An empirical analysis of sector-wise private investment for a small open economy

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ABSTRACT

The present study empirically analyses the sector-wise private investment behaviour in Pakistan using the autoregressive distributed lag model from 1964 to 2015. The results indicate that credit availability and infrastructural development considerably affect private investment in agriculture, industry, and services. However, the user cost of capital does not have any influence on investment. The response of investment demand to credit availability is inelastic (i.e. 0.259) for agriculture but relatively higher for the industrial sector with a magnitude of 0.554. However, its value is slightly higher than the unit elastic value (1.059) in services. Fertiliser use positively impacts investment in agriculture, which is negatively affected by access to water. The values of the corresponding coefficients are 0.726 and −2.731, respectively. Remittances and foreign direct investment positively contribute to private investment in services. Openness significantly demotes private investment in services, and its magnitude is relatively high (−5.127). The findings signify and implicate the role of water availability, government support, and financial development in the agricultural sector. However, a stable political environment and cost of investment are very important for investment activities in the industry. Nevertheless, the role of openness in investment in services is vital.

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1. Introduction

Investment is a critical factor in determining the level of national income and its fluctuations. It plays a vital role in economic growth by increasing productive capacity, employment level, and economic competitiveness (Michaelides, Athena, and John 2005). Investment activity in an economy is determined by a host of economic and non-economic variables. These include output/income, the user cost of capital, physical infrastructure, level of human capital, credit availability, law and order situation, political stability, and so on. The economic literature provides rich theories/models (e.g. classical and Keynesian approaches) to study and analyse investment behaviour.1 A range of different economic and non-economic variables are used to determine investment across various categories and levels (i.e. sector, micro, and macro) in developing and developed countries.

Few studies have attempted to analyse sector-wise investment behaviour. The studies have mainly analysed investment behaviour in a single sector in the case of developing countries, including Pakistan. To our knowledge, no comprehensive analysis has been carried out on private investment behaviour across major economic activities/sectors, including agriculture, industry, and services, in a single study in developing countries, including Pakistan. In this regard, a comparative sector-wise inquiry to explore the relative and idiosyncratic investment behaviour in primary, secondary, and tertiary sectors will add value towards determining sector-specific investment activities. By considering the historical data on investment expenditures in various sectors of Pakistan, there is a substantial variation in trends across industries. For example, on the one hand, the share of the industrial sector in total gross private investment expenditure has significantly declined from 44% to just 24% from 1964 to 2015. On the other hand, the share of the service sector in total gross private investment expenditure has significantly increased from 40% in 1964–58% in 2015. The share of the agricultural sector has risen slightly from 16% to 18% during the same period.2 This means that there has been a significant shift in the composition of investment expenditure from the commodity production sector to the service sector.

Similarly, the composition of investment in the public and private sectors has also undergone substantial

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changes during this period. Interestingly, the share of public investment in total investment expenditure is 35% in 1964, and it starts to rise during the 1970s, mainly due to the nationalisation policy of the government. It reaches its maximum level in 1978 (62.6%). After this era of nationalisation, it has been continuously declining, reaching just 10% in 2015.\(^3\)

Based on the above-mentioned observations, it becomes a motivating research question vis-à-vis what factors are more critical in determining the investment level in various production sectors of the private sector. Developing economies with similar characteristics can learn from Pakistan’s experience. This case study will assist in formulating sector-specific effective investment policies to attract investors and boost investment activities in various sectors, such as agriculture, industry, and services.

A few studies have attempted to empirically analyse the behaviour of private investment at a disaggregated level or on a sector-wise basis (i.e. agriculture, industry/manufacturing, and services) in Pakistan (Ahmad, Qayyum, and Salam 2008; Ahmad and Qayyum 2009, 2008; Amjad 1976; Khan 1988; Looney 1997; Saghir 2012; Siddiqui 1983).\(^4\) However, there are hardly any studies on the holistic determining factors that incorporate a wide range of theoretical and empirical content that affect private investment in various sectors (economic activities)/categories for the Pakistani economy. This study differs from previous studies in terms of data size, scope, technique, and a range of determining factors/variables based on theoretical and empirical content. Prior studies have been confined to a limited and narrow set of potential determinants mainly confined to a single sector.

Therefore, the present study explores the determinants of private investment in major economic activities/sectors, namely, agriculture, for the Pakistani economy. Notably, disaggregated investment analysis is expected to help understand investment behaviour across different sectors (economic activities)/categories for effective and efficient requisite policy measures to encourage investment activity in the economy. The models of private gross fixed investment in each sector are developed based on the theoretical and empirical research in the field of study. The autoregressive distributed lag (ARDL) econometric modelling technique is applied to estimate Pakistan’s sector-wise private investment behaviour from 1964 through 2015. Notably, the ARDL framework is justified for the present study because it is simple, entirely appropriate, and considerably adequate to empirically analyse investment behaviour.

The following section provides a brief review of the theoretical and empirical literature, followed by Section 3, which focusses on building the econometric model for sector-wise private investment. Section 4 describes the data and estimation techniques employed. A discussion of the estimation results is presented in Section 5. The conclusions and policy implications are presented in the last section.

### 2. Review of the literature

Various investment theories, such as the accelerator principle, Keynesian theory, liquidity or cash flow theory, neoclassical model, neoliberal approach (McKinnon and Shaw hypothesis), Mundell–Tobin hypothesis/ effect, and Tobin’s Q theory, with their various versions are equally applicable to analyse the overall/aggregate and sector-wise/disaggregate (private) investment behaviour (Michaelides, Athena, and John 2005; Samuel 1998; Twine, Kiiza, and Bashasha 2015). Owing to the difference in types of chosen data, that is, micro/macro and model, the results across empirical studies vary considerably. Profits and competitive pressure effects are analysed at the micro level, while the output/income level, interest rate, and tax incentives effect are examined at the macro level. This study analyses macro-level data; therefore, macro-level studies are the main focus. The literature on sector-wise private investments, that is, agriculture, industry/manufacturing, and services, is discussed separately because of their distinct determining factors.

Different theories and models of private investment behaviour suggest various determinants/factors of total or overall investment and investment in a specific category or sector (economic activity). These include liquidity/cash flow and output, price factors (input/output prices, interest rates, and taxes), autonomous shocks (i.e. technological shocks), business expectations, governance, political stability, macroeconomic policies (i.e. investment, industrial, monetary, and fiscal policies), and demography (i.e. population) (see Agenor and Peter 2008; Michaelides, Athena, and John 2005; Samuel 1998).

