# Minimum Wages and Optimal Redistribution: The Role of Firm Profits*

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**Abstract**

I find that US state-level minimum wage changes in 1997-2019 raised low-skill workers' earnings at the expense of firm profits and increased the labor share in affected industries. Is the minimum wage a desirable tool for redistributing profits? I study this question in models with efficient labor markets, firm profits, and optimal corporate and labor income taxes. A minimum wage is desirable when it redistributes profits more efficiently than corporate taxes. This condition prevails when capital mobility keeps corporate taxes low and affected industries are labor-intensive. A sufficient statistics analysis suggests welfare gains from raising the US minimum wage.

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*"The simplest expedient which can be imagined for keeping the wages of labor up to the desirable point would be to fix them by law; the ground of decision being, not the state of the labor market, but natural equity; to provide that the workmen shall have reasonable wages, and the capitalist reasonable profits."*

John Stuart Mill - *Principles of Political Economy* (1884).

# 1 Introduction

The minimum wage is a widely used and controversial policy. A large literature studies its effects on employment and earnings (Manning, 2021a; Dube and Lindner, 2024). A small but growing literature compares the minimum wage to government transfers like cash welfare and in-work benefits (e.g., Lee and Saez, 2012; Lavecchia, 2020). That literature has found only weak support for a minimum wage when the labor income tax-transfer system is optimal, suggesting that the redistributive aims of the minimum wage may be best achieved with alternative policies (e.g., Stigler, 1946; Mankiw, 2013).

Whereas earlier work has focused on optimal within-labor-income redistribution, this paper studies an alternative rationale for the minimum wage that dates back to Mill (1884): efficient redistribution of profits. There are equity gains from redistributing profits because they are concentrated at higher incomes. Corporate taxes redistribute profits at an efficiency cost. Can a minimum wage redistribute profits more efficiently than a marginal increase in corporate taxes?

To motivate the importance of profits, I begin with an empirical analysis that closely follows the research design of Cengiz et al. (2019, 2022) based on variation in minimum wages across US states from 1997 to 2019. Using publicly available data, I show that minimum wages in the US have increased average pre-tax earnings of low-skill workers (even after accounting for potential disemployment effects), have decreased government expenses on income maintenance benefits, and have reduced average profits in exposed industries (food and accommodation, retail trade, and low-skill health services), thus increasing the within-industry labor share of these sectors. These margins configure the main tradeoffs explored throughout the formal analysis: the minimum wage can redistribute profits to low-wage workers, relaxing the government's budget constraint but potentially inducing alternative distortions.

I study this distributional tension by modeling the problem of a generalized utilitarian social planner who chooses a minimum wage, a labor income tax-and-transfer schedule, and a linear corporate tax to maximize social welfare. I present the results in two models of the labor market. First, I consider a simple neoclassical model with limited heterogeneity and a frictionless labor market. Second, I produce results in a model with directed search and two-sided heterogeneity. While the simple model parsimoniously shows the fundamental intuition of the analysis, the richer model features additional, empirically-relevant mechanisms through which the minimum wage can affect welfare while providing formulas suitable for sufficient statistics analysis. Importantly, the decentralized equilibrium is efficient in both models, allowing me to focus on redistributive tradeoffs by excluding Pigouvian rationales for the minimum wage.[1]

[1]While not the focus of this paper, some previous work discusses the desirability of the minimum wage on efficiency

The neoclassical framework with perfect competition considers equally productive workers who make extensive margin labor supply decisions and a representative capitalist who allocates capital between a domestic firm with decreasing returns to scale and a foreign investment opportunity with a fixed after-tax return. While stylized, this framework contains the main ingredients for the analysis: firm profits, corporate tax distortions, worker-level behavioral responses, and general equilibrium effects.

In this model, a minimum wage redistributes profits to workers, yielding equity gains when the planner values workers' utility more than that of firm owners. However, the minimum wage may generate efficiency costs proportional to its employment effects. In addition, the profit effects of the minimum wage introduce a negative fiscal externality in corporate tax revenue, which is proportional to the corporate tax rate. If the planner can use taxes and transfers alongside the minimum wage, can the planner achieve similar equity gains more efficiently by using the tax system alone? I show that the net benefits of a binding minimum wage, even with optimal taxes, are positively related to the distortions of the corporate tax. As the distortions introduced by the corporate tax grow, complementing the tax system with a binding minimum wage can help the social planner to make overall redistribution more efficient.

The bulk of the intuition can be obtained from the following thought experiment. Consider an allocation with optimal taxes but no minimum wage. The planner can implement the following reform: (1) a small binding minimum wage, (2) an equal-sized reduction in transfers to workers (so that workers' consumption is held constant), and (3) a corporate tax cut that holds employment constant by offsetting the minimum wage's effect on labor demand. Workers' welfare is constant in this experiment: consumption and employment are unaffected. However, the reduction in transfers generates fiscal savings, while the corporate tax cut reduces corporate tax revenue. Hence, the net fiscal externality determines whether the reform is welfare-improving. If the corporate tax induces *large* distortions, then a *small* corporate tax cut will be sufficient to compensate for reduced labor demand from the minimum wage introduction. In this case, the negative fiscal externality of the reform will be *small*, and the reform is more likely to be desirable. On the contrary, if the corporate tax is close to non-distortionary, the tax cut needed to keep employment constant will have to be very large, making for a large negative fiscal externality and weakening the case for a minimum wage. In the limiting case where corporate taxes do not distort employment, the minimum wage becomes superfluous regardless of its employment effects.

