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OVERREACTIVE TO INTERNATIONAL MARKETS? PRICING MECHANISMS AND VALUE CHAINS IN RA VEGETABLE OIL MARKET

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A B S T R A C T

Armenia imports all of its vegetable oil for domestic consumption, consisting mainly of sunflower oil imported almost entirely from Russia. Thus, the price in Armenia is formed based on the purchasing price, transportation costs, and margin. But the price movements in the Armenian retail market are not always consistent with the international markets, which rises the need for a comprehensive micro and macro-level analysis. In this article, the authors analyze the price value chains on micro-level data and reveal factors determining retail market price with econometric models. The analysis showed, that the key determinants are the international price of vegetable oil, USD/AMD exchange rate, and domestic inflationary factors. The article argues that the movements of the Armenian vegetable oil market are not always consistent with the changes in these factors: the market overreacts with increased margins during turbulent periods. This pattern was confirmed both in 2021 and 2022 when despite the divergence of Russian and international prices and the relative stability of the Armenian market, the analysis showed increased markups.

1. INTRODUCTION

Being a final product of household consumption, vegetable oil plays an important role in food consumption. Sunflower oil and corn oil make up the majority of the total import and consumption of vegetable oils in RA. In recent years, only imported oils are sold on the vegetable oil market.

The majority of households in RA consume vegetable oil daily, which also implies that the increase in vegetable oil prices can sharpen the social problems for Armenian households. Hence, the research on vegetable oil pricing is important both in terms of revealing the cost components and identifying the main factors affecting the price and assessing their impacts.

Taking into account the geopolitical developments of recent years and the fluctuations in the international

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food markets caused by the Russian-Ukrainian war, a comprehensive analysis of international prices and other external shocks on vegetable oil prices needs to be conducted.

Moreover, although Armenia consumes only imported vegetable oil, not all price movements can be explained by the changes in international markets: the prices can overreact or underreact to the latter, which makes the research more important also in the point of competition protection policies.

This research aims to analyze the pricing mechanisms in the vegetable oils market of RA, as well as to identify and evaluate the main factors affecting vegetable oil prices.

2. LITERATURE REVIEW

Currently, food security issues are at the center of the international community's attention due to the reduction in the volume of food production and rising prices as a result of various crises. International organizations – The World Bank, The International Monetary Fund, The UN, and other institutions announced in April 2022, that the world is being shaken by periodic crises (COVID-19 pandemic, Russian-Ukrainian war), which is a serious food security challenge that could affect millions of households, make them poor. The choice of models for forecasting food prices becomes much more complicated since the composition of the fundamental factors and the magnitude of their influence make it very difficult to assess the impact of the latter on food prices.

Some of the research implemented in sunflower and corn price analysis is based on the use of ARIMA time series forecasting models. In 2006 and 2007, respectively, sunflower and corn oil price forecasts were made by H. Sibel Gulse Bal and Rüştu Yayar in Turkey, where the authors assess that forecasts made by ARIMA models are highly accurate (Bal & Yayar, 2006; Yayar & Bal, 2007). The peculiarity of these studies is that it was performed based on time series of prices from 1994-2005, and since the prices showed almost stable dynamics for several years until 2005, the forecasts of the ARIMA model, due to the stable nature of this historical dynamics, were quite reliable.

In a 2017 study on the macroeconomic impact of global food price shocks on the Turkish economy, Ayhan Kapuzuzoglu, Xi Liang, and Nildag Basak Ceylan used SVAR models (Kapusuzoglu et al., 2018) to examine interactions between some of the macroeconomic fundamentals (inflation rate, real exchange rate, and economic growth) and food prices (including sunflower oil).

In 2018, Helena J. Purba, Bonar M. Sinaga, Tanti Novianti, and Reni Kustiari explored the impact of external factors on the global vegetable oil market (Purba et al., 2018). The authors have developed a world (global) vegetable oil trade model, which is composed of a system of 53 simultaneous equations. According to this study, in terms of world trade, the increase in imports of vegetable oil (palm oil) exceeds the increase in exports, which leads to an increase in the world (global) price of palm oil.