In principle, private investments related to profitability are associated with output demand, output prices, input prices, and cost of capital, including interest rate, depreciation rate, tax rate, government/public investment, openness, foreign (direct) investment, savings, and credit availability (Eklund, 2013; Michaelides, Athena, and John 2005; Samuel 1998). The relative prices of capital stock are also considered as determinants of investment (Kim and Lim 2004; Serven 1998).

It is also pertinent to note that the determining factors/variables of overall and sector-wise private investment (in various economic activities/categories)
are not markedly different. Moreover, sector-specific peculiarities are considered while explaining the investment behaviour in an economy, such as the price/quantity of fertiliser and water availability in agriculture (Gandhi 1990); tariffs on machinery and equipment in the case of commodity-producing sectors, such as agriculture and manufacturing (Siddiqui 1983); sector-specific credit availability; foreign direct investment (FDI); and remittances, especially in the service sector, notably ownership of dwellings or real estate (Siddiqui 1983). Behrman (1972) provides a lucid analysis of the behaviour of sectoral investment in Chile. The output and relative prices are found to be critical determinants.

Ahmad, Qayyum, and Salam (2008) analyse the private investment behaviour in the agricultural sector of Pakistan. The study concludes that public development expenditures and macroeconomic stability enhance private investment activities in the agricultural sector. By exploring private investment behaviour in the service sector, Ahmad and Qayyum (2008) show that the government’s non-development expenditures, interest rates, and macroeconomic uncertainty/instability negatively impact private investment in Pakistan.

In another study, Ahmad and Qayyum (2009) examine the private sector large-scale manufacturing investment behaviour in Pakistan from 1972 to 2005 and find that public development spending stimulates, while non-development public expenditures and macroeconomic uncertainty deter, the investment level.

In a relatively recent study, Hosamane and Niranjan (2015) investigate the private investment behaviour in India’s manufacturing sector. The study supports the accelerator principle and finds that profitability, internal liquidity, demand, and policy variables are the key determinants of private investment.

Raphael (2020) analyses the investment behaviour of Gambia by employing the ARDL model on time-series data ranging from 1980 to 2019. He argues that exchange rate depreciation adversely affects investment decisions by raising the import bill of capital goods and imported raw materials. Owing to an inefficient credit market, credit to the private sector cannot promote investment in the country. Real interest rate, inflation, aggregate demand condition, and real exchange rate, all perform below expectation. Hence, the author favours the adoption of an exchange rate policy that decreases the import bill of capital goods. He further argues that there is a need to explore the domestic raw materials.

Zahra, Ihsan, and Rashid (2020) analyse the relationship between private and public investments at the sectoral and aggregate levels. They employ the Johansen co-integration approach using data from 1971 to 2019. The mining and quarrying, manufacturing, construction, transport and communication, finance, and agricultural sectors are included in the analysis. According to their findings, a complementary relationship exists between private and public investments in the long run at both the sectoral (except the finance sector) and aggregate level. In the short run, the complementary relationship is insignificant in agriculture, and transport and communication. Finally, the results indicate that public investment plays the role of a facilitator in the economy.

The above-stated review of the literature shows that the determinants of private investment expenditure in different sectors are as diverse as the economies under consideration. The empirical results vary across not only countries and sectors but also datasets for a particular sector in a given country. We learn here that the list of potential determinants of sector-wise private investment cannot be the same for all economic activities/categories. However, the literature provides valuable input towards selecting relevant variables that can potentially determine private investment in each category.

3. Models for agricultural, industrial & services sectors’ investment behaviour

Broadly, investments may vary due to the economic environment, political climate, institutional setup, and social conditions. The decisions to invest are influenced by multifaceted variables, including output (demand), the costs of the investment (interest rate, depreciation rate, price of capital, and taxes), liquidity or cash flows, availability of credit, monetary and fiscal policies, future business expectations, and uncertainty about the state of the economy (for details, see Agenor and Peter 2008; Akanbi 2016; Badawi 2005; Chaney, Sraer, and Thesmar 2012; Eklund, 2013; Hamuda et al. 2013; Le 2004; Michaelides, Athena, and John 2005; Mishkin 2010; Twine, Kiiza, and Bashasha 2015).

Conspicuously, none of the economic theories of investment, such as the accelerator principle, standard neoclassical, and Tobin’s Q model, are sufficient to empirically explain the proper investment behaviour in its entirety for a developing economy like Pakistan (Akkina and Celebi 2002; Rehman, Khan, and Khan 2009; Twine, Kiiza, and Bashasha 2015). In this study, the famous investment theories and models, namely, ‘(flexible) accelerator/neoclassical models/approaches, are mainly considered to explore the behaviour of sector-wise private investment in the various economic activities/categories, namely agriculture, industry, and services for the case of Pakistan economy.

It is helpful in distinctly analyze the private investment behaviour in various sectors (economic
activities) categories because of their differing investment decisions and for forecasting the related investment activities in an economy. Based on the literature (theoretically and empirically), the analysis of investment behaviour enables us to determine the factors that can potentially affect sector-wise investment activity and explore the distinct private investment behaviour. Theoretical models for private business (fixed) investment primarily focus on the output, rate of return, and finance cost. The variation in the investment spending with changes in production can be referred to as the ‘accelerator principle’ (Naa-Idar, Ayentimi, and Frimpong 2012). This study tries to capture this accelerator effect in two dimensions, i.e. by introducing aggregate output and sectoral output. The neoclassical model suggests that an increase in the cost of capital/doing business leads to a reduction in investment (Akkina and Celebi 2002; Hall and Jorgenson 1969); the user-cost of capital mainly relies on the interest rate, depreciation rate, price of capital and expectations about future economic conditions (see Boyes 1984).

The bank credit and foreign capital inflows are also considered as the critical determinant of private investment. In the developing countries, due to underdeveloped financial markets, interest rate does not reflect the actual cost of capital, and the availability of financial resources rather than cost is a binding constraint. Availability of financial resources is captured by credit availability (Akkina and Celebi 2002). The availability of bank credit also reflects the stance of monetary policy. The easy monetary policy raises real estate prices. It minimises the credit risk due to an increase in the value of the collateral of bank capital, and so the availability of more bank credit can positively affect the investment (Hamuda et al. 2013; Chaney, Sraer, and Thesmar 2012).

