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The Returns to Education over Time and the Effect of COVID-19

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ABSTRACT

The Returns to Education over Time and the Effect of COVID-19*

This paper examines the effects of the COVID-19 pandemic on the returns to education in the United States. Using data from the Current Population Survey 2011-2022, the analysis reveals that, after a period of decline, returns to education increased significantly because of COVID, particularly for men and those with university education. The returns to university for men increased by 1 percentage points. The results underscore the importance of continued investment in education to mitigate the adverse effects of future crises.

JEL Classification: E24, J11, J17, J31

Keywords: pandemics, human capital, returns to education, labor markets, COVID-19

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1 Introduction

COVID-19 was a shock that disrupted the lives of workers around the world and their fate might have been determined by their educational attainment. Research from the financial crises of the 1990s and the late 2000s global recession finds that private rates of return to education increased during crisis years (Chen and Kelly 2020, 2019; Cholezas et al. 2013; Fasih et al. 2021; Fiszbein et al. 2007; Psacharopoulos et al. 1996; Patrinos and Sakellariou 2006). The returns to schooling rise during a crisis as the earnings of those with less education fall due to increased unemployment. At the same time, educated workers are better able to cope with the changing needs of employers (Autor et al. 2014; Oreopoulos et al. 2012; Rosenzweig 1995; Schultz 1975).

Aggregate shocks affect the returns to education (Rosenzweig and Udry 2020). To assess this, one needs to estimate returns over time (many do) and assess impact of shocks (few do) (Angrist and Krueger 1991; Card 1995). There are many estimates of the returns to education for the United States (Card 1999, 2001, 2018; Goldin and Katz 1999; Ryscavage and Henle 1990) showing that the returns to schooling increased significantly from the 1980s until 2011 with historic highs in 2001 (dot com recession) and in 2011 in the aftermath of the Great Recession. After 2011, the returns to education fell into a decreasing trend (Abel and Deitz 2019, 2014; Wolla et al. 2023). The after-effects of the Great Recession lasted long and the incomes of most of the families recovered until 2015 (Saez 2018), when the returns to education exceeded their pre-recession level. The Great Recession increased the rate of return to schooling for both men and women, and the female-male difference in the returns to schooling decreased by 0.4 percentage points in the post-recession period (Chen and Kelly 2019).

During the COVID-19 pandemic, Beuermann et al. (2024) find that increased education causally reduces job loss for females during economic downturns, suggesting that education

enhances worker skills rather than just signaling ability. Chen and Kelly (2024) examine how COVID-19 impacted the rate of return to schooling across 20 US industries, finding varied effects—rate increases in seven industries, decreases in seven, and no change in six.

We estimate the returns to schooling from 2011 to 2022 using surveys conducted before and after the COVID-19 onset to explore if the pandemic shock caused an increase in the premium to education, with a focus on levels of education and gender. The results indicate that the returns to education deviated from their long-term trend and increased during the pandemic. COVID-19 increased the returns to schooling for men and especially for those with university education.

2 Data and Methods

We use the Annual Social and Economic Supplement of the Current Population Survey (CPS). Our period of study goes from 2011 to 2022 to observe the returns trend before and after the pandemic. Since CPS collects annualized income and employment data corresponding to the previous year of its publication, we use the databases published between 2012 and 2023. We estimate hourly wages as a function of schooling and experience for full-time, year-round employees, males and females, ages 15-65 years. The sample means are in Annex Table 1a. We estimate the returns to schooling using the equation (Mincer 1974):

$$\ln W_{it} = \alpha + \beta S_{it} + \gamma_1 EX_{it} + \gamma_2 EX_{it}^2 + \varepsilon_{it} \quad (1)$$

where $\ln W$ is the worker's natural logarithm of hourly wages, S is the number of years of schooling, and EX is years of labor market experience defined as $(age - S - school\ starting\ age(6))$, which is standard in the literature (Patrinos 2024), i is the individual index and t is the year index, β is interpreted as the average return to one more year of schooling, and ε is the error term with its

normal properties. To estimate the returns by level of education for each year from 2011 to 2022, we use the function:

$$\ln W_{it} = \alpha + \beta_1 SEC_{it} + \beta_2 UNI_{it} + \gamma_1 EX_{it} + \gamma_2 EX^2_{it} + \varepsilon_{it} \quad (2)$$

where SEC and UNI refer to secondary and university, while less than secondary is the reference category. After fitting the extended earnings function using the above dummies instead of years of schooling in the earnings function, the private rate of return, r , to secondary and university education are derived from the formulas:

$$r_{SEC} = \frac{\beta_1}{S_{SEC}} \quad (3)$$

$$r_{UNI} = \frac{\beta_2 - \beta_1}{S_{UNI} - S_{SEC}} \quad (4)$$

where S_{SEC} and S_{UNI} stand for the total number of years of schooling completed for those with secondary and university education, assumed to be 12 and 16.

We use these functions to estimate the returns to schooling for each year from 2011 to 2022. To detect significance levels between the years we use the Z-test method developed by Clogg et al. (1995). As a further test, we use the Chen and Kelly (2019, 2024) approach of estimating an extended earnings function with a COVID dummy variable using pooled data:

$$\ln W_{it} = \alpha + \beta_1 SEC_{it} + \beta_2 UNI_{it} + \beta_3 SEC_{it}C + \beta_4 UNI_{it}C + \beta_5 C + \gamma_1 EX_{it} + \gamma_2 EX^2_{it} + \delta T_t + \varepsilon_{it} \quad (5)$$

where $SEC \cdot C$ and $UNI \cdot C$ and are interaction terms of the university and secondary dummy variables and the COVID dummy, with a value of 1 for years 2020-2022 and 0 otherwise. In this

case, the rate of return to secondary and university schooling can be computed with the following functions:

