DEPARTMENT OF ECONOMICS
UNIVERSITY OF CYPRUS

EFFECTS OF MINIMUM WAGES ON TOTAL EMPLOYMENT WHERE THE LEGISLATIVE COVERAGE IS LIMITED: EVIDENCE FROM CYPRUS TIME SERIES DATA

Pandelis Mitsis

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P.O. Box 20537, 1678 Nicosia, CYPRUS Tel.: +357-22893700, Fax: +357-22895028
Web site: http://www.econ.ucy.ac.cy

Effects of minimum wages on total employment where the legislative coverage is limited: Evidence from Cyprus time series data

Pandelis Mitsis
Department of Economics
Faculty of Economics and Management,
University of Cyprus, P.O. Box 20537 CY-1678, Nicosia, Cyprus
Office Number: 0211 FEB02
Phone Number: +357-22893695
Fax: +357-22895028

Email: pmitsi@ucy.ac.cy

Abstract

Empirical labour market studies on the effects of minimum wages are typically confined to the sector or the worker group directly affected. Also, they often address the cases where the legislative coverage of minimum wage is universal or almost universal. This study examines the relationship between total employment and minimum wage in the special case where only a number of occupations are covered by the relative legislation. A theoretical background is provided by a recently developed search and matching model and empirical evidence is provided by analysing time series data from Cyprus, one of the few countries in the world, and the only country in the European Union, where the minimum wage coverage is limited to only a small number of occupations. The analysis is done by carefully addressing the issues of stationarity, dynamic specification and endogeneity that most of the existing literature ignores. In order to ensure the estimated results are valid, the stability of the series is examined, using unit root tests under exogenous and endogenous structural breaks. Evidence is found of a significant and negative relationship between the minimum wage and total employment, despite the limited coverage of the minimum wage legislation. This suggests the existence of significant spillover effects to the occupations that are not covered by the minimum wage legislation.

Keywords: minimum wages, matching models, time series models.

JEL classification: J60, J64, C32.

1. INTRODUCTION

The effect of statutory minimum wages is an issue that has gained a lot of attention in the literature, partly due to conflicting theories and findings from empirical studies. The “textbook” competitive labour market model predicts that when a minimum wage is introduced above the competitive wage, this will lead to reduced employment. On the other hand, in monopsony models, there is a probability that a minimum wage increase may actually increase employment. In that manner, the employment effects of minimum wages crucially depend on the labour market structure and due to this plethora of proposed theoretical frameworks, the minimum wage effect remains an empirical rather than a theoretical question. Even if the empirical literature remains inconclusive today on whether minimum wages are an effective tool in driving down poverty and unemployment or they actually cause more harm than good, most of the evidence points to disemployment effects.

Something that all these studies have in common is that they are examining the case where a minimum wage has a nearly universal coverage, meaning that almost all the occupations of the economy are entitled to receive minimum wage. Since a “universal” minimum wage increase is expected to affect mainly the workers that are low in the wage pyramid, a position usually “occupied” by teenage employees, most of the studies carried out are usually confined to the sector directly affected (i.e. the teenagers) and abstract from the minimum wage effects in “uncovered” sectors or on total employment.

The effect of minimum wages on uncovered sectors is not something new in the theoretical literature. However, this was recently examined through a new scope: the search and matching theoretical framework. This framework allows predictions on the possible outcomes that minimum wage changes have on total employment, when a sector of the economy is not covered by the minimum wage legislation.

This study considers this topic by using data from Cyprus, a country where there is a special case of minimum wage enforcement, since there is no statutory national minimum wage or widely applied sectoral level agreements that constitute de facto minimum wages. Instead, only a number of occupations are protected by the Minimum Wage Law and for the rest of the workers the bipartite

wage negotiations are not subject to an institutional minimum. A time series analysis is conducted to determine if there is a stable relationship between total employment and minimum wage indices are calculated, taking into account the aforementioned limited legislative coverage. Vector autoregression (VAR) models are used in order to properly address the specification issues largely ignored by the existing literature: the stationarity of the variables, the dynamic specification and the potential endogeneity of the main variables.

In this paper, the literature is extended in several ways. First, the effects of minimum wages on employment are estimated for Cyprus, a country not previously studied. Second, the impact of minimum wages is examined in one of the few countries in the world where the legislative coverage of the minimum wage is limited to only a few occupations. Third, a measure of the minimum wages in Cyprus (the Kaitz index) is calculated that may be used in future studies. The calculation of the Kaitz Index is essential because, inter alies, allows examining the minimum wage effects separately from the coverage effects.

The study examines in detail the relationship between total employment and the minimum wage and the role the exogenous variables play. It quantifies their relationship and tests its dynamic properties by examining the existence of a long-run relationship. Particular attention is given in the detection and proper consideration of possible structural breaks in the data that, if not accounted for, could render invalid all the results concerning the stationarity or the existence of cointegration in the endogenous variables.

The empirical results suggest the existence of a negative long-run relationship between the minimum wage and total employment. A 10% increase in the minimum wage in Cyprus is associated with a decrease in total employment of 0.2%. This result seems moderate if compared with some European countries like France: -46%, but substantial if the fact that in the rest of Europe the legislative coverage of minimum wage is universal or almost universal is taken into consideration. In addition, the empirical evidence indicates that the variance of the employment variable is greatly affected by the variability of the minimum wage measure. The estimations also suggest that the coverage effects of the minimum wage are not significant. The negative sign in long-run relationship in the search and matching framework is translated with minimum wages eventually

increasing the bargaining position of the workers in the uncovered sector, making the firms more reluctant to hire new workers. In the same framework, the higher labour costs associated with minimum wages increase results with firms in the covered sector also discouraged from expanding their personnel.

The organization of this study is as follows: Section 2 provides a literature review (theoretical and empirical), Section 3 describes the data used and in Section 4 the unit root analysis is carried out. Section 5 presents the estimation results and Section 6 concludes. A number of appendices provide further detail on the variables used, the calculations applied, the background of the statutory minimum wages in Cyprus (including the historical developments) and some particular aspects of the empirical results.

2. LITERATURE REVIEW

There is no consensus regarding the benefits and drawbacks of minimum wages. Supporters of the minimum wage assert that it prevents the exploitation of workers, while its opponents suggest that it reduces employment and destroys job positions. 'Standard' economic theory suggests that minimum wage reduces employment and until the 1990s economists generally agreed that this was the case. This consensus is weakened in the mid-1990s due to the highly influential work of David Card and Alan Krueger, which leads to a development of the alternative models examining the effect of minimum wages on employment. However, the Card-Krueger study is very controversial, since it concludes that an increase in the minimum wage may actually increase employment; and it has received more than its share of criticism.

2.1 Theoretical Background

According to the standard economic theory, where the labour market is assumed complete and perfectly competitive, increasing the minimum wage decreases the employment of minimum wage workers. Using a demand and supply model to analyze this effect (and assuming that the supply and demand curves for labour will not change as a result of raising the minimum wage), this model suggests that since the minimum wage is set above the equilibrium wage, more labour will

be willing to be provided by workers and less will be demanded by employers, creating a surplus supply of labour, i.e. unemployment.

An alternate view of the labour market has low-wage labour markets dominated by monopsonist firms that have significantly more market power than the workers. This could be a result of intentional collusion between employers, or naturalistic factors such as segmented markets, information costs, imperfect mobility and other reasons. Such a case is a type of market failure and results in workers being paid less than their marginal value (perfectly competitive wage). Under the monopsonistic assumption, an appropriately set minimum wage (if the minimum wage is set between the existing wage and the perfectly competitive wage) could increase both wages and employment. This strand of literature is surveyed by Manning (1993, 2003) and Boal and Ransom (1997).

These approaches have in common that they consider only a one-sector labour market. Some economists disagree with that approach: many early papers on minimum wage effects, like Stigler (1964) and Gramlich (1976), argue that the standard theoretical arguments incorrectly measure only a one-sector market. They suggest a two-sector market instead, where some groups (such as the self-employed, service workers and farm workers) are typically excluded from minimum-wage coverage. Thus a complete analysis should also examine the uncovered sector and the mobility between the two sectors. Since the predictions derived from the perfectly competitive model do not extend to the two-sector case, then the predictions produced from the standard theory are not complete.

A recent approach in that direction is to consider the effects of the minimum wage through the matching framework scope of Mortensen and Pissarides (1994, 1999 and 2003) and Pissarides (2000). In the search and matching models in the labour market, the rate at which new jobs are created depends on both the workers' search decisions and on firms' decisions to open job vacancies. Flinn (2006) develops a bargaining model between firms and workers in a continuous-time search environment. His paper shows that in the presence of a binding minimum wage, when the contact rates between individuals and

firms[1] are exogenously determined, fewer contacts will result in jobs. However, with endogenously determined contact rates the minimum wage may actually increase the steady state employment rates, due to increased inflows into the labour market.

Moser and Stahler (2009) also use the search and matching framework to examine the effects of minimum wage, but they depart from the pattern of only a one-sector labour market by introducing an additional sector and by investigating whether minimum wages exert a negative spillover effect from the covered to the non-covered sector. They assume differences in the sector productivity and label one sector productive and the other one unproductive. The minimum wage is introduced in the unproductive sector, where the wage rates are expected to be lower.

In this framework, the introduction of a minimum wage will certainly reduce employment in the uncovered sector, since it increases the unemployed workers' outside option, as any employment in the unproductive sector now yields a higher wage. An increasing outside option improves their bargaining position and ability to demand higher wages in the productive sector, increasing the labour costs and leaving firms less willing to hire.

In the covered sector, however, the minimum wage has a dual effect. Since as the job creation in the uncovered sector falls, the chances of the covered employees to find employment in the uncovered (and more productive) sector fall as well, the average duration of the jobs in the covered sector will increase. This, on the one hand, may trigger more job creation. On the other hand, the increase in the minimum wage in the covered sector leads to higher labour costs and thus less willingness from firms to hire new workers. Ultimately, the employment effect in the unproductive sector depends on which of these effects dominates. The effect on total employment will be deteremined by the sign and magnitude of the effect on covered sector.

[1] The rate at which workers searching for (new) employment meet with firms with opened job positions.

2.2 Empirical Studies

The empirical effects of minimum wages are examined in a variety of ways. Stigler (1946) and Mincer (1976) are among the first papers in the area and their analyses are based on tables with average values of the minimum wages and the average changes in employment and unemployment. Most of the subsequent empirical literature (Gramlish 1976; Brown et al. 1982, 1983; Neumark and Wascher 1992; Katz and Krueger 1992; Card II 1992; and Kennan 1995) focuses on the estimation of employment and/or unemployment equations, using either time series data or panel data.

Until the mid-1990s, the norm in the empirical findings is that the minimum wage reduces employment, especially among younger and low-skill workers. For example, Gramlich (1976) finds that teenagers are made worse off by the unemployment associated with the minimum wage and Brown et al. (1982; 1983) note that previous time series studies indicate that a 10 percent increase in the minimum wage is associated with a decrease in teenage employment of 1-3 percent.

One of the most influential studies in the area dates from 1992, when David Card and Alan Krueger gathered information on fast food restaurants in New Jersey (where the minimum wage increased) and eastern Pennsylvania (where it remained unchanged) in an attempt to assess the effect of the wage increase on employment within New Jersey. The authors conclude that the increase in the minimum wage increased employment in the New Jersey restaurants, contrary to the predictions of the perfectly competitive model.

Card and Krueger expand their initial 1992 article in their 1995 book *Myth and Measurement: The New Economics of the Minimum Wage*, where they argued that negative employment effects of minimum wage laws are minimal if not non-existent. However, they were harshly criticized (e.g. Neumark and Wascher, 1992, 2000; and Kennan, 1995), for the methods they employ in examining the minimum wage effects. They are also criticized for some bias in interpreting their results (i.e. where there are inconclusive results, they claim this is evidence against the perfectly competitive model).

Focusing on the time series literature, which this study is concerned with, the most frequently cited studies remain the aforementioned Brown et al. (1982; 1983) and Wellington (1991) papers, where the following model is estimated:

$$E_t = a_0 + a_1 MW_t + X_t a_2 + e_t \quad (1)$$

$$e_t = \beta e_{t-1} + u_t, u_t \sim N(0, \sigma^2) \quad (2)$$

E_t is the employment rate, MW_t is the minimum wage measure (see the Kaitz Index description in section 3) and X_t is the vector of control variables that typically include a time trend, a cyclical control (business cycle) variable, some supply constraint variables and seasonal dummies (when quarterly data is used).

