



Bank of Mauritius

**Demystifying output gap pressure through surveys in a
monetary analysis setting: An experimental perspective**

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Demystifying output gap pressure through surveys in a monetary analysis setting: An experimental perspective

Abstract

The estimation of output gap is crucial in determining whether or not inflationary pressures exist in a monetary policy centred economy. Despite being riddled with statistical errors, univariate and multivariate filters are still widely used in estimating output gap, which can lead to gross misinterpretation of inflationary pressure in the domestic economy. The problematic nature of statistical filters can exacerbate the misinterpretation of output gap and inflationary pressure in small island economies, where data collection practices in many sectors are poor or practically inexistent. The inability to collect specific sector-wise data can lead to output gap inaccuracies, resulting in deficient monetary analysis. For the purpose of this paper, the case of a small island economy, namely Mauritius has been used. Typical imprecise output gap estimation is reflected in Mauritius' drivers of growth, namely the tourism and retail sector, whereby data on room occupancy and changes in sales volume, are not accounted for. The gap left by statistical filters can be filled in by a survey-based approach. This paper proposes the use of surveys to correct the statistical issues in filters for output gap estimation, thus providing additional support for monetary analysis.

1. Introduction

Mauritius is the classical case of being a small, open and diversified economy where numerous industry groups co-exist together. Compared to other Sub-Saharan African countries, data collection practices across industry groups are generally better in Mauritius. However, Mauritius still faces the typical problem of unreliable or inexistent datasets in some industry groups. The lack of data collection practices for some industry groups can be attributed to inadequate budget, limited manpower and inexperience. The failure to capture specific data across industry groups can indeed be a cause of concern in the formulation of sound economic decision-making.

Although the main government data collection agency, namely Statistics Mauritius, has made great strides in its data collection standards and practices recently, there are still many inexistent indicators and datasets under its portfolio. Compared to data collection agencies in developed economies, there are many low-frequency and high-frequency datasets which are not captured by Statistics Mauritius.¹

Globally, the computation of Gross Domestic Product (GDP) lies under the purview of the government's main data collection agency. Calculation of GDP is an exhaustive task by nature, whereby the higher the number of industry groups, the higher the likelihood of measurement errors. In the case of Mauritius, there exists seventeen industry groups and the probability of measurement error is significantly higher due to limited manpower and lack of appropriate data collection. On the premise of inappropriate and scarce data for computation of GDP in Mauritius, there is a strong belief that GDP figures do not provide an accurate picture on the performance of the economy. Since output gap is a function of GDP, the resulting question is whether or not measurement of output gap is technically flawed in Mauritius

Central banks use different methodologies to measure output gap. On the quantitative side, popular techniques such as Dynamic Stochastic General Equilibrium (DSGE), Forecasting and Policy Analysis System (FPAS) and Cobb-Douglas production function are employed. On the qualitative side, survey methodology is a common practice and is considered to be an additional tool in the monetary decision-making process. The discretion to use either methodology is based on preferences, statistical validity and data availability. The Bank of Canada is a good example whereby economic models, surveys and expert judgment² are used to make quarterly forecast of output gap. Departing from its existing quantitative model, the possibility of employing a qualitative technique such as a survey to gauge inflationary pressures and to measure the economy's production capacity is considered.

As such, the Business Perspective Survey (BPS) has been designed with the aim to fill the qualitative gap in output gap forecasting. BPS can also be employed to gain real-world

¹ Examples include business demography, business expectations, energy, sustainability and food retailing,

² It is to be pointed out that although quantitative and qualitative techniques are used, expert judgment tends to supersede both techniques.

