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Bounds testing approach to cointegration: An examination of the impact of foreign direct investment and trade on growth in Saudi Arabia, 1970-2010

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It is widely recognized that trade and foreign direct investment (FDI) inflows are important factors in long-term economic growth. Trade openness enhances skills through the adoption of imported superior production technology and innovative processes, and thus exerts a positive and significant impact on economic growth. Similarly, FDI augments and stimulates domestic investment, enhances technology transfer, increases export capacity and foreign exchange earnings, and thus promotes capital formation and long-run growth. This paper examined the empirical relationship between economic growth on one hand and trade and FDI flows on the other hand for Saudi Arabia during the last four decades (1970-2010). The autoregressive distributed lag (ARDL) methods to cointegration and the associated error correction model (ECM) are adopted. The results suggest that human capital, government expenditure, trade openness and infrastructure are important determinants of long run growth in Saudi Arabia. In contrast, FDI together with domestic private investment has impacted negatively on real gross domestic product (GDP). This is attributed partly to the dominant role of the public sector in the economy emanating from the huge oil resources, thereby leaving little room for the domestic and foreign private investment to play their role in the economy, and partly to the concentration of FDI in unproductive sectors. Nonetheless, the interaction of FDI either with government expenditure or with domestic investment could impact positively on growth. Efforts should therefore focus on enhancing the integration between these factors on long-term growth. Privatization, economic liberalization, and diversification measures are expected to provide real opportunities for domestic and foreign investment to play an important role in economic activity and growth.

Key words: Saudi Arabia, FDI, unit roots, ARDL cointegration, ECM, trade.

INTRODUCTION

It is widely recognized that trade and FDI inflows are important pillars of long-term economic growth. For developing countries, trade may lead to the enhancement of skills through the adoption of imported superior

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production technology and innovative processes. Exporters learn or adopt advanced production technology and innovation, either through intensive competition in international markets or through sub-contracting to foreign businesses. Since producers of capital-intensive import-substitutes face fierce competition from foreign counterparts, they need to adopt better production techniques to survive. Further, FDI augments domestic investment resources and promotes capital formation in the host country. Inward FDI can also stimulate domestic investment through linking the production chain when foreign firms use local inputs or when they supply intermediate inputs to local firms. FDI is also associated with new job opportunities and enhancement of technology transfer in the host countries. Along similar lines, inward FDI can increase the host country's export capacity and foreign exchange earnings, which is further emphasized by improved macroeconomic environment (Frankel and Romer, 1999; Wacziarg, 2001).

At the empirical level, most cross country and country-specific studies concluded that both trade and *FDI* inflows promote economic growth (Borensztein et al*.,* 1998; Balasubramanyam et al*.,* 1999; Mansouri. 2005; Lipsey, 2000; Asiedu, 2002; Pahlavani et al. 2005). However, the growth enhancing effects of trade and *FDI* inflows vary from country to country (Balasubramanyam et al., 1996; Borensztein et al., 1998; Lipsey, 2000; de Mello, 1999; Xu, 2000). Bhagwati (1985) argued that with due adjustments for differences among countries for their economic size, political stability and attitudes towards *FDI*, both the magnitude and efficacy of *FDI* flows in promoting long run growth is greater in countries pursuing export promotion strategy than in those adopting import substitution strategy. Unbalanced distribution of *FDI* inflows in favour of predominantly import-substituting sectors may fail to generate the linkages necessary for economic growth to the wider economy (Frimpong and Oteng-Abayie, 2006).

This study assesses the growth enhancing impact of *FDI* and trade openness for Saudi Arabia. We hasten to note that, with its huge oil wealth, the importance of *FDI* for the Saudi's economy stems from the spill over effects of such inflows, namely the enhancement of skills through the adoption of imported superior technology and innovative processes, especially in production, management, and marketing. Annual time series data covering the period 1970-2010 are analyzed using the bounds testing cointegration approach by Pesaran et al. (2001), which is known to be more robust for small time series data.

The results suggest that human capital, government expenditure, trade openness and infrastructure are important determinants of long run *GDP* growth in Saudi Arabia. In contrast, there is evidence that *FDI* together with domestic private investment has a significant negative impact on real *GDP*. This is attributed partly to the dominant role of the public sector in the economy emanating from the huge oil resources, thereby leaving little room for the private sector to play its role in the economy, and partly to the concentration of *FDI* in unproductive sectors. Nonetheless, the interaction of *FDI* either with government expenditure or with domestic investment could have significant positive impact on growth. Efforts should therefore focus on enhancing the integration between the roles of these factors on long-term growth. Measures such as privatization, economic liberalization, and diversification are expected to provide real opportunities for domestic and foreign investment to play an important role in economic activity and growth.

The rest of the paper is organized as follows. Section (2) briefly reviews the literature, while section (3) presents some stylized facts about *FDI* inflows into Saudi Arabia during 1970-2010. Section (4) outlines the research methodology, while section (5) reports the empirical results. Section (6) concludes with some final remarks.

A BRIEF LITERATURE REVIEW

The neoclassical growth theory emphasized two sources of economic growth, namely factor (capital and labour) accumulation and total factor productivity growth (Felipe, 1997). The theory postulates that *FDI* enhances economic growth by augmenting domestic capital. However, because of diminishing returns, the impact of capital accumulation on growth fades gradually in the long run. Endogenous growth theory, however, opines that *FDI* contributes to long-run growth through augmenting domestic capital, stimulating productivity of domestic investment, and enhancing technology transfer (Romer, 1986, 1990; Blomstrom, 1986; Lucas, 1988; Kokko, 1994; Borensztein et al., 1998; Blomstrom and Kokko, 1998; Driffield, 2001). This long-run impact on growth is further enhanced by the long-run impact of *FDI* on knowledge through research and development, and on human capital through labour training and skill acquisition (de Mello, 1997, 1999). The literature emphasized the role of the 'contagion' effect of the more advanced technology and management practices adopted by foreign firms in the host country. Such practices include new production processes and techniques, managerial skills, ideas, and new varieties of capital goods (Borensztein et al., 1998). Technological diffusion comes from subsidiaries of multinationals to domestic firms, and enables host countries to achieve higher productivity of capital and labour, and also to catch up with the technology level in developed countries (*DCs*). Spillovers may take place through demonstration and/or imitation by domestic firms of new technologies of foreign firms, competition resulting from entry of foreign firms pressurizing domestic firms to introduce new technologies and adjust their activities, linkages through transactions between multinationals and domestic firms, and/or training by domestic firms of employees to enable them work with new technologies (Dunning, 1993; Caves, 1996; de Mello, 1997; Blomstrom and Sjoholm, 1999; Borensztein et al., 1998; Sjoholm, 1999). In addition, trade theory also postulates that *FDI* improves export competitiveness of the host country (Markussen and Vernables, 1998; Blomstrom and Kokko, 1998). This thesis emphasizes the role that the interaction between *FDI* and trade could play in economic growth. The benefits reaped from such interaction are maximized when *FDI* spillovers enhance internal integration by creating further forward and backward linkages within the host economy.

