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Veröffentlichungsversion / Published Version

Zeitschriftenartikel / journal article

Empfohlene Zitierung / Suggested Citation:

Laurimäe, M., Paas, T., & Paulus, A. (2022). The effect of COVID-19 and the wage compensation measure on income-related gender disparities. *Baltic Journal of Economics*, 22(2), 146-166. <https://doi.org/10.1080/1406099X.2022.2149976>

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To cite this article: Merilen Laurimäe, Tiiu Paas & Alari Paulus (2022) The effect of COVID-19 and the wage compensation measure on income-related gender disparities, *Baltic Journal of Economics*, 22:2, 146-166, DOI: [10.1080/1406099X.2022.2149976](https://doi.org/10.1080/1406099X.2022.2149976)

To link to this article: <https://doi.org/10.1080/1406099X.2022.2149976>



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The effect of COVID-19 and the wage compensation measure on income-related gender disparities

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ABSTRACT

Many countries implemented wage compensation measures during the COVID-19 crisis to alleviate income losses and avoid employment reductions. We focus on the gender dimension of incomes in Estonia, which has been grappling with the highest gender wage gap in Europe, and investigate whether the crisis and related wage compensation may have worsened existing gender imbalances. Using detailed administrative datasets and EUROMOD microsimulation model, we show that the COVID-19 crisis had a significant negative effect on employment income for both men and women, but the wage compensation implemented in 2020 appeared to cushion these effects. Income losses were slightly higher for men, but the cushioning effect of the compensation was higher for women. Overall, income-related gender disparities did not change significantly during the crisis. Still, the wage compensation measure has contributed to preventing income-related gender disparities increasing further, particularly in the hotels and restaurants sector and wholesale and retail trade sector.

ARTICLE HISTORY


Received 22 March 2022
Accepted 17 November 2022

KEYWORDS

Income; wage compensation; microsimulation; COVID-19; gender inequality; Estonia

1. Introduction

The COVID-19 crisis has profoundly affected many aspects of life, and it has posed challenges not only to health care systems, but also to labour markets and social protection systems. Previous studies have already shown that national policies have made a significant contribution to mitigating the impact of the crisis on employment, poverty and inequality both in Europe and in the rest of the world (Almeida et al., 2020, 2021; Cantó et al., 2021; Christl, De Poli, Figari, et al., 2021; Christl, De Poli, Hufkens, et al., 2021; Christl, De Poli, Kucsera, et al., 2021; Doorley et al., 2021; Han et al., 2020; Koppel & Laurimäe, 2021). However, the effects of the COVID-19 crisis have been shown to be highly asymmetric, affecting some countries and population groups more than others, e.g. women, people with lower skills, and wages (Adams-Prassl et al., 2020; Cantó et al., 2021; Koppel & Laurimäe, 2021; Madgavkar et al., 2020; Moreira & Hick, 2021; Parker et al., 2020), which may

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in turn further exacerbate the economic inequalities already present within and between socio-economic groups (Adams-Prassl et al., 2020; Farré et al., 2020).

There are relatively few studies analysing the effect of the COVID-19 crisis on income-related disparities by socio-demographic groups, let alone the effect of the implementation of specific measures (Christl, De Poli, Hufkens, et al., 2021; Christl, De Poli, Kucsera, et al., 2021; Cook & Grimshaw, 2021; Doorley et al., 2021; Koppel & Laurimäe, 2021). Income differences by gender and how these were shaped by the crisis is one aspect that deserves more attention, because of substantial gender inequalities that existed already prior to the crisis and long-term policy concerns about them. Even though crisis measures did not typically target the gender dimension, there may have been sizeable side-effects, worsening these gender inequalities further. Our study assesses the effects of the crisis and the wage compensation measure, adopted by the Estonian government due to the COVID-19 crisis, on income-related gender disparities. Since the Great Recession, much effort has been made to reduce the wage gap between men and women. While in 2012 the gender gross hourly wage gap in Estonia was 29.9%, in 2019 it was 21.7%.¹ During the COVID-19 crisis, it emerged that some sectors with larger female employment were more severely affected, which in turn could lead to a further widening of the gender gap. It is therefore particularly important to investigate how the COVID-19 crisis and related wage compensation measures affected existing gender income balances.

The following research questions are addressed. First, have income-related gender disparities changed during the pandemic in Estonia? Second, has the implemented wage compensation measure had any effect on income-related gender disparities during the COVID-19 crisis period? Previous studies are mainly based on survey data, which are available with delay and suffer from some sample restrictions, while we use two different register-based datasets in this study (2019; 2019–2020). First, detailed administrative data for the period 2019–2020 are used to analyse actual changes in employment income, recipients of wage compensation and related gender disparities. Second, the analysis of register data is complemented by counterfactual scenarios using the microsimulation method and EUROMOD to assess the effect of the COVID-19 crisis and the wage compensation measure on income-related gender disparities. The microsimulation model uses the latest available register-based input data from 2019. In this analysis, income refers to monthly employment income.

Estonia offers an interesting case study for several reasons. First, it has the highest gender pay gap among the EU countries (21.7% in Estonia vs. 14.1% in EU-27 in 2019).² Recent research has shown that much of the wage gap in Estonia can be explained by labour market factors, including education, occupation, the field of activity and the location of the workplace (Täht et al., 2019). As the COVID-19 crisis has had a very strong impact on the labour market, and in particular on certain sectors, it may have also impacted income-related gender disparities. Second, Estonia differs from the other EU-27 countries for a higher decline in the employment rate and also gender disparities in employment patterns during the COVID-19 crisis.³ The employment rate decreased almost equally among men and women in the EU-27, but more so among men in Estonia. Between the third quarter of 2019 and the third quarter of 2020, the employment rate fell in Estonia from 80.4% to 76.8% for men and from 72.0% to 70.3% for women. Furthermore, Estonia had a very high pre-crisis employment rate and experienced the largest

decline in employment among the EU countries in the second quarter of 2020. Thus, changes in the Estonian labour market were more drastic than in other countries during the COVID-19 crisis and these lessons may provide broader interests in the analysis of ongoing labour market developments.

We find that the COVID-19 crisis would have significantly reduced household employment income without the wage compensation measure that was effective in mitigating these negative impacts. However, the effects of the crisis and the wage compensation vary by gender and economic activity. First, the total effect of the crisis and the wage compensation on employment income was slightly higher among men, though the crisis alone did not affect the income-related gender disparities significantly. Second, we also see that the cushioning effect of the measure was stronger for women, particularly for those employed in hotels and restaurants as well as in wholesale and retail trade and the wage compensation measure has thus contributed to avoid income-related gender disparities increasing further.

The findings of the analysis confirm that the implementation of the wage compensation measure during the pandemic crisis was necessary to counterbalance falling household incomes and increases in inequality. Although the wage compensation in Estonia was not specifically aimed to prevent an increase in gender disparities, it worked in such a way by supporting most vulnerable sectors, where female employment was incidentally relatively large.