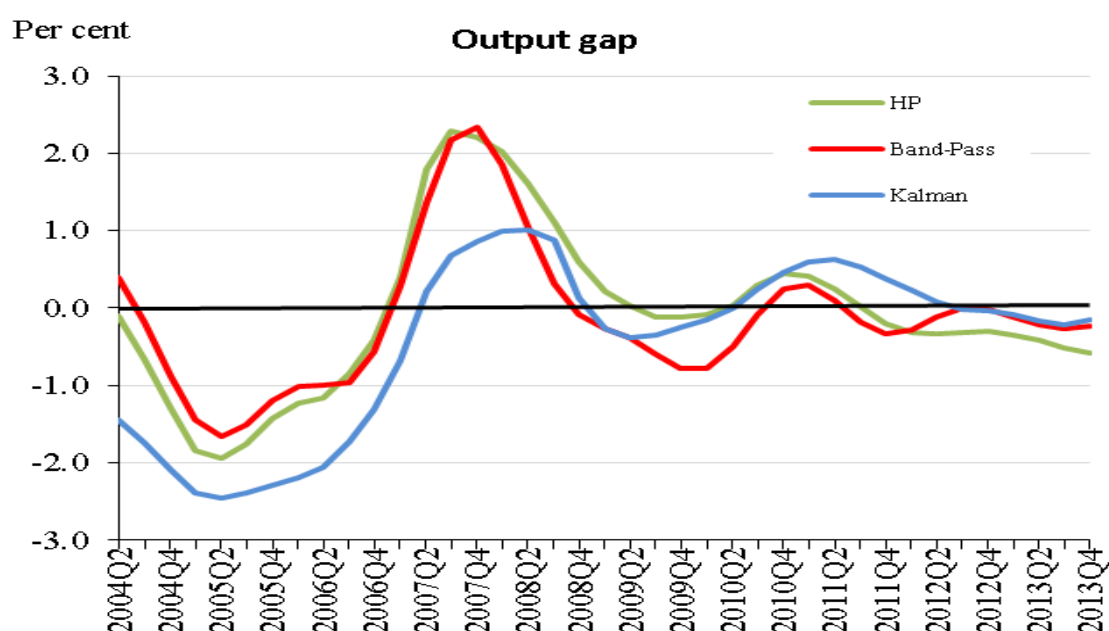
outlook from businesses about future economic activities, thus obtaining an outlook on inflationary pressures. This paper also fills the gap and contributes to the extensive output gap literature by exploring whether the use of surveys can further improve output gap estimation in a small open economy. As such, this paper presents an overview of Mauritian economy³ and subsequently introduces the BPS.

This paper advocates the setting up of the BPS, with the aim of measuring output gap of the Mauritian economy. The remainder of this paper is organised as follows: Section 2 reviews the literature on statistical filters and output gap, Section 3 focuses on the role of hotel occupancy rate and retail sales index for output gap computation, Section 4 stipulates the objectives and scope of BPS, Section 5 provides an overview of the research design, Section 6 concludes.

2. Literature review

There is no denying that univariate (Hodrick-Prescott, Band-Pass) and multivariate (Kalman) statistical filters play an important role in output gap estimation across central banks. In fact, leading central banks have already moved towards augmented statistical filters through the inclusion of enhanced variables or indicators in the computation of output gap (Borio et al. (2014)). However, this is not yet the case in Mauritius, where key variables are not computed and included in output gap estimation. The exclusion of enhanced variables or indicators in the calculation of output gap proves to be a major criticism by policymakers in Mauritius. Figure 1 presents the output gap of Mauritius using three filters namely Hodrick-Prescott, Band-Pass and Kalman for the period 2004Q2 to 2013Q4.

Figure1: Measuring output gap using univariate and multivariate filters



³ A description of the Mauritian economy is presented in the appendix.

In addition to the exclusion of key variables in output gap estimation, the use of univariate and multivariate filters has been subject to much criticism. Literature on statistical filter is widely reported by academics and central bankers. However, there is no consensus on the appropriateness of statistical filters for measuring output gap. The next section reports on the limitations of univariate and multivariate filters.

Lawrence et al. (1999) argue that the use of an ideal band-pass filter generally requires larger datasets than typical macroeconomic time series. Benati (2001) suggests that band-pass filtered output may provide a surprisingly bad proxy for structural output gap. He further advocates that band-pass filtering can alter key business cycle and create entirely spurious stylized facts. The application of band-pass filter can prove to be ineffective in economies where large datasets are not available and where structural breaks are common. This is regrettably the case in Mauritius.

