Testing the Presence of the Dutch Disease in Kazakhstan

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Abstract: This paper uses Vector Autoregression (VAR) models to test the presence of the Dutch disease in Kazakhstan. It was found that tradable industries and world oil price have immediate effect on domestic currency appreciation. This in return has delayed negative impact on agricultural production and positive delayed effect on non-tradable industries. Prolonged period of low oil prices could hurt Kazakh economy if no effective policies to combat the negative effects of the Dutch disease are implemented.

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Introduction

The Republic of Kazakhstan is a landlocked country located in the middle of the Eurasian continent. Kazakhstan has a strategic location to control energy resources flow to China, Russia and the global market. The territory of the country is 2,724,900 km^2 [1], the 9^{th} largest country in the world. The population of Kazakhstan is 17.5 million people, which represents about 0.2% of world population [2].

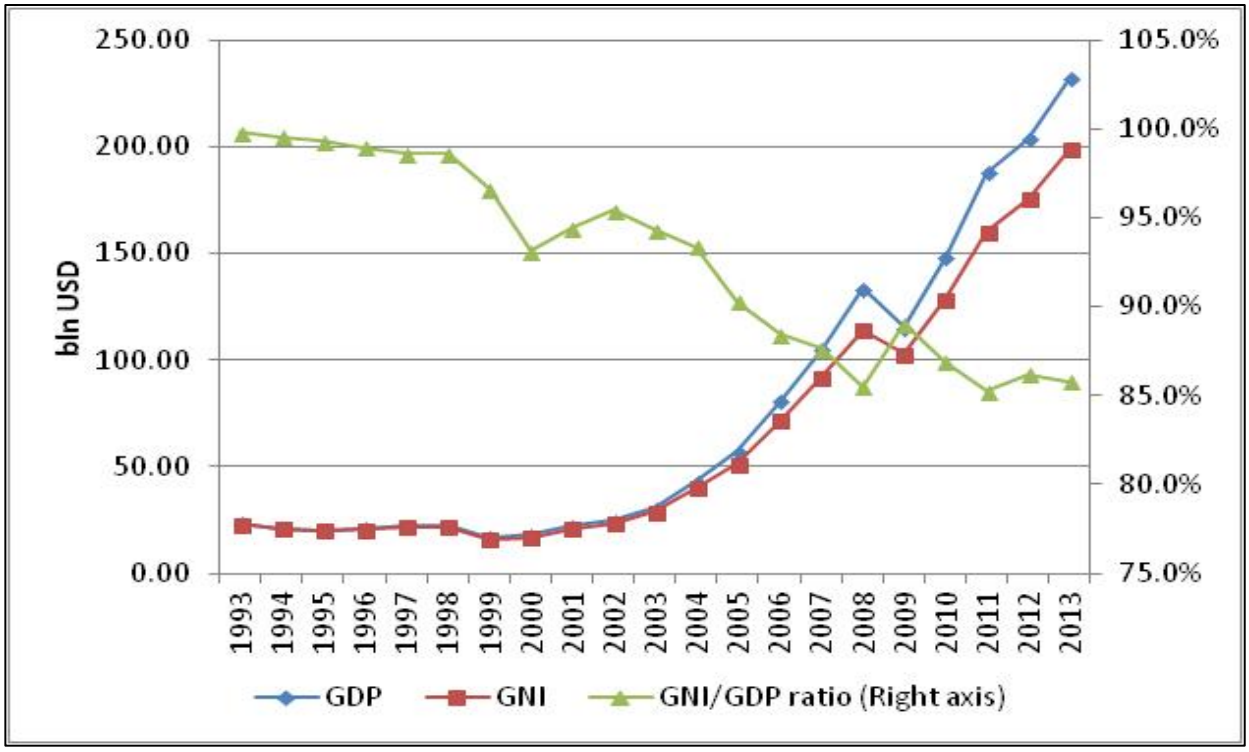
The economy of Kazakhstan is the largest in Central Asia. The Gross Domestic Product (GDP) in 2013 was 231.9 billion US Dollars (USD), which represented around 0.3% of world`s economy [2]. Kazakh economy is among the upper-middle income economies with almost 13,000 USD per capita. It has been suggested that Kazakh economy has been declining towards state capitalism [3], the system when the state often acts in the interests of big businesses against the interests of ordinary consumers [4].

The main driver of the Kazakh economic growth is the export of hydrocarbons. According to the World Bank data, total natural resources rents in Kazakhstan have increased from under 7% of GDP in 1997 till 16.6% of GDP in 2013. Overreliance on natural resources extraction causes environmental pollution and economic volatility. The oil export dependence has affected the energy system of Kazakhstan as crude oil has become a precious export commodity, and the role of coal in the domestic energy system has become enormous. Additionally, heavy dependence on export of hydrocarbons has created social disparities and a development gap between regions in Kazakhstan [5].

Kazakhstan`s economic growth has been soaring for over a decade due to 2000s commodity boom. However, when it comes to social indicators and the quality of institutions, it has made more limited progress. The model of economic growth, triggered by the commodity boom without development is unlikely to be sustainable. Despite the short-term growth, the economies with abundant natural resources tend to have lower economic growth in a long-run [6].

Unlike global financial crisis in 2009, which had short-term negative implications on Kazakh economy, the oil price collapse of 2014-2016 calls for effective structural economic reforms as the longer period of low oil prices is expected [7]. The diversification of Kazakh economy has been a policy priority for the government. However, the current diversification strategy seems to be ineffective and the economy is still dependent on the resource sectors due to misaligned economic policies, poor financial regulations and weak institutions [8], creating unbalanced economic growth.

Furthermore, the commodity-based development causes the outflow of the natural resources toward abroad. The Gross National Income (GNI) measures the total value of goods and services produced by Kazakh national and companies, while GDP measures the total value of goods and services produced in Kazakhstan by all nationals and companies. Generally, the GNI/GDP ratio is around 1.0 for most of the countries with insignificant deviations. However, in the case of Kazakhstan there is a significant separation between GNI and GDP as seen in Figure 1. The separation has started since the end of 1990s, when the number of the foreign companies in primarily resource sectors started to grow. The GNI/GDP ratio indicates that the natural resources in Kazakhstan are declining toward abroad rather than the domestic capital creation.



Source: Author`s calculations based on World Bank data [2]

Figure 1. GNI and GDP of Kazakhstan

Abundance of natural resources offers vast opportunities for development of the country. Nonetheless, a number of studies suggest that commodity-rich countries tend to perform worse economically in the long run [6, 9-12]. This is caused by the rise in international commodity prices, which leads to structural changes in country`s trade profile towards dominance of natural resources export. Consequently, the economy becomes less diverse due to structural changes in the economy triggered by natural resources boom and more volatile to commodity price`s fluctuations [15].

