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The Dutch Disease Syndrome Side Effects in Manufacturing Employment: A VAR Analysis of the Azerbaijan Economy

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Abstract

Following the painful transition process from a command economy to a market economy, Azerbaijan used its rich hydrocarbon resources to promote economic growth and development. As a result, national income and per capita income soared, infrastructure improved and poverty declined. However, in addition to short-term positive results, the long-term sustainable growth of the Azerbaijan economy seems to be lagging behind due to the adverse effects of the oil boom. In other words, non-oil tradeable sectors, such as manufacturing, have failed to follow the prosperous course and gain a significant share of the economic success, employment, and exports owing to higher real effective exchange rate (REER) and domestic prices. This fact led to a set of studies on the Dutch disease phenomenon in the case of the Azerbaijan economy. So far, the literature has focused on highly aggregated data that fail to properly separate the effects of Dutch Disease; namely, resource movement and spending effects. In this paper, the resource movement effect of the Dutch disease is analyzed by focusing on employment in the manufacturing sector. However, the consideration of the spending effect has also been included for the sake of completeness. The results indicate that the response of manufacturing employment to mining employment is positive, but when services employment rises, manufacturing employment falls, and it is also negatively affected by oil prices and REER appreciation. Therefore, the indirect de-industrialization process induced by the Dutch disease can be observed, while direct de-industrialization can be scarcely be seen using the unrestricted standard vector autoregression (VAR) model. These results may be useful for policymakers to counter Dutch disease effects, ensure sustainable development goals and promote export-led growth policies in the manufacturing sector.

Keywords: Azerbaijan economy, Dutch disease, employment, labor resources, manufacturing, Natural Resource Curse, unrestricted VAR

JEL Classification: C32, F41, Q32, Q33.

1. Introduction

Azerbaijan is located in the South Caucasus region where Armenia, Georgia, Iran, Russia and Turkey are the main neighbors. Following the collapse of the Soviet Union, the region experienced a sequence of wars, tremendous systemic changes and stagnation. Thomas De Waal called the South Caucasus “an economically broken region” due to widespread deep-seated problems like poverty and income inequality (Waal, 2012). The neighboring countries have been doing their utmost to overcome economic, political and institutional challenges, but these efforts have failed to achieve solid results, as the region continues to be one of the most problematic regions of the world (Korganashvili et al., 2017). Opportunities for the economies in the South Caucasus seem to be limited in the case of Armenia and Georgia, but this is not the case for Azerbaijan. Azerbaijan’s immense oil and natural gas resources have stimulated extractive industry-led growth and development, which commenced in 1995. Simply stated, the ceasefire with Armenia, political stability, and the Contract of the Century propelled the extractive industry and encouraged national economic growth. Meanwhile, it also created the conditions for various structural challenges as the oil and natural gas industry flourished and became the main focus for the foreign direct investments (FDI) and government support (Hübner, 2011). This situation greatly hindered the development of the private sector, institutional quality and labor-intensive employment options for the general labor force (Shaw, 2013; Weeks, 2009; O’lear 2007).

Azerbaijan experienced an oil boom between 2005 and 2014 when the main upstream and downstream oil extraction projects were finalized. Oil output peaked in 2007, and a huge oil revenue flowed into the country in a very short time (Aliyev and Suleymanov, 2015). Then, Azerbaijan’s GDP and GDP per capita soared, poverty declined, and inflationary pressures were brought under control. In spite of this, the scholars continue to argue that the adverse effects outweigh the positive effects of oil-led development, as long-term sustainable economic

growth is not occurring right now due to the hard-hit non-oil processing industries—i.e., manufacturing and agriculture sectors (Ibadoghlu, 2012; Sadik-zada et al., 2021). This led to a series of studies on the Dutch disease and Natural Resource Curse theories and the need to establish explanatory theoretical frameworks for the Azerbaijan economy (Bayramov and Conway, 2010; Hasanov, 2013).

The Dutch disease is a serious threat to an economy if there are no official policy tools to identify and fight it. The original Dutch disease theory was devised to 1982 and 1984 when Corden and Neary (1982) and Corden (1984) modeled the structural changes of the Netherlands economy following the dramatic rise in the natural gas extraction and exports during the 1970s. The main idea behind the Dutch disease hypothesis is that rapid spending of the revenue from the booming sectors strengthens the national currency and moves the workforce out of productive tradeable sectors such as manufacturing and agrarian industries (Mironov and Petronevich, 2015). If the manufacturing and agriculture sectors lose their share of the GDP and net exports as a result of exchange rate appreciation, it will be more difficult to capitalize on possible improvements (innovative technologies, industrial spillovers, technical knowledge, and so on) and to gain from the learning-by-doing and other similar positive externalities that non-resource manufacturing sectors usually provide (Magud and Sosa, 2013). Academics have claimed that industry and agriculture help maintain economic development and that any displacement between the two in favor of the short-term booming sectors would harm the economy in the long run (Krugman, 1987; Matsuyama, 1992; Lucas, 1993; Hausmann et al., 2007). Even though natural resource revenue might positively effect manufacturing value-added in the short term, in the long term if dependency increases, this can lead to the de-industrialization of non-booming sectors (Sadik-Zada et al., 2019).

In the literature, authors raised early concerns about the Dutch disease syndrome in the Azerbaijan economy in the early 2000s (Gahramanov and Fan, 2002; Kaser, 2003; Mahnovski, 2003). The lack of institutional capacity, the poor political will to reform non-oil sectors, uncoordinated economic development, and rising regional inequality in the economic development in Azerbaijan has led to an industrial lopsidedness where the only the oil industry is prosperous (Ibadoghlu, 2008). This has placed the country into the position of oil dependency (Czech, 2018). And this is why several new studies started to argue about the presence of the Dutch disease (Hasanov, 2010; Hasanov, 2013). The main message of these studies was that decreasing manufacturing employment and output were anticipated due to costly domestic production and cheap imports thanks to rapid REER appreciation (Hasanov and Samadova, 2010). This has inevitably led to Azerbaijan's lopsided industrial growth in the total value added.

The country's industrial structure manifests itself in many ways. One of them is the structure of the labor market. More precisely, the employment structure of Azerbaijan should show signs of the Dutch disease if the labor resources has moved out from the manufacturing employment towards booming sectors or the services sector because of the oil boom and REER factors. Only a handful of studies have so far focused on the labor resources and tracked possible Dutch disease effects in Azerbaijan (see the article by Hasanov, 2013). Therefore, this study seeks to redress the balance and assess the potential signs of the Dutch disease in the labor market, focusing on manufacturing employment using unrestricted standard VAR applied to the quarterly data between 2000Q1 and 2020Q4. This study contributes to the research literature by analyzing a neglected topic in the case of the Azerbaijan economy in an empirical way. The objective of this study is to develop an unrestricted standard VAR model that reveals the short-term effects of Dutch disease-related variables (such as REER and oil prices) on industrial employment, especially manufacturing employment. Therefore, the analysis of the shocks among the most important oil-related economic indicators on manufacturing employment is the main novelty of this study. This allows us to conceptualize the direct or indirect de-industrialization process of the original Dutch disease theory described by Corden and Neary (1982) and Corden (1984). Stated briefly, the results presented here tell us that manufacturing employment responds negatively due to the shocks in oil prices, REER, and services employment. This corresponds to the indirect de-industrialization process of the Dutch disease theory. To ascertain the significance of the findings of this study a VAR Granger Causality test will be also used.

