Some Scenarios on the impacts of the COVID-19 pandemic to automobile import demand function in Azerbaijan

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Abstract. The article examines the possible scenarios of price changes in the car market of Azerbaijan as a result of Covid-19. In the study, the demand and supply functions were determined by the two-stage simultaneous equation method. The author concludes that the car market in Azerbaijan depends not only on domestic and world prices but also on household incomes. As Covid-19 pandemic reduces household incomes, as well as global incomes, it is likely that demand to import will be declined and domestic prices will be decreased. But by decreasing of supply amount the prices in the domestic market will not be declined strongly. As well as the demand function to import dependences on the world price.

1. Introduction
Beginning in February 2020, COVID-19 began to have an impact on the world economy. The national economies are in crisis due to the rapid spread of the virus widely. Although the economies of other countries did not react seriously in the first weeks after the spread of the virus in the Chine, the economy of each country began to share the effects of COVID-19 due to the declaration of a pandemic by the WHO in March 2020. Successive quarantine has partially or severely limited the activities of various sectors of the economy in the world.

The economic sectors whose activities have been severely restricted since the declaration of the pandemic are mainly the service sectors, including the tourism sector, culture and art sector, restaurants and entertainment centres, sports and health centres, kindergartens and all educational institutions, international passenger transportation and so on. Areas of economic activity with partially limited activities are mainly the construction and domestic transport sectors.

Despite some restrictions on quarantine and economic activity due to the pandemic, no restrictions on foreign trade have been imposed until now by most countries. On the contrary, most countries have pursued broad liberal reforms in the import of basic consumer goods, including medical equipment and medicines. Although there are no restrictions on foreign trade, the pandemic is expected to cause significant failure in these areas as well. Because the volume of import and export of goods and services are directly related to both demand in the domestic market and current prices in foreign markets. As a result of the pandemic, a sharp change in both indicators is expected.

The paper investigates possible scenarios for the price in the cars market due to the pandemic which have a significant share in world import-export. The main purpose of this study is to predict some scenarios to reduce consumer losses in the case of demand decline for imported cars in Azerbaijan.
2. Literature review
In the economic literature, there are studies on the effects of various unexpected events, such as terrorism, wars, epidemics, natural disasters etc. on the national, regional and global economy, including on the foreign trade sector. For example, [1], [2], [3], [4] and etc. investigated some economic consequences of terrorism, [5], [6] and etc. investigated economic consequences of wars, as well as [7], [8] investigated epidemic impacts on foreign trade. The channels of Covid-19 impacts on the economy are the same as the channels of above mentioned events impacts.

But Covid-19 pandemic impacts differ from above-mentioned unexpected events' impacts on the economy, as Covid-19 has a global character and has long-run effects. Some researchers, e.g. [9] call the Covid-19 impacts on the economy as long run.

3. Methodology
As a result of COVID-19 1) A large number of people are doomed to stay at home, i.e. the number of actual occupations decreases and the income of employees decreases; 2) Many migrant workers are forced to return to their home country or are deprived of the opportunity to work in the country of their stay. This is a reduction of remittances; 3) Several areas of activity that create added value in the country are virtually closed. The incomes of the population engaged in the tourism sector, restaurants, sports and entertainment centres are declining. By decreasing incomes in the national economy, especially in small countries and by the possible increase in world prices for cars will change the demand and supply of cars.

The study treats COVID-19 as a shocking event in the economy as a whole, and in some sectors in particular. This event has already caused a short-run shock in macroeconomic indicators, including both aggregate demand and aggregate supply. Of course, the shock effects are manifested at the microeconomic levels as well.