The theoretical relationship between *FDI* and growth has motivated a vast number of empirical studies for both developed and developing countries at the micro and macro levels. Both neoclassical and endogenous growth models provided the basis for most of the empirical work on the *FDI*-growth nexus. The empirical evidence at the micro (firm) and macro (national) levels is mixed. Several studies found a clear positive link, while others found no such link. Most of the research that focused on *LDCs* tended to find a clear positive relationship; others that have ignored this distinction, or have focused on *DCs*, have mostly found no growth benefit for the recipient country.

For developed countries, the evidence suggests that productivity of domestic firms is positively related to the presence of foreign firms (Globerman, 1979 for Canada; Imbriani and Reganeti, 1997 for Italy). In this case, *FDI* complements domestic private investment in boosting economic growth in host countries by enhancing technology transfer and spillover effects such as knowledge, skills and the quality of human capital, and also by creating new job opportunities. For developing countries, some authors suggested positive spillovers (Blomstrom and Persson, 1983; Blomstrom, 1986; Blomstrom and Wolff, 1994 for Mexico; Kokko et al., 1996 for Uruguay; Sjoholm, 1999 for Indonesia; Chakraborty and Basu, 2002 for India; Fosu and Magnus, 2006 for Ghana) while others found limited evidence (Haddad and Harrison, 1993 for Morocco; Aitken and Harrison, 1999 for Venezuela). Still other authors found no evidence of positive short-run spillover from foreign to domestic firms (de Mello, 1997 for some selected Latin American countries; Dees, 1998 for China; Belloumi, 2014 for Tunisia). In its survey of the *FDI*-growth nexus, the OECD (2002) underpinned the spillover effects of *FDI* and observed that 11 out of 14 studies concluded that *FDI* contributed positively to factor productivity and income growth. Differences in the growth effects of *FDI* across countries are explained by differences in the ability to absorb new innovations. Thus, to reap the long-term growth benefits of *FDI* inflows, host countries require a minimum threshold stock of human capital (Borensztein et al., 1998; Bengos and Sanchez-Robles, 2003). This suggests that *FDI* and human capital are complementary in technological diffusion and growth.

It is also stipulated that the positive impact of *FDI* spillovers on growth depends on the macroeconomic dispensation that the host country is passing through (de Mello, 1997; Zhang, 2001; *OECD*, 2002). Some argue that developing countries have to reach a certain level of development before they can reap potential growth benefits from *FDI*. However, Bende-Nabende et al. (2002) observed that direct long-term impact of *FDI* on output is significant and positive for relatively less advanced Philippines and Thailand, but negative in the more economically advanced Japan and Taiwan. Essential capacities also include financial development. Countries with better financial systems and financial market regulations can exploit *FDI* more efficiently for growth (Hermes and Lensink, 2003; Durham, 2004; Alfaro et al., 2004). By ensuring competition, reducing market distortions, and enhancing the exchange of knowledge among firms, well-functioning markets also provide the environment conducive for technological spillovers from *FDI* to growth (Ozawa, 1992; Balasubramanyam et al., 1996). The beneficiary effects of *FDI* on growth are also stronger in countries with a higher level of institutional capability and bureaucratic efficiency (Olofsdotter, 1998).

The growth impact of *FDI* also varies across countries according to the trade regime. Balasubramanyam et al. (1996), for example, observed that *FDI* is more important for economic growth in export-promoting than in import-substituting countries. Along these lines, transnational corporations (*TNCs*) can enhance the role of *FDI* in export-led growth through introducing new forms of human capital, developing new intermediate product varieties, raising product quality, and facilitating international collaboration on *R&D* for host countries. This role works either directly through technology transfer by *TNCs* to their affiliates or indirectly through technological spillovers to unaffiliated firms in host economies. However, *TNCs* may also reduce the impact of *FDI* spillovers by influencing the nature, type, and level of technology transferred directly to their affiliates in the host country. For example, *TNCs* can provide their affiliates with low-level or wrong technological capabilities, or even limit access to the technology of the parent company. The transfer of technology can be prohibited if it jeopardizes *TNCs* profit objective, especially if the cost of preventing the transfer is low. This is achieved, for example, by restricting affiliates to low-level production activities, reducing the scope for technical change to low value intermediate products, and in some cases by “crowding out” local producers to eliminate competition. They may also limit exports to competitors and confine production to the needs of the *TNCs* (Blomstrom and Kokko, 1998; Sjoholm, 1999; Lim, 2001; Hanson, 2001; Smarzynska, 2002; Carkovic and Levine, 2005).

The mixed empirical evidence on the impact of *FDI* on economic growth may be adduced to a number of reasons. First, the envisaged forward and backward linkages may not necessarily exist in host countries, and arguments of *TNCs* encouraging increased productivity due to competition may not be true in practice (Aitken and Harrison, 1999). Second, *TNCs* tend to locate in highly productive industries, thereby forcing less productive firms to exit (Smarzynska, 2002). Third, it is also postulated that *TNCs* 'crowd out' domestic firms, leading to the contraction in total industry size and employment. However, it is contended that crowding out is a more rare event and the benefits of *FDI* tend to be prevalent. Finally, the role of *FDI* in export promotion remains controversial and depends crucially on the motive for such investment. The consensus in the literature is that *FDI* spillovers depend on the host country's investment climate and its capacity to absorb foreign technology (Obwona, 2004).

Stylized facts about FDI inflows into Saudi Arabia: 1970-2010:

It is now widely acknowledged that *FDI* has played an important role in the recent wave of globalization. Data from *UNCTAD* (2010) suggest that, although global *FDI* inflows increased by 5.0 percent from their level of $1,185 billion in 2009 to $1,244 billion in 2010, the pattern of inflows between regions and sub-regions was uneven. Flows into developing economies rose by 12 per cent (to $574 billion) in 2010, thanks to their relatively fast economic recovery, strength of domestic demand, strong growth earnings, and robust economic fundamentals (e.g. market growth), in addition to burgeoning South-South flows.

However, global inflows remained highly concentrated by recipient countries and regions. In 2009, the United States topped the list (with $130 billion), followed by China ($95 billion), France ($60 billion), Hong Kong ($48 billion), the United Kingdom ($46 billion), India ($40 billion), Russian Federation ($39 billion), Saudi Arabia ($36 billion), and Belgium ($34 billion). Thus, with the USA, China and France leading the way globally, *UNCTAD* (2010) placed the Kingdom of Saudi Arabia at number eight worldwide in attracting *FDI*, and the first among Arab and Middle East countries. Indeed, none of the Middle East countries came near to Saudi Arabia in terms of *FDI* inflows[1]. This may be attributed to many reasons, ranging from negative image of the region, to poor infrastructure, corruption and foreign exchange shortages, and an unfriendly macroeconomic policy environment.

Long hampered by restrictive regulatory frameworks, the surge in *FDI* into Saudi Arabia in more recent times may be attributed to a number of institutional and policy developments. The promotion of both domestic and foreign private investment has become one of the centrepieces of development policy. Numerous and frequent amendments have been introduced to *Investment Acts* with a view to improve the environment for foreign investment. The 1965 (1376H) *Foreign Investment Act* stipulated that the share of national investment should not be less than 51 percent of the project's investment funds. This Act was subsequently promoted into the 1972 (1383H) Act, followed by the 1988 (1399H) Act, and the 2000 (1421H) Act. The latter Act coincided with the establishment of Saudi Arabian General Investment Authority (*SAGIA*) as an autonomous body for investment promotion. It allowed foreigners to invest in all sectors of the economy, except for specific activities put on a 'negative list'. This list continued to shrink as a result of the continuous efforts to liberalize foreign trade. Further, foreign investors are no longer required to take local partners in a number of sectors and may own real estate for company activities. They can also sponsor foreign employees and are also allowed to transfer their company share from liquidation or profits outside the country.