The structure of the paper is as follows. In the next section, a brief literature review will be presented about the Dutch disease and employment issues in Azerbaijan. After, in Section 3 the data and methodology used in the study are presented. In Section 4 the results of the study are reported. Lastly, pertinent findings concerning manufacturing employment with policy implications and also a brief discussion of some limitations of the study are given in Section 5.

2. Literature Review

The economic diversification of the Azerbaijan economy has always been an enormous challenge for the government (Ismayil, 2015). Following the collapse of the Soviet Union, political instability, and the war with

Armenia, Azerbaijan rapidly transformed its oil resources into the engine of economic growth and development (Bildirici and Kayıkçı, 2013). To accomplish this, the government stimulated large FDI inflows and Multinational Companies (MNCs) were invited to revitalize the old Soviet-style extraction industry. Therefore, all the state's institutional and governance developments served to expand the output of the oil industry (Ciarreta and Nasirov, 2012). As a result, GDP and GDP per capita rose, the state budget started to make a profit, government spending surged and poverty declined. However, structural issues in industrial production, employment, and exports are mostly from the oil and natural gas sector, and this puts the economy in a vulnerable position in times of volatile commodity prices and sudden changes in international commodity prices (Huseynov, 2017).

Early studies related to the risk of the Dutch disease in the Azerbaijan economy mainly focused on the political and institutional unpreparedness of the state officials to manage the increasing oil revenue. Lauria (1999) mentioned the delays in structural reforms and problems in the economic management of the available oil and non-oil resources which might undermine the industrial structure. Similarly, Singh and Lauria (1999) stated the risks of exchange rate appreciation in the medium- and long-term due to domestic inflationary pressures that may arise from the government's high propensity to spend rather than save the oil revenue. At the same time, the observations of Mahnovski (2003) and Kaser (2003) concerning the political regimes of Caspian basin countries led them to conclude that Azerbaijan might also experience Dutch disease effects as the government was motivated to just reform the booming sectors like the oil and natural gas industry. In other words, the state officials did not see structural reforms as something vital for economic growth and development. Consequently, during the late 1990s and early 2000s, the economists voiced their early concerns about possible Dutch disease effects in the Azerbaijan economy. However, the Dutch disease studies normally require statistical and econometrical investigations of the carefully constructed models. These type studies emerged later on in the case of Azerbaijan.

Hasanov (2013) conducted the most comprehensive study on the Dutch disease in the case of Azerbaijan. His analysis indicated that public expenditure had positive and long-run associations with non-oil GDP, and highlighted the spending effect relative to the resource movement effect predicted by the theory. Furthermore, oil prices had a statistically significant influence on REER appreciation, and the rise in real wages was put down to the spending effect of the Dutch disease process rather than increased productivity. This finding contradicted the findings of Gahramanov and Fan (2002), who argued that the monetary side of the Azerbaijan economy did not have any signs of the Dutch disease. However, Gahramanov and Fans's analysis lacked a proper statistical sample size for one basic reason. The oil boom period was yet to happen in 2005. In the year 2002, the available data obviously lacked the typical characteristics of the lopsided growth in the economic sectors. That is why the articles by Huseynov (2009), Hasanov and Samadova (2010), and Hasanov (2011) continued to uncover the driving forces of the structural changes in the economy of Azerbaijan. These causes included REER appreciation, domestic inflation, oil prices and a lagging non-oil manufacturing sector.

There were also studies that either badly analyzed the Dutch disease syndrome in the Azerbaijan economy, or rejected the idea of it altogether. For instance, Bayramov and Conway (2009) conducted producer surveys to ascertain the exact number of producers against the backdrop of oil prices and the global financial crisis. The authors' findings could not establish the presence of the Dutch disease effects. Bayramov and Conway (2009) argued that the global financial crisis was more apparent than signs of the Dutch disease in Azerbaijan. Also, Şanlısoy and Ekinci (2019) conducted a nonlinear autoregressive distributed lag (NARDL) analysis between 2001Q1 and 2018Q2 to track the possible Dutch disease symptoms. They argued that Azerbaijan was not suffering from the Dutch disease because there was no withdrawal of labor resources from non-oil sectors. Şanlısoy and Ekinci (2019) argued that the oil industry had become capital-intensive rather than labor-intensive, hence it only make small demands on the country's labor resources. Also, they found that oil revenue created additional demand for the other sectors of the economy, so the rest of the economy continued to function as expected without any significant slowdowns. While their findings and arguments are not wrong per se, it is a narrow approach for the Dutch disease theory, not to consider the indirect de-industrialization outcome of the resource movement effect modeled by Corden and Neary (1982). Similarly, Suleymanov and Bulut (2012) and Nuri Aras et al. (2016) just stated that the oil revenue itself was a tool in the hands of the government that could be used to fight Dutch disease because simply spending the revenue could help counter unemployment, capital aging, and so on. Furthermore, Bayraç and Çemrek (2019) analyzed the nexus between oil prices and GDP, and concluded that there was an absence of the Dutch disease syndrome in Azerbaijan. However, Corden and Neary (1982) and Corden (1984) never sought to analyze the commodity prices and GDP of countries as an explanation for the Dutch disease. Nevertheless, the studies by Hwand et al. (2010), Uçan and Ünal (2018) and Zulfugarov and Neuenkirch (2019) documented the significant role of the oil industry in the economy of Azerbaijan and its ability to shape the main macroeconomic realities such as the industrial structure, REER appreciation and

government spending. The literature contains lots of pro-Dutch disease studies and they considerably outnumber those that reject or badly analyze this syndrome in the case of the Azerbaijan economy.

Oxford Analytica's (2019) expert briefings continue to warn government officials about the need for economic diversification in Azerbaijan. Currently, rising oil prices and newly discovered oil and natural gas resources might influence the behaviour of the government, and once again make the economic diversification of the industrial production a non-priority of public policy. During the early years of its independence, Azerbaijan rapidly spent its oil revenue to overcome social problems (Ahmadov, 2022a). Although the government in recent years has tried to reform the economy to mitigate the signs of the Dutch disease, the real results of their policies are hard to find. Similarly, several recent research papers have also expressed worries about the Azerbaijan economy. For example, Yasmin et al. (2020) observed that, according to the Herfindahl-Hirschmann Index (Product HHI), Azerbaijan is the least diverse of the Caspian Basin countries, specializing mostly in mineral goods. Ahmadova et al. (2020), Bayramov and Abbas (2017), and Hamidova (2018) arrived at similar conclusions. These articles shed light on an essential developmental feature of Azerbaijan; namely, despite the fact that 30 years have passed since its independence from the Soviet Union and massive oil wealth has found its way into the country, the country's oil-dependency problem still remains. Naturally, an unbalanced economic system can introduce many obstacles to normal economic growth that may be explained by invoking the Dutch disease hypothesis; and employment and labor markets are no exception.