3. RESEARCH METHODS

The research was conducted based on micro-level analysis of pricing value chains and also on macro-level time series analysis – applying also econometric methods.

For the micro-level analysis, we used data provided by RA Competition Protection Commission, which covers only 2021 by months. We used the data of the three large importer companies, which cover 62% of sunflower oil imports. We analyze the weighted purchase price, costs, and sell prices of these companies for sunflower oil. We refer the micro-level analysis as complementary to the macro analysis - try to find the stylized facts on the hypothesis generated during the macro analysis.

For the macro-level analysis, we built OLS regression models, based on which we revealed the determinants of sunflower oil prices in Armenia and estimated their effects. As Armenia imports all of its consumption, supply is determined by two factors: international price, exchange rate, and transportation prices. Demand-side factors can be expressed by economic growth or inflation rates.

But the micro-level stylized facts show, that transportation prices account for only 5-7% of the cost price, and the transportation is occurred mainly by automobile transport from Russia, and this factor can't be captured with international transportation cost indexes like Baltic Dry. Meanwhile, economic growth should not positively affect the demand for vegetable oil, as it is acknowledged to be a Giffen type of good, which was also proven during the pandemic (Zhou, 2022).

Hence, for the analysis, we use only three explanatory variables: the international price of sunflower oil, USD/AMD exchange rate, and food price inflation. We also experimented with the dependent variable, considering international prices not only expressed in USD, but also in AMD and RUB.

The data sources are The World Bank for international prices, the Central Bank for exchange rates and food inflation, and RA Statistical Committee for sunflower oil price. All variables are used in annual growth rates to ensure stationarity of data series.