At another level, a host of other factors have also attracted investors into Saudi Arabia. These include stable macroeconomic environment (as manifested in controlled inflation and fixed exchange rates), openness to foreign trade, the large local market with a high spending power manifested in a population of over 27 million and high standard of living, sound infrastructure, and the extensive privatization and liberalization programs that are currently underway. Finally, huge oil reserves and the very low energy costs are also among the decisive factors for foreign investors. This substantial improvement in the foreign investment climate in the Kingdom was further enhanced by the accession of Saudi Arabia to the WTO membership in 2005.

To gain some insights into the trends of *FDI* flows into Saudi Arabia, the period 1970-2010 is broken down into four sub-periods. The first period (1970-1980) was characterized by the hostile environment and restrictive policies, the second period (1981-1990) witnessed the gradual adoption of adjustment policies, the third period (1991-2000) saw the adoption of stronger adjustment policies under *SAP*, and the fourth period (2001-2010) was characterized by the establishment of *SAGIA* in 2000 and the strong wave of globalization. Table 1 presents some basic summary statistics on *FDI* inflows during the four sub-periods.

Although *FDI* inflows have trended upwards during the four sub-periods, both in terms of value and as shares of total inflows, the coefficients of variation reflect the high volatility of these flows. The hostile attitude and restrictive

[1] Data from UNCTAD (2011) suggest that total FDI flows into Saudi Arabia represented 55.5 percent of inflows into GCC countries and 30.8 percent of inflows into Arab countries during 1970-2010.

Table 1. Basic Summary Statistics of FDI flows into Saudi Arabia, 1970-2010.

Period	FDI		Coefficient of variation (CV)		
	Value (SR. million)	%	Mean	Standard deviation	CV
1970-1980	52,293.9	4.33	4,754.0	5,251.8	1.105
1981-1990	169,710.8	14.06	16,971.1	2,071.3	0.122
1991-2000	230,927.4	19.13	23,092.7	5,722.0	0.248
2001-2010	754,153.0	62.48	75,415.3	39,201.9	0.520
1970-2010	1,207,085.0	100.00	29,441.1	33,256.0	1.130

Source: Authors' calculations based on data from UNCTAD: Foreign Direct Investment Statistics, 1970-2010

policy, together with the 1973 Arab-Israeli war, has probably discouraged foreign participation during 1970-1980 with inflows representing only 4.3 percent of total inflows during the entire period. These inflows were also hesitant, with a coefficient of variation of 1.1, by far the highest among other periods. However, the gradual adoption of economic and structural adjustment programs since the early 1980s has initiated the termination of the hostile policies towards *FDI*. The package of policies under *SAP*s included privatization and economic and financial liberalization. Thus, despite the crash of world oil prices in 1980, the period 1981-1990 has witnessed a strong recovery in inflows. This recovery persisted until 2000, though at a slower pace due to the hostilities in the Gulf during 1987-1989. Nonetheless, the pace of inflows improved afterwards due to the globalization wave. The strong upward spiral in *FDI* inflows started in 1996 and continued until 2010. This may be attributed largely to the stronger privatization and diversification measures, massive investment in national infrastructures, and the efforts made in providing training opportunities for the young generations. Further, *FDI* was welcomed with a view to valorising local raw materials, particularly oil derivatives.

However, despite these efforts, *FDI* flows into Saudi Arabia trended downwards during 2008-2010. A number of flagship mega-projects in the petrochemical industry involving joint ventures between the State-owned *Saudi Aramco* and foreign *TNCs* witnessed the withdrawal of foreign partners (ConocoPhillips from the *Yanbu* project), or were temporarily frozen (such as the *Ras Tanura* integrated project with *Dow Chemical*), or failed to attract enough foreign investment and became domestic operations fully funded by *Saudi Aramco* (e.g. *Jazan refinery*). Nonetheless, following the deregulation of the telecommunication sector since 2000, total *FDI* inflows increased to reach their highest value during 2001-2010, which represents 62.5 percent of total inflows during the entire period.

Although *FDI* inflows are relatively high, they are nevertheless very low relative to *GDP*. Given the great potential of the Saudi's economy and its grid of developed infrastructure and investor-friendly laws, additional efforts are currently being undertaken to encourage more *FDI* inflows. A host of problems in this respect are encountered. These include inadequate legal framework for resolving commercial disputes, lack of transparency in applying intellectual property legislation, quotas imposed on firms and companies to employ Saudi nationals, delayed payment of some government contracts, restrictive measures on entry and exit visas for foreign workers, and a conservative cultural environment enforcing segregation of sexes in most businesses.

Table 2 gives a breakdown of *FDI* flows into the Saudi's economy by sector during 2006–2009. Inflows covered a wide range of sectors. Despite the sectoral diversification, much *FDI* during 2006–2009 was destined for manufacturing, with an annual average share of 35.0 percent, followed by real estate (15.0 percent). The share of the mining, gas, and extractive sector diminished from 11.3 percent in 2006 to 7.8 percent in 2009, with an average share of over 9.0 percent during the period. Agriculture and the hotel and restaurant sectors remained the least attractive host sectors of *FDI*, with average shares of 0.09 and 0.41percent, respectively.

Also, we observe that since 2007, the transport and communication sector has become more attractive to foreign investors, raising its share from zero in 2006 to 5.1 in 2007, and further to 7.5 percent in 2008 before diving to 5.6 percent in 2009. Interest focused on the telecommunication sub-sector, with its great growth potential since the Kingdom represents one of the fastest growing mobile phone markets in the region. Over the last few years, different fields of information and communications technology (*ICT*) witnessed remarkable progress, including connectivity and access, sector reforms, national *IT* initiatives and e-services. Since its establishment in 2001, the Communication and Information Technology Commission (*CITC*) has adopted a gradual approach towards full liberalization of the *ICT* sector and the promotion of fair competition in the market. In 2005, *CITC* introduced competition in the mobile telecommunications market. Currently there are three mobile operators (*STC*, *Zain*, and *Mobily*), providing various mobile services, including broadband mobile services. The three operators are currently engaged in

Table 2. *FDI* Flows into Saudi Arabia by Economic Sector (%), 2006-2009.

Sector	2006	2007	2008	2009	Annual average (2006-2009)
Agriculture and fishing	0.00	0.11	0.09	0.12	0.09
Mining , oil extraction & gas services	11.30	11.94	7.51	7.77	9.07
Industry	36.15	42.33	31.49	32.91	34.83
Electricity, gas and water supply	9.27	6.01	5.33	3.39	5.49
Contracting	5.65	6.80	9.52	12.52	9.29
Trade	0.00	4.21	2.68	3.68	2.86
Hotels and restaurants	0.01	0.15	0.70	0.48	0.41
Transport, storage, communications	0.00	5.12	7.51	5.60	5.25
Finance services & insurance	12.45	6.79	10.85	10.53	10.20
Real estate	16.40	11.86	18.34	13.12	15.13
Other activities	8.77	4.69	5.98	9.88	7.38
Total	100.00	100.00	100.00	100.00	100.00

Source: Compiled from various SAGIA Reports accessed at *http:/www.sagia.gov.sa/*.

neck-to-neck competition, forcing the rates down and fostering consumer satisfaction. Competition was also introduced in data and *VSAT* services. In 2007, the *CITC* liberalized the fixed telecommunications market and offered licenses for three new fixed operators.

