A dynamic investigation of foreign direct investment and sectoral growth in Mauritius

Sheereen Fauzel* and Leenum Keesoonah

Department of Finance and Accounting
University of Mauritius,
Reduit, Mauritius
Email: s.fauzel@uom.ac.mu
Email: leenum.keesoonah@umail.uom.ac.mu
*Corresponding author

Abstract: Given that literature remains open to doubt concerning the impact of foreign direct investment (FDI) on growth, this paper attempts to place the discussion of the sectoral impact of FDI on the sectoral growth of Mauritius in the short, and long term. For this purpose, the autoregressive distributed lag (ARDL) approach is applied on time series data over the period 1990 to 2013 to assess the impact of FDI on the growth of the secondary and tertiary sectors. This paper shows that in the manufacturing industry which is a proxy used for the secondary sector, FDI benefits the industry’s growth more in the long term rather than in the short term. In wholesale and retail trade industry of the tertiary sector, FDI exerts significant positive impact both in the short and long term industry growth. The CUSUM and CUSUMQ tests confirm the structural stability of the two formulated models. Moreover, using a descriptive analysis, it has been noted that the primary sector does not attract much FDI.

Keywords: FDI; autoregressive distributed lag; ARDL; sectoral growth.


Biographical notes: Sheereen Fauzel is a Lecturer in Banking and Financial Services at the University of Mauritius. Having completed her BSc in Economics and Finance and Master’s degree in Banking and Finance, her areas of expertise are banking, finance and economics related issues. She is also a holder of a PGDip in Islamic banking and finance. She has participated in international conferences and has publications in notable international journals of economics and business. She is currently a doctoral student in International Economics at the University of Mauritius.

Leenum Keesoonah is enrolled in the University of Mauritius, graduating with a Bachelor degree in Banking and Finance. She is currently working as a Change Management Officer for a banking institution in Mauritius. Her areas of interest lie mainly in banking, management and finance related issues.
1 Introduction

The last three decades witnessed a worldwide phenomenal growth in foreign direct investment (FDI). FDI inflows are known to provide strong impetus for economic development in host countries. In fact, ‘FDI inflows’ acts as a long term source of capital as well as a source of technological advancement (De Mello, 1997). Moreover, foreign investors also bring along best global practices of management in developing countries thus promoting international trade.

Mauritius also derives the abovementioned benefits by welcoming FDI. The FDI situation of Mauritius as per a newsletter of the BOI dated July 2014 is described as follows: “In quantitative terms, FDI inflows into Mauritius are not high. Yet they play a significant role in boosting national growth. In as much as FDI contributed to the Mauritian miracle, today, it is helping the tourism industry, through cross-border merger or acquisition (M&A) transactions, to get access to finance, global best practices and new markets”. Despite the recession, Mauritius has continued to attract FDI amounting to more than Rs.17 billion during 2008 and 2009.

To the best of our knowledge, empirical studies on FDI and sectoral growth are rather scant mainly in the Mauritian context. Most of the studies done have focus on FDI and economic growth at the aggregate level rather than sectoral level. Hence, this paper is an attempt to fill the gaps in the world of literature related to FDI and growth by doing a sectoral analysis. In specific terms, this study attempts to carry out a descriptive analysis on the nexus existing between inward FDI in the primary sector and the growth. Furthermore, using an Autoregressive Distribution lag model given the differing stationary nature of the variable, an investigation of the short, and long term effects of inward FDI in the secondary and tertiary sectors on the growth of the respective sectors is done. Time series data for the period 1990 to 2013 is used in the Mauritian context. The manufacturing industry and the wholesale and trade industry have been used as proxies for the secondary and tertiary sectors respectively.

This paper is structured as follows; Section 1 is the introduction, Section 2 provides the theoretical review and empirical review; Section 3 is the methodology, the estimation results and discussion is provided in Section 4 and finally, Section 5 is the conclusion and recommendations.

2 Theoretical review

Economists have always tried to illuminate issues related to FDI. Some came to a conclusion that FDI is linked to economic growth positively while for some it was negatively. There are major theories showing the positive relationship.

Solow (1956) from the neoclassical view propounded that FDI is beneficial for a country’s growth leading to economic prosperity. The author tried to find a relationship between the output of an economy and inputs such as capital and labour. Capital, labour and technology progress are considered to be the leading edges of growth. Hence, inward FDI, being a source of capital, increases an economy’s capital stock and contributes to economic development positively. However, capital investment contributes to growth only in the short run. In the long run, ignoring changes in employment, natural resources,
and government intervention, as the ratio of capital to labour rises, productivity growth stops.

To overcome the above problem, Romer (1990) modified the growth model by highlighting the technological spillover effect. In fact, FDI introduces new technologies in production and is more fruitful than domestic investment. Romer (1990) found that where the capital to labour ratio is constant, there should be transfer of technological knowledge from developed to developing countries. This brings along a spillover effect in the hosting country in the long run boosting up growth, employment, knowledge and innovations.

Another theory supporting FDI is that of MacDougall (1960). The author examined the costs and benefits of FDI resulting in different sectors of the host country. The theory stipulates that an equilibrium situation is created when capital moves from countries having large amount of capital to those lacking capital. Thus, when the world’s capital resources are used more efficiently, this leads to economic growth.

Conversely, on the basis of repatriation of profits, the radical view sees foreign companies to be harmful. It is often claimed that host countries are left merely with depleted resources leading to economic downturn and enhanced poverty. According to radical view, developing and under-developed countries should cease penetration of foreign companies. However in the late 1990s, the view propounded by the above theory collapsed.

