BARTER TERMS OF TRADE IN LATVIAN TRADE IN AGRICULTURAL COMMODITIES AND PROCESSED FOOD PRODUCTS

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ABSTRACT
Since early nineties, Latvia has remained a net importer of agri-food products. At the same time, both exports and imports of agricultural commodities and processed food products has consistently grown, with total trade turnover increasing. The objective of the study is to determine the trends in development of barter terms of trade in Latvian agricultural commodities and food products. To reach the research objective, barter terms of trade indices were compiled with various levels of data aggregation over the period from 2002 to 2012. The research results in general show consistently higher terms of trade in agricultural commodities in comparison with terms of trade in processed food products. The differences exist between the terms of trade for the same products or product groups depending upon the level of aggregation. Trends in development of barter terms of trade indices for agricultural commodities and processed food products are different. In general, barter terms of trade for whole agri-food sector is not deteriorating.
KEY WORDS: *international trade, barter terms of trade, agricultural commodities, processed food products.*

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Introduction

Terms of trade (TOT) on international markets are the relative price of a country's exports compared to its imports. Barter terms (commodity terms) of trade along with the income terms of trade are the most common indicator used to evaluate this price ratio. Barter terms of trade can be viewed as the amount of imported products that can be bought by country per unit of exported products. Often the net barter terms of trade is called the commodity terms of trade, a definition proposed by Viner (Viner, 1937: 23). In the case of trade between two countries with only two products being exchanged, it is assumed that the imports of one country are the exports of the other country. Terms of trade is calculated as the ratio of country's export revenue received to the import revenue paid. When terms of trade ratio is falling the country is considered as having deteriorating terms of trade. When terms of trade ratio improves the country can benefit from the opportunity to import more for given level of exports. Terms of trade should not be considered a ratio associated with country's welfare as the terms of trade may be strongly influenced by the impact of current exchange rates on

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domestic prices and export prices. The main drawback of this concept is the loss of the importance of trade volumes. Occasional surges in prices for internationally traded commodities sometimes never become fully reversed. Thus, the long-term trend of rising prices can develop. This, in turn, might result in deterioration of country's terms of trade if the country is a major importer of this commodity. According to Reinsdorf, such deterioration has occurred in the USA with respect to oil imports (Reinsdorf, 2010: 177). He proposed to exclude oil from calculations of terms of trade. Reinsdorf coined a term of non-petroleum tradables.

Frequently, international trade is viewed as a production technology where the inputs are exports and the outputs are imports. Exports are believed to be transformed into imports at the rate expressed as the price of exports relative to the price of imports. Thus, the change in the terms of trade acts as a productivity shock. However, in a study by Kehoe and Ruhl, it is shown that changes in the terms of trade have no first-order effect on productivity when output is measured as chain-weighted real GDP (Kehoe, Ruhl, 2008: 804).

In a number of studies, terms of trade are corrected for the degree of trade openness of the economy to account for the effective impact of variations in the terms-of-trade on the real economy (Adler, Sosa, 2011: 14).

Atkin et.al regard the terms of trade as a key determinant of a nation's economic prosperity that dictates the real purchasing power of domestic output (Atkin et. al., 2014: 19). Their research suggests large movements in the terms of trade can have important macroeconomic implications as relative prices and incomes change. In their study, major terms of trade episodes in Australia are examined highlighting the differences in the duration and the nature of the shocks driving these episodes.

Kohlianalyzes the relationships between terms of trade and macroeconomic indicators, such as GDP and real domestic income (Kohli, 2004: 83). Earlier, Krueger and Sonnenschein attributed gains from trade to the price divergence (Krueger, Sonnenschein, 1976: 121). Hamada and Ivata suggest a connection between economic welfare with improved terms of trade (Hamada, Ivata, 1984: 760). The negative terms of trade effect can be adjusted either by cutting down consumption or by reducing savings. Thus, the deteriorating terms of trade damages the growth potential of the whole economy (Fatima, 2010: 14). An improvement in terms of trade, in turn, causes higher levels of investment and induces growth (Mendoza, 1997: 323). In developing countries, changes in the terms of trade can contribute for half of the output volatility (Mendoza, 1995: 101).

