Wages, Demographics, and Gender: Register Analysis among Doctorate Holders in Iceland[1]

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ABSTRACT

The percentage of female doctorate holders has steadily increased in the Western world. Despite this trend, there is a scarcity of studies addressing gender disparities among doctorate holders, within and outside academia. We analyze the earnings of Icelandic doctorate holders either in the fields of science, technology, engineering, and mathematics (STEM) or social sciences and humanities (SSH) and are employed within and outside academia. We contend that achieving gender-wage equality is crucial for doctorate holders, given that education worldwide is considered a means to empower women and a significant factor in reducing gender inequality and narrowing the pay gap. Our findings reveal a continuous gender gap in total earnings between the fifth and tenth career years regardless of the field of study or the employment being within or outside academia. Thus, our findings suggest that a Ph.D. does not improve women's earning power enough to close the gender pay gap.

KEYWORDS

Doctorate holders / gender / (in)equality / longitudinal data / register analysis / wage gap

Introduction

The number of doctorate holders in the Western world has been on the rise over the last few decades (Auriol et al. 2013; Boosten & Vandevelde 2014; Cyranoski et al. 2011; Gokhberg et al. 2016). Across the Organization for Economic Co-operation and Development (OECD) countries, the average rise in doctorate holders was a little under 40% for the first decade of the 21st century (Auriol et al. 2013; Cyranoski et al. 2011). This can be attributed to the importance of knowledge-intensive industries emphasized by policymakers and the increase of support for PhD graduates (Bryan & Guccione 2018; Passaretta et al. 2019; Pedersen 2014). Additionally, educated workers are seen as key to economic growth in many countries (Cyranoski et al. 2011). However, extensive international research indicates challenges to gender equality among doctorate holders

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in research and innovation, which need to be studied further (Bergman & Rustad 2013; Caprile et al. 2011; Heijstra et al. 2017; Meulders et al. 2010).

As Casey (2009, p. 225) points out, 'PhD holders are not a homogenous group. They do different jobs, and they are rewarded differently'. Thus, individual advantages differ. Nevertheless, as Bloch et al. (2015) show, doctorate holders are an underresearched topic, especially in terms of wage differences (Alfano et al. 2019; Webber & Canché 2015). Traditionally, more men than women have finished a PhD, but there are signs of this gender gap decreasing with growing female participation in higher education (Carter et al. 2013; Cidlinská 2019; Lörz & Mühleck 2019; Maher et al. 2004). Nevertheless, on average, women finish their PhDs later than men (Mastekaasa 2005), particularly mothers (Kulp 2020). Moreover, research has indicated that female PhD holders earn less than their male counterparts (Alfano et al. 2019; Webber & Canché 2015). However, Webber and Canché (2018) show that gendered differences among those starting careers in academia have diminished over the last two decades.

We add to the current knowledge by analyzing the gendered gap in total earnings among PhD holders in the different fields of science, technology, engineering, and mathematics (STEM) and social sciences and humanities (SSH) in Iceland, a country considered to be gender equal in an international comparison. Additionally, we compare those who work in academia to those working in other businesses. Gender equality in terms of earnings is important, as shown in Sustainable Development Goal (SDG) no. 5, which aims to achieve gender equality and empower all women and girls (Sachs et al. 2021). We argue that earning equality is especially important among doctorate holders because education is assumed to empower women and is seen as a key driver in improving gender equality and diminishing the gender pay gap (Casey 2009).

Two main ideological frameworks have mainly been used in the United States to explain inequalities in the labor market, such as gendered wage differences (Cech & Blair-Loy 2010). One is based on beliefs in meritocracy, emphasizing that each individual is in charge of seeking proper training, experience, and the motivation to succeed in their working life; if they do not, they have themselves to blame. The other is the frame of structural factors causing inequalities, such as stereotyping, discrimination, and exclusion from social networks (Cech & Blair-Loy 2010). Moreover, human capital theory considers 'education relevant in so far as education creates skills and helps to acquire knowledge that serves as an investment in the productivity of the human being as an economic production factor' (Robeyns 2006, p. 72). As human capital rises with more educated individuals entering the labor market, the likelihood of employment and possible earnings should increase (Damon & Glewwe 2011). Thus, even though education has been important in narrowing the gender pay gap (Blau & Kahn 2017), findings from Italy, Belgium, Denmark, and the United States suggest that there might be more complicated issues underlying the pay gap than education, since there is an indication of a gender wage gap among doctorate holders similar to that found in the wider population (Alfano et al. 2019; Gaeta et al. 2018; Levecque et al. 2014; Pedersen, 2016; Webber & Canché 2015). Grönlunds' (2017) research from Sweden also reveals early career wage gap among men and women, regardless of same educational investment, suggesting complex picture of gendered professional strategies. This pattern was confirmed in CORE – Centre for Research on Gender Equality (2023) analysis of the gendered pay gap among PhD holders in Norway and Sweden. The results reveal a significant gender pay gap in both countries, especially outside academia. Although the gendered wage gap

is narrower in academia than outside, both in Norway and Sweden, women in academia earn in general less than men.

We further this discussion by conducting research in Iceland, a country considered to be at the forefront of gender equality, having been ranked first on the Gender Gap Index since 2009 (The World Economic Forum 2021) and the Economist's glass-ceiling index (The Economist 2020). Considering Iceland's standing, we ask, 'Are there any differences between female and male doctorate holders in Iceland, the seeming cradle of gender equality in terms of their wages?' To answer this question, total earnings at different career stages are analyzed depending on gender, field of study (STEM vs. SSH), and employment within or outside academia. The strength and uniqueness of the data are that they are based on longitudinal register data comprising the entire Icelandic population of STEM and SSH graduates, who in 2017 held 5- to 20-year-old doctorates in Iceland.

