EXAMINING THE TOTAL FACTOR PRODUCTIVITY CHANGING PATTERNS IN KAZAKHSTAN: AN INPUT-OUTPUT ANALYSIS

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ABSTRACT

The interconnectedness of sectors displays the demand for inputs and supply as a level of output in any economy. This paper addresses the Total Factor Productivity (TFP) in Kazakhstan sectors by using input-output tables during 2012-2017. The change in total sectoral production was separated into two parts: the changes in technical coefficients of intermediate inputs and the change in value-added inputs, respectively. The main findings have identified a changing pattern in sectoral performance. At the same time, the result justified that various sectors such as; petroleum, manufacturing, construction, and food processing sectors have shown increased productivity. The country highly depends on extractive industries but still has better manufacturing value-added performance. The study suggests that to combat challenges like COVID-19 and climate change, it is vital to develop human capital and diversity. With diversification and innovative measures, an economy can attain sustainable economic growth in the long term.

Keywords: total factor productivity; value added; extractive sectors; human capital; Kazakhstan

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INTRODUCTION

Due to COVID-19, world has gone through massive healthcare and economic challenge since 2019. The pandemic has affected everyone directly or indirectly but not in the same way and magnitude (Arredondo et al., 2021; Ardo et al. 2022; Sajadi and Hartley, 2022). The COVID crisis started in end of 2019 almost ended, however economies are still struggling to come out from the negative economic impact of this shock, which has affected every sphere of life. This disease has tremendous impact at aggregate and sectoral level irrespective of regional locations.

Countries have imposed various restrictions and precautionary measures such as lock down, travel bans, social distancing and massive vaccination to combat these challenges (Capano et al., 2020; Moosa, 2020; Gong et al., 2022).

Moreover, Heintz et al. (2021) highlighted that COVID-19 has profound implications on our thoughts about economic futures. They elaborated that lessons learnt from ongoing pandemic should remember as interlocking crisis due to macroeconomic consequences. This has further a paradigm shift for social and economic policies along with overall change in economic activities. To rehabilitate the economies, governments around the globe introduced various fiscal and monetary policies. In this regard, Chen et al. (2021) investigated the national's government fiscal plans around the world from three as aspects as size, types and target. They shed light on the three dimensions of fiscal policy across various countries by developing a multidimensional framework.

Considering the resource rich economies, they also showed a positive association between the natural resources and sluggish economic growth during COVID-19. Zhou et al. (2022) examined that the impact of natural resource price instability on economic performance of four South Asian economies. They employed time series panel data analysis and found a bidirectional causal relationship among pace of economic development, oil rents and natural gas rents except coal rents. Furthermore, the country specific studies differ in result related to resource-based development. Because there are, various country based institutional variables that make it difficult to compare all countries with same indicators (Azomahou et al., 2021; Deng, 2022; Guan et al., 2021; Omelicheva and Markowitz, 2021).

Amid COVID-19 due to various restrictions like other economies, Kazakhstan has also faced economic and health sector challenges. However, by the end of November 2021, around 42 percent of population was fully vaccinated. This has helped in reopening the economy by easing mobility restrictions and boosted the service sector including retail trade and transportation. Furthermore, the resumption of domestic and external economic activities harness the exports with other trading partners. Kazakh government also introduced additional budget in 2021 comprises on 1.8 percent of GDP for healthcare sector. The economy is also facing high inflation rate along with external borrowing cost as other central banks hike interest rates to tame inflation expectations.

Besides, the overall global volatile prices and uncertainty over the scale of demand growth for oil and other risks could further pressure the exchange rate. Amid all this, banking sector of Kazakhstan remained resilient to control the money supply in order to attain target inflation rate. The government had also implemented expansionary fiscal policies with additional US$10.7 billion spending during 2021. The mining sector will benefit from increased production with high oil prices in 2022 to enhance the FDI (World Bank, 2022).

The territory has enormous petroleum and non-fuel minerals along with the unique history of industrialization since early 1940s. Luong and Weinthal, (2001) highlighted that Kazakhstan's completely privatized energy sector sold the huge shares of energy to foreign oil companies and corresponds with greater efficiency. This further justifies that overall the residual change in the total output of firms or industries are having an upward trend. Here are the vital oil indicators of Kazakhstan also reflects that there are ongoing changes in the economy with changing direction of these variables. The crude oil production and exports are showing the same trend this means that there is high oil exports with increased production. Hence, this mechanism leads the impact on oil GDP and external oil price. Oil as an extractive sector plays a vital role in economic development and stand as a key sector. This further justifies that amid COVID-19 due to upheavals in oil market lead to direct impact on economic activities (Figure 1).