Given the above, for simplicity, we will assume that demand in the automotive market (D) may vary depending on the income of the households as a result of the COVID-19 shock. In Azerbaijan, unlike other goods, a very important part (more than 99%) of the cars is imported. Domestic production is insignificant compared to imports. Thus, for the sake of simplicity, we will express the demand function in the automotive market as a function dependent on two variables - price (P) and income (Rev):

\[ D = a + b_1 * P + b_2 * Rev + e_d \]  

\[ S = c + a_1 * P + a_2 * WP + e_s \]  

Here, \( Rev \) (annually income per capita of the households) is an exogenous indicator for the demand function, as well as \( WP \) (average world price of cars) is an exogenous indicator for the supply function. The \( P \) value is an endogenous indicator for both functions. According to economic theory, \( b_1 < 0 : d_1 > 0 \). We will accept \( e_d \) and \( e_s \) are random errors and the following constraints are accepted for them:  
1) \( E(e_d) = 0; \text{var}(e_d) = \sigma_d^2 \)  
2) \( E(e_s) = 0; \text{var}(e_s) = \sigma_s^2 \)  
3) \( \text{Cov}(e_d, e_s) = 0 \)

We will apply “Simultaneous equation model” that can be shown for \( P \) as follows:

\[ P = \frac{a - \alpha \epsilon}{\alpha - \beta_1} + \frac{\beta_2}{\alpha - \beta_1} * REV - \frac{\beta_2}{\alpha - \beta_1} * WP + \epsilon_p \]  

Or

\[ P = \pi_{11} + \pi_{12} * REV + \pi_{13} * WP + \epsilon_p \]  

Q-quantity of imported cars

\[ Q = \frac{a_1 * d_1 - b_1 \epsilon}{d_1 - b_1} + \frac{b_2 * d_1}{d_1 - b_1} * REV - \frac{b_1 * d_2}{d_1 - b_1} * WP + \frac{d_1 * \epsilon_d - b_1 \epsilon_s}{d_1 - b_1} \]  

or

\[ Q = \pi_{21} + \pi_{22} * REV + \pi_{23} * WP + \epsilon_q \]

Based on “Simultaneous equation model”, we will use the two-stage least squares method (2SLS).
The necessary information for this analyze was obtained from the official website of the State Statistics Committee of the Republic of Azerbaijan (SSCRA, 2019) [10].

4. Results

As a result of the application of the “Simultaneous equation model” for the case of Azerbaijan according to the equations (1) and (2), the reduced form for quantity of the import was obtained as in Table 1.

Table 1. Reduced form for quantity of the import.

| variable | Coefficient | Standard error | t-statistics | probability |
|----------|-------------|----------------|--------------|-------------|
| c        | 69701.04    | 16010.64       | 4.353421     | 0.000568    |
| REV      | 39.1894     | 17.14681       | 2.285522     | 0.037251    |
| WP       | -10583.9    | 4307.521       | -2.45707     | 0.026668    |
| $R^2 = 0.85$ |            |                |              |             |
| F-significance =0.02 |            |                |              |             |

Note: calculation of the author

According to the Table 1 the estimated coefficients are statistically significant, and thus we can conclude that the exogenous variables, i.e. REV and WP affect the quantity import of automobile to Azerbaijan. According to the Table 1, $R^2 = 0.85$, and the overall F-statistic is 0.02, which has a p-value of less than 0.02.

According to the Table 2 estimated coefficients for automobile market price and exogenous variables REV and WP are statistically significant. According to the reduced form for price $R^2 = 0.94$, all coefficients differ from zero and $t$-significance $7.67E-10$.

Table 2. Reduced form for price index.

| variable | Coefficient | Standard error | t-statistics | probability |
|----------|-------------|----------------|--------------|-------------|
| c        | -8.02249    | 1.272638       | -6.30383     | 0.000       |
| REV      | -0.00537    | 0.001363       | -3.93723     | 0.001       |
| WP       | 3.128892    | 0.342392       | 9.138329     | 0.000       |
| $R^2 = 0.94$ |            |                |              |             |
| F-significance =7.67E-10 |            |                |              |             |

Note: calculation of the author

According to the ordinary least squares method we can find fitted price as (7) by using data from Table 2. Where $\pi_{11} = -8.02249; \pi_{12} = -0.00537; \pi_{13} = 3.128892$

Then

$\hat{P} = \pi_{11} + \pi_{12} \ast REV + \pi_{13} \ast WP = -8.02249 - 0.00537 \ast REV + 3.128892 \ast WP$ (7)

Using two-stage least squares method (2SLS) we can find demand and supply functions replace $\hat{P}$ from (7) to (1) and (2). The Table 3 shows that market price negative impacts to automobile import demand in Azerbaijan. Vice versa household’s revenues positive impacts on the import demand.

