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Research Article

The Maltese labour market through the lens of the Beveridge curve

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Abstract. This study examines labour market developments in recent periods of rapid economic growth. The shifts in the Beveridge curve, which shows the relationship between unemployment and job vacancies, are analysed to isolate transient changes in the relationship between vacancies and unemployment and the efficiency of labour market matching. The inflow and outflow risk rates are estimated for the period 1998-2022. The results show, among other things, that the matching efficiency — how effectively job seekers are paired with suitable job opportunities — improved while the job separation rate — the frequency at which workers leave their jobs — decreased over the years. The study also looks at searching externalities to show that the congestion effects caused by firms are greater than those caused by workers. The paper shows that in recent years, the negative externality caused by firms themselves has not materialised into a higher natural unemployment rate, as it has also been demonstrated that matching efficiency has increased too.

1 Introduction

Between 2013 and 2016, the Maltese economy grew remarkably well. Real GDP grew at an average rate of 7.3% per year, accompanied by dynamic job creation that brought unemployment to a record low of 4%. From 2010 to 2016, the relationship between unemployment and job vacancies, known as the Beveridge curve, appears to have shifted inward (Baldacchino & Cassar, 2022), suggesting improvements in matching efficiency, i.e., how effectively job seekers are paired with suitable job opportunities. The decline in the unemployment rate to a record low has prompted debates as to whether the underlying positive trends in the labour market are structural (Vella & Vella, 2015) and, if so, whether the low unemployment rate could persist once economic momentum weakens. The magnitude and speed of growth as well as the labour market tightness has led many to question whether it has become even more difficult to match the remaining pool of unemployed with new jobs (Ellul, 2018). It is unclear in which direction and to what extent the matching efficiency of the Maltese labour market has developed in recent years and where it stands today.

Against this background, this paper attempts to shed light on the matching efficiency in the Maltese labour market by considering the Beveridge curve and the matching efficiency process from 1993 to 2022. The hypothesis to be tested is that the rapid economic growth recorded in recent years has had a major impact on the labour market, such that the Maltese labour market is characterised by a significant increase in efficiency in matching workers and employers. This suggests that the Beveridge curve has shifted inward in recent years. To test this hypothesis, the paper estimates job entry and exit rates from the administrative data. The matching process is assumed to follow a Cobb-Douglas function with constant returns to scale.

Furthermore, the relationship between job vacancies and unemployment is discussed within the context of search externalities, about which we know little so far. In times of high unemployment, many workers engage in job searches simultaneously, which can either lead to a situation where one worker's search efforts reduce the chances of others finding a suitable match (congestion), or conversely, where one worker's search activity enhances the likelihood of a successful match for other workers (positive spillover). Conversely, in times characterised by high job vacancies, many firms engage in recruitment efforts, potentially displacing opportunities for other firms to find suitable matches. Alternatively, the heightened intensity of their search efforts can increase the likelihood of successful matches for other firms. To the knowledge of the present author, this is the first time that the natural rate of unemployment has been presented using unemployment inflows and outflows, and discussed in the

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context of search externalities.

The article is structured as follows. Section 2 introduces the conceptual framework adopted in the analysis of Beveridge curve shifts. Section 3 analyses the behaviour of the Beveridge curve, while Section 4 presents the estimation of matching efficiency and analyses Beveridge curve shifts that are likely to be of structural nature. Section 5 investigates the dimension of labour market mismatch. Section 6 concludes and discusses implications for policy.

2 The conceptual framework of the Beveridge curve

2.1 Unemployment and search externalities

The Beveridge curve, which depicts the inverse correlation between unemployment and job vacancies, is often used to classify the various types of shocks that might affect the labour market. Its justification is based on the job search hypothesis (e.g. Pissarides, 2000), which underlines the inflows and outflows of people to or from unemployment.

In the context of job searching, unemployment is in equilibrium when there are equal inflows and outflows from it. The dynamics of unemployment are therefore explained as follows:

$$U_{t+1} - U_t = EU_t + NU_t - UE_t - UN_t$$

where E denotes employed persons, U denotes unemployed persons and N denotes the non-participation state. In a situation characterised by unemployment and employment (two-state world), by normalising the labour force to one, movements in unemployment can be expressed as:

$$\Delta u_t = s_t(1 - u_t) - f_t u_t \tag{1}$$

where s is the inflow rate (or the job separation rate) and f is the outflow rate (or the job finding rate). The job separation rate is the probability that workers will become unemployed over a given period of time, usually measured on a monthly or annual basis. The job finding rate, on the other hand, is the probability that unemployed workers find new jobs in a given period of time. If $\Delta u_t = 0$, the steady-state unemployment rate is the point at which unemployment inflows and outflows balance one another, suggesting that equilibrium unemployment is dependent on these two rates:

$$u^* = \frac{s}{s+f} \tag{2}$$

Equation (2) shows the long-term natural tendency of the economy's unemployment rate. By comparing the rate at which people find work with the rate at which jobs are separated, one can calculate the natural unemployment rate. At any one time, people are either employed or unemployed. The long-term unemployment rate stabilises when inflows and outflows are equal. The unemployment at full employment is calculated as the total of frictional and structural unemployment. This is the average unemployment rate that is expected in an economy and without cyclical unemployment. Equation (2) provides the basis of the Beveridge curve.