In equation (1), the employment effects of a minimum wage are captured through coefficient a_1 which, when equation (1) is estimated in logs instead of levels, is actually the employment elasticity of the minimum wage. The estimated a_1 times ten is interpreted as the percent change in employment due to a 10 per cent change in the minimum wage. Brown et al. (1982, 1983) make a synopsis of the estimated elasticities from previous minimum wage studies for U.S.A. using time series data. These studies indicate that minimum wages have a negative employment effect and that a 10 percent increase in the minimum wage is associated with a decrease in teenage employment of 1-3 percent.

Wellington (1991) updates Brown et al. (1982) with data through 1986 to provide new estimates, encompassing a period when the real value of the minimum wage was declining, due to the fact that its nominal value had not increased since 1981. She finds that a 10% increase in the minimum wage decreased teenage employment by 0.6 percentage points, with no effect on either the teen or young adult unemployment rates.

However, Neumark and Wascher (2007) in the lengthy review of the new minimum wage research, find that in the range of studies comprising the new minimum wage research, estimated elasticities are outside the range of 1% to 3% of Brown et al. (1982, 1983). Even when limiting the sample of the studies to those focused on the effects of the minimum wage of teenagers in the United

States of America, the estimates of the a_1 coefficient range from near -1.0 to above zero. The sample of studies focusing on the European Union (of which Cyprus is a full member since 2004), also indicate a considerable variation in the a_1 estimates, from -4.6 in France (for 25-30 year-old male workers newly constrained by the minimum wage) to 0.36 – 1.00 in Sweden (for 20-25 year-old workers)[2].

However, Card and Krueger (1995) in their influential book express their concerns regarding the methodological problems associated with estimating equation (1), mainly regarding the choice of the control variables and the minimum wage measure. They argue that the results should be more thoroughly checked for robustness and for potential endogeneity of the minimum wage measure and the control variables. The problem of the possible endogeneity of some of the control variables is usually solved by using Instrumental Variables (IV) estimations, e.g. Neumark and Wascher (1994). The literature that followed indicates more econometric concerns. Williams and Mills (2001) and Bazen and Marimoutou (2002) argue that the earlier papers do not properly account for serial correlation and non-stationarity in the data. The usual norm in the presence of serial correlation in the minimum wage studies (e.g. Brown et al., 1983) is to use GLS estimates in addition to OLS.

To properly address those issues, Williams and Mills (2001) estimate vector autoregression (VAR) models, with separate equations for employment and the Kaitz Index (transformed as needed to ensure stationarity). Bazen and Marimoutou (2002) choose to account for the potential non-stationarity by specifying stochastic structures for the trend, seasonal and cyclical components of the model.

3. DATA

In this section, the data collected for the purposes of this study is briefly described. The data is selected taking into consideration that the analysis concerns a country where the legislative coverage of the minimum wage is limited, since in Cyprus there is no universal coverage from the relative

[2] See Neumark and Wascher (2007), Table 6.1, pp. 97-106.

legislature as is the case in other countries where the effect has been tested. The comparative study of Funk and Lesch (2005), reports that out of the 27 countries[3] that are currently members of the European Union, 20 have a statutory national minimum wage, in a way similar to the U.S.A., Canada and Japan, the countries with which most minimum wage studies are concerned. Cyprus is excluded from this group, since *"Cyprus (…) has a statutory minimum wage for a few specific occupations only"*.

In the remaining 6 E.U. Member States, the sectoral level agreements are widely applied, thus constituting de facto minimum wages. A common feature of this second group of countries (Austria, Denmark, Finland, Germany, Italy and Sweden) is the high coverage rate of collectively agreed minimum wages, generally laid down in sectoral agreements. The percentage of employees covered by these collectively agreed minimum wages ranges from approximately 70% in Germany to almost 100% in Austria and Italy[4].

Given that the minimum wage rates are announced on a yearly basis, in Cyprus the data collected is of an annual frequency and the sample period is 1960-2009, that is the whole period of the existence of the Republic of Cyprus. A background of the statutory minimum wages in Cyprus (including a list of occupations covered and main historical developments) is given in Appendix A.

The core variables used in this study are the employment ratio (EMPL) and the minimum wage variables. Following the existing literature, the minimum wage is measured using the Kaitz Index[5], the definition of which is given below. As suggested in equation (1), a set of control variables are added in the models: real GDP, the unemployment rate, the total population, the population share of women, the number of secondary school leavers and a linear trend. A more detailed presentation of all the variables can be found in Appendix B: Table B.1 presents their definitions, Table B.3 the descriptive statistics and in Figure B.1 (at the end of the paper) their graphs are given.

The Kaitz Index is defined as:

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[3] The study included Bulgaria and Romania, even though they were not at the time full members of the European Union.

[4] See Funk and Lesch (2005), Table 8.

[5] Named after Hyman B. Kaitz who introduced it in his 1970 paper.

$$MW = \sum_i \frac{E_i}{E}\left[\frac{MW_i^{\,N}}{AHE_i}C_i^{\,N} + \frac{MW_i^{\,S}}{AHE_i}C_i^{\,S}\right] \qquad (3),$$

where $\frac{E_i}{E}$: is the number of persons employed in each industry as a proportion of the total employment; MW_i is the minimum wage set in each industry; C_i^N, C_i^S are the proportions of workers employed in each industry with less or more than six months experience; and *AHE* represents the average hourly earnings (since usually the minimum wage is set at an hourly rate). The superscripts N and S stand for "newly covered" and "six months period", since a different minimum wage rate is usually set in Cyprus for workers that completed six month's experience. The Kaitz Index is not available in Cyprus and one of the contributions of this study is its calculation. This is done so that changes in the legislative coverage of the minimum wage are incorporated in the index. The Kaitz Index of Cyprus is calculated by combining data from two different surveys carried out by the Cyprus Statistical Service: the Censuses of Establishments (COE) and the Family Expenditure Surveys (FES). In order to address some issues created by a change in the classification system of occupations by the Statistical Service within the sample period of this study, two alternative versions of the index are created (KAITZ1, KAITZ2) and the calculations for both of them are summarily described in Appendix C.

The graphs of the data, given in Appendix B, suggest that most of the variables have a linear or a quadratic trend. What is even more obvious is that the series are characterized by the presence of structural breaks, the most eminent of them appearing in 1974. This was when a military coup, followed by the Turkish invasion, ended in the partition of the island and as a result for the period after 1974 the data refer only to the Government Controlled Area of the Republic of Cyprus. A list of political and economic events that are significant for Cyprus is given in Table B.2[6] of Appendix B.

In addition to 1974, the employment variable (EMPL) also appears to have significant breaks in 1963-64 and 1969, at the time of significant inter-communal

[6] Table B.2 is created by adjusting the Table 3 in Appendix A of Χριστοφίδης, Κούρτελλος και Στυλιανού (2006), to the sample period of this study.

fighting in Cyprus. The Gulf War, the Cyprus Stock Exchange crisis in 1999-2000, the accession to the European Union in 2004 and the late-2000s Global Financial Crisis also seem to have had their effect on the labour market in Cyprus.

All wage and minimum wage variables (W, MW6, MWW, KAITZ1 and KAITZ2) appear to have significant breaks in 1980 and 1985-86. The main reason behind them is the wage indexation mechanism used in Cyprus, a Cost of Living Adjustment (COLA) mechanism that adjusts wages every six months, using recent price developments. In that manner, the international events that affected the petrol oil market (like the second international oil crisis 1979-80 and the oil price collapse in 1986) had an impact on wages in Cyprus, through the national price level and the aforementioned wage indexation mechanism. In addition, there is a prominent effect on the mean wage variable (W) in 1991, the year of the Persian Gulf War. The Kaitz indices and the coverage variables (KAITZ1, KAITZ2, MWW, CC1 and CC2) also indicate bumps in 1970 (at the time of a significant inter-ethnic fighting) and in 1990 (the year of a minimum wage amendment described in Appendix A). The minimum wage variables contain breaks in 1985 and 1995.

As for the control variables, they also indicate a prominent effect in 1974, particularly the unemployment rate (U), the total population (POP) and the Real Gross Domestic Product (Y). The unemployment rate and the Real GDP series are, in addition, affected by the second oil crisis in 1980, the Gulf War in 1991, the stock market crisis in 1999-2000 and the recent financial crisis. The structural breaks detected visually from this basic examination need to be incorporated in the unit root analysis in the following section, in order to correctly conclude on the stationarity of the series and the incorporation of the biggest of those structural breaks using dummies in the VAR model.

4. UNIT ROOT ANALYSIS

The seminal papers of Granger and Newbold (1974) and the subsequent work on cointegration give reason to seriously doubt empirical evidence based on time series data if any of the variables used are non-stationary. However, Engle and Granger (1987) indicate that there may be linear combinations of integrated

(non-stationary) series that are stationary. In that case the series are cointegrated and, if there is a unique linear combination that is stationary, that combination expresses their long-run relationship, from which there may be short-run deviations. Therefore, the first step in estimating the long-run relationship of total employment and the minimum wage is to examine the stationarity of the series.

As the previous section indicates, the time series examined appear to have been influenced by a number of political and economic events. The seminal paper of Perron (1989) and the subsequent literature indicate that the presence of structural breaks in a series may bias the unit root tests towards accepting the null of the presence of a unit root. Therefore, for stationary series containing a structural break in the trend or the intercept, unit root tests, such as Augmented Dickey-Fuller (ADF) tests, may incorrectly indicate non-stationarity.

In the tables presented in Appendix D, the stability of the series is examined using root tests under exogenous and endogenous structural breaks. Augmented Dickey-Fuller (ADF) tests (Dickey and Fuller; 1979, 1981) were also performed for reference reasons and the results are presented in Table D.1.

The results from Perron (1989) tests are presented in Table D.3 of Appendix D., where probable structural breaks are incorporated in the auxiliary regressions used. Given the critical values provided in the 1989 paper, the null of the presence of a unit root may be tested in such a way that structural breaks do not bias the test towards accepting the null hypothesis. The Perron tests are performed using three alternative models: Model A refers to a break in the intercept, Model B to a break in the linear trend and Model C to a structural break that affects both the trend and the intercept of the series[7].

The results in Table D.3 indicate that two variables: the national mean wage (W) and the total population (POP), which the ADF tests in Table D.1 indicated as non-stationary, now appear stationary around a broken trend and a break in the intercept at 1% significance level. For the first version of the Kaitz Index (KAITZ1) and the plain Kaitz Index (MWW) the null of the presence of unit root is

[7] The adjustment suggested by Perron and Vogelsang (1994) is made in all the auxiliary regressions used.

accepted also, but only at 10% significance level. Table D.3 also confirms the ADF results that the employment ratio, the unemployment rate and the secondary school leavers variables are stationary. For the rest of the series, the coefficients of the Perron models indicate that they contain structural breaks in the years suggested in the previous section, but, incorporating those breaks with an appropriate version (Model) suggested by Perron (1989), does not remove the evidence of the presence of a unit root and the series are indicated as non-stationary. Those series are the second Kaitz Index (KAITZ2), the real minimum wage rates (MW6, MW), the coverage variables (CC1, CC2), the Gross Domestic Product in 1995 Constant Prices (Y) and the female ratio in the total population (GENDER).

Even if the methodology suggested by Perron (1989) for testing for unit roots in the presence of structural breaks is considered very reliable, the literature that follows, most notably Christiano (1992), criticizes the fact that the location of the structural breaks in the series is determined exogenously (i.e. by the tester) in the Perron methodology. This approach invalidates the distribution theory underlying the conventional estimation methods (the independence assumption, in particular). For that reason, the significance of the breaks indicated by the Perron tests may be overestimated and several studies have been developed using methodologies where the location of the break is endogenously determined. The most notable of them are: Banerjee, Lumisdaine and Stock (1992) and Zivot and Andrews (1992).

In order to account for the Christiano critique, Zivot and Andrews (1992) tests are also performed for the variables and their results are presented in Table D.2 of Appendix D. These types of tests use the three models suggested by Perron (1989), allowing for the breaks to be determined endogenously and providing the appropriate critical values. The Zivot and Andrews tests confirm the results of Table D.3 for the national mean wage (W), the plain Kaitz Index (MWW) and the total population (POP) – stationary around a broken trend and intercept. In addition, the real minimum wage variables (MW6 and MW), that ADF and Perron tests indicate as containing a random walk component, now appear as being trend stationary. On the other hand, the unemployment rate (U) and the

secondary school leavers (LEAV) variables that both the ADF and the Perron tests indicated as stationary, now appear as non-stationary.

The employment ratio (EMPL) is indicated stationary across all three tests, while the second Kaitz Index (KAITZ2), the coverage variables (CC1, CC2), the Gross Domestic Product at 1995 Constant Prices (Y) and the female ratio in the total population (GENDER), are indicated as non-stationary, whether their structural breaks are determined exogenously or endogenously.