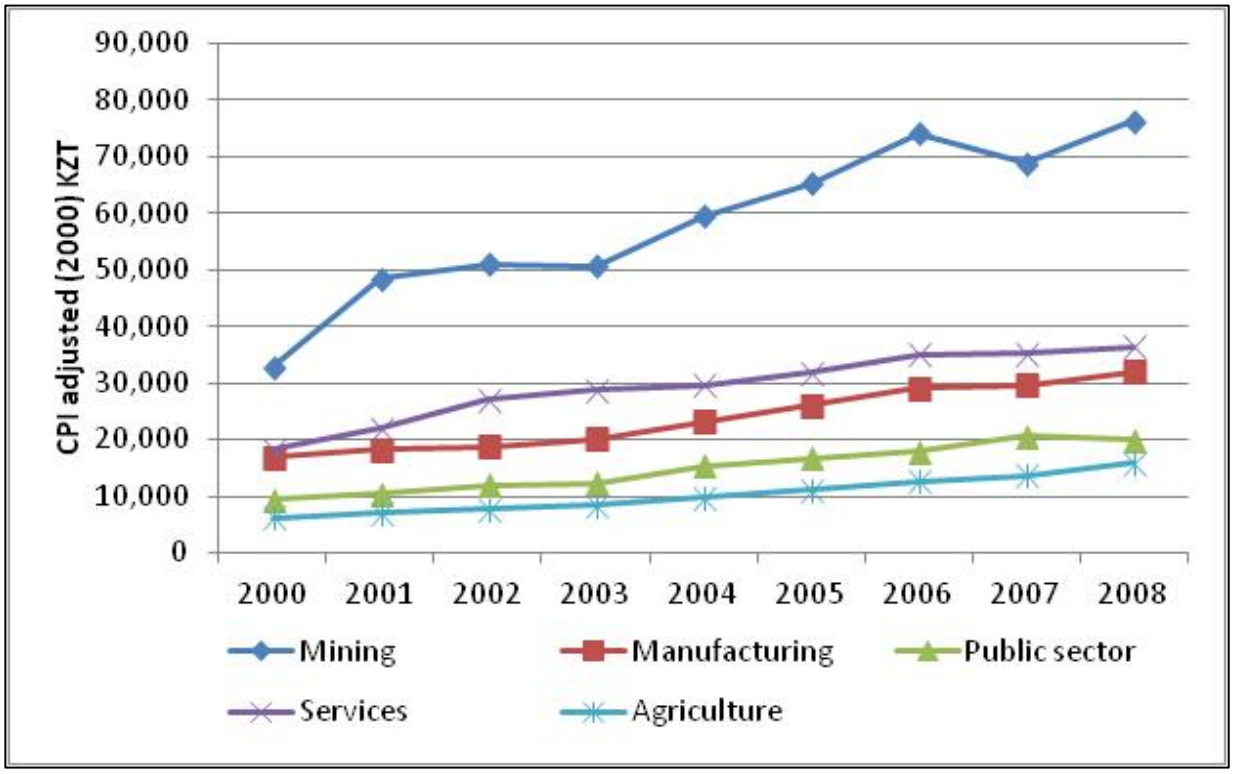
In 1997, the Economist coined a term "Dutch disease" to describe the decline of the manufacturing sector in the Netherlands after the discovery of a large natural gas field [16]. The Dutch disease implies a causal relationship between the increase in the natural resource sectors and a decline in non-commodity sectors (manufacturing and agriculture). There are two major effects that cause a decline in non-commodity sectors [17-19]:

- Capital and labor sources tend to shift from these sectors to the booming sector(s);
- The foreign currency inflow from commodity exports leads to appreciation of domestic currency, making the non-commodity sectors less price competitive on the export market.

This process leads to higher levels of cheap imports, triggering deindustrialization as the non-commodity industries decline due to capital and labor outflow towards the mineral sectors. It is suggested that the effects of the phenomenon are more severe in developing countries than in advanced economies due to the technological gap [20]. The Dutch disease remains an important problem for commodity-based economies, like Kazakhstan, and it is crucial to minimize its negative effects.

Economic Effects of Natural Resource Boom in Kazakhstan

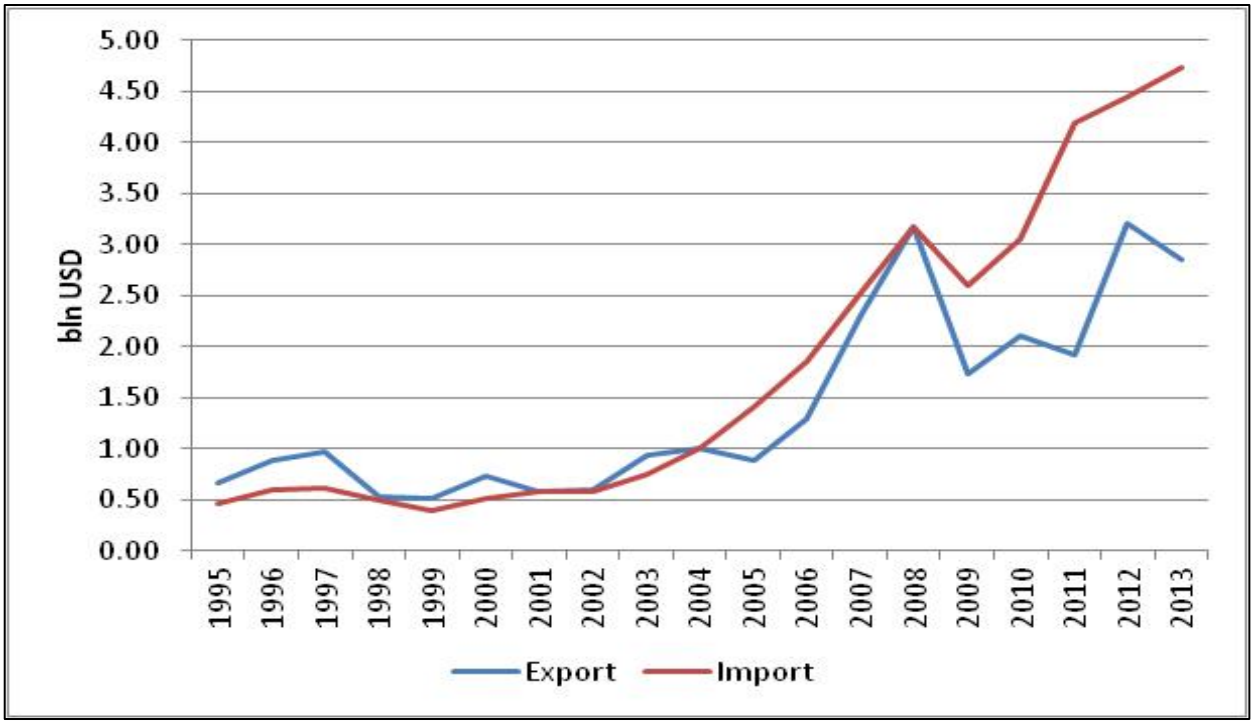
Oil boom caused a significant gap between salaries in different industries in Kazakhstan. The wages in mining industries are significantly higher than in other sectors, while the salaries in agriculture are the lowest as seen in Figure 2. Hence, the mining sectors attract the best talents from other industries.



Source: Author`s calculations based on data from Committee on Statistics [21]

