economics tells us that economic welfare is maximised under free trade, and it shows the implications for producers´ and consumers´ (real) income under this constellation. Since there is no government intervention the government budget is not affected. The presentation follows standard microeconomic analysis (see Jechlitschka, Kirschke and Schwarz, 2007, chapter 1-3 or, e.g. Pindyck and Rubinfeld, 2018, chapter 9)

If the government imposes an export moratorium domestic supply and demand determine the domestic market price, independently from the world market price. Hence, the moratorium reduces the domestic price to the "autarky" price. The implications are shown in figure 2: Production goes down and consumption goes up (depending on the elasticities of supply and demand); exports and foreign exchange earnings go down to zero. From a distributional point of view the implications for producers are negative and positive for consumers whereas the overall welfare impact for the economy is negative as indicated by the shaded area in the figure. There is no impact on the government´s budget which is zero both under free trade and the moratorium. Finally note that the export moratorium has the same implications as a corresponding export tax bringing down the domestic price to the autarky price.

The theoretical analysis presented sketches out the basic implications of an export moratorium on a market and has to be adjusted to the specific market considered. Before we move on and translate theory into a modelling approach for the Ukrainian timber market let us consider for a moment some constraints and assumptions of the analysis.

Constraints and assumptions of the analysis

Any theory or model is a simplification of reality and can only try to focus on and work out key aspects of a problem considered. In our case we focus on the export moratorium and this is a quantitative trade policy intervention on a market. The analysis, thus, reveals some basic market implications of this trade policy in a partial equilibrium framework. We assume, e. g., competitive markets neglecting potential market power; we consider just the commodity "industrial round wood" neglecting market interdependencies and the value chain of the wood processing industry; and we consider the "small country case" with a given world market price neglecting potential world market effects of Ukraine´s domestic policy.

All these assumptions are worth to be considered and reflected. Our philosophy and proposal is to focus on the essentials of the export moratorium first and this is a trade policy intervention on a market suggesting the theoretical framework as presented.

An important assumption in our partial equilibrium market model (as in most others) is the neglect of transport cost to simplify the analysis. Hence, there is no regional differentiation and there are only uniform domestic prices i.e. one uniform domestic market price, one uniform producer (supply) price and one uniform consumer (demand) price. This assumption requires to define some uniform domestic "numeraire" prices and these are most often derived from a country´s trade prices i.e. the world market prices. This the understanding when we say that, under free trade, the domestic market, the producer and the consumer price are equal the world market price. In reality, regional or local prices will deviate from the relevant world market price depending on transport costs whereas these regional or local prices, certainly, depend on world market prices. The world market price is often calculated as a "trade unit

price" which is the trade value (export value plus import value) divided by trade volume (export quantity plus import quantity). For the export-oriented Ukrainian round wood market it is straightforward to just calculate the "export unit price" as the relevant world market price which is the export value divided by the export quantity. (See the calculations in figure 1 above.)

Apart from these remarks some specific features of the Ukrainian round wood production and trade system are worth to be considered. The following points are noted:

- Further policy interventions on the Ukrainian round wood market
- Uncertainty about price responses of producers and consumers
- Market interdependencies, notably, between industrial and fuel wood production and export
- Illegal wood cutting and exports
- Concentration and market power
- Institutional constraints.

We will explicitly consider further policy interventions in our analysis. This is the implementation of a value added tax (VAT) in the baseline model whereas other policy interventions like price policies, investment policies and/or institutional changes will be discussed and considered for scenario calculations. Uncertainty, market interdependencies, illegal wood cutting and exports, concentration and market power and institutional constraints will be addressed and their implications will be discussed following the modelling analysis.

3. Modelling framework

Based on the theoretical framework we develop an (industrial) round wood market model for Ukraine. The model is based on the partial equilibrium modelling approach from Jechlitschka, Kirschke and Schwarz (2007). We have adjusted the standard framework taking into account the particularities of the Ukrainian round wood market and policy framework. A corresponding modelling approach has been developed within the framework of the Agritrade project (ATU), analysing the implications of the Ukrainian value added tax (VAT) system on agricultural markets (Kirschke et al., 2020).

3.1. Model formulation

The starting-point for model formulation is to define supply and demand functions. We use isoelastic supply and demand functions with constant elasticities of supply and demand, respectively. For the supply function, we get

$$(1) \quad q^s = c\, p^{s\,\varepsilon^s}$$

where q^s - Supply quantity, c - Constant of supply, p^s - Supply price and ε^s – Elasticity of supply; and for the demand function, equally,

$$(2) \quad q^d = d\, p^{q\varepsilon^d}$$

where q^d - Demand quantity, d - Constant of demand, p^d - Demand price and ε^d – Elasticity of demand.

The model is price-driven. The supply and demand functions indicate the supply and demand quantity, depending on the supply price and the demand price, respectively. Based on prices and quantities all other variables are calculated according to microeconomic theory and applied welfare economics, in particular.