French (2001) states that the choice of smoothness parameters of Hodrick-Prescott filters have rather been ad hoc. He also stipulates that the filter does not utilise a valid method for determining the desired gain on new data points at the end of the sample, thus facing the commonly known problem of end-sample bias. Harvey and Jaeger (1993) show that Hodrick-Prescott filters can introduce spurious features into output gap trend estimation. Following the work of Harvey and Jaeger (1993), Deserres et al. (1995) explored the limitations of Hodrick-Prescott filters and concluded that the pre-conditions needed for Hodrick-Prescott filters to successfully operate as an optimal filter are rarely met in practice. Although the use of Hodrick-Prescott filters is favoured in small open economies, there are existing limitations such as lack of large datasets and the calibration of the smoothness parameter λ that can distort output gap estimation.

The ever-growing popularity of the Kalman filter can be partly attributed to the weaknesses of the univariate filters. Nevertheless, Kalman filter still holds flaws such as being computationally complex, the use of iterative step to estimate the whole model and the time-consuming element in calibrating the variance or standard deviation of trends. Athans (1974) postulates that the use of Kalman filtering involves estimation of state variables whenever the actual measurements are influenced by white noise. Despite its inherent vices, Kalman filter remains the favoured filter for output gap estimation across central banks.

A review of the academic literature on statistical filters indicates that there is no consensus on the best filtering technique for output gap estimation. Nonetheless, the performance of filters can be enhanced through the use of new variables or indicators. In small open economies, the lack of data can pose significant problem to the proper estimation of output gap. However, the inclusion of additional indicators can augment both the reliability of statistical filters and the estimation of output gap. The next section details the introduction of new indicators, namely hotel occupancy rate and retail sales index in output gap estimation.

3. Role of hotel occupancy rate and retail sales index in output gap computation

The tourism sector has grown at a rapid pace over the last few decades and has been one of the leading contributors of GDP growth. However, it has been recently observed that the growth rate of tourist arrivals has been on a declining trend, while tourist earnings have been growing. Table 1 depicts the seasonally-adjusted year-on-year change in tourist arrivals and earnings of Mauritius for the period 2006Q-2013Q3.

Table 1: Declining tourist arrivals and earnings



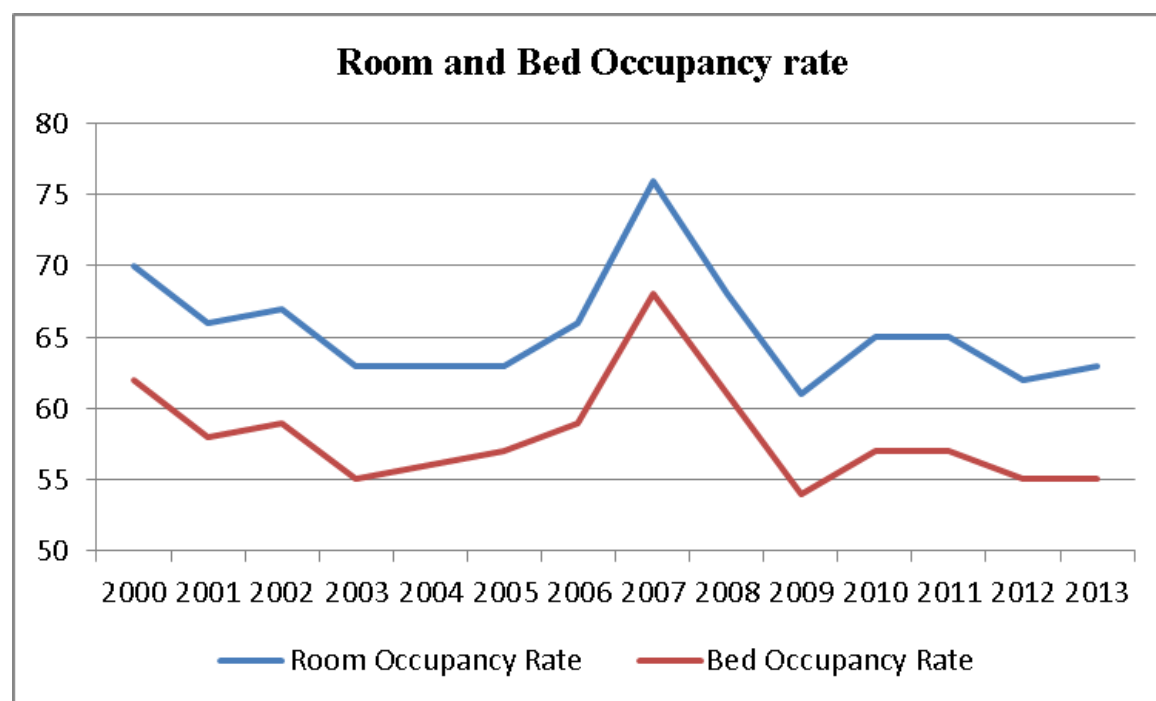
The inverse correlation between tourist arrivals and tourist earnings has not yet been properly explained by Government authorities. The existence of divergent views has undeniable lead to political commotion in Mauritius. The possible reasons for the inverse correlation between tourist arrivals and tourist earnings have been justified through the exclusion of money changers (used by tourists to exchange foreign currency), unreliable data sources and the lag period in collecting and transferring revenue from tour-operators to hotels, which ultimately remains unaccounted for the current accounting period. As a result, the computation of output gap through the use of tourist arrivals and tourist earnings remain contentious.