Some recent studies on Azerbaijan argued that oil was an important factor if one wished to determine the trends and dynamics of structural changes in employment and labor markets. For instance, Alizada (2021) found that overall low levels of labor productivity were associated with the rising oil dependency of Azerbaijan. This started to change following the sharp price slumps of commodities in 2014 and 2015, and the state made efforts to decrease its oil dependency. Ahmadov (2022b) argued that compared to other post-socialist countries like Hungary, Azerbaijan's structural problems had a significant impact on the labor market. While FDI-led economic development increased the number of well-paid jobs in Hungary, the large share of the casual employment sector and lack of economic development strategies failed to create a balanced structure in industrial employment. Namazova (2021) also mentioned the quality issues of human resources caused by the mismanagement of the labor markets. Hence, further analyses of the impact of the oil boom on the employment structure in Azerbaijan are required. This would not only enrich the literature but also help provide specific policy guidelines for the government officials.

Reviewing the relevant literature, the main research question of this study is the following: What were the effects of the Dutch disease-related economic variables such as oil prices, REER, mining and services employment on manufacturing employment between 2000Q1 and 2020Q4 in the case of the Azerbaijan economy?

3. Data and Methodology

The time series for REER were collected from Bruegel data sets (<https://www.bruegel.org>) that were based on 67 trading partners. However, the data for employment in mining, manufacturing and services came from the State Statistical Committee of the Republic of Azerbaijan (SSCRA). While mining employment means the employment in extractive industries such as oil, iron ore and natural gas extraction, manufacturing employment includes employment related to the processing industry (including the manufacturing of oil and petroleum products). Also, oil prices (BRENT trademark) were collected from International Energy Agency—<https://www.iea.org>.

REER figures are in percentage terms but the employment data are given in thousands of persons. Oil prices are given in US dollars of the BRENT trademark. Below, Table 1 lists the descriptive statistics of the variables of interest. Only REER and services data are normally distributed variables according to the Jarque-Bera test. Here all the variables are quarterly data between 2000Q1 and 2020Q4. And while REER and oil prices were simply collected in their quarterly form, sectoral employment figures were generated from the annual data by the data conversion function—from a low to high frequency—using the Eviews econometrics software package version 10.

Table 1. Descriptive statistics of the variables of interest.

	REER	Oil prices	Mining Employment	Manufacturing Employment	Services Employment
Minimum	25.9	12.9	33.5	84.1	757.4
Maximum	155.7	124.1	92.3	268.2	1424.8
Mean	102.2	50.2	43.9	129.0	1100.4
Median	98.8	46.2	37.6	107.2	1100.5

Standard deviation	24.3	28.9	15.7	47.3	171.8
Jarque-Bera value	4.3	8.8	99.9	61.6	4.70
Probability	0.12	0.01	0.00	0.00	0.09

Source: The author's calculation based on the time series.

Note: Here, figures were rounded to the first decimal point for compactness (excluding probability values for the Jarque-Bera test).

The methodology of this study is the unrestricted standard VAR. VAR is a linear technique where each variable is explained by its own lagged values and the past or current values of the explanatory variables. Sims (1980) pioneered an economics-based VAR exercise and since then it has been a widely used as forecasting and data description tool. Also, VAR is a useful econometric methodology for dynamically assessing the effect of shocks on one of the variables in time series data (Ybrayev, 2021).

The econometric methodology of this research paper was constructed after the careful consideration of the article by Koitsiwe and Adachi (2015, Dutch disease research in the case of Australia). Here, the macro-econometric model can be formally specified in the following way:

$$Z_t = \alpha + \sum_{j=1}^p \pi_j Z_{t-j} + \sum_{j=0}^m \varphi_j X_{t-j} + \delta_t + \epsilon_t \quad (1)$$

where Z_t represents the vector of endogenous variables, π_j is a matrix of k autoregressive coefficients at lag i , X_t is a vector of q exogenous variables, φ_t is a matrix of q coefficients on the exogenous variables, and ϵ_t is the error term. Similar to Koitsiwe and Adachi's article (2015), in the macro-econometric methodology it is assumed that the error term has no serial correlation and it has a covariance matrix.

As the focus of this study is manufacturing employment in Azerbaijan, Equation (1) can also be expressed as follows:

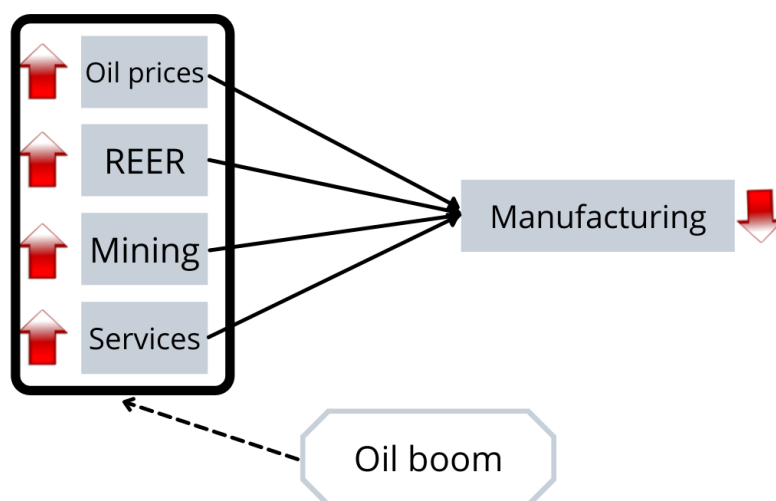
$$\begin{aligned} \Delta MANEMP_t = & \beta_{10} + \beta_{11} \Delta OILP_t + \dots + \beta_{1j} \Delta OILP_{t-n} + \beta_{12} \Delta REER_t + \dots \\ & + \beta_{1j} \Delta REER_{t-n} + \beta_{13} \Delta MINEMP_t + \dots + \beta_{1j} \Delta MINEMP_{t-n} + \\ & + \beta_{14} \Delta SERVEMP_t + \dots + \beta_{1j} \Delta SERVEMP_{t-n} + \epsilon_{1t} \end{aligned} \quad (2)$$

where $OILP$ is the oil price, $REER$ is the real effective exchange rate, $MINEMP$ is mining employment, $SERVEMP$ denotes the services employment figure, and ϵ is the error term.

