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New Unemployment Indices for Cyprus and their Performance in Established Economic Relationships

Louis N. Christofides
Andros Kourtellos
Kostantinos Vrachimis

Department of Economics and Economics Research Centre
University of Cyprus

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Abstract

The objective of this study is to assess the economic performance of the existing unemployment variables for Cyprus using quarterly data and spanning the period 1999q1 to 2006q4. Two of the measures, the Registered unemployment rate and the measure taken from the Labour Force Survey, are from the Cyprus Statistical Service. The third measure, the Harmonized unemployment rate, is published by the European Statistical Service. They are used to estimate four established economic relationships, the Beveridge Curve, Okun's Law and the Phillips and Wage Curves.

Although all three variables perform about as well in the context of a fully specified Beveridge Curve equation, the Labour Force Survey rate (LFS rate) is the only measure that it is individually negatively related with the number of vacant jobs in the labour market. All three measures are negatively associated with the output growth rate (Okun`s Law). Moreover, the LFS rate is the only one that behaves as expected when the Phillips and Wage curves are estimated.

Our results suggest that, despite the smaller sample possible, the LFS rate leads to equations that are in line with theory.

CONTENTS

ΠΕΡΙΛΗΨΗ

Ο σκοπός της μελέτης αυτής είναι να αξιολογήσει την συμπεριφορά των μεταβλητών ανεργίας που είναι διαθέσιμες στην Κύπρο χρησιμοποιώντας δεδομένα που εκτείνονται από το πρώτο τρίμηνο του 1999 μέχρι το τέταρτο τρίμηνο του 2006. Δύο δείκτες προέρχονται από την Κυπριακή Στατιστική υπηρεσία, ο Δείκτης Εγγεγραμμένης Ανεργίας και ο δείκτης που προέρχεται από την Έρευνα Εργατικού Δυναμικού. Ο τρίτος δείκτης, ο Δείκτης Εναρμονισμένης Ανεργίας προέρχεται από την Ευρωπαϊκή Στατιστική υπηρεσία. Οι μεταβλητές χρησιμοποιούνται στην εκτίμηση της καμπύλης Beveridge, του νόμου του Okun, και των καμπυλών Phillips και Μισθών.

Παρόλο που και ο τρεις μεταβλητές συμπεριφέρονται όπως αναμένεται όταν εκτιμάται μια πλήρης εξίσωση Beveridge, μόνο ο δείκτης από την Έρευνα Εργατικού Δυναμικού από μόνος του βρίσκει αρνητική σχέση μεταξύ του δείκτη ανεργίας και του αριθμού των κενών θέσεων εργασίας. Και οι τρεις μεταβλητές είναι αρνητικά συνδεδεμένες με τον ρυθμό αύξησης του ΑΕΠ (νόμος του Okun). Επιπλέον ο δείκτης από την Έρευνα Εργατικού Δυναμικού είναι ο μόνος που είναι συμβατός με μία αρνητική σχέση της ανεργίας με τους μισθούς.

Τα αποτελέσματα μας δείχνουν, παρόλο του μικρού μεγέθους του δείγματος που χρησιμοποιείται, ότι ο δείκτης από την Έρευνα Εργατικού Δυναμικού δίνει αποτελέσματα που είναι σύμφωνα με τις οικονομικές θεωρίες που εξετάζονται.

I. INTRODUCTION

The purpose of this study is to evaluate the performance of the three unemployment measures, the Registered unemployment rate and the measure taken from the Labour Force Survey (published by the Cyprus Statistical Service) and the Harmonized unemployment rate (published by the European Statistical Service) in certain well established economic theories. The study of Christofides *et al* (2007) presented the three different variables and conducted an initial comparative analysis of their properties. In this paper, the analysis will be extended to check which of the variables conform with certain economic relationships that might be used in a modelling context. This will enable us to assess the performance of each unemployment variable and to decide which variable best reflects the experience of unemployment in Cyprus.

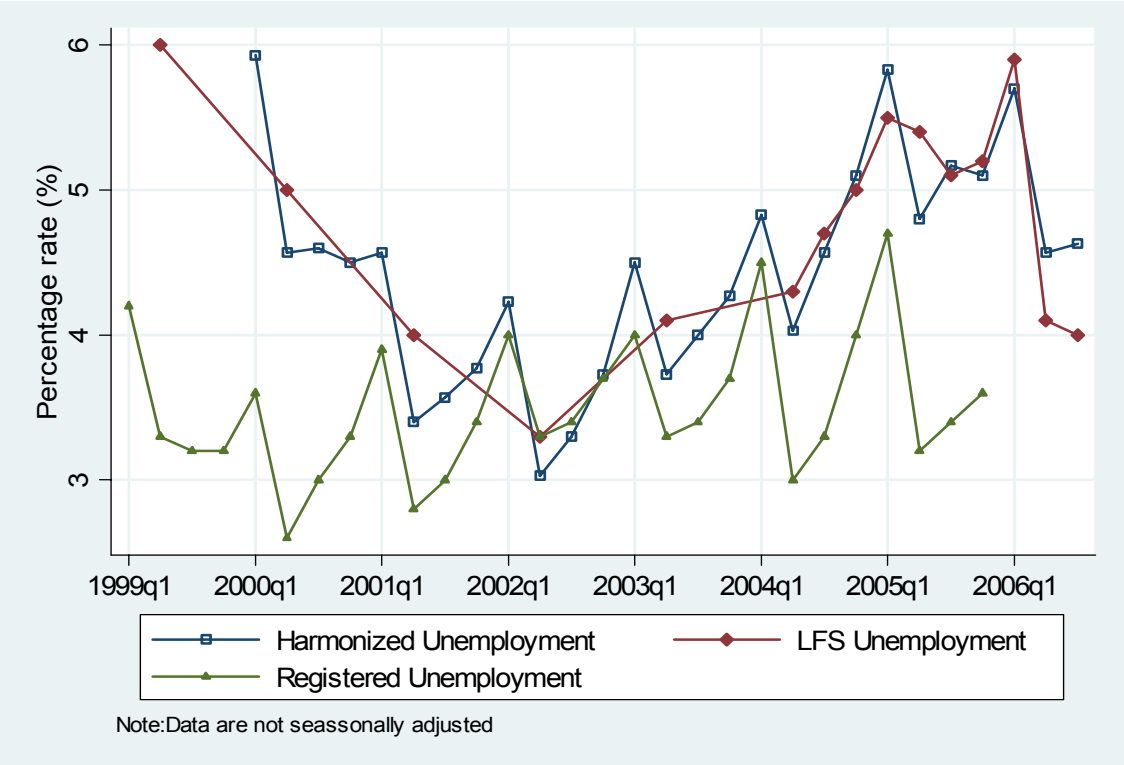
The organization of the paper is as follows: Section II will briefly present the source of the three unemployment measures. Sections III to V will evaluate the three measures in four different models, the Beveridge Curve, Okun´s Law, and the Phillips and Wage Curves. Section VI concludes and a number of Appendices provide additional description of the data used and a basic description of the underlying theory for the models used in sections III to V.

