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THE RELATIONSHIP BETWEEN ECONOMIC GROWTH, FOREIGN DIRECT INVESTMENT AND UNEMPLOYMENT IN CENTRAL ASIA: A VECTOR AUTOREGRESSIVE MODEL APPROACH

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Abstract

The article investigates the relationship between economic growth, foreign direct investment and unemployment in five Central Asian countries between 1997 and 2016. We found that GDP has a positive relationship with FDI and this implies that the growth of GDP in Central Asian countries has attracted more FDI inflows. However, GDP negatively affects FDI in lag 4 and this reflects the fact that the growth of GDP in this region depends on other variables rather than FDI. Moreover, this result also suggests that the use of FDI to boost economic growth of Central Asian countries is ineffective. Results also indicate that FDI has a negative influence on unemployment and this implies that an increase of FDI can contribute to reducing the unemployment rate in Central Asia. We also found that GDP and unemployment do not cause other variables, while FDI causes other variables. Lastly, results indicate that there is a co-integration among variables.

Keywords: *Economic Growth, Foreign Direct Investment, Unemployment, Central Asia*

JEL classification: *E22, E24, F43*

1. Introduction

Central Asia grew much faster than the global economy over the period 2000–2012 and consequently, income has increased along with reducing poverty in this region. Although countries in the region have similar histories and cultures, levels and models of their economic development are diverse. Central Asia's economy heavily depends upon international prices for energy and metals, which attracted foreign direct investment (FDI) into oil and gas extraction industries and transport infrastructure (ADBI, 2014). Economic growth of Central Asian countries is predicted to reach 3.1 percent in 2017 and accelerated to 4.1 percent in 2018, but each country grows at a

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different rate. Most economies in the region have to face both internal and external imbalances that request responses from their governments through implementing fiscal, monetary and structural policies (Samruk-Kazyna, 2017). Issues in production networks, technology transfers, market integration, and economic cooperation between Central Asia and Asia, the European Union (EU), the Russian Federation, and the United States should be resolved in order to ensure sustainable growth in this region (ADBI, 2014).

What is the relationship between economic growth, FDI and unemployment in Central Asia? How do these variables correlate in the short run and long run? This article aims to examine the causal relationship between economic growth, FDI and unemployment in Central Asia for the last two decades (1997–2016) using the vector autoregressive (VAR) model. More importantly, policies are recommended to the governments of Central Asian countries in order to achieve a sustainable development in the region.

The rest of this paper is organized as follows. Section 2 presents the empirical review. Research methods are discussed in section 3. In section 4, we present results and discussion. Finally, the conclusion and policy implications are summarized in section 5.

2. Empirical review

The relationship between economic growth, FDI and unemployment has been considered by scholars in recent years. Abu and Karim (2016) investigated the relationship between FDI, domestic savings, domestic investment and economic growth in Sub-Saharan Africa between 1981 and 2011. Results indicated that there is a unidirectional causality from FDI to growth and domestic investment, savings to growth, and a bidirectional causality between growth and domestic investment, as well as savings and domestic investment. Domestic investment had a negative impact on economic growth in the short run, but two variables had a positive relationship in the long run. Likewise, a study by Strat *et al.* (2015) examined the relationship between FDI and economic growth in the seven latest EU members over the period 1991–2012. Results showed that there was no Granger causality relation between the variables for six countries and a one-direction causal relation was identified for the remaining ones. Djambaska and Lozanoska (2015) evaluated the relationship between unemployment and FDI in the Republic of Macedonia. They concluded that FDI did not have statistically significant impact on the decrease in unemployment, and inflation and unemployment had a negative relationship.

Further, Tiwari and Mutascu (2011) investigated the effect of FDI on economic growth in 23 Asian countries between 1986 and 2008. Results indicated that both FDI and exports enhance economic growth. Labor and capital have been identified as crucial drivers for the growth of Asian countries. Similarly, Palat (2011) assessed the correlation between FDI and economic growth in Japan from 1983 to 2009. He found that there was a positive correlation between FDI and unemployment rate in this country. A research by Zeb *et al.* (2014) examined the influence of FDI on unemployment in Pakistan from 1995 to 2011. They found that FDI plays an important role in terms of reducing unemployment in this country.

