The Gender Gap in Tax Evasion

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Abstract

Differences in the labour market outcomes of men and women have been studied extensively, alongside a behavioural literature describing differences in social and economic preferences between men and women. I address a novel question which touches both of these literatures - are there gender differences in tax evasion? Using administrative tax records, I leverage a reform in the construction and manufacturing sector in Romania which eliminated income tax, and hence the incentive to under-report income, to identify the extent to which men and women in the sector evade tax. I find evidence of significant differences in income under-reporting between men and women and that this has meaningful implications for the observed gender wage gap. The data suggests that this is not driven by gender segregation in work or differences in bargaining power, but rather that preferences are driving the gender gap in income under-reporting.

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1 Introduction

Gender differences in labour market outcomes, such as participation and wages, have received large amounts of attention, as well as the structural and behavioural factors contributing to the gender gaps. One potential difference in labour market behaviour, which has so far been unexplored, is the gender gap in tax evasion. This may be a particularly important source of inequality with the rise of gig work (Giupponi & Xu, 2020) and self-employment (Abraham, Haltiwanger, Sandusky, & Spletzer, 2019) documented in many major economies. I investigate the gender gap in tax evasion, as well as disentangle the causes of the gap, and find that behavioural differences, rather than structural, seem to be driving the gap.

My data comprise of complete and matched employee-employer administrate tax records of Romanian firms and workers. The setting is particularly compelling to study tax evasion. It is commonly believed[1] that most tax evasion is at the intensive margin, where employees (and employers) are registered formally with the tax authority, but significantly under-report their true income to minimise the tax burden. This is sometimes called 'gray work', and is said to be 'as difficult to stop as it is widespread' by one Romanian news outlet[2].

Using the administrative tax data I employ a differences-in-differences identification strategy comparing individuals in sectors treated with a tax reform against individuals in the untreated remainder of the private sector. The reform I use eliminated income tax in certain sectors of the economy (construction and some manufacturing), and hence eliminated incentives to under-report income. Jumps in income following the reform are interpreted as the gap between the true salary which the employee took home before the reform, and the income they reported to the tax authority. I discuss and rule out other explanations for jumps in income following the tax reform.

Using the detailed tax records and my identification strategy, I find evidence that a significant amount of tax evasion is taking place in Romania's construction and manufacturing sector, and that there are gender differences in tax evasion. This has a striking implication for the observed gender wage gap. The construction sector, notorious for tax evasion, became income-tax exempt in January 2019, and between 2018 and 2019 the direction of the un-adjusted wage gap flipped. Women went from, reportedly, out-earning men in this sector by 8% to earning 7% less than men, once incentives to under-report income were removed.[3]

[1] Discussed, for example in this Romanian newspaper article https://www.bursa.ro/impactul-optimizarii-fiscale-a-muncii-in-romania-intre-legalitate-si-ilegalitate-21096646?fbclid=IwAR14gxCzEQpROHHcHWqd-9GCyyctYwu4V1TMi-zbHm6spQO2ktFt7g_tldM and this one https://www.europafm.ro/romania-in-direct-psd-si-pnl-maresc-si-salariul-minim-de-ce-o-treime-din-angajati-castiga-doar-salariul-minim-video/?fbclid=IwAR2dTjUZ7fq4KVJMCVb45vYyOP6u81-_c9LwobTKmzyD8BSRX3gKeeGsrho

[2] https://www.avocatnet.ro/articol_19270/Munca-la-gri-intre-evaziune-fiscala-si-avantajele-unor-taxe-mai-mici.html?fbclid=IwAROceBd1NTLp99ENYjPXUrs1bMsDOIyMsFAXF54Z6W61KNji_qREXPycFe8

[3] The adjusted wage gap, measured as the beta on a female dummy, controlling for firm size, job tenure, number of dependents and hours worked in the log-wage regression, increased from -10% to -4%. This does

In contrast, in the remainder of the private sector, the wage gap was approximately constant throughout, with women earning 12% less than men.[4] There are a number of reasons why men and women may have different propensities to evade tax. A large literature has shown that there are gender differences in risk aversion (Borghans, Heckman, Golsteyn, & Meijers, 2009), lying aversion (Abeler, Nosenzo, & Raymond, 2019; Childs, 2012; Dreber & Johannesson, 2008), as well as social preferences and competitiveness (Backus, Cubel, Guid, Sánchez-Pagés, & López Mañas, 2023; Croson & Gneezy, 2009; Fehr, Naef, & Schmidt, 2006; Niederle, 2017; Niederle & Vesterlund, 2007). Additionally, Roussille (2021) highlights the role of the gender 'ask-gap' on a job matching platform and Li and Zafar (2023) shows there is also a gender ask-gap for college regrades. Exley and Kessler (2022) shows that there is a, related, gender gap in willingness to self-promote. In Romania, income reporting is done by the employer, who withholds the salary and pays income tax on behalf of the employee, meaning that tax evasion requires joint collusion with the firm and that this might require the employee to initiate the collusion. There may be gendered differences in collaboration between employee and employer[5], differentially affecting men and women's opportunity to evade tax. Biasi and Sarsons (2022) shows that when there is flexibility to bargain over wages, women lose out in pay compared to men. In the case where employees and employers jointly collude (or negotiate) over tax evasion, beliefs about others' willingness to engage in tax evasion can influence own willingness to engage. Given its sensitive nature, negotiations over a collusion to evade taxes may be particularly susceptible to gendered differences. Exley, Hauser, Moore, and Pezzuto (2022) shows that *beliefs* about gender differences in social preferences are large while Bursztyn, González, and Yanagizawa-Drott (2020) demonstrates that beliefs about gendered social norms may be incorrect. A lack of transparency (Baker, Halberstam, Kroft, Mas, & Messacar, 2023) that tax evasion can be jointly agreed, or negotiated, may also contribute to a gender gap in tax evasion.

To deal with concerns of gender differences in bargaining between employee and employer[6] I run my difference-in-difference specifications on CEOs and one (wo)man bands, since the firm CEO should have full bargaining power with him/herself and one-employee firms should similarly be able to decide independently if, and by how much, they would like to evade tax. For further robustness I also look at industries with highly competitive labour markets, where employers have little power to take a markup over the employee's marginal

imply that the wage gap is in favour of women both before and after the policy introduction.

[4]This can be seen in Figure 14 located in Appendix A.

[5]Dreber and Johannesson (2008) showed that there were gendered differences in economics research collaborations, contributing to a gender output gap and Cullen and Perez-Truglia (2023) shows that social interactions at work contribute to a gender promotion gap. Beaman, Keleher, and Magruder (2018) shows that women may also be disadvantaged in employee referrals.

[6]The bargaining between employee and employer can be considered a similar question to that of the economic incidence of income tax. The elimination of income tax which I study has similarities with tax credit policies, for which Azmat (2019) shows that in the case of one UK tax credit policy the economic incidence was not completely passed through to the intended recipient, the employee. Rather, the employer had the power to decrease the nominal wages of eligible workers.

product. Under this setting, the incidence of the tax-cut should be passed through to the employees rather than the employers.

Gender differences in tax evasion may, instead of being due to preferences, be due to differences in ability to avoid tax - such as segregation in the kinds of work men and women do. While challenging to completely rule out, since my data does not directly contain information on the occupation of employees within firms, I provide evidence that this is not driving the gender gap in tax evasion in Romania's construction and manufacturing sector. To do this I firstly note that manual work in a construction site will exhibit much more seasonality in hours worked than work in an office, due to seasonal weather conditions. I thus use within-individual variance in hours worked to infer whether a worker does manual work in a construction site or work based in an office. Equipped with inferred (and imperfect) information on occupation, I show that within manual workers and within office-based workers the gender gap in tax evasion remains. Next, I look individually at the sector code which is most gender-neutral in construction and manufacturing (in terms of the female share of employment), which also happens to be a sector which is based "in-office" rather than on a building/construction site, meaning it is more formal and there is less scope for gender segregation in work to affect the ability to under-report income - a significant gender gap in tax evasion remains. I finally employ a triple-difference specification which utilises between-gender variation within the detailed sector codes. This controls for gender segregation between the many different industry classifications within construction and manufacturing, but not for segregation in occupations.

The country of Romania provides a compelling setting to study the question of gender differences in tax evasion. In Romania, raw and adjusted wage gaps are remarkably small relative to comparable countries (the raw wage gap is the second lowest in the EU[7]), but the gap in participation[8] is also relatively small by international standards, at 4 percentage points.[9] Romania's relative exceptionalism in gender equality makes it an ideal setting to study differences in preferences for tax evasion, since this mitigates, relative to seemingly comparable countries, concerns that it is due to gender segregation in access or ability to avoid tax. Current attitudes to gender equality are thought to have been shaped by decades of explicit policies of gender equality during the communist regime (Andrén & Andrén, 2015; Vanc & White, 2011).

I contribute to the literature on the measurement, causes, and consequences of gender wage gaps. Blau and Kahn (2017) provides a comprehensive overview of trends in the gender wage gap and Ngai and Petrongolo (2017) deliver an explanation for the narrowing

[7] https://commission.europa.eu/strategy-and-policy/policies/justice-and-fundamental-rights/gender-equality/equal-pay/gender-pay-gap-situation-eu_en

[8] Olivetti and Petrongolo (2008) shows that selection into employment is a large contributor to the negative cross-country correlation between wage and employment gaps.

[9] In 2018 and 2019, there were 4,260,890 female employees in the labour force and 4,631,312 male employees.

of wage gaps over time - the rise of the service sector. The remaining causes of gaps, such as the structure of jobs and rewards to certain types of working (Adams-Prassl, Hara, Milland, & Callison-Burch, 2023; Goldin, 2014; Petrongolo & Ronchi, 2020) and the effects of parenthood (Cortés & Pan, 2023; Kleven, Landais, & Søgaard, 2019) are emphasised as priorities for progress. I build on this work by showing that progress towards gender equality may be understated if men are more likely to under-report their incomes to tax authorities. There is also a large body of work studying tax avoidance and evasion (Kleven, Knudsen, Kreiner, Pedersen, & Saez, 2011; Pissarides & Weber, 1989; Saez, 2010) and its distributional consequences (Benedek & Lelkes, 2011). The policy implications of gender differences in tax-evasion thus extend beyond the effects of gender (in-)equality and to the tax enforcement tactics used by the relevant authorities. Additionally, I contribute to the behavioural literature on gender differences in lying, and to the best of my knowledge am the first to use observational rather than experimental data.

2 Theoretical Model

To formalise the economic logic underlying the decisions of employees and employers to tax evade or not, and the bargaining between the employee ('he') and employer ('she') over the economic rent generated by evading tax, I develop a two-period game-theoretical model. In the model, employers move first, offering the employee either an agreement to under-report income to the tax authorities or an agreement to be 'fully honest' and report the salary to the authorities truthfully. Because this is a two-period model, in which the employer is the first mover and the employee is the second mover, I solve it using backwards induction.

2.1 Preliminaries

There is an income tax, at a proportional rate t of the reported wage. The incidence of the tax is bargained over, and I denote the part paid by the employee as t' and the part paid by the employer to be $t - t'$. There is a competitive market wage for construction labour, w, which is above the national minimum wage $\bar{w}$.

