"Foreign Direct Investment, Domestic Savings and Economic Growth in Kazakhstan: Evidence from Co-integration and Causality Tests"

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# FOREIGN DIRECT INVESTMENT, DOMESTIC SAVINGS AND ECONOMIC GROWTH IN KAZAKHSTAN: EVIDENCE FROM CO-INTEGRATION AND CAUSALITY TESTS

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## Abstract

This study empirically investigates the long run equilibrium relationship and the direction of causality between economic growth (real GDP growth), domestic savings (DS) and foreign direct investment (FDI) in Kazakhstan of which the world society's interest has recently increased as it becomes more integrated into the world economy. Co-integration results suggest a long-run equilibrium relationship between each pair of the above variables except between DS and FDI. Granger causality test results suggest unidirectional causations running from both DS and FDI to real GDP growth. Lastly, although DS and FDI are not co-integrated, causality results suggest bidirectional causality between them.

**Key words:** Domestic Savings, Foreign Direct Investment, Economic Growth, Kazakhstan, Co-integration, Granger Causality.
**JEL Classification:** C32, C53, E01, F21.

## I. Introduction

Understanding the relationship and the direction of causality between economic growth and other macroeconomic indicators is important as it gives possibility for the economies to define their developing policies. The relationships between economic growth and FDI, and economic growth and DS have also found a wide application area in the literature. The start of the 90s was marked by the increased flows of international capital to developing countries, which has triggered the empirical research on the causes and consequences of these flows on the macroeconomic variables of the recipient countries (See among the others Borensztein et al., 1998; Bosworth and Collins, 1999; Hansen and Rand, 2004; Hachicha, 2003). FDI has gained significant importance over the past decade as the tool for accelerating growth and development of economies in transition (Janicki et al., 2004). It brings advantages for the standard of living and prospects for economic growth of the host nation. Almost all studies have found a positive influence of FDI on economic growth as it imports technology, managerial skills and market access, and thus, accelerates growth and development. But some studies such as Carkovic and Levine (2002) find that FDI does not exert a robust, independent influence on growth.

On the other hand, the relationship between savings and economic growth has received considerable attention in the theoretical and empirical literature (See Schmidt-Hebbel et al., 1996). The theoretical underpinnings of the relationship between savings and growth can be traced to the growth model of Harrod (1939) and Domar (1946). It is argued in the literature that an increase in the saving level alters the national investment level and ultimately produces economic growth (Schmidt, 2003). Theoretically, the focus on saving follows directly from most neo-classical growth models, which highlight the relative importance of saving and relegate investment to a more passive equilibrating role (Schmidt, 2003). On the other hand, positive relationship between GDP and domestic savings is a widely accepted fact that was documented in the vast empirical literature. Positive relationship between growth and savings is explained by the fact that domestic savings have positive impact on investment that is essential for economic growth. However, the direction of causality among them is not clear (See Christopher et al., 1994; Alguacil et al., 2004).

Connection between FDI and DS is also not clear in the literature. Edwards (1995) by using panel data for 36 countries from 1972 to 1992 concludes that there are no significant differences in the response of domestic savings to changes in capital inflows. Hachicha (2003) shows a

causal relationship in the long term running from DS to capital inflows. Gruben and Mcleod (1996) used annual data to evaluate the effects of different types of capital inflows on macroeconomic performance and vice-versa. They found a considerable evidence of a two-way causation between capital inflows and output growth.

In this study, we conduct a research on the possibility of long run equilibrium relationship and the direction of causality between economic growth, DS and FDI in Kazakhstan of which GDP is 26.5 billion US$ and per capita GDP is 1,780 US$ as of 2003 (World Bank, 2005). Recently, world society's interest in this country has increased as it becomes more integrated with the world economy. Rich agricultural, mineral, and fuel resources of the region made it a potentially attractive outlet for foreign investors. This study has two important implications: First, this study is important that it is the first of its kind to carry out such a study for the economy of Kazakhstan. Second, empirical literature has shown that the relationship between FDI, DS and economic growth is still inconclusive as to be mentioned in section II of this study. Thus, such study deserves further attention for an emerging economy like Kazakhstan. The main aim of our analysis is to examine the saving-growth, FDI-growth and saving-FDI connections. Studying these relationships is expected to be important for the policy implications in Kazakhstan.

The rest of the study is structured as follows: Section II presents empirical studies made in the field; Section III defines data and methodology used to conduct econometric analysis; Section IV discusses results of the study, and Section V concludes the study.

