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# The Services Sector and Economic Growth in Mauritius. A Bounds Testing Approach to Cointegration

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**Abstract**

This paper examines the long run and short run impact of the services sector on economic growth in Mauritius. Using an augmented aggregate production function growth model, we apply the bounds testing approach to cointegration to assess the impact of different activities in the services sector on economic performance. The Autoregressive Distributed Lag (ARDL) model is applied on time series data over the period 1975 to 2009. Our results firstly show that the services sector contributes positively to economic growth with a larger growth impact from whole sale and retail trade, followed by the transport and communication sector and the financial sector. Second, we observe the existence of a long run causal relationship from the services sector to GDP per capita while short run causality runs from per capita GDP to services sector performance. Our findings further confirm the stability of the relationship between services sector development and economic growth for a small island economy like Mauritius.

**Keywords**: Services Sector Development, ARDL cointegration, Causality, Cointegration.

**JEL classification:** C22; 011; 055

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## 1. INTRODUCTION

The relationship between the service producing sector and economic growth is rather complex. The services sector is increasingly seen as a means to promote economic development and reduce poverty. It is becoming the largest sector, in terms of share of GDP and employment, in most developing countries. From this perspective, the service producing sector can aid economic growth while another viewpoint is that the service producing sector should not be seen as independent of, nor is it a replacement for, the traditional goods producing sector such as agriculture, mining, and manufacturing (Glasmeier and Howland, 1993). The services sector is highly diverse, ranging, from infrastructure services such as telecommunications, construction, transportation, financial services to tourism to business services that directly affect firm competitiveness, to social services such as health or education. Infrastructure services support all types of enterprises. Education, health, and recreational services influence the quality of labour available to enterprises. Business and professional services provide specialized expertise to increase enterprise competitiveness.

In Mauritius, the services sector, contributes on average 68.5% of GDP, compared to 27.4% for the secondary sector and 4.1% by the primary sector which consists mainly of agricultural activities. The tertiary sector grew by 5.7% in 2008. All the services industries recorded increases in activities during the year. For instance, financial intermediation grew by 10.1%, transport, storage and communications rose by 6.2%, whilst real estates, renting and business grew by 7.1%. Education, which includes services provided by both public and private operators, rose by 3.4% in 2008, and other community, social and personal service activities increased by 8.3% in 2008, slightly higher than the 8.0% growth registered in 2007. The service industry continues to be a major engine of growth in Mauritius which is driven in part by the rapid changes in information technology and telecommunications that support service delivery. In keeping with the growth in services output, service firms have also been the primary creators of new jobs, accounting for more than 80% of employment level. Further, trade in services also plays a significant role in promoting economic growth. Mauritian exports of services, however, registered a low growth of 2.6% in 2008 compared to 23.1% in 2007, mainly due to a low growth in tourist earnings in 2008.

The objective of the study is firstly to investigate the contribution of the services sector on the economic growth of the small island economy of Mauritius. Using time series data for the Mauritian economy from 1975 to 2009, we model the rather complex relationship between the services sector and economic growth. Second we analyse the bi-directional causality between the services sector and economic growth. As income increases, the structure of the economy changes and there is a gradual movement from the traditional sectors namely agriculture and manufacturing to more upstream sectors like services. In this case, income drives the development of the services sector. On the other hand, the expansion of the services sector contributes to higher economic growth. In this case, it is economic growth that drives the services sector development. Causality almost surely runs in both directions. Third, we assess the stability of the link between services and economic performance. Lastly, this study outlines several policy implications that

draw upon the analysis. It provides a comprehensive assessment and analytical inputs to policy-makers on the policy options available to enhance the supply capacities and to maximize the contribution of trade, investment and growth in services to economic development.

The paper is structured as follows. Section 2 reviews the literature on the contribution of the services sector to economic growth. Section 3 analyses the data and section 4 sets out the methodology used. Section 5 presents the findings and we finally conclude in section 6.

## 2. LITERATURE SURVEY

Doubts on services as a viable engine of growth and employment generation have been discussed in the literature. This scepticism emanates from evidence of the relatively jobless nature of service sector growth, in particular in the developing countries. Growth and employment in developing countries has normally been led by an open manufacturing sector, both in the traded and non-traded sectors of the economy. Growth theory accords no special role to service activities, with the possible exception of financial and transport and telecommunication services. Further, the share of services in employment increases with the rise in per capita income. However, given that services have become the main source of growth in both developed as well as developing countries, new empirical evaluation of this hypothesis has become crucial. Many service industries are not stagnant and have experienced significant labour and total factor productivity growth. The process of economic development is connected with systematic structural change in most countries: As per capita income rises, the primary sector loses in importance, while the manufacturing industry initially gains momentum but is eventually surpassed by the constantly growing service sector.

