Box A: Labour Market Tightness and the Beveridge Curve in Singapore

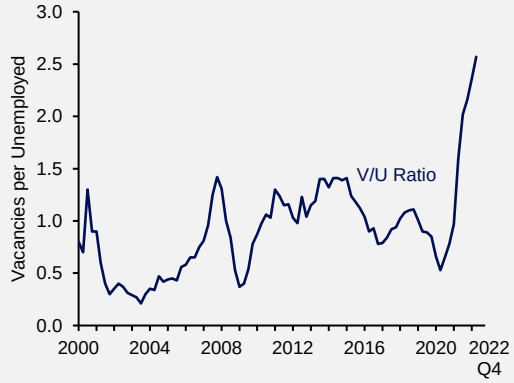
This Box item provides possible explanations for the recent labour market tightness in Singapore and draws out their broader economic implications. Following the removal of pandemic-related mobility restrictions, economic activity and demand for labour has risen strongly. As a result, unemployment declined steadily in 2021–22 and has stayed below the pre-COVID average of around 3.0% since Q3 2022. Further, the vacancy-to-unemployment ratio has exceeded 2 since Q3 2021, signalling that the job market has been unusually tight when compared to previous economic recoveries **(Chart A1)**.

The Beveridge Curve Framework

While the resident unemployment rate has been low in recent quarters, it may not fully reflect the difficulty employers are having in finding staff, and hence, the degree of labour market tightness. For a more complete understanding of labour market conditions, this Box item investigates Singapore's Beveridge curve—the inverse relationship between the vacancy rate and the unemployment rate in the economy. Blanchard *et al.* (1989) and Mortensen and Pissarides (1994) present search-theoretic frameworks that provide intuitive explanations for this relationship. During a period of strong economic growth, worker productivity rises, which increases the marginal benefit of new workers. Firms thus create more job vacancies, thereby raising the probability of unemployed workers finding jobs. The result is an association between a rise in job vacancies and a fall in unemployment.

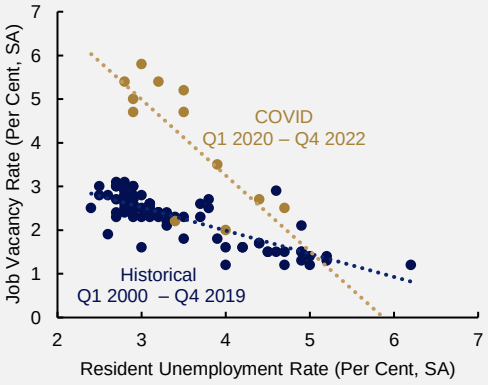
Over the course of a typical business cycle, strong economic conditions usually lead to a tightening of the labour market, as represented by a leftward movement along the Beveridge curve. However, in recent quarters, declining unemployment in Singapore has been accompanied by increases in vacancy rates that have been larger than expected, based on the observed historical relationship between these two variables **(Chart A2)**. In effect, the Beveridge curve seems to have shifted rightward, even as the recovery in economic activity has induced a leftward movement along this curve.

Chart A1 Vacancy/Unemployment ratio



Source: MOM

Chart A2 Beveridge Curve 2000–2022



Source: MOM and EPG, MAS Estimates

Declining Matching Efficiency

Search-and-matching models of the labour market as expounded by the earlier references offer a way to understand the possible causes of a rightward shift in the Beveridge curve. At the core of these models is an assumption about how new job matches are formed, which is represented as a "matching function".

$$m_t = \sigma_t v_t^{\alpha} u_t^{1-\alpha} \quad (1)$$

In equation (1), m_t , v_t and u_t represent the number of new job matches, job vacancies and unemployed workers at time t, respectively. σ_t represents matching efficiency in the labour market, i.e., the rate at which unemployed workers are paired to job vacancies. The equation states that if efficiency σ_t falls, the number of vacancies required to maintain a constant rate of job matches rises for a given number of unemployed workers. In effect, a fall in σ_t would cause the Beveridge curve to shift to the right.

A fall in matching efficiency during the present recovery can be explained in two ways. Firstly, there could have been a structural reallocation of labour demand across economic sectors, which is especially likely to have occurred due to disruptions caused by COVID-19. If during 2020 to 2022, the pandemic had truly led firms to demand a new set of skill profiles but workers were unable to acquire them in the near term, employers would have greater difficulty hiring workers with the required skills. As a result, vacancies would rise even with sufficient unemployed workers to fill them. At the aggregate level, this is equivalent to a decline in matching efficiency (see for example, Blanchard, Summers and Domash, 2022).