Figure 2. Average salaries in different sectors of Kazakhstan

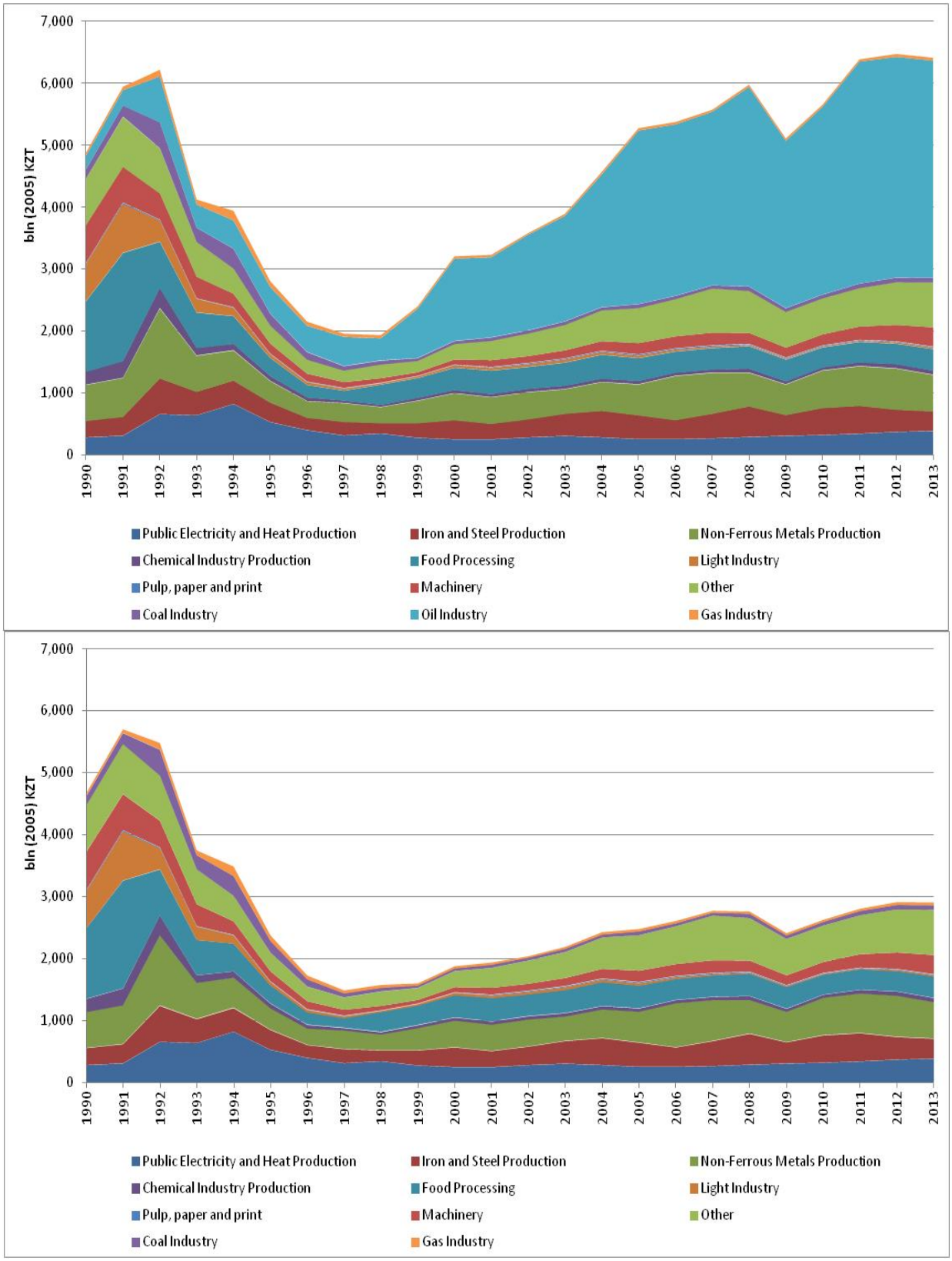
While the decline in the manufacturing sector was inevitable in Kazakhstan straight after the collapse of the USSR due to its obsolete technological level, poor product line-up and the low quality of goods offered, decline in agriculture and food processing sector was caused by bad policies, lack of support of producers and the effects of the Dutch disease. As a result, the real agricultural output has slumped more than four times since 1990. Subsequently, Kazakhstan has transformed from agricultural and food exporting country to importing country, raising the issue of food security as seen below:



Source: WTO [22]

Figure 3. Trade balance of food and agriculture products in Kazakhstan

The industry of Kazakhstan has undergone a significant structural transformation since the Soviet Period. The industry has transformed from diverse with dominant share of processing industries into mostly oil-dependent as displayed in Figure 4. The share of oil industry has increased from 5% in 1990 till 55% of total industrial output in 2013, while the food processing industry had significant decline from 23% till 5% respectively.



Source: Author`s calculations based on data from the Committee on Statistics and UN [21, 23]

Figure 4. Industrial output with and without oil industry

Transformation of trade profile of Kazakhstan in 1995-2012 is provided in Appendix I. The resource dependence inevitably leads to the transformation of the trade profile of the country towards reliance on commodity export. The share of crude oil and gas in total export from Kazakhstan has reached over half of all export by 2000, when the increasing prices of oil and gas caused a boom in the sectors. By year 2012, the combined share of oil and gas reached 60% of the total export. The main exporting commodities from Kazakhstan include crude oil, gas, wheat, metals and radioactive chemicals. The main importing commodities include animal and vegetable products, foodstuffs, chemicals, closing, stones, machinery and transportation. The commodities that went from net exporting to net importing are chemicals, textiles, raw leather and furs. The commodities that went from net importing to net exporting are gold and gas.

The dominance of one type of commodity in the trade profile leads to the lesser export diversity, causing the risk of the commodity price volatility. The export diversity in Kazakhstan is measured by the Herfindahl-Hirschman Index (HHI) for the period 1995-2012 based on data from Hausman et al. (2011) and Simoes and Hidalgo (2011) [24-25]. The HHI is the preferable measure of export concentration and it is defined as follows [26]:

$$HHI = \sum_{i=1}^{N} s_i^2 \quad (1)$$

where s_i is share of commodity i in total export and N is the number of commodities in the export profile. The higher values of HHI indicate less diversity of export.

The results indicate that the Kazakh export has become less diverse due to the dominance of crude oil exports as seen in Figure 5. Export diversification will have a positive effect on income growth. However, it will not only require industrial diversification, but also urges faster development of Kazakh agriculture.

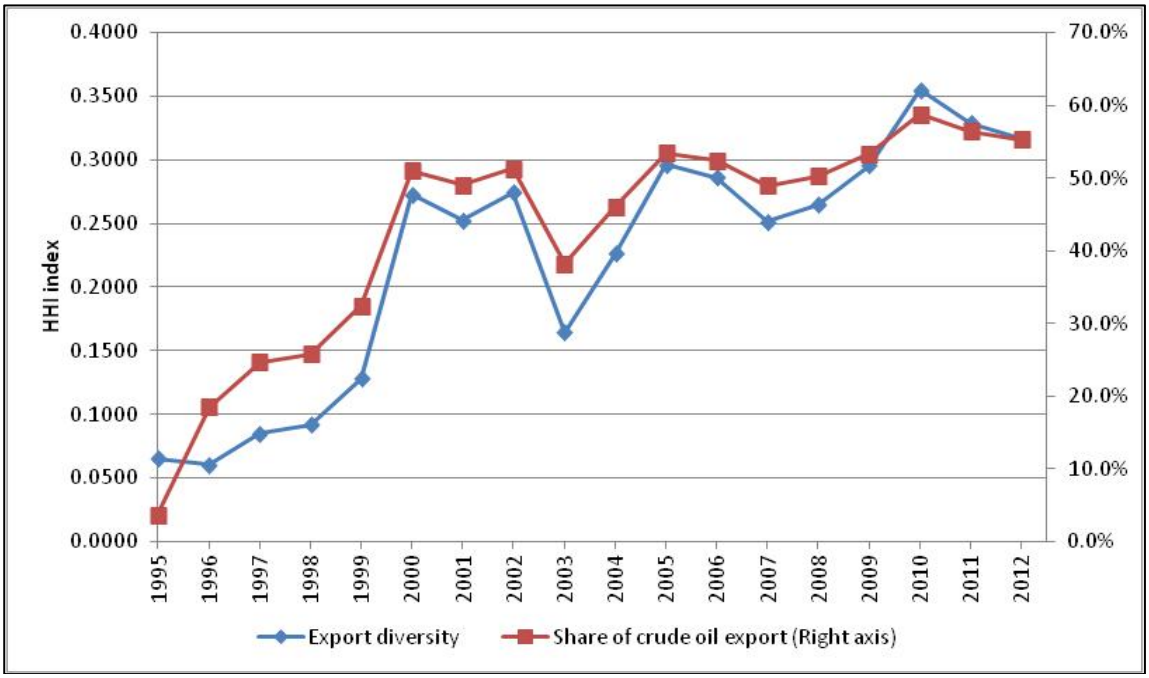


Figure 5. Export diversity and share of crude oil volume in total export

The transformation of Kazakhstan towards oil-based economy had effects on regional