The structure of the paper is as follows. The next section gives an overview of the earlier literature on this topic. Section 3 introduces the data and methodology used to conduct the empirical analysis. Section 4 presents the main findings, and the final section concludes.

2. Related literature

Previous studies show that the effect of the COVID-19 crisis on the labour market and individual incomes varies considerably not only across countries (Almeida et al., 2020, 2021), but it is also unequally distributed within countries and did not affect all individuals uniformly (Adams-Prassl et al., 2020; McCurdy & Gustafsson, 2020). For instance, those workers who could not work from home, low-skilled workers or people who are less educated, were more affected by the crisis and at greater risk of losing their jobs or reduced incomes (Adams-Prassl et al., 2020; Farré et al., 2020). Non-standard workers were also in a more difficult situation compared to the traditionally employed, since they are often not covered by the social protection system (Eichhorst et al., 2020). Low-income groups would disproportionately bear employment and income losses as working from home due to social distancing is often more difficult for them. Moreover, they are largely employed in the sectors that were more affected by the crisis (Almeida et al., 2020; Martin et al., 2020; Parker et al., 2020). Low-income people also tend to have less savings and are more at a risk of economic hardship if they lose their jobs and income (Parker et al., 2020). Since women's incomes in Estonia are lower than those of men and there is a high gender wage gap, women are also more vulnerable to this risk.

Regarding gender disparities, much of the preceding literature has focused on the effect of the crisis on well-being, work and family life (e.g. increased childcare

responsibilities, violence) or job loss, but there are only few analyses focusing on income-related gender disparities. So far, it has mainly been found that women are more severely affected by the crisis and the resulting social restrictions than men (Alon et al., 2021; Madgavkar et al., 2020; Oreffice & Quintana-Domeque, 2021). Women are more at risk of losing their jobs than men because women tend to engage in activities that were more affected by the COVID-19 crisis and related pandemic measures (Madgavkar et al., 2020). In the case of Austria, it has been found that women lost more market income, but this shock was cushioned by other taxes and benefits (Christl, De Poli, Kucsera, et al., 2021). The impact of the COVID-19 crisis and the wage compensation measure on poverty rates by gender in Estonia has briefly been analysed, and it was found that the impact of the crisis and the measure on relative poverty was greater for men than for women and for those aged between 50 and 63. In addition, the impact of the COVID-19 crisis on household disposable incomes without the compensation measure was greater among low-income people, but their overall losses were smaller than for other households when taking also the compensation measure into account (Koppel & Laurimäe, 2021). Our study complements previous studies by examining in more detail the impact of the COVID-19 crisis and the compensation on income-related gender disparities in Estonia.

Already before the crisis, women were more involved in family responsibilities and care than men, but due to the closure of kindergartens and schools and distance learning, their burden has increased even more (Adams-Prassl et al., 2020; Alon et al., 2020; Centre for Economic Performance, 2020; Del Boca et al., 2020; Farré et al., 2020). This might in turn have caused more work disruptions (Carli, 2020) and unemployment (Landivar et al., 2020) among women. Besides the increased risk of losing jobs and incomes, women are hence also more exposed to work-life imbalance that could affect their future career progression and earnings (Deloitte, 2020; Landivar et al., 2020). This is particularly true for women with young children (Deloitte, 2020). On the other hand, there is evidence from the United Kingdom, Germany and the Netherlands, which show that men and women were fairly equally affected by the crisis in terms of labour market outcomes, i.e. employment, working hours or income (Hupkau & Petrongolo, 2020; Meekes et al., 2020).

The impact of a crisis on various socio-demographic groups and the gender pay gap has also been studied in the context of the Great Recession. Due to the high sectoral segregation in Estonia and the fact that a large proportion of men worked in construction, the impact on male employment was greater. The Great Recession had a higher negative effect for men compared to women in terms of unemployment, hours of work and wages (Espenberg, 2013). In addition, the gender pay gap narrowed at the onset of the crisis (2008–2009) (Masso & Krillo, 2011), but as the sectors where male employment was more prevalent recovered more rapidly, the pay gap soon began to widen again (Espenberg, 2013).

However, it should be noted that crises are of a different nature, so their impacts on different socio-demographic groups may vary. The COVID-19 crisis was a health crisis that required social restrictions and therefore affected people working in certain areas where more serious restrictions were imposed (e.g. accommodation, services). In Estonia, as in the majority of European countries, there are more women working in the tertiary sector and more men working in the primary and secondary sectors.

During the COVID-19 crisis, the service sector suffered the most, but at the same time, cushioning measures also supported those sectors the most.

3. Methodology and data

3.1. Data sources

We investigate whether the crisis and related wage compensation measures may have exacerbated existing gender imbalances by using two different register-based datasets (2019; 2019–2020), both of which cover the whole population, and a microsimulation approach. First, the gender dynamics of the wage distribution in the COVID-19 crisis and the role of the wage compensation measure are analysed using detailed register data from 2019 to 2020 (dataset A). This dataset also includes information about the wage compensation. Second, the analysis of register data is complemented by counterfactual scenarios using a microsimulation model EUROMOD with register-based input data for 2019 (dataset B). It allows us to assess the effect of the COVID-19 crisis and the wage compensation measure separately on the distribution of employment income by gender. Unfortunately, due to technical limits and data protection, administrative data from 2020 (dataset A) cannot be used in the EUROMOD microsimulation model. Thus, the 2019 register based input data (which also includes the whole population) is used in conjunction with the reweighting approach, as explained further below.

The Estonian Unemployment Insurance Fund (*EUIF*) provided wage compensation to the employers significantly affected by the crisis from March to June 2020 to mitigate the effects of the COVID-19 outbreak. Firms where the turnover, wages or working hours had significantly fallen⁴ were considered eligible (Laurimäe et al., 2020). The wage compensation was 70% of the employee's gross wage between March and May and 50% of the employee's gross wage in June with a maximum amount of €1000 initially and €800 in June. The employer itself had to pay in addition a minimum of €150 to the employee. In total, the employee received at least the gross minimum wage (€584) or due to working part-time the income remained the same. The conditions were the same for men and women.

Detailed monthly register data from 2019 to 2020 are used to analyse the evolution of employment income in this period. The dataset includes everyone whose age was at least 15 years as of January 2016 and at most 75 years as of November 2020, in total of 1.5 million persons. The data from the following registers are combined: demographic data from the Estonian Population Register (gender, time of birth, time of death); income data from the Employment Register and Register of Taxable Persons (total monthly amount of personal (gross) income by type of income such as employment contract and civil service); and wage compensation data from the Unemployment insurance database and the state register of jobseekers and of employment services (time of receipt of wage compensation, monthly amount of wage compensation).