On the other hand, fiscal decisions are also important determinants of private investment. The government expenditures on infrastructure are expected to complement private investment; government investment in non-infrastructure may compete with private investment, primarily if the government competes with the private sector for funds or in the product market. Public investment may crowd out private investment via increased deficits and a high-interest rate (i.e. the Ricardian Equivalence Theorem) and the competition for scarce resources (e.g. skilled labour, raw materials etc.). Thus, the public investment in the concerned sector is likely to crowd out the private investment in that sector (Ajide and Lawanson 2012; Fowowe 2011; Frimpong and Marbuah 2010; Asante 2000).

Infrastructural development increases the productivity of capital (Looney 1997); reduces the external (transaction) costs and hence boosts the rate of return (Asiedu 2002); and enlarges the market (Suhendra and Anwar 2014; Badawi 2003).

Foreign direct investment (FDI) may boost or deteriorate investment activity in any economy. Encouraging effect of foreign investment on domestic investment works through provision of novel investment opportunities in terms of accessibility to technology and equipment, imitation of new technology at a local level, possible business alliances/joint ventures of domestic firms with foreign firms, the introduction of new industries (Ali, Hasan, and Iqbal 2015; Hanif and Jalaluddin 2013; Ang 2009). On the other hand, FDI may discourage domestic investment activity when the foreign firms contest with local firms to grab the regional limited (human, capital, natural and financial) resources (Ang 2009; Jansen 1995).

The theories of investment also emphasise the role of profits rather than output in determining investment behaviour. Private investment is linked with profitability, which is associated with output demand, output prices, input prices, and cost of capital. In general, the desired capital stock function can be determined by the output price level. For example, Amjad (1976) considers sales, output prices, and profit to determine private investment activity. In this study, we have used the relative costs (terms of trade) because the relative increase in the price level of any sector related products will boost the rate of return of investment in that sector. It will attract investment toward that sector.

The baseline model is as follows:

$$I_{PI} = f (G, GVA_{i}, UC_{i}, PC_{i}, P^{UB}, PI, FDI, TOT_{i}) \ (1)$$

Where, $I_{PI}$ is real gross fixed private capital formation (investment) in the ith sector (Rs. Million)

- $GVA_{i}$ is real growth rate of value-added (GDP) in the ith sector (%)
- $PC_{i}$ is real private credit available to the ith sector (Rs. Million)
- $G$ is real GDP growth rate (%)
- $PI$ is physical infrastructure proxies by road density (length of roads in kilometres per total (country’s) area)
- $TOT_{i}$ is terms of trade and is measured by the ratio of sector-specific GDP deflator to the rest of the economy specific GDP deflator(s) (Base Year: 2000-01 = 100)
- FDI is a real foreign direct investment (Rs. Million)
- $UC_{i}$ is user cost of capital constructed using Jorgenson (1971) method.

$$UC_{i} = P_{ki} \left( 1 - \tau_{i} + \delta_{i} - \frac{\Delta P_{ki}}{P_{ki}} \right)$$

In equation 2, $P_{ki}$ (the price of capital in the ith sector) is proxied by investment deflator, $\tau$ is the weighted rate of return on advances, $\pi_{i}$ is inflation based on value-
added GDP deflator, $\delta_i$ is the depreciation rate (it is assumed to be 5%)$^{6}$, and the last term $\Delta p_{ki}$ is an inflation price of capital in the $ith$ sector.

Additionally, there are some sector-specific factors/variables for each category, and a brief description is given below.

### 3.1. Model of private investment in agriculture

In addition to the baseline model, investment in the agricultural sector is likely to depend on two additional critical factors, including fertiliser use (FERT) and water availability (WAT). Both are essential for the productivity of agricultural products. The use of fertilisers increases farm productivity and appears to be a complement to investment. The non-availability of water will require a high level of capital to meet the water requirements by constructing water storages/reservoirs, tube wells, and so on. Water availability would also alter the decision to select the desired agricultural activities/crops and ultimately the capital requirements for harvesting them.

The corresponding regression/econometric equation (ARDL model) of the above-stated function is given below:

$$
\Delta A^{PRI} = \alpha + \sum_{i=1}^{p1} a_i \Delta A^{PRI} t - 1 + \sum_{i=0}^{p2} b_i \Delta GVA t - i + \sum_{i=0}^{p3} c_i \Delta UC t - i + \sum_{i=0}^{p4} d_i \Delta PC t - i + \sum_{i=0}^{p5} e_i \Delta G t - i + \sum_{i=0}^{p6} f_i \Delta P t - i + \sum_{i=0}^{p7} g_i \Delta TOT t - i + \sum_{i=0}^{p8} h_i \Delta FDI t - i + \sum_{i=0}^{p9} i \Delta W A t - i + \sum_{i=0}^{p10} j \Delta WA t - i + \alpha_0 A^{PRI} t - 1 + \alpha_1 GVA t - 1 + \alpha_2 UC t - 1 + \alpha_3 PC t - 1 + \alpha_4 G t - 1 + \alpha_5 P t - 1 + \alpha_6 TOT t - 1 + \alpha_7 FDI t - 1 + \alpha_8 FERT t - 1 + \alpha_9 W A t - 1 + \epsilon_t
$$

3.2> 0, $\alpha_2 > 0, \alpha_3 > 0, \alpha_4 > 0, \alpha_5 > 0, \alpha_7 > 0$ or $< 0, \alpha_8 > 0, \alpha_9 > 0.$

### 3.2. Model of private investment in industrial sector

In addition to the base line model, three additional variables i.e. nationalisation dummy (ND), government regime dummy (GD), and ‘political stability (POL)’ are included to investigate the behaviour of private investment in industrial sector in Pakistan.

Political uncertainty adversely affects investment due to a gloomy investment climate. It shatters business confidence and raises the cost of doing business because property rights cannot be adequately enforced. Political stability (POL) is denoted by polity IV score. The lower value represents political instability and vice versa.

During the regime of Zulfikar Ali Bhutto (1971–1977), nationalisation policies were adopted. Under which banks, financial institutions, insurance companies, engineering and steel industry (and eight other sectors) were nationalised. A dummy variable (ND) is used to capture the effect of nationalisation.