According to the Diamond (1981), Mortensen and Pissarides (1994) and Pissarides (2000) regarding job search hypothesis, labour market frictions make it costly for both employees and employers to find suitable partners. Workers take time to apply for and interview jobs, while firms invest resources in advertising job openings and conducting interviews.[1] In order to analyse the behaviour of the Beveridge curve throughout the course of the business cycle, Cardullo and Guerci (2019) extend the standard mismatch model by constructing an agent-based computational model of the labour market with heterogeneous workers and firms. According to this concept, search frictions occur because it costs money and time to fill a position, whereas productivity mismatch comes from firms' imperfect information about the value of the workers before the job interview takes place. Cardullo and Guerci conclude that because of these frictions, despite an increase in job openings, unemployment can still remain high.

The matching function implies that there are externalities in the matching process, as suggested by Diamond (1981) and Mortensen (1982). Thick market externalities refer to the positive effects that arise from having a large number of buyers and sellers in a market. When a market is thick, there are more opportunities for buyers and sellers to find each other, which can lead to more efficient matching and lower search costs. For example, in a thick labour market, there may be more job opportunities available for job seekers, which can lead to faster and more efficient job matching. This suggests that the job finding rate of employees is expected to be positively correlated with the hiring rate of companies, everything else remains constant. Hence, by searching more intensively, the individual firm increases the rate at which it fills a job, and if the worker searches for a job more intensively, firms will fill their vacancies more easily. This is called as an externality because recruitment efforts have spill over effects on the counterpart in the labour market that are not internalised until a match is found.

[1] The conceptual framework of matching has been developed for other domains such as the housing market, from which a novel concept of unemployment for the rental and condominium markets is emerging (Ioannides & Zabel, 2018).

Congestion externalities, on the other hand, refer to the negative effects that arise from too many buyers and sellers in a market. When a market becomes congested, the search costs and congestion costs for buyers and sellers can increase, leading to less efficient matching. For example, in a congested labour market, the high demand for workers can lead to higher wages, making it more difficult for employers to find and retain workers and vacancies remaining unfilled, despite a theoretically large pool of unemployed or underemployed workers. A similar congestion could develop during periods with substantial job openings, when firms themselves make it more costly for other firms to hire (Cardullo & Guerci, 2019), increasing the wages provided and, consequently, the cost of hiring new employees.

In search and matching theory, thick market externalities are generally seen as positive, while congestion externalities are seen as negative. The challenge for policymakers and market participants is to find ways to promote thick market externalities while avoiding congestion externalities. This is due to the possibility that falling hiring activity as a result of a slower rate of job finding could be the cause of unemployment. This kind of unemployment results from congestions in the matching process, irrespective of the reservation wage, and is still there when the market wage is clearing the labour market.

Diamond (1981) goes on to demonstrate that when thick market externalities are sufficiently strong, the matching function can exhibit increasing returns to scale, making it possible for there to be multiple steady-state unemployment rates.[2] There could be a high or low levels of activity, meaning that as the number of job seekers and job openings in the market increases, the number of matches between job seekers and job openings increases at an even faster rate. This means that it is more likely that a match will be made the more unemployed people and firms there are on the market. Along the trajectory path towards the high-level equilibrium, firms and workers put more resources in search, driving up the returns from search available, hence the positive expectations become self-fulfilling. Conversely, if the number of employees and employers falls, job opportunities decline more quickly, and as a result, the labour market may reach a low-level equilibrium. It is feasible for both steady states to exist, but which equilibrium materialises depends on what economic agents anticipate. Thus, the search externalities explain cyclical fluctuations in unemployment by alternating waves of optimism and pessimism that cause the economy to oscillate between the various equilibrium levels, independent of wages.

[2] Although the complementarity between firm and worker actions still exists at constant returns to scale, it is unable to support multiple equilibrium levels due to increasing marginal search effort costs.

2.2 Conceptualising the Beveridge curve

The matching process between employees and firms is typically summarised and can be represented by a matching function where it is assumed that the job finding rate depends on unemployment, job vacancies and matching efficiency. The process is assumed to follow a Cobb-Douglas function with constant returns to scale, $m(u, v) = u^{\alpha} v^{(1-\alpha)}$, as follows:

$$\begin{aligned} f_t(\theta) \equiv M(u,v)/u = & m(1,\theta) = \frac{\mu u^{\alpha} v^{1-\alpha}}{u} \\ f_t(\theta) = & \mu \theta_t^{1-\alpha} \end{aligned} \tag{3}$$

where θ denotes the labour market tightness measured as the ratio of vacancies to unemployment, μ_t is the efficiency of the matching process and $\alpha \in (0, 1)$, which measures the job finding elasticity with respect to unemployment. $1 - \alpha$ captures represents how labour market tightness translates into job finding rate, f, for any given level of matching efficiency. Higher u is associated with more matches since there are more applicants for each job ($\partial M/\partial u > 0$), everything else remaining constant. Likewise, holding everything else constant, more vacancies is associated with more matches, ($\partial M/\partial v > 0$).