Importantly, the above rationale for the potential desirability of the minimum wage is independent of previous arguments developed in the literature around in-work benefits like the Earned Income Tax Credit (EITC). For example, Lee and Saez (2012) argues that a binding minimum wage can increase the efficiency of the EITC by correcting its incidence on pre-tax wages (Rothstein, 2010; Gravoueille, 2024; Zurla, 2024).[2] While I derive a generalization of this result in the presence of firm profits and

grounds (e.g., Robinson, 1933; Burdett and Mortensen, 1998; Acemoglu, 2001; and other articles discussed below).

[2] Intuitively, the EITC increases labor supply, which decreases pre-tax wages in general equilibrium. A binding minimum wage prevents this decrease, thus generating a positive fiscal externality by making the EITC cheaper for the government.

corporate taxes, this logic is orthogonal (and possibly complementary) to the aforementioned rationale relating to its interaction with the corporate tax. In other words, if the corporate tax is distortionary, complementing it with a minimum wage can be desirable even if the government imposes positive net taxes on minimum wage workers. The only difference is that, if the government imposes net taxes on minimum wage workers, the resulting positive fiscal externality would take the form of higher taxes rather than reduced in-work transfers.

Interactions with corporate taxes become more important in the presence of firm heterogeneity. Consistent with recent evidence (see Swonder and Vergara, 2024 for a discussion), the model suggests that the relative corporate tax distortion increases with capital intensity. Building on this intuition, I show that the minimum wage may be desirable as a kind of industry-specific corporate tax when unaffected industries are particularly capital-intensive (and, therefore, more responsive to corporate taxes). To see why, consider the US case, where the minimum wage primarily affects labor-intensive services industries, unlike corporate taxes which affect all industries, including capital-intensive sectors such as manufacturing. In these circumstances, governments can benefit from using the minimum wage to "tax" profits in the affected industries to relax distortions in unaffected industries: the corporate tax cut sketched in the argument above would generate a positive externality in the unaffected sector. This suggests that the minimum wage desirability may be more likely under strong international tax competition, which has made it costlier for governments to enforce large effective corporate taxes.

One shortcoming of the stylized neoclassical model is that it oversimplifies the effects of the minimum wage on the labor market. The emerging consensus is that labor markets have frictional competitive structures (Manning, 2021b; Card, 2022) which mediate the minimum wage effects on wages and employment – even affecting workers who earn more than the minimum wage. Motivated by this reflection, I reproduce the analysis in a richer labor market model that accommodates more realistic patterns of heterogeneity and predictions of minimum wage reforms.

The model features directed search and two-sided heterogeneity. A population of workers with heterogeneous skills and costs of participating in the labor market decides whether to enter the labor market and which jobs to apply to. A corresponding population of capitalists with heterogeneous productivities and technologies decides whether to create firms, how many vacancies to post, and the wages attached to those vacancies. In the model, minimum wages affect workers' application strategies, which, in turn, affect the posting behavior of firms (Holzer et al., 1991; Escudero et al., 2025). These behavioral responses can lead to limited employment effects and spillovers to non-minimum wage jobs. Decentralized allocations are shown to be constrained efficient (as in standard directed search models, e.g. Moen, 1997) so the analysis keeps the attention on the redistributive role of the minimum wage.

Using this model, I derive conditions under which a binding minimum wage is a desirable complement to an existing tax system. As before, minimum wage desirability increases with the distortions of the corporate tax. The general formula illustrates how several margins of adjustment – including wages, employment, participation, spillovers to non-minimum wage jobs, profits, and firm entry – interact to determine the desirability of altering a minimum wage.

The full model yields a tractable sufficient statistic representation that empirical researchers can use to aggregate the minimum wage's effects on low-skill labor markets into a single estimable elasticity. I use the sufficient statistics representation and my event study estimates to evaluate whether a marginal increase in the 2019 US federal minimum wage would increase or decrease social welfare. I find that the plausible range of relative social marginal welfare weights between low-skill workers and capitalists implies that raising the minimum wage would increase social welfare. When the marginal weight on capitalists is less than one-third of the economy-wide average, any positive marginal weight on low-skilled workers suffices. When the marginal capitalists' weight equals the economy-wide average, the marginal low-skilled weight must be at least twice that of capitalists. Using my publicly available data, I can compute the mean annual post-tax earnings of low-skill workers ($\approx \$20,000$) and the mean after-tax profits per exposed establishment ($\approx \$135,000$). These numbers imply that log social welfare functions would suggest a marginal low-skilled weight over six times that of capitalists.