Similar to Koitsiwe and Adachi (2015), the order of the variables is based on the level of exogeneity of the explanatory variables. This means that oil prices are the first, REER is the second, mining employment is the third and services employment is the fourth variable to affect manufacturing employment in Azerbaijan. Employment in the mining sector and employment in the services sector are the domestic factors that influence manufacturing employment, but oil prices and REER reflect international realities in the case of the Azerbaijan economy. Chart 1 shows the expected empirical direction of the relationship among the variables of interest. In other words, manufacturing employment should decrease when oil prices, REER, services and mining employment increase. There are additional factors that affect the employment of non-booming sectors within the Dutch disease theory such as domestic output, consumer and producer prices, and subsidies for non-oil sectors but these are only of secondary importance in this study.

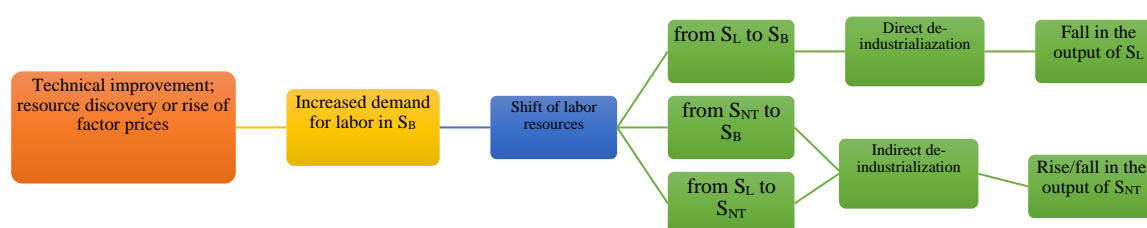
As the main focus here, the analysis is essentially based on the resource movement effect of the Dutch disease syndrome rather than the spending effect. However, these two rarely occur separately. Stated briefly, if a three-sector economy is assumed, namely booming sectors (S_B), lagging sectors (S_L) and non-tradable sectors (S_{NT}), then technical improvements, resource discoveries, or simply a rise in the factor prices lead to an increased demand for labor in S_B (see Chart 2). This either shifts labor from S_L to S_B , which is called direct de-industrialization and shrinks the output of S_L or the labor out of S_L shrinks with the movement from S_B to S_{NT} . The latter is called indirect de-industrialization, and this leads to a fall in the output of S_{NT} . In some cases, the output of S_L rises (Corden, 1984).

Chart 1. The expected direction of the relationship among the variables of interest.



Source: Adapted from the Dutch disease theory by Corden (1984).

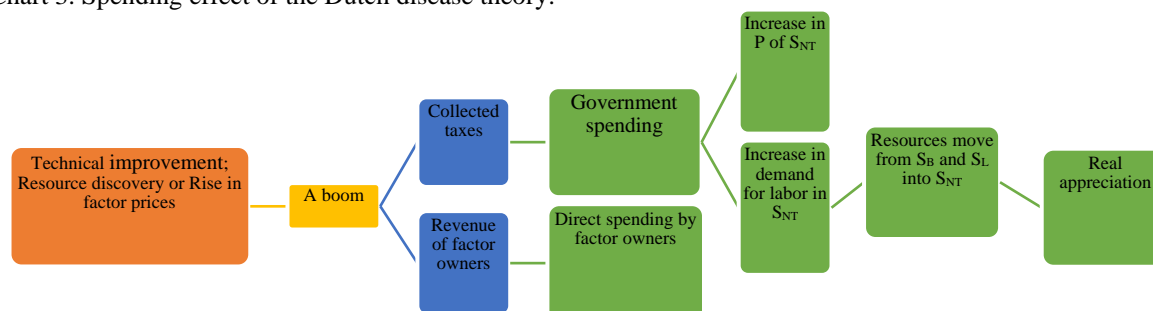
Chart 2. Resource movement effect of the Dutch disease theory.



Source: Adapted from Corden (1984).

The spending effect of the Dutch disease phenomenon takes place when a fraction of additional revenue is spent either directly by factor owners (i.e., when a business directs spending to intermediate inputs) or indirectly by the authorities (when the government gets revenue in the form of royalties, taxes, or profits, Corden, 1984). Corden (2012) noted that the spending effect is limited to "at-home" expenditure, as opposed to spending on imports, premium transfers, and the purchase of foreign assets. In addition, a particular instance arises when S_B is not a participant in domestic factor markets and it is not a movable factor in the economy during an oil boom. S_B is an "enclave" (Corden, 1984). In this scenario, the economy does not undergo direct de-industrialization (the resource movement impact is absent), and resource allocation occurs during the period of real appreciation. Thus, the spending impact causes resources to flow from S_B and S_L into S_{NT} , but demand flows in the other direction - from S_{NT} to S_B and S_L . The spending effect mostly results in an increased production in S_{NT} during and following the boom period.

Chart 3. Spending effect of the Dutch disease theory.



Source: Adapted from Corden (1984).

Notes: P denotes prices.

4. Results

4.1. Descriptive Analysis

Before the VAR analysis, the overall sectoral decomposition of employment, REER and oil prices were descriptively analyzed to conceptualize the data. Average values and growth rates—year-over-year and cumulative growth rates, and proportion of the total employment figure—based on time periods of the Azerbaijan economy show the main trends and dynamics behind the variables of interest utilized in this study (see Table 2).

Here, an overview of employment in the Azerbaijan economy makes it clear that the mining industry had the smallest labor force, while the services sector was the biggest source of employment between 1990 and 2020. In other words, the mining industry experienced a decline of 5.6% and 14.5% in 1990–1994 and 1995–1999, then an increase of 1.2% between 2000 and 2004 because in the pre-boom period there was rapid construction and development of the oil the pipeline infrastructure. Meanwhile, manufacturing employment declined from 279.6 thousand persons between 1990 and 1994 to 109.7 thousand persons between 2015 and 2020. Despite this, its manufacturing employment share rose to 7% in the period of 2015 and 2020 following the lowest share of 6.6% between 2010 and 2014. Employment in the services sector had been gradually rising since 2000 and this sector had the most stable and consistent upward trend in the study period.

REER and oil prices are important variables for establishing the effects of the commodity supercycle that started in the early 2000s. As soon as Azerbaijan started to undergo an oil boom in its economy when world oil prices rose, REER appreciated and it had positive year-over-year growth rates of 1.04% and 3.70% in the periods 2005–2009 and 2010–2014, respectively (see Table 2). Only the post-boom period (2014–2020) delivered lower cumulative growth rates in REER in parallel with the lower annual oil prices of 54.62 USD per barrel.

Table 2. Employment, REER and oil prices in Azerbaijan between 1990 and 2020.