In addition, Chang (2005) assessed interactions between FDI, economic growth, unemployment, and trade in Taiwan for the period 1996–2003. Results demonstrated that both economic growth and exports have positive effects on FDI inflow. However, export expansion had a negative relationship with FDI outflow. There is no relationship between FDI inflow and unemployment. Lastly, Sothan (2017) explored the relationship between FDI and economic growth in Cambodia between 1980 and 2014. Results indicated that there was no causality between FDI and GDP in this country.

3. Methodology

3.1 Data and sources

A panel dataset for the relationship between economic growth, FDI and unemployment in Central Asia is gathered from the World Development Indicators released by the World Bank (WB). Specifically, a panel dataset is collected in five Central Asian countries, including Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, for the last two decades (1997–2016). Thus, a total of 100 observations is entered for data analysis. The panel data is used for this research because of the following advantages: (1) it benefits in terms of obtaining a large sample, giving a greater degree of freedom, more information, and less multi-collinearity among variables; and (2) it may overcome constraints related to the control of individual or time heterogeneity faced by the cross-sectional data (Hsiao, 2014).

3.2 The vector autoregressive (VAR) model

The VAR model is used to examine the causality between economic growth, FDI and unemployment in Central Asian countries for the period 1997–2016. The VAR model is chosen for this study because it interprets the endogenous variables solely by their own history, apart from deterministic regressors, and therefore this method incorporates non-statistical a priori information (Pfaff, 2008). In addition, the VAR model is a popular method in economics and other sciences since it is a simple and flexible model for multivariate time series data (Suharsono *et al.*, 2017).

The specification of a VAR model can be defined as follows (Pfaff, 2008):

$$Y_t = A_1 Y_{(t-1)} + \ldots + A_p Y_{(t-p)} + \varepsilon_t \qquad (1)$$

Where: Y_t denotes a set of K endogenous variables such as gross domestic product (GDP), FDI, and unemployment rate; A_i represents (K x K) coefficient matrices for i = 1,…, p; and ε_t is a K-dimensional process with $E(\varepsilon_t) = 0$.

An important characteristic of the VAR model is stability and therefore it generates stationary time series with time invariant means, variances and covariance structure, given sufficient starting values. The stability of an empirical VAR model can be analyzed by considering the companion form and computing the eigenvalues of the coefficient matrix. A VAR model may be specified as follows (Pfaff, 2008):

$$\mathcal{E}_t = A\mathcal{E}_{(t-1)} + V_t \quad (2)$$

Where: $\mathcal{E}_t$ denotes the dimension of the stacked vector; A is the dimension of the matrix (K_p x K_p); and V_t represents (KP x 1).

Table 1. Description of covariates in the VAR model

Variables	Unit
GDP	US$
FDI	US$
Unemployment rate	%

Source: Author, 2018

Note: US$ means United States Dollar

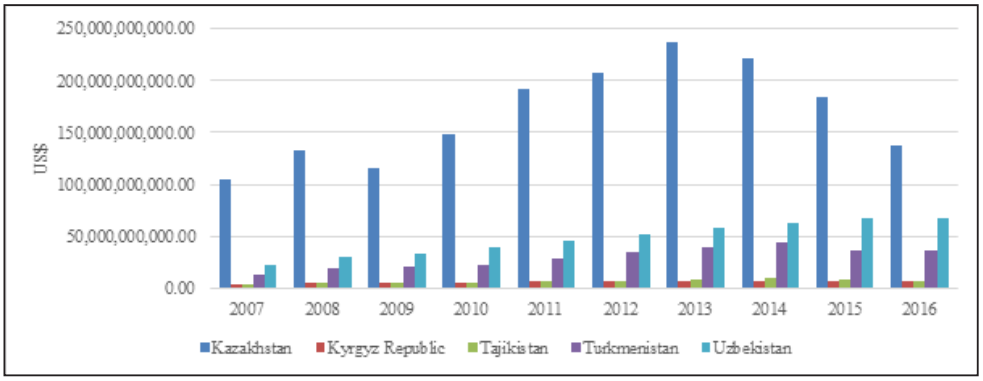
In this research, the procedure of a VAR model includes six steps, consisting of (1) performing the unit root test; (2) determining the lag length; (3) estimating the VAR model; (4) testing the Granger causality; (5) checking the stability of eigenvalues; and (6) implementing the Johansen test for co-integration. The VAR model is estimated by the Stata MP 14.2 software.