## II. Literature Review

In the theory, models that support the relationship between DS and economic growth have different implications for causality. For example, the central presumption of Solow's growth model (1956) is that higher saving precedes and causes economic growth. It implies that high-savings economies will grow faster through increased investment that is a source of capital accumulation in the economy. On the other hand, such models as life-cycle models predict a reverse direction of causality. According to this theory, as economic growth increases, the life-time resources of the young increase relative to the old, and since the young save a larger fraction of lifetime wealth than the old, aggregate savings rates increase. Model of consumption with habit formation is another model that supports the view of life-cycle model. As it is noted in Carroll and Weil (1994), habits cause consumption to respond slowly to an unanticipated growth in earnings, and the result is higher saving, at least in the short-run.

While theories differ in their implications for causality, empirical studies also differ in their results. The view that growth appears to cause saving rather than the reverse has found support in several recent papers. Christopher et al. (1994) examined the relationship between saving and economic growth in a sample covering sixty four countries over several decades, and found that past growth predicts future saving rates, while past saving rates do not predict future growth. The study of Gavin et al. (1997), where authors look at saving behavior in Latin America, also emphasizes that higher growth precedes higher saving rather than the reverse. It is only after a sustained period of high growth that saving rates increase and may do so with a delay that can be quite significant. Some papers support the reverse view. Alguacil et al. (2004) investigate the saving-growth nexus in Mexico by taking into account both the role played by foreign inflows in complementing DS and the beneficial effects of FDI on domestic investment and income. Results of this paper support Solow's growth model (1956) presumption that high savings lead high growth and not vice versa.

There is also vast empirical literature that deals with the effect of FDI on economic growth especially in developing countries. Most of them have concluded that FDI has a positive effect on the economic growth. Borenzstein et al. (1998) suggest that foreign direct investment brings with it technology, managerial skills and market access and thus accelerates growth and development. But other papers suggest that there is no long-run impact of FDI on economic growth of the host country. Carkovic and Levine (2002) find that the exogenous component of FDI does not exert a robust, independent influence on growth.

Another strand of the literature has focused more directly on the causality between FDI and growth by using different samples and techniques. Zhang (2001) studied 11 countries on a country-by-country basis, dividing the countries according to the time series properties of the data. His results of the long run causality based on an error correction model indicate a strong Granger-causal relationship between FDI and GDP-growth. For six counties Zhang (2001) found no co-integration relationship between FDI and growth where only one country exhibited Granger causality from FDI to growth. Chowdhury and Mavrotas (2003) take a slightly different route by testing for Granger causality using the Toda and Yamamoto (1995) specification. Using data from 1969 to 2000, they find that FDI does not Granger cause GDP in Chile, whereas there is a bi-directional causality between GDP and FDI in Malaysia and Thailand. Nair-Reichert and Weinhold (2001) test causality for cross country panels, using data from 1971 to 1995 for 24 countries. They find that FDI on average has a significant impact on growth, although the relationship is highly heterogeneous across countries. Hansen and Rand (2004) analyze the Granger-causal relationships between FDI and GDP in a sample of 31 developing countries covering the period of 1970-2000. Using estimators for heterogeneous panel data they find bi-directional causality between the FDI/GDP ratio and the level of GDP. FDI is found to have a lasting impact on the level of GDP, while GDP has no long run impact on the FDI/GDP ratio. In that sense FDI causes growth.

The resurgence of international capital flows to less developed countries in the early 1990s has renewed the empirical research dealing with the causes and consequences of these flows on DS of the recipient economies. The negative relationship between capital inflows and savings in less developed countries is an accepted fact in the existing literature. Edwards (1995) concludes that there are no significant differences in the response of DS to changes in capital inflows among the Asian and Latin American countries. He finds that in both regions, domestic and foreign savings are substitutable: a 1% increase in foreign savings is associated with a decline of about 0.5% to 0.63% in DS. However, this result is essentially based on standard econometrics, which ignores the non-stationarity of the variables dealt with. Besides, the direction of causality still remains a subject of debate. Hachicha (2003) by using time-series data of the Tunisian economy finds unidirectional causality running from DS to capital inflows in the long-term. In the short run, author finds a two-way causation between these two aggregates. Gruben and Mcleod (1996) used annual data to evaluate the effects of different types of capital inflows on macroeconomic performance and vice-versa. They found a considerable evidence of a two-way causation between capital inflows and output growth. According to these two authors, capital inflows also affect savings rates positively, thus contradicting the conventional wisdom. Bowles (1987) used Granger's causality test for 20 developing countries on time series data from 1960-1981 to determine the direction of the causality between national savings and foreign capitals. For 10 countries Bowles (1987) found a causal relationship either from domestic savings to capital inflows or vice-versa or a bi-directional causality.

