Dutch Disease Perspective on Vegetable Exports in the Azerbaijan Economy

Ibrahim NIFTIYEV
Institute of Finance and International Economic Relations
University of Szeged[1], Hungary
niftiyev@eco.u-szeged.hu; ibrahimniftiyev@gmail.com

Katarzyna CZECH
Department of Econometrics and Statistics, Institute of Economics and Finance
Warsaw University of Life Science[2], Poland
katarzyna_czech@sggw.edu.pl

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Abstract:

Agriculture or agrarian sectors together with non-resource manufacturing can be the key drivers of non-mineral development among natural resource-rich countries. However, agricultural development lags behind the extractive industry which puts a big share of the labor force into an uncertain position and creates food security risks. In Azerbaijan, which is an oil-rich post-soviet country, details focus on individual exports like vegetable exports that have not been carried out against specific economic indicators such as the Extractives Dependence Index (EDI), the Real Effective Exchange Rate (REER), *etc.*

This paper is based on one-way variance analysis (ANOVA) and Tukey's honest significance test (Tukey's HSD test), as well as the Granger causality test. Our analysis shows that Azerbaijan's dependency on natural resources (measured by the EDI) has a significant effect on the value of vegetable exports. Moreover, the Granger causality test revealed a one-side causal relationship from the REER and production costs to the vegetable exports, at a 10% significance level. Similarly, a unidirectional Granger causal relationship from crude oil prices to the REER, at a 1% significance level was found. Thus, our findings indicate that overall Dutch disease affects the Azerbaijan economy towards vegetable exports.

Keywords: Dutch disease; Azerbaijan economy; agriculture sector; agrarian sectors; vegetable exports; non-oil sectors.

JEL Classification: C01; C12; F41; Q17; Q33.

Introduction

After the break-up of the Soviet Union, member countries entered into an era of broad-based uncertainty, political instability, economic collapse, civil wars, and social distrust. Economic recovery and reforms started to emerge between 1995–2000 (Spoor and Veisser 2001) to catch up with the rest of the world, as well as to restore the collapsed economic capacities. Meanwhile, new economic and social conditions challenged the old economic structures and posed a barrage of impediments to establishing long-term sustainable economic growth and development. Resource-rich countries, however, preferred to follow extractive industry-led recuperation which established multiple conundrums to having balanced economic growth, sustainable development, and long-term-oriented government policies. Disequilibrium in the economic structure - having booming sectors that produce the highest value-add and take the lion's share in exports, while certain economic sectors exhibit serious deterioration - is one of those challenges.

The role of the mining industry in Azerbaijan's total industrial production rose from 13% (1991–1996, independence and transition period) to 49.5% (1997–2008, pre-oil boom period) and 73.2% (2009–2018, post-oil boom period) (SSCRA 2020). Relevantly, mineral (mainly oil) exports took a share of 61.8% in total exports in the period of 1994–1999 but since the oil boom started in 2008, mining exports have gained a share of 92.5% in2019 (SSCRA 2020). Needless to mention, the mining industry contributed the highest value-add in overall GDP and sourced the main tax income in Azerbaijan. Also, increased oil extraction and exports boosted gross domestic product (GDP), GDP per capita, and government spending.

[1] 6722 Szeged, Kálváriasgt. 1., Hungary
[2] Nowoursynowska St. 166, 02-787 Warsaw Poland

The main concern pops up about Azerbaijan's economic structure, as oil-rich countries do not tend to develop their agricultural sectors during periods of high dependency on oil revenue (Czech 2018a). As mineral discoveries are being found, increased extraction, production, and exports bring in a high amount of foreign currency, and the associated negative externalities create Dutch disease effects (Czech 2018b).

Briefly, first modeled by Corden and Neary (1982) and Corden (1984), Dutch disease refers to the diminished non-resource output and exports in the Netherlands economy due to the natural gas discoveries (The Economist 1977). The theory describes two main effects that make the Dutch disease phenomenon occur: resource movement effect and spending effect. Brahmbhatt *et al.* (2010) summarize the Dutch disease effects as follows: the resource movement effect is the withdrawal of the labor and capital resources in favor of booming sectors which reduces the output and labor in non-tradable and non-resource tradable sectors. Meanwhile, the spending effect happens when the government (or other factor owners and revenue beneficiaries) spend part of the income, thus increasing the aggregate demand toward the non-tradable sector, as well as the price levels in the tertiary sectors.

Agricultural and agrarian sectors play a significant role in food security and employment, as well as having historical importance in many countries. Common sense in economic development studies always argued about the importance of agricultural productivity followed by rapid industrialization as a source of long-term sustainable economic growth (Timmer 1988). Productivity growth in agriculture allows increasing income per worker by boosting the shift of the labor to the other sectors, especially to industry, thus leading to the industrialization process (Gollin *et al.* 2002). Any delays in modernization and failures in agricultural reforms impact the rest of the economy notably, especially the poor countries that try to catch-up with high-income countries (Gollin *et al.* 2002). Thus, Azerbaijan's extractive industry-based economic development activates concerns about the non-oil tradable sectors' fate, especially agrarian sectors because agrarian output compounds the agriculture and manufacturing sectors that exhibit a sensitivity to the Dutch disease effects.