4. Results and discussion

4.1 Characteristics of economic growth, FDI and unemployment in Central Asia

In Central Asia, economic growth is dominated by Kazakhstan, followed by Uzbekistan, Turkmenistan, Tajikistan, and Kyrgyzstan. GDPs of Uzbekistan, Tajikistan, and Kyrgyzstan tended to increase dramatically for a decade (2007–2016), while the economic growth of Kazakhstan and Turkmenistan has significantly decreased since 2014. By 2016, the GDP of Kazakhstan reached more than US$137 billion, which was more than doubled than that of Uzbekistan, more than tripled compared to Turkmenistan, more than 19 times higher compared to Tajikistan, and more than 20 times higher compared to Kyrgyzstan (Graph 1).

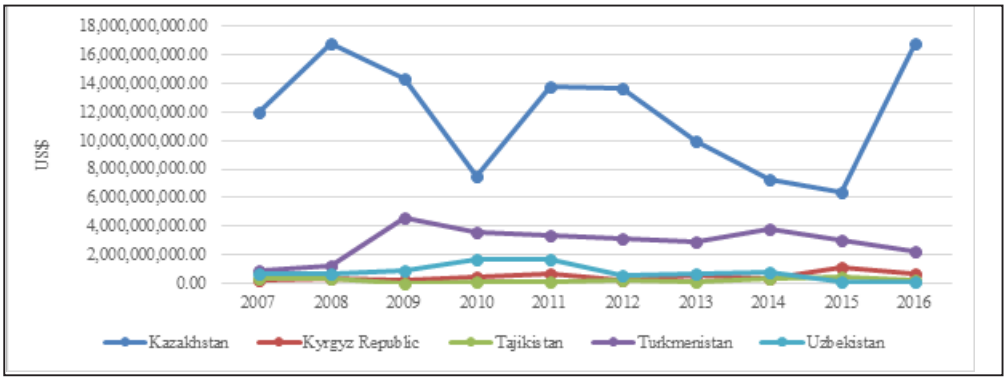
Graph 1. GDP values of Central Asian countries (2007–2016)



Source: World Bank, 2018

FDI of Kazakhstan significantly fluctuated between 2007 and 2016. Starting at US$12 billion in 2007, FDI of this country increased by nearly US$5 billion to reach US$16.7 billion in 2016. In 2009, FDI of Turkmenistan accounted for more than US$4.5 billion, but it rapidly declined by more than US$2 billion to stand at US$2.2 billion in 2016. FDI of Uzbekistan, Kyrgyzstan, and Tajikistan dramatically fluctuated over the period 2007–2016 (Graph 2).

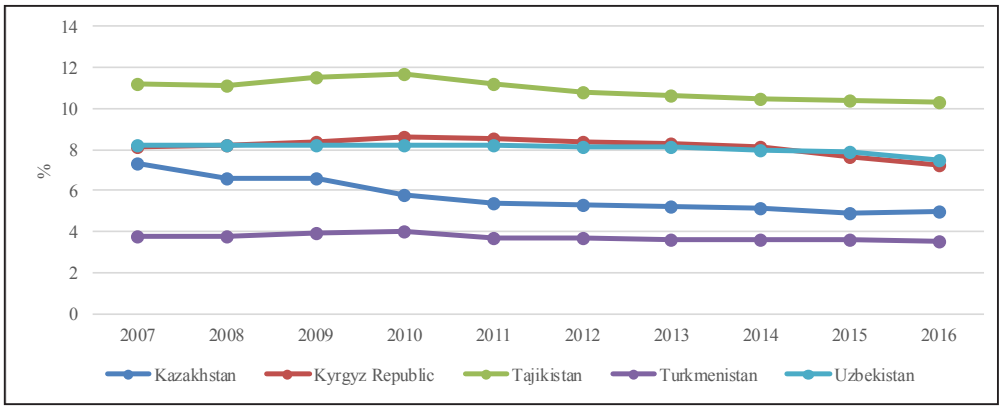
Graph 2. FDI of Central Asian countries (2007–2016)



