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### **A Secular View of the Gender Wage Gap in the Minimum Wage Occupations of Cyprus**

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## **Διαχρονική ανασκόπηση του έμφυλου χάσματος μισθών στα επαγγέλματα κατώτατου μισθού της Κύπρου**

**Λούης Ν. Χριστοφίδης και Παντελής Μισής**

### **ΠΕΡΙΛΗΨΗ**

Οι υφιστάμενες οικονομετρικές μελέτες για το έμφυλο χάσμα μισθών (EXM) στην Κύπρο, δεν περιλαμβάνουν κάποιες που (α) να προσδιορίζουν το μερίδιο του ολικού EXM που μπορεί να εξηγηθεί από τα παραγωγικά χαρακτηριστικά των εργαζομένων, (β) να λαμβάνουν υπόψη πιθανές επιδράσεις του κατωτάτου μισθού (KM) στον προσδιορισμό του EXM, (γ) να επικεντρώνονται στα επαγγέλματα τα οποία καλύπτονται από την περι κατωτάτου μισθού νομοθεσία, και (δ) να χρησιμοποιούν τα πλέον πρόσφατα διαθέσιμα δεδομένα. Το παρόν δοκίμιο στοχεύει να καλύψει αυτό το κενό χρησιμοποιώντας 4-ψήφια δεδομένα προερχόμενα από τις Διαρθρωτικές Έρευνες Απολαβών (ΔΕΑ) της Στατιστικής Υπηρεσίας για τα έτη 2006, 2010, 2014 και 2018. Το ολικό EXM, όπως εκτιμάται από τις έρευνες αυτές, είναι 0.316, 0.225, 0.113 και 0.117 λογαριθμικές μονάδες, αντίστοιχα. Στις πρώτες δύο έρευνες (2006 και 2010) τα παραγωγικά χαρακτηριστικά των εργαζομένων φαίνονται να εξηγούν ένα σημαντικό μερίδιο του EXM, με το υπόλοιπο (ανεξήγητο) EXM να ανέρχεται σε 0.217 και 0.135 λογαριθμικές μονάδες, αντίστοιχα. Ωστόσο στις τελευταίες δύο έρευνες (2014 και 2018) η Κυπριακή Οικονομική Κρίση (2012-2016) και οι επιπτώσεις αυτής στην αγορά εργασίας έχουν ως αποτέλεσμα τα διαθέσιμα δεδομένα να χάνουν την επεξηγητική τους δύναμη στο ολικό EXM και το μερίδιο του EXM που μπορεί να εξηγηθεί από τα υπάρχουσα δεδομένα (εξηγημένο EXM) να μη διαφέρει σημαντικά από το μηδέν. Το ανεξήγητο EXM ανέρχεται σε 0.118 για το 2014 και 0.110 για το 2018. Τα υψηλά επίπεδα του ανεξήγητου EXM προκαλούν το ερώτημα κατά πόσον οι μειώσεις στο EXM μέσω ευεργετικών παραγόντων έχουν πλέον παύσει, ένα θέμα που εγείρεται και σε άλλες διεθνείς μελέτες.

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# A Secular View of the Gender Wage Gap in the Minimum Wage Occupations of Cyprus

Louis N. Christofides\* and Pandelis Mitsis

## ***Abstract***

Existing econometric studies on the Gender Wage Gap (GWG) in Cyprus, which (i) net out of the raw GWG the portion that can be explained by productive characteristics, (ii) take into account possible effects from the Minimum Wage (MW) in calculating the GWG, (iii) do so, using fine occupations which correspond to the legal implementation of the MW, and (iv) are as up-to-date as existing data allow, are not available. This paper aims to fill this gap using 4-digit data from the 2006, 2010, 2014, and 2018 Structure of Earnings Survey (SES) data. The unconditional GWG in the four surveys was 0.316, 0.225, 0.113 and 0.117 In wage points respectively. In the first two surveys, netting out the Explained contribution of productive characteristics removes a substantial amount from the GWG, leaving an Unexplained GWG of 0.217 and 0.135 In wage points. By the time of the last two surveys, which overlap with the Cyprus Crisis (2012-2016) and its effects on the labour market, no further role is left for the *available* explanatory variables, leaving the Unexplained component for 2014 and 2018 at 0.118 and 0.110 In wage points respectively; the total Explained portion is not significantly different from zero in either 2014 or 2018. The high Unexplained levels of the GWG prompt the question of whether reductions in the GWG through explanatory variables have stalled, a concern raised in several international studies.

**Keywords:** Gender Wage Gap, Decompositions, Explained, Unexplained.

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## 1. Introduction

The economic involvement of and labour market outcomes for women have been torturous and chronologically late. Even for the US (Goldin 1984, 1990, and 2014), broadly defined female labour supply has been U-shaped with a low point after World War I. Olivetti and Petrongolo (2016, Figure 1) note that in many other countries large gains in female employment did not occur until after World War II. In addition, the trend of Female/Male earnings between 1970 and 2010 remained flat in several countries (see their Figure 4). Indeed, there is concern that the US decline in the gender wage gap (GWG) has stalled at an unacceptably high level (Blair and Posmanick 2023), and that women in many countries are facing several challenges (Buzmaniuk 2023).

In general, however, the GWG (see footnote 5 below) has narrowed secularly in many, if not most, countries. Several forces have been at play: (i) the evolution in social norms has induced policy and institutional developments that favour increased and non-discriminatory female labour market involvement in all occupations and at all levels<sup>1</sup>, (ii) medical developments in family planning have allowed the pursuit of higher education and the later entry of women into challenging and more rewarding positions, (iii) improvements in technology have reduced the burden of home production, which still weighs more heavily on women, encouraging female labour supply, (iv) the adoption of various forms of work-family reconciliation policies has facilitated the labour force participation of women and the pursuit of more challenging careers<sup>2</sup>, and (v) 'post-industrial' structural shifts towards the service sector are producing jobs in which women have a comparative advantage (see, inter alia, Olivetti and Petrongolo 2014, and Ngai and Petrongolo 2017). These and other related issues such as unionisation, work preferences, and risk aversion (Kettlewell et al 2023), are discussed in the Olivetti and Petrongolo (2016) survey.

One aspect of point (i) on policy developments is the evolving concern with increased inequality and in-work poverty. While these policy initiatives are not specifically gender-

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<sup>1</sup> Two particularly pertinent examples, the European Commission's (2021) *Pillar of Social Rights Action Plan* (p. 44) and the European Union (2022) *Directive on Adequate Minimum Wages*, aim to reduce in-work poverty and inequality and to improve the adequacy of a statutory minimum wage and collective bargaining – see Appendix C.

<sup>2</sup> However, Blair and Posmanick (2023, pp. 28, 29) ask: "... 'why did gender wage convergence in the United States stall?' We offer a novel solution to the puzzle — the introduction of family leave policies". These authors remain agnostic (p. 29) about the mechanism that produces the adverse impact of family leave policies. Christofides et al (2013) note that, while countries with a generous value of the Index All Family Reconciliation Policies are associated with lower GWGs, the *individual effect* of maternity policies that may distance women from their workplaces is adverse; a discussion and references to other similar findings are also offered. In a different vein, Goldin (2014) flags the emergence of very time-inflexible jobs in the service sector which discourage the advancement of women that have other commitments. Battisti et al (2023) stress that the prevailing gender pattern of cognitive skills may slow down the decline of the GWG.

based, they inevitably relate to the economic engagement of women and the GWG, because women are often found in low-paying jobs. Minimum wage (MW) policies have come into policy favour, sometimes at the national level<sup>3</sup> and their impact on the GWG may be ambiguous: In the female wage distribution, a new MW level may become a modal point, attracting earnings which might otherwise have been higher. Also, a new MW level may exert upward pressure on male wages in occupations which are viewed as 'hierarchically superior' – see Forsythe (2023) for evidence of MW spill overs within establishments. Thus, a new MW level may have an ambiguous effect on the GWG and this impact needs to be examined empirically. Several recent studies have added to early papers by Robinson (2002) for the UK and Ganguli and Terrell (2005) for the US. The introduction of a national MW in Germany in 2015 has focused considerable attention on its possible gender effects, but several studies for other countries have also appeared<sup>4</sup>. The broad, but not unanimous, conclusion in this large and diverse literature is that the MW acts as a moderating force on the GWG, a force additional to the structural and other forces which have reduced inequality and edged the GWG closer to zero<sup>5</sup>.

In Cyprus, the GWG has also declined over time. Christofides and Pashardes (2000) used the Cyprus Survey of Household Expenditure and Income (CSHEI) for 1990/91 to measure an 'unconditional' or 'total' GWG of 0.534 ln wage points, of which 0.323 ln points could be explained by the available variables (the 'conditional explained'), and 0.211 ln points remained unexplained (the 'conditional unexplained' GWG). Christofides and Vrahimis (2009) used the CSHEI for 1990/91, 1996/97, and 2002/03 to reproduce the 1990/91 results in Christofides and Pashardes (2000), and to extend that study to 2002/03. In the 1996/97 and 2002/03 surveys, the 1990/91 unconditional GWG dropped to 0.418 and 0.381 ln wage points, with the 'conditional explained' component being 0.104, and 0.148 ln points respectively; the balance was unexplained by the conditioning variables. Based on a study of 26 European countries and the 2007

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<sup>3</sup> A National MW was introduced in Cyprus, effective January 1, 2023; see Christofides (2019 and 2021) and Mallis et al (2022).

<sup>4</sup> The German experience is explored in, inter alia, Calliendo and Wittbrodt (2022), Ingwersen and Thomsen (2022), Link (2022), and Bossler and Schank (2023). Bargain et al (2018) consider MW issues for the UK and Ireland, Engbom and Moser (2022) events in Brazil, Li and Ma (2015) study experience in China, Majchroska and Strawinsky (2017) in Poland, Redmond and McGuinness (2023) in Ireland, and Haapanala et al (2022) and Hennig and Stadler (2023) in a cross-section of countries.

<sup>5</sup> In policy and journalistic discussions, the GWG is often defined as the difference between the reported average male *minus* the reported average female earnings, as a percentage of the average male earnings. Earnings are typically in pre-tax levels and there is no attempt to subtract the portion that can be accounted for by productive characteristics such as education; this reported GWG is referred to as 'total' or 'unconditional'. Econometric studies, typically refer to the average ln male minus the average ln female earnings. In these econometric studies, an attempt is made to net out of the ln reported male and female earnings the portion that is explainable by productive characteristics (e.g. education), leaving an 'unexplained' GWG portion as the subject for a discussion about missing variables and possible attribution to discrimination.

EU SILC data (see section 2), Christofides, Polycarpou and Vrahimis (2013) reported an unconditional GWG for Cyprus equal to 0.370 ln points (their Table 2), of which only 0.181 ln points could be explained by the variables in the survey, leaving a conditional unexplained GWG of 0.189 ln wage points; Cyprus had the highest unconditional GWG among all the countries examined (their Figure 1). Comparing the 1990/91 and 2007 information above, a decline of 0.164 ln points had been achieved in the 'unconditional' GWG, but the unexplained GWG remained practically unchanged at 0.189 ln wage points (relative to the 0.211 ln wage points in 1990/91, a decline of only 0.022 ln points).