II. UNEMPLOYMENT VARIABLES

A first inspection of the variables indicates that two of the three measures, the Harmonized and the Labour Force Survey measure, are closely related. This is not surprising, given that they are based on the same methodology by construction. The Registered unemployment measure consistently reports a smaller number of unemployed persons across different population and age groups, compared to the other two measures. In this paper the total unemployment rate is used because it is the variable generally used as an indicator of labour market conditions. In Graph 1 the three variables are presented. The Labour Force Survey and the Harmonized unemployment rates tend to be higher than the Registered unemployment rate. The divergence is remarkable during the start and the end of the period under study. The two measures report unemployment rates as high as 6% but the registered unemployment rate fluctuates close to the level of 4%. The difference between the Registered unemployment rate and the other two measures is attributed to the fact that the former fails to report a growing number of female and young workers who are willing to enter the labour market. These segments of the population usually do not register as unemployed because normally they are not entitled to unemployment benefits. However, they do report their job-seeking status in the survey conducted by

the Cyprus Statistical Service. If the Registered unemployment rate is considered as the variable that reflects labour market conditions, then a large part of those willing to work but unable to work at going wage rates will be excluded from the analysis.

Graph 1: Unemployment Variables (from 1999q1 to 2006q4)



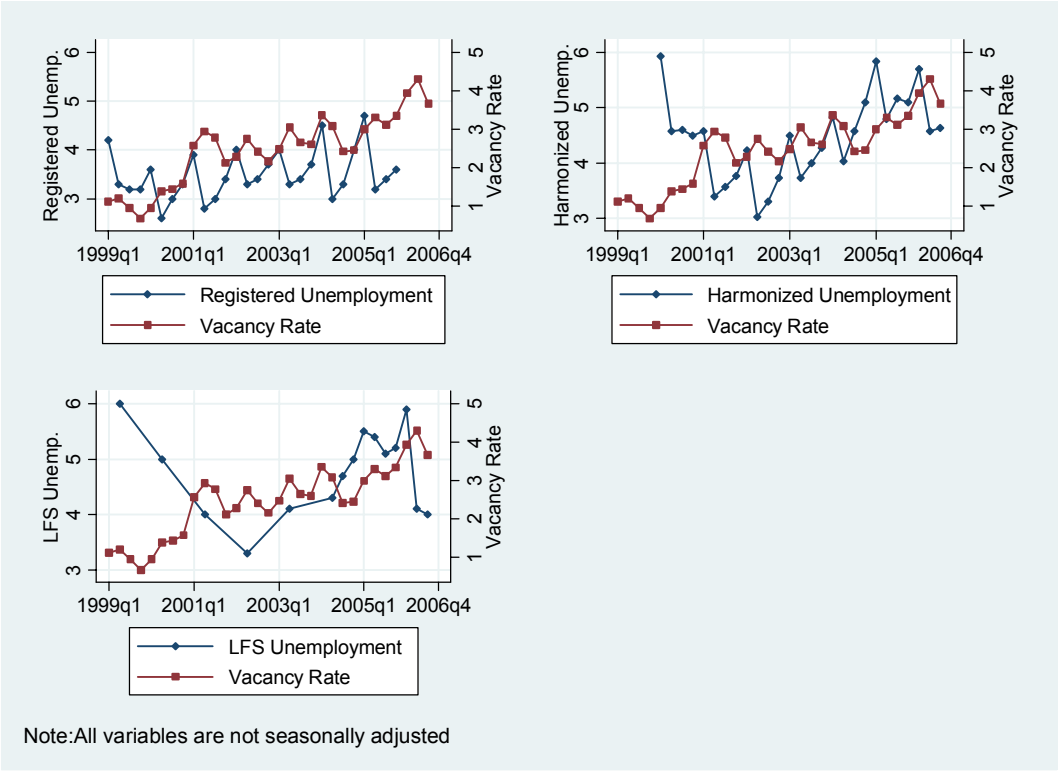
An extensive analysis of the three variables is presented in Christofides *et al* (2007).

III. BEVERIDGE CURVE

The first economic relationship that we will test is the Beveridge Curve relationship. Under this model, an inverse relationship exists between job vacancies in the economy and the unemployment rate. A brief summary of the model is provided in Appendix A1.

Graph 2 plots the Vacancy rate against the three unemployment rates. It shows that an inverse relation seems to exist between the Vacancy rate and two of the Unemployment variables, the Harmonized rate and the rate taken from the Labour Force Survey. The Registered unemployment rate seems to move together with the Vacancy rate. This relationship is not visually clear towards the end of the sample for any of the unemployment variables.

Graph 2: Vacancy and Registered Unemployment Rates



Note:All variables are not seasonally adjusted

Table 1: Correlation Coefficient Between Vacancy Rate and Unemployment Rates

Not Seasonally Adjusted

	vac	harm	reg	lfs
vac	1			
harm	0.049	1		
reg	0.195	0.465*	1	
lfs	-0.249	0.885*†	0.355	1

Seasonally Adjusted

	vac	harm	reg	lfs
vac	1			
harm	0.137	1		
reg	0.518*†	0.075	1	
lfs	-0.178	0.906*†	0.169	1

[a] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

† Denotes that the Spearman rank correlation coefficient (not shown) is significantly different from zero at the 5% level.

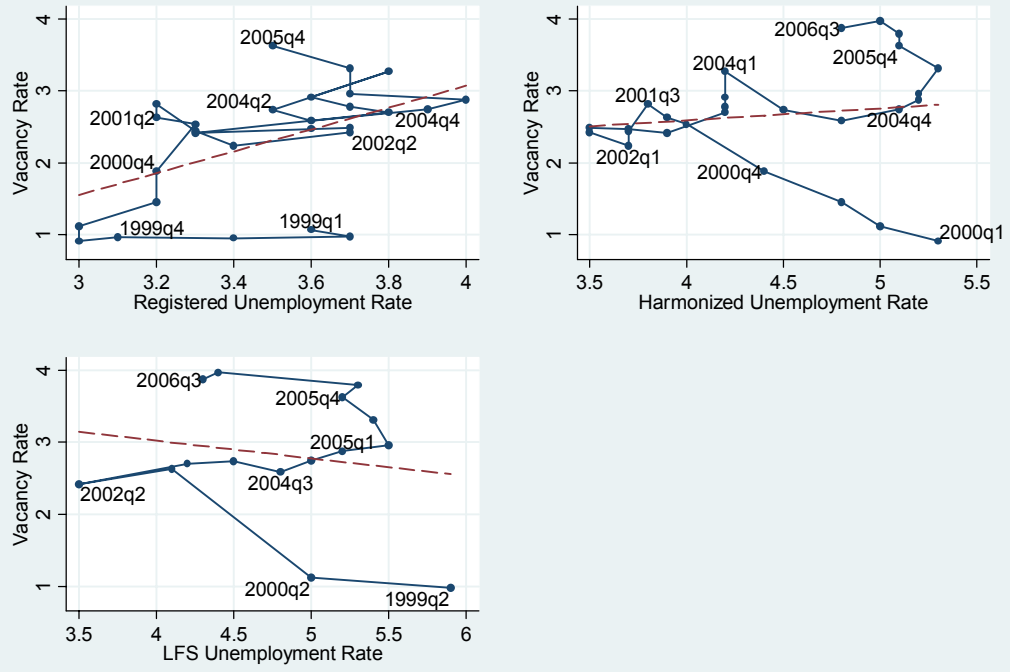
The correlation coefficient reveals that the Vacancy rate is only negatively correlated with the LFS measure, although this relationship is not statistically significant[1]. This is

[1] It should be noted that the first few observations of the LFS series may suffer from error. Once the 1999q2 observation is omitted, the correlation coefficient is no longer negative. When the correlation coefficient is estimated beginning in 2004q2 (when the quarterly LFS series begin) it is again negative albeit not significant.

true for both the seasonally and not seasonally series. The correlation of the vacancy rate with the Registered Unemployment rate is positive and significant when the data are seasonally adjusted.