The matching probability for a worker is thus $p_w = \mu\theta^{1-\alpha}$ and the matching probability for a firm is $p_c = \mu\theta^{-\alpha}$. With $\alpha = 0$, the matching function is degenerated in the sense that more vacancies do not lead to more job occupations in the aggregate.

Equation (3) constrains the Beveridge curve to be negative and convex to the origin, which captures the relationship between the unemployment rate and the job vacancy rate. Movements along the Beveridge curve are usually associated with changes in market tightness, as measured by the ratio of job vacancies to unemployment, and interpreted as business cycle fluctuations. For example, during an economic recession, the job vacancy rate falls because firms are posting fewer vacancies, which in turn means higher unemployment rates. The underlying intuition behind the negatively sloping curve is that, for a given level of α, in times of high unemployment it takes the number of vacancies to decrease to match the high rate of job separation, thereby balancing between the inflow rate s and the outflow rate f according to equation (2) is restored. Conversely, at a given level of α, when unemployment is low, more vacancies are required to ensure that f is again equal to s. This implies that, with regard to the movement on the Beveridge curve, each point on the Beveridge curve represents a labour market equilibrium where the number of job vacancies matches

the number of unemployed workers, i.e., the job finding rate is equal to the job separation rate. This means that at that particular point, there are no excess job vacancies or unemployed workers, and the labour market is in a state of balance.

In contrast, shifts in the Beveridge curve occur when there is a change in the relationship between job vacancies and unemployment in an economy. This can happen due to a variety of factors, such as changes in matching efficiency or job separation rates. Matching efficiency refers to the ability of the labour market to match unemployed workers with available job vacancies. Given a level of labour market tightness, any improvement in matching efficiency shifts the Beveridge curve to the left, implying that at a given unemployment rate, balancing s and f would require a lower rate of job vacancies in the economy. Similarly, when the job separation rate decreases, it causes a shift inward in the Beveridge curve. This means that there are fewer job vacancies available for the same level of unemployment, indicating that the labour market is becoming more efficient at retaining workers and reducing job losses and fewer vacancies are required to balance s with f, everything else remaining constant.

2.3 Cyclical and structural shocks

But where does the equilibrium structural unemployment lie on the Beveridge curve? The incentives for firms to hire must be considered in order to determine the equilibrium. In Figure 1, the Job Creation (JC) curve is a representation of the incentive to fill vacancies, which is dependent on the conditions of labour demand. Here, the higher the unemployment rate, the more incentive there is for firms to post job opportunities since the downward pressure on wage rates increases the profitability of job creation. As can be seen in Figure 1, the intersection of the BC and JC curves at point 'b' marks the location of equilibrium unemployment.

Cyclical and structural shocks describe changes in the steady-state unemployment rate. On the one hand, a positive unexpected labour productivity shock tilts the JC curve up, because a higher marginal product of labour leads to a higher net rate of return for the firm, thus increasing both wages and labour market tightness (increasing job vacancies, reducing unemployment), everything else remaining constant. This causes a movement along the Beveridge curve from point 'a' to point 'b', indicating a reduction in unemployment for the same level of job vacancies.[3] This occurs because the increase in job vacancies has made it easier for unemployed workers to find employment, resulting in a decrease in the number of job vacancies that remain unfilled. Such movements are associated with changing incentives for firms to advertise vacancies, which in turn are related to cyclical fluctuations in the labour demand.

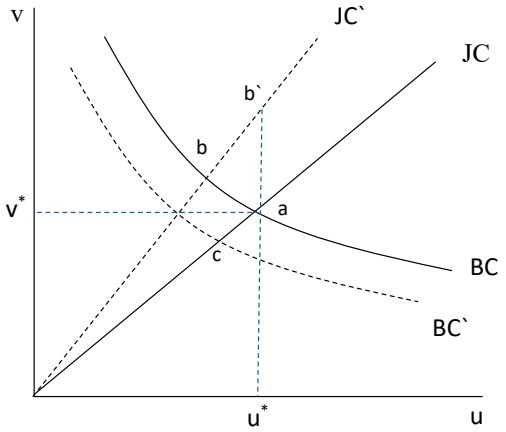

Figure 1: Hypothetical Beveridge and Job Creation Curve.

On the other hand, shifts in the Beveridge curve are generally related to structural changes in the labour market, and can also describe changes in steady-state unemployment. This could be explained by changes in job separation rates and matching efficiency, which are structural in nature and mainly caused by changes in institutions or policies. Shifts in the Beveridge curve could also stem from cyclical shocks, simply because a tighter labour market makes it easier to find a job when times are good.

