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Employment and labour hoarding: a production function approach

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Abstract

Purpose – This paper aims to test the hypothesis that the effect of production slowdown on labour demand can be muted by labour hoarding.

Design/methodology/approach – This study adopts a production function approach, using data from Malta, a small state in the EU.

Findings – The results confirm the hypothesis and indicate that firms are normally prepared to employ and dismiss more workers in the long run than in the short run.

Practical implications – This finding has important implications for developed countries, including that labour hoarding can be of certain relevance in times of economic slowdown as shocks are absorbed by internal flexibility.

Originality/value – The results of this study add on to the existing literature in two ways. First, this study compares two industries – manufacturing and financial services – for which the former sector received support to hoard labour after the financial turmoil of 2008. Consequently, the dominance of labour hoarding in manufacturing relative to financial services is uncovered and the effect of hoarding practices on labour demand is estimated. Second, Malta is an interesting case because it is one of the smallest economies in the world and faces a high degree of vulnerability because of constraints associated with small size and insularity. As a result, firms adopt policy-induced measures to minimise adjustment costs.

Keywords Labour demand, CES production function, Disequilibrium model, Labour hoarding

Paper type Research paper

Introduction

As the world economy is slowly recovering the deep and widespread recession since the 1930s, a policy challenge in many developed countries is the deteriorated labour market outcomes. Job shedding became widespread and unemployment increased at record levels in most developed countries. The financial turmoil and the economic crisis have had repercussions on the growth prospects, and without in-built economic resilience mechanisms, resulting from internal flexibility and good economic governance, countries were unable to recover quickly from or adjust instantaneously to the adverse exogenous shock. Indeed, as observed in many studies, unemployment increases have been contained in countries with comparatively strong internal flexibility (Eichhorst *et al.*, 2010; Carballo-Cruz, 2011; Eichhorst, 2014; Muffels *et al.*, 2014).



Sharp drops in output instigate firms to reduce labour costs by shedding workers, reducing hours worked, or reducing compensation per employee. Firms tend to hoard labour, meaning that workers are retained more than is required to produce the demanded level of output. This is based on the expectations that demand will recover and soon the excess number of workers will be needed again. Furthermore, it may also be advantageous for firms, as they do not incur redundancy payments.

Though adjustment costs of firms, such as hiring-and-firing and training costs, are considered to be crucial in determining the responsiveness of firms to external shocks (Hamermesh, 1993; Hamermesh and Pfann, 1996), they are not abundant and reported in literature. Empirical literature confirms that firms do not adjust employment instantaneously in response to an aggregate demand shock, as they should under convex cost situation. By contrast, the response is often lagging, staggering and discontinuous, with periods of inertia and large adjustments to large shocks (Hamermesh, 1989; Caballero *et al.*, 1997; Varejão and Portugal, 2007; Ejarque and Portugal, 2007).

A common approach to address this problem is to extrapolate labour demand dynamics as a partial-adjustment-like path towards new equilibrium, meaning that a distinction between desired and actual employment is made. Other studies describe the dynamics of labour demand as the result of the interaction between the shapes of the adjustment hazard function (Varejão and Portugal, 2007). The importance of nonlinearities and non-convex cost structures was also tested with micro-data (Hamermesh, 1993, 1996; Anderson, 1993). Consistent with this group of studies, empirical results have often reported a “lumpy” adjustment (Caballero *et al.*, 1997).

Small states economies are a good example to test the hypothesis that negative impacts on labour demand can be muted if against the background of negative output growth firms hoard labour and consequently stabilise labour market trends[1]. It is generally acknowledged in the literature that countries with properly designed labour market institutions that promote “flexicurity” (Wilthagen and Tros, 2004; Muffels and Wilthagen, 2013) tend to perform well in both economic and social dimensions (Muffels *et al.*, 2014). Such transformation also requires flexibility in the attitudes of the social partners (Esping-Andersen and Regini, 2000) to facilitate coordination between employers and employees at both central and industry level.

This paper will focus on the Maltese economy, a small and open economy in the European Union, which is highly dependent on external trade and investment relationships with the European bloc. The Maltese economy was not heavily impacted in the financial sector, the main reason being that Malta tends not to be highly exposed to the main factors that led to the crisis, including excessive reliance on wholesale financing and collateralised debt obligations. However, Malta have been affected by the spillover effects of the crisis, and experienced, amongst other things, drops in manufacturing orders and tourist inflows. With the aim “to maintain current employment and possibly [...] help to stimulate the creation of new jobs”, the Maltese authorities embarked micro-level and tailor-made aid schemes designed to the different needs of the different firms (European Commission, 2009). Consequently, the Maltese experience is a good case study to capture the effect of hoarding tendencies on labour demand.

The study adds on to the existing literature on labour hoarding by estimating a dynamic labour demand equation for two industries –manufacturing and financial services in Malta. Malta is an interesting case because over the past decade, particularly during the 2009 economic crisis, aid was provided to companies, many in manufacturing, which because of a slump in demand were planning to shed their workforce. Therefore, labour hoarding can be at large the result of state intervention to mitigate the situation and avoid upheavals during

the crisis. As a result of these policy measures, by estimating a sectoral-based labour demand equation, one could uncover the presence of labour hoarding in manufacturing and explain why it is more dominant relative to the financial industry.

This study will test the hypothesis, using a production function approach that the effect of production slowdown on labour demand was muted by amongst other things labour hoarding. To do this, the paper investigates labour demand in Malta by using quarterly data for the period 2000 to 2016.

The paper is organised as follows. Following this introduction, the paper presents a brief discussion on labour hoarding in Section 2. This is followed, in Section 3, by a description of the methodology employed to test the hypothesis just mentioned. Section 4 presents the results, while Section 5 concludes the study with some implications derived from the results.