To assess the effect of the wage compensation measure on employment income, we compare two situations: (1) where the measure is available and (2) where the measure is not available. Since there are no actual data available in the theoretical situation

where no action is taken, the corresponding scenario needs to be simulated. The methodology used and extended further in this study is based on an analysis by the European Commission (Almeida et al., 2020), which measures the effect of the COVID-19 crisis across European countries with EUROMOD.

EUROMOD is the EU-wide tax-benefit microsimulation model that simulates social benefits, direct taxes and social contributions for a representative sample of households (Sutherland & Figari, 2013). EUROMOD allows changes in policy rules to be simulated and their effect on incomes to be evaluated. This approach has widely been used in the past to measure inequality and poverty, see Callan et al. (2018) and Paulus and Tasseva (2020) for the effects of automatic stabilizers on inequality during the Great Recession; Leventi et al. (2019) for the effects of changes in the tax-benefit policies on poverty; Vandelannoote and Verbist (2020) for the impact of in-work benefits on poverty. Several studies have already been conducted with EUROMOD to assess the impact of the COVID-19 crisis, see Midões and Seré (2021) and Cantó et al. (2021) for the effect on households' financial vulnerability and incomes; Doorley et al. (2021) for effects on income inequality; Koppel and Laurimäe (2021) for effects on poverty in Estonia. The EUROMOD microsimulation model has also been used to analyse the effect of the COVID-19 measures and the tax-benefit system on specific socio-economic groups in some countries, e.g. in the case of Austria (Christl, De Poli, Kucsera, et al., 2021) and Germany (Christl, De Poli, Hufkens, et al., 2021), however, the effects of the wage compensation on gender disparities during the COVID-19 crisis have not received much attention yet.

The main EUROMOD input data that are compiled each year and previously used are based on the EU-SILC⁵ survey data. In this study, we use instead unique register-based EUROMOD input data available for Estonia that cover the entire population (information about register based EUROMOD input data is available in Paulus and Piirits (2019)).⁶ These data refer to 2019 and include 1.32 million observations. We simulate 2020 policy rules with EUROMOD version I3.0+. To account for the gap between the income year and the policy year, monetary variables are updated based on the changes in average value or indexation (see Laurimäe et al. (2020) for the Estonian Country Report).

3.2. Simulation scenarios

The analysis carried out with EUROMOD consists of three scenarios that depict a hypothetical situation without the crisis and two crisis scenarios, with and without the wage compensation (see Table 1). To model changes in the labour market resulting from the crisis, we use a reweighting approach following Pacifico (2014). Initially, each household has a statistical weight of unity as the dataset covers the whole population. The weights are then recalculated to reduce the total number of employees and increase the total number of unemployed and recipients of unemployment benefits, in line with observed aggregate statistics and macroeconomic projections. The demographic structure of the population is kept unchanged by controlling for the size of the population by gender and age groups (0–15, 16–40, 41–65, 65+) (see Appendix 2 for technical details). The reweighting is the same for the two crisis scenarios. Taxes and benefits are simulated in all scenarios and the same uprating factors are used to uprate gross market incomes and public pensions to 2020.

Table 1. Reweighting and simulation of the wage compensation measure in different scenarios.

Scenario	Reweighting of employment, unemployment, and unemployment benefits recipients	Income modelling related to the wage compensation measure in EUROMOD	Simulating taxes and benefits in EUROMOD and uprating	Data
No crisis (baseline scenario)	Yes – statistics by economic sector for 2019 (Statistics Estonia) are combined with the projections by the Ministry of Finance in the Fall of 2019 for 2020 (employment and unemployment growth)	No	Yes	EUROMOD 2019 register-based input data updated to 2020
Crisis and compensation	Yes – statistics by economic sector for 2020 are used (Statistics Estonia)	Yes – the receipt of the wage compensation is simulated using the EUIF aggregate data on the receipt of benefits by activity and gender.	Yes	EUROMOD 2019 register-based input data updated to 2020
Crisis without compensation	Yes – statistics by economic sector for 2020 are used (Statistics Estonia)	Yes – the employment income of the compensation recipients has been reduced to zero based on the receipt of benefits by activity and gender.	Yes	EUROMOD 2019 register-based input data updated to 2020

Source and Notes: Compiled by the authors. The table used for statistics is TT207: Hõivatud ja palgatöötajad soo ja majandussektori järgi.

More specifically, the first scenario, labelled as ‘no crisis’, is our baseline and describes the situation if there had been no COVID-19 crisis and no wage compensation would have been required. Employment is assumed to have increased slightly in 2020 compared to observed levels for 2019 in the input data. According to the projections by the Ministry of Finance in the fall of 2019 before the pandemic hit, aggregate employment would have increased by 0.1% and the unemployment rate by 0.2% in 2020. Thus, input data are reweighted so that changes in employment and unemployment by economic sector follow the forecasts of the Ministry of Finance for 2020.

The second scenario involves the COVID-19 crisis and the wage compensation measure, i.e. ‘a crisis and compensation’ scenario. It aims to model the actual situation during the COVID-19 crisis in 2020 by reweighting 2019 input data according to observed employment figures at the sectoral level for 2020. The receipt of the wage compensation is simulated in EUROMOD using the Estonian Unemployment Insurance Fund’s (EUIF) aggregate data on the number of recipients by economic activity and gender. Combining this information with aggregate employment statistics, we derive the share of workers receiving the wage compensation by economic activity and gender, and then randomly assign workers to the scheme until reaching required target shares of recipients in each group of workers. Within each group, the likelihood of receipt is hence constant and not dependent on other individual characteristics. The maximum duration of the benefit, the replacement rate, and the minimum and maximum amounts of benefits were determined according to the policy rules for each worker assigned to the scheme, which are described in detail in Laurimäe et al. (2020). As EUROMOD does not contain information on the turnover of the company, it is not possible to consider the detailed eligibility conditions of the companies in the model. However, as the model is based on the aggregate statistics of the

recipients of the compensation, this is indirectly accounted for. Technically, individual labour market statuses and incomes have been adjusted using a special EUROMOD module.⁷

The third scenario, the 'crisis without compensation' scenario, describes a situation where there is the COVID-19 crisis, but the government does not provide compensation. Comparing this counterfactual scenario with the scenario where the wage compensation is present allows us to evaluate the effect of the measure. The reweighting in this scenario is based on the same aggregate employment statistics as used in the second scenario, but additionally the employment income of those who qualified for the measure in the second scenario were reduced to zero in the corresponding months. This assumption has limitations because some employees might still have received part of their salary or found a new job, so we likely underestimate employment incomes and overestimate the effect of the wage support during the intervention months (between March and June). On the other hand, we likely overestimate employment incomes and underestimate the effect of the wage support in the following months, because some people could have remained unemployed for longer. Overall, we expect the two biases to largely balance each other. To our best knowledge, there are no published estimates on how many people would have received their salary, lost their job or found a new job, and strong assumptions would be needed to model such behavioural effects in depth. However, the results of a recent analysis suggest that the wage compensation helped preserve approximately 20,000 jobs (Meriküll & Paulus, 2022). Although we have a simplified approach, on an aggregated level it matches the assumptions of our 'crisis without compensation' scenario, where all beneficiaries would have lost their employment income for the corresponding months.⁸ In addition, as already mentioned, similar approaches have also been effectively used in previous studies.