The Beveridge Curve covering the period 1999-2006 is presented in Graph 3. An inverse relationship (as measured by a simple regression shown by a straight broken line) seems to exist only between the LFS unemployment rate and the Vacancy rate. The other two measures have a positive relationship with the Vacancy rate. The estimation results of the simple regression of the vacancy rate on the unemployment rate, given by equation 1.1 in Appendix A1, are presented given at Table 2. Only the LFS rate is negatively related with the Vacancy rate, although the relationship is not statistically significant. The other two measures are positively related with the vacancy rate and the Registered rate relationship is significant at the 1% level. It is worth noticing that, in all graphs, observations appear to have shifted upwards through time. This indicates that the process of allocating unemployed persons to vacant jobs may have become less effective. At the end of the period, for the same number of vacant jobs, there are more unemployed persons seeking a job in the labour market.

Graph 3: The Beveridge Curve (1999q1 to 2006q3)



Note:All variables are seasonally adjusted

Table 2: Estimation of Beveridge Curve [a,b,c,d]

	(I)	(II)	(III)
Unemployment Rate$_t$	1.514*	0.166	-0.244
	(0.491)	(0.240)	(0.375)
Constant	-2.988***	1.925***	3.998**
	(1.717)	(1.077)	(1.823)
R^2	0.268	0.019	0.032
Observations	28	27	15

[a] The depended variable is the Vacancy rate.

[b] Registered, Harmonized and LFS unemployment rates are used in specifications I, II and III respectively. Variables are in natural logarithms.

[c] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

[d] Standard errors in parentheses.

The estimation results of the matching function model, based on the work of Pissarides (1986), are given in Table 3. The equation that is estimated (1.3) is given in Appendix A1. The three unemployment rates are used separately in the estimation of the model. All three unemployment variables have a positive relationship with the number of job matches in the labour market. When the number of unemployed persons is large then it is easier for firms to find a worker with suitable characteristics to fill their job. This is in line with the theoretical model used. However, the relevant coefficients are not significantly different from zero. It must be noted that we have not used White's standard errors because the misspecification tests revealed that, in the majority of equations estimated, the assumption of homoskedasticity was not rejected. The coefficient of the unemployment rate is greater when the Labour Force Survey and Harmonized unemployment rate is used. This fact is expected because the two measures capture the number of young and the female new entrants who are unemployed. An increase in the unemployment rate in these segments of the population is better reflected in these two measures. As a consequence the probability that a job will be filled may be greater.

Table 3: Estimation of the Matching Function Model (Seasonally Adjusted) [a,b,c,d,e]

	(I)	(II)	(III)
Outflow_{t-1}	0.763*	0.673*	0.663*
	(0.168)	(0.183)	(0.193)
Vacancy rate ($vrate_t$)	-1.755	-3.307	-0.171
	(1.490)	(4.082)	(3.006)
Unemployment rate ($urate_t$)	0.194	2.265	1.210
	(0.942)	(4.091)	(3.175)
$(V/U)_t$	1.731	3.457	0.973
	(1.036)	(4.045)	(2.887)
Trend (t)	-0.023	-0.014	-0.038
	(0.030)	(0.031)	(0.037)
Constant	-3.789	-4.729***	-5.183
	(2.664)	(2.634)	(3.205)
R^2	0.854	0.717	0.783
Observations	28	27	15

[a] Registered, Harmonized and LFS unemployment rates are used in specifications I, II and III respectively.

[b] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

[c] Standard errors in parentheses.

[d] The depended variable is Outflow_t (see appendix A1).

[e] The Normality hypothesis is rejected in equations I, and II and accepted in equation III. Homoskedasticity and the no Serial Correlation hypotheses are accepted in all equations. The no omitted variable hypothesis is rejected in equation I and accepted in equations II and III. All hypotheses where tested at the 5% significance level.

The three unemployment rates perform about equally in Table 3, though it is must remembered that the LFS specification relies on considerably less observations.

IV. OKUN´S LAW

The second model considered is Okun's Law. This model explores the relationship between output and unemployment. This model suggests that an increase in output production leads to a drop in unemployment. An outline of the model is given in Appendix A2.

As can be seen from Table 4, all three unemployment measures are statistically negatively correlated with the output growth rate. This statement holds for both seasonally and not seasonally adjusted data. In the not seasonally adjusted data, this relationship is statistically significant. Thus, an increase in GDP is associated with a reduction in the unemployment rate.

Table 4: Correlation coefficient between Output and Unemployment growth rates

Not Seasonally Adjusted

	gdp	Reg	harm	lfs
Gdp	1			
Reg	-0.935 *†	1		
Harm	-0.917 *†	0.860 *†	1	
Lfs	-0.775 **†	0.538	0.774 **†	1

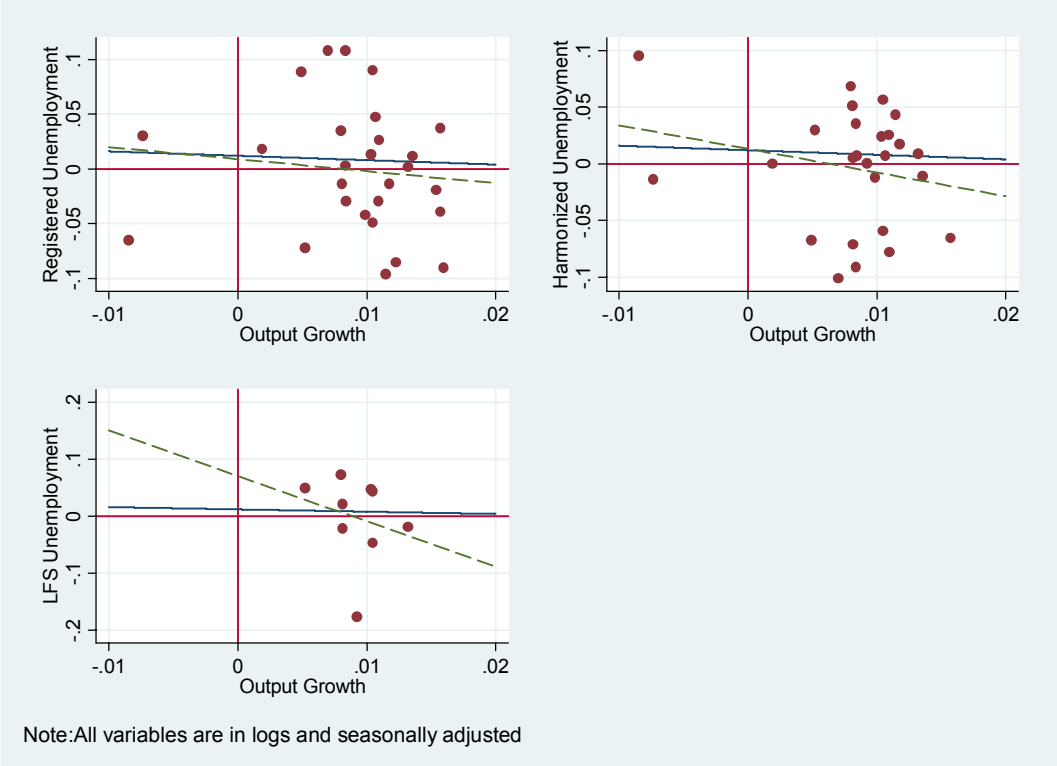
Seasonally Adjusted

	gdp	reg	harm	lfs
gdp	1			
reg	-0.112	1		
harm	-0.220	-0.242	1	
lfs	-0.223	0.395	0.506 †	1

[a] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

† Denotes that the Spearman rank correlation coefficient (not shown) is significantly different from zero at the 5% level.