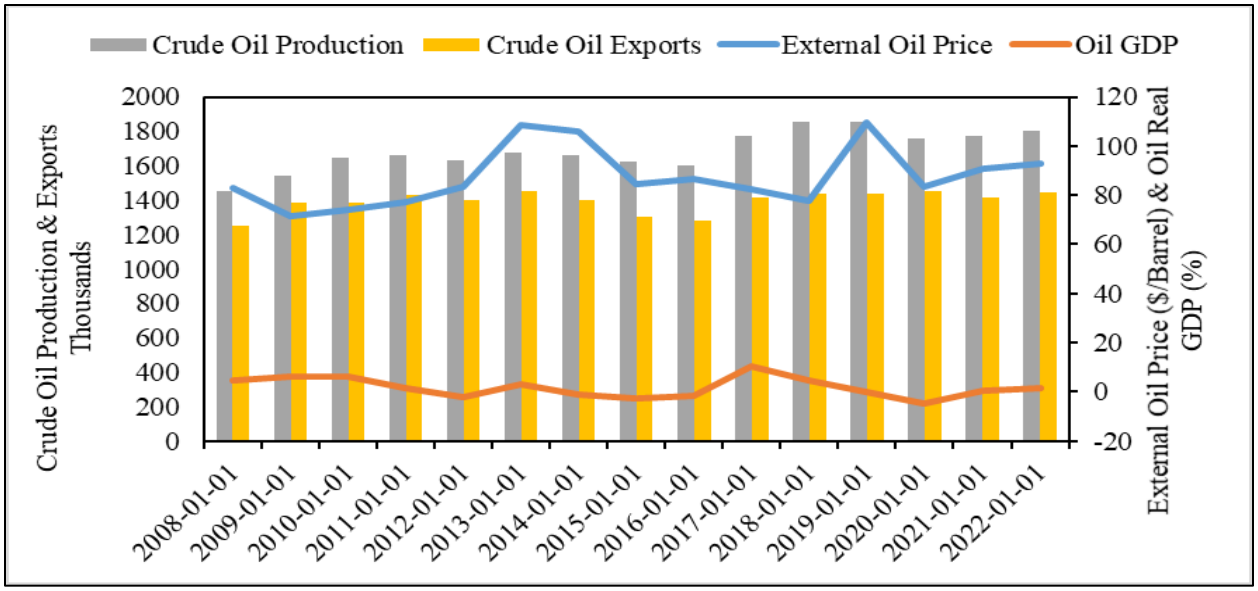

Figure 1: Kazakhstan Oil Indicators.
Source: Authors' work based on (Federal Reserve Bank of St. Louis, (2022).

This study contributes by reassessing the second largest Central Asian transitional economy with petroleum-rich resources and a privatized energy sector. The paper has scope in the existing literature by extending the knowledge of total factor productivity with interaction of sectoral performance. It examined the productivity growth during various years to capture the changes in sectoral performance and the rest of economy by using input-output framework. Furthermore, the study shed light on growth of total level of output by utilizing the value-added inputs. The intersectoral performance and change in productivity further shed light upon the structural changes and reforms especially in post COVID-19 time. To assess the volatile oil prices and uncertainty over the scale in Kazakh economy with tighter monetary stance is leading to revenue shrinkage. Therefore, the result of this research will generate some potential policy implications for the short run and long-run sustainable growth.

The remainder of the study organized as follows: Section 2 analyze the existing literature by focusing on productivity growth and sectors performance especially considering the Kazakhstan economy. Section 3, describe the data sources and derives the appropriate methodology by displaying the interactions in the model economy. Section 4 presents and result analysis and lastly Section 5 concludes with some relevant policy implications.