Careers of doctorate holders

The number of doctorate holders who stay in academia varies across countries (Auriol et al. 2013). Regarding earnings differences, recent research from the United States and Europe showed that doctorate holders working outside academia are paid better than average professor in academia (Hamermesh 2018).

Little is known about what processes drive people to make early career choices in terms of sector and occupation (Bloch et al. 2015; Pedersen 2014). Previous research indicates that PhD students who prefer industrial employment to academic jobs have a weaker 'taste for science' (Bloch et al. 2015; Roach & Sauermann 2010). However, Bloch et al. (2015) revealed a more complex reality, since doctorate holders not only make career choices between higher education institutions and other businesses, but also between research and development and non-research and development sectors. Therefore, the choice of career seems to follow more complex patterns than suggested earlier (Bloch et al. 2015).

Almost 80% of doctorate holders who participated in the 2010 OECD, UNESCO, and Eurostat survey worked as permanent employees; women, however, were likelier than men to be on temporary contracts and earn less (Boosten 2014; Webber & Canché 2015). However, research done by Casey (2009) indicates that a PhD degree might still be more valuable for women, since female doctorate holders appeared to improve their earning power to a greater extent than men. Nevertheless, the labor market is horizontally segregated, and fields of study are gendered. Studies have shown that the positive wage premium for completing a PhD as well as the gender wage gap among doctorate holders varies significantly by field of study and occupation (Bobbitt-Zeher 2007; Casey 2009; Ochsenfeld 2014; Passaretta et al. 2019). These studies point out that women continue to be underrepresented in STEM fields, which tend to lead to better opportunities for high-paying jobs compared to SSH fields. In her study, Bobbitt-Zeher (2007) links the horizontal gender segregation in higher education, and its influence on earnings, to the devaluation theory, which holds that certain tasks are socially and economically devaluated as they are done mostly by women. Ochsenfeld (2014), on the other hand, links his findings on the gender wage gap among doctorate holders to the gender role theory. Ochsenfeld finds indications that men are much likelier to internalize a

breadwinner role during adolescence than women, which they then act on when choosing their study program at university. This makes men disproportionately self-select into STEM fields. Gender segregation in higher education has been acknowledged as a critical factor in ongoing gender inequalities in the labor market (Barone & Assirelli 2020), and differences in academic careers between men and women are partially accountable for the ongoing pay gap among higher education graduates (Lörz & Mühleck 2019). However, despite the gendered selection of the field of study as well as occupation, and the explanation value it might have when it comes to differences in wage premiums and the gender wage gap, Webber and Canché (2015) found that women in the United States consistently earned lower salaries than male peers, regardless of the employment sector.

In Iceland, as elsewhere, there is scarce research comparing wages between women and men who hold doctorates in SSH and STEM within and outside academia. The main research contribution of this study is adding to this scant knowledge. This knowledge is important, as education is assumed to empower women (Casey 2009) and has been found to play an important role in narrowing the gender pay gap (Blau & Khan 2017).

The Icelandic setting

Much like in other parts of the Western world (Auriol et al. 2013; Boosten & Vandevelde 2014; Gokhberg et al. 2016), higher education has been on the rise in Iceland. This is especially true for women (Bjarnason & Edvardsson 2017), as has been the trend in the other Nordic countries as well (Mustosmäki et al. 2021). In 2019, women make up around 70% of PhD graduates from Icelandic universities (Reykjavik University 2019; University of Iceland 2019).

Iceland's reputation as the most gender-equal country in the world has been quite prominent in public discourse and in the media, both in Iceland and around the world. This media discourse has portrayed Iceland as a paradise for women and implies that gender equality in Iceland has more or less been achieved (see, e.g., Hertz 2016; Jakobsdóttir 2018; Kilpatrick 2017; Tuttle 2017). The success has even been used by Icelandic authorities for nation gender branding (Einarsdóttir 2020).

Iceland, as a social democratic welfare state (Esping-Andersen 1990; Ólafsson 2003) like the other Nordic countries, has relatively strong family policies and a large public service sector, encouraging female workforce participation and dual-earner households (Arnalds et al. 2013; Mandel & Semyonov 2006). Daycare attendance in Iceland is quite universal; around 96% of children aged 2–5 spend their days in pre-primary schools (Statistic Iceland 2019). A progressive parental leave, with long non-transferable quota for both parents, was introduced by law in the year 2000, with the results that great majority of fathers take paternal leave and have increased their participation in other care for their children as well (Arnalds et al. 2022). As Eydal and Rostgaard (2011) point out, this policy is often reviewed and recommended internationally for its contribution to gender equality through high female labor force participation without reducing fertility to the low levels that characterize many other European countries. However, such family policies do not necessarily benefit all women equally (Mandel & Semyonov 2006), and there are some indications that social democratic welfare policies might have negative occupational and earnings consequences for more advantaged

women (Mandel 2010). Furthermore, Boye et al. (2017) show that the gender wage gap in Sweden is the largest among highly skilled employees. This has been referred to as the welfare state paradox (Korpi et al. 2013; Mandel 2010; Mandel & Samyonov 2006).