Other theories like, the dependency theory stipulates that FDI would make developing and under-developed economies become dependent on the developed economies in the sense that multinationals acting as controllers of the market and national resources would create imbalances and increase the poverty gap between rich countries and poor countries. Ultimately, according to this theory ‘the rich get richer and the poor get poorer’.

The structuralist theory is another theory that conforms to the dependency approach. It is believed that FDI is mostly present in industries that are capital intensive. This restricts other sectors to grow by creating inequality and unemployment problems in the labour intensive industries. However, contrary to the dependency approach, this theory does not advice ‘delinking from the international economy.’

2.1 Empirical review

Many empirical studies were carried out to have a better understanding of the impact of FDI on economic growth. Some researchers found that FDI is favourable for economic growth, for instance, Ozturk (2007) concluded FDI enhances economic growth significantly through transfer of technological knowhow and human capital. Using panel data of 31 developing countries for the period of 1970–2000, Hansen and Rand (2004) concluded that foreign owned capital boosts up growth in the economy through knowledge transfer and adoption of new technology. This argument is additionally supported through evidence from the OECD report which is read as follows “Foreign direct investment (FDI) is an integral part of an open and effective international economic system and a major catalyst to development”. Noorbakhsh et al. (2001) argued that FDI induces competition and creates jobs which are beneficial for the hosting country.

By using the same panel regression technique and by examining the interaction among FDI, output and the spillover variables, Bende-Nabende et al. (2003) found that
the influence of FDI on growth is significantly positive for less advanced economies (lower income countries) and negative for well-developed ones (higher income countries). This result is supported by those of Johnson (2006) and Blomstrom et al. (1994). Other empirical studies have shown that FDI has a positive but insignificant impact on growth (Obwona, 1991; Ousseini et al., 2011).

Furthermore, the fact that FDI has a positive effect on growth is not a general rule. For example, Herzer et al. (2008) concluded that in 4 out of 28 developing countries, FDI did not result in increase in growth. In addition, Carkovic and Levine (2002) identified no relationship between FDI and economic growth. In fact, it suggests that FDI enhance growth in countries with low educational attainment However, Fry (1993) pointed straight ahead that FDI deteriorates the economy. FDI is linked with reduced domestic investment.

2.2 Empirical evidence on FDI and growth at sectoral level

Recently, studies have started focusing on the sectoral level and effectively showed that the growth effect of FDI differs across sectors (Alfaro, 2003; Vu et al., 2008; Aykut and Sayek, 2007). This area is worth studying as it is important for the policymakers to know which sector benefits more from foreign owned capital in order to make the right decision. Empirically, it can be noted that this field of study has been explored by some sector specific researches while there equally exist some researches which focus on more than one sector.

There is little research that discussed on the effect of FDI on primary sector. Subramanian et al. (2003) argued that FDI in extractive field affect the competiveness in other sectors of the economy adversely. Moreover, a report issued by the OECD (Awudi, 2002) concluded that the mineral sector brought huge FDI in Ghana. However, the contributions to the country’s GDP are poor. It wrote “There is lack of linkage between mineral sector and the rest of the internal economy”. Capital intensive methods of extraction were utilised and few people were employed. In addition, the little gain from extraction sector has been achieved at the expense of the environment, health and social costs to people in Ghana. However the empirical work was limited to Ghana only. A panel data for a sample of 106 countries was used by Hayat (2014), who found out that the FDI associated with natural resource sector instead of inducing growth, it slows down economic growth.

Concerning the secondary sector, according to a study on spillovers of FDI in Italian manufacturing sector conducted by Reganati et al. (2008) used OLS estimator as testing method and used data for the period 1997 to 2002 to show that MNEs transfer knowledge to host countries which allowed them to produce more efficiently and to sell abroad at lower cost. On the other hand, Krishnan and Chandran (2008) used a different methodology which is the ARDL approach and a larger time period from 1970 to 2003 was used. However, the results were relatively the same recommend policymakers to focus on attracting FDI in this sector. Similarly, according to a research of Sahu and Adebola (2013), the impact of FDI on the productivity spillover in Indian manufacturing industry is positive and attributes it to some internal factors, such as liberalisation of policy related to inward FDI which allowed transfer of up to date technology. There are also some external factors. For instance, credit policies that encourage firms to bring in foreign capital. In contrast, as regards to the US manufacturing sector, there is no
productivity spillover through foreign owned companies (Mullen and Williams, 2007). The author stipulates "this may be the effect of a smaller market share on domestic firms with high fixed costs operating in imperfectly competitive industries" and technology spillover is small. However, the study in US focused only on labour productivity. There is another model that found no links between FDI and growth in the manufacturing sector in the long run (Lean, 2008) due to bureaucratic, corruptions and restrictions on capital flows.

The tertiary sector is also worth studying. One interesting finding by Awan et al. (2010), using cointegration and ECM, arrived at the conclusion that FDI in the tertiary sector leads economic development and economic growth through transfer of advanced technology and skills. It also contributes to an increase in employment level in the service sector. The research work focused only in Pakistan. According to Awan et al. (2010) who studied more precisely on the role of the domestic financial sector, the domestic financial sector is crucial for economic growth as an innovative and developed financial sector can be seen as a ‘comparative advantage’ that able the country to absorb the spillovers.