LITERATURE REVIEW

The extractive industries led economic growth is a historical debate in economics. Adam Smith highlighted that expensive and uncertain projects which bring bankruptcy when greater number of people engage in and could be ruinous than search for gold and silver. Graulau (2019) debate on the same lines that Adam Smith did not anticipate the innovative industries force of mining industries and land improvements in nineteenth century. He argued that mining preceded agriculture as the first true capitalist enterprise of the modern world. In the following part, a brief literature on the extractives industries and their linkage with economic growth has presented. This linkage can be in various forms such as direct as input side or output side means the intermediate inputs. This can also reflect in value-added means the he value of labor and capital used in producing gross output. There is contemporary debate over the detrimental growth and natural resources sectors such as oil, coal and other mining industries. Due to increasing exports of natural resources will lead to enhance revenues and will lead to appreciation of local exchange rate. Consequently, the factor especially the labor cost of tradable will increase. This further can result of movement of labor from manufacturing to extractive sectors (Chirikure, 2014; Tamba, 2017; Scholvin et al., 2021; Ren et al., 2022).

Li and Liu (2010) examined the total factor productivity in the Australian construction sector by employing input-output decomposition analysis from 1990 to 2007. The analysis revealed changes in industry productivity with passage of time due to variations in technical efficiency and scale economy. This lead to policy suggestion that various effective reforms can enhance productivity level and efficiency in multiple sectors. In another study, Lin and Liu (2016) examined the energy consumption and carbon emissions as loss of resource productivity in China. They used input-output analysis and verified the natural resources loss among industries by measuring factor productivity.

Locating in Central Asian region, despite the abundant resources the Kazakh economy is still facing some challenges of regional disparities. Turganbayev and Diener (2018) discussed the special inequalities as considering the political, social, economic, ecological, and geopolitical circumstances in Kazakhstan. They emphasized that country as former Soviet Republic has periodically revise its regional economic policies. The study tracked the changes by using government documents and assessed their effect on disparity across the region. Furthermore, Aliev (2015) has reviewed the critical growth path of Kazakh economy while considering the territorial, structural and social disparities. He has further examined the sectoral-based economic growth and found various disparities in sectoral growth. This further indicated that there are some imbalances in the growth patterns with the various changes in macroeconomic variables. Junisbai (2014) argued that the Kazakh economic system is not legitimate and this further led to many distributive challenges in economy. The author also mentioned that this could cast negative impact in the long-term stability of country.

Shahbaz et al. (2017) discussed that income inequality in Kazakhstan impaired by financial development. The study proposed that for sustainable economic growth the FDI should be attracted other than hydrocarbon sector to alleviate income inequality along with adaptation of better education system. In this context, Turganbayev (2016) also discussed that private investment in Kazakhstan heavily affected by the natural resources. Therefore, regional policy needs to shift the economy from a resource-based growth model to another. Mahmood and Mostafa (2018) explored the prospects of economic cooperation between Kazakhstan and the BRICS countries. They suggested that a bilateral relationship could generate mutual economic benefits for both players. There are certain challenges in economic integration process but this can accelerate long-term economic growth.

In summary, various studies have examined the resource led growth in multiple economies. Their conclusions highlighted that the performance in one sector affect the others due to interconnectedness of economic activities. In this regard, analyzing the intermediate demand and value-added in various sectors can highlight the performance of individual sectors. This will further determine the factor productivity by looking the input and output side with various level of production in different times. Most of the previous studies, considered various research variables such as FDI, oil rent, exchange rate and GDP by looking role of extractive industries. However, there is still need to have some further analysis for Central Asian Kazakh economy. This will suggest effective policies in post-COVID-19 time, where it is vital to have such compelling insights.

METHODOLOGY

Current study has employed latest computable input-output tables of Republic of Kazakhstan during 2015 to 2020 from Asian Development database (ADB, 2022). Each table consists of 34 sectors and all values were represented in US dollar in millions (Appendix Table A1). These sectors show the inter economy connections by providing important set of data by having inputs and outputs.

The rate of economic productivity is the key source of growth and health phenomenon in any economy. Broadly defined the productivity also reflects in overall level of output in an industry or economy as a whole per unit of input. Hulten (1975) explained the conventional approach of measuring total factor productivity is a change in aggregate production function means technical change. However, this approach does not allow the vital interaction of capital accumulation and technical change. Therefore, in this context Hulten (1978) further highlighted that the expansion in the production of intermediate goods occurred due to increased efficiency of

factors. He stressed that it is important to distinguish between two vital aspects as 'the productivity change emerging in a sector and the impact of change on the sector'. Therefore, in the first aspect the productivity change refers as the shift in sectoral technology, which can measured by productivity residual. Whereas, the second aspect measures the shift in sectoral technologies include the reallocation of factor inputs among sectors and capturing the effect of technical change in the sectors as expansion of factor inputs. Overall, to assess the productivity change as source of growth the second aspect is more relevant as it is the impact of productivity change, which affects the transformation of sector not the factor efficiency within the sector.