$$r_{SEC} = \frac{\beta_1 + \beta_3 C}{S_{SEC}} \quad (6)$$

$$r_{UNI} = \frac{(\beta_2 + \beta_4 C) - (\beta_1 + \beta_3 C)}{S_{UNI} - S_{SEC}} \quad (7)$$

where β_1/S_{SEC} is a measure of the return to secondary in the pre-COVID period of 2011-2019, and the sum of the coefficients, $(\beta_1 + \beta_3)/S_{SEC}$, measures the returns during COVID and beyond, while β_3/S_{SEC} indicates the difference in the returns between the two periods. The measure of the return to university in the pre-COVID period of 2011-2019 is $(\beta_2 - \beta_1)/(S_{UNI} - S_{SEC})$ and the sum of the coefficients, $((\beta_2 + \beta_4) - (\beta_1 + \beta_3))/(S_{UNI} - S_{SEC})$ measures the returns during COVID and beyond, while $(\beta_4 - \beta_3)/(S_{UNI} - S_{SEC})$ indicates the difference in the returns between the two periods.

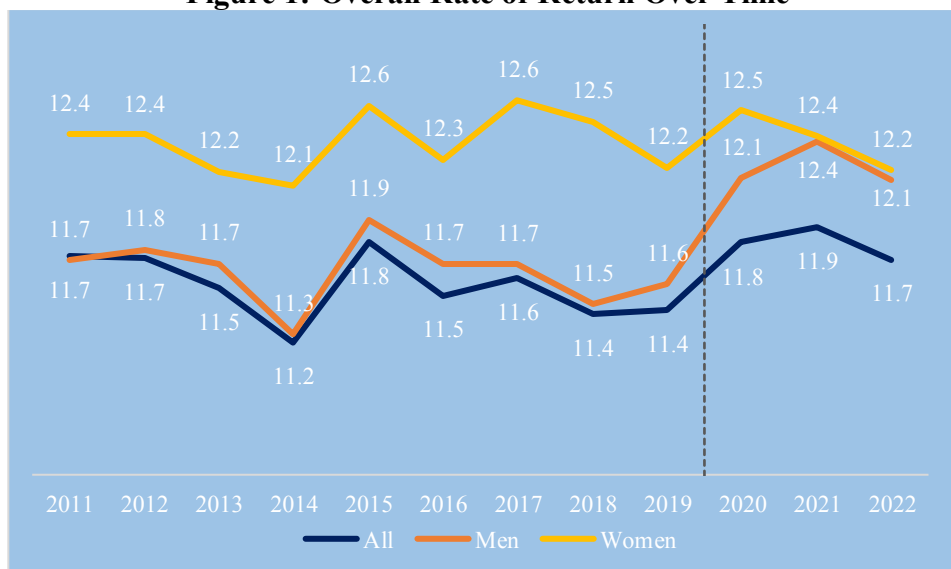
3 Results

Over the past decade, the returns to schooling have remained stable (Figure 1) and high by international standards. Overall, in 2022, they are 11.7 percent, which is the same as in 2011. However, there have been small increases and decreases over time. Just prior to the pandemic, in 2019, the average returns to schooling were 11.4 percent. The average return to a year of schooling increased during the pandemic and beyond. Although this is above the global average of 10 percent (Gunderson and Oreopoulos 2020; Psacharopoulos and Patrinos 2018), the average returns in 2019 were the second lowest in the decade of 2010 since the returns to schooling were on a decreasing trend during that period.

Nonetheless, the overall return to schooling increased significantly with respect to its pre-pandemic level of 11.4 in 2019 to 11.8 and 11.9 in 2020 and 2021 and remained above its pre-

pandemic level at 11.7 in 2022. These changes are significant (Annex Table 2) and larger than the changes that occurred earlier. In 2021, the average return to schooling increased by 0.5 percentage points in comparison to 2019. By 2022, the average return was 11.7 percent, which is the same as it was in 2011. The increase in the returns to schooling for men was also significant and even higher, reaching a peak of 12.4 percent in 2021 and remaining above pre-pandemic levels at 12.1 in 2022. The average return to a year of schooling increased by 0.8 percentage points relative to 2019. For women, the returns also increased during the first two years of the pandemic from 12.2 in 2019 to 12.5 and 12.4 in 2020 and 2021, respectively. However, those changes were not significant and female returns went back to their pre-pandemic level in 2022.