Distinguishing cyclical, demand-driven shocks from structural movements raises a number of issues. First, it is commonly observed in empirical data that a labour demand shock causes a counter-clockwise loop in the space between job vacancies and unemployment without causing a lasting shock in the Beveridge curve, thereby causing a temporary deviation from the curve. For example, adjustment to a positive labour demand shock is generally followed by a transient increase in job vacancies (e.g. Blanchard & Diamond, 1989; Hansen, 1970). As illustrated in Figure 1, a positive labour demand shock reduces the expected cost of maintaining a vacancy, makes it more attractive for firms to post vacancies, and tilts the JC curve upwards due to higher labour market intensity (movement from point 'a' to point 'b''). An increase in the intensity of the labour market in turn shortens the duration of unemployment and increases the expected value of unemployment. Through the negotiated settlement between workers and firms, firms compensate workers for a share of the reduction in the expected cost of keeping a job vacant. As wages rise, vacancies adjust downward. However, as labour market intensity increases, so does the job

[3] Wage determination is typically specified according to Nash's solution to a negotiated solution problem in which workers' bargaining power is less than 100%.

finding rate; reducing unemployment until the economy is repositioned at a different point on the original Beveridge curve (movement from point 'b'' to point 'b').

Second, it can be difficult to distinguish between temporary and structural changes in job finding and job separation rates. These movements are illustrated in Figure 1 where a movement from point 'a' to 'b' is associated with cyclical labour demand shocks. However, a movement to point 'c' is associated with structural improvements and represents a permanent shift in the Beveridge curve. In light of cyclical fluctuations, I make use of the matching function in order to assess the permanent shifts in the Beveridge curve as explained in the next section.

3 Beveridge curve for Malta

Figure 2 plots the job vacancy rates against the unemployment rates in Malta for the period between 1993 and 2022. The job vacancy rate is constructed as the ratio of the number of vacancies to the sum of all wage earners plus the number of unfilled vacancies. The job vacancy rate measures the frequency of open but unfilled jobs in the economy.[4] Baldacchino and Cassar (2022), using data from 2002 to 2019, claim that the Beveridge curve saw two inward shifts, the first in 2012 and the second, larger shift, in 2016. The second inward shift was also affected by a positive output gap. Both changes were brought on by the entry of foreign workers and, to a lesser extent, by the acceleration of active labour market measures.

In general, identifying persistent shifts in the Beveridge curves requires a longer time series. However, from the available data, we can still see possible break in the relationship that corroborate these arguments. As expected, this shows that there has been both a leftward movement and an inward shift over the years, suggesting an improvement in matching efficiency coupled with a decrease in NAIRU. A notable break can be seen during the pandemic as the job vacancy rate fell sharply and the unemployment rate rose only slightly, causing the Maltese Beveridge curve to shift inward. The inward shift was driven by a low job separation rate due to unprecedented fiscal interventions and uncertainty, leading to a decline in the job vacancy rate. 2021 was followed by a recovery in the vacancy rate and a slight decline in the unemployment rate. The year 2022 was also marked by a decrease in vacancy along with a decrease in overall unemployment.

How do the Maltese Beveridge curve changes compare to those in other countries? Arpaia et al. (2014) are

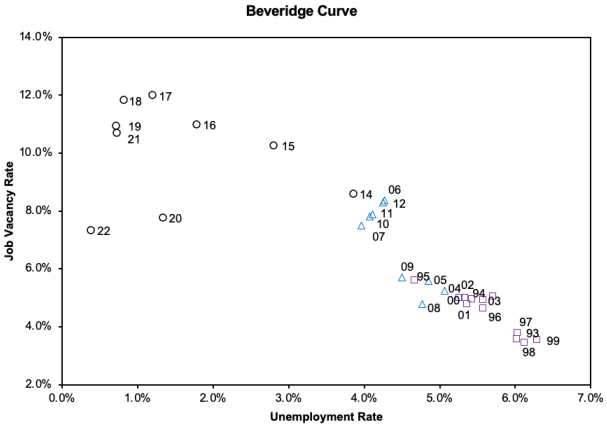

Figure 2: Beveridge Curve.

one of the studies to track the changes in the Beveridge curves across the post-crisis period from a cross-country perspective. Overall, it was found that there is significant variability amongst EU member states in terms of Beveridge curve shifts. In reality, evidence of a structural decline in labour market adjustment was mostly found in euro area countries that were hit by the debt crisis, whereas evidence from certain other countries, particularly Germany, shows to increased adjustment effectiveness. The study also revealed that skill inequality worsened in most EU countries as demand for unskilled labour continued to decline and was insufficient to absorb the existing workforce, while demand for skilled labour fell even further. Similar to this, Consolo and Da Silva (2019) found that the Beveridge curve for the euro area appears to have dramatically shifted outwards, indicating that aggregate matching efficiency has drastically declined since the start of the Great Recession and the debt crisis. The increasing mismatch between skill supply and demand and the growing disparity in unemployment rates among countries, according to the authors, are the two key causes of the fall in matching efficiency. The interesting thing about this is that it was noticed before the Covid-19 pandemic made matching inefficiency worse during the post-lockdown recovery. Kiss et al. (2022) revealed that there was a slight upward shift in the EU Beveridge curves during 2020, which was partially reversed in 2021. Despite the fact that there was some worsening of skill mismatches in the aftermath of the COVID-19 pandemic, this decline seems to have had a minimal impact on the matching efficiency. In summary, various factors indicate that the coexistence of both labour market slack and shortages was likely a temporary phenomenon. The shortages in labour appear to be primarily a result of the labour market recovery rather than obstacles in reallocating la-

[4] The definition adopted by this study is the same as that used by Daly et al. (2012), but differs from the Eurostat definition. Eurostat defines the job vacancy rate as the proportion of total posts that are vacant expressed as a percentage of the sum of occupied posts and number of job vacancies.

bour resources.