## III. Data and Methodology

Data used in this paper are quarterly figures covering the 1993:Q1-2002:Q4 period. Variables used in this study are real GDP, DS and FDI. The source of data is the Agency of Statistics of Kazakhstan (2005). GDP is at constant 2000 US$ prices. FDI and DS are taken as a percentage of GDP. All variables are expressed at their natural logarithmic forms.

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)[1] unit Root Tests are employed to test the integration level (the level of stationarity of the series) and the possible co-integration among the variables (Dickey and Fuller, 1981; Phillips and Perron, 1988). The series under consideration should be tested if they are stationary at level, I(0), or at their first or second differences, I(1) and I(2). But a possible co-integration would be searched if the series are integrated of the same order, I(d). On the other hand, the PP procedures, which compute a residual variance that is robust to auto-correlation are applied to test for unit roots as an alternative to ADF unit root test.

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[1] PP approach allows for the presence of unknown forms of autocorrelation with a structural break in the time series and conditional heteroscedasticity in the error term.

Unless the researcher knows the actual data generating process, there is a question concerning whether it is most appropriate to include constant term and trend factor in the unit root process (Enders, 1995). It might seem reasonable to test the existence of a unit root in the series using the most general of the models. That is,

$$\Delta y_t = a_0 + \gamma y_{t-1} + a_2 t + \sum_{i=2}^{p} \beta_j \Delta y_{t-i-1} + \in_t , \tag{1}$$

where $y$ is the series; $t$ = time (trend factor); $a$ = constant term (drift); $\varepsilon_t$ = Gaussian white noise and $p$ = the lag order. The number of lags "p" in the dependent variable was chosen by the Akaike Information Criterion (AIC) to ensure that the errors are white noise. One problem with the presence of the additional estimated parameters is that it reduces the degrees of freedom and the power of the test.

On the other hand, the researcher may fail to reject the null hypothesis of a unit root ($\gamma =$ 0) because of a misspecification concerning the deterministic part of the regression. Therefore, Doldado, Jenkinson and Sosvilla-Rivero (1990) also suggest starting from the most general model to test for a unit root when the form of the data generating process is unknown. The general principle is to choose a specification that is a plausible description of the data under both the null and alternative hypotheses (Hamilton, 1994). If the intercept or time trend is inappropriately omitted, the power of the test can go to zero (Campbell and Perron, 1991). "Reduced power means that the researcher will conclude that the process contains a unit root when, in fact, none is present" (Enders, 1995: p. 255). A linear combination of integrated variables is said to be co-integrated if the variables are stationary. Many economic models entail such co-integrating relationships (Enders, 1995).

To confirm the test results obtained from the ADF and PP tests, *Kwiatkowski Phillips, Schmidt and Shin's* test (1992) (*KPSS*) is suggested to eliminate a possible low power against stationary near unit root processes which occurs in the *ADF* and PP tests. The KPSS test complements the ADF and PP tests in which the null hypothesis of KPSS test is that a series is stationary. This means that a stationary series is likely to have insignificant KPSS statistics and significant ADF and PP statistics.

The KPSS test is based on an assumption that a series can be investigated in three parts: a time trend, a random walk and a stationary error in the following equation:

$$y_t = \rho t + r w_t + \varepsilon_t, \tag{2}$$

where $rw_t = rw_{t-1} + v_t$ and $v_t$ is i.i.d $(0, \delta_v^2)$. Basically, the regression above can be run in two ways: first with a constant in the case of level stationary, second both a constant and a trend in the case of trend stationary. We then use the residuals $\varepsilon_t$ from the regression and compute the LM statistics in the following equation:

$$LM = T^{-2} \sum_{i=1}^{T} V_t^2 \Big/ V_{\varepsilon_t}^2 , \tag{3}$$

where $V_t^2$ is the estimate of the variance of $\varepsilon_t$ and $V_t$ is defined as follows:

$$V_t = \sum_{i=1}^{t} \varepsilon_i . \tag{4}$$

Kwiatkowski et al. (1992) provide the critical values for the distribution of LM which is nonstandard. Due to the assumptions of the behavior of $\varepsilon_t$, $V_t^2$ can be constructed to be a more consistent estimator like in Phillips and Perron's (1988) paper as in the following equation:

$$V^2(p) = T^{-1}\sum_{t=1}^{T}\varepsilon_t^2 + 2T^{-1}\sum_{v=1}^{p}w(v,p)\sum_{t=v+1}^{T}\varepsilon_t\varepsilon_{t-k}. \qquad (5)$$

