Box Article 1.1

RELATIONSHIP BETWEEN GROSS DOMESTIC PRODUCT AND EMPLOYMENT

Overview

Economic activity in Singapore has slowed since the second quarter of 2022, and the labour market has also shown signs of cooling in recent quarters. Historically, labour market conditions tend to lag changes in economic activity. This box article examines the relationship between economic activity and labour market conditions, specifically that between real Gross Domestic Product (GDP) growth and employment growth, in Singapore.

Economic Activity and its Impact on the Labour Market

The academic literature postulates several reasons why a change in economic activity may affect the labour market with a lag. First, adherence to hiring practices could delay employment responses to changes in economic activity (Australian Bureau of Statistics, 2006; Edwards & Gustafsson, 2013). For example, the hiring process may take up to several months as employers have to advertise a job posting before evaluating suitable candidates. Employment contracts may also stipulate notice periods of a few months before an employee can leave.

Second, faced with hiring rigidities, firms may choose to temporarily increase production without hiring more workers by maximising the utilisation of existing resources when economic activity picks up (Reserve Bank of Australia, 2014). Conversely, during a downturn, firms may hold on to their workforce and delay retrenchments, possibly because of minimum staffing requirements or employment contracts and/or to avoid losing the human capital that they have invested in, even as they cut production (Kuan, 2022).

Third, sector-specific characteristics and policies to support local employment during downturns may affect local employment responses to changes in economic activity in Singapore (Chan & Tang, 2012). For example, sectors that are reliant on temporary or part-time workers may see a shorter lag in employment responses. Government support during economic crises may also incentivise firms to hold on to their local manpower despite a decline in economic activity.

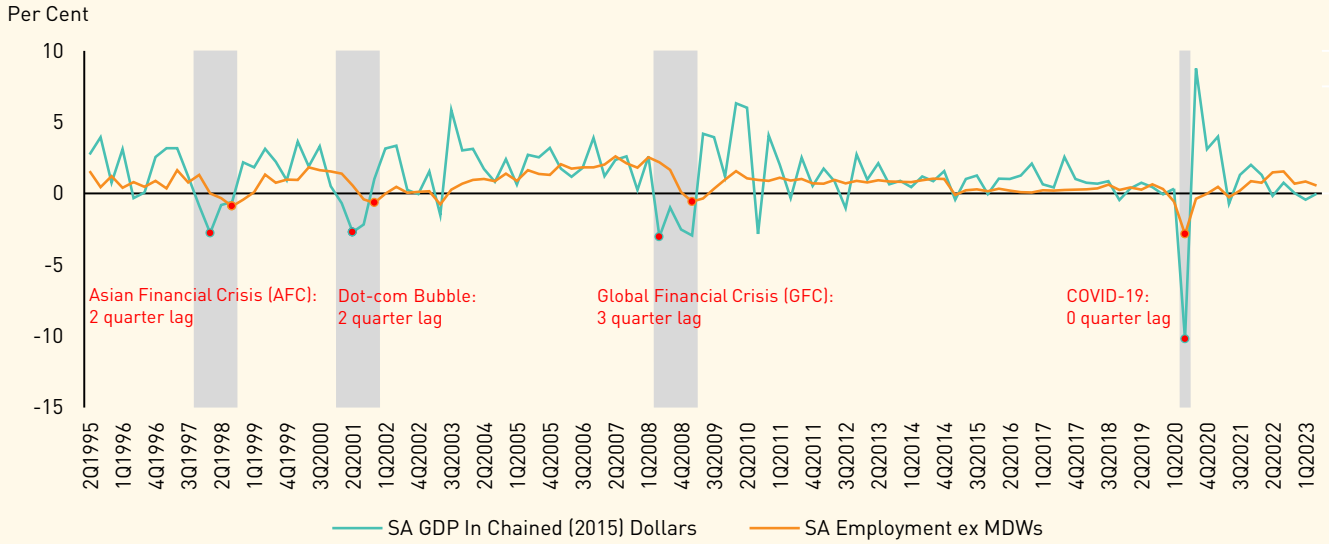
Based on a scan of the literature, apart from Chan & Tang (2012), several authors have documented the relationship between employment and economic activity in various economies (Akkemik, 2007; Chen, 2014; Ciuhu & Vasile, 2018). On the other hand, other authors have examined the relationship between economic activity and labour market conditions through the lens of Okun's law, which models the changes in GDP against changes in unemployment (Elbourne & Teulings, 2011; Reserve Bank of Australia, 2014; Sadiku et al., 2015; Omitogun & Longe, 2017; Di Iorio & Triacca, 2022). The latter empirical approach is useful in labour markets with sufficient fluctuations in unemployment rates. However, as unemployment rates in Singapore tend to be stable over extended periods of time, this study focuses on changes in employment instead.