Fisher (1939) and Clark (1940), emphasize the shift from agriculture to industry in the course of economic growth but do not pay much attention to the share of services. Kuznets (1953) concludes that the share of services in national product did not vary significantly with per capita income. Chenery (1960) notes that the relationship between services and per capita income is not uniform across countries and Chenery and Syrquin (1975) observes that there is a concave link where services rise with per capita incomes but at a decelerating rate. Kongsamut, Rebelo and Xie (2001), in contrast, find the share of services in output to be linear in per capita income. Dutt and Lee (1993) use cross country-level data for three decades (1960s, 1970s and 1980s) and show that the effect is negative or positive depending on how the role of the service sector is measured, but argue that there is a strong case that the effect is, in fact, usually negative.

Miles and Boden (2000) describe services as the 'Cinderella sector' which is largely ignored. They argue, however, that as the share of services in national economies continues to grow, and the linkages between services and other sectors of the economy are extended, the tendency to overlook services becomes less rational. Wu (2007) examines and compares service sector developments in two Asian giant economies namely China and India. It investigates the determinants of

demand for services and sheds light on the outlook for service sector growth in the two countries. The study reveals that growth in the services sector has mainly been driven by increasing specialization of production, rising standard of living and accelerated urbanization in both societies. There are also non-economic factors like biased development strategies in China, India's early linkage with the West and recent boom in Indian IT exports that have played important respective roles in service development in the two countries. India's service sector is seen as a dominant contributor to GDP growth but employment absorption is not very high whilst the service sector has been the main provider of new jobs in China. In comparison with India, China's service sector is lagging behind. Even in international perspective, China's service sector is below the average.

Linden and Mahmood (2007) analyse the long run dynamic relationship between sector shares (agriculture, manufacturing and services) and economic growth for 15 Schengen countries in period 1970-2004. There is evidence of a two-way causality between services share growth and growth rate of GDP per capita. Eichengreen and Gupta (2009) identify two waves of service sector growth, a first wave in countries with relatively low levels of per capita GDP and a second wave in countries with higher per capita incomes. The first wave is made of traditional services whilst the second wave of modern (financial, communication, computer, technical, legal, advertising and business) services that are receptive to the application of information technologies and increasingly tradable across borders. They observe an increase in the share of services in GDP at all levels of income after 1970 and, in addition, of a further increase in the share of services in countries with relatively high per capita incomes. The change in the second wave is not equally evident in all countries: it is most apparent in countries that are open to trade, that are democratic, and that are relatively close to the major global financial centres.

The stylized fact is less than clear. Despite the huge number of studies on service sector productivity and economic growth in the developed economies, there are few studies for SSA. The underdeveloped nature of the sector and the dominance of the informal sector which is largely a service producing sector accounts for the dearth of studies on the sector in SSA. To our knowledge there is no study assessing the impact of services sector development on growth in Mauritius.

## 3. SITUATIONAL ANALYSIS OF THE MAURITIAN ECONOMY

Despite the inherent constraints of a small island economy, Mauritius has achieved remarkable economic success over the years. Back in 1968, the economy was entirely dependent on sugar exports and showed little scope for sustained economic progress and improvement in living standards. Mauritius has since evolved into an upper middle income economy. The three major sectors of the economy namely, sugar, textile and tourism as well as the new growth areas in financial and business services provided the main engines for growth. The economy grew at an average rate of 5.7 % between 1990 and 2000. However, Mauritius was faced with the challenge of adjusting to the phasing out of trade preferences in textiles and sugar. Economic growth slowed down to 4.7% per annum on average from 2000 to 2005 as a result of increased global competition and a less favourable international

economy with rising oil prices. In 2008, GDP growth rate stands at 5.3% but growth is expected to fall to 2.5% in 2009 because of the world economic downturn. GDP growth and per capita GDP over the last three decades is shown in Figure 1 below:

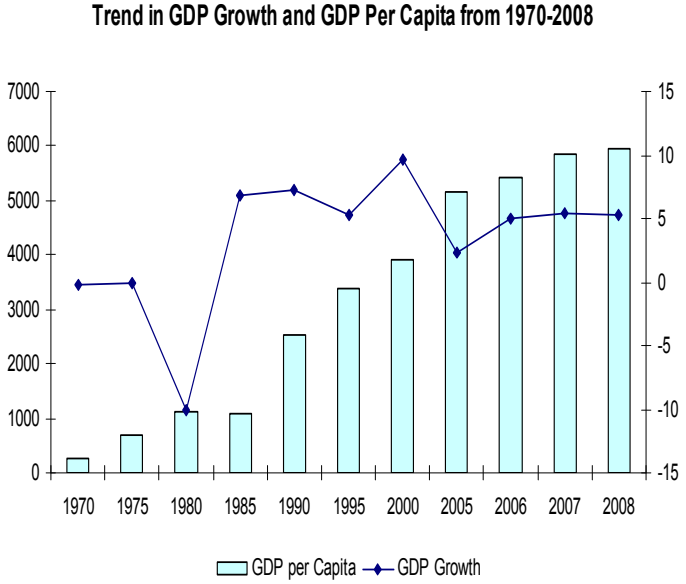
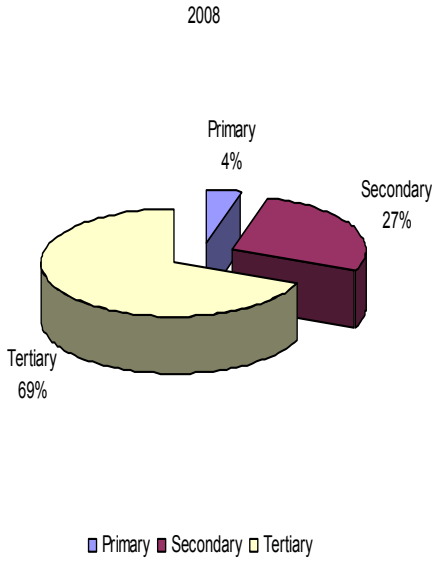