	1990– 1994	1995– 1999	2000– 2004	2005– 2009	2010– 2014	2015– 2020
Mining ^a						
Overall employment, thsd. persons	96.2	56.7	37.7	39.6	35.8	34.2
Year-over-year growth rate, in %	-5.6	-14.5	1.2	-2.1	0.1	-0.6
Cumulative growth rate, 1990=100%	85.9	37.8	5.1	10.8	1.8	-2.5
Cumulative growth rate, 2000=100%	–	–	102.6	153.7	172.4	169.6
Share of total employment, in %	5.0	4.2	3.1	2.9	2.5	2.2
Manufacturing ^a						
Overall employment, thsd. persons	279.6	176.9	110.4	105.1	96.1	109.7
Year-over-year growth rate, in %	-5.6	-6.7	-10.4	0.1	1.8	3.8
Cumulative growth rate, 1990=100%	85.9	45.6	4.1	1.7	-5.8	8.2
Cumulative growth rate, 2000=100%	–	–	75.7	73.3	65.9	79.9
Share of total employment, in %	14.6	13.2	9.0	7.7	6.6	7.0
Services						
Overall employment, thsd. persons	1,030.4	8,66.0	969.7	1,114.0	1,227.7	1,318.3
Year-over-year growth rate, in %	-1.7	-0.6	2.3	2.1	2.1	1.7
Cumulative growth rate, 1990=100%	97.1	80.5	93.9	108.1	118.0	125.3
Cumulative growth rate, 2000=100%	–	–	108.9	123.3	132.3	138.4
Share of total employment, in %	53.9	65.1	79.3	81.8	84.3	83.8
Real Effective Exchange Rate ^c						
Average values, in percent	83.60	81.45	80.28	96.41	116.97	103.91
Year-over-year growth rate, in %	-3.00	-0.17	3.16	1.04	3.70	-2.25
Cumulative growth rate, 1990=100%	91.73	90.11	89.20	108.60	129.43	118.12
Cumulative growth rate, 2000=100%	–	–	105.92	125.33	146.16	134.85
Oil prices, BRENT trademark						
Average prices, in USD	19.20	17.49	29.04	70.17	102.00	54.62
Year-over-year growth rate, in %	-1.53	5.64	19.14	14.14	11.49	-8.75
Cumulative growth rate, 1990=100%	79.18	76.68	152.65	257.07	314.74	275.99
Cumulative growth rate, 2000=100%	–	–	102.28	206.70	264.38	225.62

Source: SSCRA, 2022.

Notes: a- Mining employment data for 1990–1998 were calculated based on the average share of mining employment in the overall employment total for the period 1999–2020 as SSCRA provides only aggregated data for 1990–1999 with a general category of “industry”, not mining and manufacturing separately; b- Agriculture, forestry, and fishery data only include agriculture and forestry for the period of 1990–1998; c- REER calculations for year-over-year growth rates do not include the data of 1990.

4.2. Unit Root Tests and Optimum Lag Length Criteria

Before performing a time series analysis, the stationarity of the variables of interest needs to be examined. An augmented Dickey-Fuller unit root test of the variables of interest revealed that all of the variables are not stationary at their level, but at their first difference they do not have any unit root, so they are stationary (see Table 3). Only services employment with a constant and a trend maintained its non-stationarity at the first difference, while all the other variables were stationary to first order. Nevertheless, this fact does not prevent a consideration of the first difference of the variables for the analysis of the short-term dynamics. This is why in the VAR model employed the differenced form of the variables is used so to have the same integration order, and this made them suitable for analysis.

Table 3. Augmented Dickey–Fuller Unit Root Test of the Variables of Interest.

<u>At Level</u>		MAN	MINING	OIL PRICE	REER	SERVICES
With Constant	t-Statistic	-1.3377	-2.2696	-2.5541	-1.2623	-0.5424
	Prob.	0.6082	0.1842	0.1068	0.6437	0.8762
With Constant & Trend	t-Statistic	-1.4497	-3.7627	-2.4272	-1.2263	-2.9812
	Prob.	0.8382	0.0239	0.3632	0.8982	0.1441
Without any Constant & Trend	t-Statistic	0.6805	-0.7599	-0.6120	-0.0561	2.1897
	Prob.	0.8607	0.3842	0.4493	0.6612	0.9929
<u>At First Difference</u>						
		d(MAN)	d(MINING)	d(OIL_PRICE)	d(REER)	d(SERVICES)
With Constant	t-Statistic	-3.8325	-3.5432	-7.5232	-8.2174	-3.1126
	Prob.	0.0039	0.0093	0.0000	0.0000	0.0297
With Constant & Trend	t-Statistic	-4.0690	-3.6447	-7.5957	-8.1759	-3.0902
	Prob.	0.0101	0.0324	0.0000	0.0000	0.1159
Without any Constant & Trend	t-Statistic	-3.8758	-3.5700	-7.5706	-8.2659	-2.0189
	Prob.	0.0002	0.0005	0.0000	0.0000	0.0423

Source: The author’s own calculations based on the collected data.

Notes: 1) Here, n0 means the null hypothesis. This hypothesis indicates that the series has a unit root; 2) the symbols *, **, and *** indicate a statistical significance at the 10%, 5%, and 1% levels, respectively.

To determine the optimal lag length, a lag length criteria analysis was carried out. According to Table 4, the lag of five quarters is the optimal one because the LR, FPE and AIC criteria overlapped in their recommendation. SC and HQ indicated only one lag as a selection criterion; however, a one-quarter lag does not make any empirical sense in a large sample size that is based on quarterly data. This is why five quarters best fitted the main research design and were incorporated into the VAR model.

Table 4. VAR optimum lag length criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1020.211	NA	252577.1	26.62885	26.78104	26.68973
1	-950.3427	128.8475	78876.96	25.46345	26.37662*	25.82871*
2	-935.4083	25.60184	103295.0	25.72489	27.39904	26.39453
3	-920.7449	23.23291	137956.7	25.99337	28.42850	26.96740
4	-876.4074	64.49086	86900.87	25.49110	28.68720	26.76951
5	-829.1269	62.63132*	52098.74*	24.91239*	28.86946	26.49518
6	-808.3481	24.82672	64480.44	25.02203	29.74008	26.90921

Source: The author’s own calculations based on the collected data.

Notes: Here, * indicates the suggested lag length; LR: sequential modified LR test statistic (each test at the 5% level); FPE: final prediction error; AIC: the Akaike information criterion; SC: the Schwarz information criterion; HQ: the Hannan-Quinn information criterion.