One possible way to correct the issues between tourist arrivals and tourist earnings in the estimation of output gap is the use of hotel occupancy rate⁴. Hotel occupancy rates are crucial

⁴ The existence of occupancy rate that are less than the hotel capacity means that there are lost selling opportunities, which leads to a depletion in the hotel revenue (Taha 2000. p 432).

ratios for countries where the tourism industry is a major portion of their GDP⁵. Hotel occupancy rate is measured using two standards, namely, room occupancy rate and bed occupancy rate. Table 2 shows the evolution of room and bed occupancy rate in Mauritius. Historical hotel occupancy rate data can be employed as a proxy for tourist arrivals and tourist earnings for the computation of output gap, instead of relying on inaccurate earnings data.

Table 2: Evolution of room and bed occupancy rate



Whilst retail sales index⁶ data is not yet compiled by Statistics Mauritius, several data collection agencies such as Singapore Department of Statistics⁷, United Kingdom Office of National Statistics and Central Statistics Office of Ireland have already broadened their data collection portfolios through regular compilation of retail sales index. The central bank literature shows that one of the variables employed by the Bank of England for the computation of output gap is retail sales data. In addition, the Central Bank of Colombia uses data from various sources such as sectorwise data and surveys to compile retail sales data,

⁵ Hotel occupancy rate is compiled by numerous statistical offices such as National Bureau of Statistics (Tanzania), National Bureau of Statistics (Seychelles), Statistics Mauritius and Government of Macau Special Administrative Region Statistics and Census Service.

⁶ The retail sales index (RSI) measure the short-term performance of retail industry based on the sales records of retail establishments. Sales figure refers to the value of retail goods sold to consumers during the month, excluding taxes on products such as Goods and Services Tax (GST), Additional Registration Fee (ARF) and Certificates of Entitlement (COE).

⁷ In Singapore, the retail sales index is presented at both current prices and constant prices. The index at current prices measures the changes of sales values which can result from changes in both price and quantity. By removing the price effect, the index at constant prices measures the changes in the volume of economic activity. (Department of Statistics Singapore, 2014).

thus creating a coherent assessment of the demand situation (Rodriguez et al. 2006). Studies conducted by the Hong Kong Institute for Monetary Research indicate that there is a strong positive correlation between retail sales and GDP (Gerlach and Yiu (2004)).