These measures have resulted in remarkable improvements in major *ICT* indicators, including service offerings, quality of service, customer care, reduced prices, and subscriber growth. The most noticeable growth is observed for mobile subscribers, with the total number growing from 12 million by end of 2005 (over 50 percent penetration) to 53.1 million by mid 2012 (with penetration of 181.2 percent of the population), without showing any sign of abating. Prepaid subscriptions constitute the majority (85 percent) of all mobile subscriptions, in line with the trend in similar markets around the world. However, following the *CITC* policy to regulate the sale and activation of prepaid *SIM* cards, the number of subscriptions as well as the penetration rate has decreased as a result of deactivating a large number of unidentified *SIM* cards by the service providers.

Although Saudi Arabia has officially approved the introduction of the *NET* in 1997, the service started officially on the first day of 1999. Some 30 *ISP* operators were licensed, with internet users growing from around 1 million in 2001 to 7.7 million by end of 2008 (with a penetration rate of 31 percent of the population), and further to 15.2 million by mid 2012 (with a penetration rate of 52 percent of the population). This rapid growth of internet users is attributed to increased public awareness, growth in broadband availability, decreasing costs of personal computers and laptops, and easy internet access through handheld devices. Other factors that have played a vital role in the increased use of internet services include the increase in consumer *ICT* literacy, better understanding of the value of internet at the personal and business levels, availability of local content, Arabic language sites, and e-services, such as online banking, e-commerce, and e-government applications.

In summary, *FDI* flows into Saudi Arabia have exhibited an upward trend since 1970, and particularly so during the last decade which witnessed the inflow of 62.0 percent of total inflows during 1970-2010. These inflows represented over 30.0 percent of inflows into the Arab countries, and over 55.0 percent of inflows into the *Gulf Cooperation Council* countries during the same period *UNCTAD* (2011). These figures raise the central question that this paper addresses, namely the role that *FDI* might have played in promoting growth of the Saudi's economy.

METHODOLOGY AND ANALYTICAL FRAMEWORK

Model specification and data

The methodology adopted in this paper draws heavily on that in Mahran (2012) and the relevant references cited therein. The data are modelled on the basis of the neoclassical aggregate production function (APF) framework. This function expresses aggregate output or real *GDP* (*RGDP*) as a function of conventional inputs, capital (*K*) and labour (*L*), together with multiplicative constant representing total factor productivity. Since data on capital stock is not available, we use real domestic investment (*RINV*), while labour is represented by human capital (*HUMAN*). With t denoting time, the standard neoclassical production function may be written as:

$$RGDP_t = A_t (RINV)_t^{\beta_1} (HUMAN)_t^{\beta_2}$$

The neoclassical APF also incorporates 'unconventional inputs' such as trade openness (*OPEN*) and *FDI* to capture their contribution to economic growth through the impact of FDI on total factor productivity (*A*), which in turn depends on the volume of trade (*OPEN*) of the host country. Thus, In addition to *FDI* and trade (*OPEN*), we assume that total factor productivity (*A*) is a function of government size (*GOV*) and infrastructure (*INFRA*), together with other exogenous factors encapsulated in a constant parameter (γ), so that:

$$A_t = \gamma FDI_t^{\alpha_1} GOV_t^{\alpha_2} INFRA_t^{\alpha_3}$$

Substituting this equation into the standard neoclassical production function we obtain the aggregate production function, which takes the form:

$$RGDP_t = \gamma (RGDP)_{t-1}^{\beta_0} (RINV)_t^{\beta_1} (HUMAN)_t^{\beta_2} FDI_t^{\beta_3} (OPEN)_t^{\beta_4} GOV_t^{\beta_5} INFRA_t^{\beta_6}$$

where β_i is the constant elasticity coefficient of output with respect to the i^{th} input. Thus, an explicit estimable *ARDL* model that has been widely used in assessing the impact of trade and *FDI* inflows on growth takes the log-linear form[2]:

$$\begin{aligned} \ln RGDP_t = {} & \gamma + \alpha t + \beta_0 \ln RGDP_{-1} + \beta_1 \ln RINV_t \\ & + \beta_2 \ln HUMAN_t + \beta_3 \ln FDI_t + \beta_4 \ln OPEN_t \\ & + \beta_5 \ln GOV_t + \beta_6 \ln INFRA_t + \varepsilon_t \end{aligned} \quad (1)$$

where ε is a white noise error term. Equation (1) is the long-run equilibrium model and may form a cointegration set if all variables are integrated of order 1, i.e. I(1). The importance of investment and human capital in economic growth has been recognized long time ago (Levine and Renelt, 1992; Barro and Lee, 1994; Akinlo, 2004). Trade openness is expected to contribute positively to growth. Trade, especially imports in the case of Saudi Arabia, provides opportunities to gain access to new technology as well as managerial skills. Government size is expected to exert a direct positive impact on economic growth. Higher level of government expenditure should translate into more overhead capital that encourages production and growth. Adequate infrastructure facilitates production, reduces operating costs, increases the productivity of investment, and promotes growth. The number of telephones per 1,000 persons of the population is often used to measure infrastructure development. The problem with this measure, however, is that it measures only the availability of the facility and not its reliability. Other measures used in the literature include electric power transmission and distribution losses. This paper uses per capita electric power consumption as well as the number of mobile telephones, both of which are expected to impact positively on growth. Other variables are also introduced into equation (1) to capture the interaction between *FDI* on the one hand, and human capital, investment, trade, government expenditure, and infrastructure on the other hand. Such interactions are expected to have positive impact on *GDP*.

Annual time series data sourced from the Annual Reports of Saudi Arabian Monetary Authority (*SAMA*) and *SAGIA* over 1970-2010 is used in the analysis. Real *GDP (RGDP)* is nominal *GDP* deflated by the *GDP deflator (1999 = 100)*. Since reliable time-series on capital stock is not readily available for Saudi Arabia, this variable, denoted *RINV*, is proxied by the real value of gross capital goods[3]; human capital (*HUMA*N) is measured by the share of secondary and tertiary enrolment in the population; *FDI* is the value of real gross foreign direct investment flows; *OPEN* is the sum of merchandize export and import values as a ratio to *GDP*; government size (*GOV*) is measured by government expenditure as a ratio to *GDP*; infrastructure development (*INFRA*) is measured by per capita electricity consumption (*ELECTCP*) and also by the total number of telephone lines (*TELE*) on the belief that different categories of infrastructure impact differently on *GDP*.