In an open economy with trade, domestic prices depend on the word market price and the price policy framework. The price policy formulation within the model, therefore, is a key for model specification and policy analysis. Basically, a government can intervene in trade, production and consumption. A trade policy is modelled by the protection rate. A tariff (in an import situation) or an export subsidy (in an export situation) brings up the domestic market price above the world market price whereas an export tax (a negative protection rate) reduces the domestic market price below the world market price. The functional relationship is

$$(3) \quad p = (1 + r)\, p^w$$

where p - Domestic market price, p^w - World market price and r - Protection rate.

A producer tax, or more precisely: a production-tied producer tax (or production tax), brings down the supply price below the domestic market price whereas a producer subsidy (negative producer subsidy) increases the supply price. The functional relationship is modelled as follows

$$(4) \quad p^s = (1 - t)\, p$$

where p^s - Supply price and t - Production tax rate.

Equally, a VAT pushes the demand price above the domestic market price; we get

$$(5) \quad p^d = (1 + v)\, p$$

where p^d – Demand price and v – VAT rate.

With no policy intervention at all equations (3) to (5) reduce to (6) and we get free trade

$$(6) \quad p^s = p^d = p = p^w.$$

In a closed economy with no trade, as under an export moratorium, the derivation of domestic prices is different, but the model is price-driven in the same way. We will explain the price framework under autarky in the next chapter.

Based on prices and quantities we can derive various variables that can be of interest for policy analysis. Three sets of variables are typically of interest.

Market variables describe important characteristics of markets. We consider export quantity, producer revenue, consumer expenditure and foreign exchange.

Fiscal variables describe the fiscal implications of policy interventions on markets. The government´s budget or net tax income is the sum of all budget revenues minus budget expenditures due to its policy interventions on a market considered. We get

(7) $GB^{Total} = GB^{Protection} + GB^{Production} + GB^{VAT}$

where GB^{Total} – Government´s total budget, $GB^{Protection}$ – Government´s budget due to its protection policy, $GB^{Production}$ – Government´s budget due to its production tax policy and GB^{VAT} – Government´s budget due to its VAT policy. The corresponding formulae are

(8) $GB^{Protection} = r\, p^{w}\, (q^{d} - q^{s})$,

(9) $GB^{Production} = t\, p\, q^{s}$ and

(10) $GB^{VAT} = v\, p\, q^{d}$.

The government´s budget is the sum of consumer and producer taxation. Consumers are taxed by price policy interventions if the ultimate consumer price is higher than the world market price. We get

(11) $T^{Consumer} = (p^{d} - p^{w})\, q^{d}$

where $T^{Consumer}$ – Consumer taxation.

Equally, we can calculate producer taxation. Producers are taxed by price policy interventions if the ultimate producer price is lower than the world market price. We get

(12) $T^{Producer} = (p^{w} - p^{s})\, q^{s}$

where $T^{Producer}$ – Producer taxation.

Welfare variables, finally, describe distributional and welfare implications of policy interventions. We consider (variable) cost of production and total benefit of consumption; producer surplus and consumer surplus as welfare indicator for producers and consumers, respectively; and welfare describing welfare of the overall economy.

3.2. Data requirements and data base

To use the model for the analysis of the Ukrainian timber market, realistic figures for this market must be fed into the model. Hence, we now have to specify the Ukrainian industrial round wood market according to classification code 4403 where the moratorium applies. The idea is to define a proper starting-point for model and scenario calculations and this is the current market situation under the current policy framework. We define this starting-point as baseline (scenario), and since the current situation is characterised by the export moratorium, we could, equally, speak of the export moratorium scenario.

Based on the model specification discussed above the following data are needed for starting the model:

Market parameters: Supply and demand quantity; world market price and domestic market price; supply and demand price

Function-related parameters: Elasticities of supply and demand; constants of supply and demand

Price policy parameters: Protection rate; production tax rate; VAT rate.

We will discuss data requirements in detail and define the data base for the baseline scenario. The information is summarised in Figure 3.

Figure 3: Data base for the timber market model for Ukraine

Market parameters	Supply quantity	6.831	m tons
	Supply quantity (free trade)	7.487	m tons
	Demand quantity	6.831	m tons
	World market price	70.00	USD/ton
	Domestic market price	51.56	USD/ton
	Supply price	51.56	USD/ton
	Demand price	61.88	USD/ton
Function-related parameters			
	Elasticity of supply	0.30	
	Elasticity of demand	- 0.40	
	Constant of supply	2.093044	
	Constant of demand	35.571152	
Price policy parameters			
	Protection rate	0	%
	Production tax rate	0	%
	Value added tax rate	20	%

Source: Own compilation based on figure 1 and corresponding data sources.

Supply quantity. The information should, usually, be available from production statistics. For simplification, we assume that the supply quantity is given by the production quantity; hence, we neglect subsistence consumption of producers. Under a constant policy framework, production figures for the last three to five years indicate the level/trend of supply. However, in our case the derivation of the supply quantity is somewhat more difficult.