To capture the productivity change input-output is a suitable method due to detailed framework of supply and demand. 'Input-output technique', which is closely associated with the name of Wassily Leontief as the founder of this methodology. This modeling technique accounts for the economy by having direct and indirect interdependencies among different sectors. Several researchers have used input-output methods to capture changes in demand and supply-side sectoral performance individually and the economy as a whole (Bjerkholt and Kurz, 2006; Kofoworola and Gheewala, 2008; Reis and Rua, 2009; Bekhet, 2012, 2013; Gregori and Pietroforte, 2015; Haddad et al., 2021).

In input-output analysis, the technical coefficients matrix as, *aij*, the value added coefficients, *vj*, and also the total industry level of output, *Xj*, display the fundamental relationship of input usage stated as below in Equation 1 (Miller and Blair, 2009):

$$x_j = \sum_{i=1}^{n} a_{ij}\, x_j + v_j x_j = \left(\sum_{i=1}^{n} a_{ij} + v_j\right) x_j \qquad (1)$$

Here, can further elaborate the above rule as differential as below in Equation 2:

$$dx_j = d\left[\left(\sum_{i=1}^{n} a_{ij} + v_j\right) x_j\right] = \left(\sum_{i=1}^{n} a_{ij} + v_j\right) dx_j + \left(\sum_{i=1}^{n} da_{ij} + dv_j\right) x_j \qquad (2)$$

Usually, the Total Factor Productivity (TFP) growth is represented below in Equation 3:

$$\tau_j = -\left(\sum_{i=1}^{n} da_{ij} + dv_j\right) \qquad (3)$$

Therefore, the second equation is rewritten and becomes as (Equation 4):

$$dx_j = \left(\sum_{i=1}^{n} a_{ij} + v_j\right) dx_j - \tau_j x_j \qquad (4)$$

Based on TFP literature, some studies also express the continuous differentials form into logarithmic term, by using the calculus rule that d ln(z) = (1/z)(dz) or dz = z(d ln z). This can further express as in (Equation 5):

$$\tau_j = -\left[\sum_{i=1}^{n} a_{ij}\left(d\, ln\, a_{ij}\right) + v_j\left(d\, ln\, v_j\right)\right] \qquad (5)$$

Furthermore, the v_j is usually decomposed into two components as capital and labor, k_j and l_j respectively. This is also cited as measure of sectoral based technical change which originally proposed by Leontief et al. (1953).

In order to use the input-output table it is necessary to use the relationships as mentioned in Equation 2 and 3 in finite difference form.

Therefore, where $dx_j \cong \Delta x_j = x_j^1 - x_j^0$, $da_{ij} \cong \Delta a_{ij} = a_{ij}^1 - a_{ij}^0$ and $dv_j \cong \Delta v_j = v_j^1 - v_j^0$.

Further, ignoring the second order effects (Equation 6) which called interaction in structural decomposition method and here the TFP resembles especially decomposition of changes in element A.

$$x_j^1 - x_j^0 = \Delta\left[\left(\sum_{i=1}^{n} a_{ij} + v_j\right) x_j\right] = \left(\sum_{i=1}^{n} a_{ij}^0 + v_j^0\right) \Delta x_j + \left(\sum_{i=1}^{n} a_{ij} + v_j\right) x_j^0 \qquad (6)$$

Or this can be expressed (Equation 7) in the form of a portion of change accounted by using old technology as reflected in a_{ij}^0 and v_j^0 to meet the new input requirements. Whereas the portion of change represented by using new technology is reflected as a_{ij}^1 and v_j^1 to fulfil input requirement.

$$x_j^1 - x_j^0 = \Delta x_j = (\sum_{i=1}^{n} a_{ij}^0 + v_j^0)x_j^1 - (\sum_{i=1}^{n} a_{ij}^0 + v_j^0)x_j^0$$

$$+ (\sum_{i=1}^{n} a_{ij}^1 + v_j^1)x_j^0 - (\sum_{i=1}^{n} a_{ij}^0 + v_j^0)x_j^0 \quad (7)$$

The productivity studies are usually concerned to capture the rate of productivity change relative to the initial output level. This can be calculated by dividing the total initial output level, x_j^0.