The terms of trade can be affected by exogenous shocks arising from global market trends, political unrest and climate disasters, such as drought. Recent global developments in terms of trade concerning the major exporters of commodities are influenced by industrialization and urbanization of developing countries, most markedly, China. Often improvement in terms of trade is simultaneous with the rise in country's GDP per capita.

Bhattacharyya and Williamson assess the relative magnitude and policy responses to Australian terms of trade volatility with respect to frequent and large commodity export price shocks (Bhattacharyya, Williamson, 2011: 150).

Easterly et. al. examine a large number of countries with respect to long-term growth (Easterly et. al., 1993: 459). They conclude that shocks to the terms of trade are greatly behind the variance in growth.

Similarly, large panel of countries was used by Becker and Mauro to determine the relationship of output drops to various external shocks (Becker, Mauro, 2005: 7). Their findings suggest that, especially for developing countries, terms of trade shocks prove to be costly.

In multilateral trade when multiple products are exchanged between a set of countries, terms of trade is usually calculated using a Laspeyres (fixed weights) index over the relevant range of exported and imported products. When calculations are done over the time series including trade data from a period of consecutive years, usually a base year is used for establishing a share of particular product in country's exports and imports. The World Bank (2014) provides net barter terms of trade indexes for all countries, measured relative to the base year 2000. Unit value indexes are based on country reports and previous year's trade values at the SITC Classification three-digit level are used as weights.

The estimation of Latvian net barter terms of trade in agricultural commodities and processed food products would allow for a better assessment of the situation in the whole agri-food sector. The purpose of the study is the calculation of net barter terms of trade at various levels of product classification along with the

identification of possible terms of trade shock episodes. The object of the research is Latvian foreign trade. The main tasks in reaching the research objectives are compilation of net barter terms of trade indices and identification of possible trade boom episodes. To perform these tasks, widely accepted net barter terms of trade formulae are used based upon the price indices for exports and imports, as well as the cumulative and average trade shock calculation method.

1. Barter terms of trade

The barter terms of trade of country *i* in year *t* according to WTO (World Trade Organization, 2012: 33) recommendations is defined as:

$$BTT_t^i = \frac{P_t^{iX}}{P_t^{iM}} * 100, \quad (1)$$

where: P_t^{iX} is the price index of country's i exports in year t, P_t^{iM} is the price index of country's i imports in year t.

The price indices for exports and imports are calculated as:

$$P_t^{iX} = \sum_{k \in N_X} s_{k0}^{iX} p_{kt}^{iX}, \quad (2)$$

$$P_t^{iM} = \sum_{k \in N_M} s_{k0}^{iM} p_{kt}^{iM}, \quad (3)$$

where: N_X is the range of exported products, N_M is the range of imported products, p_{lt}^{iX} is the export price index for product k in year t, p_{lt}^{iM} is the import price index for product k in year t, S_{k0}^{iX} is the share of product k in country's i exports in the base year, s_{k0}^{K} is the share of product k in country's i imports in the base year.

Usually calculations are based on the individual product level data, with FOB values for export prices and CIF values for import prices. The values of calculated ratios depend much upon the trade classification systems used and the level of aggregation. A broader level of aggregation can provide rather distorted values as possible product quality differences are not controlled in this case. Another well-known caveat can arise from possible price shocks in the base year. This bias can be avoided by replacing base year values by the averages of three year period around the base year. Terms of trade can be either calculated for entire list of products traded getting the country's single ratio or at the industry or sector level. The statistical aggregation of trade information varies upon the availability of data and research objectives. Potelwa et.al. (Potelwa et. al., 2013: 3) use 4-digit HS code data in South African agricultural trade analysis. However, use of these classificators explicitly does not allow to provide a clear distinction between primary goods and processed products. Moreover, products from the same code group may have been processed by different industry sectors. Berge and Crowe (Berge, Crowe, 1997: 3) use the indices built from SITC 4-digit and 5-digit categories in their research on South Korean terms of trade. A combined approach, using PRODCOM classification with references to HS nomenclature provided in EUROSTAT guidelines allows for an acceptable distinction both between primary and processing and between industry sectors.