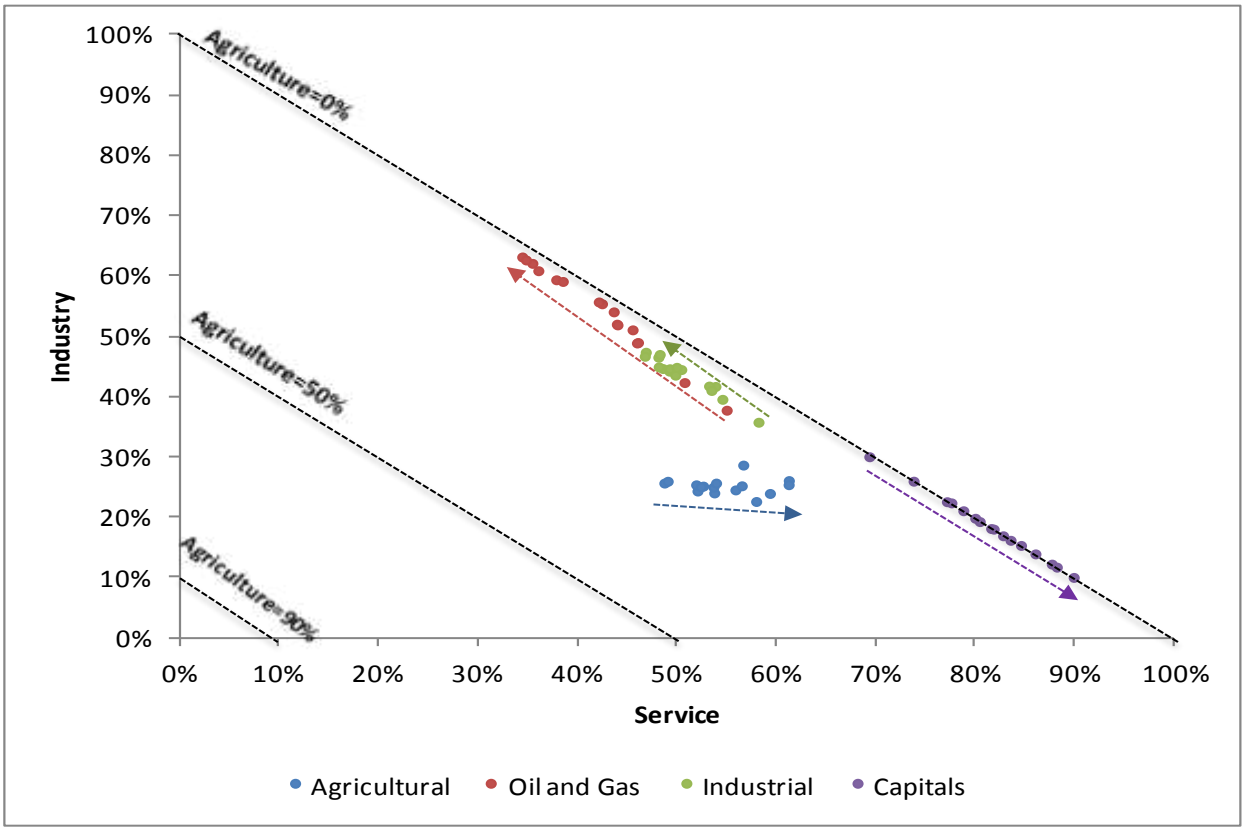
economic development. Based on the structure of the regional output (presented in Appendix II), the regions of Kazakhstan could be divided into four distinct groups: agricultural, oil and gas, industrial and capitals (political – Astana and financial – Almaty city), where the share of subsequent dominant sectors more than 30% of total combined industrial and agricultural outputs. In the early 1990s the outputs of industrial regions were the largest in the country, followed by agricultural regions, while oil and gas regions located near the bottom of the rating. However, the transformation process has lifted oil and gas regions to the top, while agricultural regions have slumped to the bottom of the rating presented in Table 1.

Table 1. Rating of the regions based on combined industrial and agricultural outputs

Region	1990	1995	2000	2005	2010	2011	2012	2013
Agricultural								
Akmola	4	5	12	13	13	13	13	13
Almaty	7	10	7	10	10	10	9	9
Zhambyl	9	13	15	15	15	15	15	15
Kostanay	3	4	8	9	9	9	11	11
South Kazakhstan	5	6	5	11	11	11	10	10
North Kazakhstan	6	9	14	14	14	14	14	14
Oil and Gas								
Aktobe	10	7	9	5	4	5	5	6
Atyrau	15	8	1	1	1	1	1	1
West Kazakhstan	12	14	10	4	5	3	3	3
Kyzylorda	14	16	13	6	7	6	8	8
Mangystau	13	11	3	2	2	2	2	2
Industrial								
Karagandy	1	1	2	3	3	4	4	4
Pavlodar	8	2	6	7	6	7	6	5
East Kazakhstan	2	3	4	8	8	8	7	7
Capitals								
Astana	16	15	16	16	16	16	16	16
Almaty city	11	12	11	12	12	12	12	12

Atyrau, Mangystau and West Kazakhstan have become the economic leaders in Kazakhstan due to significant increase in oil and gas production. The economies of industrial regions are based on utilization of ferrous metals, coal and non-ferrous metals resources. The share of output of oil and gas regions has increased from 13.8% in 1990 till 55.5% in 2013, while the shares of industrial and agricultural regions have declined from 30% and 50.4% till 20.8% and 19.2% respectively.

Overall the value added of agriculture has declined between 1998 and 2013 in all regions of Kazakhstan as seen in Figure 6. For agricultural regions between 1998 and 2013 the reduction in the contribution of agriculture in the overall Gross Regional Product (GRP) has been compensated by an increase in the share of the services. The decline in the services in industrial and oil and gas regions has been compensated by an increase in the share of industry, while the services have increased in capitals in this period.



Source: Author`s calculations based on data from the Committee on Statistics [21]

Figure 6. Relative contributions of the agriculture, industry and service to total regional value added. The share of agriculture is 45° to XY axis

Literature Review

There are number of research papers that studied the effects the effects of oil dependence and the presence of the Dutch disease in Kazakhstan. Auty (1999) noted that heavy foreign investment in mining led to wage equilibrium closer than other transition countries [27]. Furthermore, it was identified that the employment-intensive sectors lack investments. It was foreseen that the government of Kazakhstan (GOKZ) might face the combination of a relatively high real exchange rate, weak growth and rising inequality.

Kutan and Wyzan (2005) examined the presence of the Dutch disease in Kazakhstan by using the extended Balassa-Samuelson model to include the effects of oil price [28]. The study established that the increase in world oil price causes real exchange rate appreciation. Hence, it was concluded that the Kazakh economy is vulnerable to the Dutch disease in medium- and long-term.

Egert and Leonard (2007) tested the presence of the Dutch disease using cointegartion techniques based on the disaggregated sectoral data [29]. The Dutch disease was tested by the presence of negative effects of oil price increase on non-oil manufacturing output. It was concluded that the manufacturing sectors did not experience negative effects of oil price increase. It was suggested that extended period of high oil prices may eventually have negative effects on the economy. Hence, counteracting policymaking was recommended.

Esanov (2009) suggested that economic diversification aspirations of the GOKZ were not backed with adequate institutional reforms [8]. The unbalanced economic and institutional

reforms caused unbalanced growth. The author called for better macroeconomic policy stabilization measures and better designed diversification strategies.

Guriev et al. (2009) outlined the negative effect of the Dutch disease to human capital accumulation in the form of underinvestment in education [30]. Moreover, it was suggested that the manufacturing sectors might not boost when resource prices decrease due to a gap with foreign counterparts due to extended period of underinvestment. Manufacturing sectors might lose their technological edge during the boom period.

The regional panel data analysis by Oskenbayev and Karimov (2013) aimed to test the presence of the Dutch disease by including relative unit labor costs of the non-traded sectors to traded sectors [31]. It was identified that labor force demand causes the contraction of traded sector. Furthermore, price increase of non-traded goods used as inputs of the traded sectors causes bigger increase of traded sector costs.

