Estimating Okun's Law for Malta

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Introduction

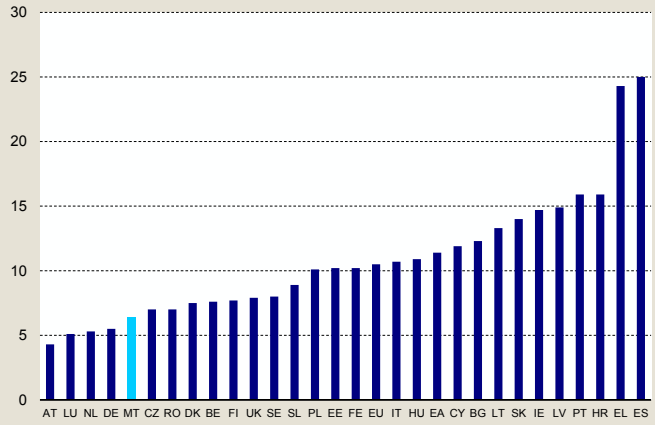
The economic and financial crisis of 2008-2009 and, more recently, the sovereign debt crisis of 2012 have taken a heavy toll on the labour market in Europe, although to differing degrees in various countries. This is most evident by the different unemployment rates, which have reached unprecedented levels among EU countries (see Chart 1). For instance, in 2012, the lowest unemployment rate in the European Union was registered in Austria, at 4.3%, whereas in Spain it stood at 25%. Youth unemployment has reached even more alarming figures in some countries, exceeding 50% in Spain and Greece. At 6.4% in 2012, the unemployment rate in Malta remains one of the lowest in the European Union.[2] This divergence among EU countries is mainly explained by differences in the sectoral composition of employment, country-specific labour market institutions and variations in policy initiatives designed to deal with fluctuations in economic activity.

In economic literature, the negative relationship between output and unemployment is known as Okun's Law, named after the economist who first documented this relationship in the early 1960s.[3] The original formulation, estimated with post-second World War US data, suggested that a 2.0% to 3.0% drop in output growth is associated with an increase in the unemployment rate of around 1 percentage point.

More recent estimates for the euro area in the pre-crisis period suggest that a 1 percentage point decline in output growth is associated with a contemporaneous 0.4 percentage point rise in the unemployment rate.[4] Estimates based on a period that includes the recession point to a reduction in the output-unemployment relationship, to around 0.3 percentage point, as measures adopted during the crisis to stem the pace of job losses have led to some distortions in this relationship.

Part of the appeal of Okun's Law is its simplicity, even though it is widely recognised that this "law"

Chart 1
UNEMPLOYMENT RATE IN EU COUNTRIES IN 2012
(per cent of the labour force)



Source: Eurostat.

[1] Prepared by Brian Micallef. Mr Micallef is a Senior Research Economist in the Bank's Modelling and Research Office.

[2] For an in-depth analysis of the sources of labour market resilience in Malta after the 2009 recession, see the box entitled "Labour market resilience in Malta", published in the *Central Bank of Malta Quarterly Review* 2013:1.

[3] See Okun, A.M., "Potential GNP: Its Measurement and Significance", *Proceedings of the Business and Economic Statistics Section,* American Statistical Association, 1962, pp. 98-104.

[4] See box entitled "Back to Okun's Law? Recent developments in euro area output and unemployment", *ECB Monthly Bulletin*, June 2011.

is just a statistical relationship and not necessarily a structural feature of an economy. This means that this relationship may not be stable over time, especially when the economy undergoes structural changes. Indeed, recent studies suggest that this may be the case, especially after the economic and financial crisis of 2008.[5] Empirical studies also document significant variations in Okun's coefficient across countries.[6] Furthermore, recent studies point towards the presence of asymmetries in Okun's relationship, with unemployment likely to rise more during recessions than to decrease during periods of expansion.[7]

Against this background, this report presents empirical estimates of the link between GDP growth and the unemployment rate in Malta based on Okun's Law. It also compares the strength of this relationship with that in other EU countries, tests the stability of this relationship over time and its sensitivity to the economic cycle.

Okun's Law

There are two versions of Okun's Law.