Analytical methods

To examine the empirical long-run relationship and dynamic interactions among the variables, the model is estimated using the autoregressive distributed lag (*ARDL*) bounds testing approach to cointegration, as developed by Pesaran et al. (2001). The *ARDL* procedure is adopted for three reasons[4]. First, it is simple compared to other conventional multivariate cointegration techniques[5]. Unlike conventional cointegration methods which estimate the long-run relationship in the context of a system of equations, the *ARDL* procedure allows the estimation of a single cointegration equation by *OLS* method once the lag order of the model is identified (Pesaran et al., 2001). Second, unlike other techniques such as the Johansen approach, the *ARDL* method is applicable irrespective of whether the model regressors are purely *I(0)*, or purely *I(1)* or a mixture of both, meaning that it does not require pre-testing the model variables for unit roots. However, since the *ARDL* procedure collapses in the presence of *I(2*) series, pre-testing the model variables for unit roots becomes necessary to determine their order of integration and avoid spurious results. Third, the *ARDL* procedure performs better in small or finite samples (as in the present study) in the sense that it gives relatively more robust (efficient) results than other cointegration techniques.

The first step involves running the *ADF* unit root test to examine stationarity of the series of variables in equations (1). The null hypothesis is that each variable has a unit root (i.e. it is non-stationary), which is tested against the alternative hypothesis that the variable has no unit root (i.e. it is stationary). Along the lines of Pesaran et al. (2001), if all variables involved are stationary, the next step is to apply the bounds testing approach to examine cointegration between the variables. According to Pesaran and Pesaran (1997), the bounds testing approach to cointegration involves three steps. The first is to write the long-run equilibrium equation in (1) in the form of an autoregressive distributed lag (*ARDL*) model. Assuming maximum lag lengths of *q* and *k* for the dependent and explanatory variables, respectively, the general (unrestricted) error correction model (*ECM*) underlying the *ARDL* model in equation (1) takes the form:

$$\begin{aligned} \Delta \ln RGDP_t = {} & \gamma + \beta t + \lambda_1 \ln RGDP_{-1} + \lambda_2 \ln RINV_{-1} + \lambda_3 \ln HUMAN_{-1} \\ & + \lambda_4 \ln FDI_{-1} + \lambda_5 \ln OPEN_{-1} + \lambda_6 \ln GOV_{-1} + \lambda_7 \ln INFRA_{-1} \\ & + \sum_{i=1}^{q} \xi_i \Delta \ln RGDP_{t-i} + \sum_{i=1}^{k} \theta_i \Delta \ln RINV_{t-i} \\ & + \sum_{i=1}^{k} \psi_i \Delta \ln HUMAN_{t-i} + \sum_{i=1}^{k} \eta_i \Delta \ln FDI_{t-i} \\ & + \sum_{i=1}^{k} \delta_i \Delta \ln OPEN_{t-i} + \sum_{i=1}^{k} \phi_i \Delta \ln GOV_{t-i} \\ & + \sum_{i=1}^{k} \mu_i \Delta \ln INFRA + u_{it} \end{aligned} \quad (2)$$

where λ_1, λ_2, λ_3, λ_4, λ_5, λ_6 and λ_7 are the long-run parameters (elasticities), while $\xi_i, \theta_i, \phi_i, \psi_i, \delta_i, \eta_i, \mu_i$ are the short-run dynamic

[2] *Some authors included other exogenous variables such as inflation and political risk, while others included a dummy variable (D) to equation (1) to take account of switches in the trade regime (D = 0 for the period before liberalization; D = 1 for the period after liberalization). However, due to economic and political stability, and the rather gradual and shy move towards liberalization, such variables become irrelevant in the case of Saudi Arabia.*

[3] *Ideally, one should have used Gross Fixed Capital Formation (sum of Capital Goods and Change in Stock). However, because of negative values in the series, the real value of Gross Capital Goods is used instead.*

[4] *The power of co-integration analysis of time series lies in the span of data rather than on the number of observations (Shiller and Perron, 1985).*

[5] *E.g. Engle-Granger (1987) two-step residual based test, Johansen (1988) and Johansen-Juselius (1990)ML based tests.*

coefficients of the underlying *ARDL* model; u_{it} are white noise errors. In the second step of the bounds testing approach, we examine cointegration (i.e. the existence of a long-run relationship between the system variables). This is accomplished by applying *OLS* methods to estimate the (unrestricted) *ECM* given in equation (2). Since the coefficients $\lambda's$ of the lagged variables represent the long-run parameters of the underlying *ARDL* model, the existence of a long-run relationship among the variables is examined by conducting the *Wald test (F*-test or the *Chi-square test)* for the joint significance of these coefficients. The null hypothesis of no cointegration (no long run relationship among the variables in the system) is $H_0 : \lambda_1 = \lambda_2 = \lambda_3 = .\lambda_4 = \lambda_5 = \lambda_6 = \lambda_7 = 0$, which is tested against,

$$H_1 : \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq \lambda_7 \neq 0 \cdot$$

As usual, the *F*-test for example involves applying *OLS* to estimate equation (2). Then impose the restrictions given by H_0 and re-estimate the equation with the first difference terms only. From the two regressions, calculate the *F*-statistic and test for the joint significance of the parameters of the lagged level variables. According to Pesaran et al. (2001), the distribution of this *F*-statistic is non-standard in the sense that it depends on: (a) the number of regressors *m*, (b) whether the variables in the system are *I(0)* or *I(1)*, and (c) whether the model contains an intercept and/or a trend term. Nonetheless, Pesaran and Pesaran (1997) and Pesaran et al. (2001) generated two sets of asymptotic critical values of *F*-statistics that cater for these aspects. In general, these two sets provide a test for cointegration when the regressors are *I(d)*, where $0 \le d \le 1$. This means that, for each application, the two sets provide the bands covering all possible classifications of the regressors that are *I(0)* or *I(1)*, or mutually integrated. In particular, the set of lower critical bounds corresponds to the case where all variables in the *ARDL* model are *1(0)*, while the set of upper critical bounds assumes that all variables are *1(1)*.

If the computed *F*-statistic exceeds the corresponding upper critical bound value for a given significance level, the null hypothesis (of no cointegration) is rejected, meaning that there is evidence of a non-spurious long-run level relationship between the regressors and the dependent variable, regardless of the order of integration of variables. If the computed *F*-statistic lies below the corresponding lower critical bound value, the null hypothesis (that there is no long-run level relationship between the regressors and the dependent variable) is accepted; and if the computed *F*-statistic lies within the lower and upper critical bound values, the result is inconclusive, meaning that no inference can be made without knowledge of the order of integration of the underlying regressors. In this latter case, the error correction term will be a useful way of establishing cointegration, so that we continue with the *ARDL* procedure (Banerjee et al., 1993).

The *ARDL* model requires prior knowledge (selection) of the lag orders of variables. Thus, if there is evidence for the existence of cointegration (long-run relationship) between variables, the third step involves selecting the appropriate lag orders of the dependent variable and regressors to obtain what is known as the conditional (restricted) *ARDL* model. This is normally accomplished by applying *OLS* methods to estimate the general *ARDL* model of the form:

$$\begin{aligned} \ln RGDP_t = {} & \alpha + \beta t + \sum_{i=1}^{q} \lambda_{1i} \ln RGDP_{t-i} + \sum_{i=0}^{k_1} \lambda_{2i} \ln RINV_{t-i} \\ & + \sum_{i=0}^{k_2} \lambda_{3i} \ln HUMAN_{t-i} + \sum_{i=0}^{k_3} \lambda_{4i} \ln FDI_{t-i} \\ & + \sum_{i=0}^{k_4} \lambda_{5i} \ln OPEN_{t-i} + \sum_{i=0}^{k_5} \lambda_{6i} \ln GOV_{t-i} \\ & + \sum_{i=0}^{k_6} \lambda_{7i} \ln INFRA_{t-i} + u_t \end{aligned} \tag{3}$$

In addition to the log-likelihood ratio statistic, two criteria are commonly used in empirical applications for selecting the lag lengths (*q and* k_i) of variables in the *ARDL* model in equation (3), namely Akaike Information Criteria (*AIC*) and/or Schwarz Bayesian Criterion (*SBC*). The *AIC* is a particularly useful indicator in determining the appropriate lag length in small sample sizes. The lag length that minimizes either *AIC* or *SBC* is selected. However, because of the small size of annual data, a maximum of two lags length is used, so that ($q = 2 = k_i$) in equation (3)[6].