Source: World Bank, 2018

For a decade (2007–2016), Tajikistan had the highest unemployment rate, followed by Uzbekistan, Kyrgyzstan, Kazakhstan, and Turkmenistan. After ten years, the unemployment rate of Tajikistan and Kazakhstan reduced by 1 percent and more than 2 percent, respectively, while the unemployment rates of the other countries presented slight variations (Graph 3).

Graph 3. Unemployment rates of Central Asian countries (2007–2016)



Source: World Bank, 2018

Table 2. Characteristics of macroeconomic indicators in Central Asia

Variable	Mean	SD	Min	Max
GDP	3.14e+10	5.10e+10	8.61e+08	2.37e+11
FDI	1.97e+09	3.74e+09	-2360125	1.68e+10
Unemployment rate	7.91	2.75	3.5	13.5

Source: Author's calculation, 2018
Note: SD denotes standard deviation

The average GDP and FDI of Central Asian countries account for US$31.4 billion and US$1.97 billion, respectively. Unemployment rate of this region is 7.9 percent, on average (Table 2).

4.2 The relationship between economic growth, FDI and unemployment in Central Asia

4.2.1 Implementation of the unit root test

The unit root test is carried out to check the stationarity of the time series variables (Adeola and Ikpesu, 2016). In this study, the Augmented Dickey-Fuller (ADF) test is used to examine the stationarity of economic growth, FDI and unemployment with the hypothesis as follows:

Null hypothesis (H_0): The variables contain a unit root
Alternative hypothesis (H_a): The variables do not contain a unit root

Results show that we cannot reject the null hypothesis because P-values of all variables are greater than critical values at 1%, 5%, and 10%, respectively and these imply that variables exhibit a unit root (Table 3).

Table 3. The ADF test for the unit root

Variables	Level	1st difference	2nd difference
LnGDP	T-statistic: -1.65	T-statistic: -1.88	T-statistic: -2.24
	P-value: 0.45	P-value: 0.34	P-value: 0.18
	Critical values:	Critical values:	Critical values:
	1% level: -3.51	1% level: -3.51	1% level: -3.51
	5% level: -2.89	5% level: -2.89	5% level: -2.89
	10% level: -2.58	10% level: -2.58	10% level: -2.58
LnFDI	T-statistic: -5.23	T-statistic: -3.47	T-statistic: -3.08
	P-value: 0.00	P-value: 0.00	P-value: 0.02
	Critical values:	Critical values:	Critical values:
	1% level: -3.51	1% level: -3.51	1% level: -3.51
	5% level: -2.89	5% level: -2.89	5% level: -2.89
	10% level: -2.58	10% level: -2.58	10% level: -2.58
LnUnemployment rate	T-statistic: -2.26	T-statistic: -2.32	T-statistic: -2.37
	P-value: 0.18	P-value: 0.16	P-value: 0.14
	Critical values:	Critical values:	Critical values:
	1% level: -3.51	1% level: -3.51	1% level: -3.51
	5% level: -2.89	5% level: -2.89	5% level: -2.89
	10% level: -2.58	10% level: -2.58	10% level: -2.58

Source: Author's calculation, 2018

4.2.2 Determination of the lag length

The purpose of this step is to specify the optimal lag for the VAR model. If the lag is used too little, then the residual of the regression will not show the white noise process and as the result, the actual error could not be accurately estimated by the model (Suharsono *et al.*, 2017).