The **difference version** relates the change in unemployment rate (UNR) to real GDP growth:

$$\Delta \mathrm{UNR} = c_1 - c_2 * \Delta \mathrm{GDP} \quad (1)$$

where $\Delta \mathrm{UNR}$ represents the annual percentage point change in the unemployment rate and $\Delta \mathrm{GDP}$ measures the annual percentage change in real GDP. This equation captures the contemporaneous correlation between GDP growth and changes in the unemployment rate. The parameter c_2 represents Okun's coefficient, which a priori is expected to be negative, since positive GDP growth is associated with a declining unemployment rate. The ratio $\frac{-c_1}{c_2}$ represents the rate of output growth that is consistent with a stable unemployment rate.

More recently, a dynamic version of Okun's relationship has evolved through the introduction of lags in equation (1) in both the dependent and the explanatory variables.[8] This is meant to account for changes in economic activity that affect the labour market with a lag and for the possible omission of relevant variables from the equation.

The **gap version** relates the level of the unemployment rate to the output gap, i.e. the difference between actual and potential GDP:

$$\mathrm{UNR} = c_1 - c_2 * \mathrm{output\ gap} \quad (2)$$

In this specification, the parameter c_1 is associated with the unemployment rate that is consistent with full employment while, a priori, one expects c_2 to be negative. The problem with this specification is that the output gap and potential output are unobservable variables. Economists usually estimate these variables by statistical filtering techniques or by using a

[5] See Knotek, E., "How useful is Okun's law?" *Economic Review Federal Reserve Bank of Kansas City* 4, 2007, pp. 73-103.

[6] See Ball, L., Leigh, D. and Loungani, P., "Okun's Law: Fit at 50?" Paper presented at the 13th *Jacques Polak Annual Research Conference* held by the IMF, November 2012.

[7] See Cazes, S. and Verick, S., "What has happened to Okun's law in the US and Europe? Insights from the great Recession and longer time trends", Research Conference on *Key Lessons from the Crisis and the Way Forward*, ILO, February 2011.

[8] See reference in footnote 5.

production function approach. To avoid a debate on the appropriate approach to estimate the output gap, and in the light of the sensitivity of the results of the method chosen, the rest of this report will focus on the difference version of Okun's Law.

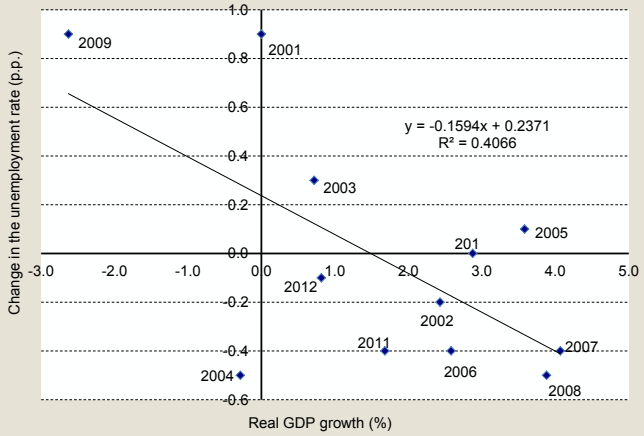
Empirical estimates

Chart 2 shows the annual changes in the unemployment rate against real GDP growth for Malta, using annual data for the period between 2000 and 2012. The chart shows that, as expected, there is a negative relationship between real GDP growth and the change in the unemployment rate, with periods of economic expansions being associated with a declining unemployment rate and vice versa. The rate of output growth consistent with a stable unemployment rate is estimated at 1.5%. The regression line that runs through the scatter plot implies an Okun's coefficient of 0.16. This means that a 1 percentage point increase in GDP growth in excess of 1.5% lowers the unemployment rate by around 0.16 percentage point.

Excluding 2004 from the analysis, which as seen in Chart 2 is a clear outlier, the estimated Okun's coefficient increases to 0.2, while the rate of output growth consistent with a stable unemployment rate rises to 1.9%. In this case, we also observe a considerable improvement in the fit of the equation, with the R^2 increasing from 0.41 to 0.64.

Table 1 presents further econometric estimates for the difference version of Okun's Law for Malta, using quarterly data from the first quarter of 2001 to

Chart 2
OKUN'S RELATIONSHIP IN MALTA
(annual data)



Sources: Eurostat; Author's calculations.