The next step involves applying *OLS* to the conditional (restricted) *ARDL* long-run model in equation (3) to obtain estimates of the long-run parameters λ_1 , λ_2 , λ_3 , λ_4 , λ_5 , λ_6 , and λ_7 . The estimated equation is also used to obtain an estimate of the error correction term *(*EC_t), obtained from (3) as:

$$\begin{aligned} EC_t = {} & \ln RGDP_t - \alpha - \beta t - \sum_{i=1}^{q} \lambda_{1i} \ln RGDP_{t-i} - \sum_{i=0}^{k_1} \lambda_{2i} \ln RINV_{t-i} \\ & - \sum_{i=0}^{k_2} \lambda_{3i} \ln HUMAN_{t-i} - \sum_{i=0}^{k_3} \lambda_{4i} \ln FDI_{t-i} - \sum_{i=0}^{k_4} \lambda_{5i} \ln OPEN_{t-i} \\ & - \sum_{i=0}^{k_5} \lambda_{6i} \ln GOV_{t-i} - \sum_{i=0}^{k_6} \lambda_{7i} \ln INFRA_{t-i} \end{aligned} \tag{4}$$

Once the conditional *ARDL* model in equation (3) is estimated, diagnostic tests are applied to examine model specification and functional forms. These tests include the well known regression specification error test (*RESET*) due to Ramsey (1969) to examine the functional form, Breusch-Godfrey autocorrelation test, White's general heteroscedasticity test, and Jarque-Bera normality test. Finally, stability of the estimated coefficients over the sample period will also be examined by adopting the recursive residual test for structural stability as proposed by Brown et al. (1975). The Cumulative Sum of Recursive Residuals (*CUSUM*) and the Cumulative Sum of Square of Recursive Residuals (*CUSUMQ*) obtained from a recursive estimation of the model will be plotted against the time horizon of the sample. These are compared with the bound critical values at specified significance level. If the plot of the *CUSUM* and *CUSUMSQ* remains within the boundaries of the 5 per cent critical bound the null hypothesis that all coefficients are stable cannot be rejected.

Having estimated the long-run parameters and the error correction term, the final step involves estimating the short-run dynamic parameters. This is accomplished by applying *OLS* to the error correction representation of the conditional *ARDL* model in equation (3). The *ECM* model is given by:

$$\begin{aligned} \Delta \ln RGDP_t = {} & \gamma + \beta t + \sum_{i=1}^{q} \xi_i \Delta \ln RGDP_{t-i} + \sum_{i=1}^{k} \theta_i \Delta \ln RINV_{t-i} \\ & + \sum_{i=1}^{k} \psi_i \Delta \ln HUMAN_{t-i} + \sum_{i=1}^{k} \eta_i \Delta \ln FDI_{t-i} \\ & + \sum_{i=1}^{k} \delta_i \Delta \ln OPEN_{t-i} + \sum_{i=1}^{k} \phi_i \Delta \ln GOV_{t-i} \\ & + \sum_{i=1}^{k} \mu_i \Delta \ln INFRA + \rho EC_{t-1} + \nu_t \end{aligned} \tag{5}$$

where EC_{t-1} is the error correction term in (4). The parameters $\xi_i, \theta_i, \phi_i, \psi_i, \delta_i, \eta_i$, and μ_i in (5) are the short-run dynamic coefficients, which measure the model's convergence to equilibrium; ν_t is an error term. The coefficient of the EC_{t-1} term ρ is the

[6] *The ARDL model may or may not have a trend and a constant term.*

Table 3. ADF unit root test for stationarity of variables.

Variable	lag length	Calculated ADF Statistic						Order of Integration I(d)
		Log Variable (ln Z)			*Log First Difference (∆ln Z)*			
		Without Intercept and Trend	With intercept	With intercept and Trend	Without Intercept and Trend	With intercept	With intercept and Trend	
lnRGDP	*1*	-0.2915	-4.3443a	-4.4489a	-11.4781a	-11.3398a	-11.1794a	*I(0)*
	2	0.1314	-1.9952	-2.0616	-5.5988a	-5.5342a	-5.4537a	*I(1)*
lnRINV	*1*	0.6219	-3.4548b	-3.3684c	-5.4739a	-5.4566a	-5.4153a	*I(1)*
	2	0.4879	-2.7365c	-2.7220	-3.5242a	-3.5045a	-3.4533c	*I(1)*
lnGov	*1*	0.0750	-2.2898	-3.4935c	-5.6558a	-5.5829a	-5.5536a	*I(1)*
	2	0.1308	-2.0871	-4.0673b	-4.5224a	-4.4549a	-4.3094a	*I(1)*
lnHuman	*1*	0.1858	-2.5378	-4.5378a	-7.2595a	-7.2426a	-7.1389a	*I(0)*
	2	0.4616	-1.8913	-3.7113b	-5.7006a	-5.7439a	-5.6566a	*I(1)*
lnOPEN	*1*	0.1743	-1.5701	-1.3954	-4.2354a	-4.1855a	-4.3105a	*I(1)*
	2	0.1890	-1.4396	-1.1601	-2.9408a	-2.8940c	-3.1137b	*I(1)*
lnFDI	*1*	-0.5129	-2.4741	-3.4182c	-4.7622a	-4.8223a	-4.7673a	*I(1)*
	2	-0.0721	-2.0463	-2.6738	-4.4842a	-4.6975a	-4.7461a	*I(1)*
lnTele	*1*	1.8879c	-2.0101	-1.2145	-1.6607c	-2.3689	-2.8768	*I(1)*
	2	1.4100	-1.9818	-1.4754	-1.3661	-1.9603	-2.5513	*I(1)*
lnElectcp	*1*	-2.4580b	-3.2627b	-1.9905	-1.3218	-1.7250	-2.5954	*I(0)*
	2	-1.6384c	-3.1990b	-2.6834	-1.1164	-1.1960	-1.7362	*I(0)*

Source: Author's calculations. a, b, and c mean significant at 1, 5, and 10%, respectively.

adjustment parameter, which gives the proportion of deviations (errors) of the dependent variable from its long-run equilibrium value that has been adjusted (corrected). This coefficient must be negative and statistically significant. The negative sign of the coefficient means that the dependent variable *adjusts back* to its equilibrium value (or that the dynamic model converges to equilibrium) following a disturbance; the magnitude of the coefficient measures the speed of adjustment.

THE EMPIRICAL RESULTS

Unit root test and cointegration analysis

The first step involves examining stationarity of the series of the model variables in equations (1). Results of the *ADF* unit root test are reported in Table 3. Each variable is tested for stationarity using one or two lags. The results suggest that variables are either *I(0)* or *I(1)*.