4.3. VAR Estimations (Impulse Response Functions)

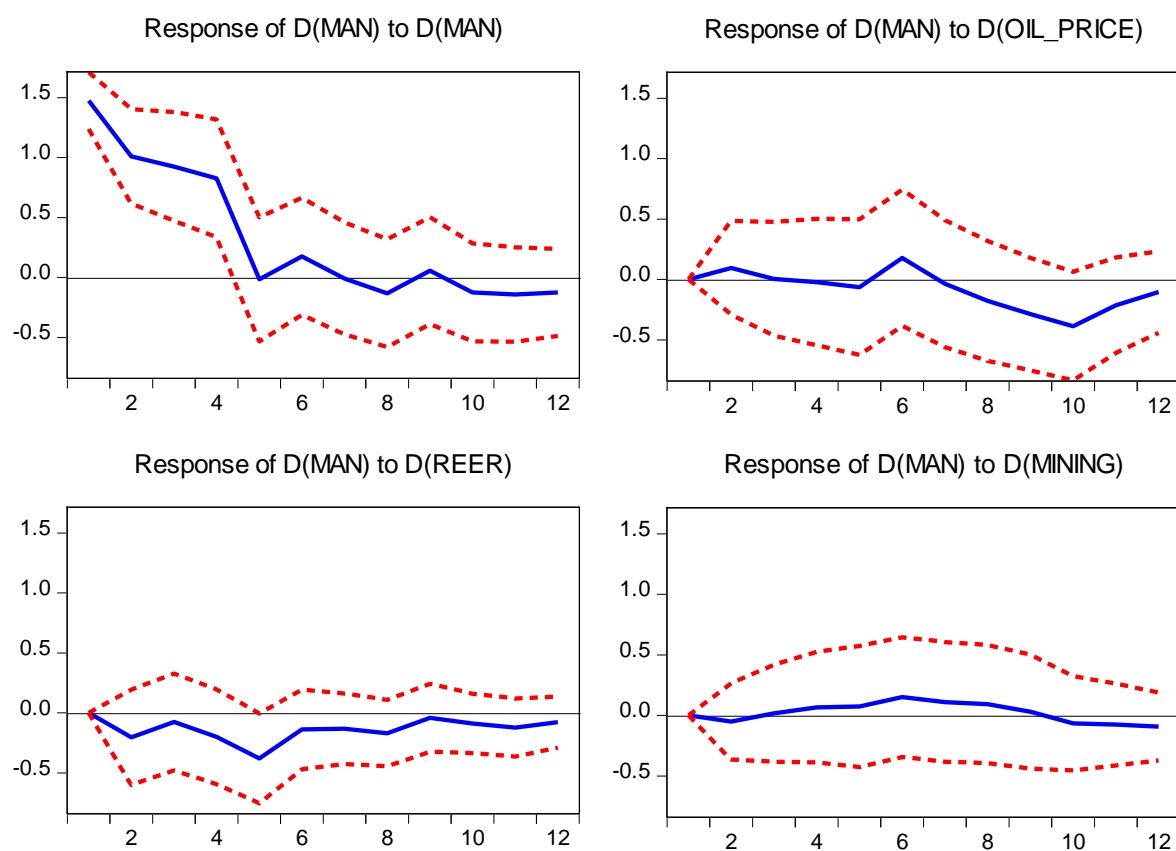
Figure 1 shows the impulse response functions (IRFs) of manufacturing employment to itself, to oil prices, to REER, to mining and services employment. The response of manufacturing employment to the shocks caused by itself is positive in the first four quarters, but starting from the fifth quarter it fluctuates up to the tenth quarter. The last two quarters indicate negative responses of manufacturing employment to the shocks to itself.

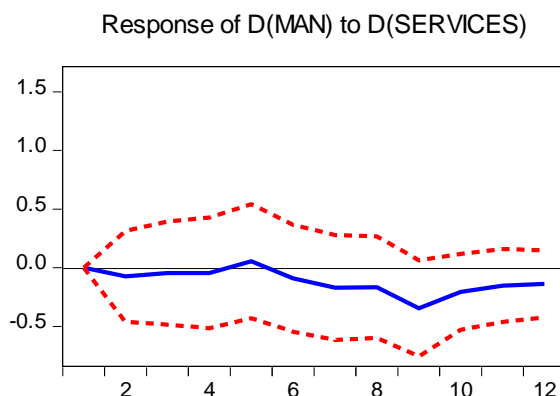
The response of manufacturing employment to the shock in oil prices is initially positive (second quarter), but the third, fourth and fifth quarters produce either zero or negative responses. Following the positive response of the sixth quarter, the rest of the periods are negative responses to the shocks in the oil prices.

The response of manufacturing employment to REER shocks is negative in all the periods examined. This implies that there is a strong and significant impact of REER on manufacturing that coincides with the signs anticipated by Dutch disease theory. Furthermore, manufacturing employment negatively responded to the shocks in mining employment during the second quarter, but from the third to the ninth quarter the responses were positive. This aspect of manufacturing and mining employment reflects the capital-intensiveness of the oil industry in Azerbaijan because the work force that moves out of the oil industry sector was absorbed by non-oil manufacturing sector. However, the response of manufacturing employment turned out to be negative following the mining employment shocks commencing from the tenth quarter.

In the case of the response of manufacturing employment to the shocks in the services sector, employment was only positive in the fifth quarter and in all the other quarters it was negative.

Figure 1. Impulse response functions (IRFS) of manufacturing employment in VAR models.





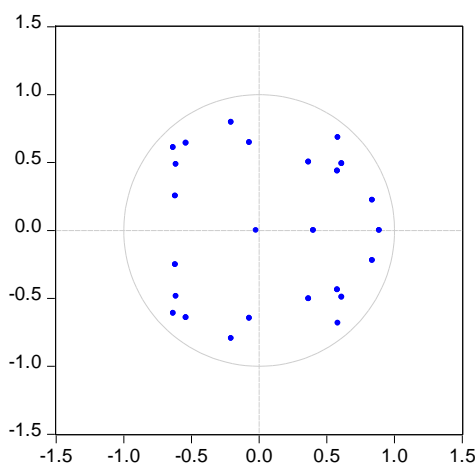
Source: The author's own calculations based on the collected data.

Notes: Here, 1) Response to Cholesky one S.D. Innovations ± 2 S.E; 2) MAN denotes manufacturing employment, MINING is the mining employment in thousands of persons, SERVICES is the employment in the services sector in thousands of persons. Similarly, REER is the real effective exchange rate and OIL_PRICE denotes oil prices.

4.4. Diagnostics of VAR Results

The VAR results should be checked using several stability tests to ensure the validity of these results. For instance, after estimating a VAR model, usually the dynamically stable model is examined, and the dynamical stability requirement is checked using Roots of the Characteristic Polynomial. If all of the eigenvalues fall within the unit circle, the VAR model satisfies the stability requirement. Figure 2 shows the inverse roots of the Auto-Regressive (AR) characteristic polynomial and all the eigenvalues lie inside the circle.

Figure 2. Inverse roots of Auto-Regressive (AR) characteristic polynomial.



Source: The author's own calculations based on the collected data.