Table 1
REGRESSION COEFFICIENTS FOR OKUN'S LAW

Dependent variable: $\Delta(UNR_t)$

Sample: 2001Q1 - 2012Q4

	Explanatory variables			
Specification	intercept	$\Delta(GDP_t)$	$\Delta(GDP_{t-1})$	$\Delta(UNR_{t-1})$
Static	0.06	-0.05		
Dynamic (1)	0.11	0.02	-0.10***	0.57***
Dynamic (2)	0.13		-0.09***	0.57***

*Statistical significance: * at 10% level, ** at 5% level, *** at 1% level*

Source: Author's calculations.

the last quarter of 2012.[9] The first equation, named static, points to an Okun's coefficient of -0.05, while the rate of output growth consistent with a stable unemployment rate is estimated at 1.2%. However, both the intercept and the slope of the regression are not statistically different from zero at conventional levels of significance. This suggests that, at a quarterly frequency, there is no contemporaneous relationship between unemployment and output in Malta.

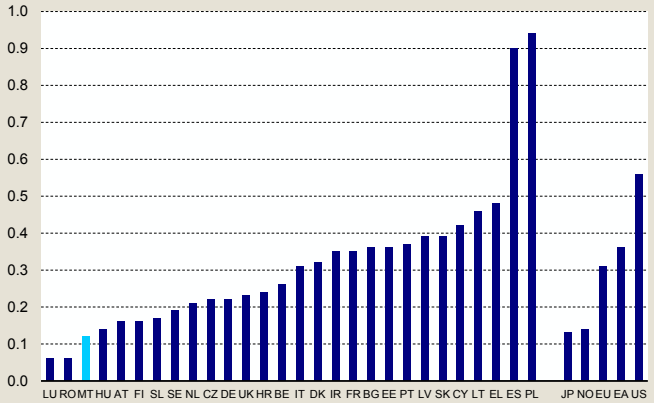
The second and third row of Table 1 present results of the dynamic specification, with lags of both dependent and explanatory variables. The first dynamic version confirms that the effect of contemporaneous GDP growth on unemployment is not statistically significant. Both dynamic specifications suggest that developments in domestic economic activity affect the labour market with a lag. In both specifications, the rate of output growth consistent with a stable unemployment rate is estimated around 1.4%. The short-run Okun's coefficient, lagged by one quarter, is estimated at around 0.1, while the long-run coefficient stands at 0.2.[10]

Comparison with EU countries

Using the static specification in Table 1 and estimating it on the basis of annual data from the start of the monetary union, Chart 3 plots Okun's coefficient for EU countries and various other advanced economies. The chart shows that Okun's coefficient for Malta is one of the lowest in the European Union. [11]

The cross-country comparison shows a considerable degree of heterogeneity in Okun's coefficient. This heterogeneity is due to a number of factors, such as country-specific labour market institutions, employment protection legislation, labour market flexibility and the source and magnitude of shocks hitting the economy. For instance, the high coefficient in Spain could be related to the elevated incidence of temporary contracts, which, over the past decade or so, have accounted for around a third of Spanish

Chart 3
OKUN'S COEFFICIENT IN EU AND ADVANCED ECONOMIES
(estimates based on annual figures from 1999 to 2012)



Source: Author's calculations.

[9] Since quarterly data start from 2000, the first four observations are lost when taking the annual growth rate in GDP and the change in the unemployment rate. GDP and unemployment statistics are derived from the National Accounts and the Labour Force Survey, respectively.

[10] The long-run effect is calculated as: $\frac{-0.09}{(1-0.57)}$. For further information on the long-run effects of dynamic models, see Vogelvang, B., Econometrics: Theory and applications with Eviews, *Pearson Addison Wesley Publications*, 2005.

[11] This is consistent with the analysis in the box entitled "Recent developments in the Okun relationship in the euro area", *ECB Monthly Bulletin*, July 2012. Even when the year 2004 is excluded, the results would still leave Malta at the lower end of the rankings.

employment, thereby making it easier for firms to adjust employment in response to changes in economic activity.

Testing the stability of Okun's coefficient

A number of studies have recently questioned the stability of Okun's coefficients over time.[12] To test this hypothesis, the empirical version of Okun's Law presented above is re-estimated using the rolling regressions technique.[13] This means that the equation is estimated for Malta over a sequence of sample periods, thereby producing a set of estimated coefficients. This exercise applies the static specification using a fixed window of 20 quarters (five years). This means that the first equation is estimated over the period 2001Q1-2005Q4, the second one for 2001Q2-2006Q1, and so on. This process is repeated until the final regression with a 20-quarter window includes the last observation from the sample (i.e. 2008Q1 – 2012Q4).

If the relationship between output and unemployment remained stable over the sample period, the coefficients from the regressions estimated over different samples should be relatively similar. On the contrary, substantial changes in the coefficients imply that the relationship has not been stable over time. This method provides the means for detecting whether developments in the early part of the last decade are influencing the estimation of recent relationships.