Figure 1: Overall Rate of Return Over Time

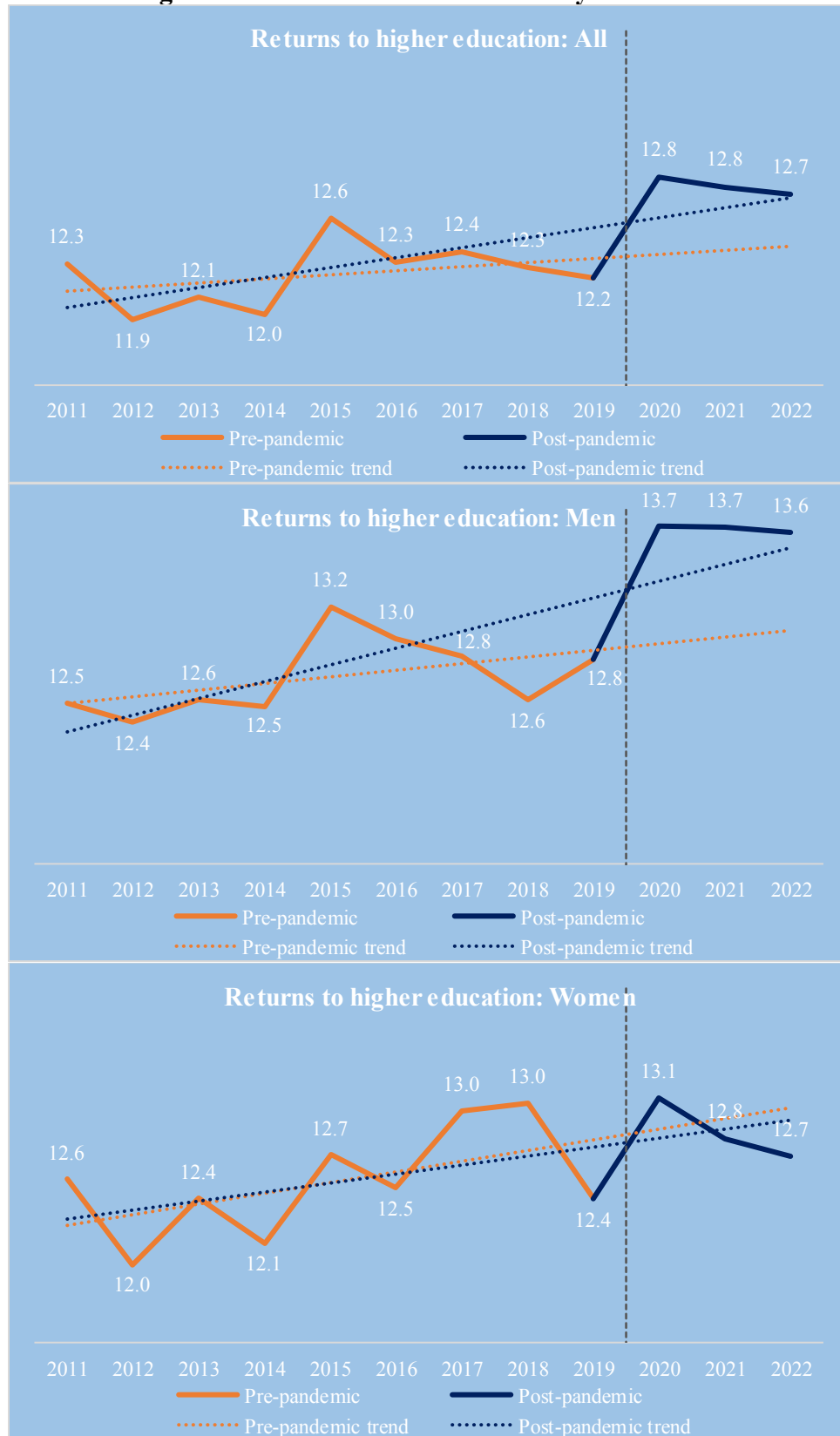


We use the extended earnings functions to estimate the returns to schooling by level. In this case, we compare university to secondary, and secondary to less than complete secondary. The coefficients on university suggest that the returns increased during the pandemic and remained above their pre-pandemic levels, particularly for men. The coefficients on secondary were always low and much lower than they are for other levels. The previously stable trend in university

education shifted to an upward trajectory with the onset of the pandemic in 2020 (Figure 2). The returns to university education deviate more than the overall returns, declining for some time, then increasing after COVID-19 more than the overall returns did. The onset of the pandemic put the returns to university on an upward trend, exceeding the maximum value they achieved in 2015. This was especially true for university-educated men as their returns increase by 0.8 to 0.9 percentage points relative to 2019 with the onset of the pandemic, which was higher than the increase that occurred between 2014 and 2015. The returns to university increased more than the average returns to another year of schooling, while the returns to secondary continued their downward trend, suggesting that the returns are driven by the supply and demand for university education. Although the returns to university for women also increased with the onset of the pandemic, these changes were not significant. Prior to the pandemic, the difference between the returns to university for men and women was of 0.4 percent in benefit of men. But that difference increased even more after the pandemic with the returns to university almost a percentage point higher for men than for women in 2021 and 2022.

We also pool the data to detect the impact of COVID-19 more precisely on the returns (see Table 1). Overall, the rate of return to schooling for the period of 2011-2022 is 11.4 percent. For men it is 11.5 and for women it is 12.3 percent. COVID-19 had a negative effect on wages, but not for women. The interaction between schooling and COVID shows that the returns increased post-pandemic, especially for men. There was no significant change in the returns to schooling for women, but they did not decline either. The rate of return to schooling increased to 11.8 percent overall, a 3.8 percent change. The increase was higher for men, from 11.5 to 12.2 percent, an increase of 6.5 percent. For women, the changes were small and insignificant.

Figure 2: Rate of Return to University Over Time



Source: Own estimations based on CPS 2011-2022.

By level of education, the returns to secondary are extremely low and slightly decreasing, and COVID-19 had no impact on them. The returns to university, on the other hand, are high and increased due to COVID, although the change for women was not significant. The returns to university were 12.2 percent overall, and increased to 12.8 percent due to COVID-19, a 5 percent increase. The returns to schooling for both men and women increased but the impact of COVID was not significant for women, though it was positive but small. For men, the increase was substantial, from 12.7 percent before COVID to 13.7 percent after COVID, an increase a full percentage point, or almost 8 percent.

Table 1: The Percent Change in Returns by Education Level

		Returns before COVID-19 (%)	Returns after COVID-19 (%)	Percent change
<i>All</i>	Years of schooling	11.4	11.8	3.8%
	Secondary	2.4	2.4	ns
	University	12.2	12.8	5.0%
<i>Men</i>	Years of schooling	11.5	12.2	6.5%
	Secondary	2.6	2.5	ns
	University	12.7	13.7	7.9%
<i>Women</i>	Years of schooling	12.3	12.2	ns
	Secondary	2.6	2.7	ns
	University	12.7	12.9	ns

Notes: ns = not significant; full regression results in Annex Table 4
Source: Own estimations based on CPS 2011-2022.