**Related literature.** This paper contributes to the normative analysis of the minimum wage in frameworks with optimal taxes by incorporating profits and corporate taxes into the discussion. To focus on the interaction between the minimum wage and the labor income tax, most of the existing work imposes zero profit conditions or assumes that profits can be taxed away with no efficiency costs. Allen (1987) and Guesnerie and Roberts (1987) consider two-type models with intensive margin responses and argue that the minimum wage is superfluous when non-linear income taxation is available. Marceau and Boadway (1994) and Boadway and Cuff (2001) overturn these results by including participation costs and a continuum of types, respectively. Hungerbühler and Lehmann (2009) and Lavecchia (2020) use random search models and focus on congestion inefficiencies that cannot be addressed by the income tax system, while Gerritsen and Jacobs (2020) consider the incentives that the minimum wage generates on skill formation. Few papers in this tradition assess the robustness of the results to the inclusion of profits. Lee and Saez (2012) use a perfectly competitive model with two skill types and find that the minimum wage can be desirable under optimal taxes when rationing is efficient. The authors informally argue that their logic is robust to the inclusion of pure profits. Cahuc and Laroque (2014) contest Lee and Saez (2012) results using a neoclassical monopsony model, finding that the minimum wage is superfluous when there is a continuum of skill types. The authors extend their analysis to a model with endogenous firm entry and a corresponding entry distortion of the corporate tax and find that their results are unaffected. Finally, Gerritsen (2023) finds stronger support for the minimum wage when preference heterogeneity induces dispersion in hours worked conditional on wages. The author argues that the case for the minimum wage is strengthened when profits cannot be fully taxed. As far as I am aware, my paper is the first to explore in depth the interactions between minimum wage and corporate tax. To do so, I explicitly model corporate tax distortions in employment and capital and consider general equilibrium effects on wages across the wage distribution. More importantly, I formalize new qualitative rationales for using the minimum wage in optimal redistribution schemes that have not been discussed in previous work.

A different literature studies the welfare consequences of the minimum wage using quantitative analyses based on rich structural general equilibrium models that abstract from the optimal tax question. Flinn (2006), Wu (2021), Ahlfeldt et al. (2023), and Drechsel-Grau (2024) focus on efficiency rationales motivated by labor market imperfections, while Berger et al. (Forthcoming) and Hurst et al. (2023) consider both efficiency and redistribution. This paper (and those referenced above) complements this literature by providing additional qualitative insights on the tradeoffs involved in the optimal design of the minimum wage, while the structural literature allows for richer quantitative explorations that include additional margins such as dynamics, strategic interactions, or spatial distortions.

This paper also contributes to multiple sub-literatures on optimal redistribution. First, there is a theoretical literature that explores deviations from production efficiency (Diamond and Mirrlees, 1971a,b). Naito (1999) developed an argument for production inefficiency (extended in Saez, 2004, Scheuer, 2014, Gomes et al., 2018, and Costinot and Werning, 2023) based on technological constraints and missing instruments. My argument for production inefficiency differs from this work in that I focus on the existence of profits whose taxation is costly. This paper also contributes to the literature that explores whether the combination of different policy instruments can improve the efficiency of redistribution (e.g., Atkinson and Stiglitz, 1976; Saez, 2002a; Ho and Pavoni, 2020; Ferey, 2022; Gaubert et al., 2024). More generally, this paper adds to the analysis of redistributive policies in labor markets with frictions (e.g., Hungerbühler et al., 2006; Stantcheva, 2014; Kroft et al., 2020; Bagger et al., 2021; Mousavi, 2022; Craig, 2023; Doligalski et al., 2023; Hummel, 2024; Sleet and Yazici, 2024; Atesagaoglu and Yazici, Forthcoming).

Finally, this paper adds to the vast positive literature on the minimum wage. The directed search model contributes to a theoretical literature that tries to rationalize minimum wage evidence (see, for example, Engbom and Moser (2022), Haanwinckel (2024), Vogel (2025), and the structural literature referenced above). In addition, the empirical results add to a large literature that studies the effects of minimum wages on different outcomes (Dube and Lindner, 2024). The workers' side results, which differentiate between workers with different skill levels, complement the vast literature studying effects on wages and employment (Manning, 2021a). Results on income maintenance transfers and other fiscal outcomes complement the evidence presented in Reich and West (2015), Dube (2019), and Giupponi et al. (2024). Finally, the results on profits and the labor share add to the findings of Draca et al. (2011), Harasztosi and Lindner (2019), and Drucker et al. (2021).

**Structure of the paper.** Section 2 presents empirical evidence on the tradeoffs studied throughout the paper. Section 3 proceeds with the policy analysis using the stylized model. Section 4 extends the analysis to a model with richer worker- and firm-level heterogeneity and directed search. Section 5 presents the sufficient statistics analysis. Section 6 concludes. All proofs are presented in Appendix B.1.

## 2 Empirical effects of minimum wages on workers and firm profits

To motivate the importance of the tradeoffs discussed throughout the paper, I provide empirical evidence on the effects of minimum wages on employment, wages, transfers, and profits. In what follows, I provide a general description of the empirical strategy and the data. Appendix A contains additional details on the estimated models, data sources, and sample restrictions, as well as additional results.