Econometric estimates show that the unemployment-output relationship in Malta has changed considerably over the last decade. In particular, the relationship between these variables was not statistically significant in the mid-2000s. However, Okun's coefficient has been relatively stable and statistically significant since 2005, standing at around -0.15. This finding is confirmed by restricting the estimation of Okun's law to the post-2005 sample, with Okun's coefficient becoming statistically significant and larger than the one showed in the first equation in Table 1.

The increased responsiveness of unemployment to economic activity since the mid-2000s can be partly explained by two developments. The first relates to the declining share of public sector employment in total employment. Contrary to those in the private sector, employees in the public sector are to some degree sheltered from developments in the real economy. The second relates to the increased use of part-timers and workers with temporary contracts. For example, the share of temporary employees in total employees has almost doubled since 2006. These workers have less employment protection relative to those with permanent contracts and, hence, their contracts are less likely to be renewed in times of falling demand.

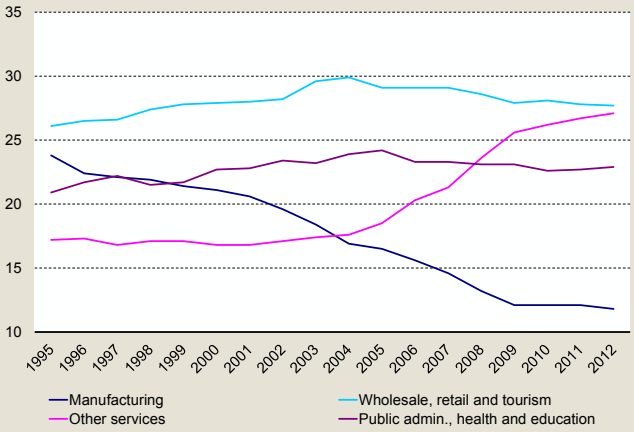
In general, this phenomenon should be seen in light of structural changes that have taken place in the Maltese economy over the last decade. In particular, these are related to the diversification of the economy towards the services sector, which is more labour-intensive, both in terms of output and employment, at the expense of traditional industries. For instance, the share of employment in the manufacturing sector has steadily declined from

[12] See the chapter "Unemployment dynamics during recessions and recoveries: Okun's law and beyond", *IMF World Economic Outlook*, pp. 69-108.

[13] A similar technique was used in the studies referred to in footnotes 7 and 12.

23.8% of total employment in 1995 to 11.8% in 2012 (see Chart 4). At the same time, the share of services excluding wholesale, retail and tourism has gone up from 17.2% to 27.1%.[14] These changes in the services sector occurred primarily after EU membership in 2004. Econometric estimates suggest that, at a sectoral level, the long-run elasticity of employment growth with respect to output growth is much higher in these service industries than in the manufacturing sector.[15] The responsiveness of unemployment to output is thus affected by these trends in the labour market, with service industries being the main driver of employment growth in recent years, in conjunction with an expansion in the supply of labour driven by a gradual increase in the participation rate of females.

Chart 4
EVOLUTION OF SECTORAL EMPLOYMENT
(percentage of total employment)



Source: Eurostat.

Testing for asymmetry

Asymmetry in Okun's relationship would imply that the response of the unemployment rate to changes in GDP depends also on whether the economy is expanding or contracting. This differs from the symmetric specification outlined in Table 1, which implicitly restricts the unemployment response to GDP to be the same during expansions and recessions. Here, the asymmetry is tested through two methods that distinguish between periods of recessions and expansions.[16]

The first approach checks directly for asymmetry. In equations (1) and (3) in Table 2, the GDP growth rate is split into, and replaced by, two variables. One is $d\_(\Delta GDP_t)^{-ve}$, which consists of the rate of change in GDP for those quarters when GDP contracted, while the remaining quarters show a value of zero. The other variable is $d\_(\Delta GDP_t)^{+ve}$, which contains the rate of change in GDP for those quarters when GDP increased, while the remaining quarters show a value of zero. Equation (3) also includes an autoregressive term.

[14] This category includes information & communication, finance & insurance, real estate activities, professional, scientific & technical sectors and the recreation sector.