The increase in unemployment in the EU during the 2008 crisis was cyclical rather than structural, according to comparisons with the US (e.g. Chen et al., 2011; Daly et al., 2012; Dickens & Triest, 2012; Elsby et al., 2010, 2013), or structural mismatches of a temporary nature (Daly et al., 2011; Lazear & Spletzer, 2012). Analysis of the primary factors influencing matching efficiency between 2000 and 2013 reveals that skill mismatch, welfare dependency, and prolonged unemployment are the main causes of the EU's declining matching efficiency (e.g. Arpaia et al., 2014).

Furthermore, the majority of the literature on the subject agrees that, in comparison to other developed countries, unemployment exit rates in European nations are more substantial than unemployment inflow rates. According to Elsby et al. (2013), 85% of the change in unemployment in Anglo-Saxon economies is attributable to job finding, with 15% of the change attributable to the separation rate. It has been noted that the split between inflows and outflows into unemployment is substantially closer to a 45:55 ratio for the countries of continental Europe and the Nordic region.

4 Method and Data

Job finding rates (outflows from unemployment) and job separation rates (inflows into unemployment) are estimated to provide insight into the Beveridge curve shifts (e.g. Barnichon & Figura, 2010; Daly et al., 2012; Şahin et al., 2014). These rates provide a quantitative explanation of the significance of inflows and outflows in influencing how unemployment behaves over the business cycle. It then estimates discrepancies in the pattern of job finding and job separation rates that might be associated with structural adjustments in labour market flows. The degree of labour market tightening (i.e., the correlation between the unemployment rate and the job vacancy rate) and its effects on unemployment flows are used to monitor structural changes. The methodology, which has its roots in the labour market's search and matching framework (e.g. Pissarides, 2000), enables one to account for the fact that it is simpler to find a job in good times simply because there are more openings compared to the number of jobseekers.

4.1 Job finding and job separation rates

Let F_t be the job finding probability which measures the probability that a jobseeker will find a job in a given time period and let S_t be the job separation probability which measures the probability that an employed person will be unemployed in a given period of time. Using data on the number of unemployed persons, U_{t+1}, and on the number of unemployed of less than d months, $U_{t+1}^{<d}$, I first construct yearly outflow rates series as in Shimer (2005) and Elsby et al. (2013). d is defined as "less than one year" based on the duration that is indicated in the administrative data sources. Specifically, the probability that an unemployed worker exits unemployment within d months, F_{t+1}, can be calculated from

$$F_t = 1 - \frac{U_{t+1} - U_{t+1}^{<d}}{U_t} \tag{4}$$

from which the outflow rate f_t can then be derived as:

$$f_t^{<d} = -\frac{\ln(1 - F_t)}{d} \tag{5}$$

f_t is the monthly job finding rate (hazard rate) associated with the probability that an unemployed worker at time t completes his spell within the subsequent d months. Here, d is equal to 12 months.[5]

The separation rate can be calculated using a similar approach. However, due to lack of data on employment duration, the job separation rates need to be estimated indirectly, using the evolution of unemployment over time: $U_{t+1}^{d} = E_t S_t$, meaning that whenever an employed person loses his job, he becomes unemployed (Shimer, 2005). However, this entails a significant time-aggregation bias. When a worker loses his job, he has on average half a month to find a new job before the person is recorded as unemployed. Hence, the short-term unemployed can be approximately written as:

$$U_{t+1}^{s} = E_t S_t (1 - F_t) \tag{6}$$

The separation probability can then be measured, by solving equation (6):

$$S_t = \frac{U_{t+1}^{s}}{E_t(1 - F_t)} \tag{7}$$

Likewise, the separation rate is:

$$s_t^{<d} = \frac{\ln(1 - S_t)}{d} \tag{8}$$

4.2 Measuring matching efficiency and natural rate of unemployment

In order to disentangle temporary and structural changes, it is common to model the matching function, which describes a stable relationship between labour market intensity and the job finding rate. Assuming a Cobb-Douglas matching function, the elasticity of the job-finding rate

[5] The workers' job finding rate can be modified in the given framework to reflect the vacancies' worker finding rate, or the percentage of all vacancies in a given month that find workers in the next month, by dividing the monthly job finding rate by the labour market intensity.

with respect to labour market tightness (i.e., the ratio of job vacancies to unemployment) can be estimated, derived from Equation (3), as follows:

$$\ln f_t = \beta_0 + \beta_1 \ln \theta_t + \epsilon_t \tag{9}$$

where β_0 is commonly used as an estimate of the matching efficiency parameter, μ, β_1 provides an estimate of the elasticity parameter $1-\alpha$ and ϵ_t is the random error, capturing the matching efficiency parameter. The estimation of Equation (9) is performed using the ordinary least squares (OLS) and two-stage least squares (2SLS) methods on the logs of the Cobb-Douglas matching function. For the 2SLS method, lags of the vacancy and unemployment rate have been used as instruments. Because of the small sample size, I also report the wild bootstrap standard error (Roodman et al., 2019).