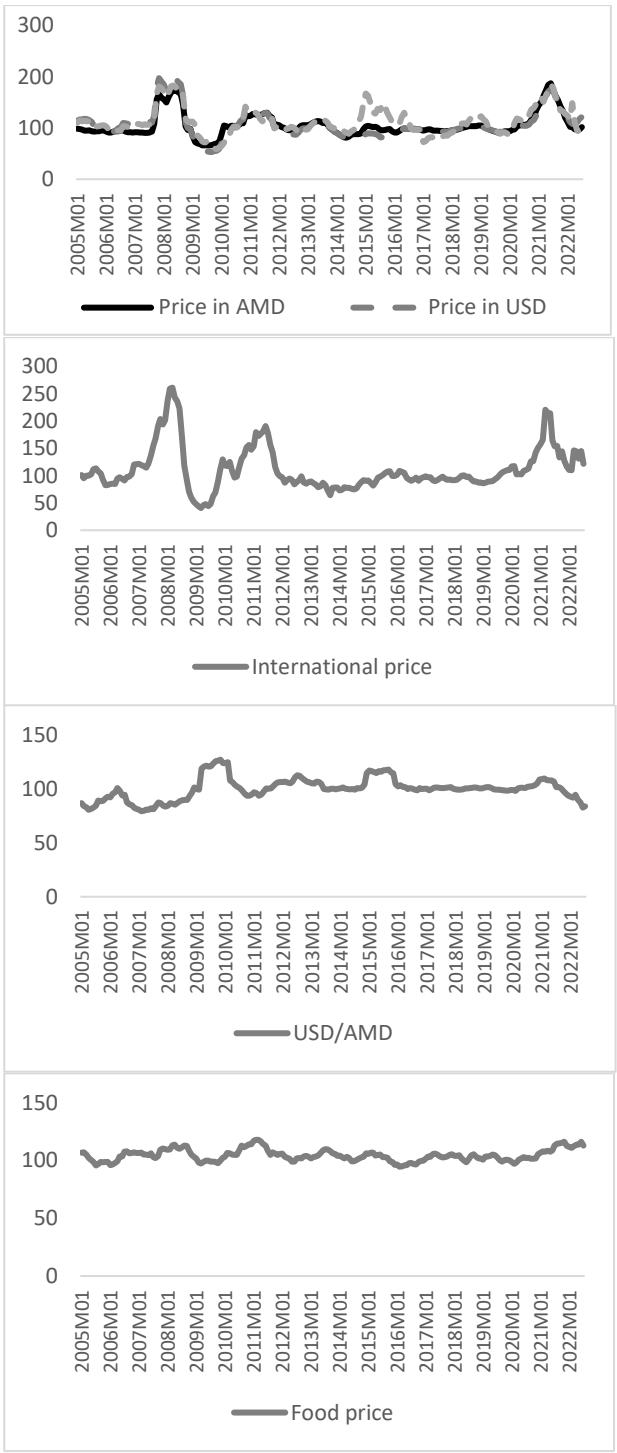

Figure 1. Variables used in econometric models, expressed in y/y growth rates, %

Before starting the econometric analysis, we discuss the market structure of Armenia and the price value chain, then analyze international and local market price trends and their determinants.

4. RESULTS

The vegetable oil market in Armenia is composed only of imports – around 25 million kg for 2021. Sunflower oil is mainly imported from the Russian Federation, which ensures 99% of imports (Figure 2).

It is noteworthy to mention, that Armenia had a notable import volume from Ukraine in 2020, when the country imported 750,000 kg (2.66%) which, however, decreased by almost 3 times in 2021. Considering the small volumes of imports from Ukraine, it can be assumed that the risks of direct import of sunflower oil from Ukraine are not high.

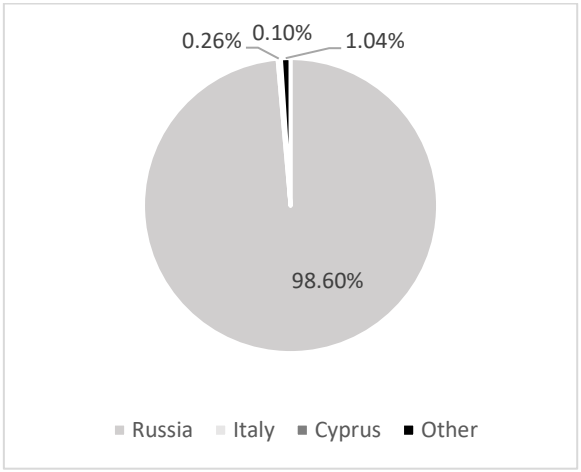

Figure 2. Structure of sunflower oil imports by country

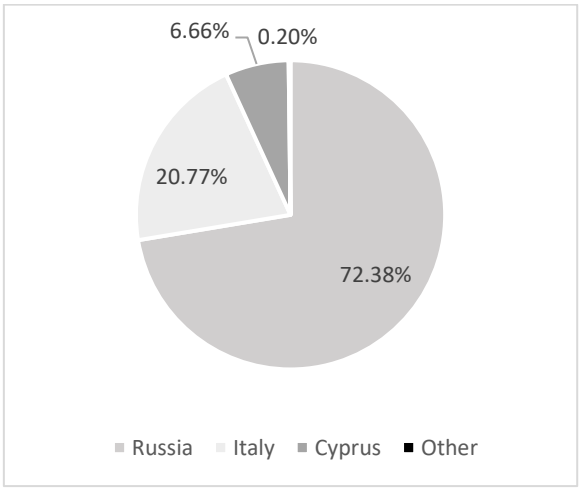

Figure 3. Structure of corn oil imports by country

Imports of corn oil consisted of 0.5 mln kg in 2021 – only 2% of the sunflower oil volume. In this market, the Russian Federation is again the main route for imports, and its share is 72%. The second largest importing country is Italy, accounting for 21% of imports (Figure 3).

We carried out a micro-level study on pricing value chains of the Armenian vegetable oil market. The costs are calculated as a sum of the purchase price and transportation costs, and the price was calculated as a sum of the cost and markup (Figure 4).