In an international comparison, Iceland certainly does well when it comes to gender equality concerning economic status, political position, education, and health. Although the participation of Icelandic women in the labor market is among the highest in the world and also the highest among the OECD countries (81.9% in the year 2019 compared to 86.2% for men; (OECD 2020), women are far less likely to be in managerial positions (Einarsdóttir et al. 2019; Júlíusdóttir et al. 2018). Furthermore, the general gender pay gap has been ongoing, with the unadjusted gender pay gap for 2020 standing at 12.6% (Statistics Iceland 2020b) and the average working hours being 43.5 for men and 36.7 for women (Statistics Iceland 2021). Data from the Office of the Prime Minister demonstrate how education is more economically rewarding for men than for women. For example, women with PhDs earn similar wages as men with bachelor's degrees (Icelandic Income Database 2021). However, the data do not compare wages between SSH and STEM nor wages within and outside academia. The present study is the first to address the gender gap in total earnings among doctorate holders in Iceland, with that particular focus.

Closing the gender pay gap is a vital issue in Iceland. As early as 1961, the Icelandic Parliament passed a law on equal pay for men and women (64th Bill on Equal Pay for Men and Women 1960). In 2018, the Government of Iceland became the first in the world to implement obligatory equal pay certification under an equal pay standard. The aim is to enforce the current legislation, which prohibits discriminatory practices based on gender and requires that women and men working for the same employer be paid equal wages and enjoy equal terms of employment for the same position or positions of equal value. Companies and institutions employing 25 or more employees on an annual basis are required to obtain equal pay certification for their equal pay system and its implementation (Government of Iceland n.d.). This legislation is considered progressive and has gained international recognition (see, e.g., Henley 2018; Morad 2018; Rubery 2019), and high expectations are tied to the Equal Pay Standard becoming the tool for finally bridging the gender pay gap in the Icelandic labor market (Alderman 2017; Morad 2018).

Data and methods

Study objectives and background

The data are part of an ongoing Nordic research project called NORDICORE. The main objective of that project is to investigate the career outcomes for people who have completed doctorates and are employed within or outside academia in Sweden, Norway, and Iceland.

Iceland, along with the other Nordic countries, is one of the few countries in the world where extensive register data are available for the total population. The personal ID code system in these countries makes it possible to follow people's life trajectories on an individual level. Detailed longitudinal register data are gathered and maintained by the statistical offices of each country.

Using longitudinal register data allows for the detection of patterns in the whole population, not just in a sample. The data represent a new frontier in the literature on the influence of gender, field of study, and employment on people's earnings over time.

Data collection and procedure

The results are based on a dataset derived from Statistics Iceland, the Icelandic statistical office. Longitudinal individual data from the Icelandic register from 1997 to 2017 were employed to identify all individuals who in 2017 held 5- to 20-year-old doctorates in Iceland and were active on the Icelandic labor market at some point during this 20-year period (N = 814). We chose this period because we anticipated that, in 5 years' time, people would have established some kind of a career, and because it still included a population whose majority would be actively employed after 20 years. Furthermore, the population was categorized based on gender, field of study, and employment, either within or outside academia. Based on these categories, we compare people's earnings 5 and 10 years after graduation and their earnings in 2017 (the last year in the dataset).

The categorization of STEM and SSH is based on the OECD classification (OECD 2007). However, when all fields of study are put into only two different categories (STEM/SSH), a considerable divergence within each category could also be expected in terms of later possible occupational and earning opportunities. Therefore, the analysis will mostly be conducted with STEM and SSH divided into two categories each to get a clearer picture of the situation. The categories are 1) SSH: education, humanities, and social sciences; 2) SSH: business, economics, and law; 3) STEM: engineering and construction; and 4) STEM: science, mathematics, and computing.

We examine the population data by descriptive analysis and OLS-regression analysis, disaggregated by gender as proposed by Webber and Canché (2015).

The dependent variable is the measure of total earnings in US dollars (USD; converted from Icelandic crowns [ISK]). USD was chosen to make the results more accessible to international readers. Total earnings include wages and other work-related income, such as vehicle subsidies, per diem allowances, and other benefits. Additionally, remuneration and earnings from abroad, other than capital income, are calculated as part of total earnings. However, study and research grants count as capital income and are therefore not part of the total earnings. The outcome variables were derived by first taking the average annual amount of each year in ISK and adjusting it to May 2020 using the Wage index (Statistics Iceland 2020a). In the regression analysis, the dependent variable is presented in real USD.

The independent variables measure the employment of the doctorate holders [dummy variable: outside academia (0) vs. within academia (1)], field of study [three dummy variables: education, humanities, and social sciences (0) vs. business, economics, and law (1)/ Science, math, and computing (1)/ Engineering and construction (1)], days of parental leave taken [sum of days taken the first 5 years/first 10 years], and graduation cohorts [two dummy variables: graduation cohort 1997–2002 (0) vs. graduation cohort 2003–2008 (1)/ graduation cohort 2009–2013 (1)].

To determine whether the corresponding coefficients for men and women present a statistically significant (gender) difference, we compare them. Here, we follow Webber and Canché's (2015) example by relying on an individual linear coefficient contrast presented in Equation 1.

$$t = \frac{\hat{\beta}_j - \hat{\beta}_k - \delta^0}{\sqrt{Se\beta_j^2 + Se\beta_k^2}} \quad (1)$$

The numerator consists of $\hat{\beta}_j$, the coefficient of interest in Model 1 (men) minus $\hat{\beta}_k$ the corresponding coefficient in Model 2 (women) minus δ^0. The value of δ^0 accounts for the covariance or the shared information used to estimate the coefficients being compared. Given that the regression models are mutually exclusive and exhaustive, meaning that no coefficient estimates in one regression model (i.e., $\hat{\beta}_k$) takes any information from the analytic sample configuring the other model (i.e., $\hat{\beta}_j$) and vice versa, the δ^0 is zero. However, the denominator consists of the square root of the sum of the coefficients' squared standard errors. Finally, the remaining difference is distributed as a t random variable with $n - (p + q) - 1$ degrees of freedom (DeMaris 2004; Webber & Canché 2015) with a cut-off value of 1.95 for $p < 0.05$.