A Romanian firm can either make an offer of 'joint evasion', or 'full honesty'. Joint evasion does not refer to black market (completely informal) work, but rather to a form of 'grey work' in which the minimum wage is reported to the authorities and the remainder of the salary is paid cash-in-hand, which has the benefit of giving the employee access to Romanian state benefits such as health insurance and a pension. The Romanian worker, however, can either accept an offer from the firm of either 'joint evasion' or 'full honesty', or leave Romania to work in a higher wage country. Romanian workers have access to the entire EU labour market, and often work abroad due to the higher wages[10]. This generates

[10] https://www.romania-insider.com/construction-companies-warning-fiscal-allowances-2023

bargaining power for the Romanian construction worker. If a Romanian worker accepts an offer of either 'joint evasion' or 'full honesty' from the Romanian firm, then the employee earns eligibility for benefits from the state, such as health insurance, pension contributions, eligibility for parental leave etc. I denote the value of this benefit as b and assume that while the market wage (net of any taxes and benefits) for construction workers is higher abroad (with value $\tilde{w} > w$) that the worker does not receive these benefits abroad. This is a fairly realistic assumption as Romanian workers may prefer to return to Romania for retirement and to raise children.

We can also imagine that as opposed to a Romanian worker operating either fully transparently with his employer, jointly evading with her employer to under-report, or work abroad, that the Romanian worker could work in the fully black market in Romania, where instead of under-reporting income the worker simply operates totally off the books and hides all of the income from the tax authority. However, this kind of work will be strictly dominated for the worker, since although there is no tax burden in Romania, there are also no benefits such as a pension for this work, and so working abroad dominates working in the Romanian black market.

2.2 Analysis

Suppose that a Romanian firm can either make an offer of 'joint evasion', or 'full honesty'. The cost of employing labour in the case of joint evasion is:

$$(1 + (t - t'))\bar{w} + (w - \bar{w}) = w + (t - t')\bar{w}$$

In the case of full honesty, the cost of employing labour is:

$$(1 + (t - t'))w = w + (t - t')w$$

It is clearly preferred for the firm to operate under 'joint evasion', since the market wage for labour is the same in each case, but, so long as the employer has an incidence of the labour tax above zero ($t - t' > 0$) the tax burden is higher in the case of 'full honesty'.

Since the employer prefers to jointly evade, she would like to induce the employee to accept an agreement to jointly evade. The employer also prefers to minimise her share of the income tax incidence, so she will offer the employee the highest level of t' (conversely, the lowest level of $t - t'$) that he would be willing to accept.

The Romanian worker, in the case of 'joint evasion' earns:

$$(1 - t')\bar{w} + (w - \bar{w}) + b = w - t'\bar{w} + b$$

He always prefers 'joint evasion' to 'full honesty', since in this case he earns:

$$(1-t')w + b = w - t'w + b$$

In order to entice the worker to accept the offer to jointly evade with her, the employer must offer an agreement which satisfies:

$$w - t'\bar{w} + b \geq \tilde{w}$$

This can be re-written as a condition for the incidence of the income tax that the employee is willing to bear:

$$t' \leq \frac{b + w - \tilde{w}}{\bar{w}}$$

Thus, the employer will offer the worker the highest incidence of tax that he is willing to bear, $t'^* = \frac{b+w-\tilde{w}}{\bar{w}}$ while the employer will pay the remaining $t - t'^*$

2.2.1 Extension

So far I have derived the conditions necessary for employers and employees to jointly collude and evade tax under the assumption that it is costless for the employer to evade tax. This need not be the case, however. In order to pay the employee with cash under the table, the employer may face a cost in doing so. This can be thought of as an aversion to lying, a risk of getting caught which increases with the amount evaded, or as the cost of producing untraceable cash (e.g. withdrawing money from the firm in the form of dividends and paying the low dividend tax rate which was 5% in Romania, or less for micro-enterprises). In this case, the cost to an employer of paying an employee would be:

$$(1 + (t - t'))\bar{w} + (1 + c)(w - \bar{w})$$

The employer would prefer to still operate with'joint evasion' and incur the proportional cost of evasion c rather than operate with 'full honesty' if:

$$(1 + (t - t'))\bar{w} + (1 + c)(w - \bar{w}) \leq w + (t - t')w$$

Which can be rewritten as $c \leq t - t'$, or in other words, the burden of paying the firms' part of the incidence is higher than the proportional cost of hiding income from the tax authorities.

2.3 Summary of Model Results

This simple model builds the intuition on how employees and employees make the decision to jointly evade income from the tax authorities. Employers benefit from joint evasion rather

than operating with full honesty so long as part of the incidence on income tax falls on them and so long as the costs of evading do not outweigh the benefits of avoiding tax. Employees are able to bargain with employers due to their strong outside option of working in the construction sector abroad where they have a higher wage rate, and so are able to shift part of the incidence of the taxation onto the employers, and find jointly evading to be worth it if the state benefits of working in Romania and the benefit of evading outweigh the higher wage which could be earned abroad.

3 Data and Identification

3.1 The Setting

The policy reform takes place in Romania, a large country by European standards, located in the EU, with a population of approximately 20 million individuals. Romania is an ideal setting to study gender differences in tax evasion as the country is very gender equal, by European standards, at baseline.

Tax evasion, however, is thought to be a pervasive issue. Anecdotally, institutions are strong enough that the vast majority of firms and employees must be formally registered with the tax authorities and report salaries, along with the corresponding tax payments. Operating formally as a firm and an employee also provides the benefits of eligibility for certain forms of government support, such as maternity/paternity benefits and unemployment insurance. Under the present levels of enforcement and monitoring, employees and firms are thought to jointly collude, reporting a low income, such as the minimum wage, while the remainder of the true salary is paid cash-in-hand. Income tax in Romania is a flat 10% rate, with no kinks in its schedule and no tax-free allowances for low earners.

The reform which my identification strategy relies on takes place in the construction sector and some of the manufacturing sector. The NACE sector codes which are related to manufacturing are 'close to' construction, such as the manufacturing of construction inputs like bricks and concrete, rather than sectors such as the manufacturing of apparel, which is likely to be more formal and more gender neutral. The reason for the policy reform was to promote the construction sector in Romania. As a relatively poorer EU country, construction workers have strong incentives to work in richer countries in Western Europe. Even after the reform which made Romania relatively more attractive, there are more Romanians working in construction outside of Romania than inside of Romania[11] A full list of the treated NACE codes is in Appendix A, along with the female share of employment in each of the NACE sector codes and the share of the total construction employment that the code makes up.

[11] According to the following Romanian news website warning that in the absence of the policy, more tax evasion would occurhttps://www.romania-insider.com/construction-companies-warning-fiscal-allowances-2023

3.1.1 The Informal Sector

Using the Ministry of Finance provided tax register data, I am unable to observe Romania's informal economic sector. The World Bank[12] provides cross-country estimates on the size of the informal economy using model based estimates and survey data, the details of which are described by Elgin, Kose, Ohnsorge, and Yu (2021). The percentage of informal output relative to GDP was estimated, using the range between the two most preferred estimation strategies[13], to be 26.6% - 29.2% in Romania in 2018. To put this into context, the informal sector's share of GDP was estimated to be 11.9% - 12.3% in the UK. Romania is comparable with other Central and Eastern European countries, however. The corresponding figures are 27.8% - 31.8% in Bulgaria, 23.3% - 24.7% in Poland and 16.1% - 16.6% in Slovakia.

According to the same World Bank source, this time using World Bank Enterprise Survey data from 2013, 95.9% of Romanian firms were formally registered when they began their operations in the country. This figure is similar to nearby Central and Eastern European countries.

Although my data do not cover the informal economy, coverage of organised firms is very high and the high rates of informal economic activity are in line with the high rates of under-reported income which I identify.

3.2 Data

I use administrative tax records provided by the Romanian Ministry of Public Finance. The matched employee-employer data are monthly and cover 2018 through 2020. I use the data up to and including January of 2020. In the February of 2020 an issue of missing data prevents me from extending the length of the panel. I create a balanced panel, keeping only individuals whom are active in the labour market throughout the whole period and do not move between the construction and manufacturing sector and the rest of the private sector labour market.[14]

Income reporting in Romania is done by the firm[15], which is what I observe in the data. Because the data are tax records, demographic variables are limited, but crucially include gender. The number of dependents is also observed. Otherwise, for each individual I observe monthly income, monthly hours of actual work, contracted hours of work, and the firm that the individual works for. At the firm level, industry NACE codes are provided, which are used to identify whether firms have been treated by the policy.

[12] https://www.worldbank.org/en/research/brief/informal-economy-database

[13] A Dynamic General Equilibrium estimation strategy and a Multiple Indicators Multiple Causes Model Based estimation strategy

[14] I address individuals switching firms in the robustness section.

[15] The tax system has been modernised and digitised, through a partnership with the World Bank: https://www.worldbank.org/en/news/press-release/2013/04/26/romania-modernizes-revenue-administration

Because tax evasion, as a joint employee-employer collusion, is less likely to take place in the most large, formally run, firms, I exclude the largest 5% of firms by number of employees from my analysis. I make this choice because identifying the extent of tax evasion in the treated sectors is not the aim of this paper, rather it is to identify the gender-difference in evasion, so I choose to exclude the firms in which tax evasion is least likely to occur. Robustness checks around this cutoff value are provided in the robustness section. The results are not sensitive to this cutoff, particularly the difference in tax evasion between genders. However, the tax evasion estimated according my identification strategy declines rapidly amongst the largest firms[16]. In my sample there are 973,330 individuals and 376,205 firms remaining. The average firm in the sample has 5 employees while the largest has 64 employees.

3.3 Selection

It may be the case that women in the construction and manufacturing sector are differentially selected than the women in the remainder of the private sector. Women make up only 16% of the sector, in spite of having a much more equal share of overall labour force participation. In Table 1 I provide descriptive statistics comparing the women in the construction and manufacturing sector and those in other sectors. Based on observables, the women appear very similar - they are also similar to men in their sector.

There does, however, appear to be some segregation in the sector. Women tend to work in firms with higher shares of women than men. Additionally, men in construction are much more likely to be 'seasonal' workers than women. The specific seasonal pattern I am referring to here is a dip in working hours during the winter months. Because my data does not contain direct information on worker occupation, I use this seasonality in work patterns to infer something about occupational segregation between men and women, since construction work is more seasonal, due to weather conditions, than for example administrative or logistics work in the construction sector. In Table 1 I define a seasonal worker by finding, for each worker, the ratio between working hours in the winter months of December, January and February and the working hours in the remainder of the calendar year. This generates a distribution of 'winter hours relative to other hours' across workers, and I define an employee as a seasonal worker if this ratio is below the 10^{th} percentile of this distribution. Women in construction are only slightly more likely to be seasonal than women in the non-construction private sector, but men are almost twice as likely to be seasonal if they work in the construction sector.