The rest of the article is organised as follows. First, we descriptively identify the timing of the troughs in real GDP and employment during past periods of economic downturns in Singapore. Next, we run a vector autoregression (VAR) analysis to estimate the lag and magnitude of the employment response subsequent to a real GDP shock. Similar to Chan & Tang (2012), we exclude the construction sector from our analysis as its business cycles did not align closely with that of the wider economy. The last section concludes.

Trough-to-trough Analysis of Real GDP and Employment

Using quarter-on-quarter seasonally-adjusted (qoq sa) real GDP and employment data from 1Q1995 to 2Q2023, we compare the difference in the timing of the troughs in both data series. Exhibit 1 shows that changes in employment tended to lag GDP shocks by two to three quarters, as seen during the Asian Financial Crisis, Dot-com Bubble Bust and Global Financial Crisis. By contrast, the real GDP-employment dynamics during the COVID-19 pandemic exhibits an atypical contemporaneous relationship. This was partly because of the stringent measures put in place, especially border restrictions, to limit the spread of the pandemic, which had simultaneously curbed both economic activity and the inflow of non-resident workers.

Exhibit 1: Quarter-on-quarter Real GDP and Employment Growth in Singapore (excluding Migrant Domestic Workers (MDWs) and Construction Sector), 1Q1995 – 2Q2023



Sources: Ministry of Manpower, Singapore, Singapore Department of Statistics

Notes: Employment data excludes MDWs and employment count in the construction sector, while the real GDP data excludes real value-added from the construction sector. Red dots on the charts represent the trough employment and real GDP change on a quarter-on-quarter basis during each of the following downturns: Asian Financial Crisis, Dot-com Bubble Bust, Global Financial Crisis, and COVID-19 Pandemic.

VAR Analysis of Real GDP and Employment

To formally examine the dynamics of the real GDP-employment relationship, we use a VAR model to estimate the lag and magnitude of the employment response to changes in real GDP.[1] Apart from real GDP, we also include wages as proxied by average monthly earnings (AME) in the model. We postulate that including wages would better account for the effects of policy measures that affect employment through wages, e.g., the Job Support Scheme during COVID-19.

1 *Our theoretical framework is motivated by Tan et al. (2002)'s study, where they derived the dynamics between employment changes and economic growth through the theory of marginal productivity and labour demand. In particular, a positive GDP shock that leads to an increase in marginal productivity and thus labour demand would result in positive employment responses.*

The VAR methodology models the interdependencies between multiple time series and estimates how each variable responds to shocks in the other variables. The resulting impulse response functions (IRFs) shed light on the magnitude and persistence of the impact of a shock to a variable in the model on the other variables, assuming no further shocks. The system of equations is as follows:

$$\Delta Emp_t = c_1 + \sum_{i=1}^{p} (\Delta Emp_{t-i} + \Delta GDP_{t-i} + \Delta AME_{t-i}) + u_{1t}$$
$$\Delta GDP_t = c_2 + \sum_{i=1}^{p} (\Delta Emp_{t-i} + \Delta GDP_{t-i} + \Delta AME_{t-i}) + u_{2t}$$
$$\Delta AME_t = c_3 + \sum_{i=1}^{p} (\Delta Emp_{t-i} + \Delta GDP_{t-i} + \Delta AME_{t-i}) + u_{3t}$$

where:

- Emp_t refers to Singapore's employment (excluding MDWs and workers in the construction sector) in quarter t;
- GDP_t refers to Singapore's real GDP (excluding the real value-added of the construction sector) in quarter t;
- AME_t refers to real average monthly earnings;
- c denotes a set of constants;
- u_t denote the error terms

The optimal lag order of the VAR model is selected based on the Akaike's Information Criterion (AIC). We also transform the data using a log-difference transformation to ensure stationarity. Augmented Dickey-Fuller (ADF) tests, which test the null hypothesis that a unit root is present in the series against the alternative hypothesis of stationarity, indicated stationarity in the three variables after transformation. We then derive IRFs from the estimated VAR model, with a focus on analysing the magnitude and persistence of employment changes over time in response to an exogenous one-off shock to real GDP.