Table 4. Selection of the lag length

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-400.13				1.284	8.763	8.796	8.846
1	-222.34	355.59	9	0.00	0.032	5.094	5.227	5.423*
2	-216.95	10.77	9	0.29	0.035	5.172	5.405	5.748
3	-212.38	9.14	9	0.42	0.039	5.269	5.601	6.091
4	-162.48	99.79*	9	0.00	0.016*	4.380*	4.811*	5.449
5	-158.48	7.99	9	0.53	0.018	4.488	5.019	5.804
6	-156.77	3.42	9	0.94	0.021	4.647	5.277	6.209
7	-156.02	1.51	9	0.99	0.025	4.826	5.556	6.635
8	-152.84	6.35	9	0.70	0.029	4.953	5.782	7.008

Endogenous: LnGDP LnFDI LnUnemployment rate

Exogenous: Constant

Number of observations = 92

Source: Author's calculation, 2018

*Notes: *denotes lag order selected by the criterion; LL means log likelihood values; LR represents sequential modified LR test statistics; FPE denotes final prediction error; AIC means Akaike information criterion; HQIC represents Hannan-Quinn information criterion; and SBIC means Schwarz's Bayesian information criterion.*

As seen in Table 4, results suggest that the optimal lag length in this case is four lags because this value is recommended by FPE, AIC and HQIC indicators, while one lag is only recommended by SBIC. Therefore, four lags (the number of lag is equal to 4) is chosen to run the VAR model in the next step.

4.2.3 Estimation of the VAR model

We found that GDP has a positive relationship with FDI and this implies that the growth of GDP in Central Asian countries has attracted more FDI inflows. However, GDP negatively affects FDI in lag 4 and this reflects that the growth of GDP in this region depends on other variables rather than FDI. In addition, this result also suggests that use of FDI to boost economic growth of Central Asian countries is ineffective. Results also addressed that FDI has a negative impact on unemployment and this implies that an increase of FDI can reduce the unemployment rate in Central Asia (see details in Table 5 of appendices).

4.2.4 Testing the Granger causality

The goal of this step is to assess the predictive capacity of a single variable on other variables (Musunuru, 2017). In this research, three hypotheses need to be tested as follows:

Testing the relationship between GDP and other variables (H_1):
Null hypothesis (H_0): GDP does not cause FDI and unemployment
Alternative hypothesis (H_a): GDP causes FDI and unemployment

Testing the relationship between FDI and other variables (H_2):
Null hypothesis (H_0): FDI does not cause GDP and unemployment
Alternative hypothesis (H_a): FDI causes GDP and unemployment

Testing the relationship between unemployment and other variables (H_3):
Null hypothesis (H_0): Unemployment does not cause GDP and FDI
Alternative hypothesis (H_a): Unemployment causes GDP and FDI

Table 6. Results of the Granger causality Wald test

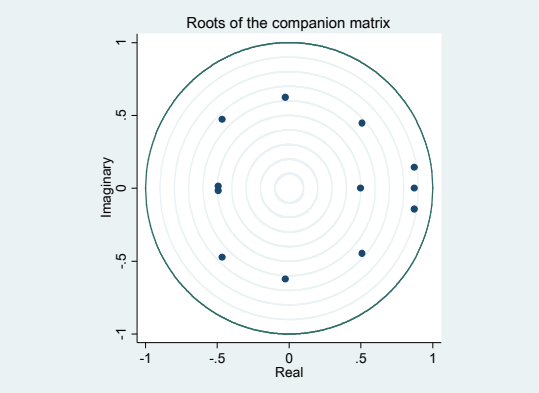
Hypotheses	F-Statistic	Probability
H_1	0.18	0.99
H_2	19.26	0.00
H_3	1.50	0.16

Source: Author's calculation, 2018

For two hypotheses (H_1 and H_3), we cannot reject the null hypothesis because the probability values are greater than the critical value (0.99 > 0.05 and 0.16 > 0.05) and this reflects that GDP and unemployment do not cause other variables. In contrast, in terms of H_2, we can reject the null hypothesis because the probability is less than the critical value (0.05) and this implies that FDI causes other variables (Table 6).