Here $w(v,p)$ is an optional weighting function regarding the choice of a spectral window. Following Newey and West (1987) the Bartlett window can be used as $w(v,p)=1-v/(v+1)$. Finally the test statistics of the KPSS test can be considered as follows:

$$t = T^{-2}\sum_{i=1}^{T}V_t^2 \Big/ V^2(p). \qquad (6)$$

It is worth of emphasizing that the value of the test statistics depends on the choice of the lag truncation parameter and the sample of autocorrelation function of $\Delta\varepsilon_t$ can be calculated to find out the maximum value of the lag length $p$.

After the order of integration is determined and if the series are at the same order of integration, I(d), co-integration between the variables should then be tested to identify any long run relationship. Johansen trace test is used for the co-integration test in this paper. Cheung and Lai (1993) mention that the trace test is more robust than the maximum eigen value test for co-integration. The Johansen trace test attempts to determine the number of co-integrating vectors among variables. There should be at least one co-integrating vector for a possible co-integration. The Johansen (1988) and Johansen and Juselius (1990) approach allows the estimating of all possible co integrating vectors between the set of variables and it is the most reliable test to avoid the problems which stems from Engel and Granger (1987) procedure[1]. This procedure can be expressed in the following VAR model:

$$X_t = \Pi_1 X_{t-1} + ... + \Pi_K X_{t-K} + \mu + e_t \quad (\text{for } t=1,...T), \qquad (7)$$

where $X_t$, $X_{t-1}$, ..., $X_{t-K}$ are vectors of current and lagged values of $P$ variables which are $I(1)$ in the model; $\Pi_1,....,\Pi_K$ are matrices of coefficients with $(PXP)$ dimensions; $\mu$ is an intercept vector[2]; and $e_t$ is a vector of random errors. The number of lagged values, in practice, is determined in such a way that error terms are not significantly auto-correlated. Adding $X_{t-1}$, ..., $X_{t-K}$ *and* $\Pi_1 X_{t-2}$, ..., $\Pi_{K-1} X_{t-K}$ to both sides and rearrange term the VAR model will be in the following form[3]:

$$\Delta X_t = \Gamma_1\Delta X_{t-1} + ... + \Gamma_{K-1}\Delta X_{t-K+1} + \Pi X_{t-K} + \mu + e_t, \qquad (8)$$

where $\Gamma_i = -(I-\Pi_i-....-\Pi_i)$; (i=1, 2, ..., K-1); $\Pi = -(I-\Pi_1-....-\Pi_1)$ and $I$ is the identity matrix. The rank of the matrix of coefficient, $\Pi$ gives the number of long-run relationships between the variables of the system. Three possible cases are stated by Johannes and Juselius (1990): i) If the ranks equal $P[r(\Pi) = P]$ meaning that $\Pi$ has full rank, then any linear combination of $I(1)$ series is stationary. ii) If the rank equals zero $(r(\Pi) = 0$, i.e. $\Pi$ is a null matrix), then there is no co-integration relationship. Although a long-run relationship seems to be unlikely, a short-run relationship may be identified by the first differences. iii) If the rank is between zero and P $(0 < r(\Pi) < P)$, then there are matrices $\alpha$ and $\beta$ with $(pxr)$ dimension, so that it is possible to represent $\Pi = \alpha \beta'$. Matrix $\beta$ is called the 'co-integrating matrix' whereas matrix $\alpha$ is referred to as the 'adjustment matrix' or the 'feedback matrix'. Matrix $\beta$ has the property to transform $\beta'X_t$ into a stationary process even though $X_t$ is not in the equilibrium relationship. The rank of $\Pi$ is the number of co-integrating relationship(s) (i.e. $r$) which is determined by testing whether its eigen values $(\lambda_i)$ are statistically different from zero. Johansen (1988) and Johansen and Juselius (1990) propose that

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[1] See Kremers et al. (1992) and Gonzalo (1994) for the comments about disadvantages of Engel and Granger (1987) procedure compared with Johansen and Juselius (1990) cointegration technique.