We also conduct heterogeneity analyses by estimating the VAR model for the manufacturing and services sectors to provide additional insights for these broad sectors.

Results of VAR Analysis

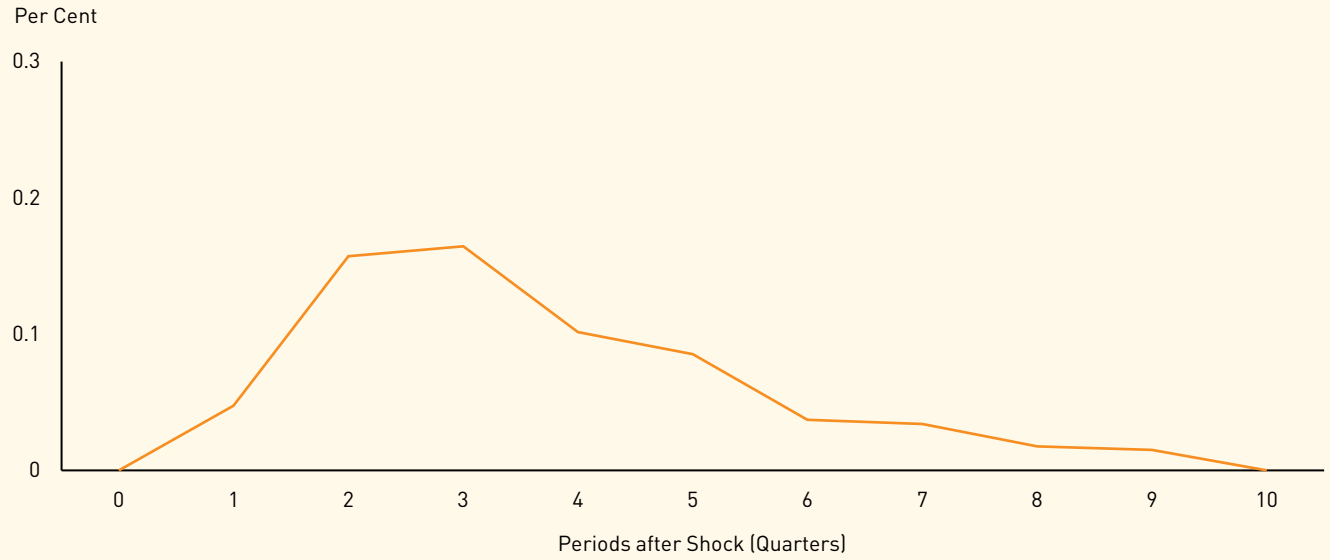
Overall Economy

The results show that given a one-off 1 per cent increase in real GDP, employment growth peaks three quarters after, before tapering off in subsequent quarters (Exhibit 2). The delayed employment response to changes in economic activity is consistent with the presence of labour market frictions, including the time taken by firms to assess the persistence of the economic shock before adjusting their manpower needs. Cumulatively, employment increased by 0.37 per cent in the first three quarters after the initial shock to real GDP, and 0.66 per cent by the tenth quarter.[2] The persistence in the employment response suggests that businesses tend to gradually expand their workforce to meet the increased demand for goods and services, leading to a permanently higher level of employment after the initial real GDP increase, in the absence of a further shock to real GDP.

These findings are consistent with the trends observed in the earlier trough-to-trough analysis, and are also robust to the use of the Bayesian Information Criterion (BIC) to select the optimal lag for the VAR model as well as the exclusion of AME from the model.

2 *It should be noted that the estimates lose statistical significance at the 5% level from the sixth quarter onwards.*

Exhibit 2: Impulse Response Function of Employment from Shock in Real GDP for the Overall Economy



Source: MTI staff estimates

Notes: Y-axis indicates the change in employment (in percentage terms) following a shock in real GDP. Employment data excludes MDWs and employment count in the construction sector, while the real GDP data excludes real value-added from the construction sector.