There are other noteworthy studies examining FDI effect by looking at the three sectors of an economy. Alfaro (2003) was the leading edge of the research at the sectoral level and used cross country data of 47 countries. The paper concluded that FDI in the primary, secondary and tertiary sector do not have similar effect on economic growth. Agriculture and mining have a slightly positive or negative effect on growth. While in secondary sector, FDI has a positive growth effect. This is because it raises physical capital as investment is made in tradable and it increases demand for labour as it is a labour intensive sector and for the service sector it is ambiguous.

Similarly, Vu et al. (2008) analysed impact of FDI on each sector using time-varying coefficient estimation method that created heteroscedasticity. However, compared to Alfaro, They took two developing-transition countries which are China and Vietnam. The results conformed to the pioneering work that the gains are not equally distributed across economic sectors. For both countries, FDI in the manufacturing sector has a significantly positive effect on growth while for the primary and tertiary sector; it was statistically insignificant, in some cases negative. Exceptionally, there was a positive effect in the oil and gas sector in Vietnam. However, the sample used was restricted to discrepancies and small data sample.

Interestingly, Hirschman (1958) in his seminal book on economic development, claims that the ability to absorb foreign technology or to create linkage with the rest of the economy vary across sectors. It was reported that there is a weak link in the agriculture and mining which limit growth in an economy. Albert wrote: “The grudge against what has become known as the ‘enclave’ type of development is due to this ability of primary products from mines, wells, and plantations to slip out of a country without leaving much of a trace in the rest of the economy”. However, for the manufacturing sector it differs as there is a direct linkage (Hirschman, 1958).

In fact, in UNCTAD World Investment Report (2001), it was argued that “In the primary sector, the scope for linkages between foreign affiliates and local suppliers is often limited…. The manufacturing sector has a broad variation of linkage intensive activities. In the tertiary sector the scope for dividing production into discrete stages and subcontracting out large parts to independent domestic firms is also limited”. Variables, such as openness, do not affect the primary sector but was very important in the service sector. With this regard, Rodriguez-Clare (1997) noted that multinational make use of intermediate goods and subsequently enhances production efficiency in host economies.
Demand for inputs increases, creating positive externalities. Nevertheless, this model is more consistent to the manufacturing than to the agricultural sector. These points are also sustained by the work of Khaliq and Noy (2007). However, they propound that FDI growth nexus in the mining and quarrying sector is not positive but statistically and significantly negative. FDI in the extractive sector seems to adversely impact on economy. Similarly, as for the research, done by Chakraborty and Nunnenkamp (2008) using causality approach, there is no causal relationship between FDI and primary sector growth while for the manufacturing sector there is a strong causal relationship. FDI has a transitory effect on tertiary sector.

The results from cross-sectional analysis undertaken by Aykut and Sayek (2007) were parallel to Alfaro’s research. A different sub sector in the tertiary sector influence growth differently. FDI in the banking sector exerts a positive effect on the efficiency of the financial system but with no link to the local economic growth. Backward linkage can be created through outsourcing activities.

On the other hand, Ayanwale (2007) found that in the communication sector, FDI is positively significant for the growth of the economy. However, there is a negative and significant impact of FDI in the secondary sector on the economic growth which according to the author indicates there is a need for improvement in the business environment in Nigeria. For the primary sector also it is statistically negative. The author concluded that more of foreign goods are available and local producers are left behind. Exceptionally, for oil and gas sector, there is a positive effect of FDI.

With further analysis, it has been observed that for different countries, FDI in sectors influences the economy differently. For example, in India, the service sector provides a major contribution to the Indian economic growth which does not match with the Turkish economy. Dr. Mathiyazhagan (2005) examined for a single country, India. The study sheds light on the impact of FDI on different sectors. The result was that FDI increased productivity in sector food processing and industrial machinery. On the other hand, Durnel (2012) investigated on the Turkish economy. It was found that not all sectors gain from FDI. Industries, such as manufacturing, electricity, gas and water, wholesale and retail trade benefit from FDI. These sectors enjoy technological spillovers from FDI. Therefore, it is more appropriate to concentrate on a single country rather than on a group of countries, such as COMESA or OECD countries.

The results from various empirical studies on the link between ‘FDI and economic growth’ and ‘FDI and sectoral growth’ remain ambiguous. Recent studies of FDI at the sectoral level showed that eventually the effect of FDI on growth in the different sectors of an economy is not equally distributed and the sectoral impact of FDI differs among economies. This further justifies the importance of analysing the impact of FDI on each sectors of Mauritius.

### 3 Model specification for secondary and tertiary sector

The secondary sector accounts for many industries. However, for the purpose of this study, the manufacturing industry has been used as a proxy for the secondary sector given the shortcomings of data set for the other industries. Moreover, the sectoral comparison of GDP in Mauritius, indeed reveals that the manufacturing industry is the main driver of the economy since the introduction of the EPZ.
Although the tertiary sector is highly diverse, the wholesale and retail trade has been among the main contributors to Mauritius’s GDP. In fact, a study on the services sector and economic growth in Mauritius by Tandrayen (2010) proved that the wholesale and retail trade has had a larger impact on growth than the other industries in the service sector. With this in mind and taking into account the lack of data on most of the industries in this sector, both wholesale and retail trade have been used as a proxy for the purpose of the analysis on the aforementioned sector.