Graph 4: Changes in Unemployment vs Changes in Output Growth rate



Note:All variables are in logs and seasonally adjusted

Note: The solid line is the relationship proposed by Okun: $u_t - u_{t-1} = -0.4(g_{y,t} - 3\%)$ where u_t is the unemployment and $g_{y,t}$ is the output growth rate. The dashed line represents the fitted values after regressing unemployment change on output change using the actual data, for the three different unemployment measures. Estimation results of this regression are given in Table 5.

Next, the graph of the change in the unemployment growth rate against the change in the output growth rate is provided. All three measures have a negative relationship with

output growth in change form, as is expected from theory. All measures report a relationship that is steeper compared with the relationship proposed by Okun (solid line). The estimates of equation (2.1), given in Appendix A.2, are provided in Table 5. The coefficient of the change in the growth rate is smaller when the LFS and the Harmonized measures are used, a fact which may reveal that output fluctuations do not affect the employment of new entrants as much.

Table 5: Estimation of Okun´s Law [a,b,c,d,e]

	(I)	(II)	(III)
Growth Output ($\Delta y_t = y_t - y_{t-1}$)	-1.099	-2.085	-7.964
	(1.949)	(0.188)	(12.560)
Constant	0.008	0.013	0.070
	(0.021)	(0.018)	(0.119)
R^2	0.013	0.049	0.054
Observations	27	26	9

[a] The dependent variable is the change in the natural logarithm of the Unemployment rate ($\Delta u_t = u_t - u_{t-1}$).

[b] The independent variable is the change in the natural logarithm of GDP ($\Delta y_t = y_t - y_{t-1}$).

[c] The Registered, Harmonized and LFS unemployment rates are used in specifications I, II and III respectively.

[d] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

[e] Standard errors in parentheses.

Next, an extended version of Okun´s Law is estimated using the specification proposed by Prachowny (1993). The estimation of equation (2.3), given in Appendix A2, is presented in Table 6. Using the different unemployment measures, reveals that any increase in any of the measures reduces output. The coefficient is statistically significant at the 1% level for the Registered and the Harmonized Unemployment rates. In all equations, the working hours and the employment coefficients are positively signed. Again the small number of observations, particularly for the LFS specification, is noted.

Table 6: Estimation of Okun´s Law based on Prachowny (1993) [a,b,c,d,e]

	(I)	(II)	(III)
Unemployment Gap $\Delta\left(u_t - u^*\right)$	-0.225*	-0.245*	-0.157
	(0.027)	(0.031)	(0.097)
Employment Gap $\Delta\left(l_t - l^*\right)$	0.584*	0.863*	1.045***
	(0.172)	(0.156)	(0.516)
Working Hours Gap $\Delta\left(h_t - h^*\right)$	6.257**	0.313	10.778
	(2.667)	(2,602)	(13.735)
Constant	-0.002	-0.006***	-0.010
	(0.003)	(0.003)	(0.011)
R^2	0.931	0.789	0.789
Observations	27	26	9

[a] The depended variable is the change in the natural logarithm of output $\Delta\left(y_t - y^*\right)$.

[b] Registered, Harmonized and LFS unemployment rates are used in specifications I, II and III respectively. Variables are in natural logarithms.

[c] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

[d] Standard errors in parentheses.

[e] The Normality, Homoskedasticity and no Serial Correlation hypotheses are accepted in all equations. The no omitted variable hypothesis is rejected in equation I and accepted in equations II and III. All hypotheses where tested at the 5% significance level.

V. WAGE CURVE AND PHILLIPS CURVE

In this section the three unemployment measures will be used to estimate the Phillips and Wage Curves. These two relationships investigate the influence of the unemployment rate on wages, conditional on other variables, such as the price level, productivity and the real wage. A summary of the model and theory used is given in Appendix A3.

The methodology used to estimate the Phillips and Wage Curve is based on Blanchard and Katz (1999), and it is discussed in Appendix A3. The Phillips curve relationship states that the nominal wage change is negatively related to the unemployment rate whereas the Wage Curve indicates that real wage is negatively related to the unemployment rate. Both relations condition on other variables. Under a unified framework, both relationships can be estimated and tested.

The estimation results for the two relationships are reported in Table 7. The equation to be estimated (3.1) is given in Appendix 3. Each relationship is estimated by using as

the unemployment variable one of the three available measures. In the first column for each specification, are reported the estimation results of the nesting equation (3.1) and in the second column the Phillips Curve is imposed on the data. The estimation of the nesting equation using the LFS unemployment measure (columns III) is the only one where all four independent variables are correctly signed. When the other two measures are used to estimate this relationship, only one independent variable is generally correctly signed, the real wage per effective unit; the equations report that an increase in unemployment will lead to an increase in wages.

The estimation of the Phillips Curve shows that two of three unemployment measures, the LFS and Registered Unemployment Rates, are negatively correlated with nominal wage change. The coefficient of all specifications is very small and the three measures have a low explanatory power over wage change. In this model, for all three specifications, price inflation has the wrong sign.

The Wage Curve model requires that the coefficient on productivity and the real wage per efficient unit have the same magnitude but opposite signs - the strict form requires that they be equal to unity as well. This hypothesis is accepted when the Harmonised and LFS measures are used – see note f, Table 7. The last test checks if the data support the existence of one of the two Curves. At the 10% significance level, the first two specifications, using the Registered and the Harmonized Unemployment rates, accept the presence of the Wage Curve. The third specification accepts the presence of the Phillips Curve. The small number of observations, particularly for the LFS variable, makes inference difficult.

Table 7: Estimation of the Phillips and Wage Curve (Seasonally Adjusted) [a,b,c,d,g]

	(I)		(II)		(III)	
	Nesting Equation	Phillips Curve	Nesting Equation	Phillips Curve	Nesting Equation	Phillips Curve
Price (Δp_t)	-0.042	-0.043	-0.101	-0.016	0.006	-0.010
	(0.148)	(0.169)	(0.147)	(0.153)	(0.159)	(0.120)
Unemployment (u_t)	0.015	-0.006	0.009	0.004	-0.001	-0.0004
	(0.018)	(0.014)	(0.006)	(0.006)	(0.007)	(0.006)
Real Wage per unit ($w_{t-1} - p_{t-1} - y_{t-1}$)	-0.049		-0.047**		-0.016	
	(0.039)		(0.024)		(0.027)	
Productivity (Δy_t)	-0.193**		-0.161		0.071	
	(0.077)		(0.155)		(0.129)	
Constant	0.351	0.021	0.343**	0.007	0.132	0.138
	(0.265)	(0.017)	(0.172)	(0.009)	(0.193)	(0.009)
R^2	0.311	0.008	0.172	0.023	0.085	0.001
Observations	28	28	27	27	15	15
Phillips vs. Wage Curve [e]	0.012		0.071		0.643	
F test [f]	0.005		0.187		0.705	

[a] The dependent variable is the change in the natural logarithm of the nominal wage ($\Delta w_t = w_t - w_{t-1}$).