This study suggests testing the effects of world oil price and tradable industries output on currency appreciation. Consequently, currency appreciation negatively affects the non-tradable industries and agricultural outputs. The presence and directions of Granger causality is examined among the variables by utilization of bivariate VAR models. The types of relationships among the variables are estimated by using correlation coefficients.

Methodology and data

The industries are grouped based on the trade profile of Kazakhstan into tradable and non-tradable industries. Tradable industries include iron and steel, non-ferrous metals and oil and gas industries. Non-tradable industries consist of power, chemical, light, pulp and paper, machinery, coal and other non-specified industries.

Kazakh Tenge (KZT) is a typical petrocurrency, the value of which appreciates when world oil price rises [32]. KZT was pegged to the USD and the National Bank of Kazakhstan regulated its nominal exchange rate in the period under investigation. Furthermore, the state control of goods in the consumer basket could affect the real exchange rate in Kazakhstan. Hence, the better measure of currency appreciation/depreciation is required. Dolan (2014) suggested using the ration of GDP per capita at market exchange rates over GDP per capita adjusted to purchasing power parity (PPP) [33]. For modeling purposes, data on outputs and oil price were converted into natural logarithms. The variables under investigation are: CA is a currency appreciation; LT is an output of tradable industries; LNT is an output of non-tradable industries; LA is an agricultural production; LO is a world oil price.

The logic behind VAR model is based on the assumption that the future value of the variable depends on the past values of itself and other variables of the model. A bivariate VAR model with two time series Y and X could be presented as follows [34]:

$$\Delta Y_t = \alpha_{10} + \sum_{i=1}^{T_{11}} \beta_{11i} \Delta Y_{t-i} + \sum_{i=1}^{T_{12}} \beta_{12i} \Delta X_{t-i} + \mu_{1t} \quad (2)$$

$$\Delta X_t = \alpha_{20} + \sum_{i=1}^{T_{12}} \beta_{21i} \Delta X_{t-i} + \sum_{i=1}^{T_{22}} \beta_{22i} \Delta Y_{t-i} + \mu_{2t} \quad (3)$$

where Δ is the difference operator, T is the lag order, α and β are the estimation parameters, μ is an error term. The presence and directions of Granger causality is based on the results of Wald test with null hypothesis as follows [34]:

$$\boldsymbol{H_0}: X \neq> Y: \beta_{12i} = 0, i = 1,2, \dots q \quad (4)$$

$$\boldsymbol{H_0}: Y \neq> X: \beta_{22i} = 0, i = 1,2, \dots q \quad (5)$$

If $\boldsymbol{H_0}$ is rejected, then it is suggested that past values of *X/Y* has a significant linear predicative power on the current values of *Y/X* and the Granger causality exists. The quality of VAR models is tested by impulse response to Cholesky 1% shock of the models in Appendix III.

Prior to testing VAR models, a presence of unit root of the variables needs to be tested. The Augmented Dickey-Fuller (ADF) unit root test is utilized for this purpose. Correlation coefficients are used to explain the predictive relationships between the variables.

The study uses annual data for the period between 1993 and 2013. The data sources for industrial and agricultural outputs is the Committee on Statistics of the Republic of Kazakhstan [21], adjusted to the constant prices of FY 2005 using price deflators from the United Nations Statistics Division [23]. The data on GDP per capita at market exchange rates and GDP per capita adjusted to PPP are acquired from the World Bank Open Data [2], while the information on world oil price obtained from BP Statistical Review of World Energy [35]. The descriptive statistics of the variables are presented in Table 2.

Table 2. Descriptive statistics of the variables

Statistics	CA	Oil price, (2013) USD /bbl	Tradable	Non-tradable	Agriculture
			trillion (2005) KZT		
Mean	0.31	56.32	2.75	1.54	0.82
SD	0.14	33.50	1.37	0.45	0
Median	0.23	38.55	2.50	1.54	0.82
Max	0.59	115.22	4.72	2.70	1.20
Min	0.16	18.17	0.84	0.91	0.59

Figure 7 and Table 3 display the time series dynamics of the variables and growth rates for the different periods. As shown, the world oil price and tradable industries have experienced a faster growth since 199, while the currency appreciation has started since 2003. The global financial crisis in 2009 caused a step declines in both tradable and non-tradable industries by 16.9% and 8.4% respectively, while agricultural output increased by 11.6%, indicating the possible positive effect of oil price decline on agriculture in Kazakhstan.

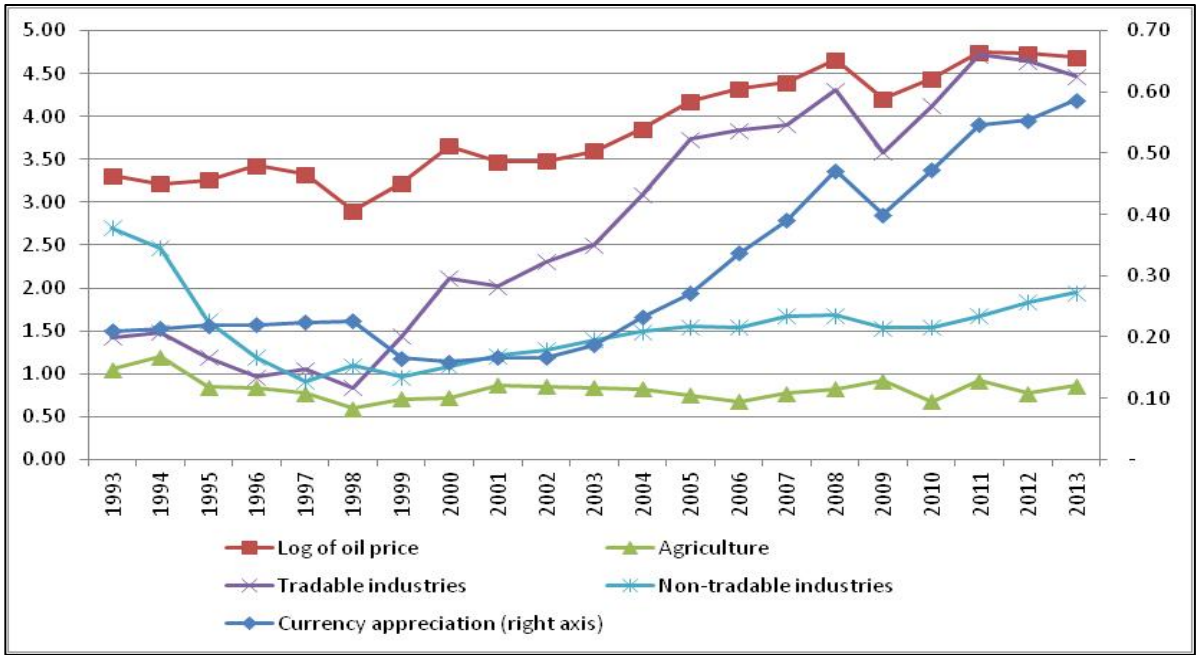


Figure 7. Time series plot of currency appreciation rate, agricultural output, log of oil price and output of tradable energy and non-tradable industries

Table 3. Average annual growth rates of variables for different periods

	1993-1998	1999-2008	2009	2010-2013
Agriculture	-16.3%	3.8%	11.6%	1.2%
Tradable industries	-15.1%	19.6%	-16.9%	6.1%
Non-tradable industries	-16.5%	4.6%	-8.4%	6.2%
Total	-17.0%	10.7%	-11.4%	5.0%

Empirical Findings

The correlation coefficients indicate the positive relationship between appreciation rate, world oil price, the outputs of tradable and non-tradable industries, while agricultural production has negative relationship with all variables, apart from non tradable industries as displayed in Table 4. It possibly suggests that increase in agricultural output may have positive effects on non-tradable industrial output.