Accordingly, the models designed to investigate on the impact of sectoral FDI on the (see Fauzel et al., 2014) sectoral growth are set out below:

Equation (1) measures the effect of FDISEC on GDPSEC

\[
\ln \text{GDPMAN}_t = \alpha_0 + \beta_1 \ln \text{FDIMAN}_t + \beta_2 \ln \text{SECENROL}_t + \beta_3 \ln \text{TARIFF}_t + \beta_4 \ln \text{LABMAN}_t + \beta_5 \text{CPI}_t + U_t
\]  

where

GDPMAN  nominal GDP for the secondary sector  
FDIMAN  nominal FDI for the secondary sector  
SECENROL  secondary enrolment ratio  
TARIFF  tariff rate, applied, simple mean, manufactured products  
LABMAN  number of workers working in the wholesale and retail trade activity  
CPI  consumer price index.

Equation (2) assesses the impact of FDITRAD on GDPTRAD

\[
\ln \text{GDPTRAD}_t = \delta_0 + \beta_6 \ln \text{FDITRAD}_t + \beta_7 \ln \text{LABTRAD}_t + \beta_8 \ln \text{INFRAS}_t + \beta_9 \ln \text{SECENROL}_t + \beta_{10} \ln \text{FINCRI}_t + U_{2t}
\]  

where

GDPTRAD  nominal GDP for the wholesale and retail trade activity  
FDITRAD  nominal FDI for the wholesale and retail trade activity  
LABTRAD  number of workers working in the wholesale and retail trade activity  
INFRAS  infrastructure variable (paved roads in Km)  
SECENROL  secondary enrolment ratio  
FINCRI  dummy variable denoting years of financial crisis by one and years of non-financial crisis by zero.

3.1 Estimation issues

Taking into account the medium sized and finite sample used, the autoregressive distributed lag (ARDL) approach of co-integration set forth by Pesaran et al. (2001) will be used to model the relationship between the set of time series variables. Besides, this
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technique does not require variables to be integrated in the same order. Previous researches have made use of this analysis technique; such as Chaudhary and Mahmood (2012) employed to determine the impact of sector specific FDI on sector specific productivity. ARDL procedure will be carried out using Microfit 5.0 software. The first step of estimation is to determine whether the variables are stationary or non stationary. This is determined by the Stata software using the Phillips Perron (PP) unit root tests.

If the test statistics is greater than the critical value, the series has a no unit root and therefore is stationary. If the test statistics is less than the critical value, the series is not stationary in their level forms. In case the variables are not stationary, they shall be differenced. Only I (0) or I (1) series will be considered while proceeding with analysis.

The next step is to test the long-run relationships among the variables of the models in question. The Bounds F-Test will be used since this test is more appropriate for small sample size and does not require the variables to be integrated in same order. In order to proceed with the Bounds Test procedure, conditional ARDL error correction models are formulated for each equation.

As a result, equation (3) is obtained by expressing equation (1) as conditional ARDL error correction models;

\[
\Delta \text{Ln GDPMAN}_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{3i} \Delta \text{Ln FDIMAN}_{t-1} + \sum_{i=1}^{n} \alpha_{2i} \Delta \text{Ln SECENROL}_{t-1} \\
+ \sum_{i=1}^{n} \alpha_{3i} \Delta \text{Ln TARIFF}_{t-1} + \sum_{i=1}^{n} \alpha_{4i} \Delta \text{Ln LABMAN}_{t-1} \\
+ \sum_{i=1}^{n} \alpha_{5i} \Delta \text{Ln CPI}_{t-1} + \eta_1 \text{Ln GDPMAN}_{t-1} \\
+ \eta_2 \text{Ln FDIMAN}_{t-1} + \eta_3 \text{Ln SECENROL}_{t-1} \\
+ \eta_4 \text{Ln TARIFF}_{t-1} + \eta_5 \text{Ln LABMAN}_{t-1} + \eta_6 \text{Ln CPI}_{t-1} + \text{U}_t
\]  

(3)

Then, equation (2) is turned into equation (4)

\[
\Delta \text{Ln GDPTRAD}_t = \delta_0 + \sum_{i=1}^{n} \delta_{3i} \Delta \text{Ln FDITRAD}_{t-1} + \sum_{i=1}^{n} \delta_{2i} \Delta \text{Ln LABTRAD}_{t-1} \\
+ \sum_{i=1}^{n} \delta_{3i} \Delta \text{Ln INFRAS}_{t-1} + \sum_{i=1}^{n} \delta_{4i} \Delta \text{Ln SECENROL}_{t-1} \\
+ \sum_{i=1}^{n} \delta_{5i} \Delta \text{Ln FINCRL}_{t-1} + \eta_1 \text{Ln GDPTRAD}_{t-1} \\
+ \eta_2 \text{Ln FDITRAD}_{t-1} + \eta_3 \text{Ln LABTRAD}_{t-1} \\
+ \eta_4 \text{Ln INFRAS}_{t-1} + \eta_5 \text{Ln SECENROL}_{t-1} \\
+ \eta_6 \text{Ln FINCRL}_{t-1} + \text{U}_t
\]  

(4)

Table 1 outlines the terms included in the conditional ARDL error correction models, along with the null hypothesis and alternative hypothesis.
Table 1: Details of ARDL ECM