[2] $\mu$ is a vector of $I(0)$ variables which represent dummy variables as well. This ensures that errors $e_t$ are white noise.

[3] This form of the equation is also called vector error correction (VECM).

using the eigen values of $\Pi$ ordered from the largest to the smallest is for computation of trace statistics[1].. The trace statistic $(\lambda_{trace})$ is computed by the following formula[2]:

$$\lambda_{trace} = -T \sum Ln(1 - \lambda_i) , \; i = r+1, \; ..., \; n\text{-}1 \qquad (9)$$

and the hypotheses are :

$$H_0: r = 0 \; H_1: r \geq 1$$

$$H_0: r \leq 1 \; H_1: r \geq 2$$

$$H_0: r \leq 2 \; H_1: r \geq 3$$

The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Empirical studies have shown that the existence of non-stationarity in the time series considered can lead to spurious regression results and invalidate the conclusions reached using Granger Causality. Toda and Phillips (1993) have led the methods to deal with Granger causality in I(1) systems of variables. A causal long run relationship between non-stationary time series when they are co-integrated could be inferred. Therefore, if co-integration analysis is omitted, causality tests present evidence of simultaneous correlations rather than causal relations between variables. The presence of a co-integrating relation forms the basis of the VEC (Vector Error Correction) specification. Additionally, standard Granger or Sims tests may provide invalid causal information due to the omission of error correction terms from the tests (Doyle, 2001).

The simple Granger's causality test becomes inappropriate when co-integrating vectors are obtained in the series. According to Granger's representation theorem (1988), the results of co-integration imply that series have the following error-correction representations. These are necessary to augment the simple Granger causality test with the ECM (Error Correction Mechanism), derived from the residuals of the appropriate co-integration relationship to test for causality:

$$\Delta \ln Y_t = C_0 + \sum_{i=1}^{k} \beta_i \Delta \ln Y_{t\text{-}i} + \sum_{i=1}^{k} \alpha_i \Delta \ln X_{t\text{-}i} + p_i ECT_{t-1} + u_t , \qquad (10)$$

$$\Delta \ln X_t = C_0 + \sum_{i=1}^{k} \gamma_i \Delta \ln X_{t\text{-}i} + \sum_{i=1}^{k} \varsigma_i \Delta \ln Y_{t\text{-}i} + \eta_i ECT_{t-1} + \varepsilon_t , \qquad (11)$$

where $Y$ and $X$ are the variables under consideration, and $\rho_i$ is the adjustment coefficient while $ECT_{t-1}$ expresses the error correction term of growth equation, $\Delta$ indicates first difference operator. In equation (10), $X$ Granger causes $Y$ if $\alpha_i$ and $\rho_i$ are significantly different from zero. In equation (11), $Y$ Granger causes $X$ if $\varsigma_i$ and $\eta_i$ are significantly different from zero. F-statistic is used to test the joint null hypothesis of $\alpha_i, \varsigma_i = 0$, and t test is employed to estimate the significance of the error coefficient.

However, when series are not co-integrated, then there could still be room for examining causality link among them at least in the short run context. The Granger causality approach to the question of whether X causes Y is to see how much of the current y can be explained by past values of Y and then to see whether adding lagged values of X can improve the explanation. Y is said to be Granger-caused by X if X helps in the prediction of Y, or equivalently if the coefficients on the lagged Xs are statistically significant. Note that two-way causation is frequently the case; X Granger causes Y and Y Granger causes X. The VAR framework for the Granger causality test is given below:

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[1] Asymptotic critical values are obtained from Osterwald-Lenum (1992).
[2] At the beginning of the procedure, we test the null hypothesis that there are no co integrating vectors. If it can be rejected, the alternative hypothesis (i.e. $r \leq 1, \; ..., \; r \leq n$) are to be tested sequentially. If $r=0$ cannot be rejected in the first place, then there is no co-integrating relationship between the variables, and the procedure stops

$$Y_t = a + \sum_{i=1}^{p} \alpha_i\, Y_{t-i} + \sum_{j=1}^{q} \beta_j X_{t-j} + \mu_t , \qquad (12)$$

$$X_t = b + \sum_{i=1}^{r} \gamma_i X_{t-i} + \sum_{j=1}^{s} \delta_j Y_{t-j} + v_t , \qquad (13)$$

where $\mu_t$ and $v_t$ are serially uncorrelated white-noise residuals; and $p$, $q$, $r$, and $s$ are lag lengths for each variable in each equation. A statistically significant F statistics of each model would be enough to have causation from X to Y in equation (12) and from Y to X in equation (13) (See Hassapis et al., 1999).