[b] Registered, Harmonized and LFS unemployment rates are used in specifications I, II and III respectively. Variables are in natural logarithms.

[c] Significance at the 1%, 5%, 10% level is denoted by */**/*** respectively.

[d] Standard errors in parentheses.

[e] F-Test that the coefficients of Productivity and Real Wage per unit are jointly equal to zero. If this test is accepted, then the data support the existence of the Phillips instead of the Wage Curve. The p-value is reported.

[f] F- Test that the coefficients of Productivity and the Real Wage per unit are equal and opposite. The p-value is reported.

[g] For the nesting equation: The Normality and Homoskedasticity hypotheses are accepted in all equations. The no omitted variable hypothesis is rejected in equation I and accepted in equations II and III. The no Serial Correlation hypothesis is accepted in equations I and II and rejected in equation III. For the Phillips Curve: Normality is rejected in equation I and accepted in equations II and III. The no Ommited variables and no serial Correlation and Homoskedasticity hypotheses are accepted in all equations. All hypotheses were tested at the 5% significance level.

VI. CONCLUSION

The purpose of this study is to examine the relative performance of the three unemployment variables available in Cyprus in the context of simple economic relations.

The first model evaluated was the Beveridge Curve relationship. Only the LFS unemployment rate has an inverse relationship with the number of vacancies in the labour market. This is obvious when the three measures are plotted against the vacancy rate and from the correlation coefficient between them. When the job matching function is estimated, the number of job matches is more responsive to the LFS and Harmonized unemployment rates. This can be attributed to the fact that these two measures are more indicative of segments of the population that are not captured by the registered unemployment rate.

The estimation of Okun's Law revealed that all three measures are negatively associated with output growth, as expected.

Finally, the Phillips and Wage Curves are estimated by using the three different measures. The LFS unemployment rate outperforms the other two rates, when the Wage Curve is estimated, at least as far as signs are concerned. An increase in the unemployment rate causes wages to fall because now firms have more bargaining power over their new employees and they can set a lower wage for them. The estimation of the Phillips Curve shows that the Registered and LFS measures are negatively correlated with nominal wage change. In general, inference is not well established with any specification, possibly owing to the small number of observations; this problem plagues the LFS measure particularly.

In general, the new measures appear to perform reasonably well in the context of well-studied relationships. This may be especially the case for the LFS measure, particularly when one keeps in mind the small number of the observations involved.

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APPENDIX A: THEORETICAL BACKGROUND

This appendix will summarize the theories used throughout the paper.

A.1 The Beveridge Curve

The Beveridge Curve illustrates the relationship between the unemployment and the vacancy rate. The vacancy rate is defined as the number of the vacant jobs in the economy divided by the labour force. During recessions the unemployment rate is high and the vacancy rate is low. When the economy is in its recovery face, the unemployment rate drops and the vacancy rate increases. This is noticed because firms during a slowdown in the economy post few new jobs and there are many unemployed workers. When the economy recovers job vacancies grow and the number of unemployed falls. So an inverse relationship between the two variables exists. This relationship can be revealed by plotting the Vacancy rate on the Unemployment rate. Also this relationship can be estimated by the regression of the Vacancy rate on the Unemployment rate.

$$vrate_t = a_0 + a_1 urate_t + \varepsilon_t \quad (1.1)$$

The mechanism that describes how job postings are matched with the workers that seek a job is described by the matching function. Following Blanchard and Diamond (1989) this function is described as:

$$h = am(U,V) \;\; m_U, m_V \geq 0 \quad (1.2)$$

where h are the new hires, a is a scaling factor and U and V are the number of unemployed persons and vacant jobs respectively. When either one of the two variables increases, it is expected that the number of new hires will increase too.

To empirically estimate the vacancy-unemployment relationship we will use the formulation proposed by Pissarides (1986). The model requires the estimation of the following equation:

$$Outflow_t = \beta_0 + \beta_1 Outflow_{t-1} + \beta_2 urate_t + \beta_3 vrate_t + \beta_4 (V/U)_t + \beta_5 t + \varepsilon_t \quad (1.3)$$

where $Outflow$ is the number of filled jobs divided by the number of unemployed persons, V/U is the number of vacancies divided by the number of unemployed persons, $vrate$ and $urate$ are the vacancy and unemployment rates respectively and t is the time trend. Under this specification the expected coefficients signs are $\beta_2 \succ 0$, $\beta_3 \succ 0$, $\beta_4 \succ 0$ while the sign of β_1 and β_5 can be either positive or negative. A review of the matching function models is given by Petrongolo and Pissarides (2001).

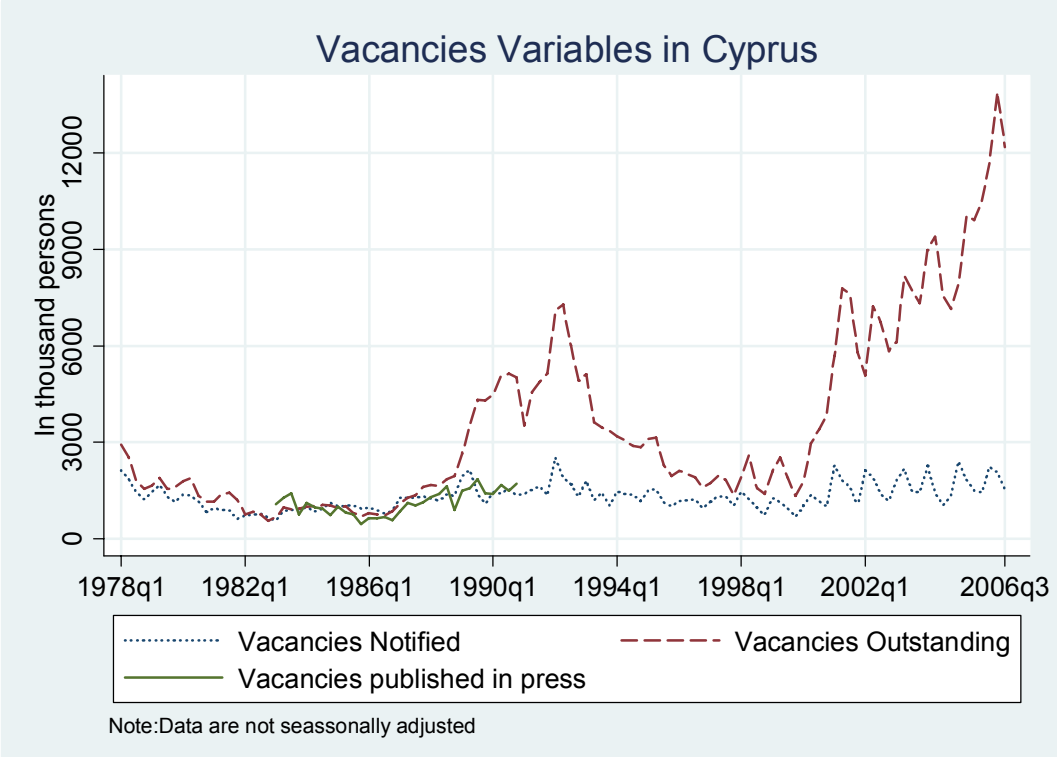
A proxy for the number of filled jobs in the economy is the number of vacant jobs that are filled through the District Labour Offices. They are reported in the Monthly Economic Indicators issued by CYSTAT. The three vacancies variables reported are: Vacancies Notified and Outstanding in district Labour Offices (which combined show the Total Number of Vacancies), and a third variable reported only for a small period of time, the number of Vacancies Reported in the Press. These variables are consistently reported by CYSTAT for the last thirty years as shown in Table A1.