Because of the unstable nature of the international commodity markets, oil exporter and small countries like Azerbaijan started to face new economic challenges (Khalilov *et al.* 2020). In general, there is a negative downward trend among the commodity prices in the international markets (Arezki *et al.* 2014) which creates risks in front of the stable revenue stream for the resource-dependent countries. The new challenges appear in front of the national economy of Azerbaijan as oil and gas reserves diminish, the buyers of oil and gas products diversify their suppliers, new environmental standards appear, and innovative industrial progress becomes more and more inescapable (Khalilov *et al.* 2020). That is why, taking into account the advice of the international financial organizations, the priority sectors to develop non-oil sectors include agriculture, tourism, information and communication, and processing industries, as 44% of the population engages in the indicated economic activities (Mammadova 2019). The government's decision to exclude agricultural producers from taxation, and Azerbaijan's new laboratories to test food quality, animal and plant health point to the attention and care toward agriculture and agrarian sectors in Azerbaijan (Godjaeva 2019). Moreover, recently the government organized the Agrarian Insurance Fund to support the dairy farmers (Azertag 2020). However, does the economic structure and macroeconomic conditions support this intention? More importantly, do the vegetable exports as the main representative show any sensitivity to resource dependency in Azerbaijan?

Macroeconomic stability is a touchstone of the production and export possibilities of a given country. Despite the numerous decisions, new trends, plans, aims, and strategies about agriculture, particularly the agrarian sectors, the relationship between the historical evolution of the macroeconomic indicators and main agrarian exports needs to be examined. Especially, employing a particular theory like Dutch disease to conceptualize the economic structure via the carefully chosen economic variables of interest. This paper aims to fill this gap by focusing on vegetable exports by applying ANOVA, Tukey's HSD test, and Granger causality tests. Our report is of high scientific interest as, to our knowledge, the current paper is the first examination of non-oil sub-sectoral Dutch disease effects, employing the calculated EDI index for Azerbaijan.

Dutch disease syndrome has been attributed several times to the Azerbaijan economy (Gahrmanov and Fan 2002, Bayramov and Conway 2010, Hasanov 2013a, Niftiyev 2020a). If agriculture and agrarian sectors did not experience productivity improvements and the oil revenue was not efficiently managed through state support and fiscal spending, then we face serious growth and development issues that endanger the long-term non-oil development of the country. If international competitiveness cannot be achieved through proper exchange rate management, the suffering of agriculture and agrarian exports might delay the diversification of the national income. This is because agriculture and agrarian sectors play an important role in the employment of the country and also present opportunities to diversify the exports of the products in a short-time range.

To fulfill the paper's aim and intentions, this study contains four main sections. The next section is the literature review which conceptualizes the Azerbaijan economy within the development of non-oil sectors and

argues about the realities of agriculture and agrarian sectors on the background of Dutch disease theory. The second section describes the data and applied methodologies. While the third section reports the results, the last section concludes.

1. Literature Review

1.1. How to Conceptualize the Azerbaijan Economy? Dutch Disease Perspective

Azerbaijan is an oil-rich country that chose extractive industry-based development after gaining the status of the former Soviet Union (FSU) in 1991. This developmental path created diverse challenges in addition to the transition process from a centrally planned command economy to a market-based economy. That is why, before focusing on the realities and main determinants of agrarian sectors in Azerbaijan, the recent economic history and developments force us to overview the agriculture and agrarian sectors in the context of the non-oil sectors. Due to the dependent nature of the Azerbaijan economy on oil revenue (Czech 2018c), there is a wide range of factors related to the non-oil segment of the national economy that heavily determine the growth and development of non-oil sectors. Therefore, the literature widely discusses the performance and the main determinants of non-oil sectors and particularly agrarian sectors in Azerbaijan since independence from the Soviet Union. There has been a high amount of concerns related to the economic mismanagement and retardments of the non-oil sectors in the country that could be the result of the confidence sourcedfrom the high oil revenue (Singh and Laurila 1999), political disinterest (Mahnovski 2003), natural resource curse (Gojayev 2010, Gasimov 2014) or Dutch disease syndrome (Hasanov 2013a, Niftiyev 2020a).

The main international trade indicators of Azerbaijan are highly cyclical concerning the oil prices (Niftiyev and Namazova 2020) that put the Azerbaijan economy in a dependent situation against oil production and oil prices (Humbatova *et al.* 2019). The cyclical nature of the national economy, together with the volatile oil revenue creates troubling conditions for non-oil sectors as they are highly dependent on state support (Ibadoghlu *et al*. 2013). In fact, agricultural sectors are heavily subsidized based on the size of the cultivated land (Sadigov 2018) which is a common picture among the resource-rich, Dutch disease countries where non-resource sectors fail to exhibit long-term sustainable growth and development (Karl 1997). Some argued that oil revenue and extractive industry-led economic development damages the non-oil sectors in Azerbaijan leading to low-level economic diversification (Kaser 2003). Concerning this, the deteriorative effect of oil and gas sectors mainly happens through the Dutch disease channel of the resource curse theory.