4. Empirical analysis and discussion

4.1. Overview of the recipients of the wage compensation and changes in income in Estonia

Between March and June 2020, a total of 137,500 people (21% of employees) received the compensation totalling 256 million euros. The proportion of men and women among the beneficiaries was approximately equal (48% and 52% respectively). By design, a large proportion of the beneficiaries were employed in the most affected sectors (about one third), such as hotels and restaurants or wholesale and retail trade (Appendix 1). The share of those receiving the wage compensation was the highest among employees in the hotel and restaurant sector, both among men and women (63% and 59%). This was followed by the arts and entertainment sector (together with some other small sectors), wholesale and retail trade sector, and construction (Figure 1).

Looking at the average gross amount of the benefits, larger disparities can be observed (Figure 2). The average amount of compensation paid to women was 120 euros lower than that paid to men (632 and 751 euros respectively), and the compensation granted to women was lower in almost all fields of activity, with the exception of the education sector. However, when the wage compensation is presented as a share of the average wage by sector and gender (Figure 3), women's compensation was actually higher in

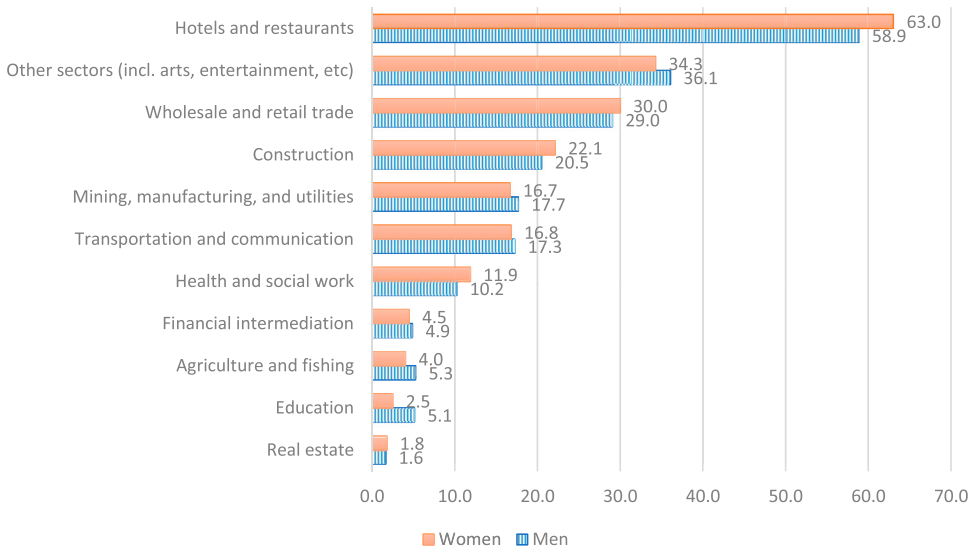
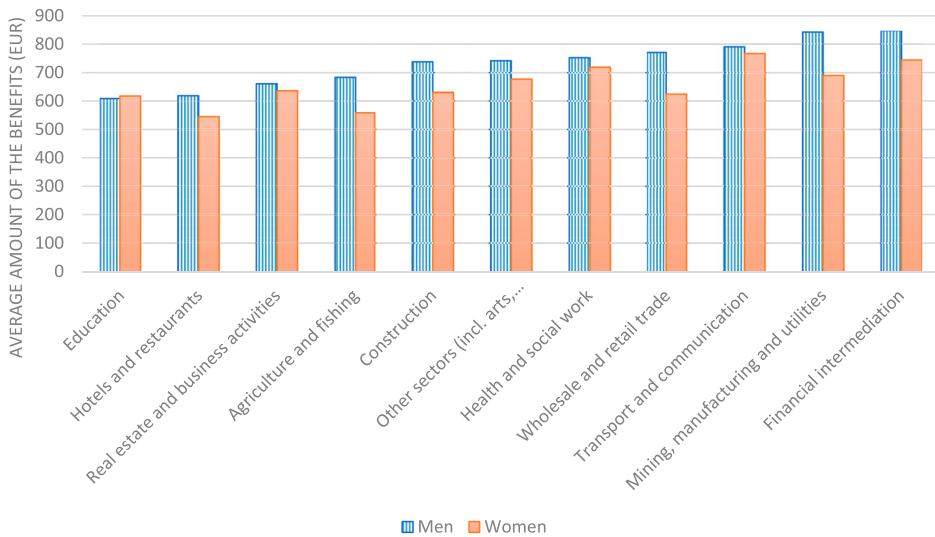


Figure 1. The share of recipients of the wage compensation by economic activity and gender (%) in 2020.

Sources and Notes: Authors’ calculations based on statistics of EUIF and EUROMOD 2019 register-based input data. Here and hereafter other sectors include: arts, entertainment, and recreation; professional, scientific, and technical activities; administrative and support service activities; other service activities; those whose economic activity is unknown.

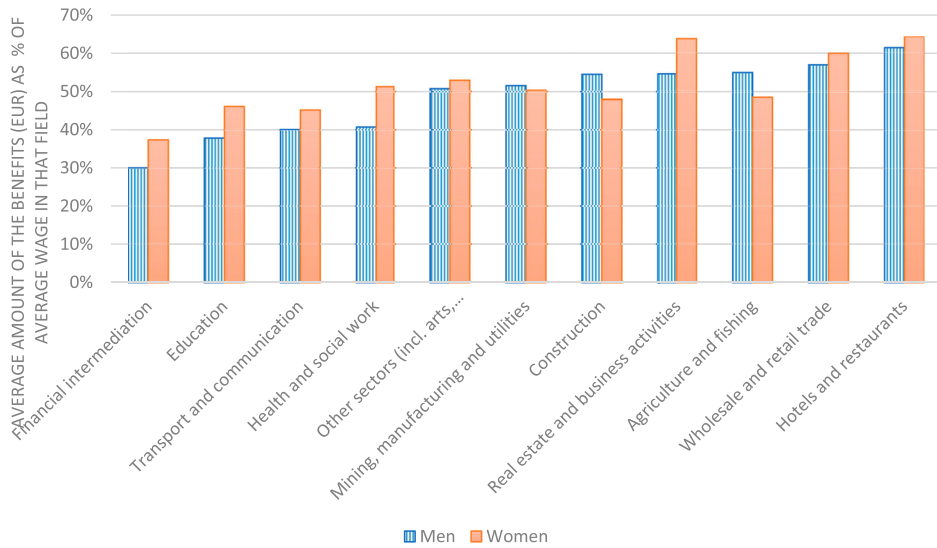


Sources and Notes: EUIF (2021).