The results from Tables D.2 and D.3 indicate that the most prominent structural breaks in the variables examined occurred in 1970 (right after an outbreak of inter-communal violence and the ratification in Cyprus of International UN Conventions on employment issues), in 1974 (at the time of the military coup and the Turkish Invasion), in 1980 (when the second international petrol oil prices crisis was on), in 1985-86 (when oil prices collapsed after OPEC countries decreased their oil production several times between 1980-1985 in order to keep prices high) and in 1995-96 (when an inter-ethnic fighting occurred that led to a political crisis and the financial sector of Cyprus was being radically reformed by the Central Bank)[8].

The evidence of structural breaks, their location and the univariate series specification that resulted from the analysis in this section informs the multivariate analysis carried out in the following section. The sensitivity of the vector autoregression models to correct specification regarding the stationarity of the variables, the appropriate dynamic specification (lag length) and endogeneity issues all suggest that the VAR specification must be carefully constructed.

5. ESTIMATION AND RESULTS

In this section the short-run relationship between the total employment and the minimum wage variables is examined, using VAR models, which may capture the effects of endogeneity, dynamic specification and the non-stationarity

[8] A more extensive analysis on the presence and effects of structural breaks in main macroeconomic variables of Cyprus, such as GDP, price level, national mean wage, money supply and unemployment rate, is given in the following papers: Christofides, Kourtellos and Stylianou (2006a, 2006b), and Christofides and Vrahimes (2006). Those studies use quarterly data for the period 1981-2004.

indicated by the univariate series analysis. These “atheoretical” models, first suggested by Sims (1980), are a simultaneous system of dynamic equations representing the relationship of the endogenous variables with their lagged values, deterministic variables such as linear trends and other variables that are considered exogenous to the system:

$$Z_t = A_o + \sum_{i=1}^{P} A_i Z_{t-i} + BD_t + \Gamma X_t + U_t \qquad (4),$$

where Z is the vector of the endogenous variables (employment ratio and the Kaitz Index), D the vector of deterministic terms, X the vector of exogenous variables (unemployment rate, Real GDP, total population, female ratio in the total population and secondary school leavers) and U the vector of error terms that are normally distributed. If the results from estimating (4) indicate the presence of a long-run relationship between endogenous variables, this can be estimated via the use of the Vector Error Correction Model (VECM):

$$\Delta Z_t = A_o + \Pi Z_{t-1} + \sum_{i=1}^{P} \mathrm{E}_i \Delta Z_{t-i} + BD_t + \Gamma X_t + U_t \qquad (5)$$

The cointegration hypothesis mentioned in the previous section is tested by examining the algebraic properties of the Π matrix.

5.1 VAR Estimation

Because the evidence from the previous section indicates that the employment variable (EMPL) does not contain a unit root, EMPL is not differentiated in any of the models. However, for the first version of the minimum wage index (KAITZ1) the null of the presence of unit root is only marginally rejected and for the second version of the minimum wage index all the tests indicate the presence of a unit root[9]. For this reason, four VAR models are specified and estimated in order to choose the most statistically adequate for examining the long-run relationship between the two endogenous variables. These models are differentiated only in regards to the minimum wage variable: the first and third models, VAR(KAITZ1) and VAR(KAITZ2), use the two versions of Kaitz Index in levels, while the second model and fourth models, VAR(DK1) and VAR(DK2), use the same

[9] Note that since the employment variable is found stationary, while the Kaitz index is indicated nonstationary, all estimates using the standard specification of equation (1) will be inconsistent.

indices in first differences. The estimation results for all four of them are given in Appendix E.

For all four models, certain steps are followed, especially regarding the lag order selected and the statistical adequacy of each model. For that manner, the tests conducted include tests for Serial Correlation, Normality and Homoscedasticity and their results are presented in Table 2, later on, when the most statistically appropriate VAR model is selected for cointegration analysis.

Given the evidence for the presence of structural breaks in most of the variables, as indicated in the previous section, special attention is given in the selection of appropriate dummy variables, in order to incorporate the significant breaks in the VAR models estimated. Not all structural breaks detected in section 3 are incorporated in the VAR models, since then the data set would be stressed too far and the estimations carried out would not have substantial degrees of freedom. For that reason, only the most prominent breaks are included, and thus all four models include a constant term, a linear trend and four dummy variables, in order to account for the structural breaks in the intercept and the trend of the variables in the years 1974 and 1980 (at the times of the Turkish Invasion and the second international oil price crisis). The one-time break (outlier) in the minimum wage indices in 1985 is also taken into account. The dummies used to capture the effect of the breaks are the same ones used in the Perron (1989) tests carried out in the previous section.

The VAR models are used for the detection of short-run relationship between the system variables and these relationships may be tested through the Granger Causality tests, where the null hypothesis is that there is no relationship between the endogenous variables. It is very important to perform Granger Causality tests in VAR models for two reasons: the first reason is that the endogenous variables of the system should be characterized by a two-way Granger causality, or else one or more equations of the system could be omitted from the estimations. The results for the Granger Causality tests performed for all four VAR models are presented in Table E.5. of Appendix E.

The second reason for which Granger Causality tests should be performed is that if the VAR model includes control variables, those should be tested to see whether they are Granger-caused by the endogenous variables. In that case, the

estimations carried out would suffer from endogeneity bias. The potential endogeneity problem of the control variables is tested with Granger Causality tests in a number of auxiliary VAR models. Out of the five control variables examined, only the unemployment rate is indicated as endogenous, not surprisingly, since as suggested in the literature review, minimum wage policies may impact unemployment rates as much as unemployment rates may impact minimum wages. For that reason the unemployment rate is omitted from all models[10].

Another concern related with the control variables included in the models is whether they are non-stationary and thus they affect the quality of the estimates. The unit root tests performed in the previous section indicate that from the remaining four exogenous variables only Real GDP (Y) and the proportion of women in the total population (GENDER) are indicated as non-stationary by all tests. Whenever those two variables are indicated as statistically significant in levels, an auxiliary VAR was used to test the null of cointegration, and if it was rejected, the variables are used in first differences. In that manner, Y is included in two of the models in levels, due to evidence of cointegration with the endogenous variables, while GENDER is included in first differences in the other two models.

As indicated in the VAR model estimates presented in the tables of Appendix E, there is evidence of a short-run relationship between employment and minimum wages, since in all four models the lagged values of the one endogenous variable appear to have significant effects on the other. However, the main concern of this study is to check whether there is long-run relationship between the endogenous variables. For that reason, the misspecification and the Granger causality tests described before are used, along with the Cointegration tests described further on, in order to select the most appropriate VAR specification – the one to be used for examining the long-run dynamics of employment and the minimum wage. The long-run properties of a model are examined with the use of Vector Error Correction Models (VECM), where the long-run relationship

[10] Estimation of trivariate VAR models were also attempted, where the unemployment rate was the third endogenous variable, but those were abandoned, since the limited number of observations led to an exhaustion of the degrees of freedom of the models from the early stages of specification.

between the variables of the system and the short-run dynamics may be simultaneously estimated.

In specifying a VAR model in a VECM form, it is necessary to determine the cointegrating rank of the model. The test procedure used is the one introduced by Johansen (1991, 1995), but the critical values are estimated using the procedure of Johansen et al. (2000) to allow for the presence of the structural break dummies. The results are indicated in Table 1 below.

Table 1: Tests for Cointegration

Endogenous Variables	Null Hypothesis	Maximal Eigenvalue	Critical Value	Trace Statistic	Critical Value	Johansen et al. (2000)
EMPL, KAITZ1	r = 0	80.08	19.39	94.89	25.87	36.06
	r = 1	14.81	12.52	14.81	12.52	18.29
EMPL, DK1	r = 0	41.25	19.39	66.42	25.87	36.06
	r = 1	25.17	12.52	25.17	12.52	18.29
EMPL, KAITZ2	r = 0	78.48	19.39	87.10	25.87	33.53
	r = 1	8.62	12.52	8.62	12.52	16.88
EMPL, DK2	r = 0	27.51	19.39	49.24	25.87	33.53
	r = 1	21.73	12.52	21.73	12.52	16.88

Note 1: Critical Values at 5% significance level.

Note 2: The alternative hypothesis for the Maximal Eigenvalue Test is that the rank of Π matrix in equation (5) is equal to: r + 1.

Note 3: The alternative hypothesis for the Trace Test is: rank(Π) > r.

From Table 1 it is evident that only one of the four estimated VAR models has a cointegrating rank equal to one and thus may be estimated in a VECM form. The other three VAR models are indicated as stationary. The choice of the models where the second Kaitz Index is used as a minimum wage variable is also supported by the Misspecification Testing results presented in Table 2, below. In the same Table, the VAR models employing the first Kaitz Index are indicated as suffering from serial correlation problems, either in levels or in first differences (no matter what number of lags were used).

Table 2: Misspecification Tests

	VAR (KAITZ1)	VAR (DK1)	VAR (KAITZ2)	VAR (DK2)
Breusch–Godfrey LM Test	0.093	0.046	0.740	0.957
Jarque-Bera Normality Test	0.000	0.000	0.000	0.000
White Heteroscedasticity Test	0.783	0.934	0.704	0.341

Note 1: The p-values of the tests are reported.

Note 2: The null hypothesis in the Breusch–Godfrey LM Test is 'No Autocorrelation', in the Jarque-Bera Test the null hypothesis is 'Normality', and in the White Test the null hypothesis is 'No Heteroscedasticity'.

In the Granger Causality tests in Table E.5 in the Appendix there is strong evidence for KAITZ2 Granger causing EMPL, but less evidence for the vice versa. The results from Table E.5, however, indicate that the hypothesis that the Kaitz Index 2 does not have an effect on total employment is rejected.

The direction of this relationship (if one variable positively or negatively affects another variable), and how long a shock impacting one variable will affect another variable, will be examined by the Impulse Response Analysis in section 5.2 of the present study. Some of the results may come as a surprise, because in the VECM estimation, the Kaitz Index did not seem to be significant in the employment equation. Nevertheless, the results indicate the presence of a cointegrating relationship between the endogenous variables and that result is consistent with at least one Granger-causality relationship between them.

5.2 VECM Estimation

Since the tests in Table 1 establish the presence of a single cointegrating relationship between total employment and the minimum wage measure (KAITZ2), a VECM model is used in order for this relationship to be identified. The estimation results are reported in Table 3 and the specification testing results are given in Appendix F. The cointegrating equation derived from the estimation of the VECM is:

$$EMPL_{t-1} = 0.0581 - 0.0199 KAITZ2_{t-1} \qquad (6)$$

Equation (6) expresses the long-run relationship between employment and the statutory minimum wage in Cyprus and, in that manner, the estimated coefficient

of the Kaitz Index may be interpreted as the long-run counterpart of the a_1 parameter in equation (1) in section 2. If the employment effects are quantified in the same manner as in the literature reviewed in the same section, then the above estimation suggests that a 10 percent increase in the minimum wage in Cyprus is related with a decrease in overall employment of 0.2 percent.

According to this result, there is negative long-run relationship between employment and the statutory minimum wage in Cyprus. Given that the coverage of the minimum wage legislation does not exceed 31% of the employed population throughout the sample period[11], the fact that the relationship is indicated as significant is really important.

In the framework of Moser and Stahler's (2009) analysis, the introduction of a minimum wage only unambiguously reduces job creation and employment in the uncovered sector, whereas its employment effect on the covered sector is ambiguous. A minimum wage may increase employment in the covered sector by increasing the job duration or decrease it because of the associated rise in the labour costs of the firms. In that manner, the minimum wage effect on the covered employment depends on which one of these effects dominates, while the effect on total employment depends on the sign and magnitude of the effect on the covered sector. The fact that the coefficient of the minimum wage variable in the cointegrating vector is negative indicates that the minimum wage in Cyprus decreases employment in the uncovered sector, while in the covered occupations the effect is either negative as well, or positive but not sufficient to counterbalance the effect in the uncovered sector.

Thus, in the Moser and Stahler framework, the negative effect on total employment suggests a situation where the minimum wages increase improves the bargaining position of the employees in the uncovered occupations, their ability to demand higher wages and leaves firms less willing to hire. The effect of the minimum wage in the covered sector is either negative (due to the firm's costs associated with minimum wage increases exceeding the benefits associated from an increase in the duration of employment), or positive, but not large enough to exceed the negative effect in the uncovered sector.

[11] See Table C.5 in Appendix C.