The resource curse, coined by Auty (1993), is the phenomenon that tries to explain why mineral-rich countries tend to grow slower compared to resource-poor countries. It is a paradoxical situation because extractive industries usually provide finance that can be injected into the economy to support the non-resource development of the country. However, it is not always the case because of low institutional quality and transparency issues (Cabrales and Hauk 2011, Williams 2011), rent-seeking behavior (Wadho 2014), corruption (Dietz *et al.* 2007, Aldave and García-Peñalosa 2009), and civil conflicts (Angrist and Kugler 2008). Resource curse has been investigated in Azerbaijan's case (Gojayev 2010, Gasimov 2014) but a conclusive statement is rare. However, the most prominent channel seems to be Dutch disease syndrome.

Dutch disease is one of the main channels of the resource curse (Karabaegovic 2009). Corden and Neary (1982) and Corden (1984) proposed the first model of the Dutch disease hypothesis to understand a resource boom as a discovery of natural resource sources, technical improvements, or price upheavals in an open and small economy. The model assumes three sectors: booming, lagging, and non-tradable. At the risk of oversimplification, the main assumptions are as follows summarized by Mironov and Petronevich (2015): there are two production factors: labor and capital; different sectors have different labor-to-capital ratio; labor is mobile, in the short-run capital is sector-specific; the employment is full; the labor market is flexible, and internal demand is the only source of the domestic consumption. The original model (Corden and Neary 1982) assumes two effects, namely, resource movement and spending effect. According to the literature review by Badeeb *et al.* (2017), income inflow into the country generates higher demand for the goods and the prices increase, which in turn decreases the competitiveness of the country's exports through the price channel (spending effect). The other effect, the resource movement effect occurs when booming sectors take the capital and labor out of the lagging and non-tradable sectors, decreasing their employment and output and imposing a huge opportunity cost (Fardmanesh 1991). However, in the countries where booming sectors are capital-intensive rather than labor-intensive, the resource movement effect is rare.

As Corden (2012) argues, inflationary processes sourcing from the exchange rate appreciation, inflows of FDI, and increases in price levels of the non-tradable sectors impose a significant challenge to the resource-rich countries that have booming sectors. In fact, in the case of Azerbaijan as a small, open, resource-rich and transition

country, appreciation of the REER, an upward trend in the share of non-tradable and resource goods, as well as, high concentration on the taxation of the resource extraction was well observed during the first years of independence from the Soviet Union (Rosenberg and Saavalainen 1998). It was similar to other transition countries. De Broeck and Sløk (2001) empirically advocated for exchange rate appreciation if transition countries cannot increase their domestic production.

Azerbaijan was considered a Dutch disease-infected country because of the strong and significant connection between the oil price and domestic price levels (Huseynov 2019, Ağazade 2018, Dikkaya and Doyar 2017), de-industrialization signs (Niftiyev 2020a, Hasanov 2013a), and negatively influenced non-oil exports (Hasanov and Samadova 2010). Of course, the existence of the Dutch disease hypothesis was also objected to. For instance, an early study from Gahramanov and Fan (2002) indicated the absence of Dutch disease because of the non-existence of the necessary monetary signs of Dutch disease. Moreover, according to the theory, traded firms should experience Dutch disease effects during the resource boom periods of the national economy; however, the findings from Bayramov and Conway (2010) indicated that neither traded firms nor non-traded firms differed in terms of the responses to the resource shocks and financial crisis, which is quite a surprising finding on the firm level. Nevertheless, there is numerous solid analysis that points to the existence of the phenomenon rather than its absence.

The appreciation of the REER negatively influences non-oil growth (Hasanov and Huseynov 2013; Mukhtarov *et al.* 2020). In terms of fiscal policy, a 1% increase in budget expenditure increases non-oil GDP by 0.55% in the long-run (Aliyev and Nadirov 2016). Similarly, Aliyev *et al.* (2016) indicated that public expenditure positively affected the output of non-oil sectors in the range of 2000Q1–2015Q2. Non-oil GDP positively responds to the directed investments and real exchange rate improvements (Mukhtarov *et al.* 2019). These findings were in line with the research from Hasanov (2013b) that private investments and state spending boost non-oil sectors in the Azerbaijan economy. Moreover, Hasanov (2013a) identified a weak link between private investments and the higher importance of government spending over non-oil GDP. Furthermore, on the background of the mentioned interconnections, limited product coverage, low level of export geography, low level of export diversity, technological limitations, scarcity of exports, and low capacity of private sectors extensively downscale the economic potential of non-oil sectors (BRI Economic Team 2020).

In contrast to the ideas that defend the harmful effects of the resource sectors on non-resource sectors, certain scholars evaluated the accumulated oil revenue as an opportunity to develop non-oil sectors in Azerbaijan. For instance, Karimov (2015) evaluates the increased role of oil sectors and accumulated mineral revenue as a chance to develop non-oil sectors with the help of increased spending of the state budget. Humbatova and Humbatova *et al.* (2020) noted that non-oil sectors are a priority for the Azerbaijan Government and it has the potential to boost the export potential of the country. Regarding agricultural and agrarian sectors, the state heavily subsidized, cut the taxes, and stimulated the farmers to cultivate the unfavored lands by income support (Danilowska *et al.* 2014). However, without institutional mechanisms to regulate oil revenue, to manage fiscal resources, and to maintain transparent governance, serious impediments will remain to achieving a better non-oil developmental path (Aslanli 2015). There are already concerns about underperformance concerning the adopted economic policy goals (Ibadoghlu 2020).