*Figure 1:*

The transformation of the Mauritian economic structure over time is reflected by changes in the relative contribution of the main sectors[1] to GDP. The contribution of the primary sector to GDP has fallen from 23.1% in 1968 to 4.4% in 2008. The share of secondary sector output rose from 24.1% in 1968 to 31.7% in 1996 but by 2008 it had fallen to 27.4%. The tertiary sector has maintained a constant expansion path. Its share in GDP has risen to 68.5% in 2008. The increased prominence of the service sector is mainly accounted for by the growth of tourism and financial and business services. Tourism represented 8.6% of GDP in 2008 compared to a mere 1.8% in 1976. The growth rate of financial and business services has averaged 3.6%, 6.3% and 7.6% over the periods 1977-1986, 1987-1996 and 1997-2006 respectively. The main drivers of the sector are banking, especially the offshore segment, and business activities such as accounting, management consultancy and legal services. The sectoral transformation of the economy is shown by Figure 2 and Table 1 below:

[1] The primary sector includes Agriculture, Forestry and fishing and Mining and quarrying. The secondary sector comprises Manufacturing, Electricity, Gas and water and Construction. The tertiary sector covers Wholesale and retail trade, Hotels and restaurants, Transport, storage and communications, Financing insurance, real estate, and business services, Community, social and personal services including Public administration.




| | 1976 | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2009' |
|---|---|---|---|---|---|---|---|---|
| Agriculture, hunting, forestry and fishing | 22.5 | 12.4 | 15.3 | 12.9 | 10.4 | 7.0 | 6.0 | 4.2 |
| Sugarcane | 17.8 | 8.1 | 11.1 | 8.0 | 5.7 | 3.6 | 3.2 | 1.7 |
| Other | 4.7 | 4.3 | 4.2 | 4.8 | 4.6 | 3.4 | 2.8 | 2.5 |
| Manufacturing | 15.2 | 15.2 | 20.6 | 24.4 | 23.0 | 23.5 | 19.8 | 19.7 |
| Sugar | 5.5 | 2.4 | 3.2 | 3.4 | 1.6 | 0.8 | 1.0 | 0.5 |
| Food excluding sugar | - | - | - | - | - | 4.1 | 5.1 | 7.1 |
| Textiles and Clothing | 2.6 | 4.3 | 9.5 | - | - | 12.0 | 6.7 | 5.0 |
| Other | 7.1 | 8.5 | 7.9 | - | - | 6.6 | 7.0 | 7.1 |
| Construction | 8.0 | 7.6 | 5.6 | 6.7 | 6.4 | 5.6 | 5.6 | 6.9 |
| Hotels and restaurants | 1.8 | 2.3 | 2.4 | 3.9 | 5.1 | 6.5 | 7.7 | 7.6 |
| Transport , storage and communications | 8.5 | 11.3 | 10.9 | 10.4 | 11.4 | 13.0 | 12.6 | 11.0 |
| Financial intermediation[ | 5.7 | 5.0 | 4.7 | 4.9 | 6.5 | 9.7 | 10.3 | 11.5 |
| Insurance | 4.2 | 3.3 | 2.9 | 1.5 | 2.1 | 2.3 | 2.9 | 2.8 |
| Banks | 1.5 | 1.7 | 1.8 | 0.0 | 4.4 | 6.6 | 6.2 | 7.4 |
| Other | | | | 0.0 | - | 0.8 | 1.2 | 1.3 |
| Real estate, renting and business activities | 10.2 | 12.7 | 11.1 | 8.9 | 8.5 | 8.9 | 10.2 | 11.9 |

*Table 1: Percentage distribution of GDP by industry group (main sectors), 1976-2009*

*S*| For the years 1976, 1980 and 1985, financial intermediation includes other business activities whilst real estate involved only ownership of dwellings.