**Empirical strategy.** The analysis closely follows Cengiz et al. (2019, 2022). I use state-level variation in minimum wages to estimate stacked event studies. State-level minimum wage data covering 1997–2019 is sourced from Vaghul and Zipperer (2016). An event is defined as a state-level real hourly minimum wage increase of at least \$0.25 (in 2016 dollars) in a state with at least 2% of the employed population affected. These restrictions are imposed to focus on minimum wage increases that are likely to affect the labor market. I also restrict attention to events where treated states do not experience other events in the three years previous to the event and whose timing allows me to observe the outcomes from three years before to four years after the event. This results in 50 "valid" state-level events.[3]

With these events, I estimate stacked event studies, which address multiple treatment challenges and potential biases driven by treatment effect heterogeneity (Cengiz et al., 2019, 2022; Baker et al., 2022). I implement the stacked event studies as follows. For each event, I set a time window that goes from 3 years before the event to 4 years after. All states that do not experience events in the event-specific time window define an event-specific control group. The event-specific treatment and control groups constitute an event-specific dataset. I append all event-specific datasets and use the resulting data to estimate a standard event study with event-specific fixed effects according to the following estimating equation:

$$\log Y_{ite} = \sum_{\tau=-3}^{4} \beta_\tau D_{i\tau e} + \alpha_{ie} + \gamma_{cd(i)te} + X_{it}'\rho_e + \epsilon_{ite}, \tag{1}$$

where $i$, $t$, and $e$ index state, year, and event, respectively, $Y_{ite}$ is an outcome of interest, $D_{i\tau e}$ are event indicators with $\tau$ the distance from the event (in years), $\alpha_{ie}$ are state-by-event fixed effects, $\gamma_{cd(i)te}$ are census division-by-year-by-event fixed effects, and $X_{it}$ are time-varying controls that include small state-level minimum wage increases and binding federal minimum wage increases, whose effect is allowed to vary by event $e$. The inclusion of time fixed effects that vary by census division allows me to better control for time-varying confounders that differentially affect states and industries while limiting the variation

[3]See Figure A.1 and Table A.1 for the state and year distribution of the events considered. As in Cengiz et al. (2019, 2022), small state-level or binding federal minimum wage increases are not recorded as events, however, regressions control for small state-level and federal minimum wage increases.

used for identification. Standard errors are clustered at the state level and regressions are weighted by the state-by-year average total population. When the outcome varies at the state-by-industry level, I allow for state-by-industry-by-event fixed effects, cluster standard errors at the state-by-industry level, and weight observations using the average state-by-industry employment in the pre-period.[4]

I also report pooled difference-in-difference estimations to summarize the average treatment effect:

$$\log Y_{ite} = \beta T_{ie}\text{Post}_{te} + \alpha_{ie} + \gamma_{cd(i)te} + X'_{it}\rho_e + \epsilon_{ite}, \tag{2}$$

where $T_{ie}$ is an indicator variable that takes value 1 if state $i$ is treated in event $e$, $\text{Post}_{te}$ is an indicator variable that takes value 1 if year $t$ is larger or equal than the treatment year in event $e$, and all other variables are defined as in equation (1). Finally, to provide estimates of elasticities $d\log Y_{ite}/d\log \text{MW}_{ite}$, I also report IV coefficients from analog regressions that instrument $\log \text{MW}_{ite}$ with $T_{ie}\text{Post}_{te}$.[5]

**Outcomes and data.** Outcome variables are state or state-by-industry annual aggregates for the period 1997–2019. I focus on low-skill wages and employment, transfers, profits, and the labor share.

I use the NBER Merged Outgoing Rotation Group of the CPS to compute average pre-tax hourly wages and the Basic CPS monthly files to compute employment rates at the state-by-year level for low-skill workers. I designate workers without a college degree as low-skill workers. To report an overall effect on low-skill workers that incorporates both wage and employment effects, I compute the average wage of active workers including the unemployed, which equals the average wage conditional on employment times the employment rate. I drop individuals aged 15 or less, self-employed, veterans, and whose hourly wage is in the upper half of the wage distribution when employed.[6] I use data on income maintenance benefits from the Bureau of Economic Analysis (BEA) to proxy for transfers disbursed to low-skill workers at the state-by-year level. This variable mainly includes Supplemental Security Income (SSI) benefits, the EITC, the Additional Child Tax Credit, and Supplemental Nutrition Assistance Program (SNAP) benefits, among other minor assistance benefits. I also construct measures of firm profits, focusing on average profits per establishment at the industry-by-state-by-year level. I use the Gross Operating Surplus (GOS) estimates from the BEA as a proxy for state-by-industry aggregate profits and divide them by the average number of private establishments reported at the state-by-industry level in the Quarterly Census of Employment and Wages (QCEW). Because minimum wage workers are distributed unevenly across industries, I divide industries into two large groups: exposed and non-exposed industries. Exposed

[4]Table 2 shows that results hold in specifications with year-by-event and census region-by-year-by-event fixed effects. However, as shown in Appendix A, while the effects on workers' outcomes and transfers are very consistent across models, specifications based on industry-by-state data display pre-trends in some cases when using the less flexible time fixed effects, suggesting that controlling by census division time trends is the preferred specification.

[5]For a graphical representation of the first stage, see Figure A.2.

[6]Figure A.7 shows that the results are robust to relaxing this restriction except when including the top decile of the wage distribution, which attenuates the wage effects. This result is consistent with wage spillovers that are decreasing in the distance from the minimum wage, implying that the very top wages should not be affected by minimum wage reforms.