2. Terms-of-trade boom

According to Adler and Magud (Adler, Magud, 2013: 6) a terms of trade boom episode is an event for which the following conditions hold: the cumulative shock (an annual increase in terms of trade index)

amounts to at least 15 %; the annual average terms of trade shock (an average annual increase in terms of trade index) is of at least 3 %. The episode can be viewed as a cycle with starting and ending years. The end of cycle takes place when at least one third of the shock is reverted. The terms of trade boom episode can be defined by the following conditions:

$$\frac{TT_P - TT_S}{TT_S} \geq 0.15, \tag{4}$$

$$\frac{\sum_{i=P}^{S}\left(TT_{i+1} - TT_i\right)}{P-S} \geq 0.03, \tag{5}$$

where: T_i is the barter terms of trade index for country in a year i, S is the starting year of the episode; P is the peak (local maximum) year of the episode. The last year of the whole period is denoted by N. The duration (spell) of the episode takes the value of $j+1$ if the following conditions are satisfied:

$$\frac{TT_{j+1}}{TT_j} - 1 < -0.33\,, \tag{6}$$

$$\frac{TT_j}{TT_{j-1}} - 1 > -0.33, \tag{7}$$

for every j, $j \in \{p, p+1, ...N\}$.

3. Latvian agri-food terms of trade

In total, trade data for 1020 products were available using 6-digit codes from HS-2002, HS-2007 and HS-2012 international trade nomenclatures. Data were retrieved from United Nations COMTRADE database (2014). There were 943 and 882 products in imports and exports, respectively, that were present in Latvian trade at least in one year from a period from 2002 to 2012. For these products, variables p_{kt}^{1X} for import CIF prices and variables p_{kt}^{1M} for export FOB prices were calculated by dividing the trade values to their respective weights. Prices were set to zero values if trade flows for particular product were missing in a year from a period. Similarly, zero values were assumed when trade weights were not reported. The shares of products with 6-digit codes in total values of import flows s_{k0}^{1M} and export flows s_{k0}^{1X} were calculated by dividing the average trade value of the product in three years from 2001 to 2003 to respective average total trade value. Given $N_X = 943$, price indices P_t^{1X} of Latvia's exports in year t were calculated for every t from 2002 to 2012 using formula (2). Similarly, given $N_M = 882$, price indices P_t^{1M} of Latvia's imports in year t were calculated for every t from 2002 to 2012 using formula (3).

For import and export flows, aggregate trade values and their respective weights were compiled for 54 product groups. The shares of product groups in total trade for import flows S_{k0}^{2M} and export flows S_{k0}^{2X} were calculated by dividing the average trade value of the product group in three years from 2001 to 2003 to respective average total trade value. Given $N_X = 943$, price indices P_t^{2X} of Latvia's exports in year t were calculated for every t from 2002 to 2012 using formula (2). Similarly, given $N_M = 882$, price indices P_t^{2M} of Latvia's imports in year t were calculated for every t from 2002 to 2012 using formula (3). Obtained values of terms of trade indices by both methods are provided in Table 1.

Table 1. Terms of trade indices of Latvian agri-food trade, 2002−2012

Level	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
HS-6 digit codes	84	100	90	78	88	84	92	103	94	92	93
Product groups	77	70	70	66	65	74	82	87	93	92	97

Source: research findings, UN Comtrade database

Research results show a certain bias depending upon a degree of aggregation. The terms of trade indices compiled at product group level in general tend to be lower. This happens when products within a group with relatively low value and relatively high weight are exported and/or when products within a group with relatively high value and relatively low weight are imported. Preferably, terms of trade indices compiled at HS-6 digit code level should be used.