Table 3: VECM Estimation Results

Cointegrating Equation:		
EMPL(-1)	1.000	
KAITZ2(-1)	-0.020* (0.008)	
C	0.058	
Error Correction:	D(EMPL)	D(KAITZ2)
CointEq1	-1.563* (0.141)	0.203 (1.793)
D(EMPL(-1))	0.600* (0.076)	0.510 (0.964)
D(EMPL(-2))	0.285 (0.087)	-0.617 (1.112)
D(EMPL(-3))	0.228 (0.068)	0.705 (0.861)
D(EMPL(-4))	-0.017 (0.080)	0.379 (1.017)
D(KAITZ2(-1))	-0.018 (0.011)	-0.006 (0.134)
D(KAITZ2(-2))	-0.004 (0.011)	-0.143 (0.141)
D(KAITZ2(-3))	-0.006 (0.011)	-0.165 (0.136)
D(KAITZ2(-4))	0.001 (0.011)	-0.118 (0.135)
C	-4.564* (0.506)	-4.885 (6.441)
T	-0.024* (0.003)	-0.065 (0.039)
O1973	-0.041* (0.018)	0.390 (0.229)
T1973	0.001 (0.002)	0.039 (0.020)
O1979	-0.033* (0.015)	-0.398* (0.195)
T1979	0.004* (0.001)	-0.004 (0.009)
O1984	0.004 (0.009)	0.519* (0.118)
Y	0.367* (0.039)	0.541 (0.498)
POP	0.326* (0.049)	0.210 (0.618)

Note 1: The asterisk (*) denotes significance at 5%.

Note 2: Standard errors are reported in parentheses.

The Impulse Response Analysis provides information to analyze the dynamic behaviour of a variable due to a random shock or innovation in other variables. Specifically, the impulse response functions trace out the effects on current and future values of the endogenous variables of one standard deviation shock to a variable. In the Impulse Response Analysis graphs, in Appendix F (at the end of the paper), it is indicated that a positive shock in the minimum wage does not have a prominent short-run effect in total employment.

The results suggest that a positive shock in the Kaitz Index (minimum wages) results in a very small increase in employment ratio. The shock in the Kaitz Index itself is large and tends to be persistent. This dynamic reaction of the minimum wage measure can be attributed to the small variation of the index in the periods for which there were no changes in the legislative coverage of minimum wages and to the fact that the most severe shocks that Cyprus experienced were absorbed through the use of dummy variables. So, even a small shock in the index causes unexpectedly large effects in its future values. A shock in employment ratio also leads to a very small but persistent increase in the Kaitz Index. The effect on employment ratio itself is very small and it fluctuates around zero before it dies out.

However, the Variance Decomposition Analysis results, also in Appendix F, indicate that the minimum wage index has a prominent impact on the variance of the employment variable. In the tenth period after a positive shock in the minimum wage, about 24% of the variation of the employment variable is due to the minimum wage. On the other hand, the variation in employment accounted for less than 7% of the variation on the minimum wage index, ten periods after a positive shock on the employment.

5.3 Evidence from Decomposition of the Kaitz Index

The studies mentioned in section 2 use a variant of the Kaitz Index as the measure of the minimum wage in their estimations. As discussed by Brown et al. (1983), this measure is desirable because it incorporates both a relative minimum wage and an adjustment for the actual coverage. However, it has some disadvantages, one of them being that it constrains the minimum wage and the coverage effects to be the same, although there is no reason to impose this

restriction a priori. Brown et al. (1983) and Wellington (1991) were the first to attempt to separate the two effects.

Given that this study is about a country where the legislative coverage is limited, the usual practice of breaking the Kaitz index is followed, where the index is decomposed into:

$$MWW_t = \frac{MW6_t}{W_t} \quad (7)$$

$$CC_t = \sum_{i=1}^{N} \frac{E_{it}}{E_t} \Phi_{it} C_{it}^{S} \quad (8)$$

$MW6_t$: is the minimum wage rate set for the employees after they reach six months of experience and W_i: is the national mean wage. $\frac{E_i}{E}$: is the number of persons employed in each main occupational group, as a proportion of the total employment (=the 'employment weight'), Φ_i: is the proportion of the workers in each occupational group that are covered by the Minimum Wage Law (=the 'coverage weight') and C_i^S: is the proportion of workers employed in each industry with more than six months' experience (=the 'experience proportion'). As with the Kaitz Index, two different versions of coverage variables are created (CC1, CC2) and the calculation of both of them is described in Appendix C.

The effect of those two alternative measures of the minimum wage are investigated with an additional VAR model, where the MWW variable (the ratio of minimum wage to the national mean wage) substitutes KAITZ2 as an endogenous variable and the related coverage variable (CC2) is added to the control variables[12]. The results from the estimations and the tests (misspecification, Granger Causality and Cointegration) are presented in Appendix F, where it is indicated that this VAR model is stationary and thus a cointegration analysis could not be carried out.

[12] An even more analytical method in decomposing the Kaitz Index effect is to use the real minimum wage as endogenous variable and both the real national mean wage and the coverage as controls. However, the real mean wage was indicated as endogenous in the preliminary tests and thus could not be added only as control in the model.

An interesting result, though, is that the coverage variable (CC2) is not significant is this model, even if used in first differences, indicating that the results above are due to minimum wage rather than coverage effects. This result is not something new in the literature, since the findings in most of the papers where the Kaitz Index is segmented indicate a weak, if any, coverage effect[13]. Neumark and Wascher (2007) also indicate that the weak empirical evidence, in combination with the lack of available data, led more recent studies to ignore the coverage effect altogether. In Cyprus, where there is a very limited legislative coverage, this result is consistent with the Moser and Stahler (2009) analysis, where the minimum wage creates significant spillover effects to the uncovered sector and thus the coverage becomes of less importance.

6. CONCLUSION

This study investigates whether there is a long-run relationship between total employment and the minimum wage, in a case where the coverage of minimum wage is very limited. The most frequently cited results about minimum wage effects on employment come from time series studies, carried out in countries where the minimum wage is legally binding for nearly all occupations, while in Cyprus the legislative coverage of the minimum wage law is calculated as 30%. It is also stressed that in the existing time series literature the econometric concerns for stationarity and endogeneity of the control variables used are not emphasized. Neither is the dynamic relationship between minimum wages and employment examined in detail. These topics are crucial in obtaining consistent and robust results, and for that reason vector autoregression models are applied in this study, where those concerns are adequately checked and dealt with.

Given the small number of observations and the presence of structural breaks in the sample period (both being caveats when testing for unit roots), the stationarity of the series is carefully examined, allowing for the structural breaks to be determined both exogenously and endogenously in the sample. Since two variants of the Kaitz Index, the most popular minimum wage measure, are calculated, more than one VAR models are examined, before a VECM is employed in order to test the existence of a stable long-run relationship between

[13] See Brown et al. (1983) for a discussion of those papers.

employment and minimum wage. It is found that there is a negative and significant relationship between total employment and the minimum wage, despite the fact that the legislative coverage is limited to a number of occupations only.

The Variance Decomposition Analysis indicates that the variance of the employment variable is greatly affected by the variability of the minimum wage measure. According to the most recent two-sector search and matching framework, this result arises from the fact that the minimum wage has a negative spillover effect in sectors that are not covered by the minimum wage legislation. Those spillovers occur when increases in the minimum wage in the covered sector act as a reference point, raise bargaining power and triggers higher wage settlements in the uncovered sector which discourages employment.

The estimations also suggest that the coverage effects of the minimum wage on total employment are not significant. This result is not new in the literature. However, in the case of Cyprus, the legislative coverage is limited and, thus, the insignificance of the coverage effects may be interpreted as additional evidence in favour of the existence of significant spillover effects of the minimum wage to the uncovered sector.

REFERENCES

English:

Banerjee, A., R.L. Lumsdaine and J.H. Stock (1992), "Recursive and sequential tests of the unit root and trend break hypotheses", Journal of Business and Statistics, Vol. 10, pp. 271-287.

Bazen, S. and V. Marimoutou (2002), "Looking for a Needle in a Haystack? A Re-examination of the Time Series Relationship between Teenage Employment and Minimum Wages in the United States," Oxford Bulletin of Economics and Statistics, Vol. 64, pp. 699-725.

Boal, W. and M. Ransom (1997), "Monopsony in the Labor Market," Journal of Economic Literature, Vol. XXXV, pp. 86-112.

Brown, C., Gilroy, C. and A. Kohen (1982), "The Effects of Minimum Wage on Employment and Unemployment," Journal of Economic Literature, Vol. 20, pp. 487-558.

-----. (1983), "Time Series Evidence on the Effect of the Minimum Wage on Youth Employment and Unemployment," The Journal of Human Resources, Vol. 18, No. 1, pp. 3-31.

Card, D. (1992a), "Using Regional Variation in Wages to Measure the Effect of the Federal Minimum Wage," Industrial and Labor Relations Review, pp. 22-37.

-----. (1992b), "Do Minimum Wages Reduce Employment?: A Case Study of California 1987-89," Industrial and Labor Relations Review, pp. 38-54.

-----. and A. B. Krueger (1992), "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," American Economic Review, Vol. 84, No. 4, pp. 772-793.

-----. (1995), *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press.

Christiano, L. J. (1992), "Searching for a break in GNP", Journal of Business and Economics Statistics, Vol. 10, pp. 237-249.

Christofides, L., Kourtellos, A. and I. Stylianou (2006a), "A Small Model for the Cyprus Economy", Economic Analysis Papers, 02-06, Economics Research Centre, University of Cyprus .

Christofides, L. and K. Vrahimis (2006), "Macroeconomic Model of the Cyprus Economy: The Wage-Price Sector", Economic Analysis Papers, 05-06, Economics Research Centre, University of Cyprus.

Dickey, D.A and W. A. Fuller (1979), "Distributions of the Estimators for Autoregressive Time Series with a Unit Root", Journal of American Statistical Association, 74(366), pp.427-481.

-----. (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", Econometrica, Vol. 49(4), pp.1057-1072.

Engle, R.F. and C.W.J. Granger (1987), "Cointegration and error correction: representation estimation and testing", Econometrica, Vol. 55, pp. 277-304.

European Industrial Relations Observatory (EIRO) (2005), “Changes in the national collective bargaining systems since 1990 – The Case of Cyprus”, http://www.eurofound.europa.eu/eiro/2005/03/word/cy0412101s.doc.

Flinn, C. J. (2006), "Minimum Wage Effects on Labor Market Outcomes under Search, Matching, and Endogenous Contact Rates," Econometrica, Vol. 74(4), pp. 1013-1062.

Funk, L. and H. Lesch (2005), “Minimum Wages in Europe”, http://www.eiro.eurofound.eu.int/2005/07/study/tn0507101s.html [9.8.2005].

Gramlich, E. (1976), "Impact of Minimum Wages on Other Wages, Employment, and Family Incomes," Brookings Papers on Economic Activity, Vol. 1976, No. 2, pp. 409-461.

Granger, C. and P. Newbold (1974), “Spurious Regressions in Econometrics”, Journal of Econometrics, Vol. 2, pp. 111-120.

-----. (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," Econometrica, Vol. 59(6), pp. 1551-1580.

Johansen, S. (1995), "Likelihood-Based Inference in Cointegrated Vector Autoregressive Models," Oxford University Press, Oxford.

Johansen, S., Mosconi, R. and B. Nielsen (2000), "Cointegration analysis in the presence of structural breaks in the deterministic trend," Econometrics Journal, Royal Economic Society, Vol. 3(2), pp. 216-249.

Kaitz, H. (1970), "Experience in the past: The national minimum. In Youth Unemployment and minimum wages", Bulletin 1657, U. S. Department of Labor, Bureau of Labor Statistics.

Katz, L. and A. Krueger (1992), "The Effect of the Minimum Wage on the Fast Food Industry," Industrial and Labor Relations Review, Vol. 46, No. 1. pp. 6-21.

Kennan, J. (1995), “The Elusive Effects of Minimum Wages,” Journal of Economic Literature, Vol. 33(4), pp. 1950–1965.

Manning A. (1993), "The Equal Pay Act as an Experiment to Test Theories of the Labour Market.", LSE Centre for Economic Performance, Discussion Paper No. 153.

-----. (2003), *Monopsony in motion: Imperfect Competition in Labor Markets*. Princeton, NJ: Princeton University Press.

Mincer, J. (1976), “Unemployment Effects of Minimum Wages,” Journal of Political Economy, Vol. 84, No. 4, Pt. 2, pp. 87–104.

Mortensen, D. T. and C. A. Pissarides, (1994), "Job Creation and Job Destruction in the Theory of Unemployment," Review of Economic Studies, 61(3), pp. 397–415.

-----. (1999), "New developments in models of search in the labor market," Handbook of Labor Economics, in: O. Ashenfelter and D. Card (ed.), Handbook of Labor Economics, Edition 1, Vol. 3, Chapter 39, pp. 2567-2627, Elsevier, Amsterdam.

-----. (2003), “Taxes, subsidies and equilibrium labor market outcomes”. In: Phelps E., (Eds.). Designing inclusion: tools to raise low-end pay and employment in private enterprise, Cambridge University Press, Cambridge.