[15] The econometric results are based on an autoregressive distributed lag model, similar to the dynamic version of Okun's Law but with the annual growth rate of sectoral employment replacing the unemployment rate. The year-on-year growth rate in sectoral employment is regressed on its own lag and contemporaneous or lagged values of the annual growth rate of sectoral gross value added. Both output and employment statistics are derived from the National Accounts and the estimation period is from 2001Q1 until 2013Q2. The long-run elasticity is calculated as described in footnote 10. The long-run elasticity for other services (excluding retail, wholesale and tourism) is 0.6, meaning that a 1 percentage point increase in the annual growth rate of output of these services leads to a 0.6 percentage point increase in employment in this sector. The elasticities for the other sectors are the following: 0.3 for retail, wholesale and tourism, 0.15 for construction and 0.1 for manufacturing.

[16] Similar approaches were used in the studies referred to in footnotes 8 and 11.

Table 2
REGRESSION COEFFICIENTS WITH ASYMMETRY

Dependent variable: $\Delta(UNR_t)$

Sample 2001Q1 - 2012Q4

			Explanatory variables				
Equatio	Specification	intercept	$\Delta(GDP_t)$	$\Delta(GDP_{t-1})$	$\Delta(UNR_{t-1})$	$d\_\Delta(GDP_t)^{-ve}$	$d\_\Delta(GDP_t)^{+ve}$
1	Static	-0.31*				-0.32***	0.07
2	Static	-0.31*	0.07			-0.39***	
3	Dynamic	-0.23			0.56***	-0.21**	0.06
4	Dynamic	0.07		-0.09**	0.55***	-0.09	
5	Dynamic	-0.14	0.10	-0.10***	0.52***	-0.27***	

*Statistical significance: * at 10% level, ** at 5% level, *** at 1% level.*

The last two columns refer to the specification of dummy variables to test for asymmetry.

Source: Author's calculations.

The specifications in the second approach (see equations 2, 4 and 5 in Table 2) account for asymmetry by retaining overall GDP growth, but also adding $d\_(\Delta GDP_t)^{-ve}$, the dummy for GDP contraction, already referred to in the previous paragraph. In this way, the second approach tests for both the standard Okun's coefficient and the coefficient during periods of negative GDP growth. Equations (4) and (5) also contain an autoregressive term.

Table 2 presents the results for Malta from both static and dynamic specifications of the difference version while testing also for asymmetry. In most instances, both static and dynamic specifications provide evidence of an asymmetric relationship between output and unemployment, indicating that during recessions the response of unemployment to output tends to be more pronounced.[17] Estimates of Okun's coefficient during periods of positive growth are lower than those during periods of negative growth, but these estimates are not statistically significant and with the wrong sign. As with findings in Table 1, the impact of contemporaneous changes in output on unemployment is statistically insignificant and with the wrong sign, thereby confirming the absence of contemporaneous impact of developments in the real economy on the labour market.

Estimates from the static versions – equations (1) and (2) in Table 2 – point to an Okun coefficient in excess of 0.3 during periods of contracting GDP growth. Statistically significant estimates from the dynamic versions – equations (3) to (5) in Table 2 – range between 0.2 and 0.3, with the differences in the range depending on whether changes in GDP growth enter the specification contemporaneously or with a lag.

Conclusion and policy implications

The results presented point to a number of interesting observations on the relationship between real economic activity and the labour market in Malta. First, developments in the real economy affect the domestic labour market with a lag. Second, the relationship between output and unemployment is relatively weak in Malta compared with other EU

[17] A similar finding for Malta was reported in the study referred to in footnote 7. To assess the robustness of the results, a separate set of regressions were estimated using the change in the growth rate instead of the growth rate as a dummy variable. The main finding in favour of asymmetric evidence remains unchanged.

economies, although the link has become more pronounced in recent years perhaps due to the changing structure of employment and the labour market. Empirical estimates suggest that the rate of output growth consistent with a stable unemployment rate is around 1.5% to 2.0%, with an Okun's coefficient of around 0.2. This implies that GDP growth in excess of 1.5%-2.0% lowers the unemployment rate. More specifically, a 1 percentage point increase in GDP above this threshold lowers the unemployment rate by around 0.2 percentage point.

Finally, the relationship appears to be more pronounced during economic recessions. This finding would strengthen the call for prudent fiscal policy during the business cycle to create fiscal space in good times, thereby allowing room for manoeuvre in times of subdued demand to stimulate economic activity and avoid job losses. In addition, the asymmetric relationship between unemployment and output implies that the pace of job creation following a recession may be insufficient to absorb the newly unemployed. Hence, a more proactive approach should be pursued to provide appropriate training and incentives to the unemployed to upgrade their skills to meet the changing requirements of the new industries, thereby facilitating their re-employment.