The portion of the Ph.D. thesis of Mitsis (2013) which relates to the history and labour market effects of the MW in Cyprus appeared in Mitsis (2015, 2019). Mitsis (2019) used the three CSHEIs mentioned above, along with the more recent 2008/9 CSHEI. He found that a higher MW increased wages in the covered sector, a compliance which spilled over and influenced wages that were near the legal minimum in the uncovered sector as well – for spillovers even within establishments, see Forsyth (2023). It seems reasonable, therefore, that MW increases could reduce the GWG, given that women are disproportionately concentrated in low-paid jobs.

The studies for Cyprus in the previous two paragraphs pre-date significant structural changes, such as the gradual adoption of EU gender and inequality policies, substantial changes in the generosity and coverage of the MW in Cyprus, and the Cyprus Crisis of 2012-2016. Accession to the EU and its progressive values may suggest an acceleration of the decline in the GWG. Changes in the MW settings increase its variability, potentially improving the identification of its effects. Finally, the Cyprus Crisis involved measures which protected the lower-paid, as austerity was pursued more actively for higher income earners, also suggesting a decrease in the GWG, given that women are concentrated in low-wage jobs.

Of course, Eurostat publishes annual updates on the unconditional GWG across the EU plus Switzerland, Norway, and Iceland. The figure given for Cyprus for 2023 is 9.7%, relative to the EU average of 12.7%. The Eurostat figures on the total GWG leave unspecified the decomposition of these totals into the portions explained by productive characteristics (such as education and experience and their market rewards) and the portions which remain unexplained by the available survey variables. The relevance of substantial changes in the MW coverage and generosity must also be taken on board. Whether barriers in attaining the zero GWG lower bound exist in Cyprus is also an issue that requires consideration; comparison of the 1990/91 and 2007 unexplained GWGs shows that they were practically unchanged at around 0.20 ln wage points. The progress of women in the labour market appears to have been



internalised by market forces that have reduced the unconditional GWG through reductions in the explained GWG but have left a stubborn unexplained gap. There is a need to update our understanding of the Cypriot GWG and its components, while also taking on board the influence of the substantial policy changes that occurred on gender inequality and the MW.

In this paper, we explore the evolution of the total, explained, and unexplained GWG at the mean<sup>6</sup> over the period 2006-2018, taking note of these structural changes, and using the consistent methodology and comparability with other European studies provided by the Structure of Earnings Survey (SES)<sup>7</sup>. The provisions and application of the MW legislation in Cyprus has changed substantially over this period. The MW applied to up to nine finely defined occupations. In seeking to establish a more up-to-date view of the GWG and the possible impact of the MW, it is necessary to work with data at the 4-digit level of occupational disaggregation. This information is not publicly released by the Statistical Service of Cyprus (CYSTAT). We were able to purchase special runs of the 2006, 2010, 2014, and 2018 SES which (at the time of writing) pertain specifically to the non-unionised occupations that were regulated by the MW legislation. We supplement the resulting SES data with relevant information from other sources, including the MW, as it varies over time, the individual worker's tenure with the same employer, and occupation.

As the international literature surveyed above suggests, many forces influence the evolution of the GWG in any particular country. While international papers tend to narrow their focus on an issue of special concern, in this study of the secular evolution of the GWG over nearly two decades, it is preferable to (i) be mindful of the lessons in the international literature, (ii) use all the information afforded by the data, but (iii) realise that there is little hope of causally isolating the individual contribution of the structural forces that operate on the GWG. We provide a non-causal discussion of how the covariates that are available in SES, and the MW in Cyprus, are associated with and may have helped shape the GWG and its explained and unexplained components.

We find that in the first two SES surveys of 2006 and 2010, netting out the contribution of productive characteristics reduces substantially the total GWG, leaving an Unexplained GWG of 0.217 and 0.135 ln wage points respectively. By the time of the 2014 and 2018 surveys, which overlap with the Cyprus Crisis and its effects on the

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<sup>6</sup> Lemieux (2002) surveys and integrates seminal contributions which focus on comparisons involving other features of wage distributions, beyond the mean.

<sup>7</sup> Caliendo and Wittbrodt (2022) use data from the German SES. Mitsis (2020) uses the 2010 and 2014 4-digit SES to study the GWG in the culinary sector of Cyprus.

labour market, no further role is left for the available explanatory variables, leaving the Unexplained component of the GWG at 0.118 and 0.110 ln wage points respectively. This decrease, over two decades, prompts the question of whether reduction in the GWG through productive characteristics (such as education, length of tenure, and female achievements in the labour market) has stalled at too high a level.

## **2. Data Issues**

### **2.1 Data Sources and Preparation**

There are only a few data sets that are suitable for evaluating the GWG and MW effects in Cyprus: (a) the EU Survey of Income and Living Conditions (EU SILC), which is conducted annually by the statistical office of the European Union (EUROSTAT), (b) the CSHEI which is conducted by CYSTAT every four years, and (c) the SES, also conducted by CYSTAT every four years. The present study uses data from the SES, since the EU SILC and CSHEI data provide occupational detail limited to 2-digit categories (i.e., the Major Occupational Sub-groups), while the MW legislation refers to finer categories which can be obtained in the SES. In Cyprus, the SES began in 2002. In the present paper, data are used from the last four surveys (2006, 2010, 2014 and 2018), since these are more comprehensive with respect to both coverage and objectives<sup>8</sup> than the 2002 survey.

The classification of the occupations in SES is based on the International Standard Classification of Occupations ISCO-08 of the International Labour Organization (ILO). Based on the Law on Minimum Wages, Chapter 183, the MW in Cyprus was set until 2022 for up to nine occupational groups: salespersons; clerks; auxiliary healthcare staff; auxiliary staff in nurseries; auxiliary staff in crèches; auxiliary staff in schools; guards; caretakers working in clinics, private hospitals and nursing homes; and cleaners of corporate premises. With the help of CYSTAT and the Ministry of Labour, we were able to determine the 4-digit occupations belonging to the nine categories listed above and (with minor alterations described below) identify the relevant SES observations for each of these nine categories. The data for these occupations were constructed by CYSTAT and purchased subject to an individual-use contract.

This SES data set reports information about the personal characteristics of each employee, including gender, age, education, occupation, citizenship, and length of

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<sup>8</sup> According to CYSTAT, SES 2002 covers NACE Rev.1.1 sections C-K, whereas SES 2006 covers NACE Rev.1.1 sections C-O. Also, SES 2002 only covers enterprises with 2 or more employees, whereas SES 2006 and later cover enterprises with 1 or more employees. Note that the latest four surveys are named according to the year of reference, not according to the year in which the survey was conducted. For example, SES 2018 was conducted during 2019 and reports data relevant to 2018 (the reference year).

service with the same employer. It also includes some information about the enterprise in which an individual is employed, such as its size. In addition, the SES provide data on the individuals' monthly earnings, working hours and other working conditions.

Some other features/caveats should be noted. *First*, the SES does not take place annually, preventing a detailed time analysis; however, this paper provides GWG estimates for each survey. *Second*, the SES does not provide panel data on the same workers and, therefore, job-to-job transitions and labour force exits cannot be identified. *Third*, the SES does not report the participants' *total* working experience, just the length of service with the same employer in integer years. Research on human capital emphasizes that on-the-job training can be an important source of labour market skills. Any event that interrupts a worker's career may reduce the potential to acquire job skills and increase their earnings. Since career breaks are more frequent among women (due to birthing and childcare), the SES data exclude an important wage determinant and a potential driver of the GWG.

Gross monthly earnings are used, subtracting incomes received from additional shifts and overtime work; these are shown in Table 1 below to be quantitatively negligible. In the working sample, data is used in monthly, rather than hourly terms because: (i) these are more common reference points in the labour market, and (ii) the number of observations for workers in occupations where the MW is defined on an hourly basis is much smaller (see Table 1 below) than the number of observations for workers in occupations where the MW is defined on a monthly basis<sup>9</sup>. Hourly conversions were also used but the results were similar.

The 4-digit SES data secured concern only employees in occupations which are subject to the MW legislation, thereby abstracting from the reasons that explain how these workers have found themselves in occupations subject to the MW; the results pertain specifically to them and not the labour market at large. Trainees (apprentices) and employees in the nine occupations who have agency over their earnings or are subject to professional and/or other administrative regulations are excluded<sup>10</sup>. The pay gap is calculated using unweighted<sup>11</sup> monthly earnings (excluding earnings from overtime and shift work) and restricting the working sample to full-time workers aged

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<sup>9</sup> For workers in occupations where the MW is set at an hourly rate, the corresponding monthly MW for the full-time workers in our sample is derived from their legal hourly MW, times regular working hours per week (38), times the average weeks per month (4.33).

<sup>10</sup> These refer to the following occupations: Shop keepers, Stall and market salespersons, Legal and related business associate professionals, Optometrists and opticians, Pre-primary education teaching professionals, Protective services workers not elsewhere classified, and Domestic helpers; the latter are subject to unique administrative procedures.

<sup>11</sup> The SES provides weights suitable to the entire survey and not the selected nine occupations which are subject to the MW.

25 to 65, to avoid the special circumstances that prevail in flexible jobs, and at the beginning and end of working life.

## **2.2 Descriptive Statistics**

The resulting 'working sample' drawn from the 2006 SES<sup>12</sup> consists of 3,218 observations of which 31% pertain to men and 69% to women. For 2010, 2014 and 2018 these sample sizes are 7,251, 7,941 and 6,967, respectively, with the related percentages of men being 24%, 26% and 29%, respectively. The higher prevalence of women in these MW samples reflects the intent of the MW legislation to protect individuals in the non-unionised sector, and these are overwhelmingly female. Table 1 contains the average values of the main available variables for each of the SES surveys.

As can be seen from Table 1, in 2006 the average age of people employed in the occupations covered by the MW law was 38 and it remained close to 40 for all years examined except 2018, when it increased to 43 years, perhaps because of the Cyprus Crisis (2012-2016). Their average tenure with the current employer was around 8 years. Regarding the type of contracts used, the percentage of individuals working on a temporary basis (instead of an indefinite-duration contract), increased from 2% in 2006 to 6% in 2014 and 9% in 2018; this probably also reflected the impact of the Cyprus Crisis.

Most workers in all four years were Cypriot citizens, but their percentage decreased from 94% in 2006 to 79% in 2018, reflecting the freedom of movement within the EU (after Cyprus joined the EU in 2004); the ratio of citizens from other EU countries, in the same period, increased from 3% to 18%. The percentage of third country citizens remained around 3% in all years. The percentage of employees holding managerial and/or supervisory positions ranged from 4% to 11%.

Regarding the level of education, in 2018, 27% of the workers in MW occupations had tertiary education (college or university degrees), as compared with 36% in 2006; however, the percentage of university graduates was higher for 2018 than 2006. Most minimum wage workers were lyceum (i.e., high education) graduates, with their percentage increasing from 58% in 2006 and 2010, to 62% in 2018. Correspondingly, the percentage of illiterate workers or those with elementary education only was 14% in 2010, down to 10% in 2018; the 2006 figure of 6% may have been an aberration.