Figure 2. Average gross amount of the wage compensation by sector and gender in 2020.

Sources and Notes: EUIF (2021).

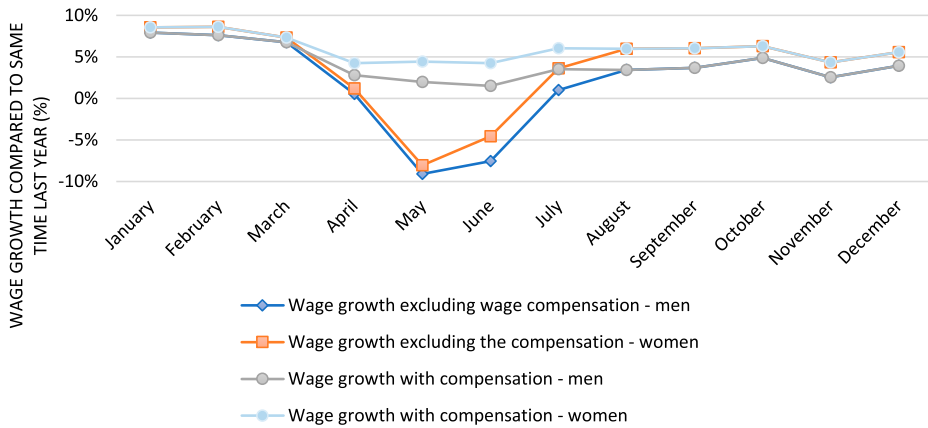
almost all fields. The compensation for women was 52% of their average wage in 2020, but 48% for men. As the replacement rate was constant and the upper limit applied, the wage subsidy was overall regressive in nature.



Sources and Notes: EUIF (2021) and Statistics Estonia (PA5335).

Figure 3. Average gross amount of the wage compensation as a share of the average wage by sector and gender in 2020.

Sources and Notes: EUIF (2021) and Statistics Estonia (PA5335).



Sources: Authors' calculations based on detailed administrative data.

Figure 4. The gross wage growth with and without wage compensation by gender in 2020.

Sources: Authors' calculations based on detailed administrative data.

Comparing the average gross employment income in 2019 and 2020, women's gross wages grew slightly faster than men's (6% vs 4% in average), especially between June and August 2020 (Figure 4). Thus, the ratio of women's wages to men's wages has also increased in that time (Figure 5). However, income related disparities overall changed little in 2020 as the ratio of average wages remained almost at the same level on an



Sources: Authors' calculations based on detailed administrative data.

Figure 5. The ratio of women's average gross wage to men's gross wage by gender in 2020.

Sources: Authors' calculations based on detailed administrative data.

annual basis. Excluding the compensation, the average gross wage is almost 10% smaller in May 2020 compared to the same period in 2019 (see Figure 4). However, this does not affect the ratio of women's wages to men's much (about one percentage point).

In conclusion, the wage compensation measure in Estonia targeted the sectors affected by the crisis and there were more beneficiaries in those sectors. The results of the analysis also showed that without this compensation, the incomes of both men and women would have been significantly lower. However, the effect on the ratio between women's and men's wages appears to have been minor.

4.2 . The effects of the COVID-19 crisis and wage compensation measure on income related gender disparities

As a consequence of the COVID-19 crisis and rising unemployment, household incomes fell sharply and would have fallen further without the wage compensation. In the scenario with the wage compensation, mean employment income decreased by 3.4% among the working age population, but without the wage compensation it would have decreased by 6.3% (see Table 2).⁹ These findings confirm the results of previous studies regarding the negative effect of the crisis on incomes and the cushioning effect of the wage compensation (Almeida et al., 2020; Christl, De Poli, Figari, et al., 2021; Christl, De Poli, Hufkens,

Table 2. The effect of the wage compensation on monthly employment income by gender among the working age population (15–64) in Estonia.

		Mean monthly income in EUR in the no crisis scenario	Mean monthly income in the crisis scenario compared to the no crisis scenario	Mean monthly income in the scenario with the wage compensation measure compared to the no crisis scenario
Employment income	Working age population	1261.8	–6.3%	–3.4%
	Women	1110.9	–6.2%	–3.0%
	Men	1421.8	–6.4%	–3.8%

Sources: Authors' calculations using EUROMOD with 2019 register-based input data.

et al., 2021). According to Almeida et al. (2021) the effect on the equivalised disposable income is even higher – it would have fallen by approximately 15% without the measure, but by 5% with the measure.¹⁰ In the German case, taking the measure into account, household market income decreased by 5% on average (Christl, De Poli, Hufkens, et al., 2021).

Based on our results, the differences between income decreases in the crisis scenario (without the wage compensation) compared with the no crisis scenario for men and women are quite small, i.e. the mean monthly income in the crisis scenario compared to the no crisis scenario would have fallen by 6.2% among women and by 6.4% among men. This is in contrast with previous studies addressing income-related gender disparities as these have found either no such differences or even the opposite pattern, though in all cases the effects on gender differences appear qualitative small. A case-study for Ireland shows that the gender gap in market income did not increase over the course of the pandemic (Doorley et al., 2021), and in the Austrian case, women lost more in terms of market income compared to men (11% vs. 10%) (Christl, De Poli, Kucsera, et al., 2021). Differences in the effect of the compensation schemes between countries can arise not only from the variation in overall tax-benefit systems and implemented compensation measures during the COVID-19 crisis, but also from differences in the situation and living conditions of persons at risk of income loss (see also Cantó et al. (2021)). Furthermore, a comparison of estimates across studies is somewhat complicated due to their differences in income definitions and the methodology (e.g. employment income vs. equivalised disposable income).

In Estonia, it is likely that the net effect of the COVID-19 crisis (with the wage compensation) was more pronounced in men's employment incomes as their wages were higher (see previous section). Moreover, wage compensation was specifically targeted at sectors, where turnover or working hours had fallen. In addition, previous analyses suggest that wage compensation measures provided income support to people on lower incomes (Almeida et al., 2020) and as women have predominantly lower wages than that of men in Estonia, it might also explain why men lost more of employment income. Indeed, the cushioning effect of the measure itself on the average employment income was larger for women and varies more substantively by gender than the effect of the crisis on the whole. The wage compensation reduced loss in the average employment income by 3.2pp for women and by 2.6pp for men (see Table 2, the difference between the second and the third column). The conclusions remain the same when the confidence intervals are considered (Appendix 3).