The role of retail sales index as a good predictor of output gap can be established based on the above-mentioned studies. However, the interaction between hotel occupancy rate and output gap remains an area where literature is limited or practically inexistent. The next section introduces BPS.

4. Objectives and Scope of BPS

The objective behind conducting the BPS is to collect information from businesses on the following themes: demand, capacity pressures and forward-looking views on economic activity. It also aims at gathering information from selected firms in different industries on topics of interest. (E.g. Long-term views on business activities).

Firstly, the objectives of BPS are to capture data on business activity with regard to changes in sales volume over the last 12 months and future 12 months and full-time employment. Secondly, BPS aims at identifying pressures on production capacity by assessing potential difficulty in meeting an unplanned increase in demand or sales and shortages of labour restricting ability to meet demand. The BPS also helps in collecting information on variables which are difficult to quantify and forecast through macroeconomic models. As such, BPS helps in identifying pressures on production capacity and hence presents a better outlook on inflationary pressure.

BPS aims at covering firms based on industry contribution to Mauritius' Gross Domestic Product. The key advantage of running BPS is that it provides practical perspectives on the evolution of economic activity as witnessed and forecasted by businesses. The BPS also provides an opportunity to obtain a viewpoint on business developments in the Mauritian economy. The results of the BPS can also be presented to the Monetary Policy Committee (MPC) on a quarterly basis so as to aid in monetary policy decision making process.

5. Research Design

This section reports on the research design and methodology.

5.1 Target Population

The survey will cover firms, sampled from the latest sector-wise contribution to Gross Domestic Product statistics⁸. As a representative profile of the Mauritian economy, participants in BPS will be private sector firms.

5.2 Sample

Presently, it is not possible to consider undertaking the BPS with the whole population due to time and labour constraints. The Statistics Division of the Bank of Mauritius already conducts surveys such as Inflation Expectations and FALS and as such, has a pre-defined list of firms from different sectors that can be concurrently used to run BPS. The methodology adopted in selecting the sample is simple in nature. Firstly, sector contribution to GDP for the year 2013 is explored and sectors with the biggest contribution to GDP are ranked accordingly. Secondly, market leaders in the selected sectors are identified. Participation in the BPS is on a voluntary basis. If a firm is unavailable or unwilling to participate in BPS, another firm will be selected so that the profile of selected firms is maintained.

5.3 The Questionnaire

The BPS questionnaire is divided into 3 main parts⁹:

- (i) A question about past business conditions
- (ii) Questions that explore the outlook for business activity
- (iii) Questions that gauge pressures on production capacity

Firms are asked to provide qualitative responses about their past and present economic activities. The newly designed BPS uses a three-part scale for measuring responses - greater/less/same. A balance of opinion¹⁰ is then used to summarise the responses obtained. It is to be noted that the statistical reliability of the BPS results is restricted due to small sample size.

6. Conclusion

This paper postulates the idea of employing hotel occupancy rate and retail sales index to improve the computation of output gap. The use of new variables can augment the performance of statistical filters, thus resulting in better output gap estimation. Since retail sales index is not compiled by the Statistical Office in Mauritius, this paper formulates a survey-based approach in order to capture it. Subsequently, BPS has been designed and the

⁸ See Appendix Two for sector wise distribution of GDP for 2013 and historical distribution of GDP by industry group (2006-2013).

⁹ See Appendix Three for BPS questionnaire.

¹⁰ A balance of opinion is a useful way of summarizing these types of responses. The balance-of-opinion data are constructed by subtracting the proportion of negative responses from the proportion of positive responses. Values can range from -100 to +100.

pilot-testing stage is forthcoming. The BPS remains a work-in-progress and stages such as final survey design, sensitization campaign and evaluation are projected in the near future.