Table 1: Descriptive statistics

| | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Low-skill workers:** | | | | | |
| Pre-tax wage including the unemployed (annualized) | 1,173 | 19,397 | 1,226 | 16,176 | 24,002 |
| Hourly wage | 1,173 | 11.55 | 0.62 | 9.74 | 13.99 |
| Weekly hours worked | 1,173 | 34.83 | 1.57 | 29.84 | 38.50 |
| Employment rate | 1,173 | 0.93 | 0.03 | 0.79 | 0.97 |
| Income maintenance benefits (per working-age individual) | 1,173 | 1,057 | 329 | 402 | 2,194 |
| **Firms:** | | | | | |
| Profit per establishment (Exposed industries) | 1,173 | 170,217 | 50,459 | 95,477 | 539,061 |
| Establishments (Exposed industries) | 1,173 | 70,314 | 103,291 | 5,397 | 914,454 |
| Labor share (Exposed industries) | 1,173 | 0.67 | 0.04 | 0.57 | 0.79 |
| Profit per establishment (Non-exposed industries) | 1,173 | 1,014,998 | 269,346 | 423,976 | 1,826,289 |
| Establishments (Non-exposed industries) | 1,173 | 63,709 | 69,305 | 5,818 | 464,462 |
| Labor share (Non-exposed industries) | 1,173 | 0.45 | 0.04 | 0.29 | 0.62 |

Notes: This table shows descriptive statistics for the non-stacked panel. The unit of observation is a state-year pair. Nominal values are transformed to 2016 dollars using the R-CPI-U-RS index including all items. The average pre-tax wage including the unemployed is annualized by computing Average Hourly Wage × Average Weekly Hours × Average Employment Rate × 52. Worker-level aggregates are computed using the CPS-MORG data and the Basic Monthly CPS files. Income maintenance benefits are taken from the BEA regional accounts. Profit per establishment corresponds to the gross operating surplus taken from the BEA regional accounts normalized by the number of private establishments reported in the QCEW data. The labor share corresponds to the compensation of employees over the compensation of employees plus taxes on production and imports net of subsidies plus gross operating surplus, all taken from the BEA regional accounts. Exposed industries include food and accommodation, retail trade, and low-skill health services.

industries include food and accommodation, retail trade, and low-skill health services.[7] Finally, I compute the labor share at the state-by-industry level, computed using standard formulas based on BEA data on GOS, taxes on inputs and imports net of subsidies, and compensation of employees.

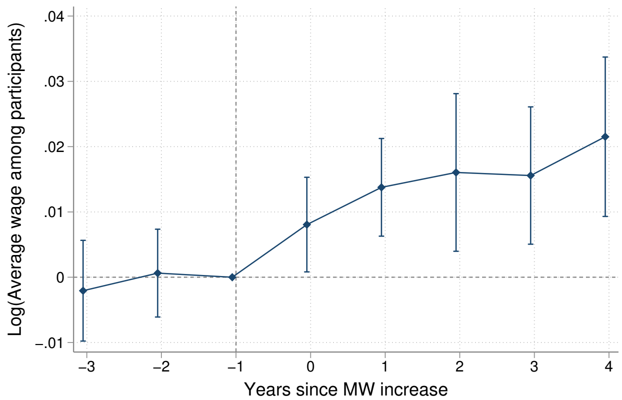
Table 1 presents descriptive statistics of the non-stacked sample for the period 1997–2019 (51 states × 23 years). All values are annual and in 2016 dollars. The average annual pre-tax income of low-skill workers (including the unemployed) is \$19,396. Average income maintenance benefits per working-age individual are \$1,051, roughly 5% of low-skill workers' pre-tax income. Average pre-tax profits per establishment are substantially larger than disposable incomes for workers: in exposed industries, the average pre-tax profit per establishment is almost 9 times the average pre-tax income of low-skill workers, suggesting equity gains from redistributing profits. In addition, exposed industries are much more labor-intensive than non-exposed industries, with average labor shares of 0.67 and 0.45, respectively.

**Results.** Figure 1 plots the estimated stacked event study coefficients $\{\beta_\tau\}_{\tau=-3}^{4}$ of equation (1) with their corresponding 95% confidence intervals. Table 2 reports the corresponding estimated $\beta$ coefficient of equation (2) and the implied elasticity with respect to the change in the minimum wage.

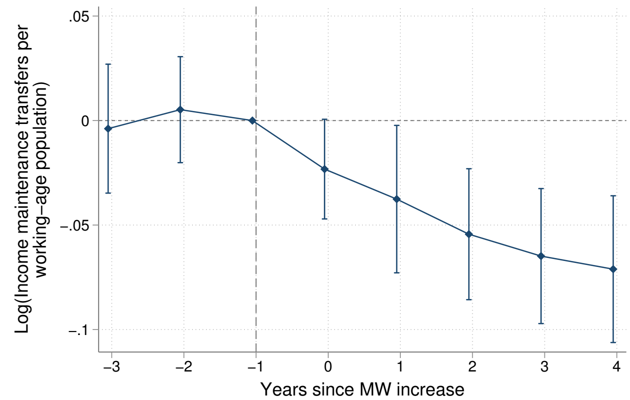
Panels (a) and (b) of Figure 1 show the effects of minimum wage reforms on low-skill workers. Panel (a) of Figure 1 shows the results for the log average wage of low-skill workers (equal to the product of the average wage and the employment rate). Factoring in both wage and employment effects, state-level

[7] A large empirical literature in the US characterizes food and accommodation and retail as the main exposed industries; see, for example, Dube et al. (2010) and Cengiz et al. (2019). Low-skill health and social services, such as the nursing home sector, are also highly exposed to the minimum wage; see, for example, Gandhi and Ruffini (2022) and Ruffini (2024).