<table>
<thead>
<tr>
<th>Model</th>
<th>Equation 3</th>
<th>Equation 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drift term</td>
<td>$\alpha_0$</td>
<td>$\delta_0$</td>
</tr>
<tr>
<td>White noise error</td>
<td>$U_{1t}$</td>
<td>$U_{2t}$</td>
</tr>
<tr>
<td>Short run dynamics</td>
<td>$\alpha_{1i}, \alpha_{2i}, \alpha_{3i}, \alpha_{4i}, \alpha_{5i}$</td>
<td>$\delta_{1i}, \delta_{2i}, \delta_{3i}, \delta_{4i}, \delta_{5i}$</td>
</tr>
<tr>
<td>Long run multipliers</td>
<td>$\eta_{1}, \eta_{2}, \eta_{3}, \eta_{4}, \eta_{5}, \eta_{6}$</td>
<td>$\eta_{7}, \eta_{8}, \eta_{9}, \eta_{10}, \eta_{11}, \eta_{12}$</td>
</tr>
<tr>
<td>Null hypothesis</td>
<td>$H_0: \eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = 0$</td>
<td>$H_0: \eta_7 = \eta_8 = \eta_9 = \eta_{10} = \eta_{11} = \eta_{12} = 0$</td>
</tr>
<tr>
<td>Alternative hypothesis</td>
<td>$H_1: \eta_1 \neq \eta_2 \neq \eta_3 \neq \eta_4 \neq \eta_5 \neq 0$</td>
<td>$H_1: \eta_7 \neq \eta_8 \neq \eta_9 \neq \eta_{10} \neq \eta_{11} \neq \eta_{12} \neq 0$</td>
</tr>
</tbody>
</table>

Source: Author’s computation

When the F-statistic value exceeds the upper critical bounds value, there is long run relationship among the variables. On the other hand, when the F statistics value is lower than the lower critical bounds value, there is no long run relationship. If the F-statistics falls between the lower and upper bounds, the co-integration test is inconclusive.

An optimal lag length is important to be determined before stepping in short run and long run estimations. This is usually based on either Schwartz Bayesian criteria (SBC) or Akaike’s information criteria (AIC). To investigate the short run dynamic relationships, the ARDL model is changed into ARDL error correction mechanism (ECM) as follows:

As a result, equation (1) is remodelled into equation (5).

$$
\Delta \text{Ln GDPMAN}_{t} = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta \text{Ln DIMAN}_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta \text{Ln SECENROL}_{t-i}
+ \sum_{i=1}^{n} \alpha_{3i} \Delta \text{Ln TARIFF}_{t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta \text{Ln LABMAN}_{t-i}
+ \sum_{i=1}^{n} \alpha_{5i} \Delta \text{Ln CPI}_{t-i} + \varepsilon_{1t}
$$

(5)

The ARDL ECM form of equation (1) is put as equation (6)

$$
\Delta \text{Ln GDPTRAD}_{t} = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \Delta \text{Ln FDITRAD}_{t-i} + \sum_{i=1}^{n} \delta_{2i} \Delta \text{Ln LABTRAD}_{t-i}
+ \sum_{i=1}^{n} \delta_{3i} \Delta \text{Ln INFRAS}_{t-i} + \sum_{i=1}^{n} \delta_{4i} \Delta \text{Ln SECENROL}_{t-i}
+ \sum_{i=1}^{n} \delta_{5i} \Delta \text{Ln FINCRI}_{t-i} + \gamma ECM_{t-1}\varepsilon_{2t}
$$

(6)

To estimate the long run dynamics, the conditional ARDL long run model should be estimated as follows;

Equation (1) is now converted into equation (7).
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\[
\text{Ln GDPMAN}_t = \alpha_0 + \sum_{i=1}^{n} \eta_i \text{Ln GDPMAN}_{t-1} + \sum_{i=1}^{n} \eta_2 \text{Ln FDIMAN}_{t-1} + \sum_{i=1}^{n} \eta_3 \text{Ln SECENROL}_{t-1} + \sum_{i=1}^{n} \eta_4 \text{TARIFF}_{t-1} + \sum_{i=1}^{n} \eta_5 \text{Ln LABMAN}_{t-1} + \sum_{i=1}^{n} \eta_6 \text{Ln CPI}_{t-1} + U_{i1}
\]

Equation (2) is converted into equation (8).

\[
\text{Ln GDPRAD}_t = \delta_0 + \sum_{i=1}^{n} \eta_1 \text{Ln GDPRAD}_{t-1} + \sum_{i=1}^{n} \eta_2 \text{Ln FDITRAD}_{t-1} + \sum_{i=1}^{n} \eta_3 \text{Ln LABTRAD}_{t-1} + \sum_{i=1}^{n} \eta_4 \text{Ln INFRAS}_{t-1} + \sum_{i=1}^{n} \eta_5 \text{Ln SECENROL}_{t-1} + \sum_{i=1}^{n} \eta_6 \text{Ln FINCRI}_{t-1} + U_{i2}
\]

3.2 Stability of models

The stability of the short and long run models can be tested by employing cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests proposed by Brown et al. (1975). If the plot of the CUSUM and CUSUMSQ lies within the 5% critical bounds implies that all coefficients are stable. If however, either of the parallel lines is crossed the model is said to be unstable.

4 Empirical results

4.1 Analysis of primary sector

The primary sector of Mauritius comprises of agriculture, fisheries, forestry and mining and quarrying, where agriculture is the prominent one. The latter faces many challenges which constrain growth. Agriculture is prone to recurrent cyclonic weather in Mauritius that affect sugarcane cultivation. The domestic market is small. The land is scarce and there are high production costs. As a matter of fact, the contribution of sugarcane industry to GDP also fell considerably over the years; 30% in 1970s, 6% in 2004 and 3.6% in 2013.

As a result, the primary sector does not attract much foreign investment although Mauritius offers excellent opportunities in Agro-industries. Another reason that discourages foreign investment is the Sugar Efficiency Act which does not allow more than 15% of foreign ownership of sugar production plants. The figures for FDI Inward in the abovementioned sector are given below.