[16] Which I show in Appendix B

	(1)		(2)		(3)
	Construction Sector		Non-Construction Sector		Difference
	mean	sd	mean	sd	b
Age	44.02	10.06	44.12	10.87	0.10***
Job Tenure	5.45	5.18	5.69	5.86	0.23***
Hours Worked	154.59	36.85	152.99	38.21	-1.60***
Number of Dependents	0.32	0.69	0.29	0.65	-0.03***
Firm Size	10.48	7.55	9.24	7.70	-1.24***
Female Share of Firm	0.47	0.30	0.76	0.25	0.29***
Full-Time Contract	0.92	0.28	0.88	0.32	-0.03***
Seasonal Worker	0.12	0.32	0.10	0.30	-0.02***
Bucharest	0.19	0.39	0.16	0.37	-0.03***
Observations	290532		9796380		10086912

Panel (a): Women

	(1)		(2)		(3)
	Construction Sector		Non-Construction Sector		Difference
	mean	sd	mean	sd	b
Age	43.71	10.51	44.16	11.55	0.45***
Job Tenure	4.25	4.39	5.34	5.36	1.08***
Hours Worked	156.94	33.96	154.86	36.75	-2.09***
Number of Dependents	0.32	0.73	0.33	0.73	0.01***
Firm Size	11.16	7.58	9.54	7.59	-1.62***
Female Share of Firm	0.10	0.14	0.24	0.24	0.14***
Full-Time Contract	0.96	0.20	0.91	0.29	-0.05***
Seasonal Worker	0.16	0.37	0.09	0.29	-0.07***
Bucharest	0.12	0.32	0.15	0.36	0.04***
Observations	1578500		9747848		11326348

Panel (b): Men

Table 1: Descriptive Statistics: Selection into Construction Sector by Gender
Notes: Job tenure is measured in years, hours worked are monthly. Bucharest is a dummy variable for working in the capital city of Bucharest.

3.4 Identification

In January 2019, the manufacturing and construction sector became exempt from income taxation, while no changes in taxation were announced for other sectors. This policy was unannounced and came into force as a 'Government Emergency Ordinance' at the very end of December 2018. I use exemption from income tax as an elimination of incentives to under-report income. A jump in *reported* income following the policy reform is thus interpreted as the income which was previously un-reported. The use of the non-treated (non-construction) firms as a control group means that the usual difference-in-difference

assumption of parallel trends applies.

In addition to exempting the employee from personal income tax, the policy also exempted employees from paying the usual health insurance contribution of 10%. Social insurance contributions are usually taxed at a rate of 25% of the income, but the policy reduced this figure to 21.25% for those in the manufacturing and construction sector.

3.4.1 Interpretation of Jumps in Income

A different interpretation to jumps in income representing the income that was previously under-reported could be that some, or all, of a jump in income following the elimination of income tax in the construction and manufacturing sector is a genuine increase. In other words, the elasticity of reported income with respect to the tax rate captures all of the possible behavioural responses to the income tax, including evasion, avoidance, work intensity and labour supply responses (Saez, Slemrod, & Giertz, 2012).

Cutting the tax rate from 10% to 0% induces a labour supply response[17], so I include controls for hours specified in the contract and hours actually worked during the month. Since hours worked are a crucial control variable, it is important that they are reported accurately. I plot the seasonality of hours worked by sector in Appendix A and show that the seasonality of the construction and non-construction sectors follow each other closely throughout most of the year, but there is a gap during the cold winter months in which hours worked in the construction sector are lower than that for the non-construction private sector, consistent with it being more difficult to do manual work in the winter weather conditions. This gives an indication that hours worked are reported, at least reasonably, accurately.

There is also the possibility that the policy induces a jump in productivity in the sector. While impossible to rule out, it lacks plausibility that jumps in productivity would match the magnitudes of the responses in reported incomes I observe. Additionally, it is even less credible that any effect on productivity would be non-trivial in magnitude and effect male and female workers differentially, particularly once I control for the type of work being done. Ultimately, I am unable to empirically separate productivity jumps from previously un-reported income now becoming revealed. Potential increases in labour productivity are thus assumed to be equal between genders, but this is an assumption.

The policy may also induce general equilibrium effects on the price of labour in different sectors, as employees move between industries. I address this in my robustness section and find that movement of employees is limited and thus my results are unlikely to be driven by general equilibrium adjustments. Additionally, I detail in what direction various results of mine might be biased if they were to be affected by general equilibrium adjustments.

To provide empirical support for my interpretation of jumps in income, I show that

[17] The treatment effects of the policy on actual hours worked are reported in Figure 19 in Appendix B.

the tax evasion implied by jumps in income declines rapidly for firms as they approach the top percentiles of the firm-size distribution in Figure 21 in Appendix B. It would be expected that the largest and most formal firms are also less likely to tax evade, and so this heterogeneity in estimated tax evasion is in line with my interpretation of jumps in income. Additionally, I find that tax evasion is estimated to be higher outside the capital city of Bucharest than within Bucharest (Appendix B), consistent with the logic that if the capital city is a relatively more formal section of the economy tax evasion is likely to be less widespread.

My interpretation of jumps in income as being previously unreported income, following the elimination of income tax in the construction and manufacturing sector, can also be supported by an analysis of the dis-employment effects of Romania's large minimum wage increases. The anecdotal evidence is that tax evasion in Romania is often a 'gray' form of evasion, where the employee is formally registered with the tax authority, but falsely reports earning exactly the minimum wage, while the remainder of the true salary is paid cash in hand. One Romanian newspaper bringing this phenomenon to light has asked "Why do one third of Romanian employees earn only the minimum wage? Is it tax evasion or the power of the economy?"[18] In the construction and manufacturing sector, before the policy reform which eliminated income tax, this figure was closer to two-thirds. If the minimum wage was indeed binding, then large increases to the minimum wage would be expected to have, at least some, dis-employment effects.

Between 2013 and 2023, a ten year period, Romania's minimum wage has increased from 750 RON to 3000 RON - an enormous four-fold increase. Despite large increases to the minimum wage occurring steadily over the past decade, Romania has not suffered from dis-employment effects or from inflationary effects (Heemskerk, Voinea, & Cojocaru, 2018; Pantea, 2020). This is entirely consistent with minimum wages being non-binding, with the true wage for many employees being above the minimum wage and paid under the table. Increases to the minimum wage thus do not affect true wages, but decrease the extent of income under-reporting and tax evasion.

3.5 Difference-in-Differences

My preferred difference-in-difference specification to identify changes in reported income following the elimination of income tax in the construction sector is the following:

$$y_{i,t} = \beta_0 + \sum_{\forall s/-1} \beta_s \mathbb{1}\{treated_{s=t}\} + \alpha_i + \alpha_t + \sum_{j=1}^{n} \delta_j x_{i,t}^{j} + \epsilon_{i.t}$$

[18] https://www.europafm.ro/romania-in-direct-psd-si-pnl-maresc-si-salariul-minim-de-ce-o-treime-din-angajati-castiga-doar-salariul-minim-video/?fbclid=IwAR2dTjUZ7fq4KVJMCVb45vYy0P6u81-_c9LwobTKmzyD8BSRX3gKeeGsrho

In this regression, β_0 is an intercept, the series of β_s coefficients are the difference-in-difference treatment effects estimated relative to the base period, one month prior to the policy's introduction. α_i and α_t are the individual and time fixed effects and the series of coefficients δ_j are included for the control variables x^j.

4 Results

4.1 Main Specification

I run my preferred specification on a number of outcomes. To capture the intensive margin of tax-evasion, I estimate how much income men and women are hiding from the tax authority - specifically, the log of gross reported income. For the extensive margin, I look at the jump in both men and women who report that they earn above the minimum wage[19].

4.1.1 Reported Monthly Income

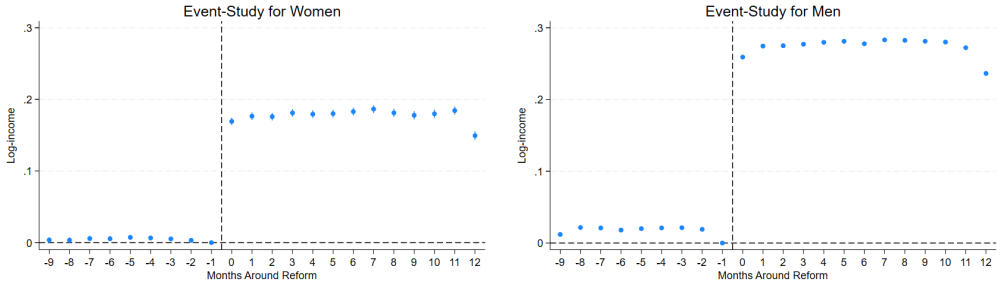

Figure 1: Event Study-Monthly Reported Log-Income

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

In Figure 1 I plot the event-study of my preferred DiD specification on log-income. Following the elimination of income tax in the construction sector, reported income in the sector jumps by approximately 20% for women, but 30% for men. The interpretation is that the amount of income which went unreported by men was significantly higher than for women, about 50% higher.

This is a measure of hidden income at the intensive margin, but does not reveal the extensive margin of tax evasion, which is the proportion of the male and female population hiding income from the tax authority. To measure this margin, I look at jumps in the

[19]The minimum wage increased from 1900 RON to 2080 RON in 2019, an increase of 9.5%. In 2020 (January of 2020 is month 12 around the reform), it increases to 2230 RON

reporting of any salary above the minimum wage, relying on the assumption that those evading tax in the 'optimal' way are recording only the minimum wage in the tax forms.

4.1.2 Earning Above the Minimum Wage

For a tax-evading worker, reporting the minimum wage on paper provides the benefits of formal employment, such as childcare leave/benefits and unemployment insurance, while minimising the income tax burden, since the remainder of the 'true' salary is paid cash-in-hand by the employer. Anecdotally, this is a very common method of evading taxes. In the 9 months prior to the elimination of income tax in the construction sector, 71% of men and 61% of women reported earning exactly the minimum wage. In the non-construction sector, these figures are 58% and 55% respectively. To put these figures in perspective, in April 2022 it was estimated that only 5% of workers in the UK were earning the minimum wage[20] while the corresponding figure in the United States was 1.4%[21] in 2021. In Germany, the figure was estimated to be 3.5% in 2019[22].

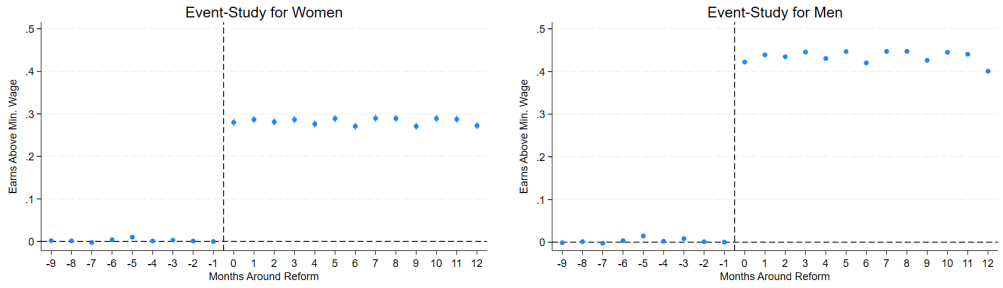

Figure 2: Event Study-Earns Above Minimum Wage

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). The outcome variable plotted is a dummy variable equal to zero if the reported income equals the minimum wage, and equal to one if it is above the minimum wage. Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

Figure 2 shows that following the policy introduction, there is an excess number of men and women reporting that they earn above the minimum wage. Under the interpretation that reporting a wage over the minimum wage entails truthful reporting of income, the policy induced an increase of truthful income reporting. The number of women induced to switch to truthful income reporting jumps by about 30 percentage points, while the number for men is around 45 percentage points. Prior to the policy reform, approximately 15% more men than women were hiding income from the tax authority.