Furthermore, from Equation (2) it can be shown that the matching efficiency has a direct effect on u^*:

$$u^* = \frac{s}{s + \mu \theta_t^{1-\alpha}}$$

where,

$$\mu_t = \left(\frac{s_t}{u_t^*} - s_t\right)\left(\frac{1}{\theta_t}\right)^{1-\alpha} \tag{10}$$

All else equal, Equation (10) implies that reduced matching efficiency will raise the frictional or structural level of unemployment, hence the natural rate of unemployment.

According to Pissarides (2000) and Petrongolo and Pissarides (2001), the job finding and job separation rates can be seen as a representation of the externalities that the total pool of unemployed people and job vacancies have on the probability that an unemployed person or firm would find a job and fill a vacancy. This is so because during the individual level search process, vacancies and unemployment are assumed to be taken as given. From Equation (3), one can solve for the elasticity of job finding with respect to the aggregate unemployment as $\alpha - 1$. The absolute value of $\alpha - 1$ reflects the strength of the negative congestion effect of the unemployed pool on an individual job seeker's likelihood of finding a job. In other words, the greater the absolute value of $\alpha - 1$, the harder it is for an unemployed person to match with a job vacancy. By contrast, α captures the degree of the thick market effect of the pool of unemployed on the job finding likelihood of an employer. That is, the greater the absolute value of α, the easier it is for an employer to find a job seeker.[6]

The positive spill over impact of vacancies is the converse of the congestion externality, as noted by Petrongolo and Pissarides (2001). Particularly, the elasticity of job finding with respect to vacancies is $1-\alpha$. This means that as the number of job vacancies increases, it becomes easier for workers to find a suitable job. By contrast, $-\alpha$ measures the congestion effects of firms on each other, in that more job vacancies makes it harder for other firms to find a suitable job seeker for their open positions.

The underlying intuition of this externality concept is that, independent of a job seeker's own activities, the chances of finding a job decrease as the total number of unemployed rises. The probability that a job seeker will fill a vacancy again regardless of his activities grows with a larger pool of open positions. As a result, this approach makes the estimation of the matching function — which is simply represented by the coefficient under the assumption of constant returns to scale — essential for determining the magnitude of these labour market congestion externalities.

To that end, I use Equation (9) that suggests a log-linear relationship between job finding rate and labour market tightness in the estimation of matching function for Malta. Petrongolo and Pissarides (2001) found that the estimated unemployment elasticity is about 0.7 and the job vacancy elasticity is 0.3, implying that the congestion effects caused by firms are larger than those caused by workers.

5 Results

5.1 Unemployment inflow and outflow rates

Figure 3 shows the annual outflow and inflow rates for the years 2022 to 2022 expressed on a monthly basis. Between 2002 and 2013, marked by structural fiscal efforts by the authorities and a period of recession in the second half of the noughties, the job finding rate appears to have fluctuated between 4% and 6% and to have steadily declined for three consecutive years between 2007 and 2013. 2009 and 2010-2013. Indeed, despite the potential economic gains in favour of Malta's EU accession in 2004, Malta's catching-up process has been less positive as the income gap compared to the EU15 countries widened rather than closed in the first decade of EU accession (Vella, 2015). For the period 2014-2019, the job finding rate retained sustained moderate-to-high levels as the Maltese economy was tied to a process of robust economic growth, largely driven by the service sector. This growth led to a significant increase in the demand for labour and, as a result, the number of unemployed fell. The finding rate significantly rebounded to a record high in 2021 following the Covid-19 pandemic. This is because the Maltese economy saw a stronger and faster recovery in jobs than almost everyone expected for 2021 and 2022.

Interestingly, the rate of job separation suggest that

[6] For a full discussion see Kanik, Sunel and Taşkin (2013).

after 2005, job destruction began to decrease, only to increase again year-on-year between 2008 and 2010. After 2010, the job separation rate improved considerably, indicating strong labour demand and structural improvements in the labour market.

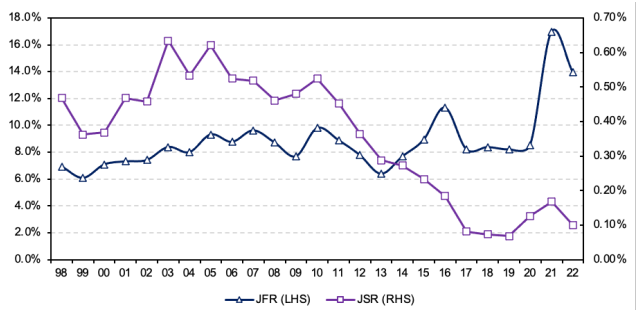

Figure 3: Job finding and separation rates.

5.2 Labour market tightness

The relationship between job vacancies and unemployment summarises the tightness of the labour market and illustrates the demand and supply conditions. The labour market tightness is measured as the ratio of job vacancies to unemployment.