' Forecast

The economy seems to be driven by the services sectors, especially activities in "Hotels and Restaurants", "Transport storage and communications", "Real estate, renting and business activities" and "Financial intermediation". As shown in table 2, the financial intermediation sector's contribution to GDP is likely to increase from 6.5% in 1995 to an expected 11.5% in 2009. The contribution of this sector to GDP has revolved around 10% since the year 2005. It has been estimated that the sector will grow further in 2009 following growths of 2.8% and 7.4% in insurance and banks respectively. Figure 3 below shows the main activities of the services sector in 2008.

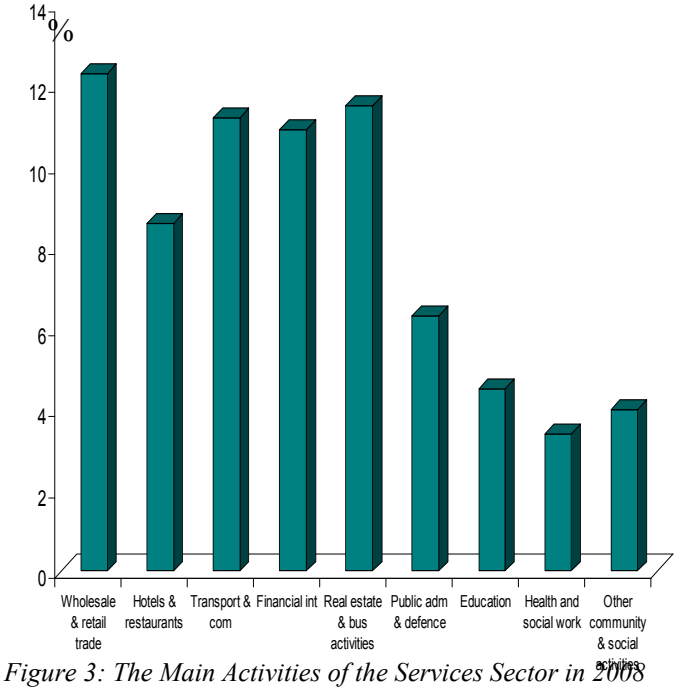



*Figure 3: The Main Activities of the Services Sector in 2008*

## 4. DATA AND METHODOLOGY

The study uses data for Mauritius from 1975 to 2009. The key data sources are the World Development Indicators (2008) and different publications of the Central Statistical Office in Mauritius our data analysis is modeled in an aggregate production function (APF) framework. The model used is as follows:

$$\begin{aligned}\ln GDPPC_t = {} & \alpha_0 + \nu_1 \ln HotelGDP_t + \nu_2 \ln WTRGDP_t \\ & + \nu_3 \ln FinanceGDP_t + \nu_4 Inflation_t \\ & + \nu_6 \ln Ser_t + \nu_7 \ln ExpsGDP_t \\ & + \nu_8 \ln Tel_t + \nu_9 \ln TransGDP_{t-1} + \varepsilon_t\end{aligned} \quad (1)$$

where *GDPPC* is nominal gross domestic product per capita, *HotelGDP* represents the contribution of the hotels and restaurants to GDP, *WRTGDP* denotes the wholesale and retail trade share of GDP, *FinanceGDP* is financing, insurance, real estate and business services as a share of GDP and *TransGDP* is the contribution of the transport sector to GDP. Inflation is the inflation rate, *Ser* denotes the secondary enrolment ratio and *ExpsGDP* represents exports as a share of GDP which is used as a measure of openness. Lastly, *Tel* is number of telephone mainline per 1000 of inhabitants. The time period is denoted by *t* and $\varepsilon$ is the error term.

The methodology used is the autoregressive distributed lag (ARDL) approach to cointegration proposed by Pesaran et al. (2001). The ARDL bounds cointegration technique has been selected to determine the long run and short run relationships between services sector and GDP per capita. The choice of this methodology is based on several considerations. First, as shown by Pesaran et al. (2001), the ARDL models yield consistent estimates of the long run coefficients that are asymptotically normal irrespective of whether the underlying regressors are I(1) or I(0). Second, this technique generally provides unbiased estimates of the long run model and valid t-statistics even when some of the regressors are endogenous (Harris and Sollis, 2003). Inder (1993) and Pesaran (1997) have shown that the inclusion of the dynamics may help correct the endogeneity bias. Third, given the size of the sample and the number parameters to be estimated the bound approach appears more appealing than the Johansen cointegration technique, which would have required the estimation of a system of equations and thus a considerable loss in degree of freedom.