Table A1:Vacancy Variables

Category	Range
Vacancies Notified	1975m1-2006m9
Vacancies Outstanding	1975m1-2006m9
Vacancies Reported in Press	1983m1-1990m12

The three vacancy variables graph is given by Graph1. It shows that the number of notified jobs each month remained stable at 2000 for the whole period. The number of outstanding jobs increased from 1989 until 1995 and from 1999 onwards. The vacancy variables used do not take into account the number of jobs filled by private job-finding centers or other ways. To our knowledge these are the only publicly available vacancy variables.

Graph 1: Vacancies Variables



In order to find the total number of vacancies in the Labour market the third variable is not used due to the lack of observations for the whole sample. The data on the vacancy variables are not in percentage rates (of the total population of employees) but in thousands of persons, so the variables are transformed into rates using the formulation used by Archambault and Fortin (2001). The vacancy rate is calculated as: $Vacancy\ \ rate = 100 * \left(V \diagup J \right)$ where the total number of the jobs in the economy is defined as $J \equiv E + V$. In this formulation, V is the number of vacant jobs and E is the number of filled jobs in the economy.

A.2 Okun's Law

Okun´s Law describes the relationship between output growth rate and unemployment. This law states that output fluctuations influence the labour market. When firms face positive (negative) economic conditions and increased (decreased) demand they employ more (less) workers to produce more (less) output. So the unemployment rate falls (rises). This relationship is represented by the following equation:

$$u_t - u_{t-1} = -\beta \left(g_{y,t} - \overline{g}_y \right) \quad (2.1)$$

where u is the unemployment rate, $g_{y,t}$ is the output growth rate and $\overline{g}_y$ is the average growth rate of the economy. The magnitude of the coefficient β depends in part on how firms adjust employment to fluctuations of their production. Also this coefficient depends on the legal and institutional regulations that prevail in the labour market. For example, if it is difficult for a firm to fire or hire employees then β is expected to be low. This relationship estimated for US data involves $\beta = 0.4$ and $\overline{g}_y = 3\%$

A simple extension of the Okun's Law, which allows other factors to influence the output-unemployment relationship, is given by Prachowny (1993). Starting from a simple production function:

$$Y = T \left(cK \right)^a \left[\left(\gamma N \right) \left(\delta H \right) \right]^\beta \quad (2.2)$$

where Y is output, T is a technology factor, K is capital input and c is its utilization rate, N is the number of workers , H are the number of hours that they work and γ and δ are the contributions of workers and weekly hours to the labour input. Finally a and β are the output elasticities. By taking logs and using the definition: $N = L + U$ where L is the number of the employed and U the number of unemployed, he derives an equation that can be econometrically estimated. Such equations usually transform the variables to measure the deviation of each variable from its long run sustainable

value. So the variables considered are the deviation of each variable from its trend. The series were tested for stationarity and a unit root for all variables could not be rejected. The unit root test used is the augmented Dickey-Fuller test. The results are reported in Table A2. The reported t-value is that for the coefficient a_2 in the regression of the first difference Δy_t on a constant, a trend, the lagged value of the level of the relevant variable and four lags of the depended variable (see Table A2, notes).

Finally, the equation is estimated in first differences and the equation becomes:

$$\Delta\left(y_t - y^*\right) = \beta_0 + \beta_1 \Delta\left(u_t - u^*\right) + \beta_2 \Delta\left(l_t - l^*\right) + \beta_3 \Delta\left(h_t - h^*\right) + \varepsilon_t \quad (2.3)$$

where $y_t - y^*$, $u_t - u^*$, $l_t - l^*$,and $h_t - h^*$ are the deviations of output, unemployment, employment and working hours from their trend. Under this specification the expected coefficients signs are $\beta_1 \prec 0$, $\beta_2 \succ 0$ and $\beta_3 \succ 0$. Endogeneity issues obvious in equation (2.3) are not examined here, as the objective is not the estimation of (2.3) per se.

Table A2: Unit Root test [a,b,c]

	GDP	Hours	Empl.	Reg. Un.	LFS Un. [b]	Harm. Un.
Coefficient	-2.701	-2.227	-0.762	-2.191	-1.095	-1.829
5% Critical value	-3.572	-3.592	-3.576	-3.600	-3.600	-3.600

[a] Regression equation used: $\Delta y_t = a_0 + a_1 t + a_2 y_{t-1} + \sum_{i=1}^{k} a_{i+2} \Delta y_{t-i}$. For all variables except the LFS unemployment rate $k = 4$ .Due to the small number of values of the LFS unemployment rate we use $k = 2$. All variables are in natural logarithms.

The graphs of the variables used are presented in Appendix D.

A.3 Phillips and Wage Curve

The other two well known relationships that relate unemployment with wage and price inflation, are described by the Phillips and Wage Curves. The Phillips curve relationship states that the change in nominal wages is negatively associated with unemployment conditional on price inflation. The Wage Curve indicates that the real wage is negatively related with unemployment conditional on the level of productivity.

Blanchard and Katz (1999) provide a model that nests both equations and allows studying the existence of the two curves. This model enables us to test if one of the curves prevails over the other one. Starting from a wage equation that is derived from wage-bargaining models, they derived an equation which nests both the Phillips Curve and the Wage Curve. The equation is:

$$\Delta w_t = \beta_0 + \beta_1 \Delta p_t - \beta_2 \left(w_{t-1} - p_{t-1} - y_{t-1} \right) + \beta_2 \Delta y_t - \beta_3 u_t + \varepsilon_t \quad (3.1)$$

where w is the nominal wage, p the price level, y the productivity level and u the unemployment rate. All level variables are in natural logarithms. If β_2 equals to zero, then wages are influenced only by price inflation and unemployment and the Phillips Curve prevails. If, on other hand, β_2 is equal to unity, then the real wage level is influenced by the unemployment rate and productivity and the Wage Curve prevails. When $0 \prec \beta_2 \prec 1$ then a hybrid model suggests itself.

The Graphs of the variables used in this section are given in Appendix D.

The complete equations of the three models are estimated with all variables initially defined in natural logarithm form. Differences, where they appear, refer to variables which are already in logarithmic form.