The events of 2014-2015 showed that high dependency on oil impacts the resource-rich countries who specialize in energy exports as they experienced decreased government spending, state budget deficits, the balance of payments, and trade imbalances (Aleksandrova 2016). If we add other issues related to the non-oil development of the national economy like high demands for the collateralization of the financial loans (Alirzayev and Abdurazzakov 2016), low-interest rates of the commercial banks and non-bank financial organizations to finance agricultural activities (Danilowska *et al.* 2014); labor-intensive and inefficient nature of agricultural sectors because of small farm sizes (Danilowska *et al.* 2014) we can understand that opportunities and threats are hand-in-hand in Azerbaijan's case in regards to achieving sustainable long-term non-oil economic development.

Macroeconomic developments that the Dutch disease model encompass heavily identify the direction of success and sustainable long-term development of non-oil sectors, including the agriculture and agrarian sectors in the Azerbaijan economy. By the same token, financial factors reflect high priorities for managing the successful formation of the agrarian sectors. For example, Hasanov and Huseynov (2013) found a positive co-integration between non-oil economic growth and financial development. This finding supported the claim by Bairamli and Kostoglou (2013) that domestic savings can promote the growth and economic viability of non-oil sectors through developed financial systems, domestic savings, and private investments. The flow of Foreign Directed Investments (FDI) into non-oil sectors should be raised to maintain sustainable development and to ensure the long-term success of the national economy (Ibadoghlu 2012). Papyrakis and Gerlagh (2003) pointed to the investment

channel as a significant and distinct channel of the resource curse. If it is not well-managed and regulated, inefficiencies and disincentives might impede the growth of agrarian sectors. All in all, we can easily observe a contrasting picture: on one hand, huge revenue streams create opportunities to restructure and revitalize the agrarian sectors, on the other hand, multiple challenges emerge out of the market and institutional failures.

1.2. Agriculture and Agrarian Sectors in Azerbaijan

Each FSU country has had its specificities and local realities to restructure and rebuild the collapsed agrarian sectors since independence from the Soviet Union. Hoffman and Visser (2014) listed those specific characteristics like lack of mechanization in the agrarian sector, the needlessness of the large infrastructure (meaning already established infrastructure), and narrow specialization according to the economic pathways determined by the command economy. FSU countries followed the recommendations and suggestions of the international organizations to restructure their agriculture and agrarian sectors to stabilize the economy. For instance, Russia and Kazakhstan stick to large-scale farming, while Azerbaijan committed to individual farming via the individual redistribution of land after the collapse of the Soviet Union (Rzayeva and Rzayev 2019). Following Hoffman and Visser (2014), it should be noted that agriculture in Caucasian countries was traditionally horticulture and extensive livestock-oriented. The authors also evaluated the Caucasian countries as leader countries where agricultural reforms were implemented compared to the Central Asian countries. The main consensus for the agricultural reforms was the recommendations of the international financial organizations like IMF, WTO, and World Bank to dismantle large-scale farming (Maharramov 2020). As cited in Rzayeva and Rzayev (2019), Aslund (2013) evaluated Azerbaijan as a "star performer' in terms of economic catch-up and reformation of the economy.

However, Spoor and Visser (2011) argued about the shortcomings of the adopted agrarian reforms. They indicated that the reforms offered by international organizations oriented FSU countries wrongly, centering China and Vietnam (rice-producing countries) on the reform agenda. If we consider the fact that before independence, "monoculture cropping and mismanagement of agro-ecosystems resulted in environmental problems, which further reduced productivity and competitiveness of the agricultural sector' (Aksoy *et al.* 2018, 81) in Azerbaijan, we can easily understand how big challenges came true during early stages of the market reforms. Under these conditions, post-soviet economies, including Azerbaijan experienced a set of challenges to adapt and restructure its agriculture and agrarian sectors to the market conditions. Suddenly finding yourself in the middle of the harsh capitalistic competition after approximately 70 years of centrally planned economic structure put a mountain of pressure on the shoulders of the economic agents who cannot push through the market barriers among the international market players. The inefficiency of the agricultural markets, lack of results, and various structural factors delayed the desired development of the agriculture and agrarian sectors among FSU countries, including Azerbaijan.

Today, agriculture is highly protected in Azerbaijan as it provides a big share of employment despite occupying a small share of overall economic output (Cornell 2014). It was difficult to restructure agrarian sectors in Azerbaijan due to the low opportunities to utilize modern inputs and the lack of educated farmers (Lamers *et al.* 2000). Compared to the other FSU countries like Russia and Belarus, agricultural productivity is low (Cornell 2014). Huge mineral revenue challenged the adaptation of the agrarian sector to modern conditions. So, the sustainable growth and development of agriculture were troubling in Azerbaijan during 2006–2008, just before the peak of oil production and revenue (Ibadoghlu 2008). Despite Aliyev (2019) stressing that the agrarian sector is the key area for Azerbaijan to participate in the global value chains, Morgan *et al.* (2019) evaluated the agrarian export potential of Azerbaijan as very low because of the minimal role of SMEs (Small and Medium-Sized Enterprises) in processing industries and small farm sizes. The low role of SMEs creates uncertainties about mobilizing the market forces to fulfill the export-oriented growth of agrarian sectors against the background of low FDI and national currency appreciation. Despite the economic importance of agriculture decreasing in the background of the extractive industry's dominance since the beginning of the 1990s, agriculture still plays a significant role in the economic self-sufficiency of rural households. However, the agricultural farms are mainly subsistence in nature and only surplus production is marketed if the government's subsidies were efficiently channeled (Ahouissoussi *et al.* 2014).