The returns to schooling for women did not decline, but they also did not increase as the returns to schooling for men did after the pandemic. The overall returns to schooling and the returns to university for women were similar and stable, until about 2015 when the aftermath of the Great Recession played out. From then on, the returns to university increased for women until 2019 when there was a noticeable blip, before increasing after COVID-19, though the increase is not statistically significant. Meantime, the returns to schooling for men significantly increased to

the level of women's and the returns for university male graduates exceeded and remained well above those of women after the pandemic shock. It could be that women were not protected from the negative effects of the pandemic because of their job losses since they are concentrated in heavily affected sectors such as restaurants (Alon et al. 2020), which is specially the case of less educated women. Childcare needs caused by school and daycare closures could also have negatively affected labor market prospects of women independently of their education level. If women had to take time off work or devote more time to address child schooling needs during the closures, then this could explain why the returns did not increase. It has been shown elsewhere that children's school schedules contribute to the persistence of the gender pay gap between parents (Duchini and Van Effenterre 2024). Even if working women who were university-educated and could work from home, they still had to experience the stress of educating their children and this could have led to lower returns compared to men (Goldin 2022). Early on during the pandemic it was shown that school and childcare closures increase negative wage impacts for married mothers (Drozd et al. 2024). One can say that the returns to women's education have been very stable over time, compared to men, and this warrants further analysis.

4 Discussion

The returns to schooling were on a downward trend in the United States. This is not surprising given the continued increase in the educational levels of the workforce. However, during COVID-19 the returns increased significantly, especially for those with university education and men. The earnings of workers with less schooling and lower-order skills are more vulnerable to crises in comparison to skilled workers, which is likely to contribute to persistent wage inequality. In contrast, skilled workers – those with university – are better at learning new skills and adapting to different conditions. In economies undergoing technological change educated workers are better

at learning new skills and adapting to different work conditions (Schultz 1975). The labor market puts a premium on these skills, which protects skilled workers. This difference in the abilities to adjust to the labor market disequilibria due to a crisis has implications for income inequality reflecting on widening earnings gaps, which are likely to persist and have intergenerational consequences on educational attainment and income. This is consistent with canonical human capital theory suggesting that education reduces the likelihood that a worker will be laid off during times of economic change (Farber 2005, 2015). It seems counter-intuitive that fewer young people are enrolled in college today than a decade ago (Fry 2023).

5 Conclusion

This paper investigates the relationship between earnings and education in the United States. The time series feature of the data allows us to assess how the returns to education behave in a country during the COVID-19 pandemic shock. The results indicate that the returns to education deviated from their long-term decline and increased during the pandemic and the early recovery. The returns were higher for men and especially for university-educated men. Using data from the Current Population Survey 2011-2022, the analysis reveals that, after a period of decline, returns to education increased significantly during the pandemic, particularly for men and those with university. The returns to university for men increased by 1 percentage points, or 8 percent. As a result, the returns to schooling are now higher for men than for women.

Human capital theory suggests that education improves workers' ability to learn new skills and adapt to different work conditions. A sizable portion of the economic return to schooling is attributed to the enhancement of these abilities through education. Our estimates of the returns to schooling using surveys conducted before and after the COVID-19 onset suggest that the pandemic caused an increase in the premium to education. The deviation in the returns to education from

their long-term trend gives credence to human capital theories suggesting that a significant portion of the returns to schooling are due to worker ability to navigate change during crises. The fact that private rates of return to university education rise during a crisis suggests that education enhances worker skills.

Though tested during the COVID-19 crisis, our results could be useful for other crises. Higher levels of schooling are likely to protect future workers from the detrimental effects of economic downturns. However, for women, economic shutdowns and school and daycare closures are unlikely to be fully mitigated with more education. This makes it imperative that people continue to invest in schooling, during downturns and economic booms. This will make them resilient and provide them with a tool which protects them during times of uncertainty.

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Annex Table 1a: Sample Means Yearly Regressions