This decomposition allows us to analyze the key factors behind changes in price. For example, in the studied period, vegetable oil prices have risen significantly starting from March 2021 and this growth continued for three months due to an increase in the purchase price of vegetable oil[1].

We can also analyze the weighted average share of the transportation costs of the studied companies. Following the calculations, the share of transportation costs in the cost of vegetable oil varied in the range of 5-7% during the studied period (Figure 5).

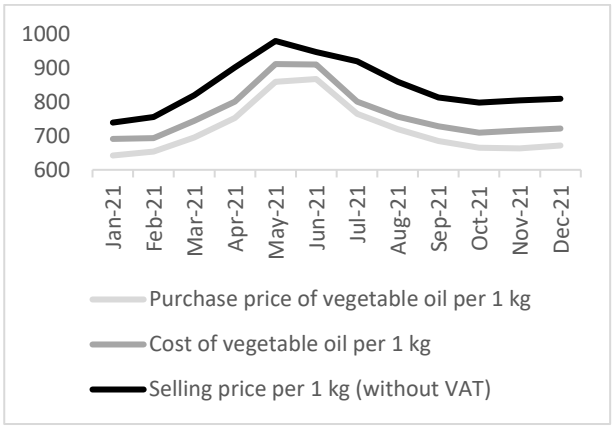

Figure 4. Purchasing cost and selling price of vegetable oil, an average of data by three companies

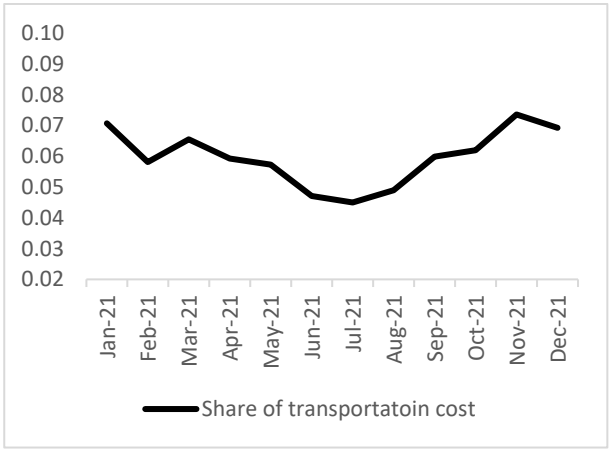

Figure 5. Share of transportation costs in the cost price of vegetable oil
Source: Company-level data provided by RA Competition Protection Commission

During 2021 the size of the markup (the difference between the sale price and the cost price) increased. In particular, compared to almost 8% at the beginning of the year, the markup was 10% at the end of the year.

[1] Based on the micro-level data, we estimated a negative correlation between the sales volume and the price of vegetable oil (linear correlation coefficient: -0.19). The elasticity coefficient, calculated on the results of a linear regression between sales volume and sales price, is -0.15. But, given the short sample for this estimates, we belive that further analysis is needed for revealing the price-sale interlinkage.

Although the micro-level analysis is useful for understanding market structure and characteristics, more long-term macro analysis is needed to reveal the key trends and patterns – both for international and the Armenian markets.

In the international market, vegetable oil prices in the last two decades fluctuated between 600 to 2000 USD for a metric ton and were highly volatile. Meanwhile, the prices of different types of vegetable oil are correlated (Figure 6).

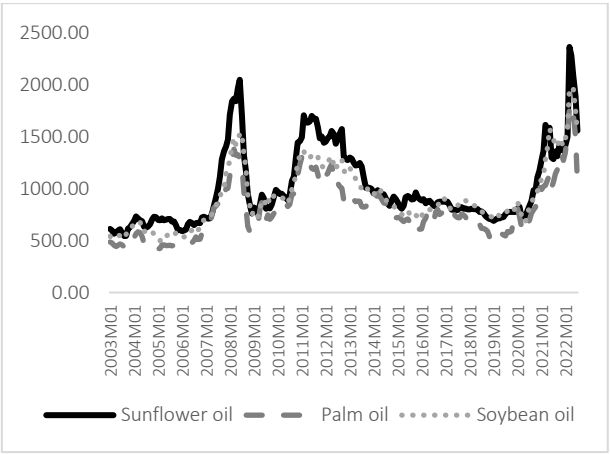

Figure 6. Price of different types of vegetable oil, USD per ton

The price of sunflower oil peaked in 2008, 2011, and 2022. It was also correlated to average food and commodity prices (Figure 7).