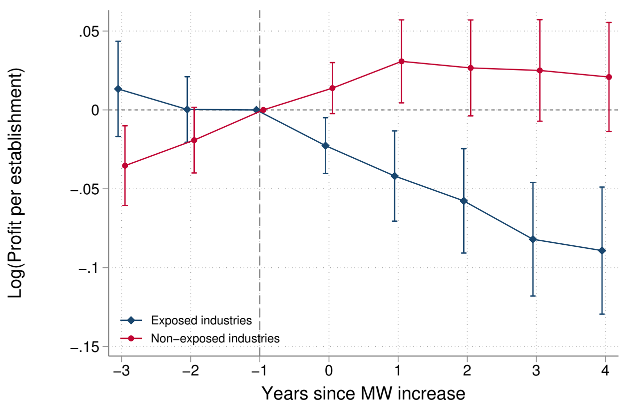
Figure 1: Effects of state-level minimum wage reforms on low-skill workers, profits, and labor share



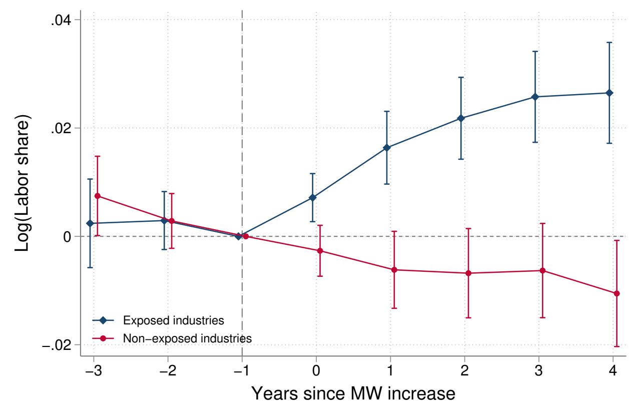

(a) Pre-tax wage (including 0s) of low-skill workers




(b) Income maintenance benefits




(c) Profits per establishment




(d) Labor share

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (1) with their corresponding 95% confidence intervals. Panel (a) uses the log of the average pre-tax wage of active low-skill workers including the unemployed, equal to the average wage conditional on employment times the employment rate, as the dependent variable. Panel (b) uses the log of total income maintenance benefits per working-age population as the dependent variable. Panel (c) uses the log of the profit per establishment as the dependent variable. Panel (d) uses the log of the labor share as the dependent variable. The analyses in Panels (a) and (b) are at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. The analyses in Panels (c) and (d) are at the state-by-industry-by-year level, standard errors are clustered at the state-by-industry level, and regressions are weighted by the average pre-period state-by-industry-by-year employment. Exposed industries include food and accommodation, retail trade, and low-skill health services.

minimum wage increases have raised the average wages of low-skill workers (including low-skill workers who are unemployed or earn more than the minimum wage). The implied elasticity ranges between 0.11 and 0.15, meaning that a 1% increase in the state-level minimum wage leads to a 0.11%-0.15% increase in average pre-tax wages of low-skill workers. Table 2 and Figure A.4 show that minimum wage reforms have no detectable effects on low-skill employment rates. This finding implies that the overall effect on low-skill workers is explained by an increase in the wage conditional on employment, which I show

Table 2: Difference-in-difference results

Panel (a): Low-skill workers and income maintenance benefits

| *Dependent variable:* | Pre-tax wage (including 0s) (low-skill workers) | | | Employment rate (low-skill workers) | | | Inc. maint. benefits (per working-age ind.) | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\hat{\beta}$ | 0.017 | 0.013 | 0.015 | 0.002 | 0.001 | 0.005 | -0.040 | -0.049 | -0.050 |
| | (0.006) | (0.006) | (0.005) | (0.003) | (0.003) | (0.003) | (0.015) | (0.012) | (0.015) |
| Year FE | Y | N | N | Y | N | N | Y | N | N |
| Year x CR FE | N | Y | N | N | Y | N | N | Y | N |
| Year x CD FE | N | N | Y | N | N | Y | N | N | Y |
| Obs. | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 |
| Events | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| *Elasticity estimate:* | | | | | | | | | |
| First stage ($\Delta \log \mathrm{MW}$) | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 |
| | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) |
| F-test | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 |
| Second stage (elasticity) | 0.148 | 0.110 | 0.139 | 0.022 | 0.006 | 0.043 | -0.352 | -0.415 | -0.453 |
| | (0.045) | (0.045) | (0.037) | (0.030) | (0.029) | (0.024) | (0.128) | (0.116) | (0.148) |