Equation (3) can be rewritten in finite form as below:

$$\tau_j = -\left(\sum_{i=1}^{n} \Delta a_{ij} + \Delta v_j\right) \quad (8)$$

So,

$$\Delta x_j = \Delta\left[\left(\sum_{i=1}^{n} a_{ij} + v_j\right)x_j\right]$$

$$= \left(\sum_{i=1}^{n} a_{ij} + v_j\right)\Delta x_j - \tau_j x_j^0$$

This can displayed in matrix form as $\Delta x = [(i'A) + \hat{v}]\Delta x + (i'\Delta A) + (\Delta v)]x$ and

$$\tau = -\left[(i'\Delta A)' + \Delta v\right] = -\left[\sum_{i=1}^{n} \Delta a_{ij} + \Delta v_j\right)\right]$$

RESULT ANALYSIS

Based on Table 1, the analysis display that the positive elements of change in value added (Δv) reflect increasing use of value added. In contrast, the negative values indicate the opposite, which can be seen during (2015-2020). Another important point highlighted in the total factor productivity coefficients changes in various sectors as positive and negative coefficients over time. In Kazakhstan, the level of productivity differs based on intermediate inputs and value-added levels. The calculated coefficients also show that the productivity process is stagnated which means that the structure of market is missing an element of competitiveness. The value added inputs during 2015-2020 also display that there is slowdown in economy, which is due to oil price change and reflects structural elements.

Furthermore, the swinging oil price is having negative impact on employment and investment, which is gradually weakening the overall level of output. The total factor productivity (TFP) has shown a decline since 2000 as further declining to negative growth. At the same time, some sectors display massive improvement in productivity, for example, food and beverages (Sector 3), coke and refined petroleum (Sector 8), manufacturing (Sector 16), electricity (Sector 17), another business service (Sectors 32 & 34) and health (Sector 33) accordingly. Moreover, the change in most factor input coefficients is positive this means that with the passage of time the economic activities are changing. Hence, the study revealed that the primary sectors of Kazakh economy has higher interconnected activities.

Table 1: Summary of Value Added and Total Factor Productivity (2015-2020).

Sectors	$VAD_{(2016-2015)}$	$TFP_{(2016-2015)}$	$VAD_{(2017-2016)}$	$TFP_{(2017-2016)}$	$VAD_{(2018-2017)}$	$TFP_{(2018-2017)}$	$VAD_{(2019-2018)}$	$TFP_{(2019-2018)}$	$VAD_{(2020-2019)}$	$TFP_{(2020-2019)}$
1	-0.0349	0.0326	-0.0194	0.0028	-0.0397	0.0447	-0.0152	-0.0167	-0.0018	0.0032
2	-0.0149	0.0149	-0.0191	0.0191	-0.0505	0.0505	-0.0247	0.0247	-0.0013	0.0013
3	-0.0132	0.0229	-0.0171	0.0009	0.0883	-0.0329	-0.0462	0.0027	0.0020	-0.0016
4	-0.0086	0.0205	-0.0156	0.0062	0.0733	-0.0455	-0.0245	0.0146	0.0002	0.0007
5	-0.0023	0.0023	-0.0172	0.0172	0.0927	-0.0927	-0.0298	0.0298	-0.0023	0.0023
6	-0.0104	0.0196	-0.0180	0.0056	0.0865	-0.0578	-0.0276	0.0195	-0.0008	-0.0003
7	-0.0161	0.0168	-0.0165	0.0157	0.0761	-0.0741	-0.0022	0.0013	0.0091	-0.0090
8	0.0097	-0.0097	-0.0098	0.0098	0.1017	-0.1017	-0.0123	0.0123	-0.0092	0.0092
9	0.0049	-0.0049	-0.0162	0.0161	-0.0545	0.0546	-0.0134	0.0134	-0.0014	0.0014
10	-0.0082	0.0082	-0.0159	0.0159	0.3569	-0.3569	-0.0822	0.0822	-0.0007	0.0007
11	-0.0113	0.0113	-0.0157	0.0157	0.0207	-0.0207	-0.0258	0.0258	-0.0008	0.0008

Table 1: Continued.