We have argued in chapter 2.1 that there have been peculiar developments on the Ukrainian round wood markets following the export moratorium. In 2019, we have the highest production volume and share for industrial round wood, with a drop in fuel wood production. Probably, the development points to substitution effects and/or incorrect classifications for these commodities. Hence, we cannot simply take the 2019 figure for industrial round wood production from the statistics. Instead, we proceed as follows: We start from a rather realistic situation under free trade in 2016 and calculate a supply quantity of 7.487 m tons, using the indication in figure 1 and international

forest product conversion factors (FAO, ITTO and United Nations, 2020). Assuming that industrial round wood supply under the moratorium follows the same production cut as total round wood production until 2019 (which is 8.8 per cent) we get an industrial round wood supply of 6.831 m tons under the moratorium and baseline scenario.

Demand quantity. In a similar way we could determine an expected average demand quantity for the current year, based on demand data for the last three to five years. Often, statistics do not directly show demand quantities, and to derive the industrial round wood demand from the various processing industry activities is difficult. A better way, usually, is to look at figures from production and trade statistics. The demand quantity is calculated as supply (or production) quantity plus import quantity minus export quantity. In our case of the export moratorium, the exercise is even simpler: Since the policy framework leads to autarky the demand quantity under this policy framework equals the supply quantity which is 6.831 m tons.

World market price. World market prices can be available in trade statistics as "free on board" (fob) prices for exports or "cost, insurance and freight" (cif) prices for imports. If this information is not available the world market price can be calculated as a "trade unit price" defined as trade value (export value plus import value) divided by trade volume (export quantity plus import quantity). In a distinct export situation (which has been the case for the Ukrainian timber sector before the export moratorium) we suggest to simplify and to calculate the "export unit price" given by export value divided by export quantity. This would be the "fob" world market price for an export market. In a similar way the "cif" world market price could be calculated for an import market.

Figure 1 shows the evolution of such trade unit and export unit values for the Ukrainian round wood trade. The situation is complicated, though: There have been fluctuations on the world market and the figures after the moratorium are not really representative and reliable due to the new policy framework. Interpreting the figures and observing the world market development we consider a world market price of 70 USD/ton as appropriate for the baseline scenario which, certainly, is an "expert guess".

Domestic market price. The domestic market price can be derived from the world market price using equation (3) , if the government just applies a price policy intervention in international trade. Things are different in case of quantitative restrictions like the export moratorium. In this case the domestic market price has to be derived from domestic supply and demand functions, irrespective of the world market price. In our case we have argued that domestic supply would probably amount to 7.487 m tons under free trade. Using equation (1) we can determine the constant of supply and then derive the corresponding price for the autarky market quantity of 6.831 m tons, again using equation (1) . The procedure yields a domestic market price of 51.56 USD/ton under the export moratorium.

Supply price. The supply price is derived from the domestic market price using equation (4). With no producer tax the domestic market price also is the supply price.

Demand price. In a similar way we can calculate the demand price following equation (5). The VAT rate of 20% pushes the demand price to 61.88 USD/ton.

Elasticity of supply. In the best case, supply elasticities have been estimated in a recent study. Sometimes, analogous values can be considered drawing on older studies or figures from similar commodities, regions and/or countries. A "rough and dirty" way is to just assume some "inelastic" parameter value since many studies have shown that agricultural and natural resource elasticities of supply are rather small. Due to limited information we assume an elasticity of supply of 0.3.

Elasticity of demand. In a similar way the elasticity of demand has to be determined. As before we take a "rough and dirty" approach assuming an elasticity of demand of -0.4 due to limited information.

Constant of supply. The parameter has already been determined (see domestic market price determination above). In case of price policy interventions, the parameter is determined using equation (1) . This is called calibration.

Constant of demand. The parameter is determined using equation (2) . This is called calibration.

Protection rate. Price-related trade policy interventions can either tax or subsidize imports or exports. This information should be available from (fiscal) statistics. In the case of an export moratorium such trade policy interventions do not make sense since there is no trade. We implement a 0% protection rate in the baseline.

Production tax. Price-related interventions on the production side can either tax or subsidise production. This information should, also, be available from (fiscal) statistics. We assume no intervention (0% production tax rate).

VAT rate. Price-related interventions on the consumption side can either tax or subsidize consumption. The typical case in many countries is a value added tax. This information should, also, be available from (fiscal) statistics. In Ukraine, the VAT rate, typically, is 20%, and we implement the same VAT rate in the model.

3.3. Implementing the model in Excel

The proposed timber market model for Ukraine has been implemented in Excel. Excel based modelling provides quantitative information for policy-making and allows comprehensive and quick scenario calculations. It is a powerful approach to better understand problem settings and policy-making, and it is particularly suited for interactive use and joint problem discussion and solving. Furthermore, it allows adaptations and extensions of the modelling approach for specific market and policy questions. The opportunities and potentials of Excel based market and policy analysis are extensively discussed in the textbook of Jechlitschka, Kirschke and Schwarz (2007).

The Excel based timber market model for Ukraine (Version 1.0) is documented in Annex 1. Figure 4 presents an overview of the model.