The procedures to carry out the ARDL approach to cointegration technique includes the determination of the long run relationships among the variables used in the models; and the estimation of the coefficients of the long and short run relationships. To estimate the ARDL model is to test for the presence of long run relationships among the variables by using the Bounds F-Test. To implement the bound test procedure, equation (1) is modelled as a conditional ARDL error correction model (ECM) as follows:

$$\begin{aligned}\Delta \ln GDPPC_t = {} & \alpha_0 + \sum_{i=1}^{n} \alpha_i \Delta \ln HotelGDP_{t-i} + \\ & \sum_{i=1}^{n} \delta_i \Delta \ln WTRGDP_{t-i} + \\ & \sum_{i=1}^{n} \beta_i \Delta \ln FinanceGDP_{t-i} \\ & + \sum_{i=1}^{n} \sigma_i \Delta Inflation_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta \ln Ser_{t-i} \\ & + \sum_{i=1}^{n} \omega_i \Delta \ln ExpsGDP_{t-i} + \sum_{i=1}^{n} \upsilon_i \Delta Tel_{t-i} \\ & + \sum_{i=1}^{n} \varphi_i \Delta TransGDP_{t-1-i} + \eta_1 \ln GDPPC_{t-1} \\ & + \eta_2 \ln HotelGDP_{t-1} + \eta_3 \ln WTRGDP_{t-1} \\ & + \eta_4 \ln FinanceGDP_{t-1} + \eta_5 Inflation_{t-1} \\ & + \eta_6 \ln Ser_{t-1} + \eta_7 \ln ExpsGDP_{t-1} \\ & + \eta_8 \ln Tel_{t-1} + \eta_9 \ln TransGDP_{t-2} + \varepsilon_t \end{aligned} \qquad (2)$$

where $\alpha_0$ is a drift component and $\varepsilon_t$ is the white noise error. The long run multipliers are represented by the coefficients of the lagged level variables while $\alpha_i$, $\delta_i$, $\beta_i$, $\sigma_i$, $\lambda_i$, $\omega_i$, $\upsilon_i$ and $\phi_i$ represent the short run impacts on GDP per capita. The equation is estimated using OLS. The next step is to test the presence of cointegration by restricting all estimated coefficients of lagged level variables equal to zero. That is the null hypothesis of no cointegration $\left(H_0 : \eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = \eta_6 = \eta_7 = \eta_8 = \eta_9 = 0\right)$ **is tested against the alternative hypothesis**

$$\begin{pmatrix} H_0 : \eta_1 \neq 0, \eta_2 \neq 0, \eta_3 \neq 0, \eta_4 \neq 0, \eta_5 \neq 0, \eta_6 \neq 0, \eta_7 \\ \neq 0, \eta_8 \neq 0, \eta_9 \neq 0 \end{pmatrix}$$

by the mean of a F-test with an asymptotic non-standard distribution. Two asymptotic critical value bounds provide a test for cointegration when the independent variables are $I(d)$ with $0 \leq d \leq 1$. The lower bound assumes that all the regressors are $I(0)$ , and the upper bound assumes that they are $I(1)$ . If the computed F-statistics lies above the upper level of the band, the null is rejected, indicating cointegration (Pesaran and Pesaran, 1997). If the computed F-statistics lies below the lower level band, the null cannot be rejected, supporting the absence of cointegration. If the statistics fall within the band, inference would be inconclusive.

Once the long run relationship has been established the final step of the ARDL analysis involves estimating the coefficients of the long run relations and making inferences about their values (Pesaran and Pesaran, 1997). This stage involves two further steps. The first stage involves selecting the orders of the lags based on Schwarz Bayesian Information Criteria (SBIC) or the Akaike Information Criteria (AIC). In the second step, the selected optimal ARDL model restricted to the lag structure defined in the first stage of the final ARDL process is then estimated including the short run and error correction model. We construct a lagged error correction term to substitute the whole set of lagged level variables. It is therefore possible to estimate the short run coefficients as an error correcting model while allowing for the long run estimates as follows:

$$\begin{aligned}\Delta \ln GDPPC_t = \alpha_0 &+ \sum_{i=1}^{n} \alpha_i \Delta \ln HotelGDP_{t-i} + \\ &\sum_{i=1}^{n} \delta_i \Delta \ln WTRGDP_{t-i} + \\ &\sum_{i=1}^{n} \beta_i \Delta \ln FinanceGDP_{t-i} \\ &+ \sum_{i=1}^{n} \sigma_i \Delta Inflation_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta \ln Ser_{t-i} \\ &+ \sum_{i=1}^{n} \omega_i \Delta \ln ExpsGDP_{t-i} + \sum_{i=1}^{n} \upsilon_i \Delta Tel_{t-i} \\ &+ \sum_{i=1}^{n} \varphi_i \Delta TransGDP_{t-1-i} + \psi_t ECM_{t-1} + \gamma_t\end{aligned} \tag{3}$$

$ECM_{t-1}$ is the error correction term and its coefficient $\psi_t$ is the speed of adjustment. The other coefficients in the model are the short run dynamics that cause the model to converge to equilibrium. These methodologies will be applied to avoid spurious results.