Moser, C. and N. Stähler (2009), “Spillover effects of minimum wages in a two sector search economy“, Deutsche Bundesbank Discussion Paper, Series 1: Economic Studies, No. 01/2009.

Neumark, D. and W. Wascher (1992), “Employment Effects of Minimum and Subminimum Wages: Panel Data on State Minimum Wage Laws.” Industrial and Labor Relations Review, Vol. 46(1), pp. 55–81.

-----. (1994), “Employment Effects of Minimum and Subminimum Wages: Reply to Card, Katz and Krueger,” Industrial and Labor Relations Review, pp. 497-512.

-----. (2000), “Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: comment,” American Economic Review, Vol. 90, No. 5, pp. 1362-1396.

-----. (2007), “Minimum Wage and Employment,” IZA Discussion Paper No. 2570, University of California.

Perron, P. (1989), “The Great Crash, the Oil Price Shock and the Unit Root Hypothesis”, Econometrica, Vol. 57, No. 6, pp. 1261-1401.

Pissarides, C. A. (2000), *Equilibrium Unemployment Theory*, Cambridge, MA: MIT Press.

Sims, C. A., (1980), “Macroeconomics and Reality”, Econometrica, Vol. 48, No. 1, pp. 1-48.

Stigler, G. (1946), "The Economics of Minimum Wage Legislation," American Economic Review, pp. 358-365.

Vogelsang, T.J. and P. Perron (1994), "Additional Tests for a Unit Root Allowing for a Break in the Trend Function at an Unknown Time," Cahiers de recherche 9422, Centre interuniversitaire de recherche en économie quantitative, CIREQ.

Wellington, A.J. (1991), "Effects of the Minimum Wage on the Employment Status of Youths: An Update," Journal of Human Resources, Vol. 26, No. 1, pp. 27-46.

Williams M. and J. Mills (2001), "The minimum wage and teenage employment: evidence from time series," Applied Economics, Vol. 33, pp. 285-300.

Zivot, E. and K. Andrews (1992), “Further Evidence On The Great Crash, The Oil Price Shock, and The Unit Root Hypothesis”, Journal of Business and Economic Statistics, Vol. 10 (10), pp. 251–270.

Greek:

Γεωργίου, Α., Κωμοδρόμου Δ. και Α. Πολυκάρπου (2005), “Ενοποιημένη Βάση Δεδομένων των Ερευνών Οικογενειακού Προϋπολογισμού 1984\85, 1990/91,

1996/7 και 2002/03", Δοκίμια Οικονομικής Ανάλυσης, 06-05, Κέντρο Οικονομικών Ερευνών, Πανεπιστήμιο Κύπρου.

Χριστοφίδης, Λ., Κούρτελλος, Α. και Ι. Στυλιανού (2006b), "Προσεγγίσεις στη Διαμόρφωση Μοντέλου της Κυπριακής Οικονομίας", Δοκίμια Οικονομικής Ανάλυσης, 13-06, Κέντρο Οικονομικών Ερευνών, Πανεπιστήμιο Κύπρου.

Data Sources:

Statistical Service of Cyprus, *Census of Establishments (1976, 1981, 1985, 1989, 1995 and 2000),* Nicosia: Printing Office of the Republic of Cyprus.

Statistical Service of Cyprus, *Family Expenditure Survey (1985, 1991, 1997 and 2003),* Nicosia: Printing Office of the Republic of Cyprus.

Statistical Service of Cyprus, *Labour Statistics (1982-2009),* Nicosia: Printing Office of the Republic of Cyprus.

Statistical Service of Cyprus, *Statistical Abstract (1991, 2009)*, Nicosia: Printing Office of the Republic of Cyprus.

Appendix A: The Minimum Wage Background in Cyprus

In Cyprus there is a unique standard regarding protecting remunerations at the bottom of the labour market. Wages and salaries are set as the result of bipartite negotiations between the most representative employers' organisations and trade unions, at the sectoral and enterprise levels. However, the parties to the collective agreements are not bound by the principle of a national statutory minimum wage. Based on the existing legislation (Law on minimum wages, Chapter 183), the monthly[14] minimum wages are currently set for the nine occupational groups listed in Table A.1.

Table A.1: Occupations Covered by the Minimum Wage Law in Cyprus

Occupations Covered	Period of Coverage
1. Salespersons	1944 – currently
2. Clerks	
3. Auxiliary Healthcare Staff	1990 – currently
4. Auxiliary Staff in Nursery Schools	
5. Auxiliary Staff in Crèches	
6. Auxiliary Staff in Schools	
7. Guards	2008 – currently
8. Caretakers Working in Clinics, Private Hospitals and Nursing Homes	
9. Cleaners in Business/Corporate Premises	2010 – currently

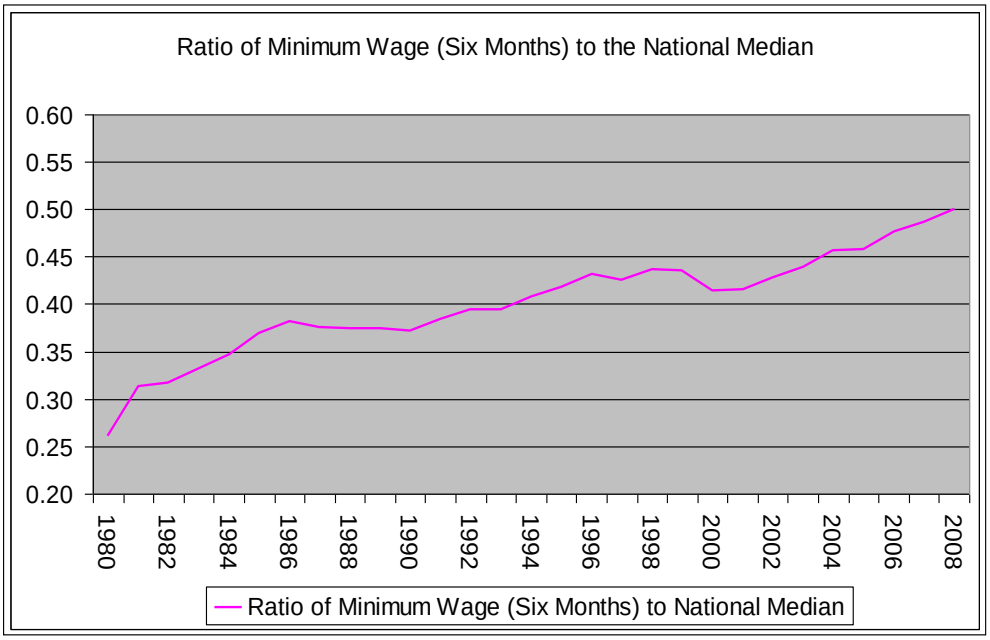
The Cyprus Minimum Wage Law was created in 1941 in order to protect the rights of mining workers. In 1944 the Law was amended in order to include

[14] In 2009, the minimum wage for Guards started to be set at an hourly rate instead. In 2011 the same happened to the Cleaners of Business/Corporate Premises.

salespersons and clerks and in 1957 the Law ceased to include mining workers. Initially the minimum wage rate was being increased periodically (1951, 1974, 1977, 1979), but as of 1981 a minimum wage rate is set every year. In 1990 a new amendment of the Law was carried out, in order to cover four additional occupations: auxiliary health staff and auxiliary health staff in schools, crèches and nursery schools. As is the case in other countries, a different minimum wage is set for the employees after they reach six months of experience.

In 2005 the European Industrial Relations Observatory (EIRO) comparative study on minimum wages indicated that the national minimum wage in Cyprus was approximately 60% of the corresponding average in the 15 EU countries having a statutory national minimum wage. According to the Labour Institute of Cyprus (INEK) the minimum wage in 2004 was only 41% of the national average gross wage (net wage plus employee contributions to social security for full time employees). As this was considered very low, the percentage increases of the minimum wage from 2002 and after aimed at gradually bringing the minimum wage up to 50% of the national median by 2008 (Ministerial Decision No 55.535, 24 April 2002). As may be seen in Figure A.1, this goal was achieved.

Figure A.1: Comparison of the Minimum Wage and the Median Wage



In 2008 guards and carers were added to the covered groups and in 2010 the Law was amended once again in order to include the cleaning personnel in business/corporate buildings, after this was suggested by the findings of an ad-hoc study carried out by the Statistical Service of Cyprus.

A.1 Conflicting Opinions

The statutory minimum wage was launched with the aim to cover certain categories of non-unionized workers paid at unreasonably low wage rates. However, not all the parties to the collective agreements agree on its necessity.

In the opinion of the Employers' and Industrialists' Federation of Cyprus (O.E.B.), the reasons that made legislation covering certain categories of non-unionized workers necessary in the past, have long since disappeared. The reason for this is the particularly high level of union density in Cyprus that has made the continuation of the current practice unnecessary. This, among other things, distorts the system of collective bargaining, since it pushes minimum wages, freely agreed in collective agreements, upwards. They also express concerns about potential disemployment effects.

The Cyprus Chamber of Commerce and Industry (K.E.B.E.), is not in favour of the abolition of minimum wage. Nevertheless, they maintain that labour market conditions should be examined first and that minimum wage rates should be adjusted accordingly. Otherwise, minimum wage may be raised to such a degree that it endangers collective bargaining. In this context, K.E.B.E.'s opinion is that the minimum wage should cease to be renewed, because the recent minimum wage changes have overcome the level agreed upon in the collective agreements. K.E.B.E., like O.E.B., also maintains that there is no need for new sectors of the economy or new occupations to be covered by the minimum wage.

On the other hand, trade unions urge that the minimum wage should be maintained and improved. In particular, they believe that it is necessary to strengthen control mechanisms for monitoring the implementation of minimum wage. It was also expressed that there is a need for collective labour agreements to acquire a legally binding content, if not in their entirety then at least with regard to the basic terms and conditions of employment.

A.2 Enforcement

The implementation of minimum wage is carried though the provisions of the Law on minimum wages, Chapter 183, Article 5(1): any employer or representative of the employer who fails to comply with the provisions of the law, and in particular the minimum rates set by the Council of Ministers, may be fined with an amount that does not exceed £100 (€171), together with an additional amount for every day of non-compliance that does not exceed £25 (€43).

There are no data available on the degree of compliance or non-compliance, but there are indications that in some sectors of the economy, such as in retail, the law on minimum wages is often violated. For example, according to data from the Ministry of Labour given to social partners in 2005, in the retail sector out of 936 saleswomen that participated in the survey, 20% are paid less than the minimum wage upon hiring. In this context, the Pancyprian Federation of Labour (Π.Ε.Ο.) recognises that there is a problem with the control mechanisms in place for monitoring the implementation of minimum wage.

Appendix B: Data Description

Table B1: Variable Description and Sources

Variable	Description	Source
EMPL	Gainfully Employed Population / Economically Active Population	CYSTAT
KAITZ1	The Kaitz Indices are calculated using the minimum wage, the mean national wage and weights calculated from two surveys of the Statistical Service of Cyprus. Their calculation is described in Appendix C.	CYSTAT, ERC and MOL
KAITZ2		
MWW	Minimum Wage at Six Months / Mean Wage (The simplest version of the Kaitz Index)	CYSTAT and MOL
MW6	Minimum Wage at Six Months / Consumer Price Index (Base Year 1992)	MOL
MW	Minimum Wage at Start / Consumer Price Index (Base Year 1992)	MOL
W	Mean National Wage / Consumer Price Index (Base Year 1992)	CYSTAT
CC1	The Legislative Coverage of the Minimum Wage is calculated in two variants, using data from the Census of Establishment's (COE) and the Family Expenditure Survey's (FES) surveys of the Statistical Service of Cyprus. Their calculation is described in Appendix C.	CYSTAT and ERC
CC2		
U	The Unemployment Rate: unemployed persons as % of Economically Active Population	CYSTAT
Y	Gross Domestic Product (GDP) at 2005 Constant Prices	CYSTAT
POP	Total Population	CYSTAT
GENDER	The share of women in the total population	CYSTAT
LEAV	Total Secondary School Leavers / Total Population	CYSTAT

Note 1: All variables are in natural logarithms, except the unemployment rate.

Note 2: CYSTAT: Statistical Service of Cyprus, ERC: Economics Research Centre of the University of Cyprus, and MOL: Industrial Relations Department of the Ministry of Labour.