Moreover, it is important to further examine the effect of the crisis and the wage compensation measure on income by sector, because some sectors were more affected by the crisis than others. The results show that, for both men and women, the negative effect of the crisis was more pronounced among the employees in the hotel and restaurant sector. Thus, without the wage compensation measure, the average employment income would have decreased by 18.5% among women and 17.7% among men (see Table 3). However, when we also consider the compensation measure, the average employment income fell by 4.3% for women and 5.3% for men. The effect of the crisis on employment income is also higher in the wholesale and retail trade sector. It can be seen again that, although the negative effect of the crisis on employment income in these sectors was initially greater among women, the cushioning effect is also much higher for women. Thus, the combined

Table 3. The effect of the wage compensation on monthly mean employment income by gender and economic activity among the working age population (15–64) in Estonia.

		Mean income in EUR in the no crisis scenario	Mean income in the crisis scenario compared to the no crisis scenario	Mean income in the scenario with the wage compensation measure compared to the no crisis scenario	
Women	Agriculture and fishing	949.7	–1.5%	–0.8%	
	Mining, manufacturing, and utilities	805.1	–7.6%	–4.2%	
	Construction	1056.9	–6.7%	–3.0%	
	Wholesale and retail trade	974.4	–9.0%	–3.2%	
	Hotels and restaurants	694.7	–18.5%	–4.3%	
	Transportation and communication	1442.4	–5.0%	–2.5%	
	Financial intermediation	1910.1	–1.6%	–1.0%	
	Real estate	1076.6	–1.4%	–1.1%	
	Education	1268.9	–1.2%	–0.7%	
	Health and social work	1410.1	–3.7%	–1.9%	
	Other sectors (incl. arts, entertainment, etc)	1249.3	–11.5%	–6.3%	
	Men	Agriculture and fishing	1166.4	–1.9%	–1.0%
		Mining, manufacturing, and utilities	1232.9	–7.0%	–4.1%
Construction		1268.6	–6.4%	–3.0%	
Wholesale and retail trade		1439.9	–8.2%	–3.9%	
Hotels and restaurants		815.2	–17.7%	–5.3%	
Transportation and communication		1700.9	–4.8%	–2.6%	
Financial intermediation		3044.9	–1.5%	–1.1%	
Real estate		1407.1	–1.4%	–1.1%	
Education		1583.0	–1.6%	–1.0%	
Health and social work		1988.5	–3.3%	–2.2%	
Other sectors (incl. arts, entertainment, etc)		1585.4	–14.9%	–11.4%	

Sources and Notes: Authors' calculations using EUROMOD with 2019 register-based input data.

negative effect of the crisis and the measure is in fact more pronounced for men. Again, the conclusions remain the same when the confidence intervals are also considered (Appendix 3).

As the social protection system provides additional support to employees and unemployed in the event of a labour market crisis, we consider interactions with the entire tax and benefit systems by assessing the effect of the crisis and the compensation measure also on household disposable incomes. The analysis reveals that the effect of the crisis and wage compensation on disposable income is approximately equal among men and women. This can be explained by the fact that at the household level the effects of the crisis seem to be smoothed out to some extent. For example, while one household member loses a job, another one continued to work. Previous research has also found that the general tax-benefit system plays an important role in cushioning the negative

effect of the COVID-19 crisis in market income and reducing gender differences (Christl, De Poli, Kucsera, et al., 2021).

To conclude, our case study of Estonia shows that the total negative effect of the crisis and the measure on the average monthly employment income is slightly greater among men. Moreover, the cushioning effect of the wage compensation was found to be higher among women, particularly in sectors more affected by the crisis such as hotels and restaurants, wholesale and retail trade. Thus, the wage compensation measure has contributed to preventing an increase in income-related gender disparities.

5. Summary and conclusions

The COVID-19 crisis has had an enormous impact on many areas of life, including the labour market and the social welfare system. To mitigate the negative economic effects of the COVID-19 outbreak, the Estonian Unemployment Insurance Fund provided a wage compensation to employers significantly affected by the crisis from March to June 2020. This study assesses the effect of the crisis and implemented wage compensation measure on employment income by focusing on income-related gender disparities in Estonia – a country with the highest gender wage gap within the European countries.

The results of the study confirm that the crisis has reduced employment income, but the wage compensation measure has effectively mitigated its adverse effects. Previous studies focusing on gender aspect have shown that women were more affected by the crisis in terms of labour market outcomes or work-life balance. Few studies address income-related gender disparities in other countries, but the findings vary (Christl, De Poli, Kucsera, et al., 2021; Doorley et al., 2021). Differences in the results could be related to the fact that the COVID-19 crisis might have had a different impact across countries as there are variations in the tax-benefit systems, implemented policy measures, living conditions of persons, etc.

In the case of Estonia, we show that the wage compensation measure implemented in 2020 contributed to preventing the income-related gender disparities increasing further, particularly in sectors where the share of female employment was higher, i.e. the hotels and restaurants sector and wholesale and retail trade sector. Moreover, it appears that at the aggregate level (across all sectors) the employment income losses were somewhat higher among men in the crisis scenario (without the wage compensation) and the cushioning effect of the wage compensation was higher for women. As a result, the combined effect of the COVID-19 crisis and the wage compensation measure showed that the income-related gender disparities did not change significantly during the crisis.

Although a significant share of women was employed in the vulnerable sectors, the negative effect of the crisis on employment income was smaller for them, as the measures implemented in response to the COVID-19 crisis also targeted these sectors. The differences may be caused by the high gender wage gap in Estonia as men with higher incomes have lost relatively more than women – this measure was regressive in nature.

We can conclude that the implementation of such a measure in a crisis situation was necessary to partly stem the sudden loss of incomes and managed to achieve that. Although it was not aimed directly at reducing gender disparities, the design of the measure efficiently targeted the sectors most affected by the crisis and restrictions.

It can be assumed that there would have been an even greater negative impact on the tourism and services sector and therefore on gender disparities in the long run, if there had not been any compensation. Still, studies on the Great Recession show that the impact of the crisis on the pay gap may take time to realize. Therefore, this topic needs further investigation to assess the long-term effects of the crisis and implemented measures.