APPENDIX B: VARIABLE SOURCES AND DESCRIPTION

Variable	Description	Source [a]
Employment	Data are based on the results of a quarterly survey covering all establishments employing 30 or more persons and a rotating probability sample of establishments employing up to 29 persons. They refer to the average number of persons employed during the month, and part-time employees are converted into full-time equivalent on the basis of the number of hours worked. The data include working proprietors and working partners, unpaid family workers, and persons temporarily absent from work, e.g. on sick leave, casual leave or vacation.	CYSTAT
Registered Unemployment	Comprises all persons who are registered as unemployed at the District Labour Offices on the last day of each month and are currently available for work. It includes persons receiving unemployment benefit under the Social Insurance Scheme as well as those not entitled to any benefit The number of individuals unemployed is available from the inception of the Republic of Cyprus in 1960. The Registered unemployment rate is available until 1995m12. A simple average is taken to transform the monthly data to a quarterly basis.	CYSTAT
LFS Unemployment rate	The definition of unemployed persons in the LFS survey is: persons aged 15 years and over who comply to the following standards: -Neither worked nor had a job from which they were temporarily absent during the reference week - Had actively sought work, i.e. had taken specific steps during the previous 4 weeks to find work - Were available to start work within the 2 weeks following the reference week and or, - Neither worked nor had a job from which they were temporarily absent, but found a job which will start within a period of at most 3 months. -W ere available to start work within the 2 weeks following the reference week. The unemployment rate is the number of unemployed persons of any group expressed as a percentage of the labour force in the same group. The Labour Force Survey was first carried out in the second quarter of 1999 and was carried out on a yearly basis in the second quarter of each year until 2004. Since then the Survey is conducted in a quarterly basis. The data used in the study cover the period from 1999 until 2006q3.So the total number of observations available are 15. When the equation to be estimated involves the use of the unemployment in first difference, then the observations	CYSTAT

Variable	Description	Source [a]
	drop to 9. This is because the Unemployment rate was reported once a year from 1999 to 2003. This happens during the estimation of equations 2.1 and 2.3.	
Harmonized Unemployment	The Eurostat definition of unemployed people are those aged 15 to 74 and who, following the International Labour Organization (ILO) definition: - are without work; - are available to start work within the next two weeks; - and have actively sought employment at some time during the previous four weeks. The unemployment rate is the number of people unemployed as a percentage of the labour force. The labour force is the total number of people employed and unemployed. Data are available in a monthly basis from January 2000 until August 2006. A simple average is taken to transform the monthly data to a quarterly basis.	EUROSTAT
Working Hours	Normal hours of work per week Data are available in a yearly basis. We assume that the same value prevailed across the year.	CYSTAT
Prices	Consumer Price Index (base year 1992)	CYSTAT
GDP	Gross Domestic Product in Cyprus Pounds (millions)	CYSTAT
Vacancies Notified	Vacancies notified in District Labour Offices	CYSTAT
Vacancies Outstanding	Vacancies outstanding in District Labour Offices	CYSTAT
Vacancies notified in press	They are advertisements published in the three main daily newspapers which account for more than 90% of vacancies advertised.	CYSTAT
Placements	Job Placements by District Labour Offices	CYSTAT

[a] Variable Sources: CYSTAT (Cyprus Statistical Service) and EUROSTAT (European Statistical Service).

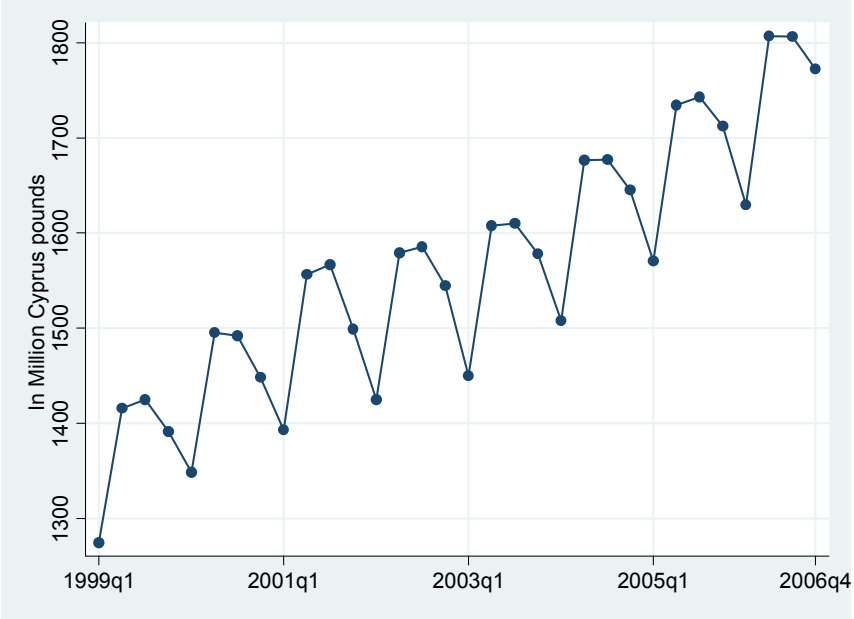
APPENDIX C: VARIABLE DESCRIPTIVE STATISTICS

Variable [a]	Number of Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Employment	31	323496.7	19452.3	293700	359700
Registered Unemployment rate	28	3.5	0.49	2.6	4.7
LFS Unemployment rate	15	4.8	0.78	3.3	6
Harmonized Unemployment rate	28	4.5	0.74	3.0	5.9
Wage	32	931	112	762	1115
Working Hours	32	38.4	0.09	38.3	38.5
Prices	32	139	9.4	112.3	154.6
GDP	32	1561.5	136.7	1274.6	1806.8
Vacancies Notified	31	1546	466	685	2408
Vacancies Outstanding	31	6779	3246	1329	13885
Vacancies Notified in Press	32	1122	378	454	1852
Placements	32	256	118	70	474

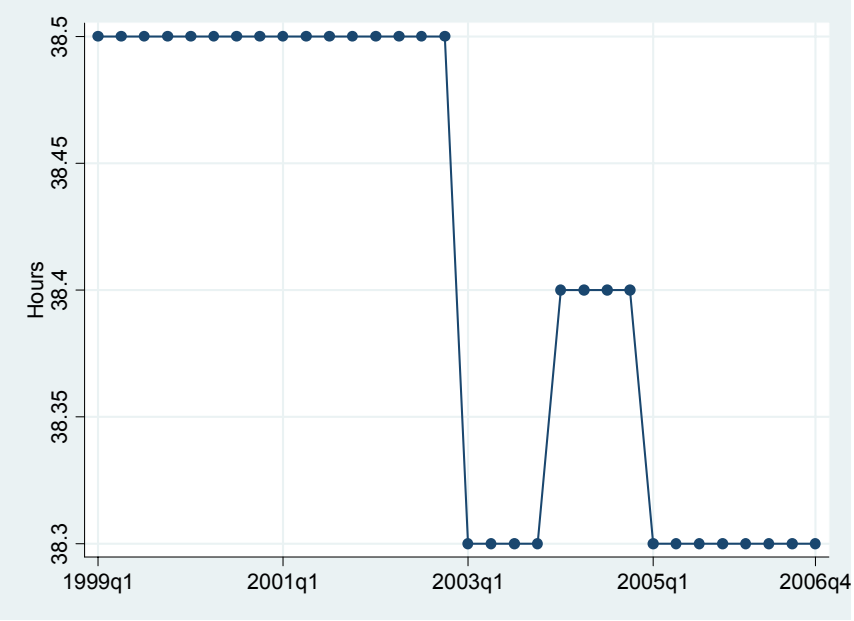
[a] Summary statistics cover the period between 1991q1 to 2006q1 except for the variable Vacancies Notified in Press which cover the period between 1983q1 to 1990q1