Nevertheless, benign conditions still existed to rebuild agriculture and agrarian sectors during the late 1990s. For example, Krajnak and Zettelmeyer (1998) found that the equilibrium dollar wages in Baltic states and Central and Eastern European countries have appreciated but in Commonwealth of Independent States(CIS) countries they were flat. It was a positive sign in terms of affordable production factors in the economy of the CIS countries to mobilize them and increase the employment and output. Furthermore, in 1996 actual dollar wages were under the estimated equilibrium values. The authors also suggested the upcoming actuality of the competitiveness issues related to the exchange rate policy among CIS countries. Shalbuzov *et al.* (2020) found that Azerbaijan's agricultural exports hold a competitive advantage in the Russian and European markets. Also,

Kerimova (2014) argued that the agrarian sector performed stably in Azerbaijan, thus creating a huge capacity to absorb domestic investments. Increased investments and steady output levels might guarantee stable export levels, as well as the fulfillment of the domestic demand.

There are new trends, challenges, and developments in agriculture and agrarian sectors that have occurred together with the macroeconomic developments that provide new opportunities to reorient the established possibilities of the agrarian sector in Azerbaijan. For instance, ecologically clean products (organic goods) and tea production (Mammadli 2020) took on new momentum which is a new path to entering the global value chains. The Law on Ecologically Clean Agriculture in 2008 provided the legislative infrastructure to go on with organic agro-food supply chains (Aksoy *et al.* 2018). From the consumers' side, increasing income and urbanization levels provided additional opportunities to expand the agrarian sectors in the domestic market (Van Berkum 2017).

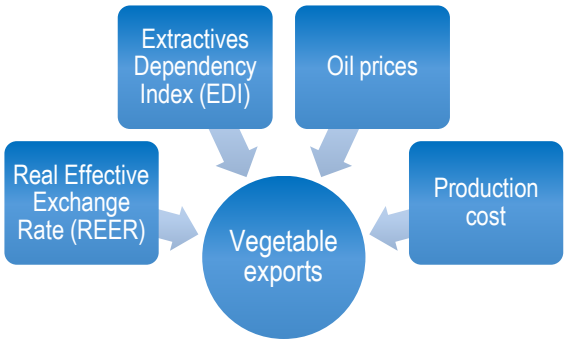
Important factors and conditions of sustainability should not be ignored to achieve long-term results. Guliyeva and Lis (2020) identified important factors that determine the supplier food sustainability in the food industry: ownership and price of lands, workforce, climate, and certification standards. The institutional framework of Azerbaijan fails to build reliable checks and balances to regulate the compliance of the produced agro-foods in terms of international standards (Van Berkum 2017). Also, the general diagnosis of sustainability from Gulaliyev *et al.* (2019) reported that the sustainability of Azerbaijan's agriculture is weak concerning the economic and environmental aspects of the national economy which creates a gap between rural and urban regions of the country. Dependency on the Russian market poses another impediment to having a solid conclusion about the sustainability of agricultural and agrarian exports (Van Berkum 2017). Besides, measurement of the agricultural and agrarian sustainability should also encompass soil management, grazing, cropping, and farm-level observation (Hayati *et al.* 2010) which is highly ignored in Azerbaijan's case.

1.3. Theoretical Framework and Research Paradigm

Multiple economic conditions function together to determine the development level of non-resource sectors among resource-rich countries and Azerbaijan is not an exception. The coordination of them is the fundamental point of departure toward the necessary actions to boost non-oil sectors. For example, financial development, fiscal policy, exchange rate policy, should not be eliminated from the matter of interest regarding the development of non-oil sectors or non-oil economic growth in Azerbaijan and other resource-rich transition countries. That is why the proper incorporation of decisive economic indicators will provide a better understanding of the growth possibilities of the agrarian sectors on the background of macroeconomic settings.

Despite the overall macroeconomic environment recovering since 1996, its contribution to agricultural development remains poor (Sedik 2006). After the comprehensive review that summarized the main nature of the non-oil sector in the Azerbaijan economy and agrarian sectors, the theoretical framework described below identifies the research design and assumed relationships among the macroeconomic determinants that the Dutch disease model predicts and agrarian exports. For instance, if the variables like the REER, EDI, oil prices, and production cost (in terms of production cost per 100 kg fruits and vegetables, as well as in terms of labor input in hours per worker) increase domestic agrarian output might shrink, thus discouraging agrarian exports too. Hence, the main theoretical economic expectation is a negative link between agrarian exports and the variables of interest.

Figure 1. The main determinants of agrarian exports determined by the Dutch disease theory.



Source: Own construction

2. Methodology and Data

As the special focus of the current paper is the cost of production and export value in current prices regarding vegetables, production cost per 100 kg among agricultural enterprises and export value in USD have been utilized.

To operationalize Dutch disease effects on vegetable exports, the EDI, oil prices, and the REER have been included in the analysis as well. Table 1 presents the variable names, observation numbers, missing values, and the method of how they were handled in more detail, alongside the description of the data sources.