Table 4. Correlation matrix of the variables

	CA	LT	LNT	LO	LA
CA	1.000				
LT	0.745	1.000			
LNT	0.416	0.376	1.000		
LO	0.895	0.936	0.356	1.000	
LA	-0.030	-0.020	0.637	-0.066	1.000

The results of unit root test indicate that the variables contain unit root in their levels, but stationary in their levels. This implies that the variables are integrated at order one, i.e. $I(1)$ as shown in Table 5.

Table 5. Results of ADF unit root test

Variable	Level	1st difference
CA	0.872	-3.914***
LA	-0.746	-6.968***
LNT	-0.186	-2.712***
LO	-0.551	-4.870***
LT	-0.581	-3.031*

Note: * and *** indicate that the null hypothesis is rejected at 10% and 1% level respectively. The optimal lag lengths are selected using AIC.

The results of Granger causality tests are presented in Table 6. The tests established the following:

- Unidirectional causality is present running from world oil price to currency appreciation rate;
- Unidirectional causality is present running from tradable industries to currency appreciated rate;
- Unidirectional causality is present running from currency appreciation rate to the output of non-tradable industries;
- Unidirectional causality is present running from currency appreciation to agricultural output.

Table 6. Results of Granger causality tests using the VAR models

Null hypothesis	Lag length	Wald test statistics	
		χ^2	p-value
LO≠>CA	1	5.465	0.019**
CA≠>LO	1	0.010	0.922
LT≠>CA	1	7.151	0.008***
CA≠>LT	1	0.379	0.538
CA≠>LNT	5	9.719	0.084*
LNT≠>CA	5	8.019	0.155
CA≠>LA	5	35.393	0.000***

Note. ***, ** and * indicates the rejection of a null hypothesis at 1%, 5% and 10% level of significance respectively.

The results of analysis indicate that increase in world oil price and the tradable industries output result in currency appreciation. Consequently, currency appreciation causes increase in non-tradable industries and decreases agricultural output in Kazakhstan. Based on the lag length, it could be suggested that the changes in world oil price and output of trade industries have immediate effect on currency appreciation, while the impact of currency appreciation on non-tradable industries and agricultural output has delayed effect. The lagged effects of the currency appreciation on tradable industries (5 years) and agriculture (5 years) could be the result of the regional economic differences. Moreover, it could be suggested that the tradable industries have a trickledown effect on non-tradable industries.

Conclusions

The presence of the Dutch disease is tested by utilizing bivariate VAR models with time series data of currency appreciation, outputs of tradable industries, non-tradable industries,

agriculture and world oil price. The theoretical framework of the Dutch disease states that the economic development of natural resources leads to a decline in manufacturing sector and agriculture. The results of correlation analysis indicate that currency appreciation rate is positively correlated with world oil price and the outputs of tradable sectors, currency appreciation positively correlated with non-tradable industries output, while it negatively affects agricultural production.

The outcomes of Granger causality tests using VAR models indicate the presence of unidirectional causalities running from world oil price and tradable industries production to currency appreciation, while there are unidirectional causalities running from currency appreciation rate to non-tradable industries output and agricultural output. The lag lengths of VAR models defined by the AIC process indicate that world oil price and output of tradable industries have immediate effect (1 year) on currency appreciation, while the currency appreciation has delayed effect (5 years) on non-tradable industries and agriculture.

The mechanisms of the Dutch disease imply that the industrial development of Kazakhstan is vulnerable to the volatility of world oil market. Moreover, oil dependency has a negative effect on agriculture. The development of the export-oriented industries led to degradation of other non-focus industries and consecutive import growth. The plummeting prices of commodities have negative effect on both financial and economic stability of Kazakhstan. Hence, there is an urgent need to reduce the effects of the phenomenon. The results of the analysis indicate that the focus of diversification strategies of Kazakh government should shift from industrial diversification towards agriculture.

The existing studies define two distinct methods to reduce the effects of the Dutch disease in the short run: by slowing the appreciation of the domestic currency appreciation and by diversifying the adversely affected non-commodity sectors [36-38]. The first method proposes sterilization of the capital inflows by saving revenues in special funds and reinvesting them slowly. It may help to reduce inflationary pressures, achieve stable revenue stream and creates savings for future generations. The GOKZ uses sovereign Wealth Fund for this purpose. However, the governance of the fund lacks a transparency [39]

The second method involves the government protectionism of non-commodity sectors by increasing subsidies and import tariffs. The aim is to create favorable conditions for sectors to become more competitive and achieve economic diversification. This will make the economy more robust to external commodity price shocks. However, this measure may lead to appreciation of domestic currency by artificially reducing demand for foreign currency by the sector, worsening the effects of the phenomenon.

There is a no general agreement among the scientists on the effective policies to minimize the effects of the Dutch disease. However, the majority of existing studies recommend investing in education and infrastructure projects to mitigate the impacts of phenomenon in the long run. It is important to develop effective combination of short- and long-term policies addressing the Dutch disease based on country-specific analysis.

Agricultural reforms were the basis of sustainable economic development in Japan, South Korea and Taiwan in the mid-twentieth century [40]. The role of agriculture in Kazakhstan remains insignificant (less than 10% of GDP) and lacks government's attention. There is a need to restructure agriculture towards labor intensive and small-scale development. The GOKZ suggested leasing land to Chinese enterprises in order to revitalize agriculture [41], which sparked violent protests among the ordinary citizens. Despite being highly unpopular among the population of Kazakhstan, the measure is unlikely to contribute to domestic capital creation.

The abovementioned policy recommendations contradict the rent-seeking attitude and widespread corruption inflicted by extractive economic and weak political institutions. Corruption has become a normal way of life as it penetrated in all aspects of daily life in Kazakhstan from oil contracts till schools, kindergarten [42-43]. The level of corruption endangers the legitimacy of the government and may affect the political stability of the country [44]. Hence, the ability of Kazakh government to improve the existing institutional qualities is questionable.