Panel (b): Profits, establishments, and labor share

| *Dependent variable:* | Profits per establishment (exposed industries) | | | Number of establishments (exposed industries) | | | Labor share (exposed industries) | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\hat{\beta}$ | -0.057 | -0.065 | -0.063 | -0.000 | -0.003 | -0.005 | 0.016 | 0.017 | 0.018 |
| | (0.012) | (0.011) | (0.012) | (0.010) | (0.006) | (0.005) | ( 0.003) | (0.003) | (0.003) |
| Year FE | Y | N | N | Y | N | N | Y | N | N |
| Year x CR FE | N | Y | N | N | Y | N | N | Y | N |
| Year x CD FE | N | N | Y | N | N | Y | N | N | Y |
| Obs. | 254,692 | 254,692 | 254,692 | 256,612 | 256,612 | 256,612 | 255,731 | 255,731 | 255,731 |
| Events | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| *Elasticity estimate*: | | | | | | | | | |
| First stage ($\Delta \log \mathrm{MW}$) | 0.116 | 0.121 | 0.114 | 0.116 | 0.121 | 0.114 | 0.116 | 0.121 | 0.114 |
| | (0.012) | (0.012) | (0.010) | (0.012) | (0.012) | (0.010) | (0.012) | (0.012) | (0.010) |
| F-test | 97.718 | 108.492 | 120.718 | 97.718 | 108.492 | 120.718 | 97.718 | 108.492 | 120.718 |
| Second stage (elasticity) | -0.488 | -0.539 | -0.554 | -0.003 | -0.024 | -0.043 | 0.134 | 0.139 | 0.155 |
| | (0.101) | (0.100) | (0.107) | (0.085) | (0.047) | (0.046) | (0.027) | (0.023) | (0.024) |

Notes: This table shows the estimated $\beta$ coefficient from equation (2) with corresponding standard errors reported in parentheses. All columns represent different regressions using different dependent variables (all in logarithms) and fixed effects. Columns (1) to (3) of Panel (a) use the average pre-tax wage of low-skill participants, equal to the average pre-tax wage of low-skill workers including the unemployed (the average wage conditional on employment times the employment rate). Columns (4) to (6) of Panel (a) use the employment rate of low-skill workers. Columns (7) to (9) of Panel (a) use income maintenance benefits per working-age individual. Columns (1) to (3) of Panel (b) use the profit per establishment. Columns (4) to (6) of Panel (b) use the number of establishments. Columns (7) to (9) of Panel (b) use the labor share. In Panel (b) I only report the coefficient on exposed industries, which include food and accommodation, retail trade, and low-skill health services. Year FE means that the regression includes year-by-event fixed effects. Year x CR FE means that the regression includes census region-by-year-by-event fixed effects. Year x CD FE means that the regression includes census division-by-year-by-event fixed effects. $\Delta \log \mathrm{MW}$ is the average change in the log of the real state-level minimum wage across events as estimated from an analog of equation (2) that uses $\log \mathrm{MW}_{ite}$ as the dependent variable. The implied elasticity is computed by dividing the point estimate by $\Delta \log \mathrm{MW}$, which corresponds to the second stage of the instrumental variables estimation. In Panel (a), the analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. In Panel (b), the analysis is at the state-by-industry-by-year level, standard errors are clustered at the state-by-industry level, and regressions are weighted by the average pre-period state-by-industry-by-year employment.

directly in Appendix A (Figure A.4 and Table A.2).[8] Appendix A shows that the effect is homogenous

[8] Figure A.5 and Table A.2 also show null effects on average hours worked and labor force participation rates.

across subgroups of low-skill workers (Figure A.6) but does not appear among high-skill workers (Figures A.3 and A.4, and Tables A.3 and A.4). These results are consistent with the positive wage effects with "elusive" employment effects documented in the literature (Manning, 2021a; Dube and Lindner, 2024).[9]

Panel (b) of Figure 1 shows the results on the log income maintenance benefits per working-age individual, which decrease following state-level minimum wage increases. The implied elasticity is between -0.35 and -0.45, suggesting that higher pre-tax earnings reduce means-tested transfers, generating a positive fiscal externality that partly offsets low-skill workers' pre-tax earnings gains. This result is consistent with the empirical findings of Reich and West (2015) and Dube (2019) for the US context and with the micro-simulations made by Giupponi et al. (2024) in the UK context.[10]

Panels (c) and (d) of Figure 1 report effects on industry-level profits and labor shares. Panel (c) of Figure 1 shows the results on log average profits per establishment. Average profits per establishment decrease in exposed industries (food and accommodation, retail trade, and low-skill health services) after minimum wage reforms, with an implied elasticity between -0.49 and -0.55, with no detectable effects in non-exposed industries. Table 2 and Figure A.9 show that minimum wage reforms do not affect the number of establishments, suggesting that profit effects are driven by intensive margin responses. This result is within the (wide) range of estimates reported in Draca et al. (2011) for the UK, Harasztosi and Lindner (2019) for Hungary, and Drucker et al. (2021) for Israel. However, implied magnitudes differ among these studies, and my regression estimates are noisy enough to provide a more precise picture of the profit effect. While these results should be interpreted with some caution because they rely on rather noisy aggregate data, they suggest nonetheless that there is non-trivial profit incidence in exposed industries.[11] Finally, Panel (d) of Figure 1 shows the results on the log labor share. The labor share increases in exposed industries, with an implied elasticity between 0.13 and 0.16, but does not change in non-exposed industries. This result completes the picture of the within-firm distributional impacts of the minimum wage: by increasing low-skill workers' earnings at the expense of firm profits, the minimum wage redistributes from firm owners to workers. This distributional tension is theoretically explored in the rest of the paper by formally considering the efficiency costs and the fiscal externalities of the minimum wage and comparing it with tax-and-transfer schemes that can replicate similar redistribution schemes.