Since all model variables are stationary, in the next step we apply bounds testing approach to examine cointegration between variables. Results of the *Wald* test to examine the significance of the lagged level variables in the unrestricted long-run equilibrium *ECM* are reported in Table 4. Both the *F*-statistic and the χ^2 statistic for the model with and without a time trend exceed the corresponding upper critical bound value at no more than the 5% significance level. This is a strong evidence of a non-spurious long-run level relationship between the regressors and the dependent variable, regardless of the order of integration of variables.

Estimation of the long-run relationship

Having established the existence of a long-run co-integration relationship, versions of the model in equation (3) were estimated with and without time trend, using the *ARDL (1, 0, 1, 0, 0, 1, 1, 0, 1, 1)* specification. While the results of the two versions are not significantly different, the model with trend has passed the functional form test. Table 5 reports the regression results of the long-run relationship for the model with time trend. The adjusted coefficient of determination indicates a very high overall goodness of fit of the long run model which also passes all diagnostic tests of normality, serial correlation, functional form, and heteroscedasticity. With a very high *p*-value, the *Jarque-Bera* test statistic suggests normality of the residuals. *White* heteroscedasticity $\chi^2(2)$ test statistic is also insignificant, suggesting that the residuals are homoscedastic. Further, *Breusch-Godfrey* $\chi^2(2)$ test statistic for serial correlation is highly insignificant, indicating that the null of no serial correlation is accepted. Finally, *Ramsey RESET,* particularly the log-likelihood ratio, is highly significant, meaning that the model suffers no specification errors.

The results suggest that in the long run human capital, government expenditure, trade openness, infrastructure

Table 4. Cointegration Test: Dependent Variable Δ *lnRGDP.*

Model	Observations included (T)	No of lagged first differences (q and k)	No of regressors	Wald Test	
				Chi Square (P-value)	F-Statistic (P-value)
With trend	39	1	21	26.0394 (0.0064)	2.3672 (0.0537)
Without trend	39	1	20	24.9959 (0.0054)	2.4996 (0.0436)

Source: Author's calculations.

Table 5. Estimation of long-run coefficients of the *ARDL (1, 0, 1, 0, 0, 1, 1, 0, 1, 1)* Model: Dependent variable lnRGDP.

Regressors	Coefficient	t-Statistic	Significance level	R^2	Adj. R^2	F-statistic
C	3.961869	2.582227	0.0153			
TREND	-0.001092	-1.578949	0.1256			
LNRGDP(-1)	0.716603	6.599537	0.0000			
LNHUMAN	0.212649	4.941667	0.0000			
LNRINV(-1)	-0.063419	-3.027376	0.0052			
LNGOV	0.064138	2.264969	0.0314		0.993	165,359.2
LNOPEN	0.104975	2.386503	0.0240			
LNFDI(-1)	-0.467646	-3.681070	0.0010	0.993		
LNTELE(-1)	-0.163355	-3.254790	0.0030			
LNELECTCP	0.139204	2.357280	0.0256			
LNGOV(-1)*LNFDI(-1)	0.069052	2.788409	0.0094			
LNRINV(-1)*LNFDI(-1)	0.024499	2.944798	0.0064			

Source: Authors' calculations. Diagnostic Tests for the Estimated Long-Run ARDL Model: Jarque-Bera test statistic for normality = 2.117 with p-value 0.347; Breusch-Godfrey serial correlation LM test statistic: $\chi^2(2)$ = 1.040031, with p-value = 0.594511; White Heteroscedasticity test statistic: $\chi^2(2)$ = 26.85174, with p-value = 0.216912; Functional Form: AIC = -3.977, SBC = -3.471, Ramsey RESET: F = 2.179, with p-value = 0.133, Log-likelihood ratio = 6.199, with p-value = 0.045

(per capita electricity consumption), together with the interaction between foreign direct investment either with government expenditure or with real domestic investment, all exert significant positive effects on real *GDP*. In contrast, both domestic and foreign investments, and the number of telephone lines exert significant negative impact on real *GDP*

The positive long-run effect of human capital on output is in line with the predictions of endogenous growth models. This could be attributed here to the impressive education track record in Saudi Arabia during the last four decades, resulting in improved quality of human capital and enhanced growth[7]. It appears that the strategy of investment in education has paid off. This strategy encompassed a number of policies, including free secondary education and access by the younger generation to basic education. The figures on school attainment indicate that the number of those with secondary education level has increased significantly from 13.9 thousands in 1968 to 1,520.3 thousands in 2010, representing nearly 110.0 times their level in 1968 (Mahran, 2010).

Trade openness has a positive and highly significant impact on growth. This is similar to previous results such as those reported by Mahran (2012) for Saudi Arabia, Liu et al (2002) for China, and Flexner (2000) for Bolivia. However, Mahran (2012) argued that the trade openness index for Saudi Arabia might be capturing the impact of other developments and policies that encourage trade but not related to openness. On the one hand, where oil constitutes a considerable proportion of exports, the windfall gains emanating from high world oil prices have little or nothing to do with actual openness to trade in the traditional sense. On the other hand, the strong impact of trade openness on growth could be attributed partly to the sufficiently high degree of openness of the Saudi's economy due to the trade regime characterized by zero

[7] *According to Mahran (2012), some caution must be exercised in interpreting these results since the proportion of foreign workers in the labour force is quite significant.*

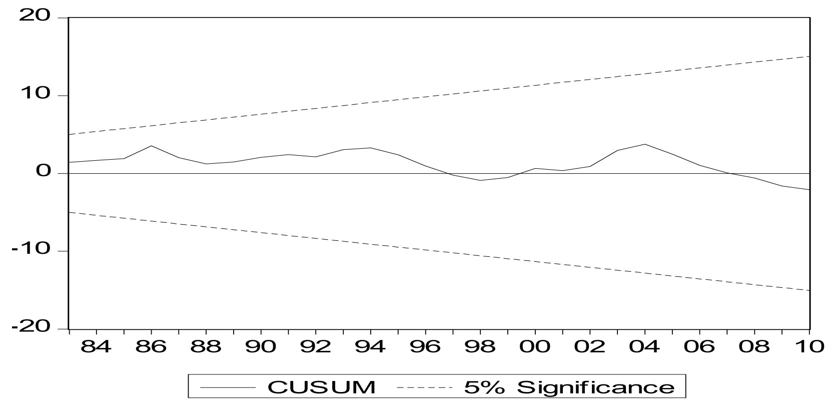

Figure 1. Cumulative sum of recursive residuals.

tariffs and minimal non-tariff barriers. It is no doubt that the index of trade openness is capturing all such effects.

In line with the predictions of Keynesian macroeconomic theory, government size has a significant positive impact on real growth. To the extent that government spending is productive, expansionary fiscal policy could have a significant positive impact on growth. However, although in the aggregate government spending increases output, this does not necessarily apply to all categories of such spending. For Saudi Arabia, this positive impact on growth may have come mainly through investment in overhead capital. This might conform with the positive and highly significant coefficient of electricity consumption.