Results

In 2017, there were a total of 814 Icelandic individuals with a doctorate, whose PhDs ranged from 5 to 20 years old. These individuals had participated in the Icelandic labor market at some point between 1997 and 2017. Among them, 463 were men and 351 were women. Within this cohort, 395 individuals were engaged in SSH, while 419 were in STEM. Table 1 shows that, inside the SSH disciplines, the distribution of men and women through all graduation cohorts is quite even, although the number of women surpasses that of men from 2002 onwards. However, within STEM disciplines, the changes between graduation cohorts are more detectable. A gradual increase in women's graduations can be seen over time, turning a very male-dominated field into a more evenly distributed one. However, men are always in the majority.

Table 1 Total number of doctorate holders in Iceland by year of graduation, gender, and field of study (N = 814)

Year of graduation	1997–2001		2002–2005		2006–2009		2010–2013		Total	
Field of study	**SSH**	**STEM**	**SSH**	**STEM**	**SSH**	**STEM**	**SSH**	**STEM**	**SSH**	**STEM**
Female (N)	51	28	50	34	47	40	57	44	205	146
percentage	(44.7%)	(27.5%)	(54.3%)	(29.1%)	(56.0%)	(40.0%)	(54.8%)	(44.0%)	(51.9%)	(34.9%)
Male (N)	63	74	42	83	37	60	48	56	190	273
percentage	(55.3%)	(72.5%)	(45.7%)	(70.9%)	(44.0%)	(60.0%)	(45.2%)	(56.0%)	(48.1%)	(65.1%)

Table 2 shows the distribution of the number of doctorate holders between the fields of study and employment inside or outside academia in 2017. The reason for the *N* being smaller here than is shown in Table 2 is mostly due to international mobility. People drop out of the register when they move out of the country, even though the move may be temporary.

Table 2 Number of doctorate holders by gender, field of study, and employment inside or outside academia (N = 652) in 2017

	Men		Women	
	STEM	**SSH**	**STEM**	**SSH**
Inside academia	68 (33%)	91 (57%)	34 (23%)	101 (58%)
Outside academia	139 (67%)	70 (43%)	77 (69%)	72 (42%)
Total	207 (100%)	161 (100%)	111 (100%)	173 (100%)

The percentages presented in the table show how men and women in each field are distributed between employment inside and outside academia. The majority of people who graduated from STEM fields work outside academia. The opposite is true for people who graduated from SSH fields. The table also denotes that the STEM field remains predominantly male-dominated, both within and outside academia, despite an increasing number of women graduating from STEM fields (see Table 1). Conversely, SSH fields exhibit a more balanced gender distribution in both academic and non-academic settings.

Table 3 illustrates the median value of total earnings for the population 5 and 10 years post-graduation, categorized by field of study and employment within or

Table 3 Comparing median values of total earnings 5 and 10 years after graduation by gender, field of study, and employment either inside or outside academia

	Education, humanities, and social sciences	**Business, economics, and law**	**Science, math, and computing**	**Engineering and construction**
Year 5 (*N* = 659)				
Men inside academia (n)	86,384 (68)	117,253 (20)	85,876 (52)	94,311 (15)
Women inside academia (n)	82,172 (78)	113,033 (21)	71,081 (31)	72,439 (4)
Percentage share (%)	95%	96%	83%	77%
Men outside academia (n)	69,865 (47)	136,116 (27)	100,080 (90)	110,053 (50)
Women outside academia (n)	64,202 (64)	92,370 (12)	69,032 (60)	87,283 (20)
Percentage share (%)	92%	68%	69%	79%
Year 10 (*N* = 434)				
Men inside academia (n)	97,720 (46)	117,124 (14)	87,783 (35)	109,318 (16)
Women inside academia (n)	90,220 (53)	94,406 (13)	79,039 (19)	83,887 (4)
Percentage share (%)	92%	81%	90%	77%
Men outside academia (n)	67,109 (28)	173,900 (16)	102,942 (68)	142,294 (39)
Women outside academia (n)	64,373 (34)	154,631 (4)	82,502 (33)	120,646 (12)
Percentage share (%)	96%	89%	80%	85%

outside academia. Additionally, it includes the average earnings of women as a percentage of men's average earnings. The analysis includes individuals who graduated between 1997 and 2013 for the 5-year benchmark and those who graduated between 1997 and 2008 for the 10-year benchmark. At the 5-year benchmark, 94 doctorate holders were registered as living abroad and 62 at the 10-year benchmark. The choice of presenting the median value is motivated by its lower sensitivity to outliers compared to the mean. Since the regression analysis relies on the mean, we find it valuable to present results in the median value as well.

The table shows that men consistently earn more than their female counterparts within the same group, regardless of which field of study they graduate from. The smallest overall gender gap is between men and women within the fields of education, humanities, and social sciences, with little difference concerning their employment being inside or outside academia. However, in the field of business, economics, and law, a distinct pattern emerges. This field exhibits the smallest gender gap within academia 5 years post-graduation, while concurrently displaying the most substantial gender disparity outside academia. In comparison to other academic groups, individuals with degrees in business, economics, and law consistently rank as the highest-earning cohort, regardless of their professional engagement within or outside academia. Notably, male professionals within this category experience more favorable financial outcomes outside academia both 5 and 10 years after graduation. Conversely, female professionals initially experience financial advantages within academia 5 years post-graduation. However, this advantage diminishes over time, with female professionals becoming financially better off working outside academia 10 years into their post-graduation trajectory.