[20] https://researchbriefings.files.parliament.uk/documents/CBP-7735/CBP-7735.pdf
[21] https://www.bls.gov/opub/reports/minimum-wage/2021/pdf/home.pdf
[22] https://www.destatis.de/EN/Press/2020/06/PE20_238_623.html

4.2 Power Dynamics

Income under-reporting relies on a joint collusion between the employee-and employer, since taxes owed and withheld are reported and paid to the authorities by the employer, not the employee. Part of this collusion involves a bargain, implicit or explicit, over the division (which can also be called the incidence) of the economic rent generated by the joint agreement to evade tax. This leads to concerns that there might be differences in bosses' willingness to jointly collude with employees of different genders, as well as differences in the division of the economic rent generated by tax evasion.

4.2.1 CEOs

To eliminate concerns over gender-differences in bargaining power between employee and employer, I look at tax evasion of firms' CEOs, who are able to decide how much income they would like to hide from the authorities and, crucially, execute this themselves. Because the data does not contain information on individuals' roles within companies, I define the CEO of a firm to be the individual with the highest income. Looking at the intensive margin of income under-reporting, Figure 3 shows that male CEOs reported income jumps significantly higher than that of female CEOs following the policy reform. This is in line with the gender gap in tax evasion in the full sample, but at a lower level of implied tax evasion for both genders. The number of male CEOs observed in the data is 182,059 and the number of female CEOs is 167,622.

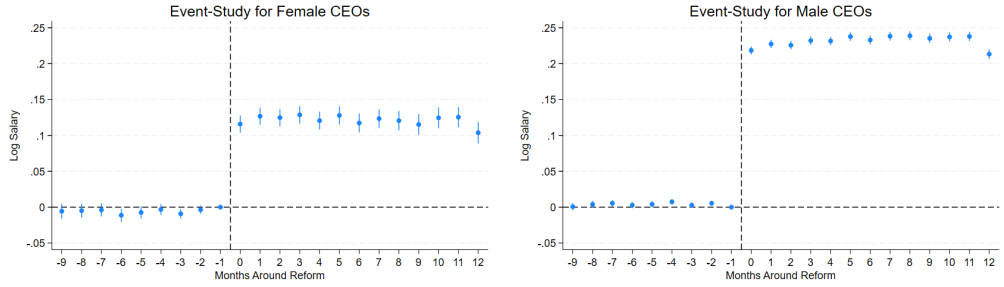

Figure 3: Event Study-Effects on CEOs

Notes: To proxy for the firm's CEO, which I do not directly observe in the data, I include for each firm only the highest earner, as per reported income. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

Since the final decision maker between the employee and employer in hiding income from the tax authority is the employer, I also look at the effect for an employee of having a male or female employer on hidden income. I find that the gender of the employee matters more

in determining how much income will be under-reported than the gender of the employer. Following the reform, men's reported income jumps by a similar magnitude whether they have a female or a male CEO, as does women's reported income. This implies that employees have a relatively high degree of bargaining power over the decision to engage in tax evasion. Figure 17 displays these results and is available in Appendix B.

4.2.2 One (Wo)man bands

Under the same logic that CEOs hold full bargaining power with their employer, firms with a single employee ('One Man/Woman bands') also eliminate concerns about the bargaining over of the economic rent that is generated from avoiding income tax. A One (Wo)man band would receive the entirety of the economic rent generated. The results, presented in Figure 4, again yield a gap between the implied under-reporting of income between men and women for the purpose of tax evasion. There are 57,399 of these firms for men and 55,614 for women.

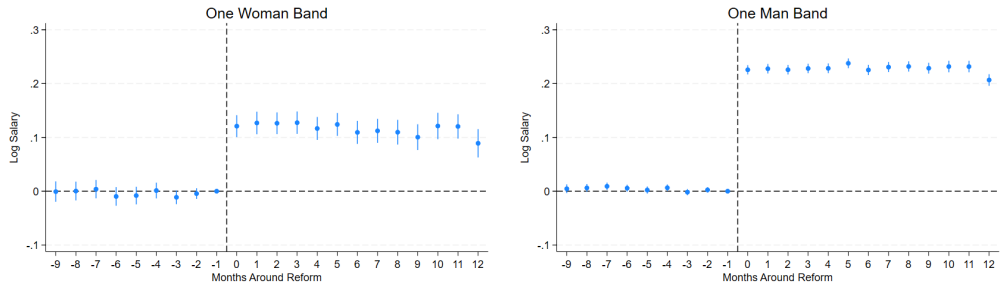

Figure 4: Event Study-Effects on One (Wo)man bands

Notes: The data includes only firms in which a single individual was employed. The specification in the regressions includes controls for actual hours worked and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

4.2.3 Competitive Industries

Concerns around sharing the economic rent generated in an employee-employer match and gender differences in the split between employee and employer rely on there being an economic rent in the first place (Manning, 2013) - meaning the market cannot be perfectly competitive. In a competitive labour market, workers are paid their marginal product. If employees were hiding income from the tax authority pre-reform, in a competitive market, then the sum of income reported to the tax authority and the under-the-table cash paid would make up the employees marginal product, while post-reform, when incentives to under-report are eliminated, the tax authority would observe the true salary, also the marginal product of labour.

I use a Herfindahl–Hirschman Index[23] (HHI) to give local-industries a competitiveness score. To define a local industry I use 4-digit NACE sector codes within each of Romania's 42[24] Counties. Rather than using firms' market shares of output[25], I use firms' employment shares within a local-industry. Specifically, for each firm i in a local-industry j, I calculate their market share of employment:

$$MS_{i,j} = \frac{\#\ Employees_i}{\#\ Employees_j}$$

I then calculate the HHI for each local-industry j using the formula:

$$HHI_j = \sum_{\forall i \in j} (MS_{i,j})^2$$

For each local-industry, I thus have a measure of market concentration, where an index value close to zero implies a relatively competitive market with many small firms and a value close to one implies a more concentrated market dominated by one or a small number of very large firms. I then run my preferred difference-in-difference specification using the most competitive local-industries - specifically, those with a HHI at or below the 5^{th} percentile of the HHI distribution.[26]

The results of my preferred specification run for this sample of the most competitive local-industry labour markets are presented in Figure 5 and look very similar to Figure 1. This implies that even in highly competitive labour markets, in which firms are less able to extract a high share of the economic rent from a employee-employer match, the implied tax evasion of men is significantly higher than it is for women.

[23] The index is described by the Federal Reserve in Rhoades (1993), which also details the history of the index.

[24] Including the capital city which is its own county

[25] Which in the tax records might anyway be under-reported for similar reasons to the under-reporting of employee income.

[26] This HHI value is 0.00038. According to the Antitrust division of the US Department of Justice, Unconcentrated Markets usually have a HHI below 0.15, however these are typically calculated using market shares of output, not employment. Although I calculate the HHIs using the full sample of data, the 5^{th} percentile of the HHI distribution is calculated not from the full sample of data but from the balanced panel I created to run my main analysis, which dropped the largest 5% of firms in the data.

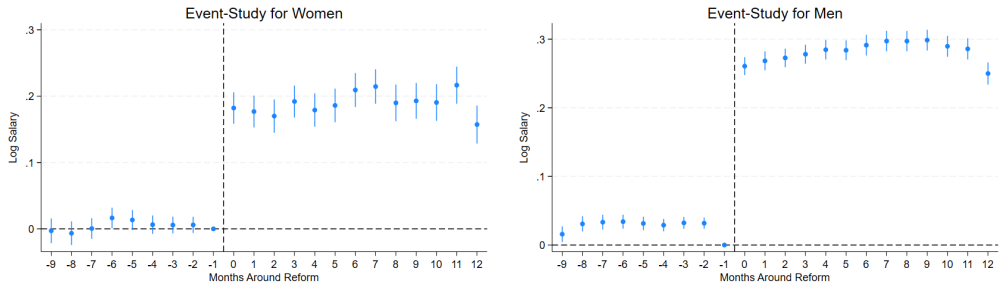

Figure 5: Event Study-Effects on the Most Competitive Industries

Notes: The data filters on only firms with a HHI index below the 5^{th} percentile of the HHI distribution. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

The HHI, a measure of employee concentration, provides one reasonable measure of competitiveness for employees in local industries. Another measure of competitiveness would be rates of flows in and out of firms in a local industry. If there is a high level of observed mobility for employees between firms, this implies that it is relatively easy for workers to take up attractive outside options which are available to them. This in turn would imply that workers in these industries are likely to take home the majority of their marginal product. I present the results for local industries with high rates of mobility in Appendix B, which shows that the implied tax evasion following the reform is higher for men than for women.

4.3 Gender Segregation in Construction and Manufacturing

A concern in arriving to the conclusion that women have preferences against evading tax compared to men is that within the manufacturing and construction sector, women may sort into different kinds of jobs than men do. For example, there may be gender segregation in the degree to which the employee's job is office-based, and it is likely that tax-evasion is more prevalent in off-site, cash-in-hand jobs. The fact that my administrative tax data does not directly record the occupation of an individual, but rather the sector code of a firm, makes it challenging for me to rule out that men and women have different abilities to evade tax due to occupational segregation. I employ a number of strategies to address this concern. Firstly, I use the individual-level variance in hours worked to infer whether an employee is a manual-worker going to a construction site or an office-based employee, since the cold winters dictate that manual work in a construction site will be much more seasonal than office-based work. This allows me to check, albeit imperfectly, whether occupational segregation is driving the gender gap in tax evasion. Secondly I look at the most gender equal 4-digit NACE sector code, which is the management and planning of construction projects, rather than construction work itself, which implies primarily office-based work. In

this individual sector code, men and women are much less likely to be segregated in the kind of work that they do than in the construction and manufacturing sector as a whole. Finally I employ a triple-difference regression strategy which controls for sector code x time fixed-effects which addresses gender segregation across different detailed industry codes, but not differences in the occupations of men and women within industries.

4.4 Occupational Segregation: Implied Occupation by Hours Worked

Manual work in a construction site is much more seasonal than office-jobs based in an indoors office space. I thus use individual-level variation in monthly hours worked to classify those with highly variable working hours as manual workers and those with less variable working hours as office based, addressing occupational segregation between men and women. If the strategy of using variation in working hours to separate office-based vs manual work is indeed picking up these different types of occupations, it would be expected that the tax evasion I identify is higher for the manual work than for the office-based work. I Appendix B Figure 23 I indeed show that the implied tax evasion identified by jumps in income is much larger for manual workers, suggesting that using variance in monthly working hours is indeed picking up the kinds of work I am attempting to separate.