Variable	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Pooled
<i>All</i>													
Hours worked per week	43.2 (7.5)	43.3 (7.6)	43.1 (7.2)	43.3 (7.5)	43.2 (7.4)	43.2 (7.3)	43.1 (7.3)	43.1 (7.2)	42.9 (7.0)	42.8 (6.9)	42.8 (6.9)	42.7 (6.8)	42.8 (7.0)
Age	41.4 (11.9)	41.4 (12.0)	41.4 (12.1)	41.3 (12.2)	41.3 (12.3)	41.1 (12.3)	41.0 (12.3)	41.0 (12.4)	41.1 (12.4)	41.2 (12.4)	41.2 (12.4)	40.9 (12.4)	41.1 (12.4)
Experience	21.4 (12.1)	21.3 (12.2)	21.3 (12.2)	21.3 (12.4)	21.2 (12.5)	21.0 (12.5)	20.8 (12.5)	20.8 (12.6)	20.8 (12.6)	20.8 (12.6)	20.8 (12.6)	20.6 (12.6)	20.8 (12.6)
Years of schooling	14.0 (2.7)	14.1 (2.7)	14.1 (2.7)	14.1 (2.7)	14.1 (2.7)	14.1 (2.7)	14.2 (2.7)	14.2 (2.7)	14.3 (2.7)	14.5 (2.7)	14.4 (2.7)	14.4 (2.7)	14.3 (2.7)
Earnings*	55,075 (56,783)	55,320 (53,220)	56,341 (54,158)	56,901 (54,850)	59,022 (57,482)	60,938 (60,934)	62,226 (61,779)	63,811 (60,387)	67,993 (68,282)	71,556 (65,936)	72,503 (69,908)	76,035 (72,698)	67,572 (64,902)
<i>Men</i>													
Hours worked per week	44.3 (8.2)	44.3 (8.2)	44.0 (7.9)	44.3 (8.3)	44.1 (8.0)	44.0 (7.9)	44.0 (7.9)	44.0 (7.8)	43.7 (7.6)	43.6 (7.5)	43.5 (7.4)	43.4 (7.3)	43.6 (7.5)
Age	41.2 (11.9)	41.1 (12.0)	41.2 (12.1)	41.2 (12.1)	41.1 (12.2)	41.1 (12.3)	40.9 (12.3)	40.9 (12.4)	41.1 (12.4)	41.1 (12.4)	41.2 (12.4)	40.9 (12.4)	41.0 (12.4)
Experience	21.3 (12.0)	21.2 (12.0)	21.3 (12.1)	21.3 (12.2)	21.2 (12.3)	21.1 (12.4)	20.9 (12.4)	20.9 (12.5)	21.0 (12.5)	20.9 (12.5)	21.1 (12.5)	20.9 (12.5)	21.0 (12.5)
Years of schooling	13.9 (2.8)	13.9 (2.8)	13.9 (2.8)	13.9 (2.8)	13.9 (2.8)	13.9 (2.8)	14.0 (2.8)	14.0 (2.8)	14.1 (2.8)	14.2 (2.8)	14.1 (2.8)	14.1 (2.8)	14.1 (2.8)
Earnings*	62,286 (64,621)	62,085 (60,883)	63,186 (60,160)	63,840 (61,796)	65,928 (64,502)	68,185 (69,448)	69,039 (66,820)	70,817 (65,851)	75,824 (75,996)	79,403 (74,198)	80,066 (78,966)	84,006 (81,544)	74,923 (72,453)
<i>Women</i>													
Hours worked per week	41.8 (6.1)	42.0 (6.5)	41.9 (6.0)	41.9 (6.1)	42.0 (6.3)	42.1 (6.3)	42.0 (6.3)	41.9 (6.1)	41.9 (6.0)	41.8 (5.9)	41.9 (6.0)	41.8 (6.0)	41.8 (6.0)
Age	41.6 (12.0)	41.8 (12.0)	41.7 (12.2)	41.5 (12.3)	41.5 (12.3)	41.2 (12.4)	41.2 (12.4)	41.1 (12.5)	41.1 (12.4)	41.4 (12.4)	41.2 (12.4)	40.9 (12.4)	41.1 (12.4)
Experience	21.5 (12.3)	21.5 (12.4)	21.4 (12.5)	21.2 (12.6)	21.2 (12.6)	20.8 (12.7)	20.8 (12.7)	20.5 (12.8)	20.5 (12.7)	20.6 (12.7)	20.5 (12.7)	20.3 (12.7)	20.5 (12.7)
Years of schooling	14.2 (2.6)	14.3 (2.6)	14.3 (2.6)	14.3 (2.6)	14.4 (2.6)	14.4 (2.6)	14.5 (2.6)	14.5 (2.6)	14.6 (2.6)	14.8 (2.6)	14.7 (2.6)	14.7 (2.6)	14.7 (2.6)
Earnings*	45,753 (42,897)	46,518 (39,471)	47,245 (43,319)	47,795 (42,418)	49,953 (45,110)	51,477 (45,892)	53,357 (53,233)	54,804 (51,145)	58,173 (55,621)	61,618 (52,007)	62,906 (54,878)	65,939 (58,089)	58,244 (52,353)

Note: * Earnings for pooled sample are CPI-adjusted (base year = 2019).

Source: Own estimations based on CPS 2011-202

Annex Table 2: Returns to Schooling Summary

Sex	Year	Schooling (years)	Overall		Secondary		University	
			Returns	Difference	Returns	Difference	Returns	Difference
<i>All</i>	2011	14.0	11.7	<u>(0.3)</u>	3.1	<u>(0.8)</u>	12.3	<u>(0.1)</u>
	2012	14.1	11.7	<u>(0.3)</u>	3.0	<u>(0.7)</u>	11.9	<u>(-0.3)</u>
	2013	14.1	11.5	(0.1)	3.1	<u>(0.8)</u>	12.1	<u>(-0.1)</u>
	2014	14.1	11.2	(-0.2)	2.7	<u>(0.4)</u>	12.0	<u>(-0.2)</u>
	2015	14.1	11.8	<u>(0.4)</u>	2.8	<u>(0.5)</u>	12.6	<u>(0.4)</u>
	2016	14.1	11.5	(0.1)	2.4	(0.1)	12.3	(0.1)
	2017	14.2	11.6	(0.2)	2.3	(0.0)	12.4	(0.2)
	2018	14.2	11.4	(0.0)	2.5	<u>(0.2)</u>	12.3	<u>(0.1)</u>
	2019	14.3	11.4	-	2.3	-	12.2	-
	2020	14.5	11.8	<u>(0.4)</u>	2.4	(0.1)	12.8	<u>(0.7)</u>
	2021	14.4	11.9	<u>(0.5)</u>	2.4	(0.1)	12.8	<u>(0.6)</u>
	2022	14.4	11.7	<u>(0.3)</u>	2.4	(0.1)	12.7	<u>(0.5)</u>
<i>Men</i>	2011	13.9	11.7	(0.1)	3.3	<u>(0.9)</u>	12.5	<u>(-0.3)</u>
	2012	13.9	11.8	(0.2)	3.3	<u>(0.8)</u>	12.4	<u>(-0.4)</u>
	2013	13.9	11.7	(0.1)	3.4	<u>(1.0)</u>	12.6	<u>(-0.3)</u>
	2014	13.9	11.3	(-0.3)	2.9	<u>(0.5)</u>	12.5	<u>(-0.3)</u>
	2015	13.9	11.9	<u>(0.4)</u>	2.8	<u>(0.4)</u>	13.2	<u>(0.3)</u>
	2016	13.9	11.7	(0.1)	2.5	(0.0)	13.0	(0.1)
	2017	14.0	11.7	(0.1)	2.5	(0.1)	12.8	(0.0)
	2018	14.0	11.5	(-0.1)	2.8	<u>(0.4)</u>	12.6	<u>(-0.3)</u>
	2019	14.1	11.6	-	2.4	-	12.8	-
	2020	14.2	12.1	<u>(0.6)</u>	2.6	(0.2)	13.7	<u>(0.9)</u>
	2021	14.1	12.4	<u>(0.8)</u>	2.6	(0.2)	13.7	<u>(0.9)</u>
	2022	14.1	12.1	<u>(0.6)</u>	2.5	(0.0)	13.6	<u>(0.8)</u>
<i>Women</i>	2011	14.2	12.4	(0.2)	3.3	<u>(0.6)</u>	12.6	<u>(0.1)</u>
	2012	14.3	12.4	(0.2)	3.2	<u>(0.6)</u>	12.0	<u>(-0.4)</u>
	2013	14.3	12.2	(-0.0)	3.1	<u>(0.5)</u>	12.4	<u>(0.0)</u>
	2014	14.3	12.1	(-0.1)	2.9	(0.2)	12.1	(-0.3)
	2015	14.4	12.6	(0.3)	3.4	<u>(0.8)</u>	12.7	<u>(0.3)</u>
	2016	14.4	12.3	(0.0)	2.9	(0.3)	12.5	(0.1)
	2017	14.5	12.6	(0.4)	2.4	(-0.2)	13.0	(0.6)
	2018	14.5	12.5	(0.3)	2.7	(0.1)	13.0	(0.6)
	2019	14.6	12.2	-	2.6	-	12.4	-
	2020	14.8	12.5	(0.3)	2.6	(0.0)	13.1	(0.7)
	2021	14.7	12.4	(0.2)	2.5	(-0.1)	12.8	(0.4)
	2022	14.7	12.2	(0.0)	2.7	(0.1)	12.7	(0.3)