The government regime structure is quite uneven. In seventy years since the independence of Pakistan, the country has experienced three military coups and has faced military governments for around thirty-four years. The second dummy variable (i.e. government dummy (GD)) is introduced to capture the impact of these abrupt and drastic changes in Pakistan’s government structure.

The corresponding regression/econometric equation (ARDL model) of the above-given function is given below:

$$
\Delta I^{PRI} = \alpha + \sum_{i=1}^{p1} a_i \Delta I^{PRI} t - 1 + \sum_{i=0}^{p2} b_i \Delta GVA t - i + \sum_{i=0}^{p3} c_i \Delta UC t - i + \sum_{i=0}^{p4} d_i \Delta PC t - i + \sum_{i=0}^{p5} e_i \Delta G t - i + \sum_{i=0}^{p6} f_i \Delta P t - i + \sum_{i=0}^{p7} g_i \Delta TOT t - i + \sum_{i=0}^{p8} h_i \Delta FDI t - i + \sum_{i=0}^{p9} i \Delta W A t - i + \sum_{i=0}^{p10} j \Delta POL t - i + \beta_0 I^{PRI} t - 1 + \beta_1 GVA t - 1 + \beta_2 UC t - 1 + \beta_3 PC t - 1 + \beta_4 G t - 1 + \beta_5 P t - 1 + \beta_6 TOT t - 1 + \beta_7 FDI t - 1 + \beta_8 W A t - 1 + \beta_9 POL t - 1 + \beta_{10} ND + \beta_{11} GD + \epsilon_t
$$

3.3> 0, $\beta_2 > 0, \beta_3 > 0, \beta_4 > 0, \beta_5 > 0, \beta_7 > 0$ or $< 0, \beta_8 > 0$ or $< 0, \beta_9 > 0, \beta_{10} < 0, \beta_{11} > 0$ or $< 0.$

### 3.3. Model of private investment in services sector

In addition to the base line model, the investment in the services sector is likely to depend on other relevant
additional factors i.e. remittances and trade openness/liberalisation.

According to the State Bank of Pakistan (SBP) statistics, expatriate Pakistanis remitted $19.9 billion in 2015-16, showing a growth of 6.38% ($1.2 billion) than $18.7 billion received during 2014-15. The consistent increase in worker remittance inflows (REM) in Pakistan kept Pakistan among the top ten countries in terms of inflows globally through their nationals settled in other countries. These remittances are primarily consumption-oriented, and an increase in the financial capacity of families sometimes enables them to acquire products or real estate assets. All of these mainly promote investment in the services sector.

The trade reforms (i.e. trade openness ‘OP’) stimulate private investment (Aysan, Nabli, and Véghanzonés-varoudakis 2006; Feder 1982; Balassa 1988). Moreover, trade openness shows developing countries’ access to the latest technology (Hamuda et al. 2013). Trade liberalisation reduces the trade barriers, creates an advantage to the export sector, and improves the current account balance and increases investment incentives (Naa-Iddar et al., 2012; Asante 2000). Busari and Omoke (2008) state that trade policy practices impede and negatively affect the investment through the high cost of imports, especially for the firms having more significant import content.

The corresponding regression/econometric equation (ARDL model) of the above-given function is given below.

$$
\begin{align*}
\Delta i_{5, t}^P & = \alpha + \sum_{i=1}^{p_1} a_{i}\Delta i_{5, t-i} - 1 + \sum_{i=0}^{p_2} b_{i}\Delta GVA_{5, t-i} - i \\
& + \sum_{i=0}^{p_3} c_{i}\Delta UC_{5, t-i} - i + \sum_{i=0}^{p_4} d_{i}\Delta PC_{t-i} \\
& + \sum_{i=0}^{p_5} e_{i}\Delta G_{t-i} + \sum_{i=0}^{p_6} f_{i}\Delta PI_{t-i} \\
& + \sum_{i=0}^{p_7} g_{i}\Delta TOT_{5, t-i} - i + \sum_{i=0}^{p_8} h_{i}\Delta FD_{t-i} \\
& + \sum_{i=0}^{p_9} i_{i}\Delta S_{5, t-i} + \sum_{i=0}^{p_{10}} j_{i}\Delta REM_{t-i} \\
& + \sum_{i=0}^{p_{11}} k_{i}\Delta OP_{t-i} + \gamma_{0,5}^{P} t - 1 \\
& + \gamma_{1,5}^{t} GVA_{5, t} - 1 + \gamma_{2,5}^{t} UC_{5, t} - 1 + \gamma_{3,5}^{t} PC_{t-i} - 1 \\
& + \gamma_{4,5}^{t} G_{t-i} + \gamma_{5,5}^{t} PI_{t-i} + \gamma_{6,5}^{t} TOT_{5, t-i} - 1 \\
& + \gamma_{7,5}^{t} FD_{t-i} + \gamma_{8,5}^{t} S_{t-i} + \gamma_{9,5}^{t} REM_{t-i} - 1 \\
& + \gamma_{10,5}^{t} OP_{t-i} + e_{t} \\
\end{align*}
$$

(5)

4. Data and estimation methodology

The specification of behavioural equations and selection of variables, given in the previous section, are based on sound theoretical reasoning and relevant empirical content. Some equations have been identified to investigate the behaviour of sector-wise private investment and general government investment separately using alternative sets of explanatory variables. The data on the variables for 1964-2015, discussed in the previous section, are extracted from the Pakistan Economic Survey and Hand Book of Statistics (2015). The variables are taken at real constant 2000–01 prices.

4.1. Rationale for estimation methodology/technique

In empirical analyses, ARDL models, which include lagged values of a dependent variable, current and lagged/past values of independent or explanatory variables, are helpful in estimating economic relationships.

It is pertinent to note that desired capital stock is rationalised through the ‘stock adjustment’ or ‘partial adjustment’ model. Because of ‘institutional/technical rigidities’, ‘inertia’, and so on, adjustment is probably incomplete (Gujarati, 2008). As an investment, a change in capital stock is a dynamic version. The endogeneity problem also arises in its behaviour (Caballero 1999). In a simple accelerator model, investment is formulated as a distributed lag function of current and past changes in sales/output. The issues of serial correlation and stochastic explanatory variables, that is, endogeneity, may likely arise in models with dynamic structures (Gujarati, 2008).

The potential econometric estimation technique should address endogeneity problems because of the (investment and output) interdependence and inertia factor therein, as well as serial correlation, misspecification, and spurious regression/relationship because of non-stationary variables, the time series econometric analysis inherent to empirical economic modelling.