4.4.1 The Gender Gap for Office Workers

We can see in Figure 6 that office-based workers, defined as having a variance in monthly working hours below the 10^{th} percentile of the distribution, have relatively lower implied tax evasion than my main specification presented in Figure 1, consistent with it being more difficult to evade taxes in a more formal office-based environment, but that the gender gap in tax evasion remains - male office-based workers evade taxes to a higher degree than female office-based workers. The number of male and female office workers is, respectively, 307,325 and 275,542.

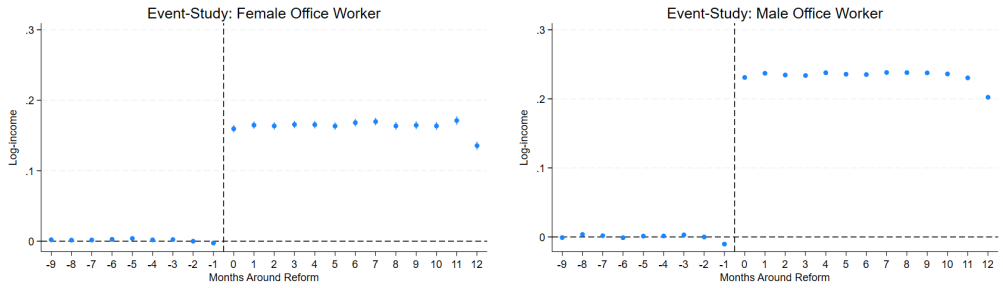

Figure 6: Event Study-Effects for Office Workers

Notes: The data filters on workers with a variance in monthly hours worked below the 10^{th} percentile in the distribution to define them as office-based employees. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

4.4.2 The Gender Gap for Manual Workers

We can conversely observe that for manual workers, defined by having monthly working hours variance above the 90^{th} percentile in the distribution, the tax evasion implied by my identification strategy is relatively high for both men and women. This is reassuring for my definition of manual workers picking up individuals who are indeed doing more work on construction sites and have greater ability to evade taxes. Indeed, within this category of occupation the gender gap in identified tax evasion remains. The results are presented in Figure 7. The number of male manual workers is 53,873 while it is only 45,021 for women.

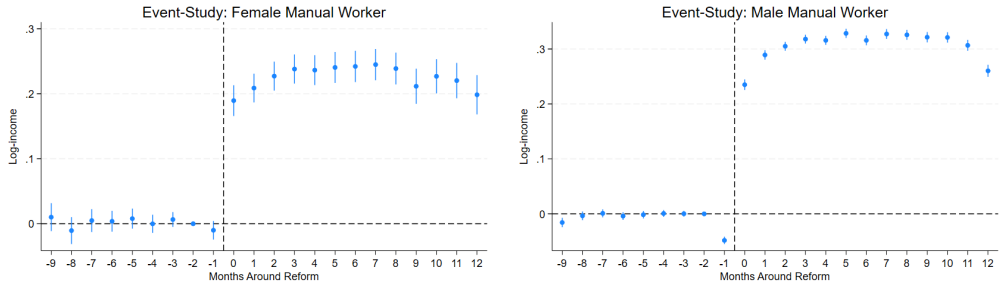

Figure 7: Event Study-Effects for Manual Workers

Notes: The data filters on workers with a variance in monthly hours worked above the 90^{th} percentile in the distribution to define them as office-based employees. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

An alternative way to implicitly separate manual workers from office-based workers, rather than using the simple within-individual variance in hours worked, is to make more

explicit the type of seasonality that would be expected for manual workers in a country where cold winters makes working on a construction site more challenging. I create another definition of a manual worker by constructing, for each individual, the ratio of hours worked in the months of December, January and February to the hours worked during the rest of the year. A low ratio means that hours dip in the colder months relative to the rest of the year. Equipped with a distribution of values of this ratio, I define my second indicator of a manual worker as a worker with a ratio under the 10^{th} percentile of this distribution. The results are similar to what I present in this section and can be found in Appendix B.

The results presented for office workers and manual workers so far suggests that my main result, that men have a higher propensity to tax evade than women, is not primarily driven by segregation in the kinds of work that men and women do. Combined with ruling out gender differences in bargaining power between employee and employer in the previous section, this points to behavioural differences as a main driver of the gender gap in tax evasion.

4.5 Office-Based Work: Implied by Industry Sector

My previous definitions of office and manual work were based on reasonable but imperfect assumptions about differences in seasonality between the different kinds of work. As a further check of whether or not the gender gap in tax evasion is driven by differences in the kinds of work that men and women do, I run my preferred difference-in-difference specification using only "building project development"[27] as a treated industry, and comparing it with the non-construction private sector. This industry classification contains the largest proportion of women across all treated industry classifications and implies primarily office-based work. It is the treated profession which is most gender-neutral and comparable with other private sector jobs. The number of individuals I observe who work in this NACE code over my sample period is 2,622. The results of the difference-in-difference are presented in Figure 8. [28]

[27]This is the 4 digit NACE code: 4110. The description for the code is the following: development of building projects for residential and non-residential buildings by bringing together financial, technical and physical means to realise the building projects for later sale.

[28]The regression is run in quarters rather than months because of a differential spike in earnings which is unique to the building project management industry in December. In the specification presented here, I include a December dummy to control for this.

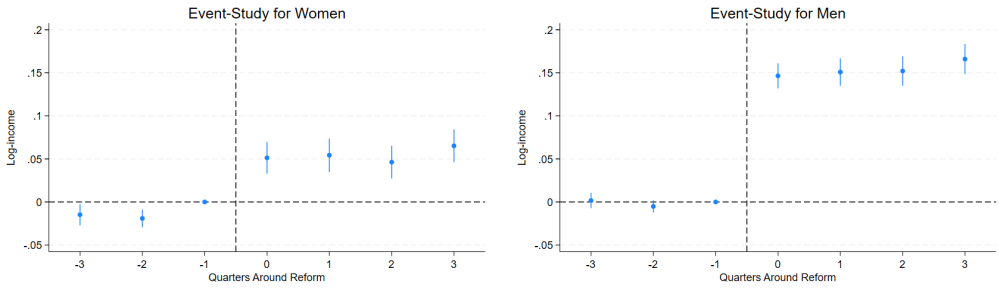

Figure 8: Event Study-Monthly Reported Log-Income

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, the share of women in the firm, a December dummy, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

The results for the "building project development" profession are, as expected, weaker than for the construction and manufacturing sector as a whole, since the industry is more formal/office-based than traditional construction jobs. The gender differential in implied tax evasion, however, remains. Following the elimination of income tax, and hence the incentive to under-report true income, the reported income of men increases more than twice as much as compared to women.

4.6 Triple-Differences Strategy

I additionally employ a triple-differences strategy to address concerns about gender segregation within the construction and manufacturing sectors. A natural extension to comparing the difference-in-difference event-studies between men and women is to run the corresponding triple-difference. The triple-difference specification has the additional benefit of allowing me to control for time x industry code, since the triple-difference specification uses variation between genders within this. The industry codes are the most detailed 4-digit NACE codes. The regression I run is the following:

$$\begin{aligned} y_{i,t} =& \beta_0 + \sum_{\forall s/-1} \beta_s \mathbb{1}\{female\} \cdot \mathbb{1}\{treated_{s=t}\} + \sum_{\forall s/-1} \kappa_s \mathbb{1}\{treated_{s=t}\} \\ &+ \alpha_i + \alpha_t + \mathbb{1}\{female\} \cdot \alpha_t + \gamma_i \cdot \alpha_t + \sum_{j=1}^{n} \delta_j x_{i,t}^j + \sum_{j=1}^{n} \phi_j \mathbb{1}\{female\} \cdot x_{i,t}^j + \epsilon_{i.t} \end{aligned}$$

The β_s dummies estimate the triple-difference event-study effects of the treatment for women, relative to the effects on men, while the κ_s dummies provide estimates of the treatment effects for men. α_i and α_t are the usual individual and time fixed-effects, while

$\mathbb{1}\{female\} \cdot \alpha_t$ gives the female x time fixed-effects. $\gamma_i \cdot \alpha_t$ gives the time x industry code fixed-effects and the series of coefficients on δ_j and ϕ_j are used for control variables and their interactions with the female dummy.

The results of this triple-difference are presented in Figure 9. It remains the case, after controlling for detailed 4-digit industry classifications, that womens' spike in gross income following the income-tax reform is much smaller than mens', implying that women evade tax less than men even after controlling for industry x time fixed effects.

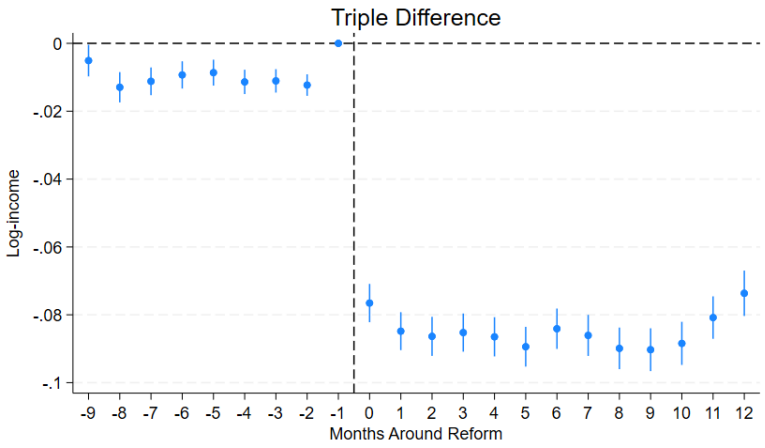

Figure 9: Triple Difference Event Study-Monthly Reported Log-Income

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm and type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

As a comparison, the plain triple-difference without time x industry code fixed-effects, which is exactly the difference between the two event-study plots presented in Figure 1, is available in Figure 18 in Appendix B. The results are almost identical. Controlling for sorting between different industries weakens the difference in implied tax-evasion only by a small margin.

5 Robustness

5.1 Strategic NACE Code Reclassification

There is a concern that firms endogenously respond to the policy and falsely reclassify themselves as a construction firm following the policy introduction. This would not affect the results I have presented, since I constructed a balanced panel in which individuals remain in either the treated or untreated NACE sectors throughout the panel period. However, this

could still affect gender gaps in tax evasion, if men were more likely to work in firms which falsely reclassified themselves as an income-tax exempt industry. More broadly, this would be a concern for the tax authority due to lost tax revenue. Figure 10 shows that this should not be a major concern. As the start of a new year, January is associated with a spike of industry reclassifications. Approximately 1.5% of firms overall reclassify their industry code, and only 0.5% of firms switch from a non-construction to a construction industry code in the January of the policy reform. Importantly, in January 2020, one year following the reform, there is no spike in relassifications into construction, but there is a spike in industry reclassifications overall.