## IV. Results

Unit root tests were performed to check out stationarity of the series. They were done for both level and first differences for all three variables. As it was previously indicated, ADF, PP and KPSS tests were used for unit root process. First, the results of ADF and PP tests are presented in Table 1.

Table 1

ADF and PP Tests for Unit Root

| Statistics (Levels) | lnGDP | Lag | lnDS | lag | lnFDI | lag |
|---|---|---|---|---|---|---|
| $\tau_T$ (ADF) | -1.43 | (4) | -3.19 | (0) | -5.07* | (3) |
| $\tau_\mu$ (ADF) | -0.01 | (4) | -1.40 | (1) | -0.81 | (4) |
| $\tau$ (ADF) | 1.34 | (4) | 0.16 | (1) | 0.49 | (4) |
| $\tau_T$ (PP) | -2.61 | (3) | -3.13 | (3) | -6.51* | (2) |
| $\tau_\mu$ (PP) | -1.59 | (5) | -2.05 | (1) | -2.62*** | (5) |
| $\tau$ (PP) | 0.33 | (4) | 0.52 | (3) | -0.94 | (5) |
| | | | | | | |
| Statistics (First Difference) | lnGDP | Lag | lnDS | lag | lnFDI | lag |
| $\tau_T$ (ADF) | -3.62** | (3) | -6.92* | (1) | -8.81* | (1) |
| $\tau_\mu$ (ADF) | -1.33 | (4) | -7.07* | (1) | -8.95* | (1) |
| $\tau$ (ADF) | -0.91 | (4) | -8.49* | (0) | -3.86* | (2) |
| $\tau_T$ (PP) | -14.83* | (4) | -9.20* | (3) | -11.84* | (1) |
| $\tau_\mu$ (PP) | -10.45* | (3) | -9.23* | (3) | -12.01* | (1) |
| $\tau$ (PP) | -10.29* | (3) | -9.23* | (3) | -13.15* | (2) |

Note: $\tau_T$ represents the most general model with a drift and trend; $\tau_\mu$ is the model with a drift and without trend; $\tau$ is the most restricted model without a drift and trend. Numbers in brackets are lag lengths used in ADF test (as determined by AIC set to maximum 4) to remove serial correlation in the residuals. When using PP test, numbers in brackets represent Newey-West bandwith (as determined by Bartlett-Kernel). *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% levels respectively. GDP stands for Gross Domestic Product, DS stands for domestic savings and FDI stands for Foreign Direct Investment. Tests for unit roots have been carried out in E-VIEWS 4.1.

As can be seen from Table 1, real GDP and DS are non-stationary at their levels, but stationary at their first differences, which means they are integrated of order one, I(1). FDI seems to be stationary at its level form according to both ADF and PP tests. However, Table 2 reveals that this result for FDI was not confirmed by KPSS test as it is non-stationary at the level but stationary at its first difference according to this test. Thus, since KPSS is suggested to eliminate a possible

low power against stationary near unit root processes which occurs in the *ADF* and PP tests as mentioned before, the result reached by KPSS tests will be taken into consideration in this study.

Table 2

KPSS Test for Unit Root

| Statistics (Level) | lnGDP | Lag | lnDS | lag | lnFDI | lag |
|---|---|---|---|---|---|---|
| $\eta_t$ | $0.20^{**}$ | (5) | $0.15^{**}$ | (4) | 0.07 | (3) |
| $\eta_u$ | $0.40^{***}$ | (5) | $0.50^{**}$ | (5) | $0.70^{**}$ | (5) |
| | | | | | | |
| Statistics (First Difference) | lnGDP | Lag | lnDS | lag | lnFDI | lag |
| $\eta_t$ | 0.07 | (1) | 0.07 | (3) | 0.10 | (5) |
| $\eta_u$ | 0.28 | (1) | 0.09 | (2) | 0.10 | (5) |

Notes: 1. $\eta_t$ and $\eta_u$ represent constant and trend in the model.
2. Numbers in brackets are lag lengths indicating the lag truncation for Bartlett Kernel suggested by Newey-West (1987).
3. ** and *** denote significance at the 5% and 10% respectively. Critical values are taken from Kwiatkowski et al. (1992).
4. Tests for unit roots have been carried out in EVIEWS 4.1.