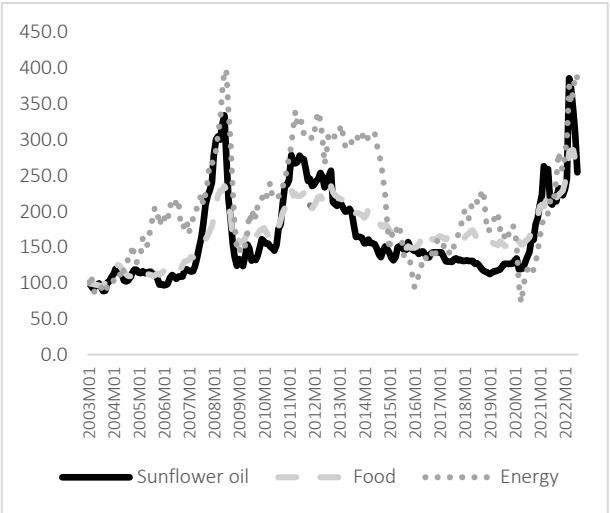

Figure 7. Indexes of sunflower oil, food, and energy, January 2003 = 100
Source: The World Bank and authors' calculations

During 2003-2006 sunflower oil prices were stable – fluctuating between 600-700 USD, while in 2006-2008 prices skyrocketed, slumping during the global financial crisis. The growth of price was conditioned by the supply-demand gap, where the latter was driven by the increase in food consumption and bioenergy

consumption of vegetable oils (FAO, 2007, 2008). During 2010-2020 the price had first upward, then a downward trend, correlating with food and energy prices. From 2020 to 2022 the prices were highly volatile – first because of the COVID-19 crisis, then of the Russian-Ukrainian war. At the beginning of 2020, during the lockdown, the price of sunflower oil declined and started to grow at the end of the year - correlating to commodity prices.

The sunflower oil prices were stable in Armenia compared to international prices of sunflower oil and also butter prices in the RA. From 2004 to 2020 the price of sunflower oil fluctuated between 500 to 1000 AMD, while after 2021, because of the post-lockdown inflationary pressures in the world and Armenia, increased from 700 to 1300 AMD, and started to fluctuate from 1100 to 1300 AMD (Figure 8). Unlike sunflower oil, butter prices had an increasing trend rising from 1500 to 6000 AMD. The margarine prices were close to sunflower oil prices (Figure 9).