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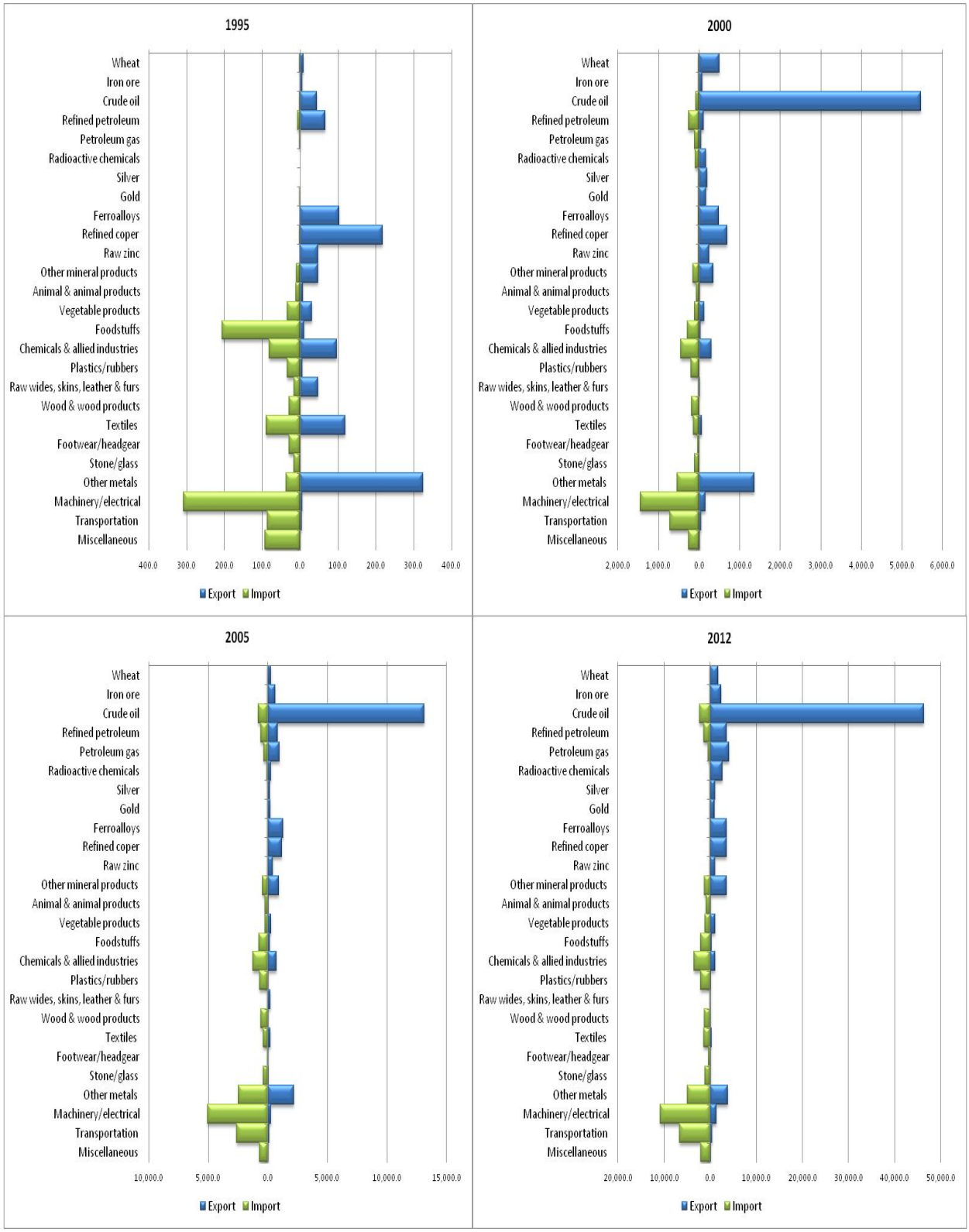
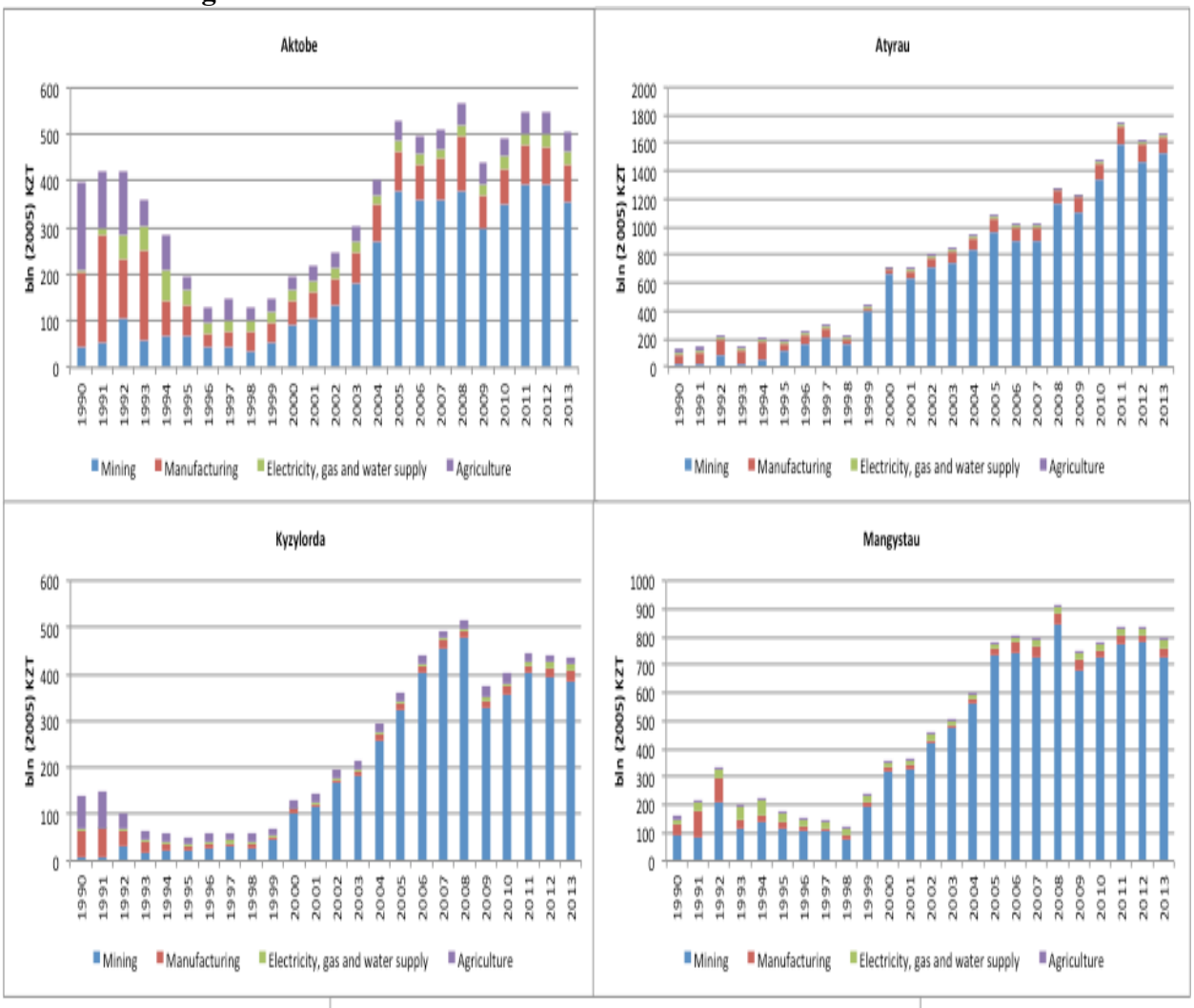
Appendices

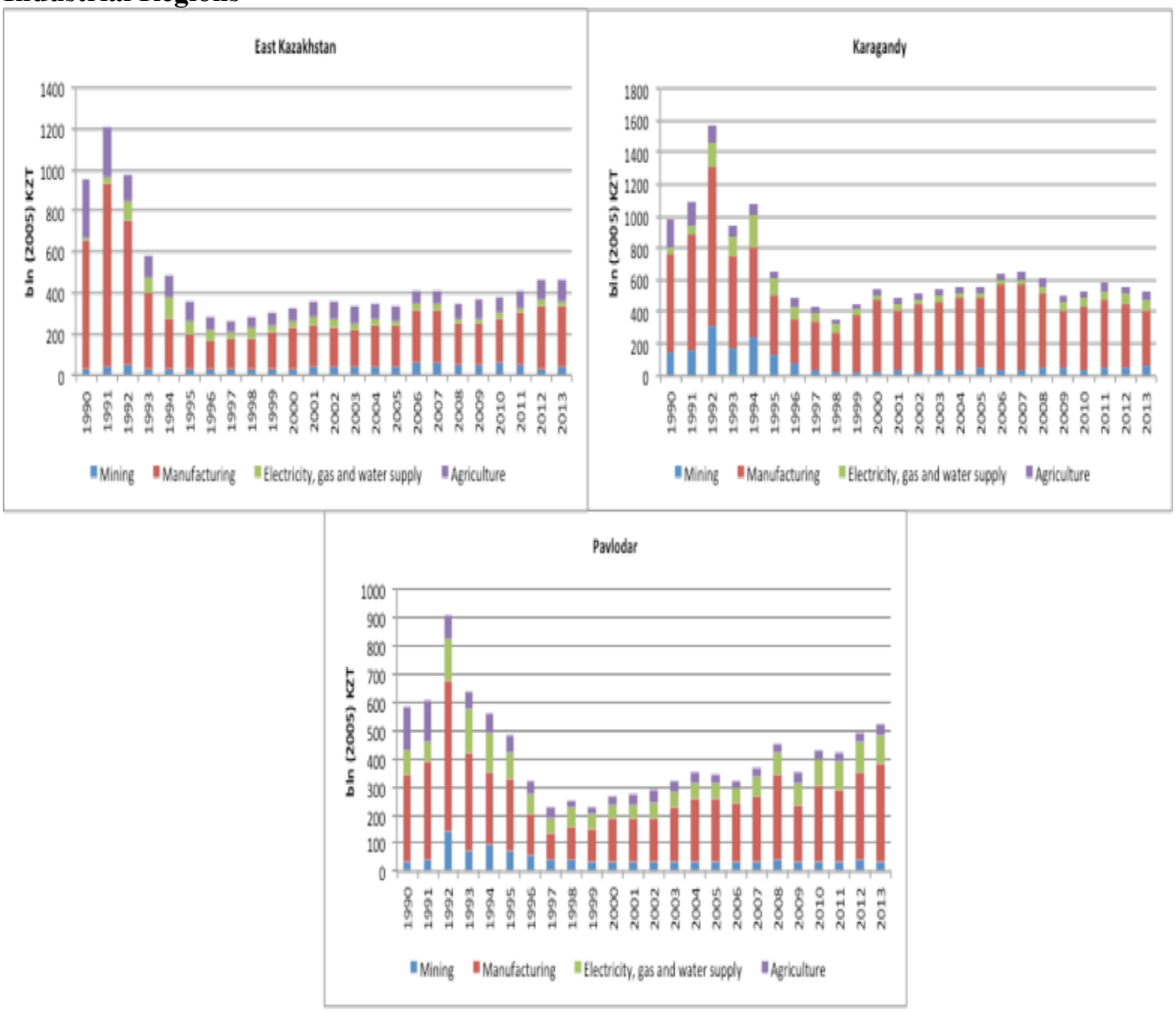
Appendix I. Transformation of trade profile of Kazakhstan in 1995-2012