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<sup>12</sup> The 2006 sample is comparably smaller, since it excludes (a) guards, (b) caretakers working in clinics, private hospitals, and nursing homes, and (c) cleaners of corporate premises. Guards and caretakers were included in the covered occupations in 2008, while cleaners were added in 2010. See also Appendix B.

There was also a significant increase in the average size of the enterprises employing MW earners, since the percentage of companies with at least 250 employees was 45% in 2006 and 67% in 2018.

**TABLE 1**  
**Characteristics of Workers by Survey Year**

SES	2006	2010	2014	2018
<b>Sample Averages</b>				
Monthly Earnings (€):				
Total Payments	1,486	1,553	1,359	1,336
Overtime Payments	36	44	42	44
Shift Work Payments	6	17	21	19
Monthly Hours Paid:				
Total Hours	168	171	172	174
Overtime Hours	3	4	5	5
Normal Hours			166	169
Age (years):	38	41	41	43
Tenure, current employer, years):	9	8	8	7
Gender (male):	31%	24%	26%	29%
Managerial Position:	11%	4%	6%	9%
Temporary Contract:	2%	2%	6%	9%
Citizenship:				
Cypriot (#)	94%	87%	84%	79%
Other EU Citizens	3%	11%	14%	18%
Third Countries	3%	2%	2%	3%
Educational Level:				
Primary (Elementary)	6%	14%	10%	10%
High (Lyceum) (#)	58%	58%	55%	62%
Higher (College)	22%	12%	14%	10%
Highest (University)	14%	16%	20%	17%
Size of the Enterprise (Personnel):				
1: 1 – 49 (#)	24%	22%	16%	14%
2: 50 – 249	30%	26%	24%	19%
3: 250 – 999	22%	30%	42%	46%
4: 1000 or more	23%	21%	19%	21%

Occupational Group:

Salespersons (#)	22%	10%	18%	17%
Clerks	74%	65%	57%	56%
Healthcare Assistants	2%	1%	2%	1%
Childcare Assistants	2%	1%	1%	2%
Guards		3%	4%	5%
Caretakers		3%	3%	2%
Cleaners		17%	16%	16%
Number of Observations:	3,218	7,251	7,941	6,967

Source: Authors' calculations using the SES data. The sample consists only of employees in the occupations eligible for the MW who satisfy the restrictions in footnote 10. The symbol # refers to the excluded category when estimating earnings equations below (i.e., the 'reference' group).

The last rows in Table 1 present the distribution of workers in the MW occupations (viz. salespersons, clerks, auxiliary healthcare staff, childcare workers<sup>13</sup>, guards, caretakers, and cleaners) by year and major occupational group. Most of them were clerks, with a percentage to the total number of MW workers ranging between 56% and 74%. The second and third most populous groups in the MW occupations were salespersons, ranging in percentage between 10% and 22% and cleaners, who maintained a percentage around 16%.

The total (inclusive of shift and overtime extras) actual earnings of these workers are summarised in the first rows of Table 1. Their nominal, average, monthly income increased from €1486 in 2006 to €1553 in 2010, and then decreased to €1359 and €1336 in 2014 and 2018, respectively, as the Cyprus Crisis unfolded. Overtime and shift hours were negligible, justifying restricting the working sample for the empirical work below to the *regular* monthly earnings (i.e., excluding the numbers in rows 2 and 3 from row 1, Table 1). Total monthly paid hours increased over the sample from 168 to 174. Normal hours were only available for 2014 and 2018 (166 and 169 respectively).

### **2.3 The Characteristics of Earnings by Gender**

Subject to rounding, Table 2 presents the average regular earnings (i.e., row 1 – row 2 – row 3, Table 1), by gender. These are the unconditional mean wages which form the basis of the policy, unconditional (see footnote 5), GWG in policy discussions; they are reported in row 4, Table 2. As can be seen, the total GWG in 2006 was, at 24.5%,

<sup>13</sup> This category includes auxiliary staff in nurseries, auxiliary staff in crèches, and auxiliary staff in schools; these are identified as three separate occupations in the application of the MW provisions.

relative to that in Christofides et al (2013) for 2007 (0.37 ln points), which referred to the EU SILC 2-digit population (not just those eligible for the MW). The GWG for 2010 was only somewhat lower (21.0%). By 2014 and 2018, however, a GWG of 12% and 12.7% respectively, can be discerned. The 2014 and 2018 GWGs have absorbed the cumulative influence of the EU agenda on in-work poverty and inequality, the increased level of female education in Cyprus, as well as the Cyprus Crisis itself. Indeed, the small increase in 2018 may reflect the recovery of male earnings following the exit from the 2013 *Memorandum of Understanding* and the official end of the Cyprus Crisis in 2016. The anatomy of these unconditional GWGs is the subject of sections 3 and 4 in this paper. As noted in section 1, the separate contribution of these and other structural changes cannot be causally separated. Instead, their influence in wage equations is allowed for through a statistically appropriate time-pooling design of the data; broadly speaking, the estimated constant terms capture the structural forces listed above.

**TABLE 2**  
**Sample Means of the Monthly Wage by Gender in the Working Sample**

Year	2006	2010	2014	2018
Nominal Wage (€):				
Male	1,737	1,776	1,422	1,400
Female	1,311	1,403	1,251	1,222
Both Genders	1,443	1,492	1,296	1,273
Uncond. GWG	24.5%	21.0%	12.0%	12.7%
Real Wage (€):				
Male	1,737	1,603	1,240	1,242
Female	1,311	1,267	1,090	1,084
Both Genders	1,443	1,347	1,130	1,129
Number of Observations	3,218	7,251	7,941	6,967

Source: Authors' calculations using data obtained from the SES, as in Table 1. Wages are expressed in real terms using the Consumer Price Index (Base Year 2006).

Figures A.1 to A.8 of Appendix A show the monthly earnings distributions by gender and each survey year; a normal distribution is fitted to the data for comparison and a vertical line indicates the position of the MW. The graphs indicate that the uppermost end of the wage distributions is often similar for men and women, signalling the absence of a glass ceiling (see Christofides et al 2013); however, there are obvious differences by gender throughout the rest of the distributions. Figures A.1, A.3, A.5 and A.7 show that the 2018 distribution of the earnings for men loses mass in the middle

and gains mass in its lower part relative to the 2006 distribution. This may be the result of the austerity imposed during the Cyprus Crisis. By contrast, Figures A.2, A.4, A.6 and A.8 show that the distribution of the earnings for women remains broadly similar throughout the period studied; in all figures, substantial mass at the lower part of the distributions is present. This may reflect a greater influence of the MW on female earnings, and the attempt, during the Cyprus Crisis, to protect lower income workers; proportionately more of these were women.

Figures A.9 and A.10 show the monthly earnings distributions of workers by gender over the whole period examined. Given the changes in the cost of living in the period 2006-2018 (and the two different levels of the MW in Cyprus for workers under and with at least 6 months experience with the same employer), the graphical analysis is simplified by plotting the monthly earnings of the covered workers divided by the corresponding MW<sup>14</sup>. Therefore, in Figures A.9 and A.10 a value of one indicates that a worker is earning the legal MW and a value above (below) one indicates that the worker earns more than (less than) the legal MW. In the case of perfect MW compliance, the wage distribution should be censored at the MW. Figures A.9 and A.10 suggest that the legal MW has an impact on these covered occupations, since the earnings distribution of both male and female workers show strong evidence of censoring below the MW. However, there are also spikes near the level of the MW. The spikes in the male earnings distribution are well-above the MW. One spike in the female earnings distribution is slightly below the MW, suggesting lower compliance for female than male workers. The MW appears to serve as a focal point to a much greater extent in the female than in the male distribution. The effect of the MW on earnings may then be negative, particularly for women. This matter is addressed in the empirical sections below.

#### ***2.4 The Minimum Wage in Cyprus***

The Minimum Wage Law was created in 1941 to protect the rights of mining workers and in 1944 the Law was amended to include clerks and salespersons. In 1957, the Law ceased to include mining workers, and, in 1990, a new amendment extended coverage to four additional occupations (auxiliary healthcare staff, auxiliary staff in nurseries, auxiliary staff in crèches, and auxiliary staff in schools). Guards and

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<sup>14</sup> To construct the earnings distributions for monthly workers, earnings are compared with the legal monthly MW. For workers in occupations where the MW is set at an hourly rate, the level of the monthly MW was approximated by the hourly MW times the number of regular working hours (38) times the average number of weeks in a month (4.33).



caretakers were included in 2008, and cleaners of corporate premises in 2010. Table B.1 in Appendix B provides further details.

In many cases the MW rate was identical for all covered occupations<sup>15</sup>, but a higher wage applied to workers who had completed six months' experience in their current employment; since this SES variable is available only in integer form, the empirical work that follows adopts the 1-year cut-off for the higher wage. The MW grids were adjusted only five times during the period 1941-1989, but from 1990 they were adjusted annually. During the Cyprus Crisis of 2012-2016, the legally binding MW was frozen at the 2012 nominal values until 2023, when a national MW was introduced – hence the identical entries for 2014 and 2018 in Table B.1 in Appendix B.

**TABLE 3**  
**Minimum, Median and Mean Wages (2006-2018)**

Year	2006	2010	2014	2018
Monthly Min. Wage (€)				
Nominal (<6, 6+)	656, 697	835, 887	870, 924	870, 924
Real (<6, 6+)	656, 697	758, 805	761, 808	773, 821
Monthly Median Wage (€)				
Nominal	1,464	1,566	1,522	1,519
Real	1,464	1,422	1,330	1,349
Monthly Mean Wage (€)				
Nominal	1,622	1,915	1,892	1,939
Real	1,622	1,739	1,654	1,772

Source: Authors' calculations using the minimum wage decrees (<6, 6+, as in Appendix Table B.1), and National Median and Mean data from CYSTAT. Real wages use the 2006 Base CPI.