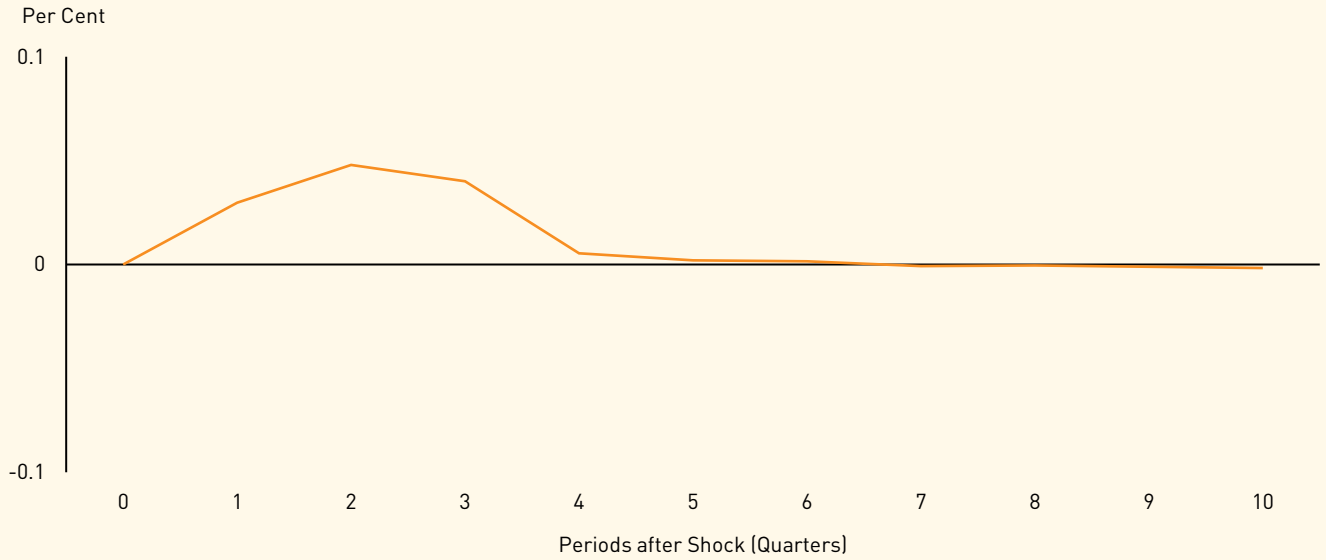
Manufacturing Sector

For the manufacturing sector, employment responds more swiftly to a 1 per cent increase in the real value-added (VA) of the sector, with employment growth peaking two quarters after the initial shock and tapering off rapidly thereafter (Exhibit 3). While the peak impact on employment in the manufacturing sector is realised faster than in the overall economy, the magnitude of the impact is smaller. The IRF indicates that a 1 per cent increase in the real VA of the sector translates to a cumulative increase in employment within the sector of 0.12 per cent by the third quarter, with minimal further increases thereafter.[3]

There are two possible explanations for these findings. First, changes in the real VA of the manufacturing sector are generally more pronounced compared to changes in employment within the sector, and this would likely manifest as a smaller employment response to a change in real VA in the sector. For example, within the manufacturing sector, the pharmaceuticals segment is subject to plant-level production schedules that may not have an impact on employment. Second, the smaller response in employment could reflect the highly productive nature of the sector as manufacturing activities tend to be capital intensive.

3 *It should be noted that only the estimate for the second quarter is statistically significant at the 5% level, although the estimate for the first quarter comes close to being statistically significant.*

Exhibit 3: Impulse Response Function of Employment from Shock in Real VA in the Manufacturing Sector



Source: MTI staff estimates
Notes: Y-axis indicates the change in employment (in percentage terms) following a shock in real GDP.