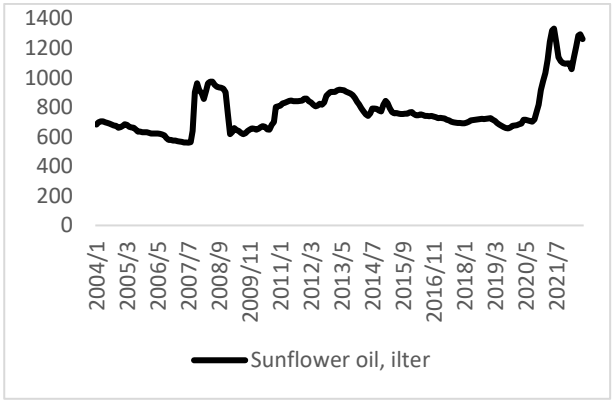

Figure 8. Sunflower oil prices in Armenia, AMD per liter

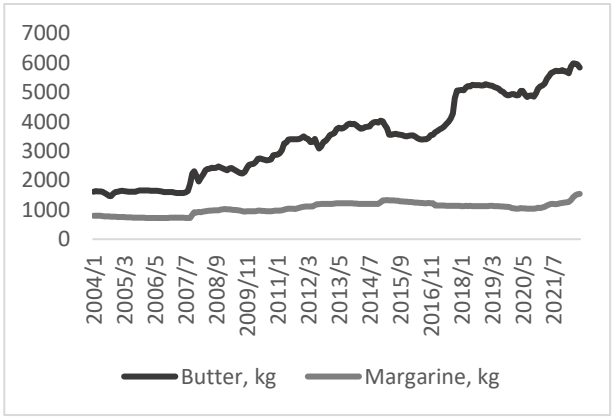

Figure 9. Butter and margarine prices in Armenia, AMD per kg

Source: RA Statistical Committee

The sunflower oil price can hardly be explained by an inflationary environment, although some correlation of trends can be noticed. Particularly, in the moderate-inflation environment (2005-2015) sunflower oil prices were also increasing. In the low-inflation environment (2016-2020) prices have decreased, and in the high-inflation environment of 2021-2022 have soared (Figure 10).

Meanwhile, sunflower oil price fluctuations can almost be entirely explained by its international price adjusted by the exchange rate. The correlation between the international price and the Armenian market price in USD is 0.8, but the domestic price is on average 2 times higher than the international price (Figure 11).

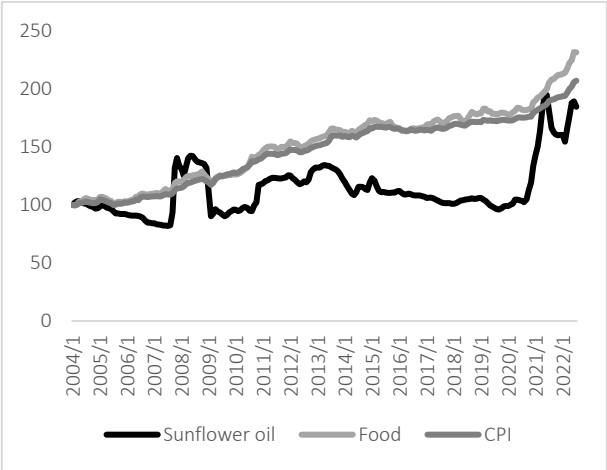

Figure 10. Sunflower oil price and consumer price indexes, seasonally adjusted, January 2004 = 100

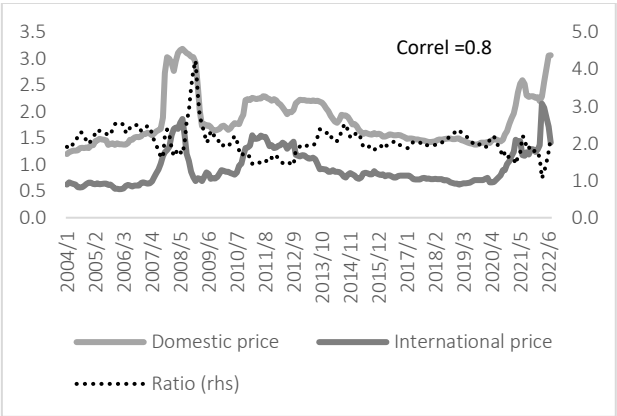

Figure 11. International and domestic prices of sunflower oil, USD per liter

Source: The World Bank, RA Statistical Committee, RA Central Bank, the authors' calculations

To differentiate the effects of international price, exchange rate, and domestic inflationary pressures on the domestic price of sunflower oil, we estimated econometric models.

First, we estimated a model, where the explanatory variables are international prices of sunflower oil, the food prices in Armenia, and the USD/AMD exchange rate. All the variables were statistically significant in the model, while the strongest impact of international prices was on a lag of 1 month. These factors explain 75% of all variations in the domestic price of sunflower oil price. Following the estimates, a 1 pp. acceleration in growth rates of international prices yields a 0.45 pp

acceleration in the growth of sunflower oil prices in Armenia. The food price growth acceleration of the same magnitude yields 0.9 pp., and the same size acceleration of USD/AMD depreciation rate yields 0.28 pp. acceleration in sunflower oil price growth. We also experimented with other possible specifications, including introducing a dummy variable that differentiates the different effects of international prices on local prices during growth and decline periods. This exercise showed, that there was no statistically significant differentiated effect.