The theory of dynamic labour demand

Labour hoarding as a response to cyclical fluctuations

There is an interesting literature debate about the relationship between economic fluctuations and employment performance. Most authors consider that the transmission of shocks on goods market to the labour market does not happen instantaneously, and indeed, some kind of time lag is observed. This means that firms allow labour input to fluctuate over the business cycle and hence suggesting that labour demand responds less than proportionately in response to a negative demand shock (Taylor, 1982; Hamermesh, 1996). However, it is also acknowledged on the theoretical side of the neoclassical theory, that with diminishing marginal returns to labour, the elasticity of employment with respect to output is expected to be higher than unity. This means that labour demand decreases more-than-proportionately when output declines, and increases more-than-proportionately when output rises. Given the assumption of diminishing marginal returns to labour, this would trigger average labour productivity to move counter-cyclically. Yet, as observed in many empirical works, labour productivity is pro-cyclical, suggesting that the output elasticity of employment is less than unity (Bernanke and Parkinson, 1991; Arpaia and Curci, 2010; Leitner and Stehrer, 2010; Hijzen and Venn, 2011; Fenger *et al.*, 2014), which Solow (1964 cited in Biddle, 2014) described as the “perverse behaviour of productivity in the short run”. In fact, labour hoarding behaviour can be associated with firms absorbing higher unit labour costs and thus decrease competitive position of the firm in the short run.

Although these two points of view would seem to be confrontational, the basic difference between them hinges on how firms optimise labour input and thus be consistent with the neoclassical theorem.

One possible reason for labour hoarding is the non-negligible fixed employment adjustment costs which abstain firms from laying off workers when faced with temporarily lower labour demand (Oi, 1962; Brechling, 1965; Bowers *et al.*, 1982; Horning, 1994). For example, hiring-and-firing and training costs make it optimal for profit-maximising firms to hoard labour over short-run cyclical variations. Indeed, in such imperfect markets, such transaction costs are influential in the production function of firms (Okun, 1963).

Hysteresis in employment could also be the result of the presence of non-convex costs incurred by firms. This restricts upward and downward employment adjustment, and inaction would be the optimal response by firms to shocks. The equilibrium thus becomes path-dependent, implying that history of past adjustment periods also determine employment.

Another factor that contributes to labour hoarding results from the human capital enjoyed by employees themselves (Oi, 1962; Becker, 1970; Williamson *et al.*, 1975). “Acquired skills that existing employees have learned on the job may make them particularly valuable

to the firm, so that it pays to stockpile underemployed labour rather than run the risk of having to hire untrained men when business conditions improve". (Okun, 1963, p. 7). A possible implication is that labour hoarding is more relevant for high-skilled workers than low-skilled workers engaged in routine tasks.

In relation to the above, the nature of industrial relations and informal rules and social norms also has an *a priori* effect on the effectiveness of changes in the level of employment. If the relationship between the employee and the employer is relational, then the costs of lay-offs can be exorbitantly high, resulting in an irreversible loss of human capital. Moreover, the firm's reputation may be destroyed which increases further the transaction cost for future recruitments (Okun, 1981). Consequently, in this regard, labour hoarding is a way of signalling to engaged and prospective workers of safeguarding a stable employment contract, and thus complements to norms of reciprocity and trust.

Finally, labour hoarding can be the product of state intervention. A possible way to cushion the negative effects during cyclical downturns is to incentivise reduction of the number of working hours, thereby aiding flexibility without redundancies. Malta is one of the countries that adopted such policies, in collaboration with the social partners and other public entities, to mitigate the situation and avoid upheavals during the crisis. During the period, Malta introduced schemes that were earmarked to support three essential components:

- (1) increasing flexibility between employers and workers;
- (2) investing in human capital; and
- (3) spreading out into new markets (Parnis, 2011)[2].

The Maltese government intervened by giving subsidies to the ailing firms so as to retain labour. With the consent of trade unions to these measures, many of these firms had to operate on a four-day working week. Indeed Rizzo (2013) relates the consensus reached between the social partners to deal with the imminent redundancies as a "social pact at company level", such that the consensus between government, unions and employers enabled the "management of the firms to seek alternative forms of production and new windows of opportunities to keep the workers on the payroll". Thus, policies to hoard labour provided an opportunity to bring about more flexicurity between employers and workers. By and large the destabilising effect of the crisis on the Maltese economy was mitigated (Rizzo, 2013), which has been so because firms mostly hit by lower international demand have been partly protected from extensive economic shocks.

Flexibility models

The concept of labour hoarding merits further attention so as to relate it with labour market institutions. In his seminal work, Atkinson (1984) distinguishes between three kinds of flexibility. First, numerical flexibility which refers to the ability of a firm in adjusting the number of employees or working hours without altering its workforce in accordance with labour demand. Second, functional flexibility which is the ability of a firm to adjust the organisation of the production process to changing demand. And finally, financially flexibility, which is sought so as labour costs reflect the state of supply and demand.

One can further segment flexibility into internal and external clusters (Eichhorst *et al.*, 2010). While external flexibility factors in outside paradigm settings –like dismissal protection, fixed-term employment, and temporary agency work– internal flexibility links with adjustment of working time, and wage flexibility.

This framework can be used to help identifying possible policy frameworks *vis-à-vis* the intensity of employment protection. By way of example, countries with strong employment

protection legislation can compensate for lack of external flexibility by offering opportunities that enhance internal flexibility within firms. Indeed, policy programmes such as subsidising wages at risk of losing their job, offering of apprenticeship, and launching of active labour market policies to foster employability and to facilitate the integration of jobseekers into the labour market can absorb and accommodate shocks through hoarding of labour. Consequently, this suggests that countries with internal flexibility are more able to control employment losses and rising unemployment. This is achieved through “automatic” labour market stabilisers that make labour market adjustments via working hours rather than through layoffs.

Production functions

The basic assumption underlying a production function is that output depends on labour and capital, given existing technology. The estimation of a production function, using empirical data, often encounters difficulties with regard to data on capital stock (Dean, 1965; Stainer, 1997). To circumvent this problem, a derived labour demand equation is often used, as is done in the current study, as this permits the estimation of some production function parameters without the need for the capital variable. As explained in the Methodology section, the labour demand equation so derived, can yield an indication of the extent of labour hoarding, through the exponent on the partial adjustment coefficient and the evolution of exponent on output, as an explanatory variables of labour demand.