To summarise the data on growth and FDI in a meaningful way, descriptive analysis is used. The correlation between the two is shown in Figure 1. There is a negative correlation between FDI and GDP in the primary sector. This is in accordance with
empirical work of researchers, such as Alfaro (2003) and Vu et al. (2008). FDI rose from Rs. 9 million in 2012 to Rs. 52 million in 2013. However, GDP fell from Rs. 10,494 million to Rs. 10,405 million.

Table 2  FDI inflows primary sector (2007–2013)

<table>
<thead>
<tr>
<th>Broad sector</th>
<th>Industries</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Agriculture, forestry and fishing</td>
<td>18</td>
<td>447</td>
<td>-</td>
<td>-</td>
<td>177</td>
<td>9</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Author’s computation

Figure 1  Correlation between FDI and GDP in primary sector (see online version for colours)

4.2 Analysis of secondary sector

4.2.1 Unit root test

The results of unit root tests shows that only LABMAN is stationary at level form. The other variables are, therefore, differenced. GDPMAN, FDIMAN, SECENROL, TARIFF are I (1) while LABMAN is an I (0) variable.

4.2.2 F bound test

The F bound tests is carried out to check for the existence of long run relationship between the variables and the results are tabulated below.

Table 3  F bound test results

<table>
<thead>
<tr>
<th>Level of significance</th>
<th>Lower bound</th>
<th>Upper bound</th>
<th>F-value</th>
<th>Pass/fail/indecisive</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>3.4088</td>
<td>4.9081</td>
<td>4.9261</td>
<td>Pass</td>
</tr>
<tr>
<td>10%</td>
<td>2.7484</td>
<td>4.0364</td>
<td>4.9261</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Source: Author’s computation

The computed F statistics of 4.9261 exceeds both 5% and 10% upper critical value leading to the conclusion that there exists a long run relationship among the variables under investigation.
4.2.3 Lag order selection

Prior to short run and long run estimation, an optimal lag length ARDL: (1, 1, 0, 1, 0, 0) is determined using the Schwarz Bayesian information criteria (SBIC).

4.2.4 ARDL ECM

The short run effects of explanatory variables on GDPMAN are be analysed using the ARDL error correction model and the results are reported in Table 4.

**Table 4** Short run results

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>dFDIMAN</td>
<td>.012530**</td>
</tr>
<tr>
<td>dSECENROL</td>
<td>.16208</td>
</tr>
<tr>
<td>dTARIFF</td>
<td>.025555**</td>
</tr>
<tr>
<td>dLABMAN</td>
<td>.0076225**</td>
</tr>
<tr>
<td>dCPI</td>
<td>.81585**</td>
</tr>
<tr>
<td>ecm (–1)</td>
<td>–.57073*</td>
</tr>
</tbody>
</table>

R² = .65798  
Adjusted R² = .46254  
F-statistics = 4.4889[.008]  
Durbin Watson = 2.0236

Notes: *Indicates the significance at 10%, ** significance at 5% and ***significance at 1%

Source: Author’s computation

The R² holds a value of 0.65798, which entail that approximately 65% of the fluctuations in GDPMAN in the short run are explained by the formulated model. The adjusted R², which fixes the lacking of the R² by taking into account the degrees of freedom, is noted to be 0.46254. The value of R² shows that FDI and the other conditioning variables are good indication of growth in the manufacturing industry. The coefficient of ECM being significant and negative indicates a stable long term relationship. Furthermore, the Durbin Watson statistics being close to two indicates the absence of autocorrelation problem.

From the regression results, it is also observed that FDIMAN has a positive coefficient of 0.012530. This implies that a 10% increase in FDIMAN will lead to a 0.13% increase in GDPMAN in the short term. This is consistent with the findings of Mullen and Williams (2007). In Mauritius, the EPZ sector attracted and allowed many investors from Asia to set up textile factories in Mauritius. Consequently, with more firms in the industry, more output is produced domestically. However, the foreign firm, being at its introductory phase, has to recruit, train staff and complete many formalities which increases the cost of setting up. There will be inefficiencies. Also, it will take time to for the population accept new products from new firms in the short run.

Moreover, SECENROL, used as a proxy for human capital, is found to be positive and insignificant. Shaikhani et al. (2011) found similar results for the short term. This means that a 10% increase in secondary enrollment ratio will lead to about 1.62% rise in GDP in the manufacturing sector in the short term.
Likewise, tariff exhibits a positive and significant impact on growth. The results are supported by Lehman and O’Rourke’s (2008) findings that tariffs were positively associated with growth in the short term. In fact, tariff on manufactured goods in the short term discourages imports and this gives opportunity to local firms to produce more and supply to the population.

LABMAN, with a coefficient of .0076225, positively influences GDPMAN. In Mauritius, the manufacturing industry continues to be labour intensive. The result echoes the concluding remarks of Kaldor (1966) that labour in manufacturing relates to economic growth positively. Consequently, an increase in labour allows firms to manufacture more goods.

CPI has a significant and positive relationship with GDPMAN. Mallik and Chowdhury (2001) concluded similar relationship between inflation and output. In fact, an increase in price due to an increase in aggregate demand will create a competitive climate in the manufacturing industry.

4.2.5 Long run coefficients

The outcomes from the long run equation are reported in Table 5.