Given the existence of autocorrelation in Model 1, we also built Model 2 with an autoregressive component, which improved the explanatory power of the model to 0.95. But in this model, we do not consider food price, and the coefficient of international price decreased. We also experimented with model estimation where the dependent variable is the domestic sunflower oil price expressed in US dollars (Model 3) or, given the share of Russia in the vegetable oil import structure, Russian rubles (Model 4). In these models, the effect of prices was estimated with autoregressive variables.

Table 1. Sunflower oil price explanatory model estimation

	Model 1	**Model 2**	**Model 3**	**Model 4**
	Sunflower oil price, AMD	Sunflower oil price, AMD	Sunflower oil price, USD	Sunflower oil price, RUB
Inernational price (-1)	0.45***	0.17***	0.19***	0.10***
Food prices in RA	0.90***	-	-	-
USD/AMD exchange rate	0.28***	0.16***	-	-
Sunflower oil price (-1)	-	0.76***	0.75***	0.85***
C	-66.29***	-9.10**	6.07***	6.30**
R^2	**0.75**	**0.95**	**0.96**	**0.90**
Akaike criterion	7.79	6.13	6.39	7.12
Schwarz criterion	7.85	6.20	6.44	7.16
Hannan-Quinn criterion	7.81	6.16	6.41	7.13
Sample	January 2005 – July 2022 (211 obs.), y/y growth rates, %			

The statistical indicators of these models (coefficient of determination, Akaike criterion, Schwarz criterion, Hannan-Quinn criterion) proved that Model 2 and Model 3 are optimal from the statistical point of view - better higher explanatory power and quality indicators. Weaker explanatory power of the model with the Russian rubble suggests, that historically import of sunflower oil to Armenia was organized with US dollars.

To assess the pricing efficiency of sunflower oil in Armenia we apply Model 1, which captures the effects of price fundamentals.

We implemented "in sample" and "out of sample" estimations focusing on the two waves of price increases during the last 2 years - after the lockdown and since the start of the Russian-Ukrainian war. The assessment showed, that during 2021 RA market of sunflower oil overreacted to international price growth. Following the estimates, the deviation of price from its fundamentals during 2021 was from 15 (based on in-sample estimation) to 20 (out-of-sample estimation) percent (At May 2021 the price in RA market was 1330 AMD, while it was estimated to be at 970-1060 AMD following the model). We refer to this as an "additional markup", which was formed because of the turbulence in the market.

Instead, the deviations were negligible during 2022, when the model predicts 24-25 percent growth in price, the price has increased only by 1.8 percent, which has neutralized the deviation accumulated since 2021 (Figure 12).

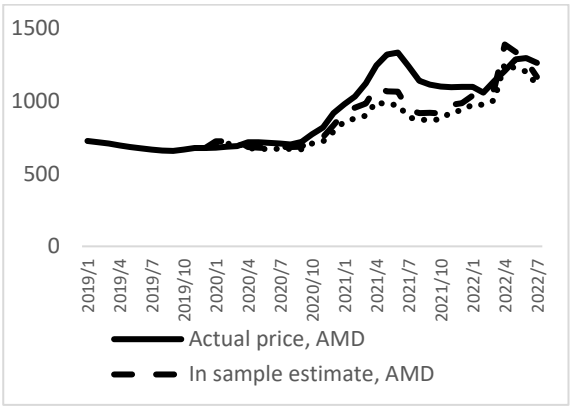

Figure 12. Actual and estimated prices of sunflower oil in Armenia

To shed light on this phenomenon, we analyze the wholesale price in Russia (Particularly, the price in closest to Armenia Krasnodar region), from where Armenia imports almost all of its sunflower oil. The analysis shows, that till August 2021 international and Russian prices were almost identical, while they started to significantly diverge after the Russian-Ukrainian war (Figure 13). Particularly, if international prices, adjusted with the change in exchange rate increased by 63% in March 2022, the price in Russia increased just by 7.7%. Afterward, in July 2022 the international price declined by 45%, while the price in Russia – was 15% (both adjusted with the exchange rate).