The upper left part is the core of the model linking production, demand and trade. Based on quantities and prices, various additional variables (as described above) are formulated to the right (copied to the lower part in figure 4). Hence, the whole market model is implemented in one Excel line, for the sake of simplicity and clarity. The data base for feeding the model and calibration is presented below the model line. The required data input is visualised by the green cells. If we have just to consider price policy interventions calibration i.e. the calculation of supply and demand constants is carried out automatically within the modelling framework. In the case of the export moratorium policy framework, calibration has to be supported "manually" as described above. An export moratorium calibration box visualises and supports the procedure.

Figure 4: Excel based timber market model for Ukraine (Version 1.0)[1)] – Baseline (© Kirschke, September 25, 2020)

Model	Supply price	Demand price	Domestic market price	World market price		Supply quantity	Demand quantity	Export quantity		Producer revenue	Consumer expenditure	Foreign exchange
	(USD/ton)	(USD/ton)	(USD/ton)	(USD/ton)		(m tons)	(m tons)	(m tons)		(m USD)	(m USD)	(m USD)
	51.56	61.88	51.56	70.00		6.831	6.831	0.000		352.2	422.7	0.0
Data and calibration												
Market parameters	51.56	61.88	51.56	70.00		6.831	6.831					

Function-related parameters	Constants		Elasticities	
	of supply	of demand	of supply	of demand
	2.093044	35.571152	0.30	-0.40

Price policy parameters	Protection rate	Production tax rate	VAT rate		
	(%)	(%)	(%)	**Check:**	
				Budget and taxation	**0.000000**
	0%	0%	20%	**Welfare**	**0.000000**

Government budget				Consumer taxation	Producer taxation		Total benefit	Cost	Producer surplus	Consumer surplus	Welfare
Protection	**Producer tax**	**VAT revenue**	**Total**								
(m USD)	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)		(m USD)	(m USD)	(m USD)	(m USD)	(m USD)
0.0	0.0	70.4	70.4	-55.5	125.9		1142.4	81.3	271.0	719.7	1061.1

Export moratorium calibration

q^s	=	c	*	p^s	^	ε^s
7.487		2.093044		70.00		0.30
6.831		2.093044		51.56		0.30
q^d	=	d	*	p^d	^	ε^d
6.831		35.571152		61.88		-0.40

1) Industrial round wood market (Code 4403).

Source: Own design and calculations based on Jechlitschka, Kirschke and Schwarz (2007), chapter 1-4 and data from figure 3.

Have a look at the figures in the baseline scenario. Beyond quantities and prices as discussed, the model yields a producer revenue of 352.2 m USD and consumer expenditure of 422.7 m USD. Government budget amounts to 70.4 m USD coming from VAT revenue and this is equal to the sum of consumer and producer taxation. As both demand and supply price are below the world market price in the baseline scenario consumers are, actually, subsidised and producers are taxed. Consumer taxation is -55.5 m USD and producer taxation 125.9 m USD. Welfare calculations, finally, are correct, but we do not want to discuss the absolute values here. It needs to be noted that the absolute values of total benefit, cost, producer surplus and consumer surplus and, thus, welfare are arbitrary due to technical reasons (due to the functional shape of the supply and demand functions used) in all scenario calculations. The important point is that they describe exactly distributional and welfare changes if we analyse policy changes or compare scenarios (see Jechlitschka, Kirschke and Schwarz, 2007) what we will do in the next chapter.

4. Scenario calculations

Based on the baseline scenario of the modelling approach we can now analyse the implications of policy changes and compare policy scenarios. Analysing the implications of a policy or policy impact assessment, simply, means to compare the results of a policy scenario considered with the results of a reference scenario. In other words: We run the model for two defined scenarios and look at the difference in the results. It is obvious that we have to be clear about what we define as reference scenario; otherwise, analysis and discussion may become confusing.

Just a note. Policy impact assessment is a necessary first step for policy evaluation, but not a sufficient one. We certainly should be clear about "impacts" in policy-making, but beyond "impact" the normative perspective comes into play: goals pursued and value judgements. Hence, a study like this can support policy evaluation and policy decision-making, but it cannot replace it.

4.1. Implications of the round wood export moratorium

A key question of this paper is to analyse the implications of the round wood export moratorium. Having defined the baseline scenario, the task is clear: We have to compare the model results under this scenario with a reference scenario. We suggest to take free trade and i.e. "no policy intervention" (but under the VAT policy) as a reference. This is a widespread approach to assess market policy interventions, and it also seems to be a relevant policy approach in the Ukrainian policy debate.

The calculations are documented in Annex 2. Figure 5 gives an overview of the results. It is obvious that the moratorium leads to a price cut on the domestic market. The size of this price cut depends on the elasticities assumed. We will pick up this topic in chapter 5. The moratorium reduces both producer revenue and consumer expenditure and the foreign exchange loss is 100.9 m USD. Government´s budget loss is 14.2 m

USD reflecting a value added tax loss. From a taxation point of view, the moratorium induces producer taxation and a change from consumer taxation under free trade (and the VAT) to consumer subsidisation under the moratorium. From an economic welfare point of view, the Ukrainian economy loses 4.6 m USD. The moratorium induces a redistribution of income from producers (producer surplus loss of 132.2 m USD) and the government/taxpayers (total budget loss of 14.2 m USD) to consumers (consumer surplus gain of 141.8 m USD), leaving the "dead weight loss" of 4.6 m USD for the economy. Note that we consider a derived demand function. Hence, the income gain for consumers due to the moratorium comprises the whole demand side: from the wood processing industry (owners, managers, workers) to final consumers of wood products. The model cannot answer the question how the gain is distributed among different groups.