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>T-ratio</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDIMAN</td>
<td>.067128</td>
<td>.25427</td>
<td>2.6400</td>
<td>.020</td>
</tr>
<tr>
<td>SECENROL</td>
<td>.28398</td>
<td>.26402</td>
<td>1.0756</td>
<td>.300</td>
</tr>
<tr>
<td>TARIFF</td>
<td>.16416</td>
<td>.050170</td>
<td>3.2721</td>
<td>.006</td>
</tr>
<tr>
<td>LABMAN</td>
<td>.013356</td>
<td>.037868</td>
<td>.35269</td>
<td>.730</td>
</tr>
<tr>
<td>CPI</td>
<td>1.4295</td>
<td>.44652</td>
<td>3.2014</td>
<td>.006</td>
</tr>
<tr>
<td>INTPT</td>
<td>9.6674</td>
<td>4.9032</td>
<td>1.9717</td>
<td>.069</td>
</tr>
</tbody>
</table>

*Source:* Author’s computation

FDIMAN exerts a significant stimulating effect on GDPMAN in the long run. Alfaro (2003) also demonstrates that FDI in manufacturing benefits growth. The contribution of FDI is beyond that of the capital received to boost the economy. In the long run, taking into account the indirect positive spillovers, the manufacturing/EPZ industry experiences growth. Rhee and Belot (1990) argue the abovementioned factors act as catalyst which explains the significance of FDIMAN.

A 10% increase in tariff causes a 1.64% increase in GDP of the manufacturing sector over time. This result is supported by Nunn and Trefler (2010). Given that there is a perception in Mauritius that imported products are of better quality, a certain level of protectionist measures are maintained by the government to ensure local consumption, production, employment and growth, hence ensuring the long term sustainable development of the industry under study.

Similarly, a 10% increase in LABMAN boosts GDPMAN by 0.13%. With increase in working population and with the retirement age at 65 years policy, after a certain point, the employment of additional staffs makes room for the law of diminishing returns to set in, given that the size of buildings and the number of machines are restricted by the budget of the manufacturing firms. The contribution of labour becomes insignificant as the additional recruited staffs can hardly contribute towards output partly because large
number of staffs is difficult to manage leading to lower productivity and efficiency. The above explains the insignificance of LABMAN in determining GDPMAN in the long run.

A 1% increase in inflation will cause GDPMAN to rise by 1.43%. Generally speaking, increases in the price level influences the profit making objective of producers which in turn seems to be a significant long term determinant of GDPMAN.

4.2.6 CUSUM and CUSUMQ

The plots of the CUSUM and CUSUMQ statistics are within the 5% confidence interval and provide evidence that the parameters of the model are stable over the period of study.

**Figure 2** CUSUM (see online version for colours)

**Figure 3** CUSUMQ (see online version for colours)
4.3 Analysis and findings of tertiary sector

The same procedures are carried out and interpreted for the wholesale and retail sector.

4.3.1 Unit root test

The results reported show that FDITRAD and LABTRAD are stationary and thus, are I(0) variables. For the other variables, the problem of non stationary is successfully removed by differencing them and are I(1) variables.

4.3.2 F bound test

The next step is to test the presence of long run relationship among variables using F bound test.

Table 6  F bound test results

<table>
<thead>
<tr>
<th>Level of significance</th>
<th>Lower bound</th>
<th>Upper bound</th>
<th>F-value</th>
<th>Pass/fail/indecisive</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>3.4088</td>
<td>4.9081</td>
<td>7.4261</td>
<td>Pass</td>
</tr>
<tr>
<td>10%</td>
<td>2.7484</td>
<td>4.0364</td>
<td>7.4261</td>
<td>Pass</td>
</tr>
</tbody>
</table>

Source: Author’s computation

According to the results, F-statistics of 7.4261 is greater than the 5% and 10% upper bound value of 4.9081 and 4.0364 respectively, suggesting that there is a long run relationship among the underlying variables. This, in turn, paves the way forward to the estimation of the short and long run coefficients.

4.3.3 Lag order selection

An estimated ARDL (1, 0, 0, 1, 0, 1) is determined by using Schwarz Bayesian Information Criteria.

4.3.4 ARDL ECM

The regression results for the short run model are tabulated in Table 7.

The adjusted R$^2$ of 99.5% suggest that the ECM fits the data reasonably well. The result highlights the importance of FDITRAD to strengthen growth significantly in the industry in question. It can be deduced that every 10% increase in FDI in the trade activity, is followed by an immediate 0.14% increase in the GDP of the same activity. The result corroborates with the review of Mundra et al. (2013), who concluded that FDI in retailing stimulate development in the sector. Foreign investors provide an opportunity for local enterprises in terms of provision of ancillary services, thus inducing more activities in the sector.

Similarly, the number of people engaged in the industry has a favourable and significant effect on the growth. It can be observed that a 1% increase in LABTRAD is expected to cause 1.74% increase in GDPTRAD in the short run. This is consistent with the Solow’s theory (1956), where labour is considered to be among the leading edge for growth.
A dynamic investigation of FDI and sectoral growth in Mauritius