*Table 2.*Barter terms of trade indices of Latvian trade in agricultural commodities, 2002−2012

Commodity		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Live animals	261	423	245	85	494	1042	368	230	194	189	33	
Live and chilled fish	52	55	49	51	49	58	57	43	37	47	44	
Eggs	20	26	21	43	n/a	52	63	63	71	76	87	
Honey	245	223	272	368	123	98	193	165	163	154	173	
Plants	75	74	69	46	20	143	148	246	149	79	114	
Vegetables	95	106	84	67	64	135	113	84	89	100	81	
Fruits and nuts	155	193	326	207	242	238	222	183	207	252	259	
Raw coffee and tea	634	508	247	708	764	532	250	379	233	192	191	
Spices	185	176	180	135	128	137	139	111	115	99	144	
Cereals	54	33	61	50	71	73	74	55	44	72	20	
Seeds	697	1121	1139	878	1423	501	947	727	407	324	985	
Crude fats and oils	194	156	152	150	189	178	154	180	131	296	175	
Ethyl alcohol	218	108	322	139	103	70	112	97	109	115	108	

Source: research findings, UN Comtrade database

To evaluate the terms of trade within the 54 product groups, shares of products with 6-digit codes in values of aggregate product groups s_{k0}^{3M} for import flows and s_{k0}^{3X} for export flows were calculated by dividing the average trade value of the product in three years from 2001 to 2003 to respective average product group trade value. The number of products within the product groups for exports N_X and imports N_M vary depending on trade structure in particular product group and year of the period. Price indices P_t^{3X} of Latvia's exports for product groups in year t were calculated for every t from 2002 to 2012 using formula (2). Similarly, price indices P_t^{3M} for Latvia's imports for product groups in year t were calculated for every t from

2002 to 2012 using formula (3). The obtained values of terms of trade for the most important agricultural commodities are provided in Table 2.

For several product groups, such as honey, live animals, seeds, fruits and nuts, rather high indices are associated with the trade structure when in trade of similar products items with higher price are exported and items with lower price are imported. This trend is especially pronounced in trade of vegetable seeds. For other product groups, such as eggs, vegetables and cereals rather low indices are associated with reverse trend when in trade of similar products items with lower price are exported and items with higher price are imported. Rather low indices for fish reflect simultaneous exports of low-priced varieties and imports of expensive salmon and trout. Relatively high indices for crude fats and oils are associated with the exports of crude food oil for refining and imports of cheaper oil used in biofuels.

The obtained values of terms of trade for the most important processed food products are provided in Table 3.

Table 3. Terms of trade indices of Latvian trade in processed foods, 2002−2012

Product	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Meat	244	182	227	295	281	337	206	210	199	207	212
Poultry meat	206	108	131	136	182	176	173	181	160	144	138
Meat products	113	85	81	80	85	72	77	100	120	116	121
Fish	35	64	74	57	37	26	33	42	43	35	25
Potatoes	140	136	141	137	154	154	133	158	155	171	197
Juices	44	46	55	57	51	44	41	48	40	39	47
Fruits and vegetables	173	179	174	181	200	164	172	161	172	180	181
Oils and fats	269	115	125	136	120	125	121	128	125	116	126
Margarine	153	134	113	122	210	138	130	210	139	161	129
Dairy	118	131	137	123	115	125	108	108	130	127	126
Ice cream	98	102	110	108	101	104	104	115	91	111	149
Milling products	58	57	68	62	74	70	77	80	76	81	83
Starches	94	95	83	79	86	96	83	74	76	92	82
Bread and pastry	143	96	82	68	72	62	64	78	72	82	83
Biscuits	88	64	46	46	52	56	65	58	63	76	70
Pasta	249	171	113	104	116	117	114	166	165	141	75
Sugar	73	56	85	70	65	78	89	164	89	96	84
Confectionery	94	86	85	99	94	95	87	93	78	96	99
Tea and coffee	64	67	85	82	79	78	71	71	65	64	85
Condiments	39	32	32	35	44	4	43	51	58	57	63
Prepared meals	129	127	132	95	120	99	88	94	81	73	73
Homogenized food	80	28	31	32	28	56	89	49	49	54	55
Feed	77	91	82	67	48	56	69	73	48	86	76
Pet foods	176	210	183	99	75	99	135	156	113	103	100
Strong beverages	43	40	45	57	56	47	84	88	89	71	82
Grape wine	113	82	56	73	101	221	268	207	266	391	345
Cider	92	78	n/a	119	81	60	76	85	81	83	85
Fermented beverages	160	n/a	40	103	100	129	124	104	149	159	168
Beer	96	95	92	93	93	100	93	79	79	81	102
Malt	94	117	111	89	77	37	n/a	88	173	132	118
Soft drinks and waters	98	122	102	123	116	98	102	133	123	131	150