These are the key market effects of the moratorium. An evaluation of this policy depends on the objectives pursued. The value judgement of economists often focuses on economic welfare and, in this context, the evaluation is clear: The moratorium leads to a national income loss of 4.6 m USD and should be abolished. However, if other policy goals are pursued, things are more complicated. Consider the objectives of sustainable forest use and wood processing industry development. In this case some additional questions have to be answered:

- What is the impact of the moratorium on these policy objectives?
- If positive impacts can be identified, are they worth the costs (welfare loss and foreign exchange loss, unintended distributional effects)?
- Are there better policies (i.e. less costly) to achieve the goals pursued?

We will come back to some of these problems for policy evaluation and policy-making in the next chapters.

Figure 5: Market effects of the export moratorium[1)]

	Supply price	Demand price	Domestic market price	World market price		Supply quantity	Demand quantity	Export quantity		Producer revenue	Consumer expenditure	Foreign exchange
	(USD/ton)	(USD/ton)	(USD/ton)	(USD/ton)		(m tons)	(m tons)	(m tons)		(m USD)	(m USD)	(m USD)
Reference scenario:												
Free trade	70.00	84.00	70.00	70.00		7.487	6.045	1.442		524.1	507.8	100.9
Policy scenario:												
Export moratorium	51.56	61.88	51.56	70.00		6.831	6.831	0.000		352.2	422.7	0.0
Policy implication	-18.44	-22.12	-18.44	0.00		-0.656	0.786	-1.442		-171.9	-85.1	-100.9

	Government budget				Consumer taxation	Producer taxation		Total benefit	Cost	Producer surplus	Consumer surplus	Welfare
	Protection	Producer tax	VAT revenue	Total								
	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)		(m USD)	(m USD)	(m USD)	(m USD)	(m USD)
Reference scenario:												
Free trade	0.0	0.0	84.6	84.6	84.6	0.0		1085.7	120.9	403.1	577.9	1065.7
Policy scenario:												
Export moratorium	0.0	0.0	70.4	70.4	-55.5	125.9		1142.4	81.3	271.0	719.7	1061.1
Policy implication	0.0	0.0	-14.2	-14.2	-140.1	125.9		56.7	-39.7	-132.2	141.8	-4.6

1)Industrial round wood market (Code 4403).

Source: Own calculations based on the Excel based timber market model for Ukraine (Version 1.0).

4.2. Implications of other policy options

In this chapter we analyse the implications of alternative policies on the Ukrainian timber market. The choice of policy options is highly subjective, reflecting the value judgements of an economist, and shall demonstrate the application of the modelling approach for policy decision-making support.

We consider the abolishment of the moratorium i.e. free trade as the first policy option. The implications are already known following the discussion in the previous chapter. As second policy option we consider free trade and an additional production subsidy. There is some discussion in Ukraine that sustainable forest use could allow higher wood production, and free trade and a production subsidy would go into this direction. We then consider, third, an investment programme to increase productivity in the timber production industry under free trade conditions. An investment programme on the supply side would point to the similar direction as a production subsidy. Finally, and fourth, we analyse the implications of a corresponding investment programme on the demand side to enhance productivity in the timber processing industry, equally under free trade. The moratorium has been justified to do this and an investment programme in the wood processing industry would be an obvious alternative. It should be noted that for all scenarios considered the current VAT policy is maintained.

The calculations with the Excel based timber market model for Ukraine (Version 1.0) for these policy options are documented in Annex 3. Figure 6 gives an overview of the results and shows the changes under the policy options considered as compared to the current moratorium scenario.

There is no need to discuss Policy scenario 1 "Free trade" in detail. Basically, this policy change would increase economic welfare, result in foreign exchange earnings and redistribute income from consumers (Consumer surplus) to producers (Producer surplus) and the government/taxpayer (Total government budget).

An additional production subsidy under policy scenario 2 "Free trade & production subsidy" would enhance supply and export quantity, foreign exchange and producers´ income, however, at considerable costs for the government/taxpayer. We have assumed a production subsidy rate of 25% for the calculations. Interestingly, there hardly is a welfare improvement as compared to the moratorium scenario: The welfare gain due to free trade is counteracted by specialisation losses due to the subsidisation policy.