Notes: Difference in the returns to schooling with respect to the returns in 2019 are in parenthesis. Significant returns difference according to the Z-test comparing coefficients are in **bold** and underlined. Significance is estimated according to a Z-test comparing coefficients and the formula used is: $Z = \frac{b1-b2}{\sqrt{SEb1^2 + SEb2^2}}$, where $b2$ refers to 2019 as the reference year, the last year pre-pandemic year (Clogg et al. 1995). Full regression results are in Annex Tables 2 and 3.

Source: Own estimations based on CPS 2011-2022.

Annex Table 2: Basic Earnings Function

Year	Schooling	Experience	Experience²	N	R2 adj	Z-test pre & post COVID
<i>All</i>						
2011	0.117 *** (0.001)	0.040 *** (0.001)	-0.001 *** (0.000)	60,548	0.2491	1.56 (0.059)
2012	0.117 *** (0.001)	0.038 *** (0.001)	-0.001 *** (0.000)	61,054	0.2470	1.53 (0.063)
2013	0.115 *** (0.002)	0.037 *** (0.002)	-0.001 *** (0.000)	18,473	0.2466	0.46 (0.324)
2014	0.112 *** (0.001)	0.035 *** (0.001)	-0.001 *** (0.000)	61,887	0.2094	-0.91 (0.181)
2015	0.118 *** (0.001)	0.034 *** (0.001)	-0.001 *** (0.000)	58,055	0.2410	1.97 (0.025)
2016	0.115 *** (0.001)	0.034 *** (0.001)	-0.001 *** (0.000)	59,243	0.2289	0.44 (0.331)
2017	0.116 *** (0.001)	0.034 *** (0.001)	-0.001 *** (0.000)	57,706	0.2194	0.92 (0.178)
2018	0.114 *** (0.001)	0.035 *** (0.001)	-0.001 *** (0.000)	58,738	0.2242	-0.10 (0.458)
2019	0.114 *** (0.002)	0.031 *** (0.001)	0.000 *** (0.000)	51,758	0.1890	- -
2020	0.118 *** (0.001)	0.031 *** (0.001)	0.000 *** (0.000)	47,928	0.2448	1.89 (0.030)
2021	0.119 *** (0.001)	0.032 *** (0.001)	0.000 *** (0.000)	48,736	0.2299	2.24 (0.013)
2022	0.117 *** (0.001)	0.030 *** (0.001)	0.000 *** (0.000)	47,998	0.2286	1.40 (0.081)
<i>Men</i>						
2011	0.117 *** (0.002)	0.045 *** (0.001)	-0.001 *** (0.000)	33,944	0.2686	0.54 (0.296)
2012	0.118 *** (0.002)	0.043 *** (0.001)	-0.001 *** (0.000)	34,480	0.2680	0.77 (0.222)
2013	0.117 *** (0.003)	0.040 *** (0.002)	-0.001 *** (0.000)	10,384	0.2806	0.33 (0.370)
2014	0.113 *** (0.002)	0.038 *** (0.001)	-0.001 *** (0.000)	34,870	0.2360	-1.12 (0.130)
2015	0.119 *** (0.001)	0.039 *** (0.001)	-0.001 *** (0.000)	32,685	0.2741	1.47 (0.071)
2016	0.117 *** (0.002)	0.037 *** (0.001)	-0.001 *** (0.000)	33,354	0.2421	0.45 (0.326)
2017	0.117 *** (0.002)	0.038 *** (0.001)	-0.001 *** (0.000)	32,357	0.2371	0.43 (0.332)
2018	0.115 *** (0.002)	0.039 *** (0.001)	-0.001 *** (0.000)	32,800	0.2446	-0.44 (0.331)
2019	0.116 *** (0.002)	0.035 *** (0.001)	-0.001 *** (0.000)	28,681	0.2164	- -
2020	0.121 *** (0.002)	0.036 *** (0.001)	-0.001 *** (0.000)	26,749	0.2747	2.27 (0.012)
2021	0.124 *** (0.002)	0.034 *** (0.001)	0.000 *** (0.000)	27,160	0.2468	2.87 (0.002)
2022	0.121 *** (0.002)	0.032 *** (0.001)	0.000 *** (0.000)	26,596	0.2573	2.19 (0.014)

(cont'd)