Upon undertaking a comparison between two STEM groups, we find that generally, engineering and construction graduates are financially better off than science, math, and computing graduates. The difference between those groups compared to the difference between the two SSH groups is smaller. Male individuals in both STEM categories and their female counterparts generally experience greater financial benefits when employed outside academia, whether it be 5 or 10 years after their graduation. However, there is an exception among female graduates specializing in science, mathematics, and computing, who initially fare better financially within academia. This situation undergoes a shift as their careers advance. Additionally, the gender gap inside the STEM groups is generally greater than that inside the SSH groups. This is true for both 5 and 10 years after graduation.

Finally, the earning gap is smaller within academia than in other businesses 5 years after graduation but changes as people's careers progress. Although the earnings of both men and women generally increase between career stages, it seems that male academics—although only within SSH fields—increase their earnings proportionally more than women between career stages, resulting in the gender pay gap widening. However, outside academia, the gender gap narrows between years, and within all fields but one (science, math, and computing), the gap becomes smaller outside academia than inside. Although initially women are better off within academia, women outside academia increase their salaries proportionally more between years than men, resulting in the gender gap decreasing outside academia.

Table 4 shows multiple regression analysis for the total earnings of men and women (in separate models) 5 years after graduation, in US dollars.

Table 4 OLS regression analysis separated by gender: The association between field of study, employment (inside or outside academia), days on parental leave, and total earnings 5 years after graduation

	Men USD	**Women USD**
Constant	79,757** (7646)	60,855** (5896)
Academia	22,588 (15,297)	36,890** (9835)
Business, economic, and law	74,593** (15,870)	30,254* (11,565)
Science, math, and computing	32,074* (15,778)	24,091 (15,452)
Engineering and construction	74,459** (11,154)	44,844** (10,056)
Business, economic, and law*Academia	–43,595* (21,998)	12,140 (15,188)
Science, math, and computing*Academia	–29,835* (16,176)	–21,701* (10,515)
Engineering and construction*Academia	–56,212** (22,923)	–44,642* (21,613)
Parental leave (days)	–39 (66)	–11 (22)
Graduation 2003–2008	–13,146 (16,883)	–800 (10,125)
Graduation 2009–2013	–16,498 (18,196)	–13,192 (10,519)
Graduation 2003–2008*Academia	–2953 (16,071)	–18,503 (11,866)
Graduation 2009–2013*Academia	–14,244 (18,247)	–23,924* (11,982)
Grad. 2003–2008* Business, economic, and law	12,665 (26,354)	–26,243 (25,021)
Grad. 2003–2008* Science, math, and computing	4285 (19,078)	12,909 (13,233)
Grad. 2003–2008* Engineering and construction	5658 (22,483)	–32,947 (20,603)
Grad. 2009–2013* Business, economic, and law	–21,798 (26,012)	–25,506 (25,066)
Grad. 2009–2013* Science, math, and computing	2355 (20,387)	12,100 (13,104)
Grad. 2009–2013* Engineering and construction	–45,986 (28,292)	–11,823 (22,195)
N	368	289
R^2	0.168	0.223

SE in brackets.
**$p < 0.01$; *$p < 0.05$.

Starting with men, the constant reveals the total annual earnings for those who had a degree in education, humanities, or social sciences, working outside academia, who graduated between the years 1997 and 2002 and took no parental leave the first 5 years after graduation. Their average annual earnings were $79,757. On average, the women of the same group earn $60,855, approximately $19,000 less than their male counterparts. Here (not shown in the table), the *t*-test reveals a statistically significant gender difference ($t = 1.96$; $p < 0.05$).

Graduates from education, humanities, or social sciences tend to earn more, on average, working within academia compared to those working outside. This holds true for both men ($79,757 + $22,588 = $102,345) and women ($60,855 + $36,890 = $97,745) of the 1997–2002 graduation cohort. Similar advantages are observed for men and women in the 2003–2008 and 2009–2013 cohorts, although these younger cohorts earn less on average than the oldest cohort. Notably, irrespective of graduation year, men consistently earn more than women, both within and outside academia.

The model also reveals that having graduated in 1997–2002 from business, economic or law comes with an earnings increase compared to those who graduated from education, humanities, or social sciences when working outside academia, for both men ($79,757 + $74,593 = $154,350) as well as women ($60,855 + $30,254 = $91,109).[1] The gender difference in this group is also significant ($t = 2.89$; $p < 0.05$) (not shown in the table). For the men, however, the increase in earnings is much greater. The same pattern is evident for the other two graduation cohorts, although people in the two younger cohorts earn on average less than the oldest cohort.

Having graduated in 1997–2002 from science, math, or computing is also associated with earnings increase in comparison to those who graduated from education, humanities, or social sciences when working outside academia. This is true for both men ($79,757 + $32,074 = $111,831) and women ($60,855 + $24,091 = $84,946). Also, on average, people from the two younger graduation cohorts earn less than the oldest cohort in the field of science, math, and computing. However, they still earn more than the ones who graduated from education, humanities, and social sciences. Furthermore, men earn on average more than the women, regardless of when they graduated.

On average, the group who graduated in 1997–2002 from engineering or construction also earn more than those who graduated from education, humanities, or social sciences when working outside academia. This is true for both men ($79,757 + $74,459 = $154,216) and women ($60,855 + $44,844 = $105,699). In this group, the *t*-test (not shown in the table) reveals a significant gender difference ($t = 2.72$; $p < 0.05$). However, for the men, the earning increase is much greater. Also, on average, people from the two younger graduation cohorts earn less than the oldest cohort in the field of engineering or construction. However, they still earn more than the ones who graduated from education, humanities, and social sciences. Furthermore, men earn on average more than the women, regardless of when they graduated.