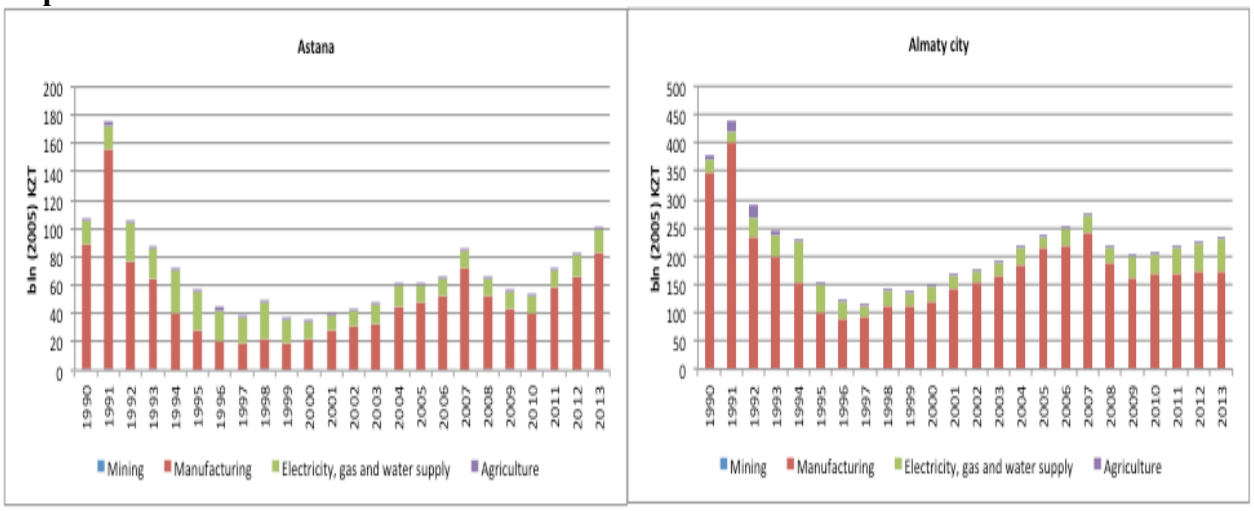
Appendix II. Structures of the total regional outputs
Oil and Gas Regions



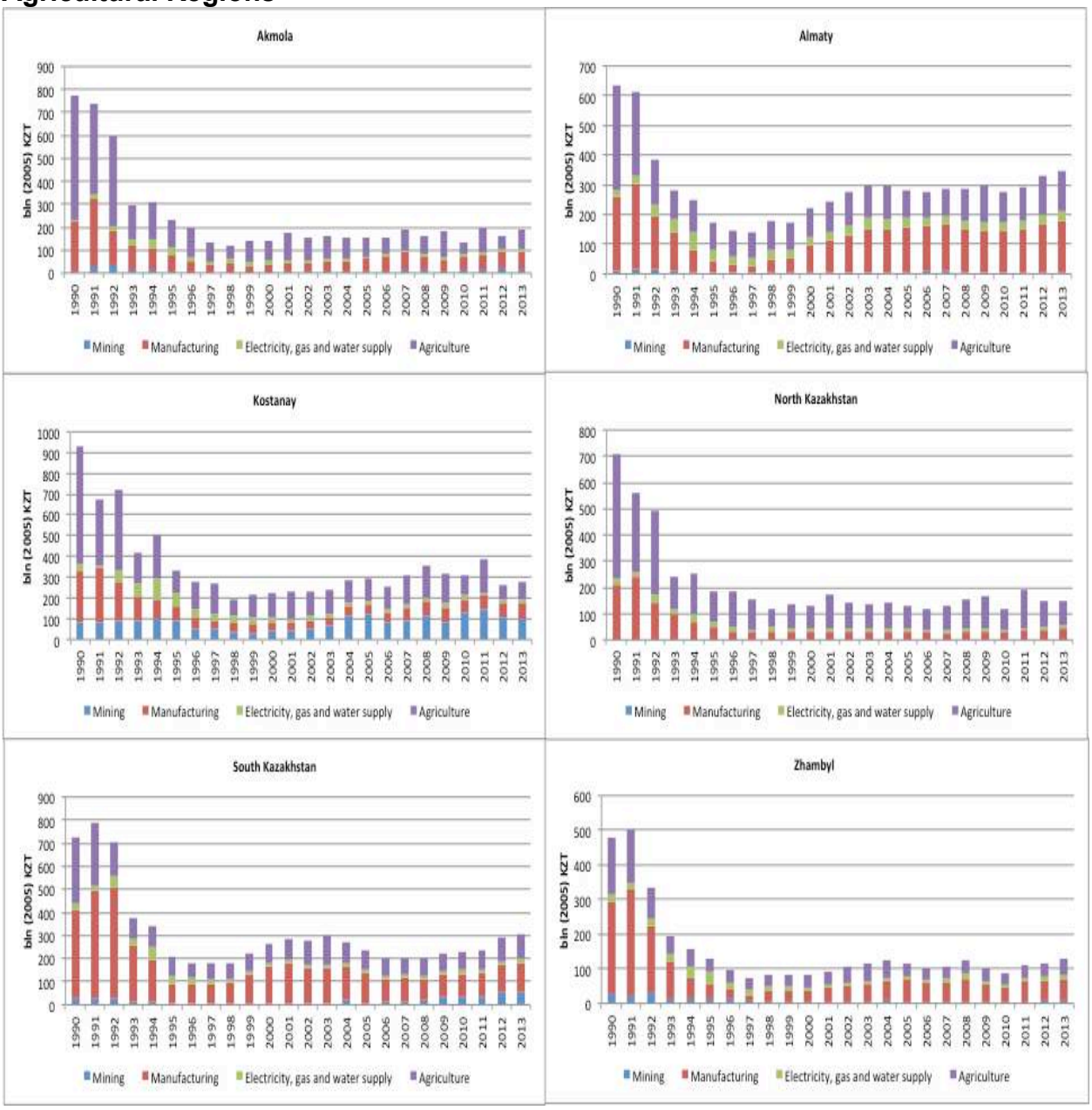
Industrial Regions



Capitals



Agricultural Regions



Appendix III. Impulse Response to Cholesky 1% Shock of VAR Models