Table 3. Demand function data according to 2SLS.

| variable | Coefficient | Standard error | t-statistics | probability |
|----------|-------------|----------------|--------------|-------------|
| c        | 42563.91    | 13013.92       | 3.270644     | 0.005       |
| P        | -3382.63    | 1376.692       | -2.45707     | 0.027       |
| Rev      | 21.02467    | 10.65276       | 1.973636     | 0.037       |
| $R^2 = 0.84$ |            |                |              |             |
| F-significance =0.02 |            |                |              |             |

Note: calculation of the author
Bu using Table 3 we can write the demand function for automobile imports in Azerbaijan as

\[ Q = 42563.91 - 3382.63P + 21.02467\text{Rev} \]  

(8)

Using of 2SLS method we can prove there are positive relationship between supply and price, and negative relationship between supply and world price (Table 4).

**Table 4.** Supply function data according to 2SLS.

| variable | Coefficient | Standart error | \( t \)-statistics | probability |
|----------|-------------|----------------|---------------------|-------------|
| \( c \)  | 11154.19    | 26011.2        | 0.428823            | 0.674147    |
| \( P \)  | 7297.84     | 3193.074       | -2.28552            | 0.037251    |
| WP       | -12250.26   | 6206.952       | 1.973636            | 0.047137    |

\( R^2 = 0.84 \)

\( F\)-significancy = 0.02

Note: calculation of the author

By using Table 4 we can write the supply function for automobile import in Azerbaijan as

\[ Q = 7297.84P - 12250.26WP \]

(9)

5. Discussion

The shock of a sharp decline of households income shifts the D curve (car import demand) to the left. In the case of sustain world price of cars, in the domestic market will be decreased car's price. But by decreasing the demand will be declined import as importers don't want to lose their benefit. Hence by decreasing demand will impact on supply to be declined. By declined supply will be the new steady-state point. But at this point, the new market price and the quantity of import are less than the previous (Fig. 1). In this case, during the transition from \( E_1 \) to \( E_2 \), both the price and the volume of import decrease. But in case of increasing world prices on cars, at the new steady-state point, the new market price is more than previous, but the quantity of import is less than the previous (Fig. 2).

The COVID-19 pandemic has played a significant role in the shift of the S curve to the left in recent months. Thus, as a result of COVID-19 1) there was a restriction of domestic production; 2) there was a decrease in imports due to the restriction of international relations. Both the decline in aggregate demand and the decline in aggregate supply affect the volume of imports.
6. Conclusion
Expressions (8) and (9) for the supply and demand functions suggest that both changes in domestic incomes and changes in world prices in any direction will have a serious impact on the car market in Azerbaijan. As a result of Covid-19, the demand curve will shift to the left as household incomes decline. In this case, prices are likely to fall (Figure 1). This could lead to a significant reduction in the number of cars entering the country. This can lead to a certain increase in prices by sliding the supply curve to the left. Undoubtedly, the decline in imports may shift the supply curve further to the left and prices may rise, as automobiles are not a commodity that loses quality in a short period of time and domestic production is not at the level to meet demand (Figure 2).

Covid-19 will also have a significant impact on car prices on the world market. This may be further in the direction of lower prices. Because the decline in global incomes will also have a negative impact on the car market. In this case, the prices of imported cars in Azerbaijan may decrease, and as a result of increased imports, prices may develop in the scenario shown in Figure 1.

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