The time range is 1994–2019 for all variables. Missing values were replaced by the trend function of Excel Microsoft Office software, version 15.26 by applying linear interpolation and extrapolation methods. State Statistical Committee of the Republic of Azerbaijan (SSCRA), Ministry of Finance data sets, Bruegel data sets, US Energy Information Administration, etc. enter the list of the data sources that are highly reliable and official.

Table 1. Variables and data sources.

Variables name	Obs. No.	Missing value	Missing Value replacement method	Data source
Extractives Dependency Index (EDI)	26	1	Imputed by the series mean for the year 2019	Own construction based on the SSCRA, http://budget.az/, Ministry of Finance of the Republic of Azerbaijan data sets.
Oil prices, USD per barrel, Brent Trademark	26	0	–	US Energy Information Administration
Real Effective Exchange rate (REER), in % (2007 = 100%), based on 66 major trading partners	26	0	–	Bruegel data sets
Production cost per 100 kg of vegetables in agricultural enterprises, in AZN	26	2	Computed via the TREND function of Microsoft Excel for the years 1994 and 2019	SSCRA
Exports of vegetable products, thousand US dollars	26	0	–	SSCRA

While Table 2 reports the descriptive statistics of the variables of interest, Formula 1 is the calculation method of EDI. During the calculation of EDI in the case of Azerbaijan, some notes should be mentioned to avoid any uncertain aspects. For example, non-resource income was mainly based on non-oil tax revenue which was available from 2005 to 2018. The missing values were calculated by finding the share of 38.5% (which is the average share of non-resource tax revenue between 2005 and 2018) for the period 1994 – 2004 to extend the data range to incorporate with other elements. Moreover, the EDI index for 2008 originally was 17.8 which was an outlier and was replaced by the next most common and high value – 4.91. All in all, this calculation of EDI for Azerbaijan is among the first trials and may not reflect full methodological sufficiency.

Table 2. Descriptive statistics of the variables of interest.

Variable	Mean	Median	St. Dev	Max.	Min.	S	K	JB (p-value)
EDI	1.5	1.4	1.5	4.9	0.0	1.0	3.0	4.0
Oil prices	53.7	53.2	32.6	111.6	12.8	0.4	2.0	2.1
REER	98.4	95.7	23.3	140.5	45.4	0.1	2.5	0.3
Production cost	8.3	7.73	3.4	15.3	4.28	0.8	2.5	2.9
Vegetable exports	199,228.1	19,829.1	185,899.4	625,904.0	5,961.2	0.8	2.7	2.8

Source: SSCRA, Bruegel data sets (2020), US Energy Information Administration (2020), http://budget.az/ (2020), Ministry of Finance of the Republic of Azerbaijan data sets (2020).

Azerbaijan's EDI has been calculated according to Hailu and Kipgen's (2017) methodology following the formula described below:

$$EDI = \sqrt{[EIX_t \times (1 - HTM_t)] * [Rev_t \times (1 - NIPC_t)] * [EVA_t \times (1 - MVA_t)}} \quad (1)$$

where: EDI is Extractives Dependence Index for a country in time *t*; EIX is revenue of extractive industries expressed as a share of total export revenue; HTM is export revenue from high-skill and technology-intensive manufactures as a share of global; HTM exported in year *t*; Rev is the share of the extractive industry's revenue in total fiscal revenue; NIPC is non-resource income that includes tax revenue, profits, and capital gains as a percentage of GDP; EVA is the share of extractives industries value-added in GDP; MVA is countrywide non-resource manufacturing potential measured by the per capita manufacturing value-added.

Presentation of the correlation results is the widespread experience among the empirical studies. We not only present Pearson's R correlation coefficient among the variables of interest, but also Spearman's rho correlation coefficients. The main reason for this is to show if any distorting powers exist because of outliers in the raw data which is not normally distributed (only REER is normally distributed, see Table 3). The results in Table 3 indicate that there is a strong and positive correlation between the REER and production cost per 100 kg of vegetables in agricultural enterprises, as well as between the export of vegetable production that implies more expensive products during oil booming but also higher export levels. Correlation analysis also shows that increased EDI and an increase in production cost happened together.

Table 3. Pearson's R Correlation Matrix

	Variable name	1	2	3	4	5	Shapiro-Wilk Normality Test (p-value)
1	EDI						0.192
2	Oil prices	.80**					0.026
3	REER	.44*	.57**				0.004
4	Production cost	.78**	.66**	.47*			0.018
5	Vegetable exports	.46*	.61**	0.09	.53**		0.006

Notes: The null hypothesis for the Shapiro-Wilk normality test is that the data is normally distributed; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Source: Own calculation based on SSCRA (2020), Bruegel data sets (2020), US Energy Information Administration (2020), http://budget.az/ (2020), Ministry of Finance of the Republic of Azerbaijan data sets (2020).

Spearman's Rho correlation shows similar results to Pearson's R. However, there is no statistically significant correlation between the EDI and the REER and also there is a higher statistical significance between the exports of vegetable products and the REER. All in all, there is an interesting starting point to argue that Dutch disease effects might impact vegetable exports through more expensive production. If the production becomes expensive, then export levels may shrink. In addition, working papers from Niftiyev (2020b) and Niftiyev (2020c) clarified that there were negative and statistically significant correlations between agriculture value-add and the EDI, value-add per worker and value-add in agriculture, investments and agriculture value-add, and exchange rate appreciation negatively affects the volume and value of real and nominal exports of fresh fruits, as well as fresh vegetables.