Various methods and techniques have been used to empirically analyse investment behaviour. These include the ARDL vector autoregressive/vector error correction model, Johansen’s co-integration, generalised method of moments, nonlinear ARDL (NARDL), dynamic conditional correlation, and copula models. Every methodology has certain advantages and disadvantages. The relevance and aptness of the model or approach, following the nature and scope of the study,
are significant. For example, the copula approach analyses co-movement between investment and uncertainty, but it is not feasible and relevant for the present study. This approach is mainly applied for variance/volatility, and it uses high-frequency data or a large sample size (Al Rahahleh and Bhatti 2017).

Moreover, the approach has also been reported as tricky and cumbersome in the literature (Palaro and Hotta 2006). Similarly, NARDL assumes that all or some independent variables have an asymmetric impact on dependent variables. The NARDL approach is mainly used in studies on uncertainty, risk, and the crowding in or out effects of public investment. The variables used in this study do not have asymmetric effects. More importantly, the Ramsey reset test results show that the specifications of the model are linear and correct. Furthermore, the cumulative sum (CUSUM) and CUSUM of squares (CUSUMSQ) tests show that the parameters are stable.

The ARDL approach is employed in this study to address the estimation issues mentioned in the aforementioned discussion. This approach has certain advantages over the other available techniques. One of the advantages of the ARDL method is that it considers the endogeneity issue (Alam and Quazi 2003; Rehman, Khan, and Khan 2009). Moreover, the ARDL model is free of residual correlations (Pesaran and Shin 1999). In the ARDL model, the selection of an appropriate lag length is crucial to tackle endogeneity and residual correlation issues. Pesaran, Shin, and Smith (2001) argue that suitable lag selection eliminates possible serial correlation from residuals. If the residuals are white noise, then endogeneity is no longer an issue (Alam and Quazi 2003). Estimating the long- and short-run responses in the variable of interest is another advantage of the ARDL approach, as it addresses problems related to autocorrelation and omitted variables. It also does not require the same order of integration that all variables can be either I (0) or I (1); it is equally efficient for a mixture of these (Rehman, Khan, and Khan 2009; Alam and Quazi 2003). The only constraint is that variables should not have a second order of integration I (2) (Ouattara, 2004). Therefore, the ARDL model addresses endogeneity and serial correlation issues and yields unbiased and efficient estimates.

5. Results and discussion

5.1. Private investment in the agricultural sector

The results of the unit root test are presented in Appendix A1. The results reveal that the variables are a mix of I (0) and I (1). Moreover, no variable has a second order of integration. Based on Schwarz Bayesian Criterion (SBC), ARDL (3, 2, 2, 3 1, 3, 2, 2, 0, 3) model for private investment in the agriculture sector is selected. The selected model explains 96.4% of the variation in the dependent variable. Diagnostics of ARDL are presented in Table 1.

In the ARDL technique, the bounds test is applied to test the existence of co-integration. The result of the bound test confirms the presence of a long-run relationship among the variables at a 1% significance level. The long-run relationships can also be established through the coefficient of error-correction (ECM) term. The value of the ECM coefficient is −1.15, which lies in the desired range of −20 [Rafindadi and Yosuf (2013)]. The estimated value implies that, on average, investment shocks in any year are adjusting within the next year by slight overshooting. For example, suppose investment exceeds (falls short of) the equilibrium level by 100 billion rupees in any year, then in the very next year. In that case, investment expenditure will decrease (increase) by 115.1 billion rupees.

The diagnostic tests, i.e., LM test, Jarque-Bera (JB) test and ARCH test, confirm that residuals are serially uncorrelated, normality distributed, and homoscedastic respectively. CUSUM and CUSUMSQ show that the coefficients of the models are stable. Finally, the Ramsey reset test shows that the linear specification of the model is correct.

The results in Table 2 show that the availability of private credit (PCA), the quantity of fertiliser (FERT), and terms of trade (TOTA) (between the agricultural and the other two sectors, namely, industry and service sectors) contribute significantly and positively to private capital formation/investment in the agricultural sector. The availability of credit signifies the role of liquidity and finance in determining investment behaviour.

Financial constraint is a binding factor (constraint), whereas the cost of capital does not significantly determine investment in agriculture. Moreover, capital accumulation/investment in agriculture is motivated by an increase in the prices of agricultural products relative to the products of the industrial and service sectors. The role of fertiliser as an essential input in agricultural production is evident from the findings of this study. The use of fertilisers increases farm productivity and appears to complement investment in this sector (Jorgenson and Kuykendall 2008).

The results also show that gross domestic product (GDP) growth (G), sector-specific output value added growth (GVA), and water availability (WAT) inversely affect investment in the agricultural sector. According to the dematerialisation theory, in the early stages of the development process, the economy is mainly based on agriculture; as the economy further develops,
it shifts to industry. Because of this further development, it becomes a service-based economy. The impact of output value-added growth in agriculture is slightly significant (i.e. at the 10% significance level, but insignificant at the 5% level). The negative impact of value-added sector-wise production (increase in sector-specific income) may be due to the insufficient demand for agricultural products. An increase in sector-specific income is spent elsewhere. That is, industrial or service-related products. The demand for agricultural produce for industrial/service products may plausibly lead to disinvestment in agricultural activities.

The impact of water availability is insignificant at the 5% level, but significant at the 10% level of significance. According to the findings, an increase in water availability reduces private investment in agriculture. Water/irrigation is mainly regulated and managed by public authorities. The intertemporal substitution/choice within various activities in agriculture over a more extended period and issues in water distribution at different points in time may engender the inverse relationship between private investment in agriculture and water availability.

Furthermore, in the short run, private investment in agriculture is positively and significantly influenced by previous investment level, fertiliser intake, water availability, growth (accelerator), physical infrastructure, terms of trade between the agricultural and other (industrial and service) sectors (economic activities)/categories, and FDI (see Appendix A2). The findings indicate the existence of inertia and the role of optimistic expectations and return on investment in the determination of private investment behaviour in the agricultural sector.