Table B2: Significant political and economic events in Cyprus

Date	Description
1963-1964	An inter-ethnic fighting broke out that led to many areas of Cyprus being bombed and napalmed.
1968-1969	The International UN Conventions on Economic, Social and Cultural Rights and on the Political Rights of Women were ratified in Cyprus. Another outbreak of inter-communal violence occurred in the same period.
1973-1974	1973 international oil crisis that started in October 1973 and lasted until March 1974.
1974	A military coup, followed by Turkey invading Cyprus, ended in the partition of Cyprus along the UN-monitored Green Line which still divides Cyprus today.
1979-1980	1979 (or second) oil crisis.
1985-1986	1986 oil price collapse after OPEC countries decreased oil production several times between 1980-1985 in order to keep prices high.
1987	A Protocol referring to the contents of the second stage of the 1972 Cyprus-EEC Association Agreement leading to a Customs Union was signed.
1991	Persian Gulf War.
1992	On June 1992 the Cyprus Pound was pegged to the ECU. On the following September, UK and Italy, two of Cyprus trading partners, withdrew from ERM (European Exchange Rate Mechanism).
1996	The Central Bank of Cyprus achieved substantial progress in its campaign to liberalize and reform the financial sector of Cyprus. Inter-ethnic fighting in Deryneia led to a political crisis.
1999-2000	Cyprus Stock Exchange crisis.
2001	September 11th terrorist attacks on the U.S.A. Cyprus interest rates were liberalized.
2003	Iraq Invaded.
2004	Cyprus becomes a full member of the European Union.

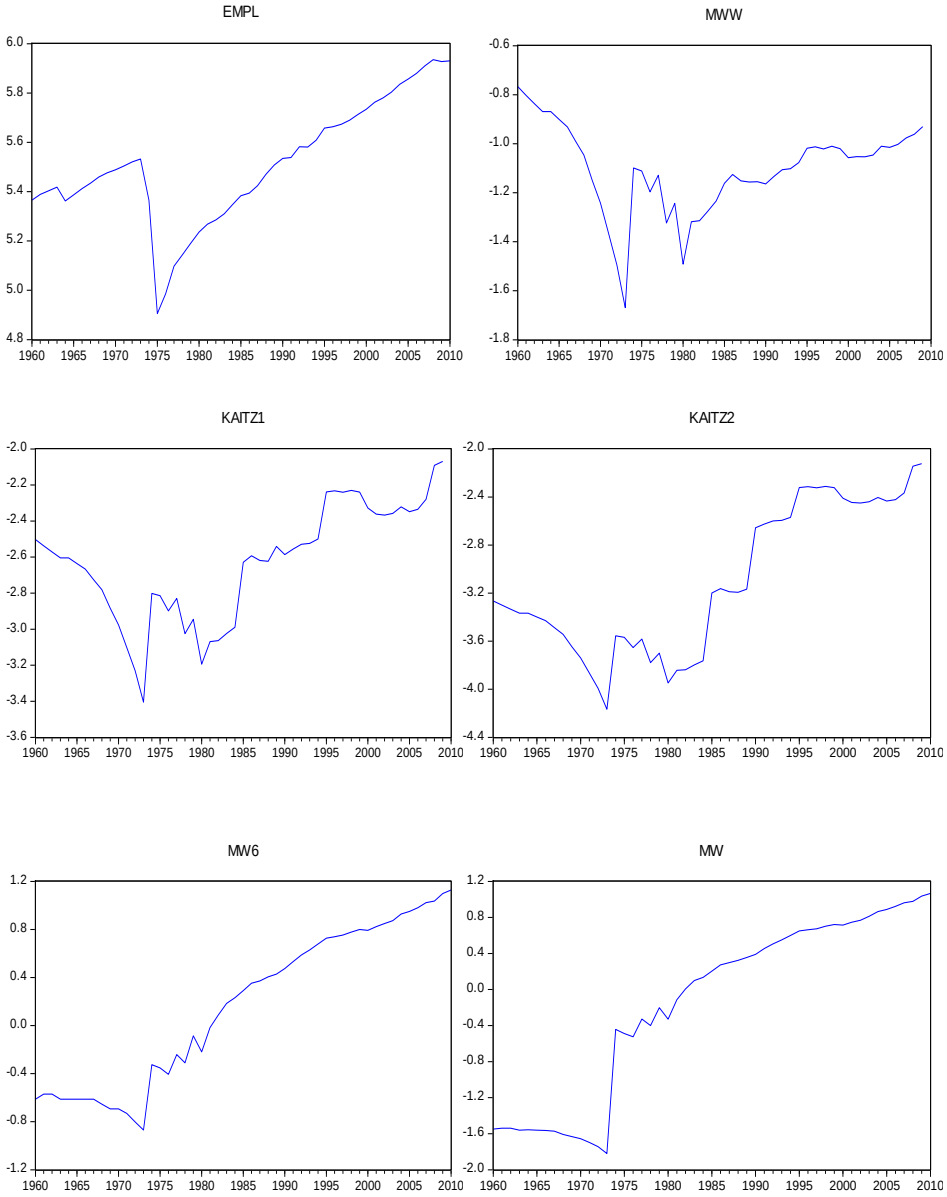
2008	Cyprus completed the third stage of the Economic and Monetary Union of the European Union (EMU) and thus adopted the Euro as its official currency.
2008-2010	Late-2000s Global Financial Crisis.

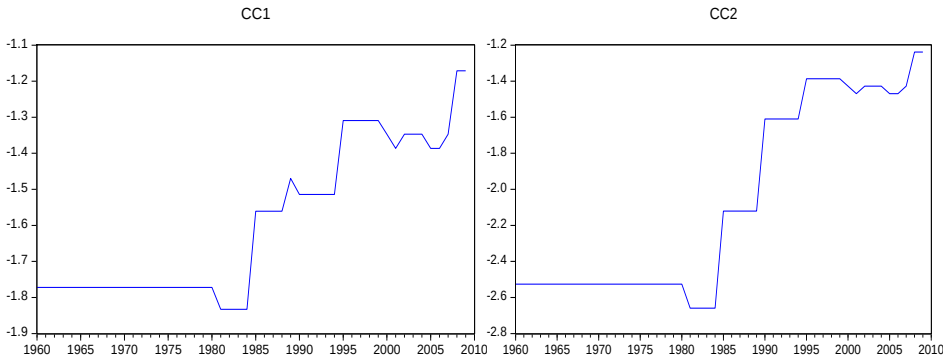
Table B3: Descriptive Statistics

Label	Mean	Median	Standard Deviation	Max	Min
EMPL	-0.1152	-0.0954	0.0599	-0.0619	-0.3840
KAITZ1	-2.6324	-2.5985	0.3186	-2.0689	-3.4045
KAITZ2	-3.1021	-3.2317	0.6130	-2.1226	-4.1666
MW6	0.1631	0.2909	0.6478	1.1279	-0.8690
MW	-0.1577	0.2047	0.9931	1.0673	-1.8191
W	1.2496	1.4643	0.6237	2.0277	0.1752
MWW	-0.8051	-1.0337	0.5371	0.2995	-1.4917
CC1	-1.5922	-1.6663	0.2090	-1.1712	-1.8326
CC2	-2.0656	-2.3230	0.5286	-1.2379	-2.6593
U	0.0338	0.0296	0.0252	0.1345	0.0092
Y	8.0424	8.0495	0.7019	9.0980	6.7569
POP	6.4134	6.3994	0.1335	6.6842	6.2096
GENDER	-0.6827	-0.6828	0.0052	-0.6739	-0.6917
LEAV	8.7271	8.8340	0.4027	9.2562	7.4725

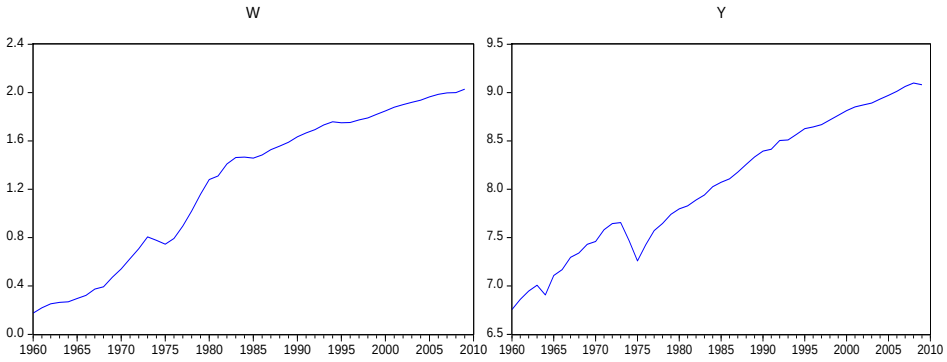
Note: All variables are in natural logarithms, except the unemployment rate.

Figure B1: Graphs of the Variables

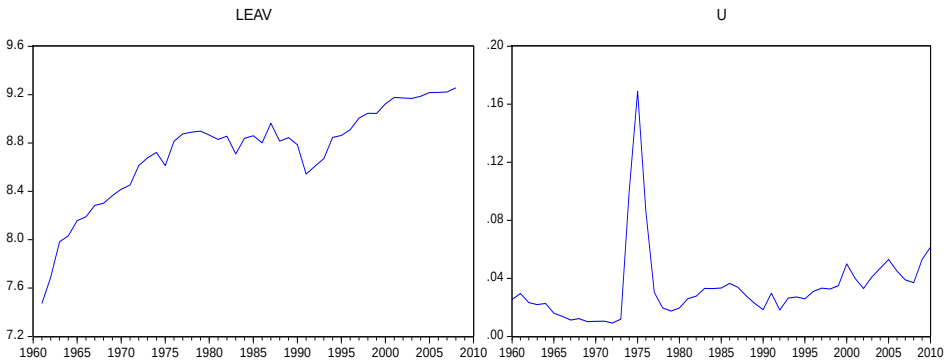



CC1
-1.1
-1.2
-1.3
-1.4
-1.5
-1.6
-1.7
-1.8
-1.9
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

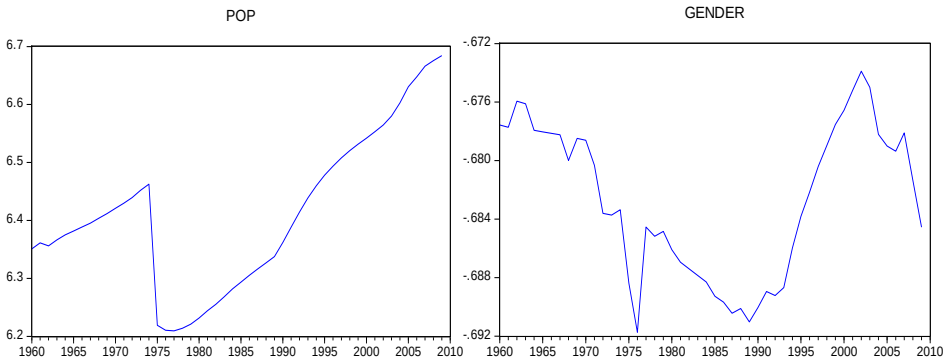
CC2
-1.2
-1.4
-1.6
-1.8
-2.0
-2.2
-2.4
-2.6
-2.8
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010


W
2.4
2.0
1.6
1.2
0.8
0.4
0.0
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

Y
9.5
9.0
8.5
8.0
7.5
7.0
6.5
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010


LEAV
9.6
9.2
8.8
8.4
8.0
7.6
7.2
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

U
.20
.16
.12
.08
.04
.00
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010


POP
6.7
6.6
6.5
6.4
6.3
6.2
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

GENDER
-.672
-.676
-.680
-.684
-.688
-.692
1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

Appendix C: Calculation of the Kaitz Index of Cyprus

As defined in section 3, the Kaitz Index is calculated as the weighted sum of the minimum wage from each industry, accounting for the fact that a different minimum wage rate is set for workers that completed six months' experience. In other words, it is merely the ratio of the legal minimum wage to the average earnings weighted by its coverage in each industry:

$$MW_t = \sum_i \frac{E_{it}}{E_t} \left[\frac{MW_{it}^N}{AHE_t} C_{it}^N + \frac{MW_{it}^S}{AHE_t} C_{it}^S \right] \qquad \text{(C.1)}$$

In Cyprus such an index is not available and is calculated in this study as follows:

$$Kaitz_t = \sum_{i=1}^{N} \frac{E_{it}}{E_t} \Phi_{it} \left[\frac{MW_t^N}{W_t} C_{it}^N + \frac{MW_t^S}{W_t} C_{it}^S \right] \qquad \text{(C.2)}$$

$\frac{E_i}{E}$: is the number of persons employed in each main occupational group, as a proportion of the total employment (=the 'employment weights'), Φ_i: is the proportion of the workers in each occupational group that are covered by the Minimum Wage Law (=the 'coverage weights'), C_i^N, C_i^S: are the proportions of workers employed in each industry with less or more than six months' experience (=the 'experience proportions'), MW^B, MW^S: are the corresponding minimum wage rates and W: the national mean wage. The superscripts "N" and "S" stand for "newly covered" and "six-month period".