Annex Table 2: Basic Earnings Function (cont'd)									
Year	Schooling		Experience		Experience ²		N	R2 adj	Z-test pre & post COVID
<i>Women</i>									
2011	0.124 ***		0.031 ***		0.000 ***		26,604	0.2579	0.64
	(0.002)		(0.001)		(0.000)				(0.261)
2012	0.124 ***		0.029 ***		0.000 ***		26,574	0.2534	0.62
	(0.002)		(0.001)		(0.000)				(0.267)
2013	0.122 ***		0.031 ***		0.000 ***		8,089	0.2374	-0.05
	(0.003)		(0.002)		(0.000)				(0.480)
2014	0.121 ***		0.029 ***		0.000 ***		27,017	0.2087	-0.33
	(0.002)		(0.001)		(0.000)				(0.372)
2015	0.126 ***		0.026 ***		0.000 ***		25,370	0.2370	1.16
	(0.002)		(0.001)		(0.000)				(0.124)
2016	0.123 ***		0.029 ***		0.000 ***		25,889	0.2476	0.16
	(0.002)		(0.001)		(0.000)				(0.436)
2017	0.126 ***		0.026 ***		0.000 ***		25,349	0.2338	1.25
	(0.002)		(0.001)		(0.000)				(0.105)
2018	0.125 ***		0.027 ***		0.000 ***		25,938	0.2389	0.85
	(0.002)		(0.001)		(0.000)				(0.197)
2019	0.122 ***		0.024 ***		0.000 ***		23,077	0.1872	-
	(0.002)		(0.002)		(0.000)				-
2020	0.125 ***		0.023 ***		0.000 ***		21,179	0.2523	1.04
	(0.002)		(0.001)		(0.000)				(0.150)
2021	0.124 ***		0.027 ***		0.000 ***		21,576	0.2449	0.56
	(0.002)		(0.002)		(0.000)				(0.286)
2022	0.122 ***		0.025 ***		0.000 ***		21,402	0.2317	-0.04
	(0.002)		(0.001)		(0.000)				(0.483)

Notes: *** p<0.01, ** p<0.05, * p<0.1

Source: Own estimations based on CPS 2011-2022.

Annex Table 3: Extended Earnings Function

Year	Secondary		Tertiary		Experience		Experience ²		N	R2 adj	Z-test secondary	Z-test tertiary
<i>All</i>												
2011	0.368	***	0.859	***	0.041	***	-0.001	***	60,548	0.2090	5.00	5.08
	(0.012)		(0.012)		(0.001)		(0.000)				(0.000)	(0.000)
2012	0.365	***	0.842	***	0.039	***	-0.001	***	61,054	0.1995	4.89	4.20
	(0.012)		(0.012)		(0.001)		(0.000)				(0.000)	(0.000)
2013	0.371	***	0.853	***	0.038	***	-0.001	***	18,473	0.2051	3.60	3.35
	(0.022)		(0.022)		(0.002)		(0.000)				(0.000)	(0.000)
2014	0.319	***	0.797	***	0.036	***	-0.001	***	61,887	0.1724	2.38	1.79
	(0.011)		(0.012)		(0.001)		(0.000)				(0.009)	(0.037)
2015	0.336	***	0.839	***	0.035	***	-0.001	***	58,055	0.1991	3.20	3.95
	(0.012)		(0.012)		(0.001)		(0.000)				(0.001)	(0.000)
2016	0.289	***	0.781	***	0.036	***	-0.001	***	59,243	0.1863	0.64	0.85
	(0.012)		(0.012)		(0.001)		(0.000)				(0.261)	(0.198)
2017	0.275	***	0.770	***	0.035	***	-0.001	***	57,706	0.1766	-0.10	0.26
	(0.012)		(0.013)		(0.001)		(0.000)				(0.461)	(0.397)
2018	0.306	***	0.796	***	0.036	***	-0.001	***	58,738	0.1848	1.60	1.71
	(0.011)		(0.011)		(0.001)		(0.000)				(0.055)	(0.044)
2019	0.277	***	0.765	***	0.034	***	-0.001	***	51,758	0.1497	-	-
	(0.014)		(0.014)		(0.001)		(0.000)				-	-
2020	0.288	***	0.802	***	0.034	***	-0.001	***	47,928	0.1962	0.54	1.82
	(0.014)		(0.014)		(0.001)		(0.000)				(0.295)	(0.034)
2021	0.289	***	0.800	***	0.034	***	-0.001	***	48,736	0.1843	0.55	1.63
	(0.016)		(0.016)		(0.001)		(0.000)				(0.291)	(0.052)
2022	0.284	***	0.793	***	0.031	***	-0.001	***	47,998	0.1848	0.34	1.41
	(0.014)		(0.014)		(0.001)		(0.000)				(0.367)	(0.080)
<i>Men</i>												
2011	0.396	***	0.897	***	0.047	***	-0.001	***	33,944	0.2322	4.57	3.93
	(0.015)		(0.016)		(0.001)		(0.000)				(0.000)	(0.000)
2012	0.392	***	0.889	***	0.046	***	-0.001	***	34,480	0.2259	4.51	3.66
	(0.015)		(0.015)		(0.001)		(0.000)				(0.000)	(0.000)
2013	0.407	***	0.909	***	0.041	***	-0.001	***	10,384	0.2390	3.65	3.22
	(0.027)		(0.027)		(0.002)		(0.000)				(0.000)	(0.001)
2014	0.347	***	0.848	***	0.040	***	-0.001	***	34,870	0.2041	2.57	1.91
	(0.014)		(0.014)		(0.001)		(0.000)				(0.005)	(0.028)
2015	0.342	***	0.868	***	0.040	***	-0.001	***	32,685	0.2345	2.28	2.79
	(0.014)		(0.015)		(0.001)		(0.000)				(0.011)	(0.003)
2016	0.294	***	0.813	***	0.038	***	-0.001	***	33,354	0.2033	0.12	0.35
	(0.014)		(0.015)		(0.001)		(0.000)				(0.451)	(0.365)
2017	0.300	***	0.814	***	0.040	***	-0.001	***	32,357	0.2002	0.37	0.39
	(0.015)		(0.016)		(0.001)		(0.000)				(0.357)	(0.348)
2018	0.334	***	0.836	***	0.041	***	-0.001	***	32,800	0.2090	1.95	1.41
	(0.014)		(0.014)		(0.001)		(0.000)				(0.026)	(0.080)
2019	0.292	***	0.805	***	0.038	***	-0.001	***	28,681	0.1806	-	-
	(0.017)		(0.017)		(0.001)		(0.000)				-	-
2020	0.311	***	0.858	***	0.038	***	-0.001	***	26,749	0.2323	0.79	2.15
	(0.018)		(0.018)		(0.001)		(0.000)				(0.213)	(0.016)
2021	0.314	***	0.861	***	0.037	***	-0.001	***	27,160	0.2060	0.82	2.04
	(0.021)		(0.022)		(0.001)		(0.000)				(0.206)	(0.021)
2022	0.297	***	0.843	***	0.034	***	-0.001	***	26,596	0.2188	0.24	1.56
	(0.017)		(0.017)		(0.001)		(0.000)				(0.406)	(0.059)
(cont'd)												