The second stage includes conducting standard Granger causality tests augmented with a lagged error-correction term. The Granger representation theorem suggests that there will be Granger causality in at least one direction if there exists co-integration relationship among the variables provided the variables are integrated order of one. Engle-Granger (1987) cautioned that if the Granger causality test is conducted at first difference through vector auto regression (VAR) method than it will be misleading in the presence of co-integration. Therefore, an inclusion of an additional variable to the VAR method such as the error-correction term would help us to capture the long-run relationship. To this end, an augmented form of Granger causality test is involved to the error-correction term and it is formulated in a bi-variate *p*th order vector error-correction model (VECM) which is as follows:

$$\begin{bmatrix} \Delta GDPPC_t \\ \Delta SERGDP_t \end{bmatrix} = \begin{bmatrix} K_1 \\ K_2 \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} d_{11}(L) & d_{12}(L) \\ d_{21}(L) & d_{22}(L) \end{bmatrix} \begin{bmatrix} \Delta GDPPC_{t-1} \\ \Delta SERGDP_{t-1} \end{bmatrix} + \begin{bmatrix} \lambda_1 ECM_{t-1} \\ \lambda_1 ECM_{t-1} \end{bmatrix} + \begin{bmatrix} C_1 \\ C_2 \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} \quad (4)$$

where $\Delta$ is a difference operator, ECM representing the error-correction term derived from long-run co-integrating relationship via ARDL model, C (i = 1, 2) is constant and (i = 1, 2) are serially uncorrelated random disturbance term with zero mean. *SERGDP* is the services sector as a share of GDP. Through the ECM, the VECM provide new directions for Granger causality to appear. Long-run causality can be revealed through the significance of the lagged *ECMs* by t test, while F-statistic or Wald test investigate short-run causality through the significance of joint test with an application of sum of lags of explanatory variables in the model.

The Granger causality test is applied to equation (4) by firstly checking the statistical significance of the lagged differences of the variables for each vector, which is a measure of short run causality and second by examining the statistical significance of the error-correction term for the vector that there exists a long run relationship.

To ascertain the goodness of fit of the ARDL model, the diagnostic test and the stability test are conducted. The diagnostic test examines the serial correlation, functional form, normality and heteroscedisticity associated with the model. The stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq). Examining the prediction error of the model is another way of ascertaining the reliability of the ARDL model. If the error or the difference between the real observation and the forecast is infinitesimal, then the model can be regarded as best fitting.

## 5. FINDINGS

### 5.1 Unit Root Test

Prior to the application of the ARDL approach, all variables are tested for stationarity. The use of non-stationary variables in the time series analysis leads to misleading inferences (Libanio, 2005). The unit root test is applied to check the order of integration and it is a crucial requirement for the existence of cointegration links (John, Nelson and Reetu, 2005). We use the traditional Augmented Dicker Fuller (ADF) test to check for the unit root in each variable and thereby determine the order of integration. This enables us to assign the order of integration for each variable i.e. I(0) or I(1) before identifying the possible long run linkages. Table 2 below

| Variable | Levels | | First Difference | |
|---|---|---|---|---|
| | Intercept | Order | Intercept | Order |
| $lnGDPPC_t$ | -4.01 | I(0) | | |
| $lnHotelGDP_t$ | | | -5.14 | I(1) |
| $lnWRTGDP_t$ | | | -5.79 | I(1) |
| $lnFinanceGDP_t$ | | | -6.42 | I(1) |
| $lnTransGDP_{t-1}$ | -29.38 | I(0) | | |
| $Inflation_t$ | -3.41 | I(0) | | |
| $lnSer_t$ | | | -8.01 | I(1) |
| $lnExpsGDP_t$ | | | -3.80 | I(1) |
| $Tel_t$ | 12.13 | I(0) | | |

*Table 2: ADF Test Results*

**Note**: Critical value at 5% level is 2.95% for intercept but no trend

For the model to be valid, the variables must be either I(0) or I(1). Therefore the test for stationarity confirms this as seen in Table 2 above. GDP per capita, inflation, telephone mainlines and the share of the transport sector to GDP; are stationary while the other variables become stationary after differencing once.

### 5.2 Results for Bounds F test

The Bounds F test result in Table 3 below shows the results of the first stage with the estimated F-test value indicative of the presence of the long run relationships among the variables. As the calculated F-statistic of 4.11 exceeds the upper bound critical value, then the null of no cointegration is rejected. As cointegration is confirmed, we move to the second stage where the ARDL model can be established to determine long run and short run relationships.

| Model | Critical Values Band | | Estimated F test value | Pass/ Fail |
|---|---|---|---|---|
| Equation (2) | I(0) | I(1) | | Pass |

| | | | | |
|---|---|---|---|---|
| | 2.850 | 3.805 | 4.11 | |

*Table 3: Bound F Test Results*

### 5.3 ARDL Model and Long Run Dynamics

In the second stage, the ARDL, long run and the short run ECM coefficients are estimated by using Schwartz Bayesian Criteria to select the appropriate lags. The model's diagnostic tests for serial correlation, functional form, normality of residuals and heteroscedasticity do not indicate any concern. Once we established that a long-run cointegration relationship existed, equation (2) was estimated using the following ARDL (1, 0, 1, 1, 0, 0, 0, 0) specification. The long run estimates of the model are presented in Table 4 below.