A second explanation relates to broad-based labour supply constraints, driven by the protracted decline in the non-resident workforce from 2020–22, and is likely to be particularly relevant for Singapore. When non-resident labour supply is constrained, firms typically look towards the resident workforce to fill job vacancies. If resident workers cannot readily take on the jobs typically performed by non-residents, i.e., if residents' labour inputs are not highly substitutable with that of non-residents, vacancies will remain unfilled for longer durations, leading to an increase in the stock of vacancies. This would also contribute to a fall in labour market matching efficiency.

To investigate if such an empirical relationship existed between non-resident employment and vacancies in Singapore, the following regression model using quarterly data from 1992 to 2019 is estimated.

$$\text{Vacancy Growth}_t = \gamma_0 + \gamma_1 \text{GDP Growth}_{t-1} + \gamma_2 \text{NonRes Emp Dev}_t + e_t \quad (2)$$

The model in equation (2) tests for a linear relationship between the quarterly growth in job vacancies and the deviation of non-resident employment from its trend value using the previous quarter's GDP growth rate (or alternatively, output gap) as a simple control for the effect of aggregate demand changes on job vacancies. The parameter of interest is γ_2, which can be interpreted as the response of vacancies to excesses or shortfalls in non-resident labour supply.

Table A1 Vacancy Rate Regression Estimates

Dependent Variable	Change in Vacancy Rate (% Point)	
Sample	Q1 1992–Q4 2019	
	Specification	
	No Output Gap (1)	No GDP Growth (2)
Constant	−0.08***	−0.09***
	(0.03)	(0.03)
Q-O-Q SA GDP Growth (%)	0.04*	
	(0.02)	
Output gap (%)		0.07*
		(0.04)
Deviation of non-resident employment from trend (100,000s)	−0.30**	−0.28**
	(0.14)	(0.12)
S.E. of regression	0.4	
F-Statistic	6.8	

Note: Hodrick-Prescott filter applied to non-resident employment level with lambda equalling 1600. Newey-West standard errors in parentheses.
* Statistically significant at 10% level
** Statistically significant at 5% level
*** Statistically significant at 1% level

Table A1 shows that as expected, the coefficient on the deviation of non-resident employment from its trend is negative and statistically significant, once aggregate demand conditions are controlled for. Specifically, a decline below trend of the non-resident workforce by 100,000 workers is associated with a 0.3% point rise in the overall job vacancy rate. When estimated at the sectoral level, the coefficient is also negative and significant for the accommodation, F&B and information & communications sectors, showing that foreign labour supply influenced the number of vacancies created.

Decomposing Beveridge Curve Shifts

Understanding the respective contributions of structural reallocation and non-resident labour supply constraints to recent labour market tightness has important implications and helps to inform the right mix of policies for alleviating matching frictions. If falling matching efficiency was related to reallocation of labour demand due to COVID-19 dislocations, elevated job vacancies may last for an extended period, as the workforce will need time to retrain and acquire the skills required by firms. Conversely, if the decline in matching efficiency was primarily due to shortfalls in the non-resident labour force, vacancy rates should return to pre-COVID norms when the supply of foreign workers returned to its trend level.

To estimate changes in matching efficiency in the Singapore labour market during 2020–22, the decomposition method in Ahn and Crane (2020) is modified to take into account the effects of non-resident labour supply. The application of the Ahn-Crane framework entails two broad steps. First, the parameters for a search-and-matching model of the labour market, notably the Cobb-Douglas parameters in equation (1), are estimated.

Second, an equilibrium relationship between changes in unemployment, the job separation rate, matching efficiency, and the number of job vacancies is used to decompose observed changes in the vacancy rate into two components—cyclical factors and matching efficiency changes due to reallocation of labour, using the estimated parameters from the first step. In the analysis here, the method is extended to include a third component, the deviation of the non-resident workforce from its average level in 2010–19:[1]

$$\text{Vacancy Dev}_t = F(\text{Cyclical}_t, \text{Reallocation}_t, \text{NonRes Emp Dev}_t) \quad (3)$$

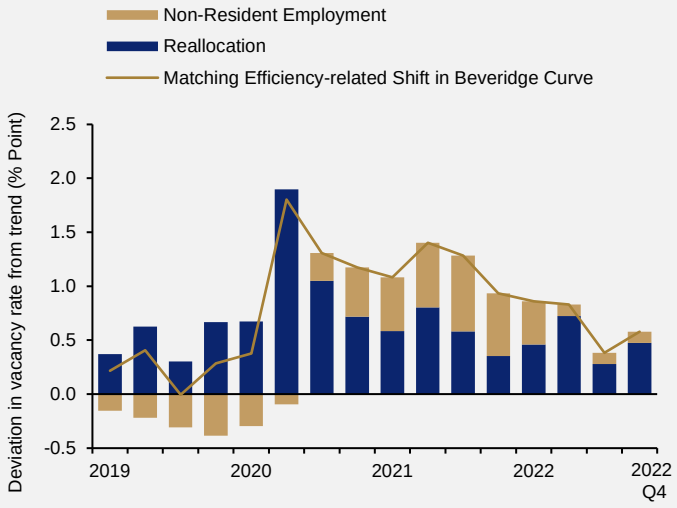
Aside from cyclical factors,[2] deviations in the job vacancy rate may also be attributed to shifts in the Beveridge Curve, arising from two components:

i) Non-resident employment: A shortfall of non-resident workers would lead to higher vacancies if resident workers cannot readily fill available job vacancies.

ii) Reallocation of labour demand: A shift in the skills demanded in the economy would lead to higher vacancies if available resident workers cannot supply those skills.