As can be seen in Figure 4, the job vacancy-to-unemployment ratio fell during the 2009 recession and has since recovered, with the exception of 2020. The easing in 2020 was due to a drop in job vacancies and slightly higher unemployment seen during the recession, a time of the pandemic. The job-finding rate also tends to be proportional to the intensity ratio (Figure 5). The number of data points below the trend line and to the right of the vacancy/unemployment ratio may indicate that the economy has not enough created new occupations, despite employers' desire to hire more workers. In fact, years of high vacancies like 2017-2019 could have led to bottlenecks in finding workers and negative externalities for companies, also known as congestion externalities.

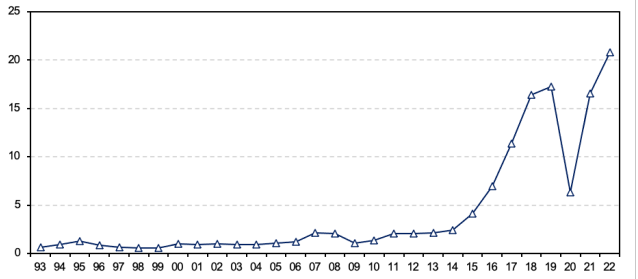

Figure 4: Labour market tightness.

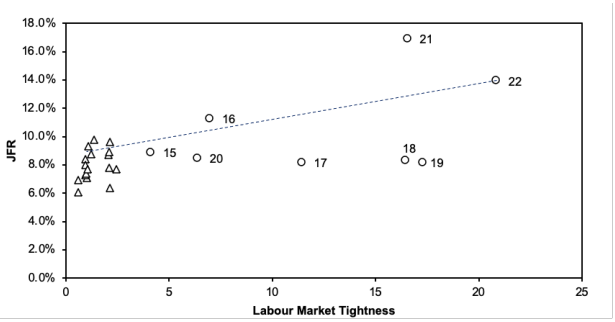

Figure 5: Job finding rate and labour market tightness.

5.3 Search externalities and matching efficiency

The elasticities of the matching function with respect to labour market tightness are presented in Table 1. These results are derived from the OLS and 2SLS estimates of Equation (9), using the lagged values of vacancies and unemployment as instrumental variables.[7] In both estimates I also set a dummy variable is set takingthat takes on the value 1 on 2020.

The results indicate that $1-\alpha$ is estimated to be positive and statistically different than zero at 1% significance level. The estimated coefficient implies that a 1% increase in vacancies (unemployment) increases (decreases) the job finding probability by about 0.13%.

The implication of Cobb-Douglas specification for the matching function and constant returns to scale are that the elasticity of the job finding rate is approximately 0.88 for unemployment and 0.13 for job vacancies. The value of α (0.88) indicates that the thick market externalities are much higher from workers to firms than from firms to workers. The findings, therefore, indicate an increase in job opportunities in the Maltese labour market when the pool of unemployed people increases. The corollary of such an argument is, of course, that other things being equal, the greater the number of unemployed, the less costly it is for firms to fill their vacancies, thereby creating opportunities to expand job creation. The fact that policies are much more responsive to unemployment than to job openings (for example, active labour market policies), which intensify job seekers' search efforts, is likely the cause of the thick market effects strength among workers. Additionally, during periods of low economic activity, there may be a major improvement in the flow of information regarding potential work prospects and the usage of referral systems during high unemployment

[7] Wooldridge's score test does not reject the null hypothesis that vacancy-to-unemployment ratio is exogenous at the 5% level. I also do not reject the null hypothesis that the instruments are valid at the 5% significance level.

	OLS	2SLS
Unemployment (α)	0.875***	0.864***
	(18.50)	(14.16)
Vacancies ($1-\alpha$)	0.125***	0.136**
	(2.64)	(2.23)

Table 1: Estimates of the matching equation. *Notes: t-values are reported in parentheses. The t-values are generated from wild bootstrap-values (Kline & Santos, 2012) with 999 replications (Roodman et al., 2019). *, **, and *** denote statistical significance at 10, 5, and 1%, respectively*

periods.

In contrast, the estimated value of α suggests that the congestion effects on firms are much larger than those on workers. This means that the cost of creating new jobs increases as more companies enter the labour market or expand their operations, causing market congestion. Indeed, the negative externality caused by firms on each other amount to -0.87, whereas the negative externality by workers is -0.13. That is consistent with what is commonly seen that, during periods of high labour market intensity in Malta, it has become more challenging to fill positions with people due to labour market frictions. Firms would search harder for workers and stay in the market longer due to the increased rewards they receive from filling new job openings, which would exacerbate the externalities of labour shortages faced by other firms. The empirical evidence is also consistent with the idea that corporations have stronger congestion effects than workers (e.g. Petrongolo & Pissarides, 2001).

The matching efficiency extracted from the estimated function is shown in Figure 6. The movements in the efficiency rate reflects the natural rate of unemployment as derived from Equation (2) and unemployed as sourced from administrative data only. A number of remarks are in order. After the Great Recession, the NAIRU has decreased, as can be shown. Around this time, similar developments were seen in the Baltic, Nordic, and Southern European nations. The matching efficiency has increased since, reaching a peak in 2022. This shows that after 2014, significant inward shifts in the Beveridge curve were observed, and this is supported by expectations that lower inflow rates and higher outflow rates cause the Beveridge curve to shift inwards and the natural rate of unemployment to drop gradually. It is important to note that the NAIRU estimates should be interpreted with great caution because it is only estimated for registered unemployed, while NAIRU estimates typically include people who are not eligible for benefits or who choose not to register with the labour authorities and are driven primarily by structural indicators.