Examining those employed within academia, the analysis indicates that among graduates in business, economics, and law from the 1997–2002 cohort, women experience an increase in earnings when working within academia compared to outside ($60,855 + $36,890 + $30,254 + $12,140 = $140,139). Conversely, for men in the same cohort, working within academia is associated with a decrease in earnings compared to working outside ($79,757 + $22,588 + $74,593 – $43,595 = $133,343). Additionally, it is noteworthy that, on average, women earn more than men in this particular context.

For the 1997–2002 science, math, and computing graduates, employment within academia in comparison to outside academia is associated with earnings increase for women ($60,855 + $36,890 + $24,091 – $21,701 = $100,135) and earnings decrease for men ($79,757 + $22,588 + $32,074 – $29,835 = $104,584). However, men still earn on average more than the women in that group.

Furthermore, for the 1997–2002 engineering and construction graduates, employment within academia as compared to outside academia is associated with earnings decrease for both men ($79,757 + $22,588 + $74,459 – $56,212 = $120,592) and women ($60,855 + $36,890 + $44,844 – $44,642 = $97,947). However, on average, men in this group earn more than their women counterparts.

Finally, the model reveals that going on a parental leave is associated with very little loss in earnings for both men and women.

Table 5 OLS regression analysis separated by gender: The association between field of study, employment (inside or outside academia), days on parental leave, and total earnings 10 years after graduation

	Men USD	**Women USD**
Constant	82,894** (21,286)	67,607** (18,176)
Academia	14,261 (23,449)	17,324 (20,946)
Business, economic, and law	64,427* (31,464)	72,022 (50,892)
Science, math, and computing	43,106 (23,857)	39,370* (23,380)
Engineering and construction	103,362** (27,446)	70,255* (32,504)
Business, economic, and law*Academia	–53,062 (37,253)	–65,492 (45,338)
Science, math, and computing*Academia	–42,072 (27,159)	–52,707* (26,542)
Engineering and construction*Academia	–80,992* (32,476)	–56,478 (45,238)
Parental leave (days)	–30 (72)	21 (40)
Graduation 2003–2008	–38,155* (24,286)	–31,830 (21,606)
Graduation 2003–2008*Academia	30,722 (22,236)	34,734 (23,924)
Grad. 2003–2008* Business, economic, and law	9274 (37,553)	–17,017 (44,966)
Grad. 2003–2008* Science, math, and computing	14,587 (26,846)	9626 (26,683)
Grad. 2003–2008* Engineering and construction	–9120 (31,281)	–32,814 (40,977)
N	261	171
R^2	0.164	0.129

SE in brackets.
**$p < 0.01$; *$p < 0.05$.

Table 5 displays multiple regression analysis for the total earnings of men and women (in separate models) 10 years after graduation, in US dollars.

Beginning with the men, the constant discloses the overall annual earnings for individuals holding a degree in education, humanities, or social sciences, who graduated between 1997 and 2002, and did not take any parental leave in the first decade post-graduation while working outside academia. On average, these men earned $82,894 annually. In comparison, women within the same group had average annual earnings of $67,607, signifying a difference of approximately $15,000 less than their male counterparts.

On average, the group of graduates from education, humanities, or social sciences, working within academia earn more than those working outside academia. This goes for both men ($82,894 + $14,261 = $97,155) as well as women ($67,607 + $17,324 = $84,931) of the 1997–2002 graduation cohort. Individuals from the 2003–2008 graduation cohort, both men and women, experience advantages in terms of earnings when employed within academia as opposed to outside. Among the men in this cohort, there is a consistent average lower income compared to their counterparts from the older graduation cohort, regardless of whether they work within or outside academia. Conversely, women who graduated between 2003 and 2008 earn slightly more on average than their counterparts from the older graduation cohort when working within academia. However, when employed outside academia, their average earnings are lower. It

is noteworthy that, in all scenarios, both within and outside academia, men consistently earn more on average than women, regardless of their graduation year.

The model also reveals that having graduated in 1997–2002 from business, economic, or law comes with an earnings increase compared to those who graduated from education, humanities, or social sciences when working outside academia, for both men ($82,894 + $64,427 = $147,321) and women ($67,607 + $72,022 = $139,629). Those who graduated between 2003 and 2008 experience higher earnings when possessing a degree in business, economics, or law, in comparison to those in education, humanities, or social sciences. However, individuals in the younger cohorts earn, on average, less than their counterparts in the older cohort. Moreover, in all circumstances, whether within or outside academia and irrespective of graduation year, men consistently earn more on average than women.

Having graduated in 1997–2002 from science, math, or computing is also associated with earnings increase in comparison to those who graduated from education, humanities, or social sciences when working outside academia. This is true for both men ($82,894 + $43,106 = $126,000) and women ($67,607 + $39,370 = $106,977). Also, on average, people from the younger graduation cohort earn less than the oldest cohort in the field of science, math, and computing. However, they still earn more than the ones who graduated from education, humanities, and social sciences. Furthermore, on average, men earn more than the women, regardless of when they graduated.

The group who graduated in 1997–2002 from engineering or construction also earn on average more than those who graduated from education, humanities, or social sciences when working outside academia. This is true for both men ($82,894 + $103,362 = $186,256) and women ($67,607 + $70,255 = $137,862). For the men, however, the increase in earnings is much greater. Also, on average, people who graduated between 2003 and 2008 earn less than the older cohort in the field of engineering or construction. However, they still earn more than the ones who graduated from education, humanities, and social sciences. Furthermore, men earn, on average, more than the women, regardless of when they graduated.