For the period Q1 2019–Q4 2022, the results of the decomposition are shown in **Chart A3**.

Chart A3 Decomposition of Beveridge Curve Shifts



Source: EPG, MAS estimates

Note: The reallocation and non-resident employment components sum up to the total shift in the Beveridge curve that can be attributed to changes in matching efficiency, with a positive (negative) number corresponding to a rightward (leftward) shift.

[1] Formally, equation (1) is modified to include the deviation of non-resident employment from trend as an additional variable that affects matching efficiency. Matching function parameters, including α, are then estimated via a regression of the ratio of quarterly job matches to unemployed workers, on the ratio of quarterly job vacancies to unemployed workers and the deviation of non-resident employment from trend. Finally, these matching function estimates are used as parameters in the modified Ahn-Crane model to decompose deviations in vacancies from trend into three components. The cyclical component of the decomposition uses time series data on the unemployment rate and job separations, while the non-resident component uses data on the deviation of non-resident employment from trend, and the reallocation component is calculated as a residual.

[2] The cyclical component is a combination of the dynamic and job separations components in Ahn and Crane (2020).

The estimates indicate that from 2020 to 2022, the Beveridge curve in Singapore shifted significantly to the right due to reduced matching efficiency, which accounted for 1.2% point, or 73%, of the average quarterly increase in the job vacancy rate over Q2 2020–Q4 2022, relative to the 2010–19 norm. The remaining 27% of the increase can be attributed to cyclical factors. Both the reallocation and non-resident employment components contributed to this fall in matching efficiency, but their relative contributions varied over the period. When circuit breaker measures were implemented in Q2 2020, the reallocation component contributed to almost the entire rightward shift of the Beveridge curve, as severe restrictions on high physical contact sectors resulted in a significant shift in the sectoral composition of labour demand for the overall economy.

In H2 2020 and 2021, limitations on inbound travel to Singapore led to a sharp fall in non-resident employment. Consequently, mismatch due to non-resident worker shortfalls rose, accounting for more than half of the Beveridge curve shift in H2 2021. In 2022, as the overall non-resident workforce recovered, matching efficiency improved, shifting the Beveridge curve to the left and partially reversing its rightward shift during the pandemic. Consequently, excess vacancies fell over the course of 2021–22 relative to its Q2 2020 peak. Meanwhile, the importance of the reallocation component relative to the non-resident employment component rose, suggesting that skills mismatch may still be an important reason for the movement of the Beveridge curve to the right.

The persistent skills mismatch between labour demand and the resident workforce might have arisen after the onset of COVID-19 as businesses had accelerated their transition towards digital solutions, such as e-commerce and work from home applications, in response to pandemic distancing requirements. The increased demand for such applications has endured, raising the need for more software developers and employees conversant with digital technologies. Correspondingly, software developers and managers were among the top PMET occupations by number of job vacancies in 2021–22, while e-commerce related roles such as delivery drivers have also seen significant increases in job vacancies.[3]

Sum-up

The analysis in this Box item has shown that the large decline in non-resident employment contributed significantly to a rightward shift of the Beveridge curve in Singapore over 2020–21, but it cannot fully explain elevated vacancy rates in recent quarters. Structural shifts in the labour market accounted for a significant portion of the shift, suggesting that increased matching frictions in the labour market may be persistent. Possible causes include accelerated digitalisation by firms, leading to an increased demand for technology skills that continue to be in short supply at least in the near term. Shifts in the composition of the non-resident workforce, giving rise to skill shortages in specific sectors such as health and social services, also played a role. Existing efforts to equip the existing workforce with skills in these areas include Career Conversion Programmes to equip jobseekers and workers with new skills. The Empower Pillar of the Forward Singapore Exercise also seeks to better enable resident workers to take charge of and improve their career prospects. To facilitate the inflow of non-resident workers who augment the workforce in areas of skill shortages, initiatives such as the COMPASS framework have been introduced. Further enhancement of such efforts would help to reduce matching frictions arising from these structural shifts.

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[3] Software, web & multimedia developers and software & applications managers have been among the top 10 vacancies in PMET jobs, while car, taxi, van & light goods vehicle drivers have been among the top 10 vacancies in non-PMET jobs in MOM's annual job vacancies reports in 2021–22.

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