Notes

1. Eurostat database (2021). Gender pay gap unadjusted form [SDG_05_20].
2. Eurostat database (2021). Gender pay gap unadjusted form [SDG_05_20].
3. Eurostat database (2021). Employment rates by sex, age and citizenship (%) [lfsq_ergan] and Unemployment rates by sex, age and citizenship (%) [lfsq_organ].
4. The employers were required to meet at least two of the following three conditions from March to May: (i) the employer's turnover was at least 30% lower compared to the same month in 2019; (ii) the employer could not provide the agreed amount of work for at least 30% of its employees; (iii) the employer had to cut the salary of at least 30% of its employees at least by 30%. To be eligible for compensation in June, these figures had to decrease by 50% compared to the same month in 2019.
5. European Union Statistics on Income and Living Conditions (EU-SILC).
6. EUROMOD input dataset for Estonia that is compiled from national registers contains data from 17 different datasets. Most variables come from the Register of Taxable Persons, but also from the Social Services and Benefits Register.
7. This module is referred to as the Labour Market Adjustment (LMA) add-on. After specifying which individuals require modelling of changes in their incomes and the type of transition (e.g. from employment to monetary compensation), the add-on adjusts relevant variables in the model, e.g. reduces employment income and duration, the wage compensation is considered when calculating income tax, granting unemployment allowance or subsistence benefits. determines unemployment duration and activates the simulation of unemployment benefits. More information about the add-on can be found in 'Summary note for EUROMOD Labour Market Adjustment Add-On', available at: <https://euromod-web.jrc.ec.europa.eu/sites/default/files/2021-02/LMA%20Add-On%20Documentation.pdf>.
8. A total of 137,500 people received the compensation. Taking approximately one-sixth of the 137,500 employees who received benefits (the benefit was received for approximately 2 months out of 12 months), we get a fairly similar number of 23,000.
9. With population data, there is in principle no uncertainty due to statistical sampling and hence standard errors are not needed to reflect that. However, taking a conservative approach, we have also provided confidence intervals for our main estimates in Appendix 3. Among others, these can also indicate sensitivity to extreme outliers and influences of certain observations in case their sample weight becomes unusually large after reweighting.
10. According to Almeida et al. (2020), the equivalised disposable income would have fallen by approximately 6–7% without the measure, but by 5% with the measure.

Acknowledgements

The authors of this publication are very thankful to Kaupo Koppel for his feedback and valuable suggestions. In addition, this paper is partly based on the data and methodology used by Merilen Laurimäe and Kaupo Koppel for the RITA project 'Assessing the Economic Impact of COVID-19 and the Effectiveness of Mitigation Policies'. The authors are also grateful for the support and comments they received during the cooperation within in the research projects "The economic integration of the Nordic-Baltic region through labor-, innovation, investments and trade" (LIFT) and Cost Action CA18214 "The geography of New Working Spaces and impact on the periphery". Additionally,

the authors want to thank anonymous reviewers for their insightful comments, which helped to improve the paper a lot. The content of this publication represents the views of the authors only and is their sole responsibility.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This paper is partly based on the research (methodology and data) carried out by Merilen Laurimäe and Kaupo Koppel for the RITA project ‘Assessing the Economic Impact of COVID-19 and the Effectiveness of Mitigation Policies’ (Koppel & Laurimäe, 2021), which was funded by the Estonian Research Council (RITA1/02-132-02).

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Data availability statement

The analysis uses administrative data that are not publicly available. Use of the administrative data requires permission from the Data Protection Inspectorate that issued a permit for the processing of personal data without the consent of data subjects for the RITA1 project on 13.01.2021 (application submitted on 27.11.2020, decision no. 2.2. 1/20/22). In the application on which the permit is based, it was permitted to process the data until April 30, 2022. On 10.02.2022, an application was submitted to extend the term of use of the data for research purposes until 1 January 2023, which was approved by the Data Protection Inspectorate on 11 March 2022.

In addition, in this study EUROMOD version I3.0+ is used with register-based EUROMOD input data that was prepared and made available by Statistics Estonia. EUROMOD version I3.0+ is made available by the Joint Research Centre.

Stata codes used for the analysis are available on request.

Ethics declarations

The permission of the Ethics Committee of the Ministry of Social Affairs was also requested for the use of administrative data (within the framework of the RITA1 project mentioned above). The Ethics Committee assessed the application according to the form submitted to the Data Protection Inspectorate. The application was approved by the Temporary Ethics Committee for Research and Analysis in the Social and Labour Field of the Ministry of Social Affairs with protocol nr 5 (electronic meeting).

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Appendices

Appendix 1

Table A1. The number of recipients of wage compensation and average amount of the benefit in EUR by economic activity and gender in Estonia.

Industry	Number of wage compensation recipients		Average amount of the benefit in EUR	
	Men	Women	Men	Women
Agriculture and Fishing	759	263	681	558
Construction	9038	1164	735	628
Education	545	1249	608	617
Financial intermediation	138	281	845	742
Health and social work	608	4368	750	716
Hotels and restaurants	4862	13447	618	544
Mining, manufacturing, and utilities	20910	14824	839	688
Other sectors (incl. arts, entertainment, etc)	9326	14215	739	674
Real estate and business activities	625	749	658	634
Transport and communication	7965	3564	788	764
Wholesale and retail trade	11091	17477	768	623
Total	65867	71601	751	632

Source: EUIF (2021).

Appendix 2

Table A2. Reweighting in EUROMOD input data.

	Variables in EUROMOD	Value in a baseline scenario	Value in a crisis scenario	Value in a scenario with work compensation
People in employment based on economic sector	yemmy > lunmy & yemmy > 0 lindi is used to define economic sectors	21,327 in agriculture; 192,941 in manufacturing; 457,872 in services	19,500 in agriculture; 191,300 in manufacturing; 445,800 in services	19,500 in agriculture; 191,300 in manufacturing; 445,800 in services
People in unemployment	lunmy > yemmy & lunmy > 0	32,935	47,900	47,900
Unemployment benefit receivers	(bunctmy > 0 bunnmy > 0) & bunctmy + bunnmy > yemmy	~49% of the unemployed	~57% of the unemployed	~57% of the unemployed
Gender	Dgn	Constant	Constant	Constant
Age groups (0–15, 16–40, 41–65, 65+)	Dag	Constant	Constant	Constant

Source: compiled by the authors.

Notes: yemmy – number of months with employment income; lunmy – unemployment months; bunctmy – number of months receiving unemployment insurance benefit; bunnmy – number of months receiving unemployment allowance; dgn – gender; dag – age.

Appendix 3

Table A3.1. Mean monthly employment income (EUR) and confidence intervals (CI) by gender and economic activity among the working age population (15–64) in Estonia.