Figure 6: Market effects of other policy options[1)]

	Supply price	Demand price	Domestic market price	World market price		Supply quantity	Demand quantity	Export quantity		Producer revenue	Consumer expenditure	Foreign exchange
	(USD/ton)	(USD/ton)	(USD/ton)	(USD/ton)		(m tons)	(m tons)	(m tons)		(m USD)	(m USD)	(m USD)
Policy scenario 1:												
Free trade	18.44	22.12	18.44	0.00		0.656	-0.786	1.442		171.9	85.1	100.9
Policy scenario 2:												
Free trade & production subsidy	35.94	22.12	18.44	0.00		1.174	-0.786	1.960		348.2	85.1	137.2
(t= -25%)												
Policy scenario 3:												
Free trade & inv. prog. production	18.44	22.12	18.44	0.00		1.405	-0.786	2.191		224.3	85.1	153.4
(supply shift = 10%)												
Policy scenario 4:												
Free trade & inv. prog. processing	18.44	22.12	18.44	0.00		0.656	-0.182	0.838		171.9	135.9	58.6
(demand shift = 10%)												

	Government budget				Consumer taxation	Producer taxation		Total benefit	Cost	Producer surplus	Consumer surplus	Welfare	Investment costs	Net welfare
	Protection	Producer tax	VAT revenue	Total										
	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)		(m USD)	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)	(m USD)
Policy scenario 1:														
Free trade	0.0	0.0	14.2	14.2	140.1	-125.9		-56.7	39.7	132.2	-141.8	4.6	0	4.6
Policy scenario 2:														
Free trade & production subsidy	0.0	-140.1	14.2	-125.9	140.1	-266.0		-56.7	80.4	267.9	-141.8	0.2	0	0.2
(t= -25%)														
Policy scenario 3:														
Free trade & inv. prog. production	0.0	0.0	14.2	14.2	140.1	-125.9		-56.7	51.8	172.5	-141.8	44.9	**??**	**??**
(supply shift = 10%)														
Policy scenario 4:														
Free trade & inv. prog. processing	0.0	0.0	22.6	22.6	148.6	-125.9		51.8	39.7	132.2	-84.0	70.8	**??**	**??**
(demand shift = 10%)														

1)Industrial round wood market (Code 4403).

Source: Own calculations based on the Excel based timber market model for Ukraine (Version 1.0).

Policy scenario 3 "Free trade & investment programme production (for the timber production industry)" should enhance productivity in production, shifting the supply curve to the right. We have assumed a shift effect of 10 per cent for the calculations. This enhances production, exports and foreign exchange earnings as well as producers´ income. The overall economic welfare effect for the economy is considerable.

In a similar way, policy scenario 4 "Free trade & investment programme processing" (for the timber processing industry) should enhance productivity in the processing industry, shifting the demand curve to the right. Again, we have assumed a shift effect of 10 per cent for the calculations. This enhances domestic demand and reduces exports and foreign exchange earnings, but increases government´s value added tax revenue and consumers´ income, and again the positive welfare effect is enormous.

Note that economic welfare effects of investment programmes are typically high as compared to price intervention policies on a market like a production subsidy or the export moratorium, provided of course that such investment programmes are successful and productivity and shift effects really occur. This is why economists typically prefer investment programmes to foster economic development as compared to market intervention policies. Furthermore, price incentives to support economic development (like the moratorium which decreases the round wood input price for the processing industry) are considered sceptically. There has been a long debate in development economics and there is little evidence that such a strategy has proven to be successful. Hence, the design of proper investment programmes to support economic development seems to be a reasonable alternative.

The design and evaluation of investment programmes, however, require additional investment or cost-benefit analysis. With a view on our modelling approach, productivity gains and, thus, shift effects have to be identified. Also, investment costs for the government (and for the private sector) have to be considered to calculate net gains. We have indicated the procedure in figure 6 by adding columns for investment costs and net welfare. In fact, the modelling approach provided can easily be extended to carry out profitability analysis of investment programmes (Jechlitschka et al., 2007, chapters 9-11). This would be a proper analytical perspective for policy-making support in the timber sector.

A final aspect needs to be emphasised. There is increased evidence and understanding that sustainable environmental and natural resource management requires an integrated ("nexus") policy approach emphasising the role of institutions and governance. This has been discussed for many country and problem settings e.g. by Kirschke et a. (2019) for the German groundwater and nitrate problem. There is no doubt that such a policy-perspective focussing on institutional development and good governance is a key policy perspective for the Ukrainian timber

market, too, in view of illegal wood cutting and exports and administrative constraints. Changing and improving the institutional framework will improve the functioning of a market, and the implications are similar to the investment programmes discussed in this chapter. Hence, such policies could also be analysed in a similar framework. It would be tempting to extend the discussion and the analysis into this direction.

5. Further aspects and modelling perspectives

Any modelling approach to policy-making is a simplification, and this is certainly true for our timber market modelling approach. In this chapter, we address some specific aspects of the timber market and discuss how they could be considered in the analysis.

Uncertainty about price responses of producers and consumers

There is little information on price responses of producers and consumers on the Ukrainian round wood market and our assumption on supply and demand elasticities can be considered a "best guess". Elasticity values affect the results of the calculations. Low elasticity values (more precisely: absolute values since the demand elasticity will be negative) will result in a higher domestic price decrease under the moratorium than calculated whereas higher elasticity values have a "price dampening effect". Generally, elasticity values determine the extent of reactions in supply and demand to price changes and of all other variables defined in the model.