Minimum wage data are available from the Industrial Relations Department of the Ministry of Labour and the mean wage rates are collected from the Labour Statistics publications of the Statistical Service of Cyprus. The employment weights, the coverage weights and the proportions of the workers that completed six months' experience are calculated using the available microdata.

In order for this calculation to be possible, the occupations that are covered by the Minimum Wage Law had to be identified in the occupational code used by the Statistical Service of Cyprus (CYSTAT).

C.1 Identification of the Covered Occupations

As mentioned in Appendix A, the occupations that are covered by the Minimum Wage legislation in Cyprus (as of 1 April 2010) are: 1. salespersons, 2. clerks, 3. auxiliary healthcare staff, 4. auxiliary staff in nurseries, 5. auxiliary staff in crèches, 6. auxiliary staff in schools, 7. guards and 8. caretakers working in clinics, private hospitals and nursing homes. (The ninth category, cleaners of corporate premises, is excluded, because it was added in 2010 and falls outside the sample period of this study).

Table C.1: Identification of the Covered Occupations in ISCO-1988

Occupations Covered by the Minimum Wage Law	ISCO-1988 Occupational Codes
1. Salespersons	5220, 5230.
2. Clerks	3432, 4111, 4112, 4113, 4114, 4115*, 4141, 4142, 4143, 4144, 4190, 4211, 4221, 4222, 4223, 4290.
3. Auxiliary Healthcare Staff	3221, 3225, 3231*, 3232*.
4. Auxiliary Staff in Nursery Schools	2332*, 3310, 3320, 5131.
5. Auxiliary Staff in Crèches	
6. Auxiliary Staff in Schools	
7. Guards	5169, 9152.
8. Caretakers Working in Clinics, Private Hospitals and Nursing Homes	5132, 9131.

The Statistical Service of Cyprus (CYSTAT) uses the International Standard Classification of Occupations (ISCO) in recording individual data for the occupations practiced within the country. The International Standard Classification of Occupations (ISCO) is one of the main international statistical standards and classifications for which the International Labour Office (ILO),

represented by its Bureau of Statistics (STAT), is responsible. The version currently used by CYSTAT is ISCO-1988 and a synopsis of the identification of covered occupations in ISCO-1988 is presented in Table C.1.

With the help of CYSTAT, 30 occupations were identified matching the eight occupations covered by the Minimum Wage Law. Each unique 4-digit numerical code in the second column in Table C.1 corresponds to an occupational category that is covered by the Law. For example, the code "5220" corresponds to the category "Shop salespersons and demonstrators". The asterisk (*) indicates an occupational category that may include occupations not covered by the minimum wage legislation (e.g. "3231" – "Nursing associate professionals").

Table C.2: Occupational Groups Covered

Occupational Groups	ISCO-1988 Occupational Codes
Professionals	**2** (2332)
Technicians and associate professionals	**3** (3221, 3225, 3231*, 3232*, 3310, 3320, 3432)
Clerks	**4** (4111, 4112, 4113, 4114, 4115*, 4141, 4142, 4143, 4144, 4190, 4211, 4221, 4222, 4223, 4290)
Service Workers and Shop and Market Sales Workers	**5** (5131, 5132, 5169, 5220, 5230)
Elementary Occupations	**9** (9131, 9152)

In Table C.2 the covered occupations are organized according to the main occupational groups, as recorded by CYSTAT. The Kaitz Index (equation C.2) is calculated according to this classification.

C.2 Calculation of the Employment and Coverage Weights

Since the employment variable used in this study is the Gainfully Employed Population, the employment weights ($\frac{E_i}{E}$) for each of the occupational groups described in the first column in Table C.2, refer to total employment. For the years 1976, 1981, 1989, 1995 and 2000 those are calculated from the Census of Establishments (CEO) surveys, while for the years 2000-2009 the employment

weights are calculated from the Statistical Abstracts, an annual publication of CYSTAT.

The coverage weights (Φ_i) refer only to salary earners[15], that is, to the share of the total employed population that is directly affected by the Minimum Wage Law. They are calculated as the ratio of covered employees (salary earners) to the total number of employees, in each of the occupational groups recorded in the first column in Table C.2. The sources of the data used are the Census of Establishments (CEO) publications, the only CYSTAT publication that classifies employment data analytically (i.e. in the 4-digit numerical ISCO-1988 classification system described previously). The CEO surveys take place every 4-6 years and the data used in this study is collected from the surveys of 1976, 1981, 1989, 1995 and 2000[16].

C.3 Calculation of the Experience Proportions

Since the CEO surveys do not record the level of experience of the workers, the proportions of persons employed according to experience (C_i^N, C_i^S) are estimated from a different database, the Family Expenditure Surveys (FES). These surveys are conducted by CYSTAT every 7 years to a representative sample of the households in Cyprus and amongst the variables collected is the level of the workers' experience. The figures of the latest four FES surveys are unified into a common database by the Economics Research Centre of the University of Cyprus (ERC)[17]. The ERC database contains data from the surveys of 1984/85, 1990/91, 1996/97 and 2002/03.

In order to correspond to the coverage weights calculated from the CEO data (which they refer to salary earners), the experience proportions for each occupational group described in the first column in Table C.2 are calculated only

[15] In the 1976 and 1981 publications, the salary earners are not recorded separately and the coverage weights are calculated from the total employment data (i.e. including self-employed) for each selected occupation.

[16] After 2000 this publication ceased to record the employment data by occupation and as a result the *Census of Establishments 2005* records the employment data only by the economic activity coding system (NACE).

[17] See Γεωργίου, Κωμοδρόμου και Πολυκάρπου (2005).

for the “full-time employees that receive labour income on a monthly instead of a weekly basis”.

C.4 International Standard Classification of Occupations in 1968 and 1988

In Tables C.1 and C.2 the covered occupations are categorized under the International Standard Classification of Occupations version of 1988 (ISCO-1988). However, for the years 1972, 1976 and 1981 CYSTAT uses a different version of this categorization system, the ISCO-1968.

In that manner, the occupations identified in Tables C.1 and C.2 had to be identified under the ISCO-1968 classification system also. This identification is made with the assistance of CYSTAT personnel and the results could be easily cross-checked using data from the *Census of Establishments 1989*, where the employment figures are recorded in both coding systems (ISCO-1968 and ISCO-1988). As described in Appendix A, in the period 1960-1989 only two occupations were covered by the Minimum Wage Law (Clerks and Salespersons) and their identification under IESO-1968 is summarized in Table C.3.

Table C3: Occupational Groups Covered under the ISCO-1968

Occupational Groups	ISCO-1968 Occupational Codes
Clerical and Related Workers	**3** (321, 322, 331, 339, 341, 342, 370, 380, 393, 394, 395, 399)
Sales Workers	**4** (451)

However, the ISCO-1968 coding classification was less analytical than the ISCO-1988 and for that reason for some of the 30 occupational categories in Table C.2 there is no satisfying match with the 13 occupational categories in Table C.3 (even when merging of some categories was attempted). The occupational categories with a non-satisfying match are indicated with an underline.

C.5 Two Alternative Kaitz Indices

Since not a perfect match between the two classification systems was possible, two versions of the Kaitz Index are calculated. The first version (KAITZ1) uses

the coverage weights calculated using all occupations given in Table C.3, for the period 1960-1989, and all occupations in Table C.2, for the period 1990-2009. On the other hand, the second version (KAITZ2) uses for both periods only the occupational categories that were perfectly or satisfyingly matched in both classification systems, i.e. the categories in Tables C.2 and C.3 that are not underlined.

Comparing the two alternative calculations, KAITZ1 has the benefit that it calculates the total coverage of the minimum wage law using all the available information, and the disadvantage that it overestimates the legislative coverage for the period 1960-1989 and, thus, causes a structural break in the index in 1990. KAITZ2, on the other hand, is consistently calculated across the whole period, since it includes more or less the same occupational categories before and after 1990. However, in order to be consistent, it sacrifices some accuracy in the period 1990-2009, since it excludes 8 occupational categories that are covered by the minimum wage law in that period.

The differences between the two alternative calculations are summarized in Table C.4. As described in Appendix A, in 1990 and 2008 the Minimum Wage Law was amended in order to include more occupations and in that manner the Kaitz Index would be expected to incorporate those changes. In Table C.4 it is indicated that KAITZ2 reflects changes in the legislative coverage of the minimum wage law, since it increased from 0.04 to 0.07 in 1990 and from 0.009 to 0.12 in 2008. KAITZ1 only reflects the change in the legislative coverage in 2008.

Table C.4: Summary of the Alternative Calculations of the Kaitz index

Label	1960	1989	1990	2007	2008
KAITZ1	0.08	0.08	0.08	0.10	0.12
KAITZ2	0.04	0.04	0.07	0.09	0.12

As described in section 5.3, in the existing literature the Kaitz Index is usually broken down into the minimum wage and the coverage component. For that

reason the legislative coverage of the minimum wage is also calculated separately as[18]:

$$CC_t = \sum_{i=1}^{N} \frac{E_{it}}{E_t} \Phi_{it} C_{it}^{S} \qquad \text{(C.3)}$$

As with the Kaitz Index, the legislative coverage is calculated in two variants: one using all the occupational categories listed in Table C.2 (CC1), and one using only the occupational categories used in calculating KAITZ2 (CC2). The differences between the two alternative calculations are summarized in Table C.5 below.

Table C.5: Summary of the Alternative Calculations of the Coverage Variable

Label	1960	1989	1990	2007	2008
CC1	17%	23%	22%	26%	31%
CC2	8%	12%	20%	24%	29%

As indicated above, the second variant of the calculation of the legislative coverage of the minimum wage law in Cyprus (CC2) increases from 12% to 20% in 1990 and from 24% to 29% in 2008. In that manner it incorporates the most significant minimum wage law amendments. On the other hand, the first variant of the legislative coverage calculation (CC1) only accounts for the 2008 minimum wage law amendment.

[18] Following the related literature, only the proportion of salary earners with more than six months' experience is used, since in the FES data, the more experienced employees account for 92-96% of the covered categories, in all periods.

Appendix D: Unit Root Tests Results

Table D1: Augmented Dickey-Fuller Unit Root Tests

Label	Type	Lagged Diffs	Test Statistic	Critical Values		
				1%	5%	10%
EMPL	3	1	-3.586**	-4.157	-3.504	-3.182
KAITZ1	3	0	-2.378	-4.157	-3.504	-3.182
KAITZ2	3	0	-2.158	-4.157	-3.504	-3.182
MW6	3	0	-2.577	-4.157	-3.504	-3.182
MW	3	0	-2.139	-4.157	-3.504	-3.182
W	2	1	-1.353	-3.574	-2.924	-2.600
MWW	2	0	-2.602	-3.571	-2.922	-2.599
CC1	3	0	-2.274	-4.157	-3.504	-3.182
CC2	3	5	-2.625	-4.181	-3.516	-3.188
U	2	1	-4.941***	-3.571	-2.922	-2.599
Y	3	1	-3.112	-4.161	-3.506	-3.183
POP	3	0	-1.061	-4.157	-3.504	-3.182
GENDER	1	0	0.501	-2.613	-1.948	-1.613
LEAV	3	0	-3.925**	-4.166	-3.509	-3.184

Note 1: The null hypothesis is unit root in the series. The null is rejected if the test statistic is smaller than the critical value.

Note 2: *** denotes significance at 1%, ** at 5%, and * at 10%.

Table D2: Zivot-Andrews (1992) Unit Root Tests

Label	Model	Break	Lagged Diffs	Test Statistic	Critical Values		
					1%	5%	10%
EMPL	A	1969	2	-4.07*	-5.34	-4.80	-4.58
EMPL	C	1974	2	-4.71	-5.57	-5.08	-4.82
KAITZ1	C	1985	0	-3.94	-5.57	-5.08	-4.82
KAITZ2	C	1985	0	-4.06	-5.57	-5.08	-4.82
MW6	C	1974	1	-4.88*	-5.57	-5.08	-4.82
MW	C	1974	0	-13.65***	-5.57	-5.08	-4.82
W	C	1979	2	-4.93*	-5.57	-5.08	-4.82
MWW	C	1971	3	-5.67***	-5.57	-5.08	-4.82
CC1	C	1985	0	-5.63***	-5.57	-5.08	-4.82
CC2	C	1985	5	-3.89	-5.57	-5.08	-4.82
U	C	1978	3	-4.72	-5.57	-5.08	-4.82
Y	C	1974	1	-4.30	-5.57	-5.08	-4.82
POP	C	1975	0	-22.86***	-5.57	-5.08	-4.82
GENDER	C	1971	0	-2.42	-5.57	-5.08	-4.82
LEAV	C	1988	0	-4.31	-5.57	-5.08	-4.82

Note 1: The null hypothesis is unit root in the series. The null is rejected if the test statistic is smaller than the critical value.