| Variable | Coefficient | Standard Error | T-ratio |
|---|---|---|---|
| **$lnHotelGDP_t$** | 0.509** | 0.233 | 2.188 |
| **$lnWRTGDP_t$** | 2.192*** | 0.507 | 4.327 |
| **$lnFinanceGDP_t$** | 1.514*** | 0.201 | 7.528 |
| **$lnTransGDP_{t-1}$** | 1.767*** | 0.348 | 5.079 |
| **$Inflation_t$** | -0.010*** | 0.003 | -2.895 |
| **$lnExpGDP_t$** | 0.918** | 0.395 | 2.327 |
| **$lnSer_t$** | 1.760** | 0.731 | 2.408 |
| **$Tel_t$** | 0.017*** | 0.002 | 6.743 |
| **Constant** | 6.873* | 3.337 | 2.060 |
| R-squared | | | 0.98 |
| No of Obs. | | | 33 |

*Table 4: Estimated long run coefficients using the ARDL approach selected based on Schwarz Bayesian Criterion. Dependent Variable is $lnGDPPC_t$*

The estimated coefficients of the long-run relationship show that the services sector in terms of the tourism sector, whole sale retail trade, financial sector and transport and communication have a very high significant positive impact on GDP per capita. A 1% expansion in the tourism sector for instance leads to approximately 0.10% increase in GDP per capita. Similarly a 1% growth in transport and communications leads to 1.77% increase in GDP per capita. Among the different service activities, whole sale and retail trade seems to contribute more to per capita

GDP. In fact growth in this activity has been increasing substantially over the last decade. Other variables like inflation for instance has a significant negative impact on standard of living as high prices reduce purchasing power of individuals. Education captured by secondary enrolment ratio has a positive effect on GDP per capita, showing that education is an essential means to get people out of poverty. Higher education implies better jobs and higher income levels and human capital is an important engine of growth. Telephone mainlines which is included as a measure of development has a positive effect on GDP per capita. Good communication services are crucial in the promotion of economic development. Foreign investors are often attracted to location where the basic infrastructural development and services are available. Good communication facilities among other services thus contribute positively to economic performance and prospects of Mauritius.

### 5.4 ARDL-ECM– Short Run Dynamics

In addition to the ARDL results, our next set of findings report the short run estimates. The fact that the variables in the model are cointegrated provides support for the use of an ECM representation in order to investigate the short run dynamics. Estimation results still based on Schwartz Bayesian Criteria are presented in Table 5 below. The $R^2$ value of 0.814 suggests that the ECM fits the data reasonably well. In terms of the short run relationships we observe a positive and significant impact of the different services activities on per capita GDP. Higher positive short term effects are noted from the transport and communication sector as well as wholesale retail trade activities. The signs of the short run dynamics are maintained to the long run. The other variables are as per prior expectations.

| **Variable** | **Coefficient** | **Standard Error** | **T-ratio** |
|---|---|---|---|
| $\Delta lnHotelGDP_t$ | 0.102* | 0.057 | 1.810 |
| $\Delta lnWRTGDP_t$ | 0.212** | 0.094 | 2.244 |
| $\Delta lnFinanceGDP_t$ | 0.126*** | 0.038 | 3.292 |
| $\Delta lnTransGDP_{t-1}$ | 0.355*** | 0.078 | 4.576 |
| $\Delta Inflation_t$ | -0.002** | 0.0008 | -2.525 |
| $\Delta lnExpGDP_t$ | 0.185** | 0.078 | 2.375 |
| $\Delta lnSer_t$ | 0.354** | 0.163 | 2.170 |
| $\Delta Tel_t$ | 0.003*** | 0.0007 | 4.917 |
| Constant | 1.387* | 0.716 | 1.931 |
| $ECM_{t-1}$ | -0.201*** | 0.0369 | -5.447 |

| | | | |
|---|---|---|---|
| R-squared | 0.814 | No of Obs. | 33 |

*Table 5: Error Correction representation for the selected ARDL model. Dependent Variable is* $\Delta lnGDPPC_t$

### 5.5 Granger Causality Test

The Granger causality test indicates that the services sector has a positive and significant long run effect on GDP per capita. Causality is established from the services sector to GDP per capita in the long run while causality is observed from GDP per capita and the services sector in the short run only. The services sector is viewed as a long term growth strategy which is seen to play a significant role for a small island economy like Mauritius. Though the level of economic development may also help to foster the services sector, we observe that it is important in the short run only.