APPENDIX D: VARIABLE GRAPHS

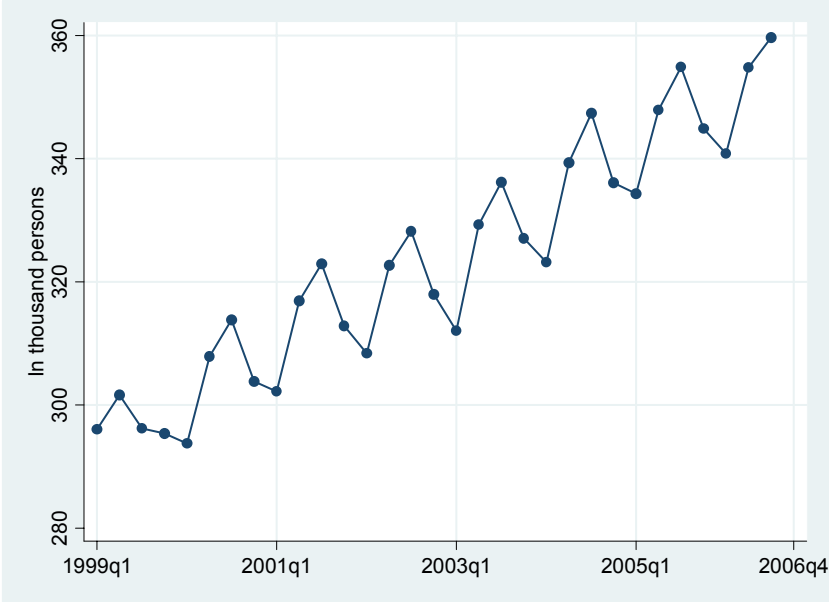
Graph 1: Gross Domestic Product



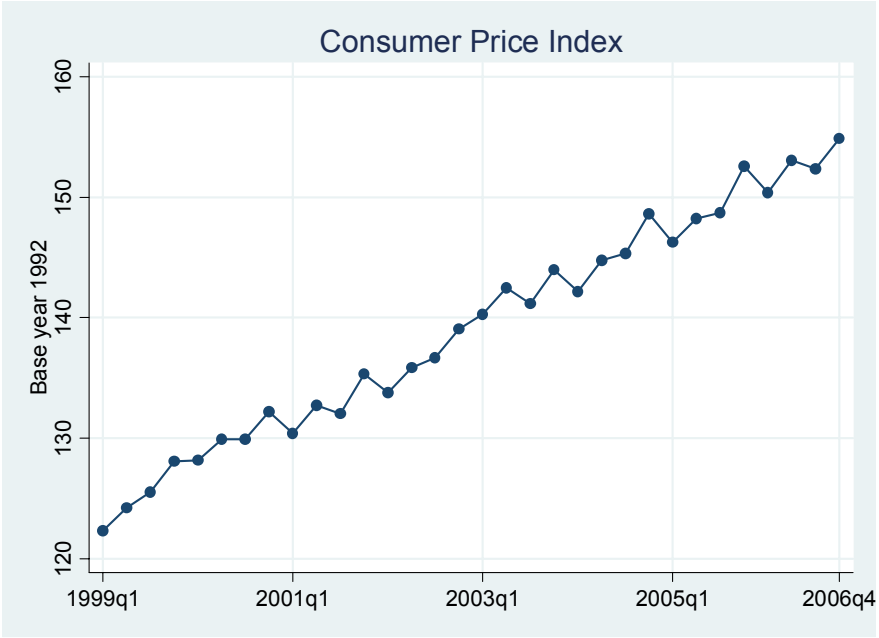
Graph 2: Average Weekly Hours of Work



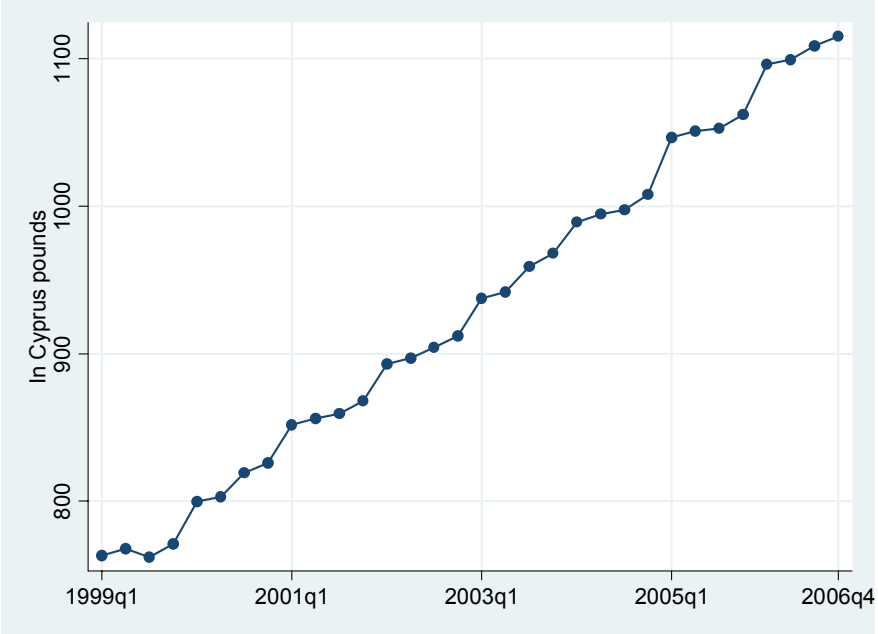
Graph 3: Employment



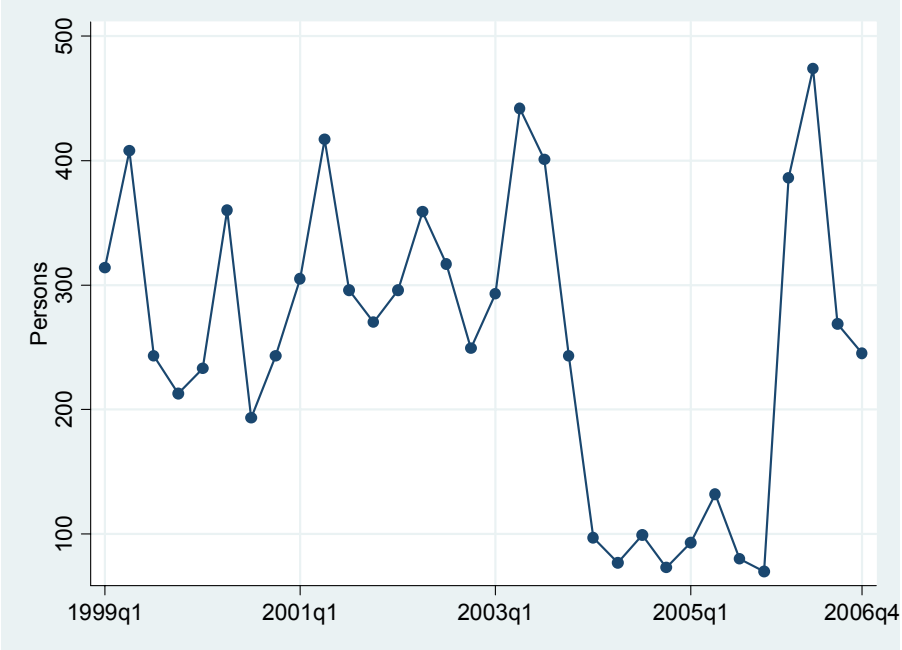
Graph 4: Consumer Price Index



Graph 5: Average Wage



Graph 6: Job Placements by District Labour Offices



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