### 5.2. Private investment in the industrial sector

The results of the unit root test are presented in Appendix B1. The results reveal that the variables are a mix of I(0) and I(1). Moreover, no variable has a second order of integration. The results of the selected model are

### Table 1. Diagnostic Tests of ARDL Model for Agriculture Sector.

| Test statistics                  | P-value   |
|----------------------------------|-----------|
| Bounds test                      | F-statistic = 4.956 | 1 (0) | 2 (1) |
| Serial Correlation LM Test (1)   | Obs*R-squared = 1.283 | 0.275 |
| Normality test                   | Jarque-Bera = 1.681 | 0.431 |
| Heteroscedasticity Test: ARCH (1)| Obs*R-squared = 0.047 | 0.828 |
| Ramsey Reset test                | F-stat = 0.549 | 0.591 |
| CointEq(−1)                      | −1.151* | 0.000 |
| Number of observations 1964–2015| R² = 0.986 Adj R² = 0.964 |
| CUSUM Square                     |            |

* indicates the coefficient significant at 1%.

### Table 2. Long-run Relationship of Private Investment in Agriculture Sector.

| Regressors                          | Coefficient | T-stats | P-value |
|-------------------------------------|-------------|---------|---------|
| Growth rate of value added (GVA<sub>A</sub>) | −0.037*** | −1.853 | 0.080 |
| User cost (UC<sub>A</sub>)           | −0.002     | −0.981 | 0.399 |
| Credit available to agriculture (PC<sub>A</sub>) | 0.259* | 3.740 | 0.002 |
| GDP growth (G)                      | −0.059**  | −2.355 | 0.030 |
| Physical infrastructure (PI)        | −2.363     | −1.435 | 0.168 |
| Term of trade (TOT<sub>A</sub>)      | 1.017**   | 2.218  | 0.039 |
| Foreign direct investment (FDI)      | 0.095     | 1.558  | 0.136 |
| Fertilizer use (FERT)               | 0.726*     | 3.064  | 0.006 |
| Water availability (WAT)            | −2.731*** | −2.043 | 0.055 |
| CONS                                | 12.55*     | 3.939  | 0.001 |

The coefficients significant at 1%, 5% & 10% are indicated by *, ** & *** respectively.
presented in Table 4. Based on SBC, ARDL (3, 1, 0, 0, 0, 1, 0, 0, 0) model is selected for private investment in industrial sector. The selected model explains 97.2% of the variation in the dependent variable. Diagnostics of ARDL are presented in Table 3.

Bounds test confirms a long-run relationship among the variables at a 2.51% level of significance. The estimated value of ECM is \(-1.035\), which is almost in the middle of the desired range, \([-2, 0]\) [Rafindadi and Yosuf (2013)]. The estimated value implies that, on average, investment shocks in any year are adjusting within the next year by slight overshooting.

Other diagnostic tests, i.e. LM test, Jarque-Bera (JB) test and ARCH test, confirm that the residuals are serially uncorrelated, normality distributed, and homoscedastic respectively. CUSUM and CUSUMSQ show that the coefficients of the models are stable. Finally, the Ramsey reset test guides that the linear specification of the model is correct.

In the case of private investment in the industrial sector, credit availability to the private sector (PC), physical infrastructure (PI), political stability (POL), and GDP growth (G) are significantly positive. Conversely, sector-specific output growth (GVAI), nationalisation (ND), and military regime (GD) have adverse effects.

The findings support the accelerator principle in a specific sense, explaining the positive relationship between GDP growth and private investment. This signifies the role of economic progress (GDP growth) in the industrialisation process. Political stability boosts optimistic expectations; thus, a favourable economic environment and positive political climate stimulate investment activities.

Finally, the inverse effects of nationalisation and the military regime show the importance of stable policies and political processes (democracy) in capital formation (investment) in the industrial sector. Pakistan can be viewed as a rollercoaster economy, and the country has been facing political instability immediately after

### Table 3. Diagnostic Tests of ARDL Model for Industrial Sector.

| Test statistics               | F-statistic | P-value |
|------------------------------|-------------|---------|
| F-statistic = 3.886           |             |         |
| I(0)                         | 1.88        | 2.99    |
| I(1)                         | 2.14        | 3.3     |
| 5%                           | 2.37        | 3.6     |
| 2.5%                         | 2.65        | 3.97    |
| 1%                           |             |         |
| Serial Correlation LM Test (1)|             |         |
| Obs*R-squared = 0.211         |             |         |
| Normality test               |             |         |
| Jarque-Bera = 0.606          |             |         |
| Heteroscedasticity Test: ARCH (1)|         |         |
| Obs*R-squared = 0.035         |             |         |
| Ramsey Reset test            | F-stat = 0.182 |       |
| CointEq(−1)                  | −1.035*     | 0.000   |
| Number of observations 1964–2015 (52 obs) | R^2 = 0.981 Adj R^2 = 0.972 |       |

CUSUM CUSUM Square

* indicates the coefficient significant at 1%.

### Table 4. Long-run Relationship of Private Investment in Industrial Sector.

| Regressors                        | Coefficient | T-stats | P-value |
|-----------------------------------|-------------|---------|---------|
| SBC selected model                | (3, 1, 0, 0, 0, 1, 0, 0, 0) |         |         |
| Growth rate of value added (GVA)  | −0.044*     | −3.282 | 0.002   |
| User cost (UC)                    | 0.00004     | 0.047  | 0.962   |
| Credit available to private sector (PC) | 0.554*      | 9.538 | 0.000   |
| GDP growth (G)                    | 0.120*      | 4.392  | 0.000   |
| Physical infrastructure (PI)      | 9.118*      | 7.316  | 0.000   |
| Term of trade (TOT)               | −0.701      | −1.173 | 0.249   |
| Foreign direct investment (FDI)   | −0.041      | −1.585 | 0.122   |
| Public investment in industry (P) | −0.045      | −0.778 | 0.441   |
| Political stability (POL)         | 0.011**     | 2.688  | 0.011   |
| Nationalisation dummy (ND)        | −0.660*     | −7.944 | 0.000   |
| Government dummy (GD)             | −0.248*     | −4.865 | 0.000   |
| CONS                              | 5.826*      | 4.027  | 0.000   |

The coefficients significant at 1% & 5% are indicated by * & ** respectively.
its independence, which shatters the confidence of domestic and foreign investors. This situation leads to a decline in investment due to the passive business expectations.

The significant impacts of the above-mentioned non-economic variables show that these variables play a crucial role in determining private investment behaviour (Rehman, Khan, and Khan 2009).