### 5.6 Stability of the Model

Finally, we examine the stability of the long-run coefficients together with the short-run dynamics. In doing so we follow Pesaran and Pesaran (1997) and apply the CUSUM and CUSUMSQ (Brown, Durbin, and Evans, 1975). The tests are applied to the residuals of the model. Specifically, the CUSUM test makes use of the cumulative sum of recursive residuals based on the first set of *n* observations and is updated recursively and plotted against break points. If the plot of CUSUM statistics stays within the critical bounds of 5% significance level [represented by a pair of straight lines drawn at the 5% level of significance whose equations are given in Brown, Durbin, and Evans (1975)], the null hypothesis that all coefficients in the error correction model are stable cannot be rejected. If either of the lines is crossed, the null hypothesis of coefficient constancy can be rejected at the 5% level of significance. A similar procedure is used to carry out the CUSUMSQ test, which is based on the squared recursive residuals. Figure 4 shows a graphical representation of the CUSUM and CUSUMSQ plots. Neither CUSUM nor CUSUMSQ plots cross the critical bounds, indicating no evidence of any significant structural instability (The figures are presented in the Appendix).

## 6. CONCLUSION AND POLICY IMPLICATIONS

The paper investigated the dynamic relationship between services sector development and GDP per capita for Mauritius by using annual time series data from 1976-2009 and applying the bounds testing (ARDL) approach to co integration. We distinguish between the long run and short run links between services sector development and GDP per capita. The bounds test suggested that the variables of interest are bound together in the long-run. The associated equilibrium correction was also significant confirming the existence of long-run relationships. The equilibrium correction is also fairly fast and is restored by less than three months of the year.

Our findings confirm that the services sector contribute positively to GDP per capita and wholesale retail trade has the strongest impact on the economy followed by the transport and communication sector and the financial sector. Tourism is also seen to contribute positively to the Mauritian economy. The results also confirm that secondary enrolment ratio, inflation, telephone mainlines and exports as a share of GDP are important elements in explaining GDP per capita. Further the empirical result shows that there is evidence of causality from the services sector to GDP per capita in the long run while causality is observed from GDP per capita and the services sector in the short run only.

From the results, a policy suggestion for enhanced GDP per capita in Mauritius will be the promotion of the services sector and its various activities. The government may also focus on human resource development in an attempt to create the skilled labour force needed by the services sector. We have also noted that trade openness has positive implication which implies that trade liberalisation of the economy and export promotion must be among the priorities of policy makers. Further a minimum level of development is also important to foster the growth of the services sector. We have seen that in the event of the world economic downturn, the Mauritian government has attempted to mitigate the negative consequences of the global economic crisis through an appropriate policy mix. Mauritius has been considered as an outlier in the Sub Saharan African region and is further seen as an example in setting the right strategies in difficult times. Mauritius has so far been resilient to the crisis relative to other African countries or emerging economies. The main reasons which underline the economy's resilience to such an unprecedented external shock is the effectiveness of the reforms which have been implemented during the past three years. Also, as recognised by the IMF we have a robust financial system.

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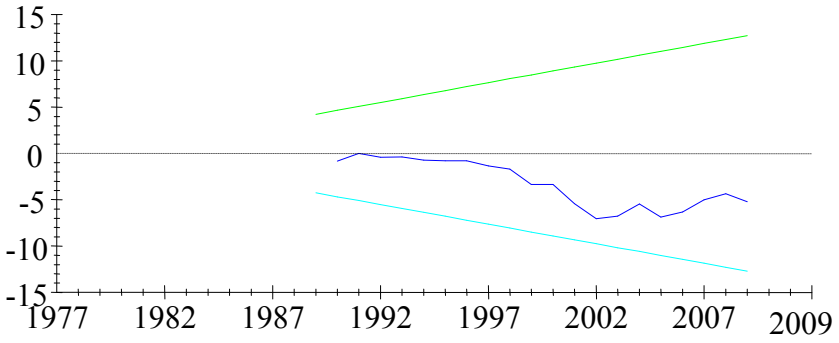
## APPENDIX

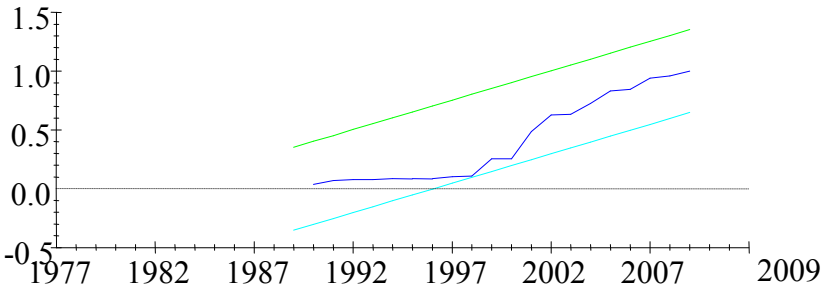
### Figure 4

Plot of Cumulative Sum of Recursive Residuals




**The straight lines represent critical bounds at 5% significance level**

Plot of Cumulative Sum of Squares of Recursive Residuals




**The straight lines represent critical bounds at 5% significance level**