12	0.0018	-0.0018	-0.0154	0.0154	0.0756	-0.0756	-0.0270	0.0270	-0.0007	0.0007
13	-0.0030	0.0030	-0.0168	0.0167	0.0087	-0.0087	-0.0274	0.0274	0.0001	-0.0001
14	-0.0057	0.0057	-0.0145	0.0145	0.0037	-0.0037	-0.0257	0.0257	0.0002	-0.0002
15	-0.0118	0.0118	-0.0146	0.0146	0.0616	-0.0616	-0.0262	0.0262	-0.0010	0.0010
16	-0.0085	0.0085	-0.0146	0.0146	0.0562	-0.0562	-0.0260	0.0259	-0.0025	0.0025
17	0.0079	-0.0078	-0.0170	0.0170	-0.0317	0.0317	-0.0251	0.0251	-0.0007	0.0007
18	-0.0065	0.0065	-0.0153	0.0153	0.0635	-0.0634	-0.0480	0.0479	-0.0009	0.0009
19	-0.0068	0.0068	-0.0227	0.0227	-0.0907	0.0907	-0.0523	0.0523	-0.0001	0.0001
20	-0.0079	0.0079	-0.0244	0.0243	-0.0964	0.0963	-0.0622	0.0622	0.0002	-0.0002
21	-0.0034	0.0035	-0.0239	0.0237	-0.0850	0.0848	-0.0639	0.0636	-0.0001	0.0001
22	-0.0111	0.0178	-0.0197	0.0141	0.1180	-0.0910	-0.0284	0.0156	-0.0005	0.0002
23	0.0030	-0.0030	-0.0195	0.0195	-0.0151	0.0151	0.0047	-0.0047	-0.0043	0.0043
24	-0.0201	0.0201	-0.0146	0.0146	-0.0266	0.0266	0.0198	-0.0198	-0.0022	0.0022
25	-0.0003	0.0003	-0.0170	0.0170	-0.0335	0.0335	0.0255	-0.0255	-0.0020	0.0020
26	-0.0062	0.0064	-0.0233	0.0231	-0.0391	0.0391	0.0376	-0.0375	-0.0014	0.0014
27	-0.0234	0.0234	-0.0218	0.0218	0.1279	-0.1279	0.0633	-0.0633	-0.0077	0.0077
28	-0.0164	0.0164	-0.0215	0.0213	-0.0027	0.0028	0.0393	-0.0393	-0.0121	0.0121
29	-0.0011	0.0012	-0.0278	0.0277	-0.0516	0.0515	0.0125	-0.0125	-0.0013	0.0013
30	-0.0099	0.0100	-0.0202	0.0201	0.0310	-0.0309	-0.0231	0.0230	0.0003	-0.0003
31	0.0078	-0.0022	-0.0134	0.0085	0.0186	-0.0126	0.0501	-0.0509	-0.0030	0.0022
32	0.0221	-0.0220	-0.0198	0.0198	0.0290	-0.0289	0.0147	-0.0147	-0.0015	0.0015
33	-0.0260	0.0261	-0.0107	0.0106	0.3318	-0.3314	0.1280	-0.1279	-0.0025	0.0034
34	-0.0032	0.0034	-0.0222	0.0221	-0.0695	0.0691	-0.0476	0.0474	-0.0025	0.0039

Source: Authors' work based on Kazakhstan Input-output Tables (2015-2020).

Note: Value Added (VAD); Total Factor Productivity (TFP).

Based on some previous studies, Sadik-Zada (2021) employed various input-output tables of Kazakh economy as for the years 2007, 2010, 2012, and 2017 and applied nonlinear autoregressive distributed lag (NARDL) models for the period 1995–2018. Mainly the result of study shown that extractive sectors has strong links to domestic manufacturing. Furthermore, the NARDL model also revealed a positive relationship between commodity revues and manufacturing value added. Therefore, this also again justified in a current study that mining and extractions sectors (Sector 2, 3 &4 as in Appendix Table 1A) total factor productivity ($TFP_{2016\text{-}2017}$) changed and turned as negative, which means that it wiped out by the decrease in productivity of value-added elements ($VAD_{2016\text{-}2017}$) respectively. Another study Turganbayev (2017) examined total factor productivity (TFP) over the period of 1997–2013 in Kazakhstan. The author concluded that average level of TFP fell by almost 40% over the period mainly due to convergence in non-oil region and divergence in oil-rich economies.