The level of the monthly legal MW for the period analysed is summarized in Table 3, along with national median and mean wages obtained from CYSTAT. These earnings are also expressed in real terms with the use of the Consumer Price Index (Base Year 2006). Real values are used when more than one surveys are pooled. The wage minima summarised<sup>16</sup> in Table 3 concern workers who have not and have completed six months (<6, 6+) with their current employer; a large majority of the total covered workers have been with the same employer for six or more months and should be

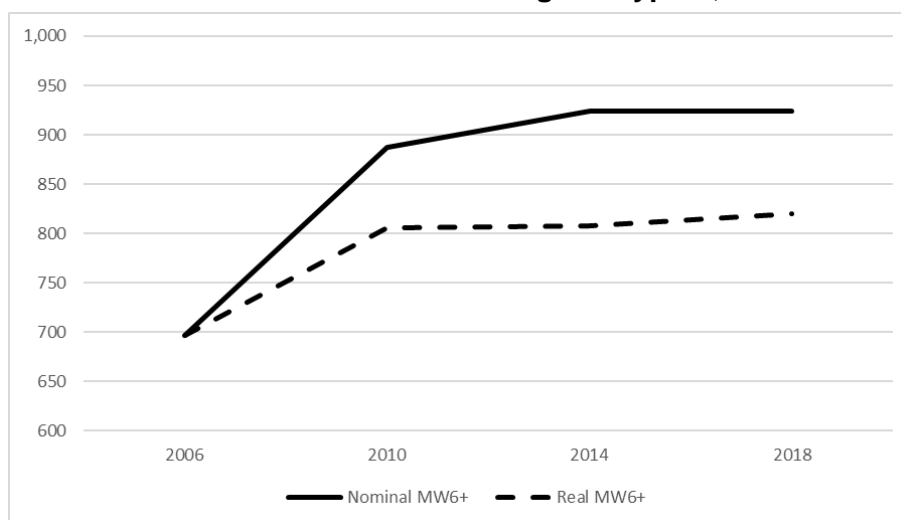
<sup>15</sup> In 2009, the minimum wage for guards began to be set at an hourly, instead of a monthly rate, and in 2011 this provision was extended to cleaners of corporate premises.

<sup>16</sup> A detailed version of the MW provisions, used at the micro level to generate the MW applicable to the individuals of a particular survey year, tenure with a given employer, regulated occupation, and, hence, monthly or hourly application, appears in Table B.1., Appendix B.

earning the higher MW figure (Mitsis, 2013). The mean monthly wage in Table 3 is much higher than the median because the distributions in Appendix A are right skewed.

Figure 1 summarises the evolution of the nominal and real MW for the most populous category of MW workers with six or more months of experience with the same employer (see rows 1 and 2, Table 3). In the empirical work that follows, the MW variable (in ln) embodies the situation of each micro-observation (year of survey, <6 or 6+ months with the same employer, and occupation).

**FIGURE 1**  
**The Evolution of the Minimum Wage in Cyprus, 2006-2018**



Source: Figure 1 presents the MW after six months of continuous employment with the same employer, in both nominal and real terms. The MW data were obtained from the decrees of the Ministry of Labour, while national data on the mean and median wages were obtained from CYSTAT.

### **3. Econometric Specification**

In this paper the evolution of the GWG in Cyprus over the period 2006-2018 is explored. The influence of the structural changes that have occurred over this period, and the explanatory force of productive characteristics, such as education, experience, etc., as well as the MW, are considered. The unconditional GWG, presented in policy discussions and Table 2, is the difference between the average earnings of men and women expressed as a percentage of the earnings of men. It does not net out the factors which partially explain the observed wage differentials between men and women. To allow for the contribution of structural changes and other variables which are likely to influence the evolution of the GWG, estimates of (natural logarithmic, or ln) wage equations are obtained and used to decompose the difference between the predicted<sup>17</sup> average ln earnings of men and women into an explained and an

<sup>17</sup> By a property of OLS the predicted and actual earnings means are equal.

unexplained component, using decompositions at the mean. The explained portion could inform policies aimed at reducing the GWG, while the unexplained component suggests an exploration of missing explanatory variables and possible discrimination; we pay particular attention to the explained portion of the GWG.

As stated in Mincer (1974), wages are a function of individual characteristics and wage policies. The functional form of the wage equations used in our approach, for each gender, is presented (in matrix notation) in eq. (1):

$$W = X\beta + u \quad (1)$$

where  $W$ =the natural logarithm of the monthly earnings of each worker,  $X$ =worker and job characteristics, including the MW appropriate to each observation, and a constant. The  $k$  explanatory variables in the  $n \times k$  matrix  $X$  include a constant, the MW (as appropriate to time, occupation and tenure for the individual), Age and Age squared, the Length of service with the current employer, whether an observation involves Managerial duties or none (the omitted base class), whether the worker is on a contract of indefinite duration or a limited one (omitted), nationality in the categories EU, Other or Cypriot (omitted), education in the categories Primary, Higher (college), Highest (university), and secondary (omitted), the size of the enterprise in terms of the number of its employees being between 50-249 (Size B), 250-999 (size C), 1000 or more (Size D), or 1-49 (omitted), and 4-digit occupation in the consolidates four categories Clerks, Health Care Assistants, Child Care Assistants, and Salespersons (omitted). When observations from more than one surveys are pooled (see Table 1 for the observations involved) and explored, dummy variables to indicate the survey years are included to, inter alia, capture the structural forces at work at the time. The  $k \times 1$   $\beta$  vector refers to the population coefficients appropriate for each variable, and  $u$  is an error term with classical properties.

The Oaxaca-Ransom (1994) decomposition divides the total GWG into a component that is explained by group differences in observed characteristics (such as the ones presented above), and an unexplained component that cannot be accounted for by gender differences in the available characteristics. The decomposition is performed using estimated coefficients from Mincer-type wage equations and average values of the observed characteristics for each gender, as follows:

$$\bar{W}^M - \bar{W}^F = (\bar{X}^M \hat{\beta}^M - \bar{X}^F \hat{\beta}^F) = (\bar{X}^M - \bar{X}^F) \hat{\beta}^N + \bar{X}^M (\hat{\beta}^M - \hat{\beta}^N) + \bar{X}^F (\hat{\beta}^N - \hat{\beta}^F) \quad (2)$$

where  $\bar{W}^M$  and  $\bar{W}^F$  are the average (ln) earnings of male and female workers, respectively,  $\bar{X}^M$  and  $\bar{X}^F$  are the average values of the observed characteristics by

gender,  $\hat{\beta}^M$  and  $\hat{\beta}^F$  are the estimated OLS coefficients from separate wage regressions for male and female workers, and  $\hat{\beta}^N$  are 'gender-neutral' coefficients from a regression which uses the entire sample (a 'pooled' regression). The use of  $\hat{\beta}^N$  in eq. (2) avoids the dependence of the Explained component (first term in eq.2) on the male or female coefficients inherent in earlier decompositions. The remaining two terms in eq. (2) estimate the 'Male Advantage' and 'Female Disadvantage' respectively: they are the difference (in the two brackets respectively) between (i) the male coefficients and the neutral vector times  $\bar{X}^M$ , and (ii) the neutral vector and the female coefficients times  $\bar{X}^F$ , respectively. We report the Total GWG on the LHS of eq. (2) and the Explained component in detail; the (remaining) Unexplained components of the GWG that we discuss, group the Male Advantage and Female Disadvantage into an 'Unexplained' component. In eq. (3), an algebraic statement of the remaining Unexplained component is offered:

$$Unexplained = Total - Explained = (\bar{X}^M \hat{\beta}^M - \bar{X}^F \hat{\beta}^F) - (\bar{X}^M - \bar{X}^F) \hat{\beta}^N \quad (3)$$

where the two terms on the RHS of eq. (3) add up to the Male Advantage plus Female Disadvantage in eq. (2) when terms involving  $\bar{X}^M$  and  $\bar{X}^F$  are grouped.

Note that a higher MW (one of the variables in  $X$ ) is applied to workers who have completed six months' experience in their current employment (here one year), and that, in occupations where the MW is set at an hourly instead of a monthly rate (i.e., guards and cleaners), the monthly equivalent is less than the statutory monthly minimum wage<sup>18</sup>. In the individual SES surveys, any difference between the sample averages of the male and female MW must be attributed to either (i) a different average tenure with the current employer, or (ii) a different average gender concentration in occupations where the MW is set at a monthly and an hourly rate.

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<sup>18</sup> In 2014 and 2018, the hourly minimum wage for experience of six months or more was equal to €5.20 for guards and €4.80 for cleaners. The derived monthly minimum rates, using the regular working hours per week (38) and the average weeks per month (4.33) are €856 and €790, respectively, as opposed to €924, which was the monthly minimum rate set for the rest of the covered occupations. In 2010, where the MW was set at an hourly basis only for guards, the basic hourly wage was €5.00, which produces a derived monthly rate equal to €823, as opposed to €840, which was the monthly minimum rate set for cleaners, and €887, which was the monthly minimum rate set for the rest of the covered occupations. Whether the variation in the MW, between monthly and hourly professions, along with the difference between the low and high level of the MW produce sufficient variation to make the MW useful in a single survey is a question that can only be answered empirically. When data from more than one surveys are pooled, the time variation in the MW also adds to the variance of the MW. We return to this issue in section 4.

## **4. Results Obtained**

### **4.1 Studying the Four Surveys**

Having described the objectives of the paper and methods of dealing with them, this section first considers whether the data from more than one, indeed all, surveys should be pooled, and, if so, how this is to be done. A natural starting point is to pool the data from all four surveys: this adds the time variation in the MW and other variables to the variation emanating from length of tenure and occupation, and this addition may be useful. However, the information in Table 3 on the unconditional GWG suggests that its decline in 2014 may entail wage equations in the period 2014-2018 which are structurally different from those of 2006-2010. Indeed, a test of structural homogeneity produces an F statistic (22, 25333 degrees of freedom) of 129.72, with a p-value of 0.000. A break is suggested: the freezing of the MW in 2012, the wage cuts implemented in the 2013 Memorandum of Understanding, and generally the Cyprus Crisis provide economic rationales for this break. Accordingly, and in the interests of economy, we do not report results for the entire period.

Turning to a possible grouping of the data into two samples with the view to maintaining sufficient variation in the explanatory variables, including that of the MW, the two periods of 2006-2010 and 2014-2018 suggest themselves. The economic reasons for this include the major decline in the unconditional GWG in Table 2, and the Cyprus Crisis, with all that that entailed. This model was estimated, obtaining fairly good results for the earlier period and unremarkable ones for 2018. Several economic reasons can be adduced for not relying on the two-period setup: the overheating of the economy in the first period, and the timing of the Cyprus Crisis are two of them. However, the main argument for further disaggregation is based on tests that indicated structural breaks between 2006-2010, and 2014-2018 (an F statistic with 19 and 10431 degrees of freedom equal to 15.24 with p-value equal to 0.000 for the earlier period; and an F statistic with 22 and 14864 degrees of freedom equal to 21.34 with a p-value of 0.000 for the later period). To conserve space, these results are not presented either.

It appears, therefore, that economic and econometric reasons favour separate estimation for each survey. This approach also provides all the details on the decline of the unconditional GWG and its components for each of the four surveys, thus extending our understanding of the history of the GWG in Cyprus (albeit, given the sample limitations, only for those eligible for the MW).

## **4.2 Estimated Wage Equations**

Before proceeding to the wage equations from the individual surveys, some general and comparative comments relevant to all the results in this section are offered; short observations pertinent to the time-context of the individual survey results are provided in sections 4.2.1-4.2.4.

In the interests of economy and to avoid four repetitive statements, this paragraph serves as a *Source* statement for all four tables (Tables 4-7 in the four sub-sections 4.2.1-4.2.4) which report wage equation results from the SES surveys. These equations form the basis of the decomposition procedures discussed in section 3. Each of the Tables 4-7 presents wage equations for the samples identified in its columns (Male, Female, and Pooled). The estimated coefficients express the effect of each characteristic on  $\ln$  monthly earnings, relative to the  $\ln$  earnings of the reference group (Cypriots of young age who finished secondary school, and who were employed on a temporary basis, as salespersons, with no managerial duties, in firms with 1-49 employees). The symbols (\*\*\*) , (\*\*), and (\*) denote significance at the 1%, 5%, and 10% level, respectively.