A straightforward way to deal with parameter uncertainty is to carry out econometric estimates. However, this requires an appropriate data base. An alternative approach to the problem would be to do some sensitivity analysis i.e. to carry calculations for different elasticity values (e. g. for a "best guess" and an "upper" and "lower" value). This would result in additional model calibrations and scenario calculations. A sensitivity analysis is what it says: It allows for a better assessment of the calculation results in view of the elasticity assumptions made.

Market interdependencies

The empirical data on the Ukrainian round wood market suggest that there is some substitution between industrial round wood and fuel wood. Also, there is an interesting debate to what extent the export moratorium for industrial round wood might have resulted in additional supply and export of fuel wood (Angel and Butin, 2018). Substitution effects between commodities mean that supply (and, possibly, demand) on another market reacts to price changes to a market considered and vice versa. In our case, the export moratorium on the market for industrial round wood would induce additional supply on the fuel wood market.

If such substitution effects are relevant it is straightforward to focus analysis not only on one market (industrial round wood), but on the other relevant market (fuel wood), too. The modelling perspective is to define a proper multi-market model (Jechlitschka et al., 2007) and a two-market model in our case. This requires additional modelling efforts and has some consequences in terms of theory and interpretation, but the crucial problem is data. Substitution effects enter into the modelling approach by specifying cross price elasticities of supply (and demand). If there is no or little information on the substitution between industrial round wood and fuel wood supply, it is arbitrary to just assume some cross-price elasticity values. (By the way: The implicit assumption of the proposed one-commodity model is that cross price elasticities are zero.)

An alternative and simpler way is to do some "rough and dirty" calculation on such substitution effects, in addition to the model results presented. But again, the problem is not to do the calculations, but to get the data.

Illegal wood cutting and exports

There is evidence of illegal wood cutting and exports (see e.g. Habekuss and Kutsai, 2020), and the problem is an important topic in the public debate on the timber market policy. Such illegal, "unofficial", "black" or "shadow market" activities could be analysed in a similar way as shown in our market modelling approach; however, the problem is just missing information and data (by definition). Some points are worth to be noted, though, complementing our analysis and discussion.

A first point is to get just an idea on the size of the "shadow" market calculating e. g. production and export quantities and values. It is an obvious assumption that illegal wood production results in corresponding wood exports since the world market price is higher than the domestic price as a result of the moratorium. We could calculate the "benefit" of illegal wood cutting and exports based on this margin between world market price and domestic price, and that is what economists call a rent. If we have such a separate "shadow" market, we can consider official and unofficial markets separately, and our analysis would not be affected.

Imagine, however, that there are interdependences between these markets. Then, we would have to consider how data of our "official" analysis would have to be adjusted according to "unofficial" market data in order to reflect the "real" market, or we could think to go for a two-market model as discussed above. This is tempting from a theoretical point of view, but a hopeless endeavour in the real world.

Note that the export moratorium creates itself a rent, probably, inducing illegal activities or, what economists call, rent-seeking behaviour. Rents on a market due to government intervention, generally, provide incentives for capturing these rents instead of looking at efficiency and competitiveness. Such a rent-seeking behaviour binds economic resources and, thus, reduces welfare. This is why many economists

are rather sceptical in view of market interventions and here we are back to our discussion to look at alternative policies like investment programmes and/or institutional and governance approaches to achieve the objectives pursued with the export moratorium.

Concentration and market power

The modelling approach assumes competitive markets which may be questioned. Wherever market power occurs the prices observed in a market may deviate from competitive prices distorting the analysis and the results. If market power is a relevant problem to be analysed industrial economics proposes the standard Structure-Conduct-Performance-Approach for the analysis. Just note: International trade and the opening of domestic markets may be a good policy as such to combat market power in an economy.

Institutional constraints

Functioning markets require transparency and rules, they need a proper institutional framework to be enforced by the government. Hence, administration and control of markets is a key policy task in a market economy. It is obvious that this is a problem for the Ukrainian timber market. We have, generally, underlined the importance of institutional development and good governance for the Ukrainian timber market. Just to add: The creation of rents by the government itself creates additional and, sometimes, insolvable problems for administration and control.

Coming to the end

The modelling approach and the calculation results presented are certainly a simplification, but they point to key market implications of the export moratorium. The discussion in this chapter should help to bring the analysis in line with the complexity of the problem and to offer additional perspectives for analysis and policy-making. The paper, hopefully, contributes to a better understanding of the round wood export moratorium, its implications and future policy-making on the timber market.