Next, there should not be any widespread deviations of residuals from two standard error bounds in terms of their autocorrelation values. As can be seen in Figure 3, the values lie inside the two standard error bounds with a handful of exceptions.

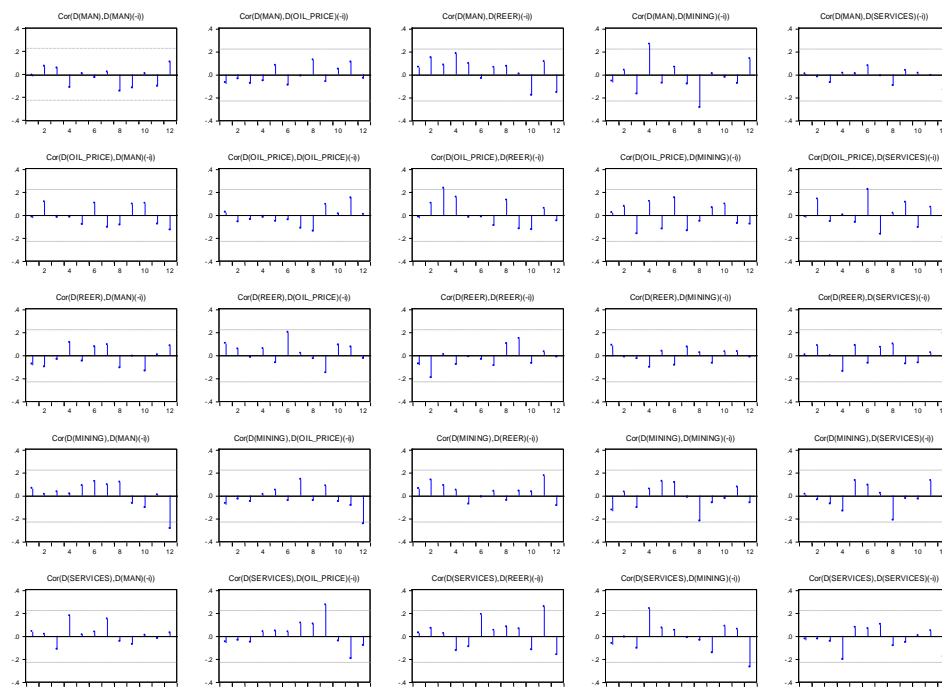
Table 5. VAR Residual Serial Correlation LM Tests.

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	20.76	25	0.706	0.82	(25, 161.2)	0.708
2	25.25	25	0.449	1.02	(25, 161.2)	0.451
3	27.00	25	0.357	1.09	(25, 161.2)	0.360
4	59.66	25	0.001	2.66	(25, 161.2)	0.001
5	22.38	25	0.614	0.89	(25, 161.2)	0.616

Source: The author's own calculations based on the collected data.

Notes: Figures were rounded to the second decimal point for the sake of compactness (excluding the probability values).

Figure 3. Autocorrelations with approximate 2 Std. Err. Bounds.



Source: The author's own calculations based on the collected data.

Lastly, the VAR residual serial correlation LM test indicated that there was no serial correlation in the model in the five-year lag form (see Table 5).

4.5. Variance Decomposition

Table 6 lists the forecast error (SE) expressed as a percentage of the VAR error, and each column shows how much of the error is explained by each variable. In this case, the variance decomposition technique was used since it provides information on the relative importance of each random shock to the VAR system (Ayadi, 2005). Therefore, the variance decomposition of the estimated VAR model for manufacturing employment in Azerbaijan between 2000Q1 and 2020Q4 indicates that the predominant determinant of the forecast error was manufacturing employment's own shocks (see Table 6). REER rapidly improved its explanatory power up to 4.89% in the six-quarter ahead period, reaching 5.55% in the twelve-quarter ahead forecast error. The same trend is observed in the case of oil prices—6.22% in the twelve-quarter ahead forecast. The services employment can explain the forecast error up to 4.76%, but mining employment has only a slight effect. The latter reveals the irrelevance of the direct de-industrialization process that occurred as the result of the resource movement effect of the Dutch disease syndrome, even though manufacturing responded positively to the mining employment shocks on IRFs (see Figure 1).

Table 6. Variance decomposition of manufacturing employment (DMAN).

Period	S.E.	D(MAN)	D(OIL PRICE)	D(REER)	D(MINING)	D(SERVICES)
1	1.48	100.00	0.00	0.00	0.00	0.00
2	1.81	98.20	0.28	1.27	0.08	0.17
3	2.03	98.38	0.22	1.14	0.07	0.18
4	2.21	97.66	0.20	1.80	0.15	0.20
5	2.24	94.60	0.28	4.62	0.26	0.25
6	2.26	93.12	0.90	4.89	0.70	0.40
7	2.28	92.05	0.91	5.17	0.93	0.95
8	2.30	90.40	1.49	5.60	1.07	1.44
9	2.35	87.04	2.93	5.42	1.05	3.57
10	2.39	83.98	5.42	5.35	1.08	4.16
11	2.41	82.75	6.10	5.50	1.16	4.48
12	2.43	82.18	6.22	5.55	1.29	4.76

Source: The author's own calculations based on the collected data.

Notes: 1) Figures were rounded to the second decimal point for the sake of compactness; 2) S.E. means standard error.

4.6. VAR Granger Causality Test

Lastly, VAR Granger Causality Tests were applied to discover whether the time series used in the analysis can predict each other, especially in manufacturing employment. The results failed to indicate a unidirectional causality from the variables of interest toward manufacturing employment (see Table 7). In spite of this, REER and mining employment can still be predicted via manufacturing employment and oil prices due to their individual and joint statistical significance.

Table 7. Results of VAR Granger Causality.

Dep. Var.	Δ MAN	Δ OIL_P	Δ REER	Δ MIN	Δ SERV	Δ JS
Δ MAN	—	5.31 (0.379)	6.09 (0.298)	0.83 (0.975)	1.99 (0.851)	14.38 (0.811)
Δ OIL_P	4.76 (0.446)	—	2.97 (0.705)	4.81 (0.440)	2.30 (0.807)	8.87 (0.984)
Δ REER	9.85 (0.080)*	74.41 (0.000)***	—	13.55 (0.019)**	10.13 (0.071)	90.86 (0.000)***
Δ MIN	21.34 (0.000)***	9.80 (0.081)*	6.11 (0.295)	—	3.98 (0.552)	48.21 (0.000)***
Δ SERV	3.17 (0.674)	1.06 (0.957)	3.60 (0.678)	1.77 (0.879)	—	8.22 (0.990)

Source: The author's own calculations based on the collected data.

Notes: Here, 1) the symbols *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively; 2) Figures were rounded to the second and to the third decimal point for compactness; 3) Figures in the parentheses are the corresponding probability values; 4) MAN, OIL_P, REER, MIN and SERV denote manufacturing employment, oil prices, the real effective exchange rate, mining employment and services employment, respectively.