Considering the cross-sectional nature of the survey samples, the goodness of fit statistics of the wage equations for men, women, and both genders is very high: they range from 0.446 in the 2018 equation for men, to 0.664 in the 2006 wage equation for women. The 2010 data offer the best fits, followed by the 2006 ones. A noticeable drop in  $R^2$  occurs during the Cyprus Crisis and its aftermath, in the 2014 and 2018 surveys. In general, the coefficients on variables are as previously recorded in the literature: Age, Length of Service, Managerial Position, and Indefinite Contract, carry the expected positive coefficients, which, with very few exceptions, are significant at the 1% level. Individuals with Cypriot citizenship earn more than other EU citizens. Surprisingly, in view of the large number of unskilled workers from third countries, they do not earn significantly less than Cypriots, except for 2018 when the relevant coefficient is negative and significant at the 10% level. Individuals with only elementary education generally earn significantly less than high school graduates, while those with Higher (college) education earn significantly more; this is even more the case for individuals with Highest (university) education. The well-known firm size premium is very evident for both genders in all surveys (relative to firms with fewer than 50 employees) and is generally significant for all sizes at the 1% level. A complex and somewhat unstable pattern of positive and negative effects (relative to Salespersons), sometimes significant at one of the three levels of significance, is evident.

The MW coefficients are of particular interest, given the idiosyncrasies of the Cypriot MW system (section 2). The wage distributions in Appendix A suggest that substantial changes in mass may occur, especially for men: an increase in the MW may shift mass towards the new MW (a negative elasticity of earnings w.r.t. the MW) or induce those earning higher wages to demand a constant or increased difference between their earnings and the new MW (a positive elasticity of earnings w.r.t. the MW). The estimated elasticities are higher for men, but positive and significant (at the 1% level) only in 2006; this was a period of an increasing nominal MW (section 2.4). Indeed, for 2010 and 2018, the female elasticities are significantly negative (1% level). The higher elasticities for men than women suggest that an increase in the MW will not reduce the GWG in this sample of workers who are subject to the MW; its socially beneficial effect is confined to the reduction of in-work poverty. This result may be a function of the limited variation in the real MW (Figure 1), along with the inclusion of variables, such as the Constant, Length of Service (a determinant of the <6/6+ MW setting), and the Occupation of the MW earner (reflecting the distinction between hourly and monthly MW earnings discussed in Appendix B); these variables vie to explain the impact of changes in the MW. Yet omitting them, would compromise the explanatory power of the wage equations, and damage the decompositions that follow.

Tables 4-7 also report the pooled regression equations, for each survey sample, which make it possible for the Explained portion of the GWG to be independent of the male or female wage structure (see Jann 2008 for details). As might be expected, the coefficients in the pooled samples chart a course between that of the two genders.

#### ***4.2.1 Wage Equation Results for the 2006 Survey***

After Cyprus joined the EU in 2004, GDP growth increased substantially (4.7% in 2006). In this year of optimism, lower interest rates, low inflation, strong GDP growth, and increasing MW, the wage equations in Table 4 are well-established. The  $\ln$  nominal MW elasticities for both genders are positive and significant at the 1% level – note that  $\ln$  earnings on the LHS are also nominal, as deflation by the CPI would not change the features of interest in any single-year survey. These equations conform well with economic expectations.

**TABLE 4**  
**OLS Estimation Output for the Wage Equations of 2006**

	Male Regression	Female Regression	Pooled Regression
<b>Coefficients</b>			
Logged Nominal Minimum Wage	1.715***	0.920***	1.184***
Age	0.040***	0.033***	0.028***
Age Squared	0.000***	0.000***	0.000***
Length of Service	0.022***	0.027***	0.026***
Managerial Position	0.103***	0.178***	0.151***
Indefinite Contract	0.155**	0.250***	0.218***
Citizenship:			
Other EU Citizens	-0.143**	-0.048	-0.079
Third Countries	-0.047	-0.107***	-0.116***
Educational Level:			
Primary (Elementary)	-0.123***	-0.075***	-0.105***
Higher (College)	0.091***	0.132***	0.131***
Highest (University)	0.171***	0.270***	0.241***
Size of the Enterprise (Personnel):			
50 – 249	0.083***	0.170***	0.143***
250 – 999	0.060**	0.152***	0.118***
1000 or more	0.276***	0.418***	0.371***
Occupational Group:			
Clerks	-0.071***	0.125***	0.052***
Healthcare Assistants	-0.126	0.118***	0.057
Childcare Assistants	-0.020	-0.077**	-0.158***
Female			-0.217***
Constant	-5.185*	-0.337	-1.666***
Number of Observations	1,001	2,217	3,218
R-squared	0.575	0.664	0.658
Adjusted R-squared	0.567	0.662	0.656

#### **4.2.2 Wage Equation Results for the 2010 Survey**

The goodness of fit attained in the 2010 wage equations is the highest among the four surveys. Nominal MW increases continued to this year, as inflation remained constant at the then historical levels. However, the coefficient for men (0.182) is not statistically significant, while that for women is -0.323 and significant only at the 5% level. The remarks, at the penultimate paragraph of the introductory comments in section 2.4, may cast light on the insignificance of the male coefficient and the change in the pattern from 2006.



**TABLE 5**  
**OLS Estimation Output for the Wage Equations of 2010**

	Male Regression	Female Regression	Pooled Regression
<b>Coefficients</b>			
Logged Nominal Minimum Wage	0.182	-0.323**	-0.222***
Age	0.037***	0.023***	0.026***
Age Squared	0.000***	0.000***	0.000***
Length of Service	0.027***	0.027***	0.027***
Managerial Position	0.154***	0.183***	0.181***
Indefinite Contract	0.045	0.070***	0.070***
Citizenship:			
Other EU Citizens	-0.151***	-0.097***	-0.116***
Third Countries	0.012	-0.125***	-0.106***
Educational Level:			
Primary (Elementary)	-0.032	-0.054***	-0.048***
Higher (College)	0.077***	0.126***	0.118***
Highest (University)	0.167***	0.259***	0.230***
Size of the Enterprise (Personnel):			
50 – 249	0.082***	0.087***	0.087***
250 – 999	0.063***	0.099***	0.085***
1000 or more	0.213***	0.183***	0.186***
Occupational Group:			
Clerks	0.018	0.241***	0.180***
Healthcare Assistants	0.107	0.257***	0.209***
Childcare Assistants	-0.300	-0.054	-0.110***
Guards	-0.126***	0.011	-0.008
Caretakers	-0.050	0.225***	0.157***
Cleaners	-0.131***	0.039**	-0.013
Female			-0.135***
Constant	4.992**	8.313***	7.769***
Number of Observations	1,726	5,525	7,251
R-squared	0.618	0.617	0.630
Adjusted R-squared	0.613	0.615	0.629

#### **4.2.3 Wage Equation Results for the 2014 Survey**

The 2014 survey occurred in the middle of the Cyprus Crisis while economic policy and wage-setting were under the 2013 Memorandum of Understanding. Wage reductions were imposed, the MW was frozen in 2012, and the earnings of lower income earners were protected. The coefficients on the MW are positive, but not significantly different from zero. A pattern of reduced relevance for this variable, first evident in 2010, can be seen. Indeed, the goodness of fit of these wage equations is substantially lower than what was achieved in the 2010 results. This is not surprising, given the economic turmoil occasioned by the Cyprus Crisis.

**TABLE 6**  
**OLS Estimation Output for the Wage Equations of 2014**

	Male Regression	Female Regression	Pooled Regression
<b>Coefficients</b>			
Logged Nominal Minimum Wage	0.296	0.054	0.109
Age	0.043***	0.026***	0.031***
Age Squared	0.000***	0.000***	0.000***
Length of Service	0.021***	0.024***	0.024***
Managerial Position	0.048**	0.080***	0.074***
Indefinite Contract	0.042	-0.027*	-0.005***
Citizenship:			
Other EU Citizens	-0.073***	-0.036***	-0.045***
Third Countries	0.016	-0.026	-0.021
Educational Level:			
Primary (Elementary)	-0.113***	-0.064***	-0.075***
Higher (College)	0.099***	0.088***	0.099***
Highest (University)	0.127***	0.146***	0.148***
Size of the Enterprise (Personnel):			
50 – 249	0.181***	0.097***	0.118***
250 – 999	0.106***	0.076***	0.079***
1000 or more	0.219***	0.083***	0.109***
Occupational Group:			
Clerks	0.059***	0.158***	0.128***
Healthcare Assistants	-0.067	0.133***	0.090***
Childcare Assistants	-0.334**	-0.135***	-0.168***
Guards	-0.111***	0.024***	-0.057***
Caretakers	-0.040	0.112***	0.082***
Cleaners	0.067	0.034***	0.026
Female			-0.118***
Constant	3.857*	5.797***	5.430***
Number of Observations	2,094	5,847	7,941
R-squared	0.481	0.460	0.468
Adjusted R-squared	0.480	0.458	0.467

#### **4.2.4 Wage Equation Results for the 2018 Survey**

Cyprus exited the Memorandum of Understanding in 2016 and, beginning from a low GDP level, GDP growth in 2016 was 6.6%. Strong GDP growth continued in 2018 (5.6%), even as inflation remained at 1.4%. The 2018 equations continued to attain the lower levels of explanatory power registered in 2014. The MW continued to be frozen, and it is not surprising that, with variation coming only from tenure with the same employer and the hourly versus monthly settings, the coefficient on this variable for men continued to be not significantly different from zero. The coefficient for women was negative (-1.517) and significant at the 1% level. It is possible that, in this post-Crisis year, the constant MW acted as an attractor and a modal signal, shifting higher wages towards it, and checking the influence of the recovery process on earnings.