Many studies have used labour demand equation derived from the constant elasticity of substitution (CES) production function to explain factors that affect employment or unemployment across countries. Studies using a labour demand analysis have been carried out to explain the responsiveness of unemployment to growth (Nickell *et al.*, 2005; Herwartz and Niebuhr, 2011b), labour market disparities among countries (Mourre, 2004; Herwartz and Niebuhr, 2011a), and the evolution of the elasticity of labour demand and the possible role of trade therein (Onaran, 2008; Hijzen and Swaim, 2010). Briguglio and Vella (2015) and Briguglio (1998) also used a labour demand equation derived from CES production function to test the hypothesis that small country size is associated with constraints relating to economies of scale.

Markets in disequilibrium

Studies of markets characterised by the possibility of persistent disequilibrium, often distinguish between excess supply, where aggregate employment would represent labour demand, and excess demand, where aggregate employment would not (Briguglio, 1984; Rudebusch, 1986; Bhaskara, 1990; Hall *et al.*, 1992). This can be explained in terms of a diagram depicting the short side of the market, where labour demand would only be observed along the demand curve when wage rates are above or equal to their equilibrium level. At wage rates lower than their equilibrium level, there will be excess demand, and employment would therefore represent labour supply. The approach adopted in the present study is based on this procedure.

A factor that may account for existence and persistence of excess supply is sluggish wage adjustment in the downward direction, because of union activity, employment contracts and minimum wage legislation (Briguglio, 1984; Arpaia and Curci, 2010).

There are also possibilities for excess demand to exist and persist, particularly during periods of rapid economic growth, when the existing labour supply would not grow enough to match, in terms of numbers and availability of skills, the fast growing demand for labour, with wage adjustment rising at a lower rate than warranted by market realities.

Methodology

Constant elasticity of substitution production function

The underlying production function that will be used is of the CES type[3], allowing for the possibility of efficiency changes and non-constant returns to scale as shown in [equation \(1\)](#):

$$Y_{it} = e^{rt} [bL_{it}^{-\rho} + (1 - b)K_{it}^{-\rho}]^{-\nu/\rho} \quad (1)$$

where Y_{it} represents value-added produced by the inputs, namely labour (L_{it}) and capital (K_{it}). The subscript i refers to industry and t is time. The expression e^{rt} captures shifts in the production function, because of technological change, which influences employment, between one observation and another, even if wage rates and output do not vary between observations. Here, r is the rate of growth of Y_i as a result of technological advance, with wage rate and output remaining constant, and t is time, taking the value of $1, 2, \dots, T$.

The coefficients of [equation \(1\)](#) can be interpreted as follows:

- b is the distribution parameter, which shows the degree of capital intensity and is related to the distribution of output between labour and capital.
- ρ is the substitution parameter, from which the elasticity of substitution $\sigma = 1/(1 + \rho)$ can be derived. Here, by using the CES production function, we are implicitly allowing for the possibility that a certain percentage decrease in factor prices need not generate a corresponding percentage increase in factor demand.
- ν is the homogeneity parameter, which measures the degree of returns to scale, and would indicate constant returns if its value is unity, decreasing returns if its value is lower than unity and increasing returns if its value is higher than unity.
- r captures the effect of technological advance on output.

Deriving a labour demand equation

The labour demand equation can be derived by assuming that the marginal product of labour is equal to the wage rate (W), as specified in [equation \(2\)](#):

$$MP_L = \partial Y_{it} / \partial L_{it} = W_{it} \quad (2)$$

Applying this condition to [equation \(1\)](#) we obtain:

$$\partial Y_{it} / \partial L_{it} = \nu b T e^{rt(-\rho/\nu)} L_{it}^{-(1+\rho)} Y_{it}^{(1+\rho/\nu)} \quad (3)$$

Combining [equations \(2\)](#) and [\(3\)](#), and expressing the equation in logarithmic form, we get the following equation:

$$\ln L_{it} = \sigma \cdot \ln(\nu b) - \sigma \cdot \ln W_{it} + [1 + \sigma(\nu - 1)]/\nu \cdot \ln Y_{it} - (1 - \sigma)/\nu \cdot r T_{it} \quad (4)$$

where $\sigma = 1/(1 + \rho)$, is the elasticity of substitution between labour and capital. [Equation \(4\)](#) can therefore be expressed as follows for estimation purposes:

$$\ln L_{it}^* = \alpha_0 + \alpha_1 \ln W_{it} + \alpha_2 \ln Y_{it} + \alpha_3 T_{it} \quad (5)$$

where the coefficients can be interpreted as follows:

- α_1 is the elasticity of substitution, indicating the extent to which labour replaces capital as wage rates become lower in relation to the rental value of capital.
- α_2 is the elasticity of employment with respect to output. This coefficient will, under certain conditions, take a value of a positive fraction if increasing returns to scale are assumed[4].
- α_3 captures, among other things, shifts in the production function because of technological change. If the coefficient has a negative sign, then technological advance exerts a negative effect on labour demand.

The coefficients of the CES production function can therefore be estimated, with the exception of the distribution parameter, using data on value-added, wage rates and technology.

Partial adjustment

As outlined in the literature review, there are cases where the optimal level of employment is truly optimal only in the long run, as in the short run, the firm may find it advantageous to employ more or less people than is technically necessary. L_t^* in [equation \(5\)](#) shows labour demand that is desired, which is a long-run response. In practice, because of various factors including the cost of hiring-and-firing labour, employees may not be discharged as fast as is technically desirable when output falls, and therefore engagement of employees when output increases after a decline may be lower than technically warranted.

Labour adjustments affect [equation \(2\)](#) as follows:

$$\begin{aligned} \partial Y_{it} / \partial L_{it} &= W_{it} + c_h \text{ if } L_{it} - L_{it-1} > 0 \\ \partial Y_{it} / \partial L_{it} &= W_{it} - c_f \text{ if } L_{it} - L_{it-1} < 0 \end{aligned} \quad (6)$$

where c_h and c_f are the hiring cost and firing cost, respectively. These conditions imply that the firm hires when the productivity is at least high enough to cover both the wage rate and the hiring cost. By contrast, the firm fires whenever marginal product of labour is so low that it is just equal to the wage rate less the termination cost. In the interval $[W_{it} + c_h, W_{it} - c_f]$, the firm does not alter employment for the gains in hiring-and-firing are less than the costs incurred in adjusting employment.