The model also reveals that for the business, economic and law graduates who graduated between 1997 and 2002, working within academia as compared to working outside academia is associated with earnings decrease for both women ($67,607 + $17,324 + $72,022 – $65,492 = $91,461) and men ($82,894 + $14,261 + $64,427–$53,062 = $108,520). Nevertheless, on average, men still earn more than the women in that group.

For the 1997–2002 science, math, and computing graduates, employment within academia as compared to outside academia is associated with earnings decrease for both women ($67,607 + $17,324 + $39,370 – $52,707 = $71,594) as well as men ($82,894 + $14,261 + $43,106 – $42,072 = $98,189). However, on average, men still earn more than the women in that group.

Furthermore, for the 1997–2002 engineering and construction graduates, employment within academia in comparison to outside academia is associated with earnings decrease for both men ($82,894 + $14,261 + $103,362 – $80,992 = $119,525) and women ($67,607 + $17,324 + $70,255 – $56,478 = $98,708). On average, the men in this group earn more than their women counterparts.

Finally, the model shows that going on a parental leave is associated with very little loss in earnings for the men and even a little gain for the women.

Table 6 OLS regression analysis separated by gender: The association between field of study, employment (inside or outside academia), years since graduating, days in parental leave, and total earnings in 2017

	Men USD	**Women USD**
Constant	69,820** (9639)	49,694** (8147)
Academia	5907 (19616)	20,058 (15109)
Business, economic, and law	97,399** (14778)	16,418 (13203)
Science, math, and computing	32,151** (11109)	28,454** (8080)
Engineering and construction	40,410** (12400)	41,902** (10727)
Business, economic, and law*Academia	–73,928** (20588)	4351 (17026)
Science, math, and computing*Academia	–24,410 (15301)	–28,841* (11784)
Engineering and construction*Academia	–24,669 (19176)	–38,167* (21733)
Parental leave (days)	42 (41)	13 (18)
Years of employment	2002* (823)	1999** (728)
Years*Academia	526 (1260)	124 (1057)
N	351	273
R^2	0.166	0.125

SE in brackets.
**$p < 0.01$; *$p < 0.05$.

Table 6 presents multiple regression analysis for the overall earnings of men and women, analyzed separately, in the year 2017, in US dollars. The analysis encompasses all individuals holding doctorates who were actively participating in the Icelandic labor market in 2017, irrespective of their career stage at that time. Therefore, two additional variables were incorporated into the analysis to assess the impact of each additional year of work experience.

Commencing with men, the constant discloses the total yearly earnings for individuals with a degree in education, humanities, or social sciences, who are working outside academia and have not taken parental leave at their career start. Their average annual earnings amounted to $69,820. In comparison, women within the same category earned an average of $49,694, representing an approximate difference of $20,000 less than their male counterparts.

The group of graduates from education, humanities, or social sciences, working within academia earn on average more than those working outside academia. This goes for both men ($69,820 + $5907 = $75,727) and women ($49,694 + $20,058 = $69,752). Although the women benefit more from working within academia compared to outside, on average, they still earn less than the men regardless of working within or outside academia.

The model also reveals that having graduated from business, economic, or law comes with an earnings increase compared to those who graduated from education, humanities, or social sciences when working outside academia, for both men ($69,820 + $97,399 = $167,219) and women ($49,694 + $16,418 = $66,112). In this group, the *t*-test shows a significant gender difference ($t = 4.30$; $p < 0.05$). However, for the men,

the earnings increase is much greater and leaves them with much higher earnings than that of the women.

Having graduated from science, math, or computing is also associated with earnings increase in comparison to those who graduated from education, humanities, or social sciences when working outside academia. This is true for both men ($69,820 + $32,151 = $101,971) and women ($49,694 + $28,454 = $78,148), although, on average, men do earn more than the women.

On average, the group who graduated from engineering or construction also earn more than those who graduated from education, humanities, or social sciences when working outside academia. This is true for both men ($69,820 + $40,410 = $110,230) and women ($49,694 + $41,902 = $91,596). Nevertheless, the men also earn, on average, more than the women in this group.

Furthermore, the model reveals that for the people who graduated from business, economic, and law, working within academia as compared to outside, is associated with earnings increase for the women ($49,694 + $20,058 + $16,418 + $4351 = $90,521) and earnings decrease for the men ($69,820 + $5907 + $97,399 – $73,928 = $99,198). Nevertheless, on average, men still earn more than the women in that group.

For the science, math, and computing graduates, employment within academia as compared to outside academia is associated with earnings decrease for both women ($49,694 + $20,058 + $28,454 – $28,841 = $69,356) and men ($69,820 + $5,907 + $32,151 – $24,410 = $83,468). However, on average, men still earn more than the women in this group.

Furthermore, for the engineering and construction graduates, employment within academia as compared to outside academia is associated with earnings decrease for both men ($69,820 + $5907 + $40,410 – $24,669 = $91,468) and women ($49,694 + $20,058 + $41,902 – $38,167 = $73,487). Nevertheless, on average, the men in this group earn more than their women counterparts.

Examining the duration of employment, it is observed that each additional year of work experience is associated with average total earnings increase of $2002 for men and $1999 for women. Ultimately, the model indicates that taking parental leave is not correlated with any loss in earnings for either men or women.

Discussion

The present article aimed to examine the total earnings of Icelandic doctorate holders in STEM and SSH fields at different career stages within and outside academia. Utilizing longitudinal register data encompassing the entire population of Icelandic doctorates holding degrees for 5–20 years as of 2017, this analysis sought to provide insights in a context where Iceland is recognized as a global leader in gender equality. A comparative analysis of total earnings was conducted based on gender, field of study, and employment status within or outside academia.