**TABLE 7**  
**OLS Estimation Output for the Wage Equations of 2018**

	Male Regression	Female Regression	Pooled Regression
<b>Coefficients</b>			
Logged Nominal Minimum Wage	-0.191	-1.517***	-1.058***
Age	0.027***	0.025***	0.027***
Age Squared	0.000***	0.000***	0.000***
Length of Service	0.020***	0.021***	0.021***
Managerial Position	0.285***	0.246***	0.266***
Indefinite Contract	0.053**	0.047***	0.043***
Citizenship:			
Other EU Citizens	-0.002	-0.034***	-0.024***
Third Countries	-0.071*	-0.082***	-0.080***
Educational Level:			
Primary (Elementary)	-0.016	-0.014***	-0.014
Higher (College)	0.075***	0.090***	0.087***
Highest (University)	0.137***	0.158***	0.150***
Size of the Enterprise (Personnel):			
50 – 249	0.147***	0.069***	0.089***
250 – 999	0.185***	0.108***	0.125***
1000 or more	0.127***	0.067***	0.080***
Occupational Group:			
Clerks	0.102***	0.156***	0.140***
Healthcare Assistants	-0.048	0.158***	0.092***
Childcare Assistants	-0.059	-0.115***	-0.126***
Guards	-0.062*	-0.073**	-0.080***
Caretakers	0.116	0.177***	0.159***
Cleaners	0.006	-0.174***	-0.113***
Female			-0.110***
Constant	4.726***	16.427***	13.371***
Number of Observations	1,990	4,977	6,967
R-squared	0.446	0.449	0.456
Adjusted R-squared	0.440	0.447	0.544

#### **4.3 Decomposition Results for the SES Surveys 2006, 2010, 2014, and 2018**

The wage equations above are a step towards establishing the Explained and Unexplained components of the unconditional GWG. In Table 8, emphasis is placed on the Explained component: it involves findings which are useful for policy formation, as it is possible to single out the contribution of individual variables to the capacity of the model to account for the GWG. Table 8 contains (rows 1-3), for each survey year, the average ln earnings of men and women and the ln Difference between them. The rows below provide the contribution of the individual variables in the wage equations to the Explained component; these sum to the overall Explained component. The overall Unexplained component is provided in the following row for reference, and the sum of the Explained and Unexplained components in the last row adds up to the Difference in the third row. This is the logarithmic GWG, the econometric model

analogue to the GWG in Table 2. This row mirrors the decline in the GWG in Table 2, from 24.5% in 2006 to 12.7% in 2018. The policy GWG in Table 2, and that in the econometric model of Table 8 are not far apart, but they are particularly similar in 2014 and 2018.

Several features can be seen. *First*, the Unadjusted Difference, or the model's GWG, declines from 0.316 ln points in 2006 to 0.117 points in 2018. *Second*, the Explained component in 2006 amounts to 31.33%  $((0.099/0.316)100)$  of the Unadjusted ln Difference, and the 2010, 2014 and 2018 ones to 40%, -4.42% and 5.98% respectively; the Explained totals for 2014 and 2018 are not significantly different from zero. The Explained component is high in the first two and extremely small in the last two surveys. It is possible that, by the 2014 survey, differences between the average educational attainment (for example) of men and women in the sample had diminished to the point where no further progress would have a substantial effect on the GWG. Continuing with education as an example, in 2014, on average, the fraction of men in the sample who had attained Higher education (0.095) was smaller than the fraction of women (0.158). To construct the contribution of Higher to the total of the Expected component, the needed expression is the difference between these averages, times the estimated coefficient on Higher in the pooled sample (0.099), namely  $(0.095-0.158) \times 0.099 = -0.006$ ; this is the 2014 entry in Table 8 for the variable Higher. By 2014, women had attained more college education than men and the contribution to the Explained total (col. 3 in Table 8) becomes negative. However, at the Highest level in 2014, more men (0.229) than women (0.193) were present in the sample and the difference between them times the pooled coefficient (0.148) was 0.005. Incidentally, the contributions -0.006 for Higher and 0.005 for Highest are significant at the 1% level (Table 8). *Third*, Length of Service (2006, 2010), Managerial (all surveys), and Indefinite Contract (2006, 2010) are all policy-malleable variables and, generally, contribute significantly to the Expected component of the GWG. The MW variable makes a significant (1%) contribution to the Expected component in 2006 and a negative one in 2018; in 2010 and 2014, it is not significant. All contributions to the Expected portion of the GWG in Table 8 are small and their combined total wanes to numbers which are not significantly different from zero in the last two surveys.

**TABLE 8**  
**Decomposition Results by Survey Year (Explained)**

	2006	2010	2014	2018
Mean In Male Earnings	7.388	7.394	7.188	7.177
Mean In Female Earnings	7.072	7.169	7.075	7.060
Unadjusted Diff. in In Means	0.316	0.225	0.113	0.117
<u>Variable Contrib. to Explained</u>				
Logged Nominal MW	0.004***	-0.000	0.001	-0.006***
Age	0.068***	-0.021**	-0.061***	-0.094***
Age Squared	-0.068***	0.016*	0.056***	0.084***
Length of Service	0.061***	0.033***	-0.004	-0.030***
Managerial Position	0.014***	0.013***	0.005***	0.029***
Indefinite Contract	0.003***	0.001***	0.000	0.000
Citizenship:				
Other EU Citizens	0.002**	0.005***	0.001***	0.000
Third Countries	0.003***	0.001*	0.000	0.001*
Educational Level:				
Primary (Elementary)	0.001	0.003***	0.005***	0.001**
Higher (College)	-0.009***	-0.002*	-0.006***	-0.003**
Highest (University)	0.011***	0.024***	0.005***	0.011***
Size of the Enterprise (Personnel):				
10 – 249	0.006**	0.002*	0.002	-0.004***
50 – 999	0.000	0.006***	0.005***	0.016***
1000 or more	-0.002	-0.003	-0.006***	-0.007***
Occupational Group:				
Clerks	0.001	0.014***	0.004***	0.001
Healthcare Assistants	-0.001	0.000	-0.001***	0.000
Childcare Assistants	0.005***	0.001***	0.001***	0.003***
Guards		-0.001	-0.007***	-0.008***
Caretakers		-0.002***	-0.002***	-0.003***
Cleaners		0.002	-0.004	0.015***
Explained: Sum of Above Contributions	0.099***	0.090***	-0.005	0.007
Unexplained: Coefficients are not Reported	0.217***	0.135***	0.118***	0.110***
Explained Plus Unexplained	0.316	0.225	0.113	0.117

Source: Authors' estimations using the Structure of Earnings Survey data. The samples consist of employees in the occupations eligible for the minimum wage, in the corresponding year of each survey. The symbol (\*\*\*) denotes significance at 1%, (\*\*) at 5%, and (\*) at 10%.

The Unexplained component reflects the influence of missing variables and possible discrimination. To interpret the Unexplained component and its elements, it is useful to think of the case where the average  $X$  matrices for men and women are equal and can be represented by  $\bar{X}^*$ . Then the Explained portion of the GWG will be zero (see eq. (2)), and the Unexplained portion reduces to  $\bar{X}^*(\hat{\beta}^M - \hat{\beta}^F)$ . When the  $X$ s are different, they serve as weights. A rough way to explore the role of individual variables on the Unexplained component, albeit with no statistical inference implied, is, therefore, to compare the male and female coefficients in Tables 4-7 above. Where

this difference is large, that may prompt questions about a possible role of policy. The mean value of the  $X$  matrix (matrices if different by gender) amplifies or dampens differences in coefficients and should not be overlooked. As an aside, equality of the average and gendered  $X$  matrices is not far from the actual situation in the case of the  $\ln$  MW in the wage equations. The average values for this variable in 2018 are 6.783 for men and 6.778 for women.

Considering this discussion, and because the Unexplained component serves to alert us to missing variables (e.g., marital status, time-use within the family, and work/family reconciliation policies) and possible residual discrimination, issues beyond the scope of this paper, we do not report the detailed version of the Unexplained component.

## **5. Concluding Comments**

Motivated by the lack of recent econometric studies of the gender wage gap (GWG) and especially its Explained component for Cyprus, this paper attempts to extend familiarity with the GWG and its composition to 2018. Wishing to also include the possible influence of the Minimum Wage (MW), and because doing so is more definitive using data at the 4-digit level which more clearly identify those in the nine occupations subject to the MW, specially constructed Structure of Earnings Survey (SES) data from the 2006, 2010, 2014, and 2018 CYSTAT surveys were purchased; at the time of the present project, population-wide, 4-digit SES data, were not available.

For this group of full-time, MW-eligible, workers, the GWG in the 2006 and 2010 SES was 0.316 and 0.225 logarithmic ( $\ln$ ) wage points, respectively. By the time of the next surveys (2014 and 2018), the GWGs had fallen to 0.113 and 0.117  $\ln$  wage points, respectively. A secular decline in the GWG has been in motion, which is even more impressive if note is taken of earlier studies which reported much higher GWGs: results from household surveys for 1996/97 and 2002/03 had found  $\ln$  wage GWGs of 0.418 and 0.381, respectively.

Along with the decline in the total GWG in the SES surveys examined here, a substantial change in its composition has occurred. Decomposition of the GWG figures above into an Explained and an Unexplained portion reveal that the Explained portion accounts for 31%, 40%, -0.4% and 6% of the 2006, 2010, 2014 and 2018 SES GWG respectively. The last two contributions are not statistically significant at the 10% level.

Various characteristics, personal (e.g., age, citizenship, educational attainment, and occupation) and work-related (e.g., occupation, the length of service with the same employer, managerial/administrative duties, contracts of indefinite duration, and firm size), play some role as components of the Explained portion of the GWG. The MW

made a small positive, statistically significant at the 1% level, contribution only in the 2006 survey.

As noted, in the 2014 and 2018 surveys the Expected portion, as a whole, is not statistically significant. Many structural changes occurred during the period after the first two SES: The Cyprus Crisis of 2012-2016, and interventions in the wage-setting process impacted and impaired the capacity of wage models and decompositions to shed light on the GWG and its makeup. In effect, these changes have added many more factors to the number of missing explanatory variables that would reduce the Unexplained and increase the Explained components of the GWG. An essentially Unexplained, statistically significant at the 1% level, GWG of 0.118 and 0.110 In wage points remained in 2014 and 2018 respectively (Table 8).

How much of the decline in the Explained portion, which has kept the Unexplained component at a high level, was due to the Cyprus Crisis remains unclear. The international literature, which naturally abstracts from the complications inherent in the Cyprus Crisis, is searching for relevant 'missing variables' that would reduce further the Unexplained portion of the GWG. Attention is focussed on the gamut of work/family reconciliation policies (e.g., Blair and Posmanick 2023), and on whether the nature of jobs (e.g., Goldin 2014) and the economy at large are antithetical to further reductions in the GWG. The role of the Cyprus Crisis and the policies/institutions just mentioned in maintaining the Unexplained portion of the GWG between 0.118 and 0.110 In basis points, remains to be explored; however, this lies beyond the scope of the present paper.