In econometrics, such a possibility is called partial adjustment and can be incorporated in the equation by applying the technique of cointegration, together with the error correction mechanism (ECM):

$$\Delta_4 \ln L_{it} = \lambda (u_{t-4}) + \Delta_4 \beta_1 \ln W_{it} + \Delta_4 \beta_2 \ln Y_{it} + \beta_3 T_{it} \quad (7)$$

where Δ_4 is the seasonally differenced annual growth rate and $t - 4$ refers to the term lagged group periods. λ is the speed of adjustment, and u_{t-4} is the error term of the long-run specification. [Equation \(7\)](#) can be rearranged as follows:

$$\Delta_4 \ln L_{it} = \lambda (\ln L_{it-4} - \gamma_1 \ln W_{it-4} + \gamma_2 \ln Y_{it-4}) + \Delta_4 \beta_1 \ln W_{it} + \Delta_4 \beta_2 \ln Y_{it} + \beta_3 T_{it} \quad (8)$$

Estimating [equation \(8\)](#) requires all variables and the stochastic term of [equation \(5\)](#) to be $I(1)$ and are cointegrated.

The partial adjustment coefficient, λ , is expected to have negative value not exceeding unity. The adjustment would be zero if $\lambda = 0$, in which case [equation \(7\)](#) would be identical to [equation \(5\)](#), after correcting for seasonality. If on the other hand $\lambda = 1$, then adjustment within a given period is instantaneous and full. Partial adjustment implies that λ is a negative fraction.

β_1 and β_2 measure the immediate impact of a change in W_{it} and Y_{it} will have on a change in L_{it} , assuming partial adjustment of labour demand in the short run. Meanwhile, λ shows the feedback effect, i.e. by how much the disequilibrium is being corrected. γ_1 and γ_2 measure the long-run elasticity, assuming full technical adjustment of labour demand. This implies that if the coefficient on λ is found not to be different from zero, it can be assumed that there is full-adjustment of labour demand in response to a change in wage rates and to output; indicating that the short- and long-run labour demand equations coincide.

Seasonal unit root

Normally, econometricians work with seasonally adjusted data; however, [Depalo \(2009\)](#) notes that information might be lost on the data generation process during the adjustment process, which might provide useful input to economic theory. Hence, a systemic approach is required to take seasonality into account.

There are several ways to handle seasonal quarterly data, each making different assumptions about the process, namely, if the series is a purely deterministic seasonal process, a stationary seasonal process or an integrated seasonal process. [Hylleberg et al. \(1990\)](#) combine the three seasonal processes as follows:

$$\Phi(L)y_{4,t} = \pi_1 y_{1,t-1} + \pi_2 y_{2,t-1} + \pi_3 y_{3,t-2} + \pi_4 y_{3,t-1} + \varepsilon_t \quad (9)$$

where y_t contains four unit roots that correspond to zero frequency, $\frac{1}{2}$ cycle per quarter, or $\frac{1}{4}$ or $\frac{3}{4}$ cycle per quarter. Here, $y_{i,t} = S_i(L)y_t$, for which the latter is a seasonal filter that removes unit roots at the specified seasonal frequency. This approach is motivated by fact that quarterly data may have stochastic trends at both non-seasonal as well as at seasonal frequencies. The non-seasonal frequency is removed by using the first-order differencing filter, whereas the seasonal frequencies are adjusted by the forth-order differencing filter. Specifically, when a time series has seasonal unit roots, its seasonal averages not only are persistent but also change persistently. The unit root test after estimating [equation \(9\)](#) therefore tests if $\pi_i = 0$. Finding that $\pi_1 = 0$ implies a unit root (non-stationary). Likewise, if $\pi_2 = 0$ it implies a seasonal unit root at $\frac{1}{2}$ frequency. If $\pi_3 = \pi_4 = 0$, a seasonal unit root exists at one cycle per year. Therefore, rejection of both test for π_2 , and joint test for π_3 and π_4 implies the absence of seasonal unit roots.

Estimation method and data used

Results of unit roots tests

Quarterly data covering the period from 2000:1 to 2016:2 are used. We investigate labour demand in the total Maltese economy for a cross-section of two sectors, manufacturing and

financial services, utilising data on total hours worked (L_{it}), wage rates (W_{it}) and gross value added (Y_{it}). The data are sourced from the EUROSTAT database. Technology is a time trend. All variables are measured in natural logs as indicated in [equation \(8\)](#).

The results of the HEGY ([Hylleberg et al., 1990](#)) seasonal unit root tests are reported in [Table I](#). Importantly, for zero frequency, values of the t -statistic larger than the critical values do not reject the null hypothesis of unit root. On contrary, values of the estimated t -values smaller than the critical values reject the null hypothesis. According to the table, the null hypothesis that the time-series has a unit root at frequency zero is not rejected at 5 per cent level for the computed t -values does not lie in either of the rejection regions. As expected, this means that quarterly data is non-stationary. This confirms that all variables need to be adjusted by applying the first-order differencing. Such result could have been inferred from the classical augmented Dickey–Fuller test (ADF). To test the unit root at all seasonal frequencies we use an F -type test for it is a joint test on coefficients. The null hypothesis is rejected in cases where the test statistic is larger than the critical value, meaning that the presence of seasonal unit roots is rejected. All in all, we also reject the joint significance of seasonal unit roots for L_{it} and Y_{it} .

The use of ECM requires cointegration, meaning that the explanatory variables are $I(1)$ and the error-term of the long-run equation is $I(0)$. This conjecture was tested and verified by using the ADF test. Hence, the ECM term can be incorporated in the equation and estimated by OLS as all variables are now stationary.