5. Conclusions

In this study, the empirical validity of the Dutch disease syndrome in the case of industrial employment in the Azerbaijan economy was examined. In other words, manufacturing employment was analyzed in terms of the most important economic indicators listed in the Dutch disease studies, namely oil prices, REER, mining, manufacturing and services employment. The Dutch disease phenomenon has an elusive and debatable nature in the case of Azerbaijan. While some scholars have rejected its relevance, some have emphasized its visible effects, especially in the structure of employment. Therefore, after considering the literature and available data, the following research question was proposed to capture possible Dutch disease effects on the industrial employment side: What were the effects of the Dutch disease-related economic variables such as oil prices, REER, mining and services employment on manufacturing employment between 2000Q1 and 2020Q4 in the case of the Azerbaijan economy?

Unrestricted standard VAR estimations provided good evidence of the indirect de-industrialization phenomenon of the Dutch disease theory in the case of manufacturing employment in the Azerbaijan economy between 2000Q1 and 2020Q4. Because while REER and services employment rose, manufacturing employment decreased. Compared to the direct de-industrialization outcome of the resource movement effect of the Dutch disease when labor moved from lagging economic sectors such as agriculture and manufacturing to booming sectors, the government spending on oil revenue created jobs in the tertiary sectors and this led to increased employment in the services. According to the AR characteristic polynomial, autocorrelations and VAR residual LM test, the estimated VAR model for manufacturing employment is very stable and valid. However, the VAR Granger Causality test failed to capture any significance between manufacturing employment and the Dutch disease-related variable. Nevertheless, REER had an individual and joint statistical significance in terms of oil prices, mining and manufacturing employment. These findings shed light on the presence of the Dutch disease syndrome that should be addressed at the government level to overcome structural challenges in the long-term sustainable economic growth and development of Azerbaijan's economy.

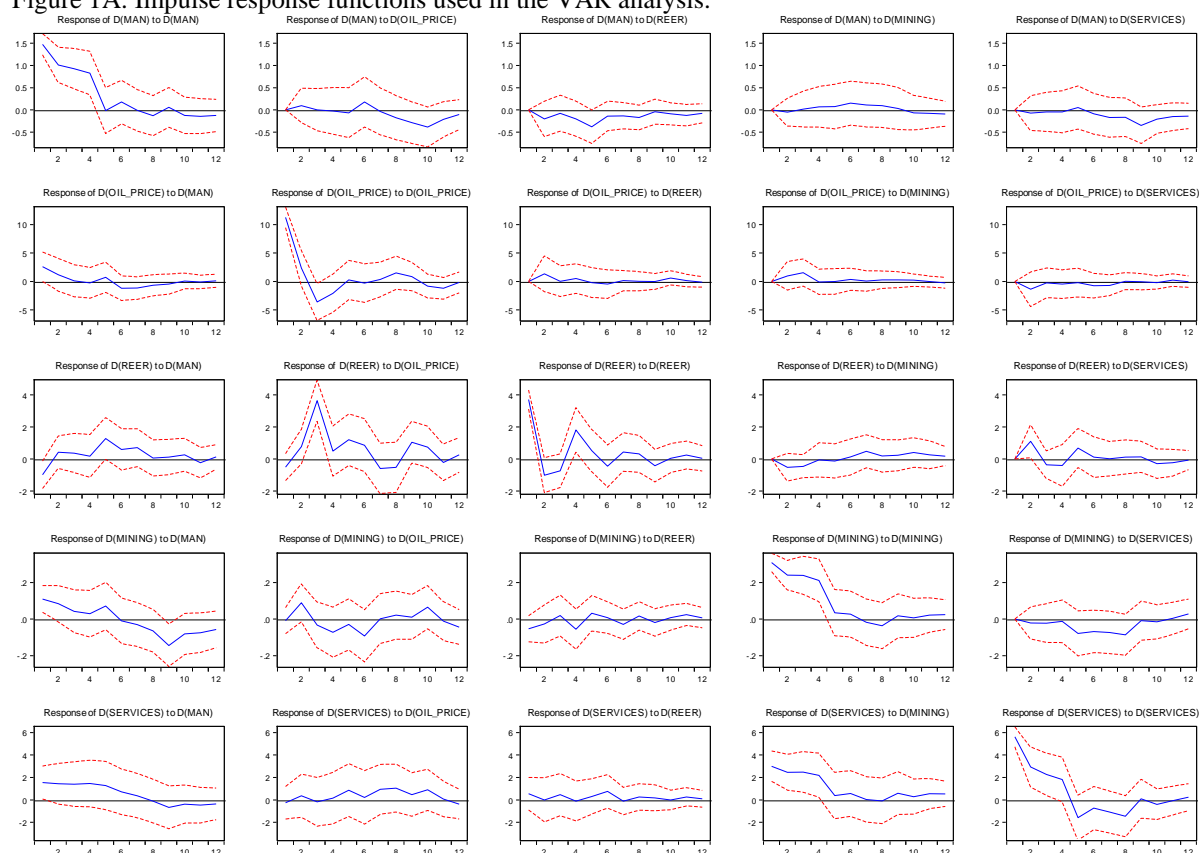
The findings of this study have several policy implications. Firstly, the capital-intensive nature of the oil sector in Azerbaijan means it has a low job-creation effect on the overall economy and occasional REER appreciations decrease the competitiveness of non-oil production. Secondly, the prevailing indirect de-industrialization process hinders the long-term economic growth and development of Azerbaijan's economy because manufacturing is the engine of growth and it failed to maintain a leading position in the economy. This is an alarming situation for the government and decision-makers because getting large oil revenues and rapidly spending them did not lead to balanced industrial employment and production in Azerbaijan between 2000 and 2020. Thirdly, the post-boom period produced several government initiatives for reforming the institutions and developing the old industrial

facilities. Despite this, REER has been appreciating since 2020 and the rise in oil prices has demotivated the government policymakers and slowed down the reforms and liberalization of the country's economy.

The surprising findings of this study are that, despite negative responses to the shocks in REER, oil prices, services and manufacturing employment obtained using IRFs, the manufacturing employment's VAR Granger Causality test failed to confirm the expected relationship between endogenous variables and manufacturing employment. Moreover, the main limitation of this study is that the econometric modeling mainly focuses on the short-term effects of the shocks in Dutch disease-related variables on manufacturing employment. If a co-integration relationship exists among the variables, long-term estimations by the Vector Error Correction Model (VECM) may be useful in the further studies. Also, additional studies could include subsector employment data in the Dutch disease theory to get a better overall picture. All in all, one thing is certain. The analysis of Azerbaijan's Dutch disease syndrome is far from over and it needs to be systematically analyzed to help guide non-oil manufacturing development policies made by the government.

Appendix

Figure 1A. Impulse response functions used in the VAR analysis.



Source: The author's own calculations based on the collected data.

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