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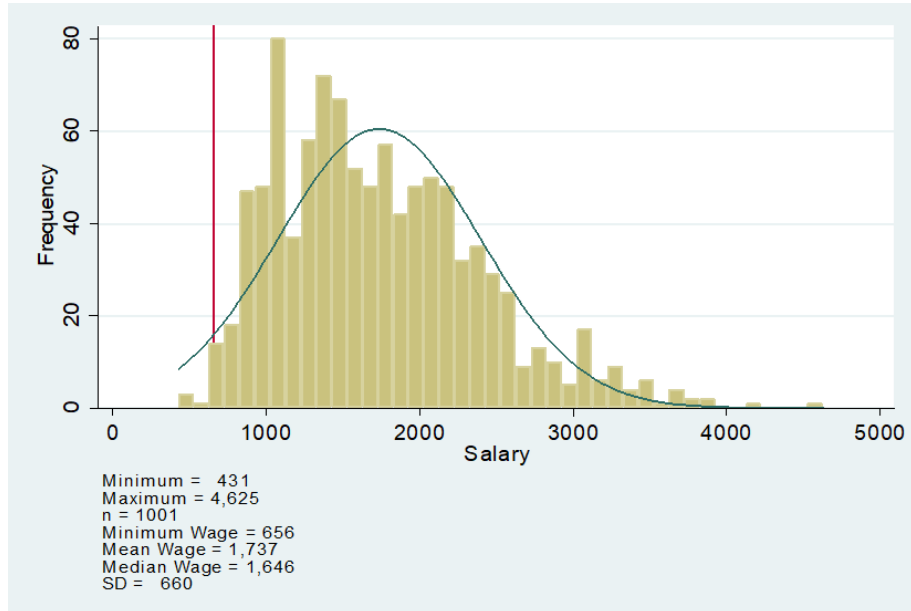
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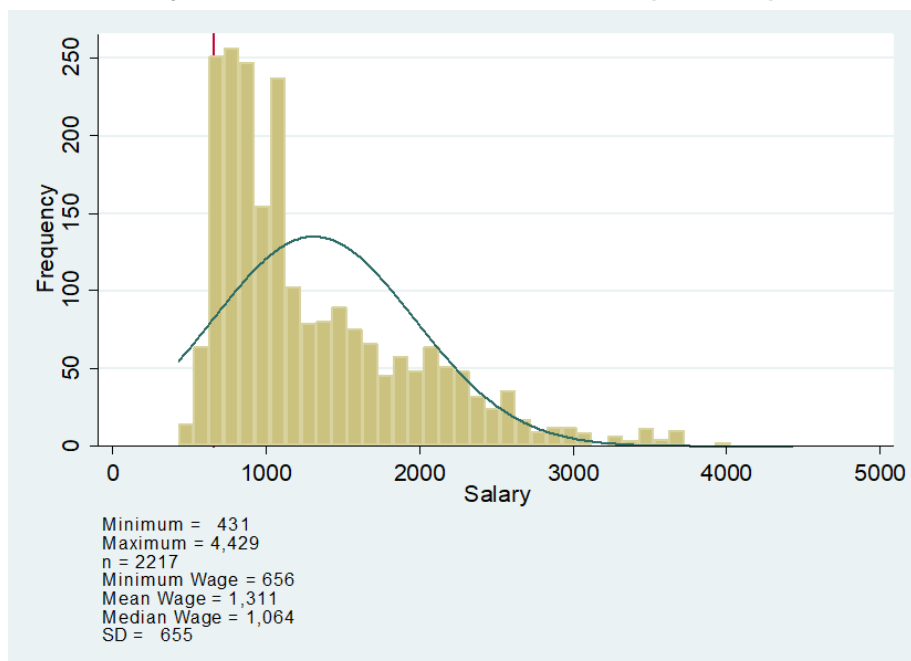
## Appendix A

### Earnings Distributions of the Minimum Wage Workers

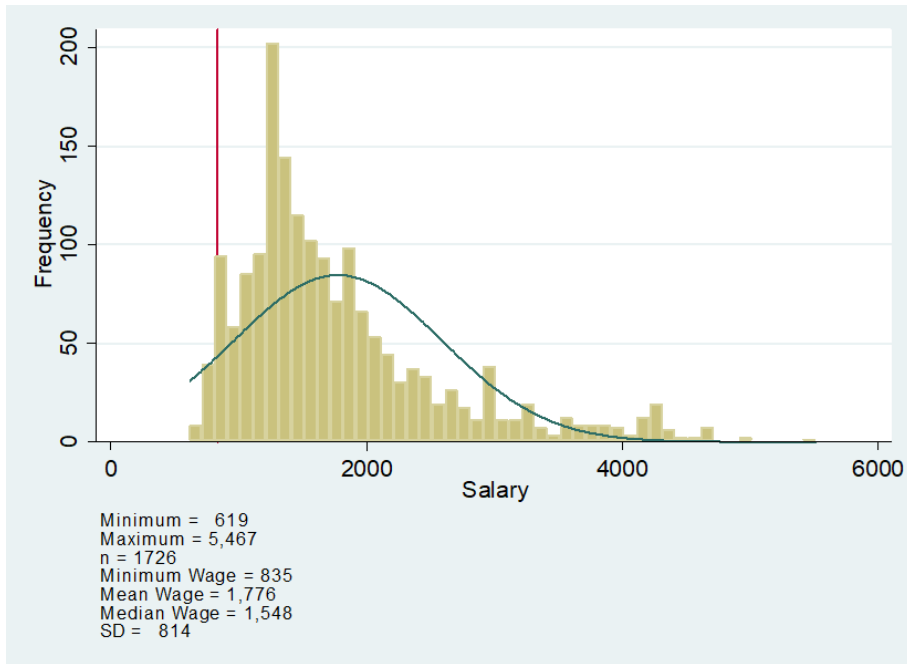
**FIGURE A.1**  
**Monthly Salaries of Male MW Workers (Fulltime) 2006**



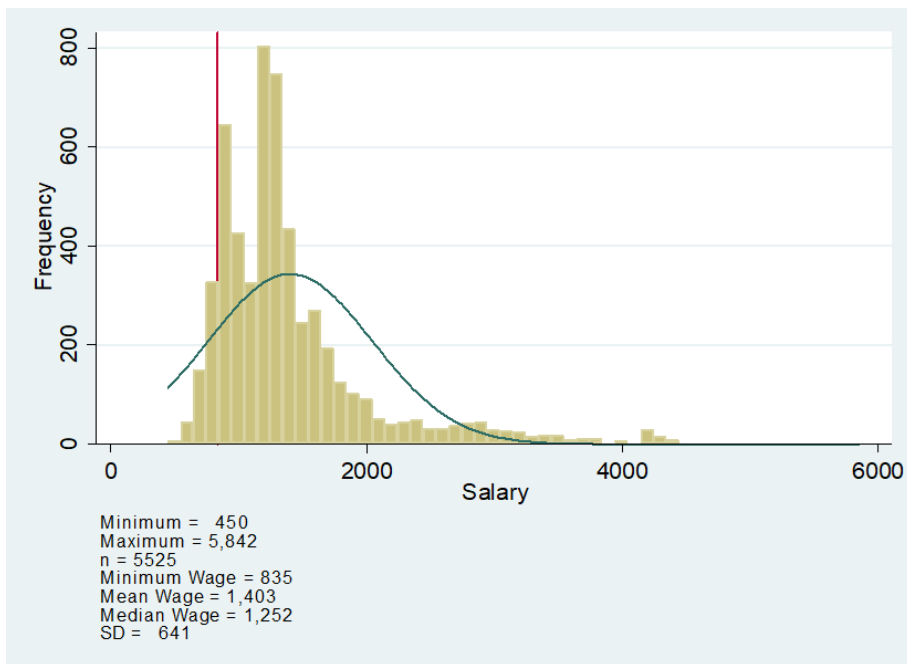
**FIGURE A.2**  
**Monthly Salaries of Female MW Workers (Fulltime) 2006**



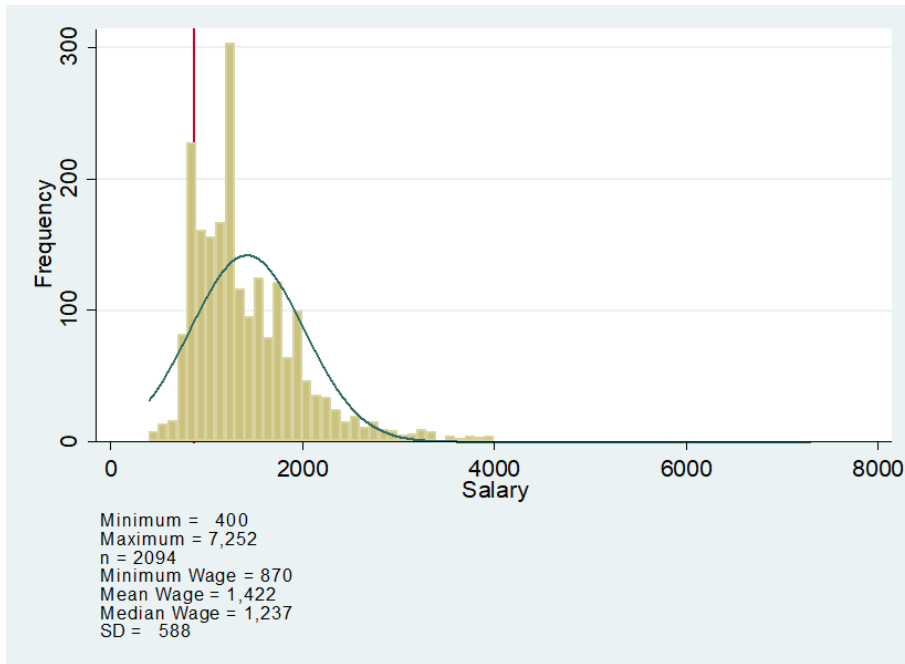
**FIGURE A.3**  
**Monthly Salaries of Male MW Workers (Fulltime) 2010**



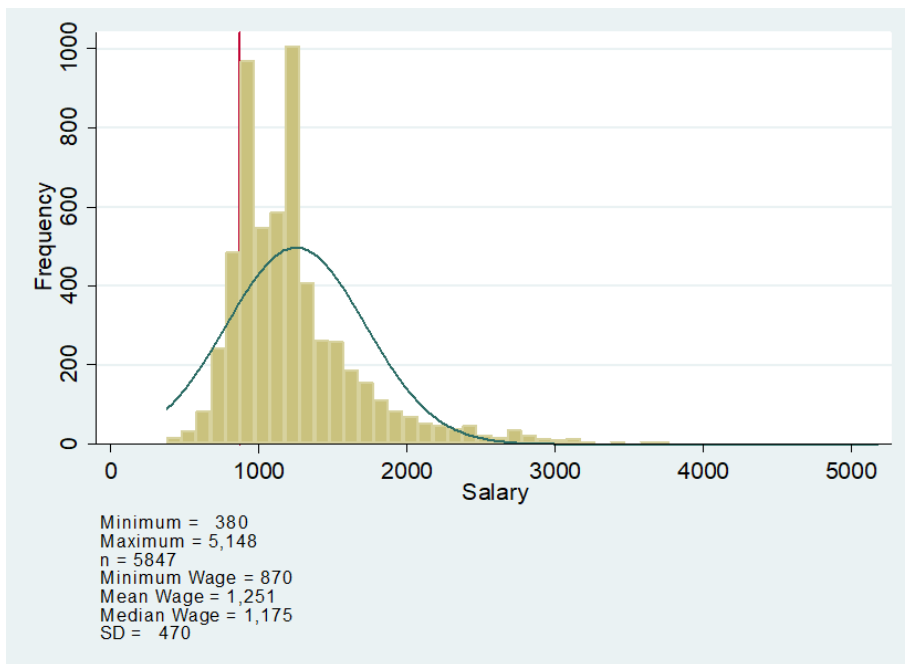
**FIGURE A.4**  
**Monthly Salaries of Female MW Workers (Fulltime) 2010**