A priori, one expects that β_1 takes a negative sign, β_2 a positive sign, β_3 a negative sign, given that the labour demand function is assumed to be derived from the production function and λ takes a negative sign.

As already explained, wage rates may not clear the market in all periods. If the labour market does not clear, we would need to relax the assumption that the model proposed in this study allows for this possibility by only considering periods when unemployment was equal or higher than the natural rate of unemployment (NAIRU). This means that during these years there was excess supply or equilibrium and consequently labour demand was observed.

The choice of 66 observations was conditioned by ESA10 methodology, which enjoys the benefit of availability, reliability, and comparability of data. It turned out, however, that the sample contains a good representation of different cyclical fluctuations, as shown in [Table I](#). Furthermore, [Table II](#) shows that between 2000 and 2015, the labour market response has remained fairly small relative to output produced by firms. This could possibly indicate, but

	Fr 0	All Seas. Fr.
Manufacturing		
L	−0.784	6.216
Y	−2.287	6.585
W	−2.231	1.942
Financial services		
L	−2.204	7.069
Y	−1.646	8.005
W	−1.458	2.825
5% critical value for zero frequency: −3.530		
5% critical value for all seasons frequency: 5.990		

Table I.
HEGY seasonal unit
root test

Note: Own elaboration

	Manufacturing		Financial services	
	Value-added (%)	Employment (%)	Value-added (%)	Employment (%)
2001	-19.1	-0.3	0.7	-0.1
2002	0.6	-5.0	-6.2	-2.1
2003	3.5	-3.2	7.9	-1.4
2004	-15.1	-6.8	18.1	3.9
2005	-0.9	-2.2	37.8	5.0
2006	-2.2	-2.3	10.5	6.4
2007	5.3	-1.5	-1.6	9.1
2008	12.0	-5.1	-11.4	6.0
2009	-20.5	-10.0	6.5	4.0
2010	4.8	0.3	10.0	6.1
2011	2.6	1.0	-2.4	2.6
2012	-1.4	-2.1	13.6	2.4
2013	-10.3	1.4	-2.0	1.5
2014	-3.0	2.1	-5.9	1.5
2015	-1.4	-0.5	5.9	2.9

Source: Eurostat

Table II.
Year-on-year
changes in real GVA
and in employment,
quarterly average

	Manufacturing	Financial services
Constant	0.357 (0.98)	0.157 (0.85)
$\Delta_4 \ln W_t$	-0.186** (-2.52)	-0.120** (-2.32)
$\Delta_4 \ln Y_t$	0.150* (1.89)	0.059*** (3.03)
$\ln L_{t-4}$	-0.186** (-2.64)	-0.295 (-4.48)
$\ln W_{t-4}$	-0.316*** (-4.70)	-0.067 (-1.31)
$\ln Y_{t-4}$	0.123** (2.11)	0.126*** (7.13)
T_t	0.002 (0.31)	0.001* (1.82)
R^2	0.4152	0.6785
$F(6,55)$	9.60	14.85
N	62	62

Note: ***, ** and * denotes significance at the 1%, 5% and 10% level respectively. Own elaboration

Table III.
Estimation results,
assuming absence of
excess demand

does not prove, that value-added growth may have exceeded employment growth because of labour hoarding. In the next section, we shall use cross-section data pertaining to Malta to test whether labour hoarding has been present.

Estimation results

Equation (7) was estimated using the ECM. This estimation technique was taken into consideration after testing for cointegration and seasonal unit roots as otherwise the regression would be spurious.

It was estimated first by assuming that all observations of employment indicate labour demand, which means that the labour market in all years was characterised by equilibrium or excess labour supply. From the available data, the estimation results are as follows.

The estimated parameters are in line with *a priori* expectations and have plausible magnitudes.

The estimated equation for the manufacturing industry shows that the coefficient on W takes a value of -0.186 respectively, indicating that a 10 per cent increase in wage rate generates a decrease in employment of 1.86 per cent, everything else remaining constant. The wage elasticity was found to be -0.12 for financial services. As already explained, this is an estimate of the elasticity of factor substitution, which is less than unity justifying the use of the CES production function rather than the Cobb–Douglas one. This parameter has important implications as its magnitude provides an insight into the labour/output ratio changes as the country's wage rates change. Indeed, the difference in elasticity is expected because the ease of factor substitution in the financial services is less pronounced than the manufacturing sector. If we had used the Cobb–Douglas production function, these parameters would have been restricted to unity. In fact, both coefficients on W_{it} are statistically different from one at 1 per cent level.

The estimated parameter β_2 , that is the coefficient on output, takes a value of 0.150 for the manufacturing industry. This would seem to suggest that as the output expands by 10 per cent, demand for labour increases by 1.5 per cent. The same parameter was estimated to be smaller for financial services at 0.059.

The short- and long-run elasticities of labour demand with respect to Y and W can be computed as per the partial adjustment scheme described in the previous section. If equilibrium condition is assumed, the long-run elasticity of labour demand to W for manufacturing and financial services takes a value of -1.70 and -0.23 , respectively. Meanwhile, for every 10 per cent increase in output, employment tended to increase by about 6.6 and 4.3 per cent in the long run for each respective industry. The estimates are compatible with a priori condition that firms are normally prepared to employ and dismiss more workers in the long run than in the short run because hiring-and-firing labour is less costly.

The long-run elasticities with respect to wages and value-added imply that the cost per unit of output for manufacturing increases as the scale of production increases. This is demonstrated by a value of 0.67 for the parameter ν in the underlying CES production function. In other words, the value of ν shows decreasing returns to scale, meaning that a given increases in inputs generates a less-than-proportionate increases in output for the manufacturing industry. One reason for this is that the domestic manufacturing industry consists mainly of micro and small firms with small production runs. Small size limits the possibilities of economies of scale (Briguglio, 1998; Briguglio and Vella, 2015). There is also some evidence in Basu and Fernald (1997) of decreasing returns to scale in non-durable goods industries. Having manufacturing consisting mostly of non-durable industries, this gives another explanation why we are observing decreasing returns to scale. By contrast, the financial services industry is found to be endowed with increasing returns to scale. The basis of trade as well as investment in human capital increases returns in scale production.