(cont'd)

Annex Table 3: Extended Earnings Function (cont'd)

Year	Secondary		Tertiary		Experience		Experience ²		N	R2 adj	Z-test secondary	Z-test tertiary
<i>Women</i>												
2011	0.391	***	0.893	***	0.031	***	-0.001	***	26,604	0.2127	2.73	2.87
	(0.016)		(0.016)		(0.001)		(0.000)				(0.003)	(0.002)
2012	0.389	***	0.869	***	0.030	***	0.000	***	26,574	0.1970	2.50	1.91
	(0.019)		(0.019)		(0.001)		(0.000)				(0.006)	(0.028)
2013	0.375	***	0.872	***	0.031	***	0.000	***	8,089	0.1980	1.33	1.33
	(0.038)		(0.038)		(0.003)		(0.000)				(0.091)	(0.092)
2014	0.344	***	0.829	***	0.029	***	0.000	***	27,017	0.1632	0.97	0.57
	(0.018)		(0.019)		(0.001)		(0.000)				(0.165)	(0.284)
2015	0.411	***	0.919	***	0.027	***	0.000	***	25,370	0.1895	3.08	3.40
	(0.021)		(0.021)		(0.001)		(0.000)				(0.001)	(0.000)
2016	0.347	***	0.847	***	0.030	***	0.000	***	25,889	0.1955	1.02	1.10
	(0.021)		(0.021)		(0.001)		(0.000)				(0.154)	(0.135)
2017	0.294	***	0.814	***	0.027	***	0.000	***	25,349	0.1798	-0.70	0.06
	(0.019)		(0.019)		(0.001)		(0.000)				(0.242)	(0.478)
2018	0.321	***	0.843	***	0.029	***	0.000	***	25,938	0.1886	0.21	1.04
	(0.018)		(0.018)		(0.001)		(0.000)				(0.415)	(0.148)
2019	0.315	***	0.812	***	0.026	***	0.000	***	23,077	0.1396	-	-
	(0.023)		(0.023)		(0.002)		(0.000)				-	-
2020	0.309	***	0.832	***	0.026	***	0.000	***	21,179	0.1887	-0.18	0.61
	(0.023)		(0.023)		(0.001)		(0.000)				(0.429)	(0.271)
2021	0.298	***	0.810	***	0.029	***	0.000	***	21,576	0.1859	-0.52	-0.05
	(0.023)		(0.023)		(0.002)		(0.000)				(0.300)	(0.481)
2022	0.328	***	0.836	***	0.026	***	0.000	***	21,402	0.1760	0.37	0.69
	(0.025)		(0.025)		(0.001)		(0.000)				(0.354)	(0.244)

Notes: *** p<0.01, ** p<0.05, * p<0.1

Source: Own estimations based on CPS 2011-2022.

Annex Table 4: The Effect of COVID-19 on the Rate of Return to Schooling

	All		Men		Women	
	(1)	(2)	(3)	(4)	(5)	(6)
Schooling (S)	0.114 ** *		0.115 ** *		0.123 ** *	
	(0.001)		(0.001)		(0.001)	
Secondary (SEC)		0.290 ** *		0.312 ** *		0.317 ** *
		(0.008)		(0.010)		(0.014)
University (UNI)		0.778 ** *		0.819 ** *		0.824 ** *
		(0.009)		(0.011)		(0.014)
C (COVID)·S	0.004 ** *		0.007 ** *		0.001	
	(0.001)		(0.002)		(0.002)	
C·SEC		-0.002 (0.012)		-0.003 (0.015)		-0.003 (0.020)
C·UNI		0.022 * (0.012)		0.037 ** (0.015)		0.006 (0.019)
	-0.064 ** *	-0.012	-0.112 ** *	-0.024 * (0.014)	-0.012 (0.026)	0.003 (0.019)
Experience	0.032 ** *	0.034 ** *	0.035 ** *	0.038 ** *	0.026 ** *	0.027 ** *
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Experience ²	0.000 ** *	-0.001 ** *	-0.001 ** *	-0.001 ** *	0.000 ** *	0.000 ** *
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year Effect	YES	YES	YES	YES	YES	YES
Constant	1.138 ** *	2.231 ** *	1.180 ** *	2.253 ** *	0.940 ** *	2.139 ** *
	(0.014)	(0.009)	(0.018)	(0.012)	(0.022)	(0.015)
Obs.	632,12 4	632,12 4	354,06 0	354,06 0	278,06 4	278,06 4
R-squared	0.223	0.180	0.248	0.209	0.231	0.176

Notes: *** p<0.01, ** p<0.05, * p<0.1

Source: Own estimations based on CPS 2011-2022.