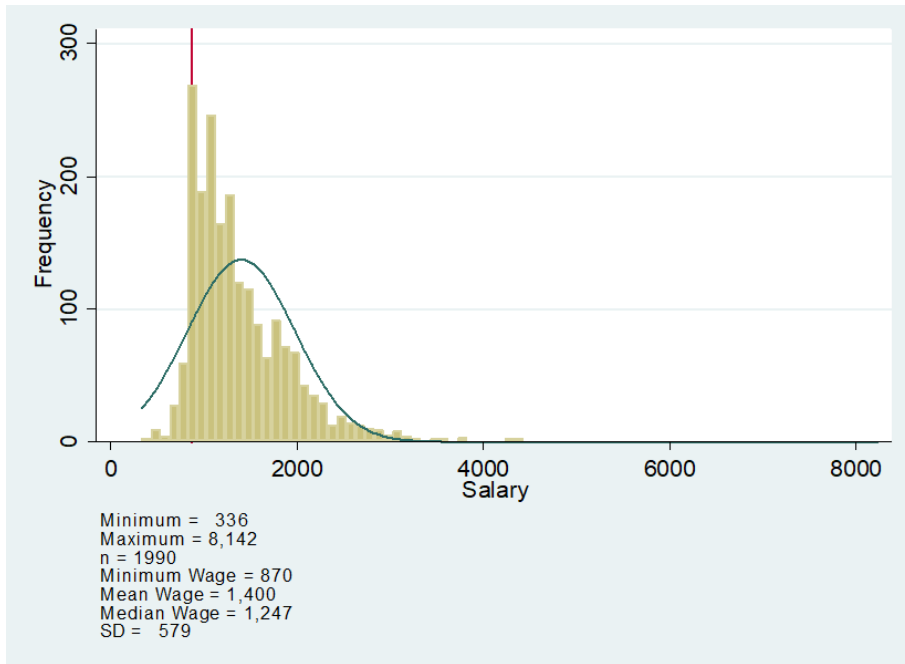
**FIGURE A.5**  
**Monthly Salaries of Male MW Workers (Fulltime) 2014**



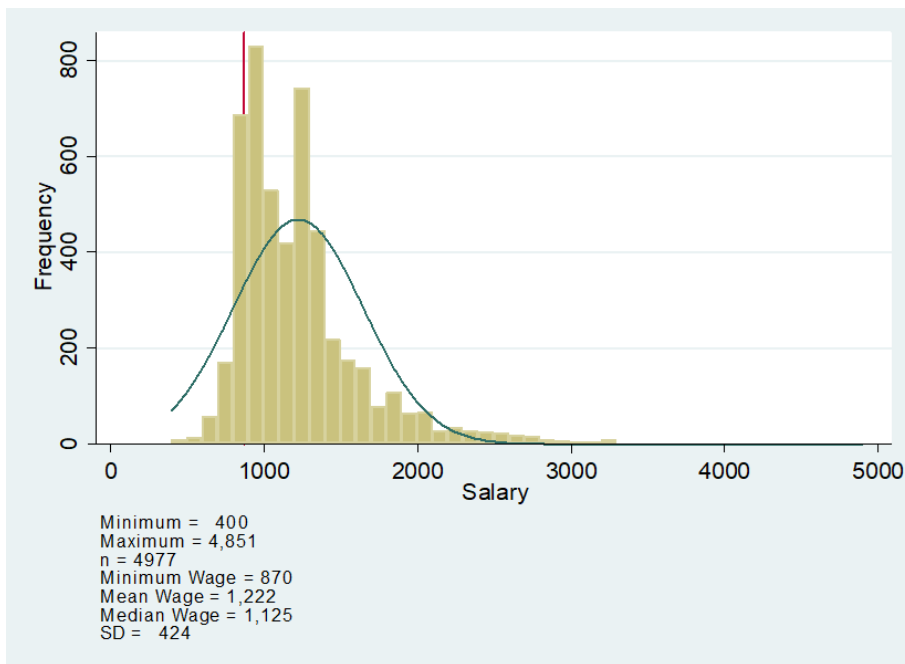
**FIGURE A.6**  
**Monthly Salaries of Female MW Workers (Fulltime) 2014**



**FIGURE A.7**  
**Monthly Salaries of Male MW Workers (Fulltime) 2018**

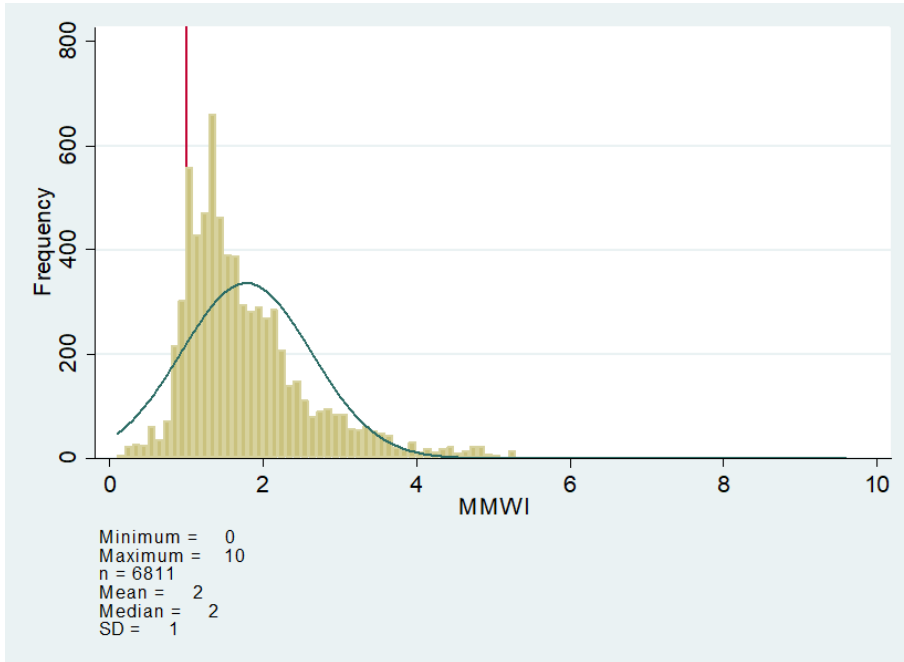


**FIGURE A.8**  
**Monthly Salaries of Female MW Workers (Fulltime) 2018**



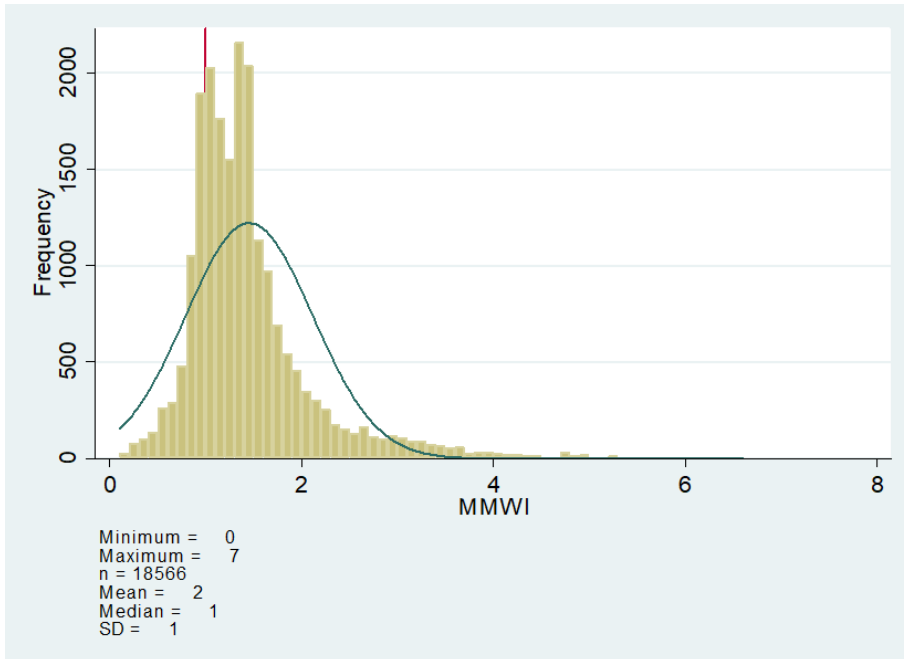
**FIGURE A.9**

**Monthly Earnings Index of Male MW Workers (Full-time) All Years**



**FIGURE A.10**

**Monthly Earnings Index of Female MW Workers (Full-time) All Years**



## Appendix B

**TABLE B.1**  
**Details of the Legal Minimum Wage (MW) Structure in Euro**

SES	How MW is Specified	MW is Set Monthly		MW is Set Hourly	
	Experience with same employer in (months)	<6 months	6+ months	<6 months	6+ months
<b>2006</b>	All Workers Except:	656	697	<i>(3.98)</i>	<i>(4.23)</i>
	Guards	n.a.	n.a.	n.a.	n.a.
	Cleaners	n.a.	n.a.	n.a.	n.a.
	Caretakers	n.a.	n.a.	n.a.	n.a.
<b>2010</b>	All Workers Except:	835	887	<i>(5.07)</i>	<i>(5.39)</i>
	Guards	<i>774</i>	823	4.70	5.00
	Cleaners	791	840	<i>(4.80)</i>	<i>(5.10)</i>
<b>2014</b>	All Workers Except:	870	924	<i>(5.28)</i>	<i>(5.61)</i>
	Guards	806	856	4.90	5.20
	Cleaners	<i>749</i>	790	4.55	4.80
<b>2018</b>	All Workers Except:	870	924	<i>(5.28)</i>	<i>(5.61)</i>
	Guards	806	856	4.90	5.20
	Cleaners	<i>749</i>	790	4.55	4.80

Source: Data are taken directly from the MW decrees. Entries in *italics* are for occupations where the MW is specified on an hourly (monthly) basis and has been converted to a monthly (hourly) basis for our main results (see footnotes 14 and 15); the reverse situation, (*italics* in brackets), was only relevant when checking robustness results where the dependent variable was converted to be hourly for the more prevalent monthly occupations.



## **Appendix C**

### **Recent EU Gender Policy Initiatives**

#### **The European Commission's (2021) *Pillar of Social Rights Action Plan* (p. 44)**

*Under principle 2 Gender Equality,*

“a. Equality of treatment and opportunities between women and men must be ensured and fostered in all areas, including regarding participation in the labour market, terms and conditions of employment and career progression. b. Women and men have the right to equal pay for work of equal value”,

*Under principle 6 Work,*

“a. Workers have the right to fair wages that provide for a decent standard of living. b. Adequate minimum wages shall be ensured, in a way that provide(s) for the satisfaction of the needs of the worker and his/her family in the light of national economic and social conditions, whilst safeguarding access to employment and incentives to seek work. In-work poverty shall be prevented. c. All wages shall be set in a transparent and predictable way according to national practices and respecting the autonomy of the social partners.”

#### **The European Union (2022) *Directive on Adequate Minimum Wages***

It aims to reduce in-work poverty and inequality and to improve the adequacy of statutory minimum wages and collective bargaining. A target for a statutory minimum wage at 60% of the gross national median wage is suggested.

See the references for a complete citation.