The estimated coefficient for technological change is not significant from zero and hence there is no conclusive evidence. This is possibly because of the fact that technological changes did not produce a systematic effect on labour demand, even though it may have had an effect on individual firms.

The parameter on L_{t-4} measures the speed of adjustment for the equilibrium error to be corrected in each period. Indeed, the magnitude of labour hoarding can be demonstrated by

the coefficient size and its value relative to other industries. This uncovers the relationship between cyclical fluctuations in output and the output elasticity of labour demand. The presence of labour hoarding in manufacturing is evident in light of smaller speed of adjustment. This means that during periods of economic downturn, firms hoard labour and therefore a reduction in the magnitude of the parameter is observed in the short-run. Indeed, in the manufacturing industry, 18.6 per cent of the adjustment takes place within a given period; meaning that the adjustment is partial. On the contrary, the adjustment is faster for financial services, estimated to be close to 29.5 per cent[5]. A possible explanation could be that firms in services are borne with more flexible employment costs and thus making labour hoarding less probable to short-term fluctuations in demand. This finding is consistent with [Apap and Gravino \(2014, p. 16\)](#) who found that “the unemployment rate has been more sensitive to developments in the services sector than those in the manufacturing sector” because firms in the direct production do not immediately adjust labour input in line with demand for their products.

Segmenting the sample

The equation was re-estimated by excluding quarters with excess labour demand, given that in such situation, employment would not reflect labour demand. It was assumed, in line with standard macroeconomic theory, that the labour market was in equilibrium when the unemployment rate was equal to the NAIRU level, and that excess labour supply or demand occurs when the unemployment is higher or lower than than NAIRU. Based on the data on NAIRU[6] 24 observations were found to be characterised by excess demand and were therefore excluded from the sample. The results of this experiment are presented in [Table IV](#).

The estimated coefficient on the error-correction term confirms the presence of labour hoarding in the Maltese labour market in the financial services industry. This confirms that firms do not immediately adjust labour input in line with demand for

	Manufacturing	Financial services
Constant	0.218 (0.41)	0.247 (1.19)
$\Delta_4 \ln W_t$	-0.176* (-1.96)	-0.144*** (-2.61)
$\Delta_4 \ln Y_t$	0.161* (1.82)	0.051** (2.20)
$\ln L_{t-4}$	-0.148 (-1.10)	-0.313*** (-4.44)
$\ln W_{t-4}$	-0.314*** (-4.00)	-0.081 (-1.44)
$\ln Y_{-4}$	0.125* (1.96)	0.118*** (5.99)
T_t	0.0004 (0.38)	0.002* (1.82)
R^2	0.3994	0.7015
$F(6,46)$	7.27	14.4
N	53	53

Note: ***, ** and * denotes significance at the 1%, 5% and 10% level respectively. Own elaboration

Table IV.
Estimation results,
accounting for labour
market
disequilibrium

their services. In addition, the adjustment was not found to be significant from zero for the manufacturing industry. This suggests a rather lengthy adjustment.

Conclusion

This paper argued that that firms tend to hoard labour, such that workers are retained more than is required to produce the demanded level of output. In turn, the transmission of shocks on goods market to the labour market does not happen instantaneously, and indeed, some kind of time lag is observed. This hypothesis was tested using a production function approach, using the marginal productivity condition for labour derived from the CES production function.

The results confirm the presence of labour hoarding, and the effect of the speed of adjustment for both wages and output depends on the time scale of economic decisions, thereby suggesting that firms operating in the short run are more able to hoard labour. Therefore, as output elasticity of labour demand becomes muted in times of negative economic shocks the total economy is provided with an automatic protective shield against job losses among the workforce.

The results of this study add on to the existing literature on labour hoarding in two ways. First, this study compares two industries –manufacturing and financial services– for which because of the international economic turmoil in 2008 the former sector received support to help companies retain their workforce and, with the consent of trade unions, firms operated on reduced-hours. In this sense, while taking into account the adverse shocks in employment and the subsequent recovery, hoarding tendencies in manufacturing can be seen as a policy-initiative. Consequently, one could uncover the dominance of labour hoarding in manufacturing relative to financial services and estimate the effect of hoarding practices on labour demand. Second, Malta is an interesting case because it is one of the smallest economies in the world, when compared to other independent countries, and face a high degree of vulnerability because of constraints associated with small size and insularity. As a result, firms adopt policy-induced measures to minimise adjustment costs.

This finding has important implication for developed countries, namely, that labour hoarding can be of certain relevance for the labour market in times of economic slowdown. Indeed, labour hoarding could be attributed with internal flexibility in that firms do not instantaneously adjust their labour force in line with demand and, instead, absorb short-run losses in their share-prices and registered profits. This is particularly relevant for small states, because these states tend to be highly dependent on international trade, in which case exposure to extensive economic shocks is high.

This does not mean that labour hoarding is always beneficial. Prolonged recessions bear labour hoarding costs excessive and hence lay-offs are inevitable. Labour hoarding could also imply lower labour turnover, inability to cope with structural changes, or the risk of jobless growth in an economic upswing. Furthermore, keeping low levels of unemployment through internal flexibility and policy interventions may bring forward important implications for structural adjustment in the long run. This means a policy approach that stimulates labour mobility and safeguards employability will be essential to promoting labour market resilience. However, in the short run, internal flexibility with aim to restricting job shedding during negative economic times and accelerating labour demand in times of recovery is desired during both sides of the business cycle. Indeed, government schemes to help ailing firms may therefore impose special conditions to invest and expand in new markets.