If summarized, unit root tests of this study reveal that all of the variables, real GDP, DS and FDI possess I (1) property where they are not stationary at their levels but stationary at their first differences.

As indicated earlier, we can run co-integration test only for those variables that are non-stationary at levels but all stationary at the same order of d. Thus, co-integration would be searched between real GDP, DS and FDI in this study since they are I(1). Table 3 gives Johansen test results for possible co-integration between real GDP and real DS based on the normalized model set by Equation (7). Johansen test suggests a unique co-integrating vector in the model. Received outcome suggests that there is co-integration between the variables and; therefore, a long-run equilibrium model of the variables in the present study could be inferred.

Table 3

Johansen Co-integration Test

| r: number of co integrating vectors (null hypothesis) | λ MAX | λ Trace | Critical values 95%/99% (λMAX) | Critical values 95%/99% (Trace) |
|---|---|---|---|---|
| (VAR lag = 3) | | | | |
| r = 0 | $48.45^{*}$ | $62.53^{*}$ | 20.97/25.52 | 29.68/35.65 |
| r ≤ 1 | 13.46 | 14.08 | 14.07/18.63 | 15.41/20.04 |
| r < 2 | 0.61 | 0.61 | 3.76/6.65 | 3.76/6.65 |
| Parameter Estimates (normalized) | | | | |
| | Variables | | Co integrating Vector | |
| | ln GDP | | -1 | |
| | ln FDI | | 0.62 | (t = 10.3) |
| | ln DS | | 0.28 | (t = 9.33) |

Note: r indicates the number of co-integration relationship. $\lambda_{max}$ is the maximum eigen value statistics and $\lambda_{trace}$ is the trace statistics respectively. * denotes rejection of the null hypothesis at 1% level.

On the other hand, the normalized coefficients in the model of Table 3 suggest that a 1% growth in FDI would cause a 0.62% growth in real GDP, and a 1% growth in DS would cause a

0.28% in real GDP of Kazakhstan. This means that although the signs of both coefficients are inelastic, both FDI and DS depict positive effect on the economic growth of Kazakhstan.

To infer the long run relationship between any pair of the variables of the study, co-integration tests were run for individual relationships. Based on the suggestion of Cheung and Lai (1993) the trace test was used for co-integration test among each pair of the variables. Table 4 gives co-integration results of on the Johansen (1988) and Johansen and Juselius (1990) approach:

Table 4

Co-integration Tests based on the Johansen (1988) and Johansen and Juselius (1990) Approach

| Variables | Trace Statistic | 5% Critical Value | 1% Critical Value |
|---|---|---|---|
| (1) GDP and DS  (VAR lag = 3) | | | |
| $H_0$: r = 0 | 26.01[*] | 15.41 | 20.04 |
| $H_0$: r ≤ 1 | 3.42 | 3.76 | 6.65 |
| | | | |
| (2) GDP and FDI  (VAR lag = 2) | | | |
| $H_0$: r = 0 | 15.54[*] | 15.41 | 20.04 |
| $H_0$: r ≤ 1 | 2.33 | 3.76 | 6.65 |
| | | | |
| (3) DS and FDI (VAR lag = 2) | | | |
| $H_0$: r = 0 | 11.72 | 15.41 | 20.04 |
| $H_0$: r ≤ 1 | 0.98 | 3.76 | 6.65 |

Notes:   1. r denotes the number of co-integrating vectors.
2. Akaike Information Criterion (AIC) and Schwartz Criteria (SC) were used to select the Number of lags required in the co-integration test. Both gave the same level of lag order.
3. [**] denotes significance at 5% level.

Results in Table 4 suggest a unique co-integrating vector between real GDP and FDI, and between real GDP and DS. However, Johansen results suggest no co-integrated vector between DS and FDI in Kazakhstan.