The short-run dynamics of private investment in the industrial sector, as reported in Appendix B2, are quite similar to the long-run relationship. According to the findings, lagged private investment in the industrial sector, credit availability, political stability, GDP growth, and physical infrastructure have a significant impact. In contrast, value-added output in industry, nationalisation, and military regime dummies significantly and negatively affect private investment in the industrial sector Table 5.

### 5.3. Private investment in the service sector

The results of the unit root test are presented in Appendix C1. The results reveal that the variables are a mix of I (0) and I (1). Moreover, no variable has a second order of integration. The results of the selected model are presented in Table 6. Based on SBC, ARDL (1, 2, 2, 0, 3, 1, 0, 0, 1, 2, 0) model is selected for private investment in services sector. The selected model explains 99.4% of the variation in the dependent variable. Diagnostics of ARDL are presented in Table 5.

Bounds test confirm a long-run relationship among the variables at a 1% level of significance. The estimated value of the ECM coefficient is negative and significant, which reconfirms the existence of a long-run relationship among the variables. ECM value is $-0.369$, showing that 36.9% of error is corrected in a single period, i.e. a year. Other diagnostic tests, i.e. LM test, Jarque-Bera (JB) test and ARCH test, confirm that residuals are serially uncorrelated, normality distributed.

### Table 5. Diagnostic Tests of ARDL Model for Services Sector.

| Test statistics | P-value |
|-----------------|---------|
| $F$-statistic = 6.873 |         |
| I(0) | 1.83 | 2.94 |
| I(1) | 2.06 | 3.24 |
| 2.5% | 2.28 | 3.5 |
| 1% | 2.54 | 3.86 |

The dependent variable is private investment in the services sector

The coefficients significant at 1%, 5% & 10% are indicated by *, ** & *** respectively.
and homoscedastic, respectively. CUSUM and CUSUMSQ show that the coefficients of the models are stable. Finally, the Ramsey test result guides that the linear specification of the model is correct.

Private investment in services is significantly encouraged by the service sector output value-added growth (GVAS), private credit availability (PC), GDP growth (G), physical infrastructure (PI), remittances (REM), and foreign direct investment (FDI). However, public investment in services (I^p^s^s) and trade openness (OP) discourage private investment in this sector.

These findings are consistent with the predictions of the accelerator principle (Naa-Idar, Ayentimi, and Frimpong 2012). The conducive economic environment through the increase in income/output at the sector-wise and national levels provides a signal of better business prospects, thus leading to high rates of investment (Blomstrom, Lipsey, and Zejan 1996; Ghura and Goodwin 2000; Greene and Villanueva 1991; Krishnaa, Ozyildirim, and Swanson 2003).

Moreover, in the short-run, private investment in services significantly and positively varies with growth in service sector output value-added growth, credit available to the private sector, public investment in services, GDP growth, physical infrastructure, and remittances, whereas trade openness exerts a significant negative impact on private investment in services (see Appendix C2).

6. Conclusion and policy implications

6.1. Conclusion

To investigate the sector-wise behaviour of private investment (in agriculture, industry, and services), this study employ the ARDL model for the period between 1964 and 2015.

The results reveal that demand significantly stimulates investment activities in all categories except agriculture. Essentially, the accelerator model is relevant in explaining sector-wise investment behaviour. Furthermore, credit availability (financial development) is found to be a significant determinant of private investment in each sector, showing that the availability of financial resources is an essential constraint for investment rather than the cost of borrowing. Thus, the neoclassical model (i.e. user cost of capital) is not applicable in explaining sector-wise private investment behaviour. Infrastructural development has a substantial impact on each type of private investment. It stimulates investment activities by enlarging the market and reducing the cost of investment/doing business.

The favourable terms of trade (relative prices) and fertiliser use/demand in the agricultural sector are investment-enhancing factors. In the industrial sector, political stability has a significant positive effect by creating optimistic behaviour among investors. However, political declines, especially military regimes, are detrimental to the stability of the industrialisation process and the momentum of investment activity. Policy reversals, such as nationalisation during the early 1970s, discourage investors.

Political stability and a democratic system are necessary conditions to enhance investment activities in the country. A businessman/private investor is primarily interested in maximising the expected profitability with minimum risk. Investment activity remains uncertain owing to the uncertain political environment. Moreover, political instability causes a lack of confidence in the business community, which leads to a decline in private investment activities. Finally, remittances and FDI positively contribute to private investment in the service sector.

6.2. Policy implications

The policy suggestions based on these findings of the present study are as follows: creating sufficient demand is essential. It can be achieved in the long run through sustained and consistent economic policies and a stable environment.

In the case of agriculture, the government may subsidise necessary inputs, such as fertilisers. Moreover, prudent support prices and procurement policies favouring framers/investors directly involved in agricultural investment activities should be devised. There is a need to deregulate the water provision and distribution network, which is currently marred by managerial inefficiencies. For the industrial sector, the availability of financial/cash flows or liquidity and physical infrastructural development are key instruments for investment promotion. Public–private partnerships and business alliances/joint ventures between domestic and foreign investors also need to be explored.

The results indicate that the privatisation process needs to be fast-tracked by working through legal, financial, and political barriers. Finally, consistency in public policy and stable political conditions are essential to accelerate investment activities.

Notes

1. Fixed investment is simply defined as gross fixed capital formation (GFCF), which is the sum of all spending on new capital goods in a specified period.
2. These figures are calculated by the author using the data from Handbook of Statistics (2015), State Bank of Pakistan (SBP).
3. The author’s own calculation based on the data from *Handbook of Statistics* (2015), State Bank of Pakistan (SBP).
4. The studies, at most, have examined the behaviour of private investment in manufacturing sector.
5. Investment deflator = nominal investment/real investment.
6. A few early studies have adopted a 4% depreciation rate (see Burney and Syed 1986; Khilji 1982). Siddique (1983) has assumed an annual depreciation rate of 5.6%.