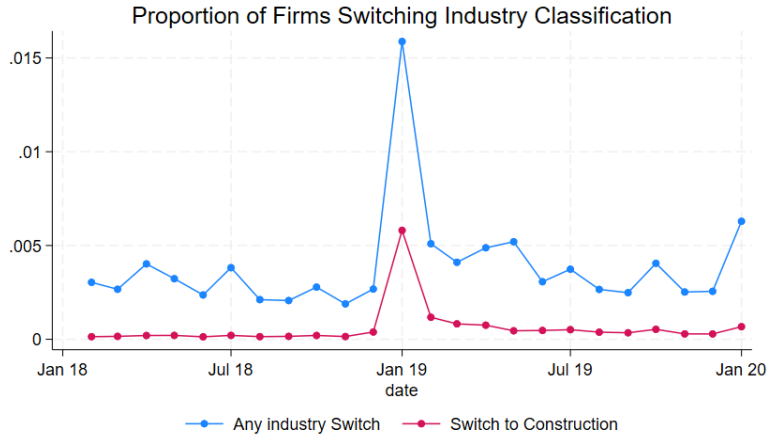

Figure 10: Industry Reclassifications

Notes: The data used in this graph removes the public sector and makes no other sample restriction.

5.2 General Equilibrium Adjustments

On the other hand, it may be the case that individuals respond to the policy by moving from a non-construction to a construction sector firm. As seen in Figure 11, this does seem to be the case, although in very small magnitude. Less than half of a percent of women make this switch, and only 1.5% of men make this switch. Men opting to move into the construction sector at a higher rate than women is consistent with gender differences in preferences for tax evasion - although differences in mobility may also explain this gap.

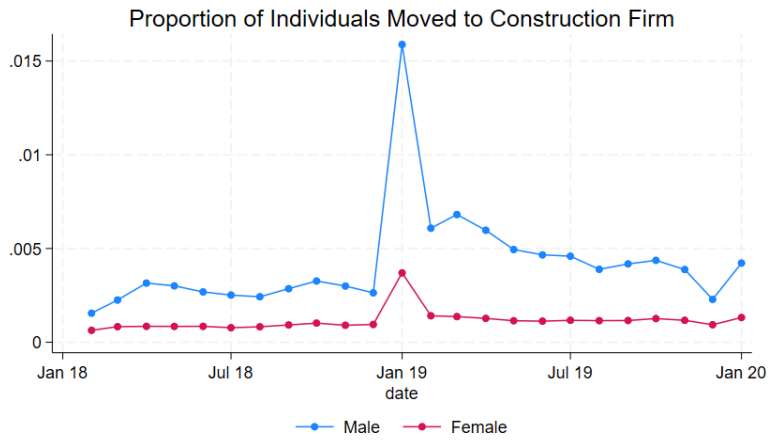

Figure 11: Firm Switching

Notes: The data used in this graph removes public sector workers and makes no other sample restriction.

The specifications presented in my results section excluded the very largest firms in Romania, but a complete picture of general equilibrium adjustments following the reform ought not to ignore these firms. As a proportion of all private sector firms in Romania, construction and manufacturing firms increased from representing 9.9% of firms before the reform, in 2018, to 10.7% after the reform, in 2019. The number of firms overall, however, does not take into account that construction and manufacturing firms have grown in terms of the number of workers they employ[29]. As a percentage of the total private sector workforce, the proportion of construction and manufacturing workers increased from 8.1% to 9.0% between 2018 and 2019.

The policy does induce movement, however limited, from the non-construction to the construction sector. Theoretically, this would push the relative price of labour in the construction sector down, and the relative price of labour in the remainder of the free market up. Thus, if my estimates of tax evasion are affected by equilibrium wage adjustments post-reform, they would be downwards biased. Moreover, since men move from the non-construction sector into the construction sector at a higher rate than women, the downwards bias would be even larger for men, since their relative wage the construction sector would decrease more than for women. This would mean that the true gender gap in tax evasion is even larger than I observe.

[29]To estimate the size of construction and manufacturing firm growth relative to the remainder of the private sector, I run a 2x2 regression comparing the number of employees in firms treated by the policy reform relative to the others, in the year following relative to the year before the introduction of the policy. The estimated increase in the size of treated firms is 0.27 ($p<0.001$)

5.3 Sample Selection

My preferred criteria for data selection was to exclude the largest firms in Romania - specifically the largest 5% of firms. This is because the focus of the paper is on the gender difference in tax evasion, and not the level of tax evasion itself. As such, since tax evasion is unlikely to be prevalent in the largest firms, it is unlikely to prove useful in identifying gender differences in tax evasion and adds noise to my empirical specifications.

To show that my results are robust to different choices of the cutoff value for the firm size percentile used to drop the largest firms from my sample, I run 2x2 diff-in-diff regressions and a 2x2x2 triple difference specification using a number of different cutoff values. The diff-in-diff specification is the following:

$$y_{i,t} = \beta_0 + \beta_1 \mathbb{1}\{treated\} + \beta_2 \mathbb{1}\{post\} + \beta_{DiD} \mathbb{1}\{treated\} \cdot \mathbb{1}\{post\} + \sum_{j=1}^{n} \delta_j x_{i,t}^j + \epsilon_{i.t}$$

The pre-period is 2019 while the post is 2020. The results are presented in Figure 13, which runs the above regression separately for men and women, including only firms below the x^{th} percentile for $x \in \{90, 91, 92, \ldots, 99, 100\}$. As expected, as the cutoff value increases and larger firms are included in the sample, the jump in income reported becomes less pronounced, reflecting the fact that tax-evasion is less prominent is Romania's largest firms. The drop is particularly steep at the 98 and 99^{th} percentiles. It remains the case that across all cutoff values, the implied tax evasion from the jumps in reported income are significantly more pronounced for men than for women.

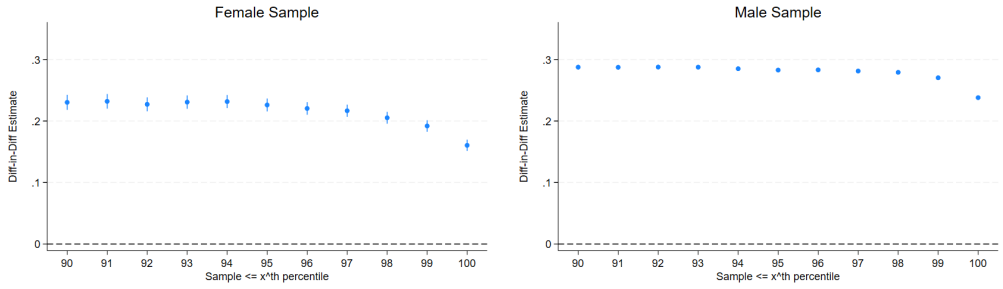

Figure 12: Robustness to sample exclusions: DiDs

Notes: The results are based on a balanced sample, dropping workers who are not active in the labour market for the full 24 month period in 2018 and 2019. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are robust to heteroskedasticity and 95% confidence intervals are plotted around the point estimates.

I additionally complete the robustness check around different thresholds for the exclusion

of large firms by percentile size with triple-difference regressions. These regressions are, in essence, the difference between the diff-in-diff regressions ran separately for men and for women, with the specification:

$$\begin{aligned} y_{i,t} =& \beta_0 + \beta_1 \mathbb{1}\{treated\} + \beta_2 \mathbb{1}\{post\} + \beta_3 \mathbb{1}\{female\} + \beta_4 \mathbb{1}\{treated\} \cdot \mathbb{1}\{female\} \\ &+ \beta_5 \mathbb{1}\{post\} \cdot \mathbb{1}\{female\} + \beta_6 \mathbb{1}\{treated\} \cdot \mathbb{1}\{post\} + \beta_{DDD} \mathbb{1}\{treated\} \cdot \mathbb{1}\{post\} \cdot \mathbb{1}\{female\} \\ &+ \sum_{j=1}^{n} \delta_j x_{i,t}^j + \sum_{j=1}^{n} \phi_j \mathbb{1}\{female\} \cdot x_{i,t}^j + \epsilon_{i.t} \end{aligned}$$

The triple-difference estimates are presented in Figure 13 and show that, interpreting jumps in reported income following the reform as tax evasion becoming revealed, that women under-report income significantly less than men. The percentage-point gap in under-reporting is relatively stable across different percentile firm-size cutoffs, but increases when the very largest firms are included, implying that the gender gap in tax evasion is relatively larger in the very largest firms. One explanation for this is that women find it relatively more difficult to evade tax at the largest firms compared to men - this may be due to weaker bargaining power, or a higher perceived risk to the behaviour at larger and more formal firms.

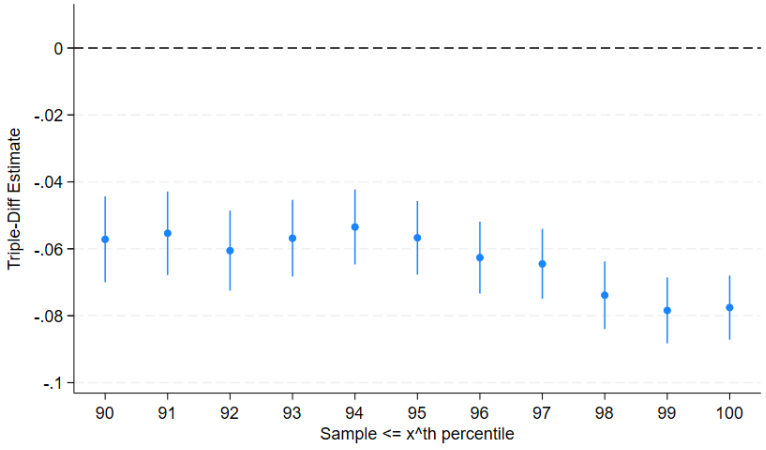

Figure 13: Robustness to sample exclusions: Triple-Diff

Notes: The results are based on a balanced sample, dropping workers who are not active in the labour market for the full 24 month period in 2018 and 2019. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are robust to heteroskedasticity and 95% confidence intervals are plotted around the point estimates.

6 Conclusions

Using a reform in the construction and manufacturing sector in Romania, I show that a significant amount of income under-reporting was taking place in the sector prior to the elimination of income tax, which eliminated incentives to under-report. The difference in tax evasion between men and women is so large, that the elimination of the incentive to evade income tax flipped the direction of the observed gender wage gap, from being in favour of women to being in favour of men, which would be ex-ante expected based on what is observed in comparable countries and the non construction private sector in Romania. There is a substantial difference, at both the intensive and extensive margin, between men and women's rates of tax evasion. Although difficult to disentangle, I provide evidence that this is not being driven by differences in bargaining power between the employee and the employer who reports wages and withholds taxes for the authorities, nor by segregation in the work men and women in the construction sector do, and that a large part of the difference is due to gender differences in preferences.

This finding contributes to the behavioural literature on gender differences in social preferences and risk aversion. Notably, this is the first study to use observational rather than experimental data to study gender differences in lying. It is difficult for me, however, to unpick the separate behavioural channels which are driving the gender gap in tax evasion. I am hopeful that future research, using new data sources and strategies for identification, will be able to shed more light on the causes of these gender differences.

I also contribute to the literature on gender wage gaps. Firstly, my findings have implications on measurement - if men are more likely than women to under-report income, the gender wage gap may not have closed as much as it is has been believed to. Secondly, the literature on gender wage gaps emphasizes the remaining obstacles to gender convergence: the effects of parenthood and the rewards to female-unfriendly types of working and jobs. I highlight a new gap to convergence in wages which requires new policy solutions.