The regression analysis findings indicate a persistent gender gap in total earnings both 5 and 10 years post-graduation, irrespective of the field of study or employment within or outside academia. This aligns with prior research, such as CORE (2023) and Webber and Canché (2015), which consistently identified lower salaries for women compared to their male counterparts across different employment sectors.

The analysis further reveals that, 5 years after graduation, women generally fare better financially within academia, with the exception of those with engineering and construction degrees. However, 10 years post-graduation, women across all study fields, excluding education, humanities, and social sciences, experience greater financial benefits when working outside academia. Conversely, for men, with the exception of those with education, humanities, and social sciences degrees, financial advantages are found in working outside academia both 5 and 10 years after graduation.

Additionally, the regression analyses demonstrate a narrower earning gap within academia compared to outside, particularly 5 years after graduation across all study fields. However, ten years post-graduation, this pattern is only observed in education, humanities, and social sciences, as well as in engineering and construction. Moreover, the gender gap in earnings outside academia diminishes in all study fields between the fifth and tenth career year.

This article's findings are partially congruent with Hamermesh's (2018) research, indicating that, on average, doctorate holders outside academia receive higher compensation than those within academia. This trend is generally observed among the men in our dataset, with the exception of those holding degrees in education, humanities, or social sciences. Conversely, women commence with higher earnings within academia but experience improved financial outcomes outside academia later in their careers.

It is important to acknowledge that our findings possess limitations due to the lack of adjustments for varying working hours between men and women (e.g., part-time vs. full-time), occupational status/responsibility, public versus private sector, and, in the case of academics, productivity measures. Despite the longitudinal and register-based nature of our data, spanning a 20-year period to track the earnings development of Icelandic doctorate holders, this information was not available. Insights into occupational status/responsibility and public versus private sector affiliations would have enhanced our understanding of career advancements among Icelandic doctorate holders. Specifically, it could have provided a more nuanced perspective on the extent to which horizontal and vertical labor market segregation contributes to the total earnings gap, a factor highlighted by Lörz and Mühleck (2019) and Barone and Assirelli (2020) as critical in the gender gap. However, even with the gendered selection of field of study and occupation, our findings, consistent with Webber and Canché (2015), underscore the persistent trend of women earning less than their male counterparts across various study fields and employment sectors.

Additionally, incorporating data on productivity measures would have been valuable, helping elucidate the extent to which the observed earnings gap within academia is attributable to differences in performance. Steinþórsdóttir et al. (2017) indicate gendered outcomes in the Icelandic academic performance assessment system, with men more likely to hold positions of full-time professors, and male dominated fields are favored both in terms of research and teaching. This could potentially explain the initial advantage for women within academia and the subsequent widening of the gender gap in total earnings within academia between the fifth and tenth career years, aligning with findings from Steinþórsdóttir et al. (2017).

Outside academia, the situation may be partially explained by the vertical division of the labor market, with men more likely to hold managerial and higher positions (Einarsdóttir et al. 2019; Júlíusdóttir et al. 2018). It could also be attributed to men securing higher-paid positions earlier in their careers, while women take longer to progress to better positions.

Furthermore, accounting for different working hours between men and women would have provided a more comprehensive explanation of factors influencing the earning gap. Although female workforce participation in Iceland is notably high (Statistics Iceland 2021), with the country having the highest participation rate among OECD countries (OECD 2020), general statistics on working hours in the labor market reveal that women work an average of 7.8 hours less per week than men (Statistics Iceland 2021). While this is general information and may not directly apply to individuals with PhDs, an online survey on academics in Iceland suggests that 71.6% of male participants reported working 50 hours or more per week, compared to 61.8% of their female counterparts (Heijstra et al. 2013).

To conclude, this study makes a significant contribution by highlighting a discernible gender earnings gap among doctorate holders in Iceland, despite the country's notable level of gender equality on a macro scale (The World Economic Forum 2021). This observation aligns with previous studies by Alfano et al. (2019), Gaeta et al. (2018), Levecque et al. (2014), Webber and Canché (2015), and Pedersen (2016).

This study's findings emphasize that achieving gender equality at the societal level through legislation and public policy does not necessarily translate into full gender equality within organizational workplaces or intimate partner relationships. The longstanding legislative efforts aimed at eradicating the gendered wage gap, might indicate that the Icelandic government has viewed the issue as rooted in structural frameworks rather than meritocratic ideologies (Cech & Blair-Loy 2010).

The introduction of the Equal Pay Standard in 2018 by the Icelandic government represents a pioneering step, and its impact on narrowing the remaining gap remains to be seen. It raises the question of whether this macro-level intervention will address micro-level patterns of gender disparities in the workplace or potentially serve as a broader, superficial measure. Future research should closely examine the effects of this initiative.

In summary, further exploration of this topic in countries with relatively high levels of gender equality at the societal level could shed light on the persisting barriers hindering the advancement of female doctorate holders, both within and outside academia. This avenue of research is essential for a comprehensive understanding of the complexities surrounding gender disparities in professional and academic spheres.

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Note

[1] When two or more means are added together ($\beta_l = \beta_j + \beta_k$). As is done when interpreting regression analyses. The new mean has a standard error which is calculated as follows.

$$Se\beta_l^2 = \sqrt{Se\beta_j^2 + Se\beta_k^2}$$

The new standard errors are needed to calculate *t*-values which determine whether the corresponding coefficients for men and women present a statistically significant gender difference.