Table 7  Short run results

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>T-ratio</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>dFDITRAD</td>
<td>0.014130</td>
<td>0.0064258</td>
<td>2.1990</td>
<td>.043</td>
</tr>
<tr>
<td>dLABTRAD</td>
<td>1.737</td>
<td>0.34357</td>
<td>5.0557</td>
<td>.000</td>
</tr>
<tr>
<td>dINFRAS</td>
<td>–0.51283</td>
<td>0.46702</td>
<td>–0.10981</td>
<td>.914</td>
</tr>
<tr>
<td>dSECENROL</td>
<td>–0.13486</td>
<td>0.19561</td>
<td>–0.68943</td>
<td>.500</td>
</tr>
<tr>
<td>dFINCRI</td>
<td>–0.82689</td>
<td>0.033477</td>
<td>–2.47</td>
<td>.025</td>
</tr>
<tr>
<td>dINTPT</td>
<td>1.6795</td>
<td>3.015</td>
<td>0.55705</td>
<td>.585</td>
</tr>
<tr>
<td>ecm(–1)</td>
<td>–0.72268</td>
<td>0.086576</td>
<td>–3.6865</td>
<td>.002</td>
</tr>
</tbody>
</table>

Source:  Author’s computation

INFRAS, SECENROL and FINCRI have a negative effect on GDPTRAD. With better infrastructures, such as paved roads, encourages the population to travel long distances in search of better prices. However, in the short term, this does not exert significant effect as the search of new suppliers and substitutes involves a time lag. GDPTRAD will fall in the short run but by little magnitude. Turning to SECENROL, Ahmad and Luqman (2012) obtained similar results for Pakistan.

Financial crisis has brought uncertainty among investors which had a detrimental effect on economic activities in Mauritius. Investment and consumption fell leading to fall in GDP in the industry. This is supported by the results.

4.3.5 Long run coefficients

The outcomes of long run coefficients are presented below:

Table 8  Results of long run coefficient

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>T-ratio</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>dFDITRAD</td>
<td>0.044273</td>
<td>0.025003</td>
<td>1.7707</td>
<td>.098</td>
</tr>
<tr>
<td>LABTRAD</td>
<td>5.4422</td>
<td>1.0831</td>
<td>5.0248</td>
<td>.000</td>
</tr>
<tr>
<td>INFRAS</td>
<td>–2.2112</td>
<td>1.7738</td>
<td>–2.9379</td>
<td>.000</td>
</tr>
<tr>
<td>SECENROL</td>
<td>–0.42253</td>
<td>0.69338</td>
<td>–0.60938</td>
<td>.552</td>
</tr>
<tr>
<td>FINCRI</td>
<td>–0.13264</td>
<td>0.11014</td>
<td>–1.2044</td>
<td>.248</td>
</tr>
<tr>
<td>INTPT</td>
<td>5.2622</td>
<td>8.9631</td>
<td>0.58709</td>
<td>.566</td>
</tr>
</tbody>
</table>

Source:  Author’s computation

The long run results suggest that FDI in the trade industry contributes positively and significantly to GDP in the Mauritian context. A 1% increase in FDITRAD will lead to 0.04% increase in GDPTRAD. In the long term, it does not only bring foreign capital, but also skill acquisition and technological transfers where the domestic retailers also benefit. The multiplier effect surge a positive impact on GDPTRAD.

The coefficient of LABTRAD remains positive and significant in the long run. A 10% increase in number of people engaged in trade will cause a 54.42% increase in
GDPTRAD. In the long run, only the most efficient businesses will survive given that the law of jungle prevails on the market. Traders will become more skilled and experienced. Traders in the wholesale and retail business will know exactly with experience and passage of time, strategies required to maximise the long term revenue.

The negative and insignificant relationship between SECENROL and GDPTRAD is maintained in the long run. Over time, financial crisis will reduce GDPTRAD. This is consistent with the findings of Tandrayen (2011) stating that financial crisis had an adverse impact on Mauritius, with serious implications on wholesale and retail trade due to low demand and business activity.

4.3.6 CUSUM and CUSUMQ

Finally, CUSUM and CUSUMQ plots were found to lie within the 5% critical bounds. The null hypothesis of no structural breakdown cannot be rejected, implying that the model is stable.

**Figure 4** CUSUM (see online version for colours)

**Figure 5** CUSUMQ (see online version for colours)
5 Conclusions

The current study investigates whether FDI inflows in the primary, secondary and tertiary sector enhance growth in the respective sectors of Mauritius for the period 1990 to 2013 within an ARDL framework. Most studies carried out in FDI-growth nexus were done at aggregate level or on an industry specific for the case for Mauritius. But this study tries to capture the FDI effects on growth at sectoral level. It can be concluded that impact of FDI do differs among the major sectors of Mauritius which is in line with previous empirical studies carried out for other countries. The findings give evidence of positive relationship between FDI inflows and growth in the secondary sector both in the short and long run. Many foreign firm set up in Mauritius bringing FDI in the manufacturing sector. On the other hand, a strong and positive relationship was found for the wholesale and retail trade industry (tertiary sector) and growth both in the short and long run. Foreign investors induce more activities in the sector. ARDL model could not be applied for primary sector. But it can be deduced that this sector is not attractive to foreign investors. In terms of policy recommendations, an agency specific to the manufacturing sector should be established which will contact the foreign investors and before these people comes to Mauritius, everything should be ready in terms of employees recruitment, infrastructure and formalities vis a vis the local authorities. Also, ‘large wholesale trade and shopping villages/towns’ and ‘Large retail trade and shopping villages/towns’ should be introduced in Mauritius whereby every trader operating in those areas needs to get their businesses officially registered. By seeing the facilities being offered in the trade and shopping villages/towns (provision of free infrastructure, tax holidays among others) together the daily volume of trade being carried out there, even those currently operating in the informal sector will wish to conduct an officially registered business there. GDP of the industry in question will automatically rise. Furthermore, foreign investors will prefer to invest in trade and shopping villages/towns rather than in isolated areas.

References


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