Furthermore, Asian Development Bank (2020) has a detailed external and internal regional analysis of Kazakh economy by using input-output coefficients as presented in Figure 2. To justify the findings of current study, this can be seen that the internal linkages in Kazakhstan economy measured based on four major aspects as: structure of economy, strength of linkages, spread of linkages and sensitivity of linkages. Overall, the measured coefficients displays low values and ranking as in backward linkages side. This means that various sectors having low intermediate inputs for many other industries. Furthermore, this also justifies that the production process confined to limited sectors as hindrance in overall growth. Whereas, the external linkages calculated on different components mainly as: participation, position, production length and specialization. Here, on this side the country has high ranking in forward participation this means that output level in certain sector is relatively more sensitive to changes in other industries' output.

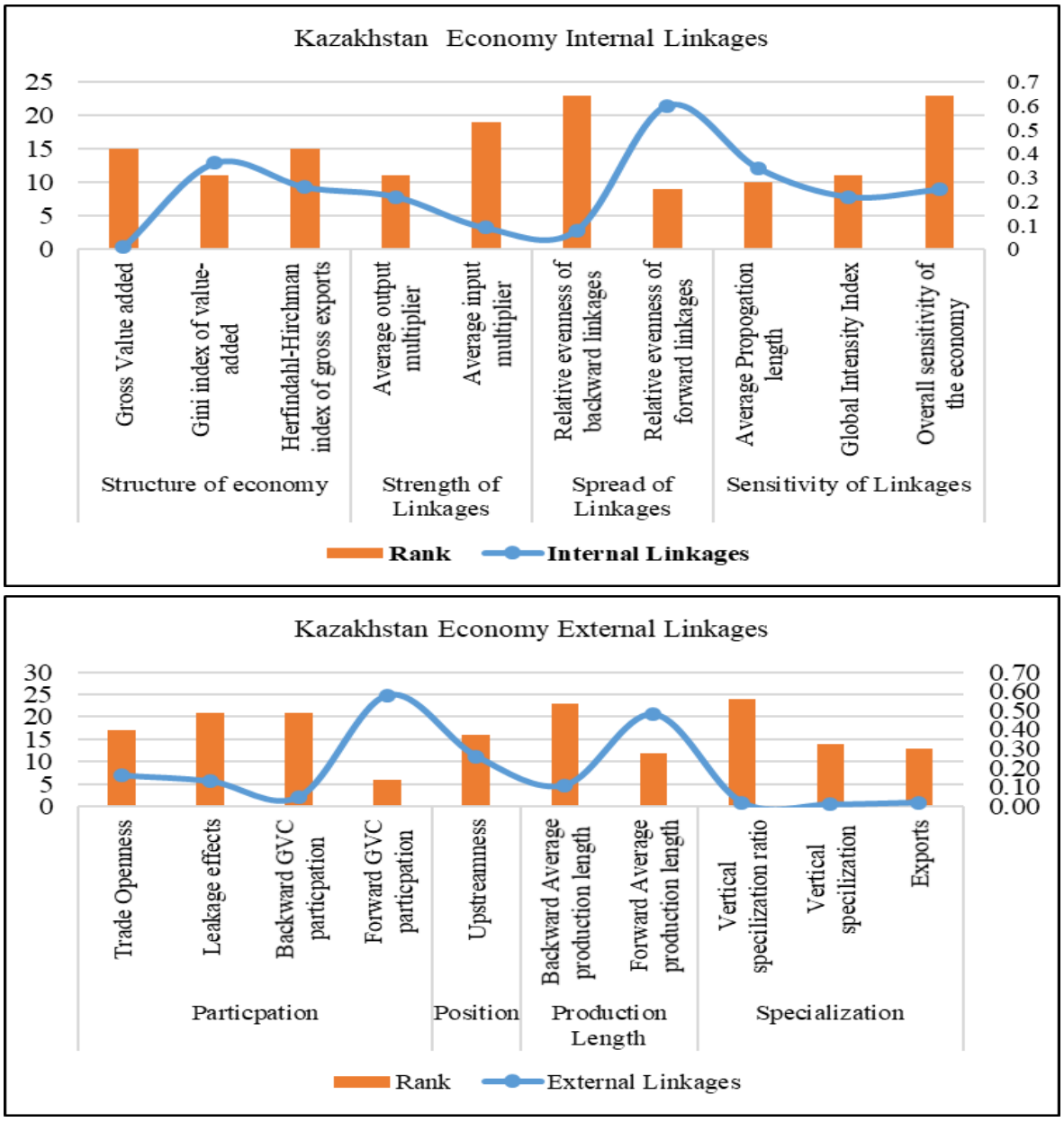

Figure 2: Kazakhstan Internal and External Linkages.