Note 2: *** denotes significance at 1%, ** at 5%, and * at 10%.

Table D3: Perron (1989) Unit Root Tests

Label	Model	Break	Lagged Diffs	Test Statistic	Critical Values		
					1%	5%	10%
EMPL	A	1970	1	-4.79***	-4.39	-3.77	-3.47
EMPL	A	1973	1	-5.12***	-4.39	-3.76	-3.46
EMPL	C	1979	1	-4.94***	-4.81	-4.22	-3.95
KAITZ1	C	1969	0	-3.65*	-4.65	-3.99	-3.45
KAITZ2	A	1969	0	-2.28	-4.39	-3.77	-3.47
KAITZ2	C	1973	0	-2.12	-4.78	-4.17	-3.87
KAITZ2	A	1979	0	-2.37	-4.34	-3.72	-3.44
KAITZ2	B	1984	0	-3.09	-4.56	-3.96	-3.68
KAITZ2	A	1989	0	-2.15	-4.45	-3.76	-3.47
MW6	A	1971	1	-2.03	-4.39	-3.77	-3.47
MW6	C	1973	1	-1.61	-4.78	-4.17	-3.87
MW6	A	1979	1	-3.65*	-4.34	-3.72	-3.44
MW6	C	1984	1	-1.81	-4.90	-4.24	-3.96
MW	A	1971	0	-4.58***	-4.39	-3.77	-3.47
MW	C	1973	0	-1.95	-4.78	-4.17	-3.87
MW	C	1979	0	-3.05	-4.81	-4.22	-3.95
MW	C	1984	0	-3.22	-4.90	-4.24	-3.96
W	C	1984	1	-4.09*	-4.88	-4.24	-3.95
W	C	1989	1	-3.96*	-4.88	-4.24	-3.95
MWW	C	1969	0	-5.08***	-4.65	-3.99	-3.45
MWW	C	1971	0	-4.80***	-4.65	-3.99	-3.45
CC1	A	1971	0	-2.73	-4.39	-3.77	-3.47
CC1	A	1973	0	-2.61	-4.39	-3.76	-3.46
CC1	C	1984	0	-3.08	-4.90	-4.24	-3.96
CC1	A	1994	0	-2.23	-4.42	-3.80	-3.51
CC2	A	1984	5	-2.37	-4.32	-3.76	-3.46
U	A	1973	3	-4.00**	-4.39	-3.76	-3.46
U	C	1974	3	-4.04*	-4.78	-4.17	-3.87
U	B	1979	3	-3.72*	-4.41	-3.80	-3.49
Y	A	1973	1	-2.51	-4.39	-3.76	-3.46
POP	C	1974	0	-5.20***	-4.78	-4.17	-3.87
GENDER	C	1973	0	-2.12	-4.78	-4.17	-3.87
LEAV	A	1989	0	-3.57***	-4.39	-3.77	-3.47

Note 1: The null hypothesis is unit root in the series. The null is rejected if the test statistic is smaller than the critical value.

Note 2: *** denotes significance at 1%, ** at 5%, and * at 10%.

Appendix E: VAR Estimation Results

Table E1: VAR (KAITZ1)

Variable	EMPL	KAITZ2
EMPL(-1)	0.242* (0.085)	0.793 (0.622)
EMPL(-2)	-0.342* (0.084)	-0.860 (0.615)
EMPL(-3)	-0.043 (0.075)	1.328* (0.543)
EMPL(-4)	-0.179* (0.062)	-0.696 (0.450)
KAITZ1(-1)	-0.002 (0.018)	0.810* (0.132)
KAITZ1(-2)	0.044* (0.018)	-0.084 (0.134)
KAITZ1(-3)	-0.023 (0.018)	-0.001 (0.120)
KAITZ1(-4)	0.002 (0.015)	-0.118 (0.110)
C	-5.516* (0.682)	-11.214* (4.968)
T	-0.034* (0.005)	-0.075* (0.033)
T1969	0.003* (0.001)	-0.003 (0.009)
O1973	-0.115* (0.027)	0.047 (0.198)
T1973	0.007* (0.002)	0.055* (0.017)
O1979	-0.021 (0.013)	-0.288* (0.097)
T1979	0.003* (0.001)	-0.005 (0.005)
O1984	0.001 (0.009)	0.280 (0.067)
Y	0.362* (0.035)	0.362 (0.256)
POP	0.474* (0.074)	1.264* (0.538)

Note 1: The asterisk (*) denotes significance at 5%.

Note 2: Standard errors are reported in parentheses.

Table E2: VAR (DK1)

Variable	EMPL	DK2
EMPL(-1)	0.188 (0.195)	1.036 (0.778)
EMPL(-2)	0.012 (0.180)	-0.550 (0.715)
EMPL(-3)	-0.487* (0.153)	1.223* (0.610)
DK1(-1)	-0.060* (0.028)	-0.182 (0.111)
DK1(-2)	0.075* (0.030)	-0.119 (0.120)
DK1(-3)	0.038 (0.032)	-0.053 (0.126)
C	-0.866 (0.725)	4.358 (2.886)
T	0.007 (0.005)	-0.010 (0.021)
T1969	0.001 (0.002)	-0.004 (0.009)
O1973	-0.021 (0.033)	0.503* (0.132)
T1973	-0.008 (0.002)	0.015 (0.010)
O1979	0.010 (0.021)	-0.261* (0.084)
T1979	0.005 (0.001)	-0.003 (0.005)
O1984	0.007 (0.019)	0.330* (0.075)
DY	-1.015 (1.154)	0.571 (4.593)
POP	0.217 (0.110)	-0.670 (0.439)
DGENDER	4.413 (2.296)	2.697 (9.136)
LEAV	-0.086* (0.033)	0.037 (0.133)

Note 1: The asterisk (*) denotes significance at 5%.

Note 2: Standard errors are reported in parentheses.

Table E3: VAR (KAITZ2)

Variable	EMPL	KAITZ2
EMPL(-1)	0.266* (0.102)	1.696 (1.001)
EMPL(-2)	-0.375* (0.088)	-1.107 (0.864)
EMPL(-3)	-0.011 (0.083)	2.056* (0.818)
EMPL(-4)	-0.193* (0.071)	0.015 (0.699)
KAITZ2(-1)	-0.002 (0.015)	0.763* (0.145)
KAITZ2(-2)	0.036* (0.015)	-0.155* (0.152)
KAITZ2(-3)	-0.017 (0.016)	-0.139 (0.161)
KAITZ2(-4)	0.006 (0.012)	0.058 (0.120)
C	-4.289 (0.837)	21.830 (8.248)
T	-0.023* (0.006)	-0.161* (0.051)
O1973	-0.076 (0.039)	-0.463 (0.380)
T1973	0.003 (0.003)	0.109* (0.033)
O1979	-0.025 (0.016)	-0.147 (0.157)
T1979	0.003* (0.001)	-0.021* (0.010)
O1984	0.002 (0.011)	0.396* (0.108)
Y	0.312* (0.048)	1.280* (0.466)
POP	0.331* (0.082)	1.920* (0.811)

Note 1: The asterisk (*) denotes significance at 5%.

Note 2: Standard errors are reported in parentheses.

Table E4: VAR (DK2)

Variable	EMPL	DK2
EMPL(-1)	0.404* (0.173)	0.006 (1.091)
EMPL(-2)	-0.155 (0.169)	-0.622 (1.063)
EMPL(-3)	-0.254* (0.120)	0.229 (0.756)
DK2(-1)	-0.069* (0.020)	-0.111 (0.128)
DK2(-2)	0.043* (0.020)	-0.128 (0.128)
DK2(-3)	-0.004 (0.021)	-0.128 (0.131)
C	0.6125* (0.269)	2.010 (1.695)
T	0.011 (0.003)	-0.013 (0.016)
O1973	-0.016 (0.029)	0.607 (0.183)
T1973	-0.010* (0.002)	0.015 (0.012)
O1979	0.010 (0.021)	-0.276* (0.130)
T1979	0.003* (0.001)	0.003 (0.007)
O1984	0.001 (0.019)	0.526 (0.117)
DGENDER	5.192* (1.942)	2.037 (12.242)
LEAV	-0.099* (0.036)	-0.243 (0.224)

Note 1: The asterisk (*) denotes significance at 5%.

Note 2: Standard errors are reported in parentheses.

Table E5: Tests for Granger Causality

Causality Hypothesis	Test Value	P-Value
KAITZ1 to EMPL	7.58	0.108
EMPL to KAITZ1	8.31	0.081
DK1 to EMPL	24.07	0.000
EMPL to DK1	0.74	0.863
KAITZ2 to EMPL	9.23	0.056
EMPL to KAITZ2	7.67	0.104
DK2 to EMPL	18.37	0.000
EMPL to DK2	4.74	0.192

Note: The null hypothesis is 'No Granger Causality'.

Appendix F: Additional Estimation Results

Table F1: Variance Decomposition Analysis

Variable	Period	S.E.	EMPL	KAITZ2
EMPL	1	0.00855	100.00000	0.00000
	2	0.00867	97.59034	2.40966
	3	0.00940	88.05653	11.94347
	4	0.00964	83.78135	16.21865
	5	0.00986	81.09832	18.90168
	6	0.00996	79.99684	20.00316
	7	0.01008	79.75378	20.24622
	8	0.01018	78.32685	21.67315
	9	0.01031	76.36648	23.63352
	10	0.01045	74.32858	25.67142
KAITZ2	1	0.10883	3.04502	96.95498
	2	0.15401	4.13466	95.86534
	3	0.17948	3.55264	96.44736
	4	0.19497	3.86494	96.13506
	5	0.20570	4.11925	95.88075
	6	0.21774	3.90619	96.09381
	7	0.23120	3.78243	96.21757
	8	0.24461	3.66351	96.33649
	9	0.25711	3.61313	96.38687
	10	0.26834	3.66886	96.33114

Table F2: VAR Model with Decomposed Kaitz Index

Variable	EMPL	MWW
EMPL(-1)	0.162 (0.172)	0.272 (0.459)
EMPL(-2)	0.074 (0.171)	-0.356 (0.458)
EMPL(-3)	-0.314* (0.133)	1.123* (0.356)
EMPL(-4)	-0.110 (0.112)	-0.342 (0.299)
MWW(-1)	-0.048 (0.057)	0.517* (0.152)
MWW(-2)	0.172* (0.038)	0.089 (0.103)
MWW(-3)	0.015 (0.044)	0.254* (0.119)
MWW(-4)	-0.037 (0.040)	-0.084 (0.106)
C	0.407 (0.207)	0.130 (0.554)
T	0.009* (0.003)	-0.016* -0.007
T1969	0.002 (0.002)	-0.010 (0.005)
O1973	0.036 (0.040)	0.302* (0.106)
T1973	-0.011 (0.002)	0.027 (0.006)
O1979	-0.010 -0.022	-0.303* (0.060)
T1979	0.005* (0.001)	-0.002 (0.003)
DC2	0.028 (0.019)	0.033 (0.051)
DGENDER	4.406* (1.807)	-5.289 (4.831)
LEAV	-0.062* (0.027)	-0.027 (0.073)

Note 1: The asterisk (*) denotes significance at 5%.

Note 2: Standard errors are reported in parentheses.

Table F3: Misspecification Tests

	VECM (KAITZ2)	VAR (MWW)
Breusch–Godfrey LM Test	0.661	0.507
Jarque-Bera Normality Test	0.000	0.681
White Heteroscedasticity Test	0.521	0.586

Note 1: The p-values of the tests are reported.

Note 2: The null hypothesis in the Breusch–Godfrey LM Test is 'No Autocorrelation', in the Jarque-Bera Test the null hypothesis is 'Normality' and in the White Test the null hypothesis is 'No Heteroscedasticity'.

Table F4: Granger Causality Tests

Causality Hypothesis	Test Value	P-Value
MWW to EMPL	46.17	0.000
EMPL to MWW	20.78	0.000

Note: The null hypothesis is 'No Granger Causality'.

Table F5: Cointegration Tests

Endogenous Variables	Null Hypothesis	Maximal Eigenvalue	Critical Value	Trace Statistic	Critical Value	Johansen et al. (2000)
EMPL, MWW	r = 0	25.30	19.39	25.30	25.87	36.06
	r = 1	0.00	12.52	0.00	12.52	18.29

Note 1: Critical Values at 5% significance level.

Note 2: The alternative hypothesis for the Maximal Eigenvalue Test is that the rank of Π matrix in equation (5) is equal to: r + 1.

Note 3: The alternative hypothesis for the Trace Test is: rank(Π) > r.

Figure F1: Impulse Response Function Analysis of the VEC Model