Appendix 1: Description of the Mauritian economy

Mauritius has evolved from a low-income, agriculture-based economy to a middle-income diversified economy. The Mauritian economy is dependent on four pillars, namely financial services, textile, tourism and sugar. However, in an attempt to diversify the economy emerging sectors such as information and communication technology, seafood, hospitality and property development, healthcare, renewable energy and education are being encouraged to grow. Since independence in 1968, Mauritius gradually adapted to changing world conditions and as such, structured its economy to remain competitive. Research by World Economic Forum (WEF) classifies Mauritius at an efficiency-driven stage (WEF report 2013). Since 2005, the competitive analysis of the WEF is based on the Global Competitiveness Index (GCI), which is a broad measure of microeconomic and macroeconomic foundations of national competitiveness. The 2013-2014 WEF report shows that Mauritius is ranked 45th in the world, becoming the highest ranked country in sub-Saharan Africa. An overview of the GCI shows that between 2001 and 2013, ranking of Mauritius has fluctuated widely, ranging from 32 to 60. This is an indication that of the struggle that Mauritius has faced in order to remain competitive.

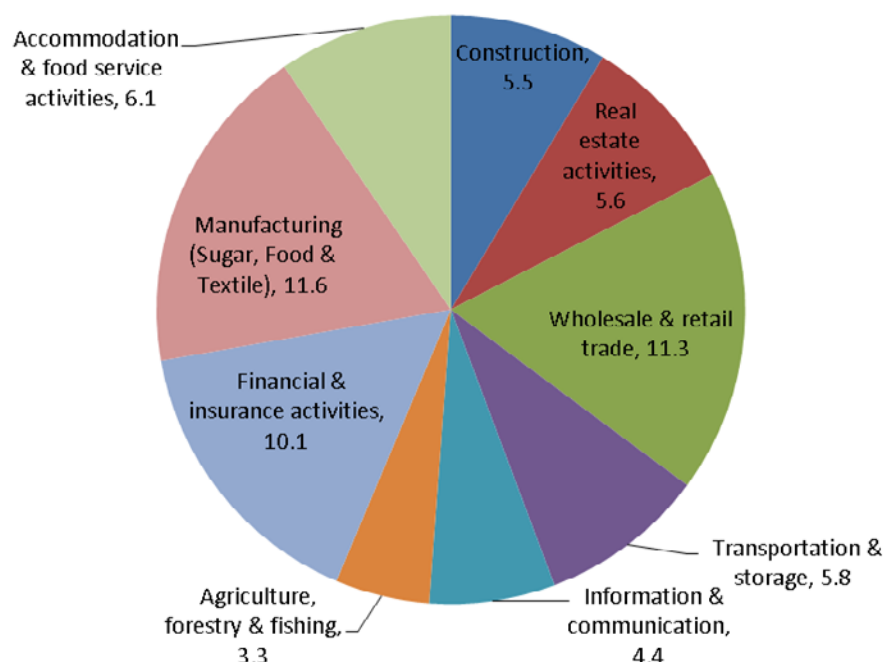
Quick Facts¹¹

- GDP per capita: approx. USD 9,300 (2013)
- Sovereign rating by Moody's: BAA1 (2013)
- Population: approx. 1.3 million
- Political System: Democracy with free and fair elections held every 5 years
- Official Language: English
- Legal System: dual system (Common & Civil Law)
- GDP Growth: 3.2% (2013)
- Unemployment: 8.3% (2013)
- Inflation: 3.6% (2013)
- Repo Rate: 4.65% (as at date)