Source: Authors' work based on (Asian Development Bank, 2020).

CONCLUSION AND RECOMMENDATIONS

In summary, the factor productivity idea has triggered valuable insights from the current paper. This revealed the weak but steady productivity changes emanating from the extractive sectors. The input-output coefficients show that with abundant natural resources, there is a substantial change in sectoral performance. Kazakhstan has dispersed oil and gas resources with a high magnitude of export-oriented minerals with liberal international trade policies. Findings also showed that the manufacturing and service sectors' value added played a vital role (Table 1).

Amid COVID-19, the economy faced upheavals with short-term risk, but there is still a need to have effective measures which could hamper economic growth. Based on current research findings, the oil sector has shown a vital change in productivity. This provides evidence that other oil exporting nations, including Kazakhstan, have a sensitivity of effectiveness due to external

global market changes. To avoid such changes in sectoral productivity the best strategy is to promote human development as a best initiative to boost productivity. In this regard, various investment projects can accumulate long-term benefits throughout the society by understanding the potential of productive members in the society. The fact is that all economies always have productivity changes due to labor inputs as well as allocation of physical capital. This notion is equally applicable where economic activities stagnated and resulted in paramount economic loss.

To address the diversity and dispersion of resources, Kazakh economy stand strong with high petroleum and mining deposits as drivers of economic growth. Due to climate change challenges, country planned to transit as green economy to achieve sustainable growth. But this need broader policies to mitigate climate shocks by generating economic diversification. The green transition process should also carefully designed as considering the fossil fuel sectors by minimizing the impact on jobs and low-income households. Along with diversification, the productivity matters for sustaining long-term growth and improving standards of living. Since 2017, due to constitutional reforms, the government received additional powers and this has changed the decision-making process. In the governance aspect, country stands at 80^{th} rank and generate huge resource based economic output with well-developed education and healthcare system. On contrary, there are some challenges consists of weak institutions, landlocked situation and insufficient transport infrastructure (BTI, 2020).

Lastly, the economic diversification measures can also lead to innovation process. Mainly, the sectoral interconnectedness and productivity will have multiplier effect that can also lead to free flow of resources and technical development. In light of result findings, Kazak economy manufacturing sectors displayed huge productivity which can lead to value added with improved output that will also push the high export orientation. This is a powerful indicator to have emphasize on non-extractive industries by gaining momentum. This point is justified by various researchers that the industrial harmonization as in manufacturing sector has huge resilience which can deepen localization and improvement in government procurement system (Aubakirova, 2015; Karenov, 2015; Graulau, 2019). Moreover, World Bank (2021) suggested that the Kazachstan economy can restart economic growth and productivity by reforming state financial programs and boosting firm capabilities. At the same time, there should be a robust evaluation system to adjust the program by evaluating real impact rather than deployed resources. It is recommended that future studies can be performed by applying input-output tables and examining the detailed structural change process using backward and forward linkages.

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Appendices

Table A1: Name of Sectors in Input-output Tables (2015-2020).

No.	Sectors
1.	Agriculture, hunting, forestry, and fishing
2.	Mining and quarrying
3.	Food, beverages, and tobacco
4.	Textiles and textile products
5.	Leather, leather products, and footwear
6.	Wood and products of wood and cork
7.	Pulp, paper, paper products, printing, and publishing
8.	Coke, refined petroleum, and nuclear fuel
9.	Chemicals and chemical products
10.	Rubber and plastics
11.	Other nonmetallic minerals
12.	Basic metals and fabricated metal
13.	Machinery, nec
14.	Electrical and optical equipment
15.	Transport equipment
16.	Manufacturing, nec; recycling
17.	Electricity, gas, and water supply
18.	Construction
19.	Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel
20.	Wholesale trade and commission trade, except of motor vehicles and motorcycles
21.	Retail trade, except of motor vehicles and motorcycles; repair of household goods
22.	Hotels and restaurants
23.	Inland transport
24.	Water transport
25.	Air transport
26.	Other supporting and auxiliary transport activities; activities of travel agencies
27.	Post and telecommunications
28.	Financial intermediation
29.	Real estate activities
30.	Renting of M&Eq and other business activities
31.	Public administration and defense; compulsory social security
32.	Education
33.	Health and social work
34.	Other community, social, and personal services

Source: Authors' work based on (Asian Development Bank Input-output Tables, 2022).

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