Based on the one-way variance analysis (ANOVA) and Tukey's honest significance test (Tukey's HSD test) we check whether the level of resource dependency has a significant impact on the vegetable exports in Azerbaijan. The EDI is assumed to be a factor that has four levels. The first-level "low', represents a low level of the country's resource dependency, *i.e.* the EDI index lower than 0.22. The "medium' level is assigned to all years when the EDI index is in the range between 0.23 and 1.34. The "high' level is attributed to all annual periods with the EDI index in the range between 1.35 and 2.46. The last level "very high' represents the highest level of the country's resource dependency, *i.e.* the EDI index higher than 2.47.

Table 4. Spearman's Rho correlation matrix

	Variable name	1	2	3	4	5
1	EDI					
2	Oil prices	.74**				
3	REER	0.35	.62**			
4	Production cost	.69**	.72**	.47*		
5	Vegetable exports	.57**	.74**	0.27	.75**	

Notes: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Source: Own calculation based on SSCRA (2020), Bruegel data sets (2020), US Energy Information Administration (2020), http://budget.az/ (2020), Ministry of Finance of the Republic of Azerbaijan data sets (2020).

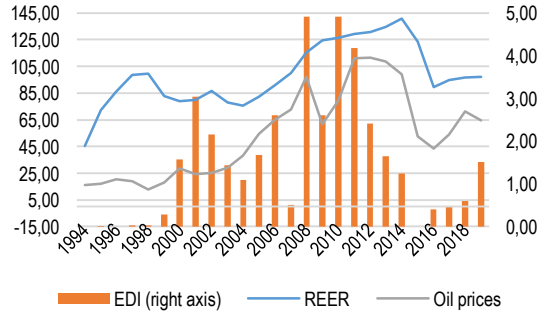
Additionally, we apply the Granger causality test (Granger 1969) to assess the causality between the value of vegetable exports and main macroeconomic variables related to the Dutch disease phenomenon, i.e. crude oil prices, real effective exchange rates, and production cost of vegetables (Scheme 1). X is said to Granger-cause Y if Y can be better predicted using the lagged values of both X and Y than it can by using the history of Y alone. The null hypothesis states that X does not Granger-cause Y. The Granger causality test is sensitive to the stationarity of the variable series. The analysis is based on the first differences of the logarithmic values of the original time series. The series stationarity is checked based on the augmented Dickey-Fuller (ADF) test (Dickey and Fuller 1979).

3. Results

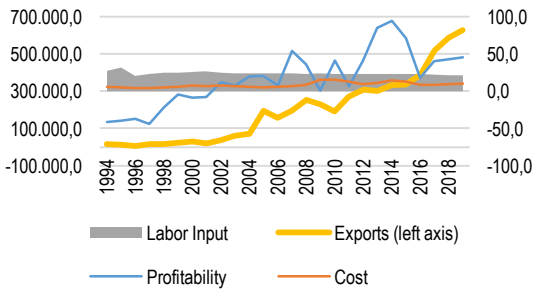
The essential source of concern that agriculture and agrarian exports might get a negative impact from booming oil and gas sectors relies on the key economic indicators like oil prices, the REER, and our constructed index which is EDI. High oil prices stimulate the government-owned oil industry to produce more and export more, pushing the REER up and making the country's exports more expensive to foreign buyers. Undoubtedly, it decreases the competitiveness of non-oil sectors, weakening the country's external position. Figure 1 panel shows an increasing trend in oil prices from the beginning of the 2000s until 2014–2015 in parallel with the appreciated REER. This also coincides with the increase in the EDI.

Figure 1. Key indicators and vegetable data, 1994–2019

a. Extractive Dependency Index (EDI, index number), Real Effective Exchange Rate (REER, in %, 2007=100%), and oil prices (BRENT trademark, in USD per barrel)



b. Labor input (per 100 kg of vegetables in agricultural enterprises, person/hour), Profitability (sold by agricultural enterprises, %), Production cost (per 100 kg of vegetables in agricultural enterprises, in AZN), and Vegetable exports (thousand USD).



Source: Own calculation based on SSCRA (2020), Bruegel data sets (2020), US Energy Information Administration (2020), http://budget.az/, Ministry of Finance of the Republic of Azerbaijan data sets (2020).

The other side of this picture is related to non-booming or lagging sectors which agriculture and agrarian exports nicely represent. Despite overall vegetable exports rose since 1994, the profitability was highly volatile (Figure 1, panel b). Moreover, labor input and cost indicators do not point to any productivity-driven development. Consequently, these points allow conceptualizing a negative association between vegetable exports and the dependence of the Azerbaijan economy on non-booming sectors like agriculture.

Based on ANOVA and Tukey's HSD test we indicate that there are significant differences observed regarding the vegetable export value depending on the EDI in Azerbaijan. The estimated F statistics equals 3.88 and the corresponding p-value equals 0.023. It implies that the mean values of vegetable export differ significantly with different levels of the EDI, at a 5% significance level. Additionally, the paper tests all pairwise comparisons among means by applying the Tukey HSD test. Tukey's HSD test results are presented in Table 5.