Source: research findings, UN Comtrade database

For processed meat products of all types high values of indices are associated with the location of production facilities of multinational companies when cheaper soft-boiled sausages, frankfurters and wieners are imported while more expensive domestically produced hard sausages and smoked meats are exported. For

dairy products, cheeses and butter with higher fat contents are predominantly exported while lower priced staple dairy produce is imported to meet local demand. Similar trends are seen in grape wine and fermented beverages segments. For strong beverages, cider, milling products, starches, bread, fresh and preserved bakery products situation is reverse. Premium brands of ice cream are exported while cheaper retailers' private label products are imported from neighboring countries.

To evaluate the terms of trade in agricultural commodities and processed products, shares of products with 6-digit codes in values of agricultural commodities or processed products s_{k0}^{4M} for import flows and s_{k0}^{4X} for export flows were calculated by dividing the average trade value of the product in three years from 2001 to 2003 to respective average total aggregated value of agricultural commodity or processed products. Given $N_X = 2$, price indices P_t^{4X} of Latvia's exports for two broad product groups in year t were calculated for every t from 2002 to 2012 using formula (2). Similarly, given $N_M = 2$, price indices P_t^{4M} for Latvia's imports for two broad product groups in year t were calculated for every t from 2002 to 2012 using formula (3). The obtained values of terms of trade in agricultural commodities and processed products along with the total agri-food terms of trade are provided in Table 4.

Table 4. Terms of trade indices of Latvian trade in agri-food products, 2002–2012

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Agri-food total	84	100	90	78	88	84	92	103	94	92	93
Agricultural commodities	267	433	316	181	430	215	208	265	127	107	178
Processed products	67	65	66	68	58	70	78	85	90	88	82

Source: research findings, UN Comtrade database

Total Latvian agri-food terms of trade indices over the period from 2002 to 2012 are not deteriorating. Nevertheless, the values of indices do not exceed 100 point threshold in general. The values of terms of trade indices for agricultural commodities are rather high, pointing towards relatively higher prices for exported commodities relative to respective imports.

To measure the performance of barter terms of trade indices for whole agri-food sector, indices are compared to net barter terms of total trade index (Figure 1).

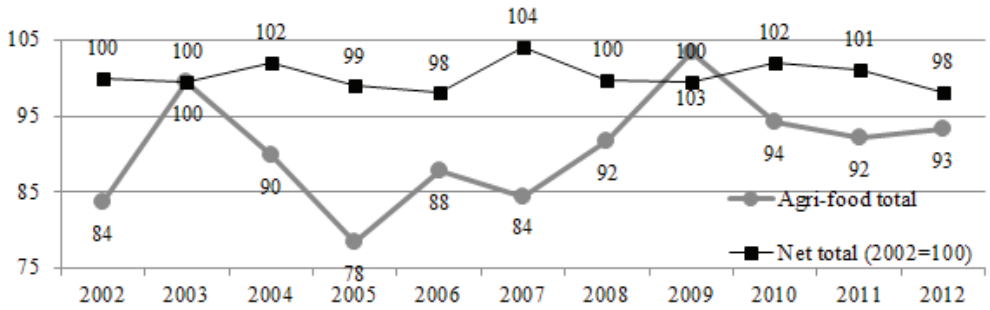

Figure 1. Latvian agri-food barter terms of trade index and total terms of trade index, 2002–2012