Notes

1. Small states tend to be highly dependent on international trade, particularly on a narrow range of exports and on strategic import, yielding them highly susceptible and vulnerable to external shocks (Briguglio and Galea, 2003; Atkins *et al.*, 2000; Guillaumont, 2010; Briguglio, 1995). Literature shows that small states face a number of economic disadvantages associated with small size, notably their limited ability to reap the benefits of economies of scale, because of, amongst other things, overhead cost indivisibilities and limited scope for specialisation, leading to relatively higher per unit costs (Winters and Martins, 2004).
2. A Task Force was set up by the Ministry of Finance in 2009 to provide a tailor-made package of financial aid to companies which because of a slump in demand were planning to shed their workforce. Amongst the schemes introduced by the Government of Malta was the Temporary Aid Scheme, whereby the majority of participating employees came from manufacturing concerns. This initiative was sanctioned by the social partners as a way of maintaining the employment and employability of affected workers who were working on a four-day week at the time (Borg, 2011).
3. A discussion on the properties of the CES is presented in Miller (2008).
4. $\alpha_2 = [1 + \sigma(v - 1)]/v$, implying that the labour demand elasticity with respect to output is not uniquely related to v but also to σ . It can be shown that $v = (1 - \sigma)/(\alpha_2 - \sigma)$, so that if α_2 is a positive fraction ($0 < \alpha_2 < 1$), v would be higher than unity, implying increasing returns to scale.
5. The manufacturing speed of adjustment is estimated to be significantly different from that of the financial services at 1% level.
6. The data on NAIRU was obtained from the annual macroeconomic database (AMECO) of the European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).

References

- Anderson, P.M. (1993), "Linear adjustment costs and seasonal labor demand: evidence from retail trade firms", *Quarterly Journal of Economics*, Vol. 108 No. 4, pp. 1015-1042.
- Apap, W. and Gravino, D. (2014), "Okun's law, in Malta lessons learnt from a sectoral perspective", *Malta: Economic Policy Department*, Ministry for Finance, Malta.
- Arpaia, A. and Curci, N. (2010), "EU labour market behaviour during the great recession", *Directorate General Economic and Monetary Affairs*, European Commission, Brussels.
- Atkins, J., Mazzi, S. and Easter, C. (2000), *Commonwealth Vulnerability Index for Developing Countries: The Position of Small States*, Commonwealth Secretariat, London.
- Atkinson, J. (1984), *Flexibility, Uncertainty and Manpower Management*. Brighton, Institute of Manpower Studies, IMS Report No. 89, UK.
- Basu, S. and Fernald, J.G. (1997), "Returns to scale in US production: estimates and implications", *Journal of Political Economy*, Vol. 105 No. 2, pp. 249-283.
- Becker, G.S. (1970), *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, Columbia University Press, New York, NY.
- Bernanke, B.S. and Parkinson, M.L. (1991), "Procyclical labor productivity and competing theories of the business cycle: some evidence from interwar US Manufacturing industries", *Journal of Political Economy*, Vol. 99 No. 3, pp. 439-459.
- Bhaskara, R.B. (1990), "A disequilibrium model of real wages, employment and unemployment for the USA during 1930-1965", *Empirical Economics*, Vol. 15 No. 1, pp. 55-75.
- Biddle, J. (2014), "The genealogy of the labor hoarding concept", The Center for the History of Political Economy Working Paper, MI State University, USA.

- Borg, A. (2011), "Getting prepared for the upswing: training and qualification during the crisis", available at: www.eurofound.europa.eu/observatories/eurwork/comparative-information/national-contributions/malta/malta-ewco-car-on-getting-prepared-for-the-upswing-training-and-qualification-during-the-crisis
- Bowers, J., Deaton, D. and Turk, J. (1982), *Labour Hoarding in British Industry*, Blackwell, Oxford.
- Brechling, F.P. (1965), "The relationship between output and employment in British manufacturing industries", *The Review of Economic Studies*, Vol. 32 No. 3, pp. 187-216.
- Briguglio, L. (1984), "The specification and estimation of a disequilibrium labour market model", *Applied Economics*, Vol. 16 No. 4, pp. 539-554.
- Briguglio, L. (1995), "Small island developing states and their economic vulnerabilities", *World Development*, Vol. 23 No. 9, pp. 1615-1632.
- Briguglio, L. (1998), "Small country size and returns to scale in manufacturing", *World Development*, Vol. 26 No. 3, pp. 507-515.
- Briguglio, L. and Galea, W. (2003), *Updating and Augmenting the Economic Vulnerability Index*, Islands and Small States Institute of the University of Malta, Malta.
- Briguglio, L.P. and Vella, M. (2015), "Labour demand in the EU and returns to scale: a production function approach", *The Journal of International Trade and Economic Development*, Vol. 24 No. 8, pp. 1-14.
- Caballero, R.J., Engel, E.M.R.A. and Haltiwanger, J. (1997), "Aggregate employment dynamics: building from microeconomic evidence", *American Economic Review*, Vol. 87 No. 1, pp. 115-137.
- Carballo-Cruz, F. (2011), "Causes and consequences of the spanish economic crisis: why the recovery is taken so long?", *Panoeconomicus*, Vol. 58 No. 3, pp. 309-328.
- Dean, G.A. (1965), "The stock of fixed capital in the United Kingdom in 1961", *Journal of the Royal Statistical Society*, Vol. 127 No. 3, pp. 327-358, No. A.
- Depalo, D. (2009), "A seasonal unit root test with stata", *Stata Journal*, Vol. 9 No. 3, pp. 422-438.
- Eichhorst, W. (2014), "Fixed-term contracts", *IZA World of Labor*, Vol. 45, pp. 1-10.
- Eichhorst, W., Escudero, V., Marx, P. and Tobin, S. (2010), *The Impact of the Crisis on Employment and the Role of Labour Market Institutions*, IZA Discussion Paper, Germany.
- Ejarque, J.M. and Portugal, P. (2007), *Labor Adjustment Costs in a Panel of Establishments: A Structural Approach*, IZA—Discussion Paper Series, Germany, p. 3091.
- Esping-Andersen, G. and Regini, M. (2000), *Why Deregulate Labour Markets?*, Oxford University Press, Oxford.
- European Commission (2009), "Letter from the EC to Malta – State aid no. N 118/2009 - Temporary aid scheme for granting limited amounts of compatible aid", available at: http://ec.europa.eu/competition/elojade/iseif/case_details.cfm?proc_code=3_N118_2009
- Fenger, M., Koster, F., Struyven, L. and Veen, R. (2014), "Smart policies or sheer luck? Labour market resilience in the low countries", *Social Policy and Administration*, Vol. 48 No. 4, pp. 492-513.
- Guillaumont, P. (2010), "Assessing the economic vulnerability of small island developing states and the least developed countries", *Journal of Development Studies*, Vol. 46 No. 5, pp. 828-854.
- Hall, S.G., Henry, S. and Pemberton, M. (1992), "Testing a discrete switching disequilibrium model of the UK labour market", *Journal of Applied Econometrics*, Vol. 7 No. 1, pp. 83-91.
- Hamermesh, D.S. (1989), "Labor demand and the structure of adjustment costs", *American Economic Review*, Vol. 79 No. 4, pp. 674-689.
- Hamermesh, D.S. (1993), "Spatial and temporal aggregation in the dynamics of labor demand", in *Labor Demand and Equilibrium Wage Formation*, Jan C. van Ours, Gerard A. Pfann and Geert Ridder, (Eds) Amsterdam, North Holland.
- Hamermesh, D.S. (1996), *Labor Demand*, Princeton University Press, NJ.