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Appendix A1. Unit Root Table for Private Investment in Agriculture Sector.

| Variables | Intercept & Trend | Intercept & Trend |
|-----------|-------------------|-------------------|
| $\Delta PI_{a}$ | -2.906 (0.051) | -2.982 (0.043) |
| $\Delta f_{FDI}$ | 2.071 (0.037) | 2.071 (0.037) |
| $\Delta WAT$ | 5.219 (0.000) | 5.219 (0.000) |
| $\Delta FERT$ | 5.686 (0.000) | 5.686 (0.000) |
| $\Delta PI$ | 5.002 (0.000) | 5.002 (0.000) |
| $\Delta G$ | 5.831 (0.000) | 5.831 (0.000) |
| $\Delta ACA$ | 8.045 (0.000) | 8.045 (0.000) |
| $\Delta UCA$ | 8.212 (0.000) | 8.212 (0.000) |
| $\Delta TOTI$ | 8.087 (0.000) | 8.087 (0.000) |
| $\Delta IPRI$ | 2.530 (0.114) | 2.530 (0.114) |
| $\Delta IPUB$ | 1.289 (0.580) | 1.289 (0.580) |
| $\Delta ACA$ | 1.702 (0.000) | 1.702 (0.000) |

The coefficients significant at 1%, 5% & 10% are indicated by *, ** & *** respectively.  
1PI is detrended using time and time square, so unit root is applied using 'no constant' specification.

Appendix A2. Short-run Dynamics of Private Investment in Agriculture Sector.

| Regressors | Coefficient | P-value |
|------------|-------------|---------|
| $PI_{a}$ | 0.394** | 0.014 |
| $\Delta ACA$ | 0.013 | 0.923 |
| $\Delta UCA$ | 0.001 | 0.139 |
| $\Delta FERT$ | 1.462* | 0.003 |
| $\Delta WAT$ | 3.21* | 0.005 |
| $\Delta G$ | 0.034** | 0.031 |
| $\Delta PI$ | 10.91** | 0.044 |
| $\Delta TOTI$ | 1.720** | 0.049 |
| $\Delta FDI$ | 0.088** | 0.034 |

The coefficients significant at 1% & 5% are indicated by * & ** respectively.

Appendix B1. Unit Root Table for Private Investment in Industrial Sector.

| Variables | Intercept & Trend | Intercept & Trend |
|-----------|-------------------|-------------------|
| $\Delta PI_{i}$ | -2.906 (0.051) | -2.982 (0.043) |
| $\Delta f_{FDI}$ | 2.071 (0.037) | 2.071 (0.037) |
| $\Delta WAT$ | 5.219 (0.000) | 5.219 (0.000) |
| $\Delta FERT$ | 5.686 (0.000) | 5.686 (0.000) |
| $\Delta PI$ | 5.002 (0.000) | 5.002 (0.000) |
| $\Delta G$ | 5.831 (0.000) | 5.831 (0.000) |
| $\Delta ACA$ | 8.045 (0.000) | 8.045 (0.000) |
| $\Delta UCA$ | 8.212 (0.000) | 8.212 (0.000) |
| $\Delta TOTI$ | 8.087 (0.000) | 8.087 (0.000) |
| $\Delta IPRI$ | 2.530 (0.114) | 2.530 (0.114) |
| $\Delta IPUB$ | 1.289 (0.580) | 1.289 (0.580) |
| $\Delta ACA$ | 1.702 (0.000) | 1.702 (0.000) |

P-values are provided in the brackets. The statistics significant at 1%, 5% & 10% are indicated by *, ** & *** respectively.  
1PI is detrended using time and time square, so unit root is applied using 'no constant' specification.
Appendix B2. Short-run Dynamics of Private Investment in Industrial Sector.

| Regressors | Coefficient | P-value |
|------------|-------------|---------|
| IPRI\(_S\)(−1) | 0.505* | 0.005 |
| GVA\(_I\) | −0.023** | 0.027 |
| UCS | 0.000 | 0.962 |
| PC | 0.574* | 0.000 |
| G\(_P\) | −0.047 | 0.475 |
| PI | 0.011** | 0.015 |
| G | 0.065* | 0.003 |
| TOT | 9.444* | 0.000 |
| FDI | −0.004 | 0.714 |
| REM | 0.304* | 0.000 |
| OP | −1.895* | 0.007 |

The coefficients significant at 1% & 5% are indicated by * & ** respectively.

Appendix C1. Unit Root Table for Private Investment in Services Sector.

| Variables | Augmented Dickey Fuller Test | Phillips Perron Test |
|-----------|-------------------------------|---------------------|
|           | Intercept & Trend             | Intercept & Trend   |
| IPRI\(_S\) | 0.201 (0.970)                | −3.355*** (0.069)  |
| ΔIPRI\(_S\) | −5.006* (0.000)             | −5.200* (0.000)    |
| GVA\(_S\) | −5.171* (0.000)             | −5.872* (0.000)    |
| ΔGVA\(_S\) | −1.783 (0.382)              | −1.932 (0.623)     |
| UCS | −8.661* (0.000) | −6.581* (0.000) |
| ΔUCS | −1.975 (0.296)            | −5.470* (0.000)    |
| TOT\(_S\) | −2.134 (0.232)             | −3.613** (0.038)  |
| ΔTOT\(_S\) | −7.490* (0.000)             | −7.404* (0.000)    |
| REM | −1.232 (0.653)             | −1.799 (0.690)     |
| ΔREM | −4.953* (0.000)             | −4.923* (0.001)    |
| OP | −3.279** (0.021)惊 | −3.758** (0.027)  |
| ΔOP | −1.289 (0.580)              | −1.758 (0.709)     |
| PC | −5.002* (0.000)             | −5.104* (0.000)    |
| ΔPC | −5.906** (0.051)            | −5.426* (0.000)    |
| FDI | −5.219* (0.000)             | −5.666* (0.000)    |
| G | −2.071** (0.037)            | −1.115 (0.237)     |
| PI | −2.071** (0.037)            | −3.708* (0.000)    |

The statistics significant at 1%, 5% & 10% are indicated by * & ** & *** respectively.

1PI is detrended using time and time square, so unit root is applied using 'no constant' specification.

Appendix C2. Short-run Dynamics of Private Investment Services Sector.

| Regressors | Coefficient | P-value |
|------------|-------------|---------|
| IPRI\(_S\)(−1) | −0.004 | 0.415 |
| GVA\(_S\) | 0.018* | 0.000 |
| UCS | 0.001 | 0.201 |
| PC | 0.391* | 0.000 |
| G\(_P\) | 0.152* | 0.002 |
| PI | 0.029* | 0.000 |
| G | 5.616* | 0.000 |
| TOT | −0.271 | 0.548 |
| FDI | −0.004 | 0.714 |
| REM | 0.304* | 0.000 |
| OP | −1.895* | 0.007 |

The coefficients significant at 1% are indicated by *. 

P-values are provided in the brackets.