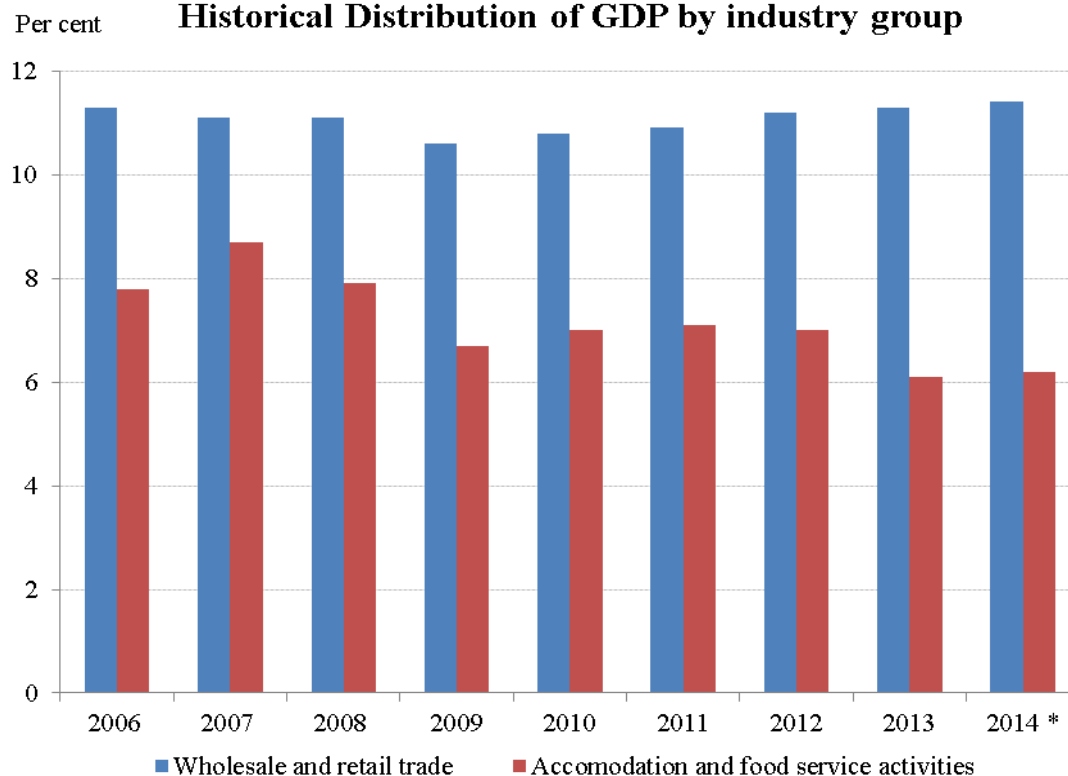
¹¹ Quick facts were obtained from the Board of Investment website (www.investmauritius.com).

Appendix 2: GDP composition

GDP - Sectorwise Distribution (%) - 2013



Historical Distribution of GDP by industry group



Appendix Three: Business Perspective Survey Questionnaire



Bank Of Mauritius

BUSINESS PERSPECTIVE SURVEY

SURVEY MONTH: Month 201X



The purpose of this Survey is to collect information from businesses on demand and capacity pressures on economic activity.

Please e-mail back this survey form not later than XX Month 201X at XXX@bom.mu

Name of Institution:

All individual responses will be kept in strict confidentiality.

PAST BUSINESS CONDITIONS

1. PAST REVENUE GROWTH

Over the past 12 months, the rate of increase in your organisation's turnover (compared with the previous 12 months) was:

- (a) Greater ☐
- (b) Less ☐
- (c) The Same ☐ *(Please tick as appropriate)*

OUTLOOK FOR BUSINESS ACTIVITY

2. FUTURE SALES GROWTH

Over the coming 12 months, the growth rate in your organisation's turnover (with respect to the past 12 months) is expected to be:

- (a) Greater ☐
- (b) Less ☐
- (c) The Same ☐ *(Please tick as appropriate)*

3. FUTURE EMPLOYMENT LEVEL

Over the coming 12 months, how do you expect the level of employment in your organisation to be?

- (a) Greater ☐
- (b) Less ☐
- (c) The Same ☐ *(Please tick as appropriate)*

PRESSURES ON PRODUCTION CAPACITY

4. ABILITY TO MEET DEMAND

To what extent do you believe your organisation will face any difficulty in meeting an unexpected increase in demand?

- (a) Significant difficulty ☐
- (b) Some difficulty ☐
- (c) No difficulty ☐

5. LABOUR SHORTAGES

Over the past year, has your organisation faced any shortfall in labour that hindered your ability to meet demand?

- (a) Yes ☐
- (b) No ☐

Thank you for participating in our Survey

Contact Person:

Contact Number:

Designation:

Email:

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