And finally, the next step is to investigate causal relationships between each pair of the variables in the study. Table 5 gives Granger causality test results for the variables of the study. There are methods for optimum lag length selection in the recent literature such as AIC (Akaike Information Criterion), SIC (Schwartz Information Criterion) and Hsiao's (1979) sequential procedure (which combines Granger's definition of causality and Akaike's minimum final prediction error (FPE) criterion). However, Pindyck and Rubinheld (1991) pointed out that it would be best to run the test for a few different lag structures and make sure that the results were not sensitive to the choice of lag length. Thus, in this study, to make better estimation for comparative purposes, alternative lag lengths ranging from 1 to 4 were preferred rather than selecting optimal lag as suggested by some econometricians (See also Pindyck and Rubinheld, 1991).

Granger (1988) suggests that in the presence of the co-integration there must be at least one direction of causality: unidirectional or bidirectional. As can be seen from Table 5, there is DS and FDI driven growth in the economy of Kazakhstan. VECM results suggest unidirectional causation running from both DS and FDI to real GDP in Kazakhstan as proved by F test and t tests for VECM terms. And lastly, the VAR results of the present study suggest bidirectional causal relationship between DS and FDI in Kazakhstan at lag one level which statistically significant at 10%.

Table 5

Granger Causality Testing Procedure

| | F-Statistic | t-statistic on ECT$_{t1}$ | F-Statistic | t-statistic on ECT$_{t1}$ | F-Statistic | t-statistic on ECT$_{t1}$ | F-Statistic | t-statistic on ECT$_{t1}$ | |
|---|---|---|---|---|---|---|---|---|---|
| Null Hypothesis | Lag | 1 | Lag | 2 | Lag | 3 | Lag | 4 | Conclusion |
| (1) GDP and DS | | | | | | | | | |
| DS does not Granger cause GDP | 2.59*** | -1.84*** | 2.90*** | 2.38** | 5.91* | -4.06* | 15.60* | -1.06 | DS ⇒ GDP |
| GDP does not Granger cause DS | 2.00** | -1.42 | 2.26*** | 1.27 | 1.91 | -1.05 | 1.35 | -1.88*** | |
| (2) GDP and FDI | | | | | | | | | |
| FDI does not Granger cause GDP | 3.01*** | -2.07** | 4.69* | -3.53* | 16.37* | -8.23* | 13.78* | -2.89* | FDI ⇒ GDP |
| GDP does not Granger cause FDI | 5.87* | -1.56 | 5.65* | -0.39 | 4.43* | -1.02 | 3.72* | -1.27 | |
| (3) DS and FDI | | | | | | | | | |
| FDI does not Granger cause DS | 4.07*** | - | 1.04 | - | 0.44 | - | 0.48 | - | DS ⇔ FDI |
| DS does not Granger cause FDI | 3.31*** | - | 2.37 | - | 0.98 | - | 0.61 | - | |

Note: ECT is Error correction term.
*, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% levels respectively.

## V. Conclusion

There is an enormous theoretical and empirical literature dealing with the relationship between FDI and growth, DS and growth, and FDI and DS. This study as the first time has investigated the possibility of long run equilibrium relationship and the direction of causality between FDI, DS and economic growth in a developing and emerging country, Kazakhstan. Johansen's multivariated co-integration techniques were used to asses the long run equilibrium relationship between DS, FDI and economic growth in Kazakhstan using a quarterly data for the period of 1993 and 2002. Additionally, the VAR and the VECM models were used to assess the direction of causal relationship between these variables in Kazakhstan. Our main results are: (i) There is a long-run equilibrium relationship between GDP and DS, and between GDP and FDI with one co-integrated vector. However, no co-integration was obtained between DS and FDI based on the results of this study. (ii) The normalized coefficients estimated in this study suggest that a 1% growth in DS and FDI would cause 0.28% and 0.62% change respectively in real income. (iii) Granger causality test results reveal that there is unidirectional causation running from DS to GDP growth that differs with Christopher et al. (1994) who found only unidirectional causality from GDP to DS; (iv) Results reveal another unidirectional causation running from real FDI to real GDP in Kazakhstan; this result is consistent with that of Zhang (2001) and Chowdhury and Mavrotas (2003). (v) According to the VAR model there is bidirectional causation between DS and FDI in the economy of Kazakhstan.

As can be seen from the results of the present study, there is DS and FDI driven economic growth in Kazakhstan that is important for the development policy of the country. Government should pay more attention to make the environment better for foreign investors as well as to encourage increasing of domestic savings.

This paper made an attempt to assess the relationship between selected macroeconomic variables of Kazakhstan; however, it was constrained by the short time period. Only 36 observations were available to carry out this study. Thus, over time opportunity will rise to do a further research by taking more extended time period and the results might then be more robust.

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