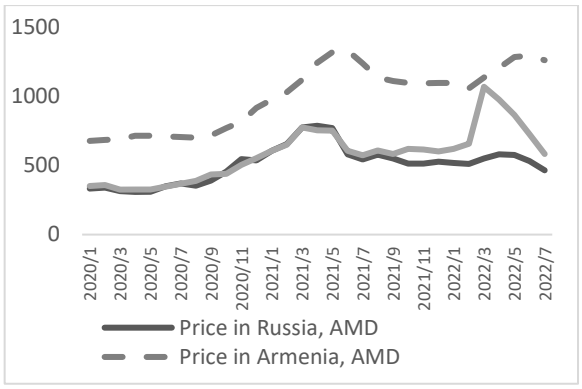

Figure 13. International, Russian wholesale, and Armenian retail prices of sunflower oil expressed in AMD
Source: The authors' calculations

Given this deviation, we adjusted data for 2021-2022 for the international price variable and calculated a measurement for additional market margin as a percent deviation of the actual and estimated price. Our estimates showed 3 hikes in the estimate of additional margin: April 2020, February 2021, and March 2022, when also the relative price indicator increased – peaking in July 2022. We also noticed, that during 2021 increase in the estimated additional margin corresponded to the stylized facts collected from micro-level data (Figure 14).

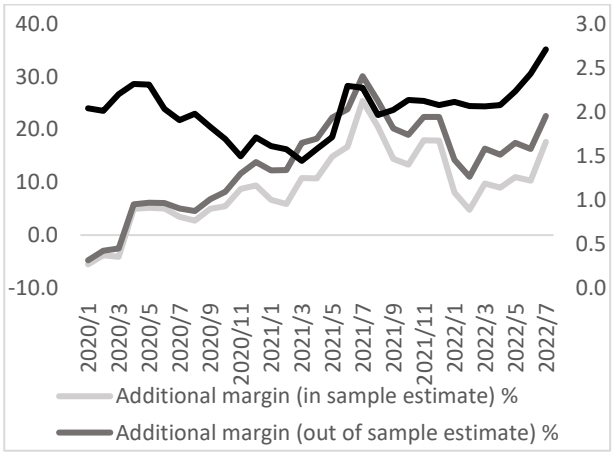

Figure 14. Additional margin (markup) estimates of sunflower oil price

5. CONCLUSION

Currently, Armenia imports all of its vegetable oil for consumption, and the market was historically sensitive to international market price fluctuations. Prices in Armenia can mainly be explained by changes in the international market, AMD exchange rate, and domestic food inflation. As the international commodity markets entered a stage of turbulence in 2020, and vegetable oil prices, being highly correlated to food and energy prices were also volatile, Armenia also experienced some turbulence.

Particularly, during the global inflationary wave of 2021, the price of sunflower oil in Armenia increased significantly more than could be expected based on historical patterns. The micro-level data pointed out an increase in the margin, and empirical analysis also shows a pattern of increasing margins (markups) during international price turbulence.

Meanwhile, the Armenian vegetable oil market did not react to international price growth after the Russian-Ukrainian war, when despite a predicted 25% growth, the sunflower oil price in Armenia increased just by 2%.

Given the fact, that Armenia imports almost all of its vegetable oil from Russia, we analyzed producer prices in Russia, and revealed, that it deviated from the international prices significantly, and the reaction of the Armenian vegetable oil market was consistent with the identified pattern.

Particularly, despite the price growth is moderate, the markup increased since March 2022. We conclude, that although the vegetable oil market in Armenia was mainly safe from international price turbulence in 2022, it continues to be characterized by an overreaction to the changes in purchasing prices.

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