4.2.5 Examination of eigenvalue stability

Graph 4. Checking eigenvalue stability



Source: Author's calculation, 2018

The objective of this step is to examine stability of the eigenvalues in the VAR model. All the eigenvalues lie inside the unit circle and we can conclude that the VAR model satisfies the stability condition (Graph 4).

4.2.6 Performance of the Johansen co-integration test

The Johansen co-integration test is carried out to examine the long run relationship among variables. If variables are co-integrated, it suggests that there is a long term relationship among variables (Musunuru, 2017).
The hypothesis to be tested can be identified as follows:

Null hypothesis (H_0): There is no co-integration among variables
Alternative hypothesis (H_a): There is co-integration among variables

In this research, the Johansen co-integration test is performed by both trace and max statistic tests. Both trace and max tests are all likelihood-ratio-type tests, which operate under different assumptions in the deterministic part of the data generation process. In some situations, the trace tests tend to have more distorted sizes compared to that of the maximum eigenvalue tests (Lutkepohl *et al.*, 2001).

Table 7. Results of trace statistic in the Johansen co-integration test

Maximum rank	LL	Eigen-value	Trace statistic	5% critical value	1% critical value
0	-243.59		39.51	29.68	35.65
1	-228.40	0.266	9.13*1*5	15.41	20.04
2	-225.65	0.054	3.64	3.76	6.65
3	-223.83	0.036			

Source: Author's calculation, 2018

*Notes: *1 and *5 denote the number of co-integrations (ranks) chosen to accept the null hypothesis at 1% and 5% critical values, respectively*

Table 8. Results of max statistic in the Johansen co-integration test

Maximum rank	LL	Eigen-value	Max statistic	5% critical value	1% critical value
0	-243.59		30.38	20.97	25.52
1	-228.40	0.266	5.49	14.07	18.63
2	-225.65	0.054	3.64	3.76	6.65
3	-223.83	0.036			

Source: Author's calculation, 2018

As seen in Table 7, we cannot reject the null hypothesis in the rank one (one co-integration) because trace statistic is less than the 5% and 1% critical values (9.13 < 15.41 and 9.13 < 20.04) and this implies that there is a co-integration among variables.

4.3 Discussion

We found that GDP has a positive relationship with FDI and this implies that the growth of GDP in Central Asian countries has attracted more FDI inflows. However, GDP negatively affects FDI in lag 4 and this reflects that the growth of GDP in this region depends on other variables rather than FDI. Moreover, this result also suggests that the use of FDI to boost economic growth of Central Asian countries is ineffective. Results also indicated that FDI has a negative influence on unemployment and this implies that an increase of FDI can contribute to reducing unemployment rate in Central Asia. We also found that GDP and unemployment do not cause other variables, while FDI causes other variables. Finally, the results indicated that there is a co-integration among variables.

Tiwari and Mutascu (2011) argued that FDI is significant and facilitates economic growth in 23 Asian countries between 1986 and 2008, while our results indicated that there is no positive impact of FDI on economic growth in Central Asian countries for the period 1997–2016. Different outcomes can be interpreted by differences in research sites and methods. Specifically, Tiwari and Mutascu (2011) investigated the effects of FDI and exports on the economic growth in 23 Asian countries (excluding Central Asian countries) by using the two-way error component model, while we employ the VAR model to examine the relationship between economic growth, FDI and unemployment in five Central Asian countries. Our findings are contrary to the conclusions of Strat *et al.* (2015) who found that FDI has a significant impact on the unemployment rate in Hungary, Malta, Bulgaria and Estonia and this implies that FDI is attracted in countries where they observe the existence of available work force. We found that FDI negatively affects the unemployment rates in Central Asian countries and this suggests that an increase of FDI can reduce the unemployment rates in this region. In fact, unemployment rates of the latest EU members, such as Hungary, Bulgaria and Estonia, are higher than those in Central Asian countries. For example, in 2002, unemployment rates of Hungary, Bulgaria and Estonia reached nearly 20 percent, 16 percent and 13 percent, respectively, while at the same time, Kyrgyzstan had the highest unemployment rate in Central Asia with 12.6 percent, while the unemployment rate of Turkmenistan was only 3.9 percent.