	No crisis scenario		Crisis scenario		Scenario with the wage compensation	
	Mean income	95% CI	Mean income	95% CI	Mean income	95% CI
Working age population	1261.8	1258.7 1264.8	1182.3	1179.3 1185.3	1218.6	1215.6 1221.6
Women	1110.9	1107.7 1114.2	1042.4	1039.2 1045.6	1077.5	1074.3 1080.7
Men	1421.8	1416.6 1427.0	1330.8	1325.8 1335.9	1368.3	1363.3 1373.4
Women Agriculture and fishing	949.7	930.6 968.9	935.2	916.1 954.2	942.2	923.2 961.3
Women Mining, manufacturing, and utilities	805.1	798.7 811.4	743.8	737.7 750.0	771.3	765.1 777.4
Women Construction	1056.9	1031.9 1081.8	985.8	961.7 1009.8	1025.4	1001.4 1049.5
Women Wholesale and retail trade	974.4	967.8 981.1	887.2	880.8 893.5	942.9	936.6 949.3
Women Hotels and restaurants	694.7	686.7 702.6	566.4	559.4 573.4	664.8	657.6 672.1
Women Transportation and communication	1442.4	1426.3 1458.6	1370.4	1354.7 1386.0	1406.3	1390.7 1422.0
Women Financial intermediation	1910.1	1879.2 1941.1	1879.9	1849.1 1910.7	1891.9	1861.2 1922.6
Women Real estate	1076.6	1066.3 1086.9	1061.1	1050.8 1071.3	1064.7	1054.4 1074.9
Women Education	1268.9	1262.0 1275.7	1253.4	1246.5 1260.2	1260.1	1253.3 1267.0
Women Health and social work	1410.1	1397.4 1422.9	1358.0	1345.6 1370.4	1383.4	1371.0 1395.7
Women Other sectors (incl. arts, entertainment, etc)	1249.3	1240.3 1258.3	1105.7	1097.2 1114.3	1170.6	1162.0 1179.2
Men Agriculture and fishing	1166.4	1148.9 1184.0	1144.8	1127.3 1162.3	1155.1	1137.6 1172.5
Men Mining, manufacturing, and utilities	1232.9	1224.9 1240.9	1147.1	1139.4 1154.8	1182.4	1174.8 1190.1
Men Construction	1268.6	1257.5 1279.7	1187.8	1177.0 1198.7	1230.8	1220.0 1241.7
Men Wholesale and retail trade	1439.9	1425.9 1454.0	1322.2	1308.9 1335.4	1383.9	1370.6 1397.2
Men Hotels and restaurants	815.2	798.1 832.2	670.6	655.9 685.4	771.8	756.6 787.0
Men Transportation and communication	1700.9	1685.9 1715.8	1618.4	1603.8 1633.0	1656.3	1641.7 1670.9
Men Financial intermediation	3044.9	2950.6 3139.2	2999.9	2907.1 3092.6	3012.7	2919.9 3105.4
Men Real estate	1407.1	1385.8 1428.4	1387.6	1366.4 1408.9	1391.7	1370.5 1412.9

(Continued)

Table A3.1. Continued.

	No crisis scenario			Crisis scenario			Scenario with the wage compensation		
	Mean income	95% CI		Mean income	95% CI		Mean income	95% CI	
Education	1583.0	1556.2	1609.8	1558.0	1531.4	1584.5	1567.5	1540.9	1594.0
Health and social work	1988.5	1927.2	2049.9	1923.8	1865.1	1982.5	1944.8	1886.1	2003.5
Other sectors (incl. arts, entertainment, etc)	1585.4	1569.3	1601.5	1348.6	1333.1	1364.1	1405.0	1389.6	1420.5

Source: compiled by the authors.

Table A3.2. Change in mean monthly employment income (EUR) in different scenarios and confidence intervals (CI) by gender and economic activity among the working age population (15–64) in Estonia.

	No crisis scenario			Crisis scenario			Scenario with the wage compensation		
	Mean income	95% CI		Change	95% CI		Change	95% CI	
Working age population	1261.8	1258.7	1264.8	-6.3%	-6.3%	-6.3%	-3.4%	-3.4%	-3.4%
Women	1110.9	1107.7	1114.2	-6.2%	-6.2%	-6.2%	-3.0%	-3.0%	-3.0%
Men	1421.8	1416.6	1427.0	-6.4%	-6.4%	-6.4%	-3.8%	-3.8%	-3.8%
Women									
Agriculture and fishing	949.7	930.6	968.9	-1.5%	-1.6%	-1.5%	-0.8%	-0.8%	-0.8%
Mining, manufacturing, and utilities	805.1	798.7	811.4	-7.6%	-7.6%	-7.6%	-4.2%	-4.2%	-4.2%
Construction	1056.9	1031.9	1081.8	-6.7%	-6.8%	-6.7%	-3.0%	-3.0%	-3.0%
Wholesale and retail trade	974.4	967.8	981.1	-9.0%	-9.0%	-8.9%	-3.2%	-3.2%	-3.2%
Hotels and restaurants	694.7	686.7	702.6	-18.5%	-18.5%	-18.4%	-4.3%	-4.2%	-4.3%
Transportation and communication	1442.4	1426.3	1458.6	-5.0%	-5.0%	-5.0%	-2.5%	-2.5%	-2.5%
Financial intermediation	1910.1	1879.2	1941.1	-1.6%	-1.6%	-1.6%	-1.0%	-1.0%	-1.0%
Real estate	1076.6	1066.3	1086.9	-1.4%	-1.5%	-1.4%	-1.1%	-1.1%	-1.1%
Education	1268.9	1262.0	1275.7	-1.2%	-1.2%	-1.2%	-0.7%	-0.7%	-0.7%
Health and social work	1410.1	1397.4	1422.9	-3.7%	-3.7%	-3.7%	-1.9%	-1.9%	-1.9%
Other sectors	1249.3	1240.3	1258.3	-11.5%	-11.5%	-11.4%	-6.3%	-6.3%	-6.3%
Men									
Agriculture and fishing	1166.4	1148.9	1184.0	-1.9%	-1.9%	-1.8%	-1.0%	-1.0%	-1.0%
Mining, manufacturing, and utilities	1232.9	1224.9	1240.9	-7.0%	-7.0%	-6.9%	-4.1%	-4.1%	-4.1%
Construction	1268.6	1257.5	1279.7	-6.4%	-6.4%	-6.3%	-3.0%	-3.0%	-3.0%
Wholesale and retail trade	1439.9	1425.9	1454.0	-8.2%	-8.2%	-8.2%	-3.9%	-3.9%	-3.9%
Hotels and restaurants	815.2	798.1	832.2	-17.7%	-17.8%	-17.6%	-5.3%	-5.2%	-5.4%
Transportation and communication	1700.9	1685.9	1715.8	-4.8%	-4.9%	-4.8%	-2.6%	-2.6%	-2.6%
Financial intermediation	3044.9	2950.6	3139.2	-1.5%	-1.5%	-1.5%	-1.1%	-1.0%	-1.1%
Real estate	1407.1	1385.8	1428.4	-1.4%	-1.4%	-1.4%	-1.1%	-1.1%	-1.1%
Education	1583.0	1556.2	1609.8	-1.6%	-1.6%	-1.6%	-1.0%	-1.0%	-1.0%
Health and social work	1988.5	1927.2	2049.9	-3.3%	-3.2%	-3.3%	-2.2%	-2.1%	-2.3%
Other sectors	1585.4	1569.3	1601.5	-14.9%	-15.1%	-14.8%	-11.4%	-11.5%	-11.3%

Source: compiled by the authors.