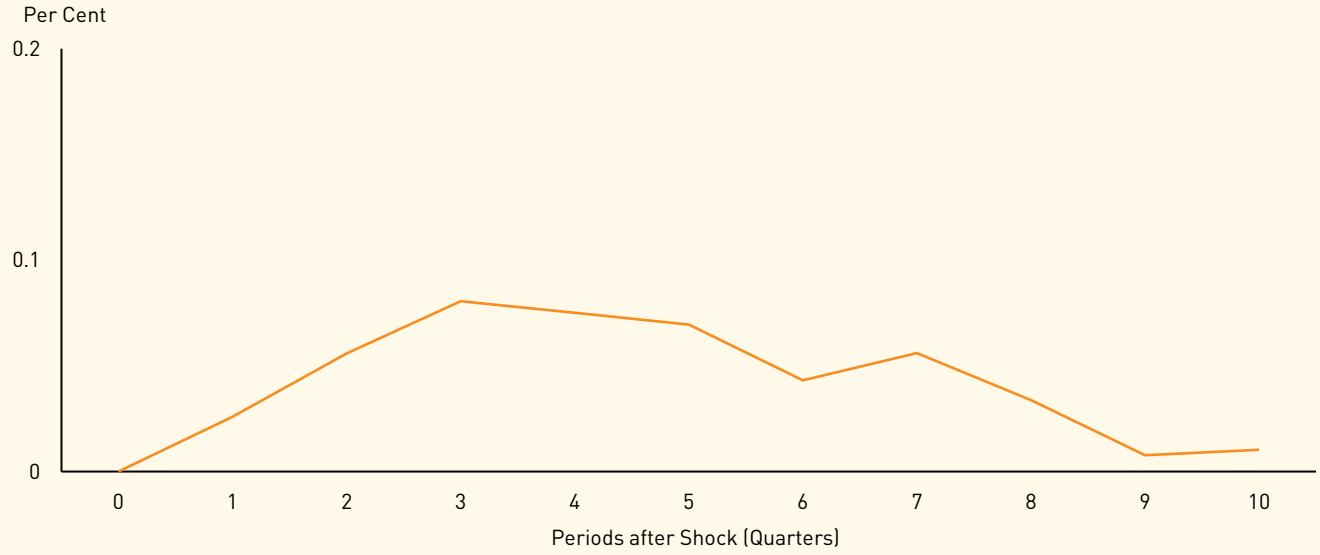
Services Sector

Given a 1 per cent increase in real VA in the overall services sector, employment growth in the sector is found to peak after three quarters, before gradually tapering over the subsequent quarters (Exhibit 4). The persistence displayed in the IRF indicates a more extended employment response compared to the IRFs of the overall economy and the manufacturing sector. Cumulatively, employment increased by 0.16 per cent in the first three quarters after the initial shock to real GDP and 0.46 per cent by the tenth quarter.[4]

While we have presented the results for the services sector as a whole, there could be heterogeneity in the relationship between employment and real VA in the various services sectors. For instance, the information & communications sector typically experiences longer product development cycles and requires more specialised skillsets. As a result, firms in the sector may not adjust their employment significantly in response to an economic shock. Over time, as the digital economy matures and becomes more saturated, firms in the information & communications sector may become more sensitive to business cycles. On the other hand, firms in the retail trade and food & beverages services sectors tend to rely on temporary or part-time workers to meet fluctuating customer demand and could hence be more responsive in adjusting the size of their workforce in response to an economic shock.

4 *These figures should be taken as indicative as the estimates are not statistically significant at the 5% level, possibly due to heterogeneity across the various services sectors.*

Exhibit 4: Impulse Response Function of Employment from Shock in Real VA in the Services Sector



Source: MTI staff estimates

Notes: Y-axis indicates the change in employment (in percentage terms) following a shock in real GDP. Employment data excludes MDWs.

Summary and Concluding Remarks

Our study finds that a shock to real GDP affects employment growth in Singapore, although the amplitude, timing and persistence vary across sectors. In particular, our results, through the trough-to-trough analysis and VAR model, show that for the overall economy, employment growth peaks around two to three quarters after a shock to real GDP. This is corroborated by our experience in recent quarters, where employment growth started to slow a few quarters after real GDP growth slowed. Specifically, while real GDP growth slowed in 2Q2022 on a qoq sa basis, employment growth began to ease only two quarters later in 4Q2022.

Looking ahead, the expected pickup in real GDP growth over the course of 2024 should lend some support to employment growth towards the end of 2024 or early 2025. At the same time, the Government remains committed to continuing to support workers and jobseekers such as through Workforce Singapore's Career Conversion Programmes, and also to helping companies make their jobs more productive and attractive to jobseekers through the Support for Job Redesign under Productivity Solutions Grant.

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