6. Discussion and recommendations

- Market models help to assess and quantify the effects of market policy interventions and of alternative policy scenarios.
- Such models can and should be used in an interactive way to prepare and support policy decision-making.
- The export moratorium results in a domestic price decrease of ca. 20 USD/ton; an export loss of ca. 1.4 m tons and a foreign exchange loss of ca. 100 m USD; a drop in producer revenue of ca. 170 m USD; a drop in VAT revenue of ca. 14 m USD; producer taxation (ca. 125 m USD) and change from consumer taxation to consumer subsidisation (ca. 55 m USD); a redistribution of income from producers (ca. 130 m USD) and government/taxpayers (ca. 14 m USD) to consumers (ca. 140 m USD) (Processing industry (owners, managers, workers) and final consumers of wood products), and a welfare loss for the economy of ca. 5 m USD. These economic effects should not be neglected in policy-making.
- If other policy objectives are pursued e.g sustainable forest use and wood processing industry development, the following questions have to be answered:
    - What is the impact of the moratorium on these policy objectives?
    - If positive impacts can be identified, are they worth the costs (welfare loss and foreign exchange loss, unintended distributional effects)?
    - Are there better policies (i.e. less costly) to achieve the goals pursued?
- Price policy interventions (export moratorium, production subsidy), generally, suffer from market distortions, welfare losses and rent-seeking behaviour.
- There is little evidence in the economic development literature that price incentives (as induced by the moratorium for the domestic wood processing industry) can foster economic development.
- Instead: The welfare effects of investment policies can be enormous.
- The design and evaluation of investment programmes requires additional investment or cost-benefit analysis. The market modelling approach developed should be extended into this direction.
- And: Institutional development and good governance is a key policy perspective for the Ukrainian timber market. The market effects can be analysed in a similar way like investment programmes.
- Some Ukrainian timber market specifics may require further information and analysis for policy-making:

- Qualitative/quantitative estimates and sensitivity analysis to deal with uncertainty about price responses of producers and consumers
- Assessment of substitution effects in production and multi-market modelling to deal with market interdependencies, particularly, between industrial round wood and fuel wood
- Assessment of shadow market and rents, possibly, by extending the modelling approach to deal with illegal wood cutting and exports
- Assessment of market power, possibly, by using a Structure-Conduct-Performance-Approach
- Establish a proper institutional framework and good governance for the functioning of the market.

Literature

Angel, E. and Butin, A. (2018): Results of the moratorium on unprocessed timber in Ukraine. Analytical and advisory report. Institute for Economic Research and Policy Consulting, Kiev.

Bemman, A. and Pylaieva, A. (2018): Holzmarktregulierungen in der Ukraine und in Deutschland. Agrarpolitischer Bericht APD/APR/03/2018. Deutsch-Ukrainischer Agrarpolitischer Dialog, Kiev.

Food and Agriculture Organization of the United Nations, International Tropical Timber Organization and United Nations Economic Commission for Europe (2020): Forest product conversion factors. Rome. https://doi.org/10.4060/ca7952en

Jechlitschka, K., Kirschke, D. and Schwarz, G. (2007): Microeconomics using Excel. Integrating economic theory, policy analysis and spreadsheet modelling. Routledge, London and New York.

Habekuss, F. and Kutsai, Y. (2020): Der Stuhl des Anstoßes. Die ZEIT, No. 28, vom 2.Juli 2020.

Kirschke, D., Moody, R., Didukh, M., Nivievskyi, O. and Tulush, L. (2019): The Value Added Tax System in Ukrainian Agriculture: Analysis and Policy Options. Agritrade Ukraine Project, Kiev and Berlin.

Kirschke, S., Häger, A., Kirschke, D. and Völker, J. (2019): Agricultural Nitrogen Pollution of Freshwater in Germany. The Governance of Sustaining A Complex Problem. Water, 11, 2450. Doi:10.3390/w11122450.

Law of Ukraine № 325-VIII (9 April 2015): On Amendments to the Law of Ukraine "On Peculiarities of State Regulation of Business Entities Related to the Sale and Export of Timber" Concerning the Temporary Prohibition of Export of Timber in Unprocessed Form. Kiev.

Law of Ukraine № 674-IX (4 June 2020): On the Customs Tariff of Ukraine. Kiev.

Marchuk, Y. (2019): Analyse der Holzmärkte und der Holzmarktregelungen in der Ukraine – Optionen und Verbesserungsmöglichkeiten. Forstpolitischer Bericht APD/FPR/03/2019. Deutsch-Ukrainischer Agrarpolitischer Dialog, Kiew.

Pindyck, R. S. and Rubinfeld, D. L (2018): Microeconomics. Ninth Edition. Global Edition. Pearson Education Limited, Harlow.

Popkov, M. (2016): Prohibition of timber exports in Ukraine: causes, consequences, alternatives. Kiev.

Weimar, H. (2011): Der Holzfluss in der Bundesrepublik Deutschland 2009. Methode und Ergebnis der Modellierung des Stoffflusses von Holz. Arbeitsbericht 2011/06. Johann Heinrich von Thünen-Institut: Institut für Ökonomie der Forst- und Holzwirtschaft, Hamburg.

State Fiscal Service of Ukraine (2020).

State Statistics Service of Ukraine (2020).

Yaroshchuk, O. (2017): Year 1: How a moratorium on the export of round wood influenced Ukrainian economy. Kiev.

Yaroshchuk, O. (2018): Year 2: Where is Ukraine with a moratorium on exports of round wood? Kiev.