Table 5. Differences in values of vegetable exports depending on the value of the Resource Dependency Index: Tukey's honest significance test (Tukey's HSD test)

Difference between EDI Index levels	Difference value	p-value
low - high	-8.95	0.099
medium - high	0.57	0.998
very high - high	-8.12	0.151
medium - low	9.52	0.072
very high - low	0.83	0.996
very high - medium	-8.69	0.113

Source: Own calculation based on SSCRA (2020), Bruegel data sets (2020), U.S. Energy Information Administration (2020), http://budget.az/ (2020), Ministry of Finance of the Republic of Azerbaijan data sets (2020).

Tukey's HSD test results show that there are significant differences in average values of vegetable exports between low and high, and low and medium levels of the EDI, at a 10% significance level. The result suggests that the country's resource dependency level has a significant impact on the value of vegetable export in Azerbaijan. Dutch disease phenomenon is closely related to the resource dependency issue (Badeeb *et al.* 2017).

To assess the causality between the value of vegetable exports and main macroeconomic variables related to the Dutch disease phenomenon, *i.e.* crude oil prices (Oil), real effective exchange rates (REER), and production

cost of vegetables (Production Cost) (Scheme 1) we apply the Granger causality test. The Granger causality test is sensitive to the stationarity of the variable series. Table 6 presents the calculated t-statistic for the ADF unit root test. The ADF null hypothesis assumes that the time series contains a unit root and therefore is non-stationarity.

Table 6. The augmented Dickey-Fuller test results

Variables	Level		First differences	
	intercept	intercept and trend	intercept	intercept and trend
Vegetable Export	1.62	-1.19	-6.41***	-6.28***
Oil	-1.52	-1.57	-4.26***	-4.29**
REER	-1.92	-2.16	-4.47***	-4.14**
Production Cost	-1.80	-3.25	-4.17***	-4.09**

Note. *** H_0 is rejected at the 1%, **5%, and *10% significance level.

Source: Own calculation based on SSCRA (2020), Bruegel data sets (2020), US Energy Information Administration (2020), http://budget.az/ (2020), Ministry of Finance of the Republic of Azerbaijan data sets (2020).

The results of ADF tests presented in Table 6 show that the analyzed time series are integrated of order 1. We obtain the stationarity processes by applying the first differences of the logarithmic values of the original time series. Table 7 presents the estimated Granger Causality F test statistics and the corresponding p-values.

The Granger causality test reveals a one-side causal relationship from the REER and production cost to the vegetable exports, at a 10% significance level (Table 5). However, the null hypothesis that crude oil prices (Oil) do not Granger-cause vegetable exports cannot be rejected. Moreover, we reveal a unidirectional Granger causal relationship from crude oil prices to the REER, at a 1% significance level.

Research results show that there is no Granger-causal relationship between oil prices and vegetable exports, but there is a significant relationship between oil prices and the REER, and a significant relationship between the REER and the value of vegetable export. This indicates that the vegetable export might be related to crude oil prices indirectly through the link with the real effective exchange rate. The results are in line with the Dutch disease theory and Scheme 1.

Table 7. Granger causality test results

Dependent variable (Y)	Predictor variable (X)	F test statistics	p-value
Vegetable Export	Oil	0.07	0.786
Oil	Vegetable Export	0.07	0.797
Vegetable Export	Reer	4.03	0.058
REER	Vegetable Export	0.18	0.672
Vegetable Export	Production Cost	3.55	0.074
Production Cost	Vegetable Export	0.52	0.480
REER	Oil	9.14	0.007
Oil	Reer	0.91	0.352
Production Cost	Oil	0.69	0.415
Oil	Production Cost	0.30	0.590
Production Cost	Reer	0.22	0.642
REER	Production Cost	2.50	0.129

Source: Own calculation based on SSCRA (2020), Bruegel data sets (2020), US Energy Information Administration (2020), http://budget.az/, Ministry of Finance of the Republic of Azerbaijan data sets (2020).

Conclusion

Sectoral investigation of the Dutch disease effects in one economy might lead to a better understanding and clear perception of resource-rich economies such as Azerbaijan. The findings of this study reveals that the different levels of EDI index impact vegetable exports differently which puts the resource dependency or Dutch disease phenomenon in the position of being the main identifier of the competitiveness of this particular non-oil, agriculture sector. The findings emphasize the existence of Dutch disease effects in the Azerbaijan economy; however, in a new way which is based on the resource dependency concept. Lower resource dependency generates more stimuli to export because of lower levels of the REER; however, oil prices did not cause direct and statistically significant impact on vegetable exports.

The limitations of this study shed light on the aspects of the new approaches which can be used to reanalyze the sectoral Dutch disease effects. For instance, new variables like real exports, extraction quantity, domestic inflation, the growth rate of non-tradable, *etc*. are popular among Dutch disease studies. Also, instead of one

general time range (*e.g.* between 1994 and 2019, as per this paper's focus), different, smaller periods can be applied to differentiate among the time-based sub-samples. In the case of the emergence of new, monthly, or quarterly-based data sets, this research can generate even greater results. Current and prospective studies regarded specific sectoral Dutch disease perspectives, will guide government institutions and units to monitor and respond at a micro level to fight the adverse effects of resource dependency in Azerbaijan.

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