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A Descriptive Graphs and Statistics

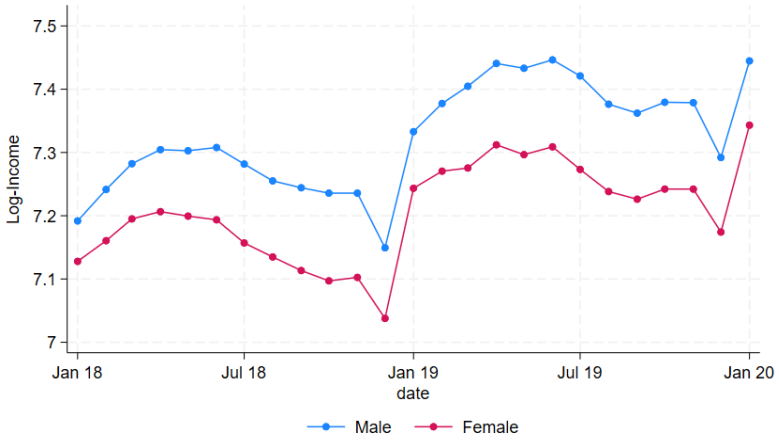

Figure 14: Raw Log-Income Gender-Gap in the Non-Construction Private Sector

Notes: This plots raw means over time. The data are monthly, spanning Jan 2018 up to and including Jan 2020. The data used in this graph removes public sector workers and the largest 5% of private-sector firms and makes no other sample restriction.

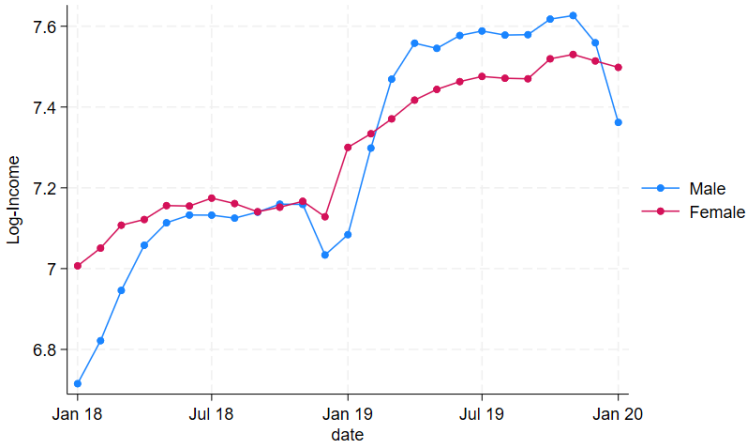

Figure 15: Raw Log-Income Gender-Gap in the Construction Private Sector

Notes: This plots raw means over time. The data are monthly, spanning Jan 2018 up to and including Jan 2020. The data used in this graph removes public sector workers and the largest 5% of private-sector firms and makes no other sample restriction.

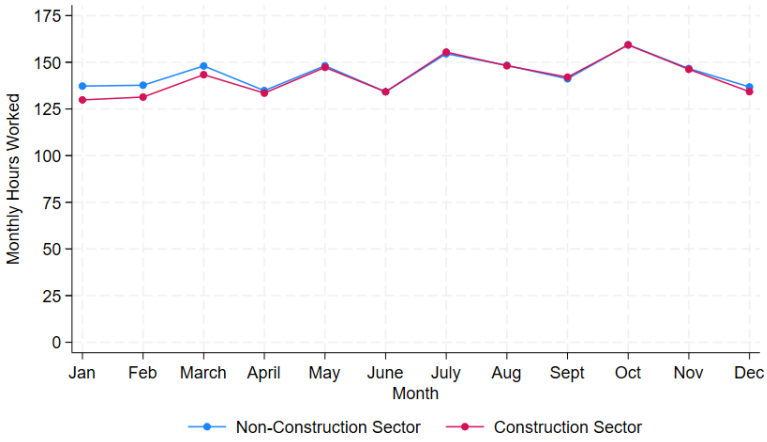

Figure 16: Seasonality of Hours Worked by Sector

Notes: This plots raw means over time. The data are monthly, spanning Jan 2018 up to and including Dec 2019.

Industry NACE Code	Female Share	Share of Construction Employment
4110	0.352	0.027
2331	0.304	0.001
2332	0.28	0.001
2362	0.243	00
2312	0.242	0.007
4291	0.239	0.003
2369	0.222	0.002
4212	0.201	0.002
1623	0.195	0.025
2370	0.193	0.01
2223	0.193	0.031
2361	0.192	0.009
2512	0.189	0.015
4299	0.186	0.008
4221	0.178	0.008
4211	0.174	0.028
4332	0.173	0.032
4222	0.168	0.005
4311	0.168	0.005
4334	0.159	0.015
811	0.154	0.007
4322	0.152	0.128
2363	0.15	0.007
4313	0.148	0.005
812	0.146	0.014
4399	0.143	0.04
4321	0.143	0.105
4329	0.139	0.016
4120	0.138	0.385
4391	0.126	0.011
2364	0.125	00
4339	0.125	0.008
4312	0.122	0.015
4213	0.12	0.001
4333	0.119	0.02
4331	0.075	0.005

Table 2: NACE Sector Codes Treated With Income Tax Exemption

Notes: I present the full list of industry codes which are eligible for the income tax exemption, ordered by the decreasing female share of employment within the industry. I also present for each sector code, the share of the construction employment it makes up.

B Additional Results

B.1 The Event-Study Difference-in-Differences by CEO and Employee Gender

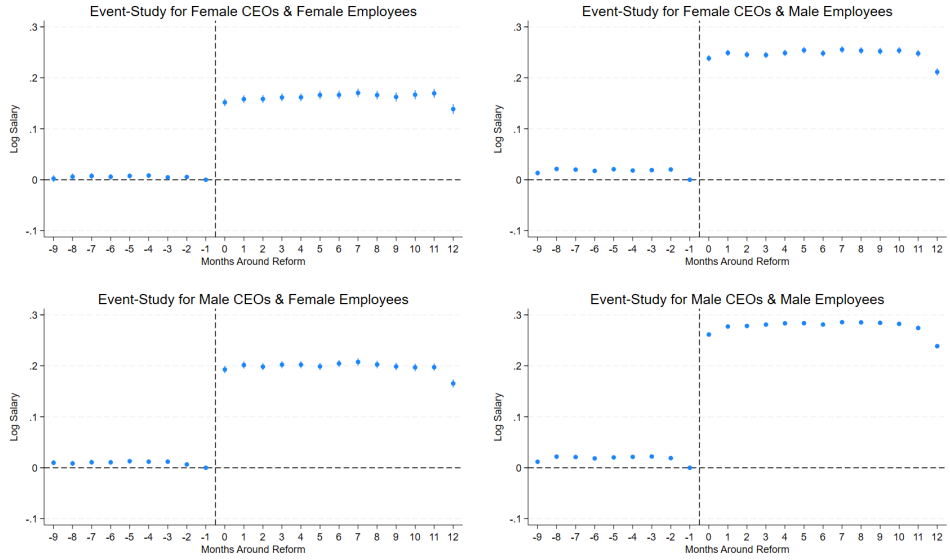

Figure 17: Event Study-Effects of CEOs on employees

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

B.2 The Triple-Difference

The event-study plot below gives the results of the triple-difference regression specification described in Section 3.3 of the paper.

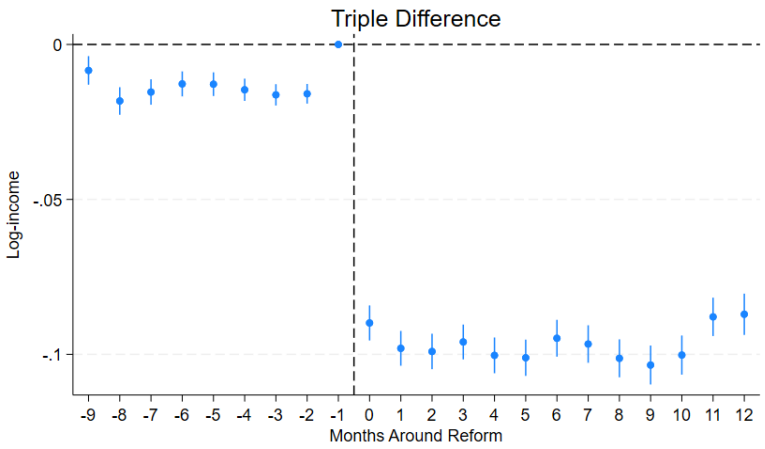

Figure 18: Triple Difference Event Study-Monthly Reported Log-Income

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm and type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

B.3 Labour Supply Response

I present the event-study results of my preferred difference-in-difference specification on hours worked for men and women in Figure 19, which shows that the elimination of income tax in treated sectors resulted in a modest but statistically precise rise in monthly hours worked.

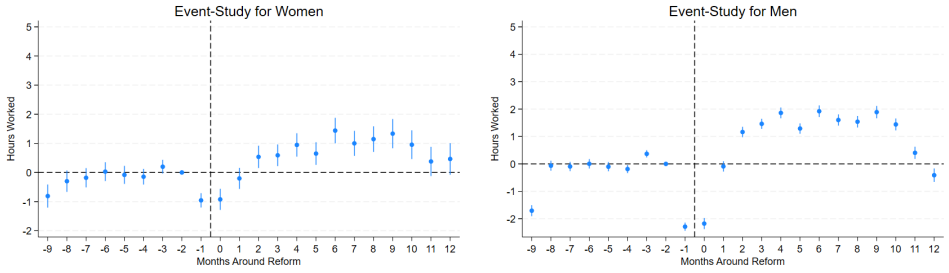

Figure 19: Event Study-Effects on Hours Worked

Notes: The specification in the regressions includes controls for the number of employees in the firm. Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

B.4 Tax Evasion by Firm Size

I chose to exclude the very largest firms from my data because in the largest and most formal firms in the economy, it is likely much more difficult for employees to tax evade, and

because this paper is studying gender gaps in tax evasion, rather than tax evasion in general, including firms in which little tax evasion takes place may obfuscate the gender difference. To verify this assumption, I estimate tax evasion for firms of different sizes to check whether this decreases as the number of workers employed by the firm increases. Using 2018 as the pre-period and 2019 as the post, and firms made exempt from income tax as the treated firms, I run the following regression:

$$y_{i,t} = \beta_0 + \beta_1 \mathbb{1}\{treated\} + \beta_2 \mathbb{1}\{post\} + \beta_{DiD} \mathbb{1}\{treated\} \cdot \mathbb{1}\{post\} + \sum_{j=1}^{n} \delta_j x_{i,t}^j + \epsilon_{i.t}$$

I run this regression separately for firm's of size x, for $x \in \{1, 2, 3, \ldots, 24, 25\}$ and present the results in Figure 20.