One also has to consider that the ability to sustain a

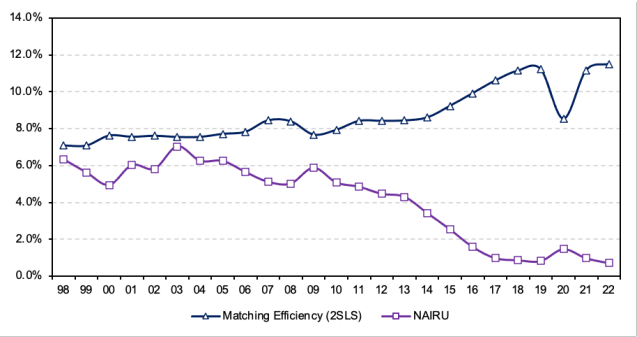

Figure 6: Matching efficiency and NAIRU.

reasonably high job-finding rate, even in a labour market with high tightness, may be partially attributed to the influx of foreign labour. When a country imports labour, it expands the pool of potential job seekers, potentially resulting in a higher job-finding rate due to the increased labour supply. This situation could potentially obscure the true extent of structural enhancements in the lab or market for native workers since the increased labour supply might lead to higher rates of job matching. Indeed, while the pool of unemployed individuals has decreased, the increase in foreign labour may have affected the matching efficiency for native populations. For foreigners (in particular third-country nationals), this might not be an issue, as they typically require employment for residency, which could imply optimal matching. Consequently, the overall matching efficiency could have had mixed effects, potentially deteriorating for natives but improving for foreigners. Unfortunately, the data at hand did not permit testing this hypothesis directly. Nonetheless, a robustness check was conducted to assess structural changes before and after 2012/13, particularly considering the heightened dependence on imported labour during the latter period. The findings remained relatively consistent. In addition, according to recursive estimates, the congestion effects on firms also suggest to be more substantial than on workers. When excluding data from the post-2013 period, congestion effects were observed at approximately 0.73.

6 Conclusions

This paper has argued that the rapid economic growth recorded in recent years has had a major impact on the labour market, such that the Maltese labour market is characterised by a significant increase in efficiency in the matching between workers and employers. This suggests that the Beveridge curve has shifted inward in recent years. The hypothesis was tested using the estimated job entry and exit rates from the administrative data.

The results also show, among other things, that despite the record high intensity of the labour market, Malta has still managed to maintain a sufficiently high job finding rate. However, the results also suggest that the economy has not created enough new occupations, despite employers' desire to hire more workers. In fact, years of high vacancies like 2017-2019 and 2012-2022 could have resulted in congestion effects created by the companies themselves, increasing search costs and thereby reducing the firms' returns from hiring additional workers, everything else remained constant. Small domestic suppliers are limited in size and therefore the search for companies is likely to crowd out other firms' chances of finding a suitable employee. So far, this negative externality has not translated into a higher natural unemployment rate, as it has also been shown that matching efficiency has also increased, likely reflecting the heavy reliance of immigration on the needs of the economy and the use of active labour market measures. However, when examining the sectoral level, one may find that if a substantial portion of imported labour is concentrated in specific industries or occupations, it could contribute to the perception of overall congestion. This sectoral congestion, in turn, might limit the extent to which structural improvements in the labour market contribute favourably to a low natural rate of unemployment.

The results presented in this study are subject to certain caveats that must be acknowledged. First, the paper analysed the main features of the Maltese Beveridge curve by estimating the annual hazard rates for inflows and outflows. The behaviour of the Beveridge curve is sensitive to changes in labour market conditions, and thus the unavailability of more frequent data makes it difficult to relate changes in adjustment efficiency to structural rather than cyclical changes in the labour market. Second, the study follows the general literature by assuming a two-state level, namely unemployment and employment. Data constraints limit efforts to also account for transitions in and out of inactivity. It is important to recognise that given the rapid convergence of the employment rate towards the EU-27 average, this transitional state was very important and the job finding rate could be even higher if the middle-aged inactive cohorts were considered as the natural unemployed. Furthermore, future research could assess the different search externalities per sector, as it is likely that there is a high degree of heterogeneity between sectors. Matching efficiency is also somewhat abstract, and this deserves a closer look at what drove matching efficiency over the years.

Future studies can consider the role of imported labour when interpreting the observed improvements in the job search outcomes. The influx of labour from abroad could have significant effects on various fronts, potentially improving job finding rates and matching efficiency, then with the consequence on the natural rate of unemployment. For example, the observed labour immigration over the recent years indeed contributed to filling labour market gaps, and in this context, it is important to consider whether the increased matching efficiency could be partially driven by the ease of finding suitable employees from abroad. In such a case, the estimated natural rate of unemployment could be artificially low. This might obscure the assessment of the effectiveness of certain domestic labour market policies and structural changes especially those targeting the native population.

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