Source: research findings, The World Bank

The total barter terms of trade index is measured against the base year 2002 and the assumed value of 100 is relative. In general, total barter terms of trade are quite stable and fluctuate around the initial value. After reaching the lowest value in 2005, barter terms of trade in agri-food sector have improved. Nevertheless, the indices in the last three years of the period have values below 100.

4. Terms of trade shocks in Latvian agricultural commodities

Terms of trade shocks in Latvian trade in agricultural commodities for period from 2002 to 2012 do not show persistent patterns. For all four episodes, the upswing in terms of trade indices is reversed next year (Table 5).

Table 5. Terms of trade shock episodes in Latvian agricultural commodities, 2002−2012

Number	Starting year	Ending year	Episode length-Start-to-End (years)	Episode length-Upswing (years)
1	2002	2005	4	1
2	2005	2007	3	1
3	2008	2010	3	1
4	2011	2012	2	1

Source: research findings

Conclusions

The Latvian net barter terms of trade in agricultural commodities and processed food products are unfavorable over the period from 2002 to 2012. Nevertheless, the terms of trade are improving.

A more detailed level of aggregation of trade data allows for a better control of possible product quality differences, providing more reliable values of terms of trade indices.

There is an increase in Latvian net barter terms of trade indices in agricultural commodities and processed food products over the period from 2002 to 2012, while total net terms of trade are stagnating or even declining.

The Latvian net barter terms of trade in agricultural commodities are favorable, but there is an downward trend in development of terms of trade indices. On the contrary, the Latvian net barter terms of trade in processed food products are unfavorable, while the trend is positive.

The trends in development of net barter terms of trade indices are associated with the changes in domestic and export demand, increase in two-way trade, development of private retailing labels and structure of the processing industry.

There are four terms of trade shock episodes in Latvian agricultural commodities during the period from 2002 to 2012. The episodes are relatively short-lived. The length of upswing period in the episodes does not exceed one year.

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PREKYBOS ŽEMĖS ŪKIO IR MAISTO PRAMONĖS PRODUKCIJA LATVIJOJE SĄLYGOS

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Santrauka

Nuo devintojo dešimtmečio Latvija tapo daugiau maisto produktų importuojančia nei eksportuojančia šalimi, šiuo laikotarpiu maisto produkcijos importas ir eksportas nuolat augo. Šio straipsnio tikslas – nustatyti prekybos žemės ūkio ir maisto pramonės produkcija sąlygų vystymosi tendencijas Latvijoje. Šiam tikslui pasiekti nustatyti prekybos sąlygų indeksai, apimantys kelių lygmenų duomenis nuo 2002 iki 2012 metų. Tyrimo rezultatai atskleidė, kad prekybos žemės ūkio produkcija sąlygos, lyginant su prekybos mais-

to pramonės produkcija sąlygomis, yra geresnės. Nustatyti skirtumai tarp prekybos sąlygų tiems patiems produktams ar produktų grupėms, priklausantys nuo agregacijos lygio. Prekybos sąlygų žemės ūkio ir apdoroto maisto produkcijos indeksų vystymosi tendencijos skirtingos, tačiau vertinant žemės ūkio ir maisto pramonės sektorius kartu, pastebima, kad prekybos sąlygų rodikliai ne mažėja.

PAGRINDINIAI ŽODŽIAI: *tarptautinė prekyba, prekybos sąlygos, žemės ūkio produkcija, maisto pramonės produkcija.*

JEL KLASIFIKACIJA: F60, Q17