At yet another level, although government expenditure could encourage economic growth through the "crowding in" effect, it may also reduce economic growth through the "crowding out" effect on domestic and foreign private investment. This is indicated here by the negative coefficient of real investment. In view of its huge wealth endowments and the absence of well developed financial markets, the Saudi's government usually finances its expenditure by increasing money supply. Thus, the crowding out effect in this context occurs not by way of raising interest rates (which discourages private investment) but rather by way of the inflationary pressure it may create. This effect might also be more emphasized by the poor efficiency and low productivity of private investment. A similar argument could also be advanced with regard to the role of foreign direct investment (*FDI*) in growth. The coefficient of *FDI* turned out to be negative and highly significant[8]. This could be attributed to a number of reasons. Government expenditure might have crowded out both domestic and foreign investment. In addition, *FDI* inflows have been concentrated in industry, finance, insurance and real estate, particularly during 2006-2009 (Table 2). Industry may have failed to generate the necessary linkages to the wider economy to serve economic growth, while finance, insurance and real estate are predominantly unproductive sectors. A similar argument also holds for telecommunication. Although the sector has been the focus of *FDI* in more recent times, its coefficient turned out to be negative and significant. Nonetheless, the impact of the interaction between *FDI* either with government expenditure or with domestic investment on growth turned out to be positive and significant. Efforts should therefore be exerted to enhance the positive role that *FDI* could play on growth by directing it to more productive activities, and also by encouraging its integration with government expenditure and domestic investment.

In the final step of the long-run analysis we apply the cumulative sum (*CUSUM*) and the cumulative sum of squares (*CUSUMSQ*) tests of recursive residuals due to Brown et al. (1975) to examine structural stability of the autoregressive model parameters. The *CUSUM* examines whether the regression coefficients are changing systematically, whereas the *CUSUM* examines whether these coefficients are changing suddenly. The *CUMSUM* and the *CUMSUMSQ* are plotted against time in Figures 1 and 2. In each graph, the two straight lines represent critical bounds at the 5 percent significance level. The null hypothesis of having stable parameters is rejected if any of the straight lines is significantly crossed by the respective plot over the sample period. Otherwise, if the plot generally remains within those straight lines, the null hypothesis is not rejected. These plots indicate stability in the coefficients and hence in the Saudi's real *GDP* during the study period.

Estimation of short-run parameters

The final step involves estimating the short-run dynamic

[8] Despites the widespread belief that FDI can generate positive spillover externalities for the host country, the results reported by Belloumi (2014) fail to confirm this belief for the case of Tunisia.

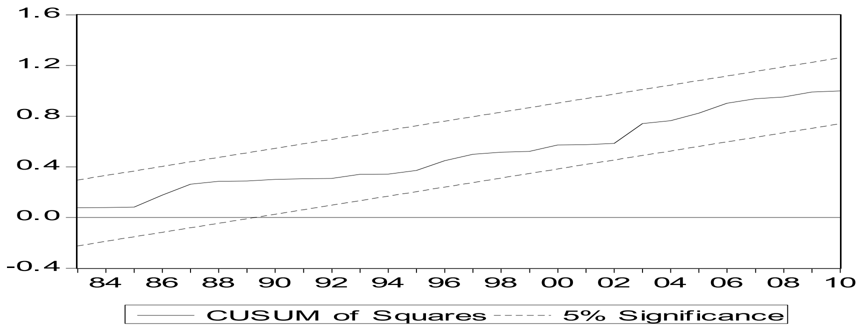

Figure 2. Cumulative sum of squares of recursive residuals.

Table 6. Estimation of the short-run dynamic coefficients of the EC representation of the *ARDL* model: Dependent Variable Δ*lnRGDP.*

Regressor	Coeff.	t-Ratio	Sig. Level	R^2	Adj. R^2	AIC	DW	F-Statistic
C	0.0599	2.7380	0.0110					
TREND	-0.0012	-2.1875	0.0379					
Δ*LNRGDP(-1)*	0.5088	5.5381	0.0000					
Δ*LNHUMAN*	0.0194	0.1829	0.8563					
Δ*LNRINV(-1)*	-0.0035	-0.9205	0.3658					
Δ*LNGOV*	0.0378	1.3994	0.1735					
Δ*LNOPEN*	0.2512	4.1656	0.0003					
Δ*LNFDI(-1)*	-0.0680	-2.4078	0.0234					
Δ*LNTELE(-1)*	-0.2724	-4.2238	0.0003	0.887	0.835	-3.941	1.870	23.140
Δ*LNELECTCP*	0.2181	2.5898	0.0155					
Δ*LNGOV(-1)*ΔLNFDI(-1)*	0.2357	1.3134	0.2005					
Δ*LNRINV(-1)*ΔLNFDI(-1)*	-0.0093	-0.7579	0.4553					
EC(-1)	-0.9639	-5.1343	0.0000					

Source: Own calculations.

coefficients. This is accomplished by using *OLS* method to estimate the error correction model (*ECM*) given in equation (5), which is associated with the estimated *ARDL* long-run relationship. Table 6 reports the results. The signs of the short-run dynamic coefficients are the same as those of the long-run coefficients for the underlying *ARDL* equation, except for the interaction variable between real domestic investment and *FDI*, which has become negative but insignificant. Government expenditure, human capital, and real investment have become statistically insignificant and have relatively lower impact on growth in the short run compared to the long-run. Similar to the long-run analysis, lagged *GDP*, trade openness, *FDI*, telecommunication, and electricity all seem to have maintained their significant impact on economic growth in the short run as well. However, it seems that human capital, government expenditure, and the interaction between *FDI* either with government expenditure or with domestic investment have insignificant impact on short-run growth. The results also indicate that the coefficient of the error correction term, EC_{-1} has the right (negative) sign and is highly significant, providing a further evidence for the existence of a stable long-run equilibrium (co-integrating) relationship between real *GDP* and its determinants (Banerjee et al., 1993). The value of the coefficient of EC_{-1} implies a high speed of adjustment of real *GDP* to its long-run equilibrium following a short-run shock. In particular, a deviation of real *GDP* from its long-run equilibrium following a short-run shock is corrected by 96.4 per cent after one year.

Conclusion

This paper employed the *ARDL* bounds testing approach to examine the long and short run impact of *FDI* on real *GDP* for Saudi Arabia during 1970-2010. The bounds test indicated that the variables of interest are cointegrated in the long-run. The associated equilibrium correction was also significant confirming the existence of long-run relationships. The correction (adjustment) to equilibrium is rather fast in that it is restored by more than 90 percent during the current year following a shock in a previous year.

The results suggest that human capital, government expenditure, trade openness and electricity consumption as a form of infrastructure are important determinants of long run *GDP* growth in Saudi Arabia. In contrast, there is evidence that *FDI* together with domestic investment has exerted a significant negative impact on real *GDP*. This is attributed partly to the dominant role of the public sector in the economy emanating from the huge resources made available from the oil sector, thereby leaving little room for the private sector to play its role in the economy, and partly to the concentration of *FDI* in unproductive sectors including industry. Nonetheless, the interaction of *FDI* either with government expenditure or with domestic investment could have significant positive impact on growth. Efforts should therefore focus on enhancing the integration between the roles of these factors on long-term growth. Measures that are currently being taken towards privatization, economic liberalization, and diversification are expected to provide real opportunities for domestic and foreign investment to play an important role in economic activity and growth.

Conflict of Interests

The authors have not declared any conflict of interests.

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