5. Conclusion and policy implications

This article explores the relationship between economic growth, FDI and unemployment in five Central Asian countries between 1997 and 2016. We found that GDP has a positive relationship with FDI and this implies that the growth of GDP in Central Asian countries has attracted more FDI inflows. However, GDP negatively affects FDI in lag 4 and this reflects the fact that the growth of GDP in this region depends on other variables rather than FDI. Moreover, this result also suggests that the use of FDI to boost economic growth of Central Asian countries is ineffective. Results also indicated that FDI has a negative influence on unemployment and this implies that an increase of FDI can contribute to reducing the unemployment rate in Central Asia.

We also found that GDP and unemployment do not cause other variables, while FDI causes other variables. Lastly, results pointed to the fact that there is a co-integration among variables.

In order to achieve the sustainable development target regarding the socio-economic environment in Central Asia, FDI should be encouraged because this is a significant driver which contributes to fostering economic growth and decreasing the unemployment rate in the region. The development of new and more advanced products requires both domestic investment and FDI. The governments in Central Asian countries have implemented policies to attract more investment, but some of these policies are discretionary and consequently, investors are required to take part in long and costly negotiations with governments. Public policies need to have a central role in terms of creating national competences in relevant sectors. For instance, a transition in labor from agriculture to manufacturing and service sectors should be considered, thus providing jobs for better educated segments of the labour force. Lastly, the transport infrastructure should be improved to connect Central Asia with the global economy (ADBI, 2014).

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Appendices

Table 5. Estimation of the VAR model

Variables	Coefficient	Standard Error	t	P-value
LnGDP				
LnGDP				
L1	1.045***	0.12	8.61	0.000
L2	0.083	0.17	0.49	0.628

Table 5. (Continued)

L3	-0.162	0.16	-0.95	0.343
L4	-0.088	0.12	-0.71	0.479
LnFDI				
L1	-0.009	0.02	-0.35	0.730
L2	0.008	0.02	0.28	0.782
L3	0.014	0.03	0.47	0.638
L4	0.010	0.03	0.35	0.730
LnUnemployment				
L1	0.143	0.42	0.34	0.736
L2	0.164	0.58	0.28	0.781
L3	-0.470	0.55	-0.85	0.398
L4	0.229	0.38	0.59	0.558
Constant	2.228*	1.25	1.77	0.080
LnFDI				
LnGDP				
L1	0.573*	0.30	1.87	0.066
L2	0.139	0.43	0.32	0.749
L3	2.784***	0.43	6.47	0.000
L4	-3.076***	0.31	-9.72	0.000
LnFDI				
L1	0.155**	0.07	2.12	0.037
L2	0.117	0.07	1.56	0.121
L3	0.016	0.07	0.21	0.832
L4	0.010	0.07	0.13	0.899
LnUnemployment				
L1	-0.640	1.07	-0.60	0.552
L2	-0.310	1.49	-0.21	0.835

L3	-0.005	1.40	-0.00	0.997
L4	0.618	0.98	0.63	0.533
Constant	4.579	3.18	1.44	0.155
LnUnemployment				
LnGDP				
L1	-0.002	0.03	-0.08	0.934
L2	0.014	0.04	0.31	0.759
L3	0.003	0.04	0.07	0.941
L4	-0.014	0.03	-0.43	0.669
LnFDI				
L1	-0.000	0.00	-0.11	0.909
L2	-0.024***	0.00	-3.03	0.718
L3	0.013	0.00	1.50	0.773
L4	0.007	0.00	0.86	0.653
LnUnemployment				
L1	0.956***	0.11	8.13	0.000
L2	-0.059	0.16	-0.36	0.718
L3	0.044	0.15	0.29	0.773
L4	-0.048	0.10	-0.45	0.653
Constant	0.300	0.35	0.86	0.393

Source: Author's calculation, 2018

*Notes: L1, L2, L3, and L4 mean lag 1, lag 2, lag 3, and lag 4, respectively; ***, ** and * denote statistical significance at 1%, 5% and 10%, respectively*