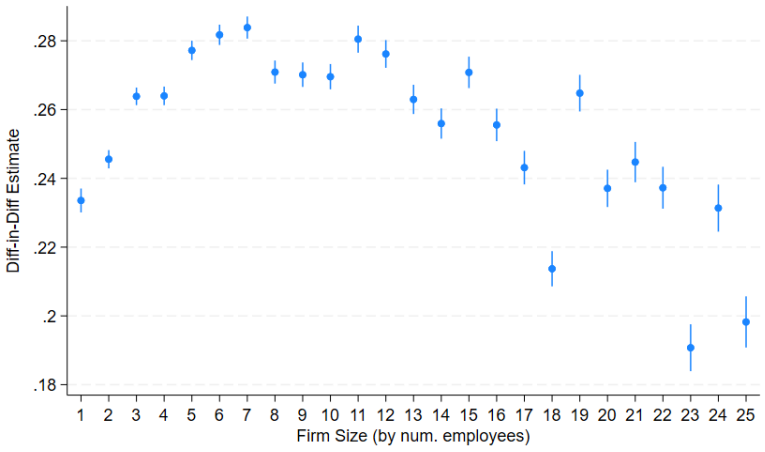

Figure 20: Tax Evasion by Firm Size

Notes: The specification in the regressions includes controls for actual hours worked and the type of contract (full or part-time). Standard errors are robust to heteroskedasticity and 95% confidence intervals are plotted around the point estimates

The tax evasion implied by jumps in income following the elimination of income tax in the treated sectors is relatively stable for firms with over 5 employees until they reach about 15 employees, at which point it begins decreasing, emphasising the logic behind excluding the very largest firm sizes in the sample I created for my preferred analysis.

I additionally run regressions, with the same specification as for the regressions above, for firms between the x^{th} and $x - 1^{th}$ percentile of the firm size distribution, for $x \in \{91, 92, 93, \ldots, 100\}$. In Figure 21 I plot the estimates of the 2x2 regressions. The estimate of the percentage of under-reported income decreases rapidly for the largest firms in the Romanian economy.

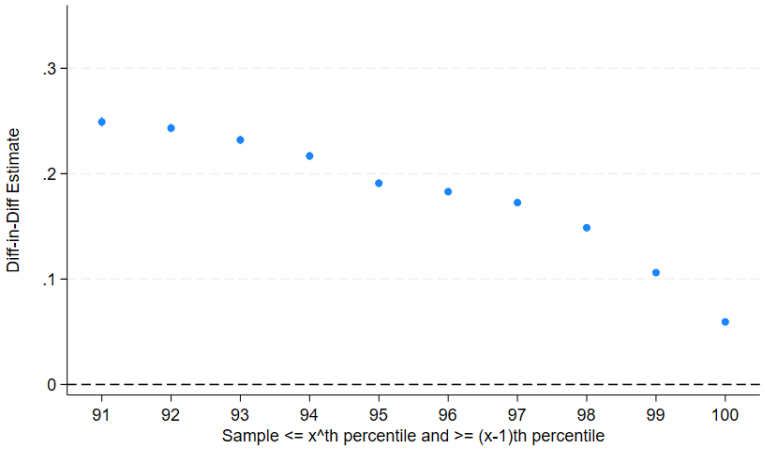

Figure 21: Tax Evasion in the Largest Firms

Notes: The results are based on a balanced sample, dropping workers who are not active in the labour market for the full 24 month period in 2018 and 2019. The specification in the regressions includes controls for actual hours worked, the number of employees in the firm, and the type of contract (full or part-time). Standard errors are robust to heteroskedasticity and 95% confidence intervals are plotted around the point estimates.

B.5 Regional Variation

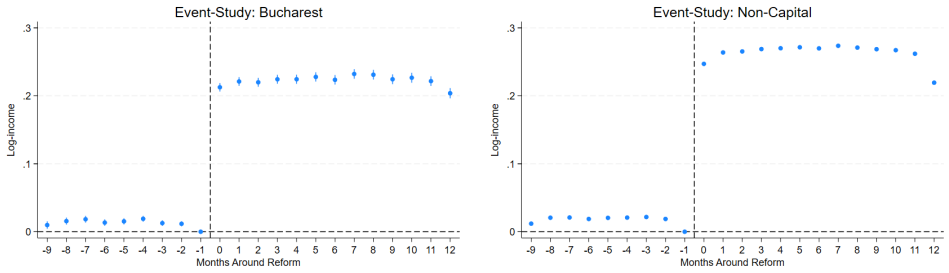

Figure 22: Event Study-Effects between Capital and Non-Capital city

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm and type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

B.6 Different Occupations

I calculate for each individual the variance in monthly hours worked and define workers to be office-based if their variance in hours worked is below the 10^{th} percentile of the distribution. Conversely, I define an individual to be a manual worker if their variance in hours worked is above the 90^{th} percentile in the distribution. The results are presented in Figure 23 and

clearly show that the tax evasion implied by my identification strategy is much higher for manual workers than office workers.

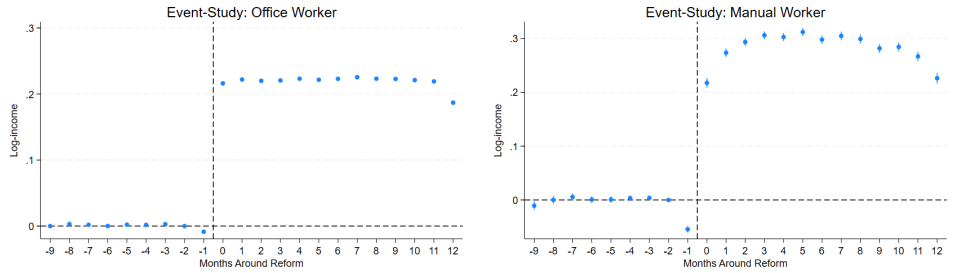

Figure 23: Event Study-Effects between Manual and Office-Based Work

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm and type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

B.7 Competitive Industries: Between Firm Mobility

Complementary to using a HHI index to measure the competitiveness of a local industry, I use the rate of between-firm mobility. The logic is that, even in a local industry with just a few firms employing the majority of workers, if the workers find it relatively easy to move between firms, the market is likely to be operating competitively and workers are able to take-home the majority of their marginal product. To construct this measure of competitiveness, I generate a flow rate, which is the sum of flows into a firm in a local industry and flows out of a firm in a local industry, as a share of the total employment in the local industry. I then run my preferred specifications on the sample of men and women employed in a local industry with a high 'flow rate', defined as being above the 90^{th} percentile of the distribution. The results are similar to what is observed in the full sample.

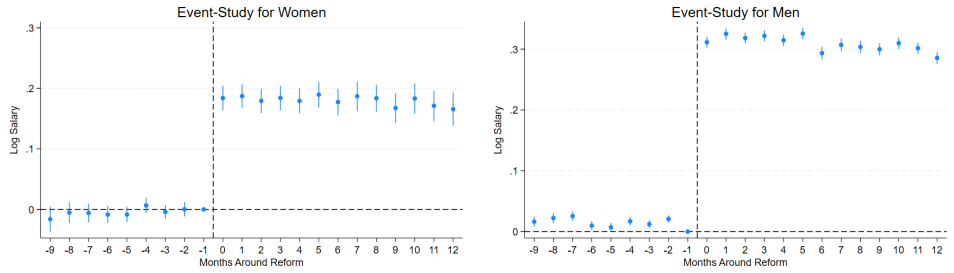

Figure 24: Event Study-Effects in Competitive Industries

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm and type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

B.8 Manual Workers: Alternative Definition

Here are the results for manual workers using an alternative definition of a manual worker. Rather than using the individual-level variance in hours worked, I construct, for each individual, the ratio of hours worked in the months of December, January and February to the hours worked during the rest of the year. A low ratio means that hours dip in the colder months relative to the rest of the year. Equipped with a distribution of values of this ratio, I define my second indicator of a manual worker as a worker with a ratio under the 10^{th} percentile of this distribution.

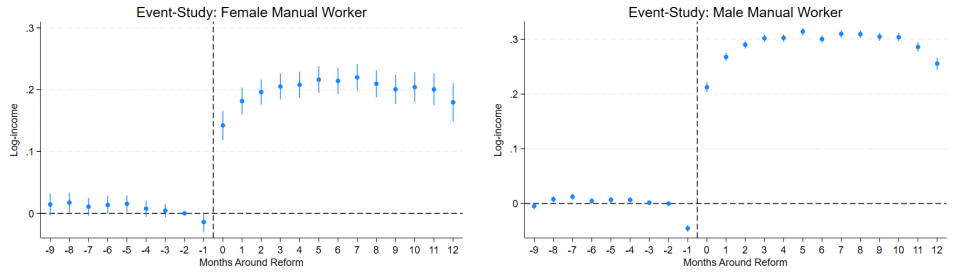

Figure 25: Event Study-Effects in Competitive Industries

Notes: The specification in the regressions includes controls for actual hours worked, the number of employees in the firm and type of contract (full or part-time). Standard errors are clustered at the individual level and 95% confidence intervals are plotted around the point estimates.

C Standard Errors

I chose to cluster my standard errors at the individual level in my regression specifications. To verify that the significance of my results is not being driven by my choice of standard errors, I run my preferred DiD event-study specification (across both genders) using a number of different choices for the calculation of standard errors. I present the point-estimates and standard errors under 1) individual-level clustering, 2) firm-level clustering, 3) 4-digit NACE industry code clustering, 4) clustering at the level of treatment (construction vs not construction industry) and 5) heteroskedasticity-consistent 'robust' standard errors. These are presented in Table 3 and the standard errors are similarly sized throughout the different specifications. Importantly, they remain remarkable small in under each standard error calculation, which can be attributed to the size of the data.

	Indiv	Firm	Industry	Constr.	HC Robust
Month -9	0.012***	0.012***	0.012**	0.012**	0.012***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Month -8	0.020***	0.020***	0.020**	0.020*	0.020***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Month -7	0.021***	0.021***	0.021***	0.021*	0.021***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Month -6	0.018***	0.018***	0.018***	0.018*	0.018***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Month -5	0.020***	0.020***	0.020***	0.020*	0.020***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Month -4	0.021***	0.021***	0.021***	0.021*	0.021***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Month -3	0.021***	0.021***	0.021***	0.021*	0.021***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Month -2	0.018***	0.018***	0.018***	0.018*	0.018***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Month 0	0.243***	0.243***	0.243***	0.243***	0.243***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 1	0.259***	0.259***	0.259***	0.259**	0.259***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 2	0.260***	0.260***	0.260***	0.260**	0.260***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 3	0.263***	0.263***	0.263***	0.263**	0.263***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 4	0.264***	0.264***	0.264***	0.264**	0.264***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 5	0.266***	0.266***	0.266***	0.266**	0.266***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 6	0.264***	0.264***	0.264***	0.264**	0.264***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 7	0.268***	0.268***	0.268***	0.268**	0.268***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 8	0.266***	0.266***	0.266***	0.266**	0.266***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 9	0.263***	0.263***	0.263***	0.263**	0.263***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 10	0.262***	0.262***	0.262***	0.262**	0.262***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 11	0.256***	0.256***	0.256***	0.256**	0.256***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
Month 12	0.218***	0.218***	0.218***	0.218**	0.218***
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)
N	21049736	21049736	21049736	21049736	21049736

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Different choices for the calculation of standard errors

Notes: I present the point-estimates and standard errors under 1) individual-level clustering, 2) firm-level clustering, 3) 4-digit NACE industry code clustering, 4) clustering at the level of treatment (construction vs not construction industry) and 5) heteroskedasticity-consistent 'robust' standard errors.