- Hamermesh, D.S. and Pfann, G.A. (1996), "Adjustment costs in factor demand", *Journal of Economic Literature*, Vol. 34 No. 3, pp. 1264-1292.
- Herwartz, H. and Niebuhr, A. (2011a), "Regional labor demand and national labor market institutions in the EU15", HWWI Research Paper.
- Herwartz, H. and Niebuhr, A. (2011b), "Growth, unemployment and labour market institutions: evidence from a cross-section of EU regions", *Applied Economics*, Vol. 43 No. 30, pp. 4663-4676.
- Hijzen, A. and Swaim, P. (2010), "Offshoring, labour market institutions and the elasticity of labour demand", *European Economic Review*, Vol. 54 No. 8, pp. 1016-1034.
- Hijzen, A. and Venn, D. (2011), *The Role of Short-Time Work Schemes during the 2008-09 Recession*, OECD Publishing, Paris.
- Horning, B.C. (1994), "Labor hoarding and the business cycle", *International Economic Review*, Vol. 35 No. 1, pp. 87-100.
- Hylleberg, S., Engle, R.F., Granger, C.W.J. and Yoo, B.S. (1990), "Seasonal integration and cointegration", *Journal of Econometrics*, Vol. 44 Nos 1/2, pp. 215-238.
- Leitner, S.M. and Stehrer, R. (2010), *Labour Hoarding during the Crisis: evidence for Selected New Member States from the Financial Crisis Survey*, The Vienna Institute for International Economic Studies, Austria.
- Miller, E. (2008), *An Assessment of CES and Cobb-Douglas Production Functions*, Congressional Budget Office, pp. 2008-2005.
- Mourre, G. (2004), *Did the Pattern of Aggregate Employment Growth Change in the Euro Area in the Late 1990s?*, European Central Bank, Frankfurt.
- Muffels, R. and Wilthagen, T. (2013), "Flexicurity: a new paradigm for the analysis of labor markets and policies challenging the trade-off between flexibility and security", *Sociology Compass*, Vol. 7 No. 2, pp. 111-122.
- Muffels, R., Crouch, C. and Wilthagen, T. (2014), "Flexibility and security: national social models in transitional labour markets", *Transfer: European Review of Labour and Research*, Vol. 20 No. 1, pp. 99-114.
- Nickell, S., Nunziata, L. and Ochel, W. (2005), "Unemployment in the OECD since the 1960s. What do we know?", *The Economic Journal*, Vol. 115 No. 500, pp. 1-27.
- Oi, W.Y. (1962), "Labor as a quasi-fixed factor", *The Journal of Political Economy*, Vol. 70 No. 6, pp. 538-555.
- Okun, A.M. (1963), "Potential GNP: its measurement and significance", *Foundation for Research in Economics*, Yale University, Cowles.
- Okun, A.M. (1981), *Prices and Quantities: A Macroeconomic Analysis*, The Brookings Institution, Washington, DC.
- Onaran, O. (2008), "Jobless growth in the central and east european countries: a country-specific panel data analysis of the manufacturing industry", *Eastern European Economics*, Vol. 46 No. 4, pp. 90-115.
- Parnis, D. (2011), "SMEs in the crisis: employment, industrial relations and local partnership", available at: www.eurofound.europa.eu/nl/observatories/eurwork/erm/comparative-information/national-contributions/malta/malta-eiro-car-on-smes-in-the-crisis-employment-industrial-relations-and-local-partnership
- Rizzo, S. (2013), "Impact of the crisis on industrial relations", available at: www.eurofound.europa.eu/observatories/eurwork/comparative-information/national-contributions/malta/malta-impact-of-the-crisis-on-industrial-relations
- Rudebusch, G.D. (1986), "Testing for labor market equilibrium with an exact excess demand disequilibrium model", *Review of Economics and Statistics*, Vol. 68 No. 3, pp. 468-476.

- Stainer, A. (1997), "Capital input and total productivity management", *Management Decision*, Vol. 35 No. 3, pp. 224-232.
- Taylor, J. (1982), "The theory and measurement of labour hoarding", *Applied Economics*, Vol. 14 No. 6, pp. 591-601.
- Varejão, J. and Portugal, P. (2007), "Employment dynamics and the structure of labor adjustment costs", *Journal of Labor Economics*, Vol. 25 No. 1, pp. 137-165.
- Williamson, O.E., Wachter, M.L. and Harris, J.E. (1975), "Understanding the employment relation: the analysis of idiosyncratic exchange", *The Bell Journal of Economics*, Vol. 6 No. 1, pp. 250-278.
- Wilthagen, T. and Tros, F. (2004), "The concept of 'flexicurity': a new approach to regulating employment and labour markets", *Transfer: European Review of Labour and Research*, Vol. 10 No. 2, pp. 166-186.
- Winters, L.A. and Martins, M.P. (2004), "When comparative advantage is not enough: business costs in small remote economies", *World Trade Review*, Vol. 3 No. 3, pp. 347-383.

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