[9] While consistent, my results differ from those of Cengiz et al. (2019, 2022) in two respects. First, I focus on a broader group (low-skill workers) that is not exclusively composed of minimum wage workers. Second, I provide results that focus on the combined effect on wages and employment rather than the pure employment effect.

[10] Figure A.8 and Table A.5 show that medical benefits and gross federal income taxes do not respond to minimum wages, reinforcing the idea that worker-level fiscal externalities are mediated by targeted transfers based on pre-tax income levels.

[11] The effect on firm owners can, in principle, generate fiscal externalities in other parts of the tax system. Figure A.10 and Table A.6 provide little support to these alternative fiscal externalities. I estimate no effects on business income per income tax return or on dividend income per income tax return, as reported in the Statistics of Income (SOI) state-level tables, and also no effects on taxes on production and imports net of subsidies, as reported by the BEA.

# 3 Minimum wage policy in a frictionless labor market

I begin the formal analysis by presenting and analyzing a stylized model of the labor market with perfect competition. In this setting, I generate sharp results which capture the main intuition of the analysis. Section 4 extends the analysis to a richer model of the labor market.

## 3.1 Setup

There is a population of equally productive workers normalized to 1 and a representative capitalist.[12] Workers make extensive margin labor supply decisions, so the terms "wage," "income," and "earnings" are interchangeable here. The capitalist allocates her capital between a domestic firm with decreasing returns to scale (DRS) and a foreign investment opportunity with a fixed after-tax return. Domestic firms are price takers in the product and labor markets. There are no labor market frictions.

**Workers.** Workers are characterized by a scalar cost of participating in the labor market given by $c \in \mathcal{C} = [0, C] \subset \mathbb{R}$, which is distributed with cdf $F$ and pdf $f$. The participation cost $c$ is dollar-valued and can be interpreted as the disutility of labor supply or as other opportunity costs such as home production. If a type $c$ worker works, she gets utility $u_1 = y_1 - c = w - T_1 - c$, where $y_1 = w - T_1$ is after-tax income (consumption), $w$ is the wage, and $T_1$ is the total taxes (net of transfers) paid by employed workers. If a type $c$ worker does not work, she gets utility $u_0 = y_0 = -T_0$, where $-T_0 \geq 0$ is a government transfer. Workers work if their utility from working $u_1$ is at least as high as their utility from not working $u_0$, that is, if $u_1 \geq u_0 \Leftrightarrow \Delta y = y_1 - y_0 = w - T_1 + T_0 \geq c$. Then, aggregate labor supply is given by $L^S(w, T_0, T_1) = F(w - T_1 + T_0) = F(w - \Delta T)$, where $\Delta T = T_1 - T_0$.

**Capitalist.** The capitalist is endowed with a fixed capital stock $\overline{k}$ which she allocates between a domestic firm and a foreign investment opportunity. The domestic revenue function with DRS is denoted by $\phi(l, k)$, with $l$ employment, $k$ capital, $\phi_l > 0$, $\phi_k > 0$, $\phi_{ll} < 0$, $\phi_{kk} < 0$, and $\phi_{lk} \geq 0$. Domestic profits are taxed with a linear corporate tax, $t$, and the firm's output price is normalized to 1, so domestic after-tax profits are given by $(1-t)\pi(l, k) = (1-t)\left(\phi(l, k) - wl\right)$. This formulation assumes that capital is not deductible from the domestic corporate tax base. All results hold as long as capital costs are not fully deductible, a case that would make the corporate tax non-distortionary. The foreign investment yields a fixed after-tax return $r^*$. The capitalist's optimization problem is therefore to maximize the return on her capital stock, i.e., to solve $\max_{l,k} \left[(1-t)\left(\phi(l, k) - wl\right) + \left(\overline{k} - k\right) r^*\right]$. Assuming an interior solution, the first-order conditions yield $\phi_l = w$ and $(1-t)\phi_k = r^*$. These equations define a labor demand function, $L^D(w, 1-t)$, and a domestic capital supply function, $k(w, 1-t)$.

[12] These populations are fixed, in the sense that I do not model selection into occupation as in, e.g., Scheuer (2014).

The capitalist's value function is given by:

$$U^K = (1-t)\Pi(w, 1-t) + \left(\overline{k} - k(w, 1-t)\right) r^*, \tag{3}$$

where $\Pi(w, 1-t) = \phi(L^D(w, 1-t), k(w, 1-t)) - wL^D(w, 1-t)$ denote optimized pre-tax domestic profits. DRS imply that $\Pi(w, 1-t)$ is positive. Because of the envelope theorem, we have that $\partial U^K/\partial w = -(1-t)L^D(w, 1-t)$ and $\partial U^K/\partial(1-t) = \Pi(w, 1-t)$.

**Equilibrium.** Without a minimum wage, the labor market clears. The labor market equilibrium is given by $L^S(w, T_0, T_1) = L^D(w, 1-t) = L$, with $L$ total employment. This market clearing condition determines the equilibrium wage, $w$, given taxes $(T_0, T_1, 1-t)$. Changes in the labor income tax, $(T_0, T_1)$, shift the labor supply curve, while changes in the net-of-corporate tax, $1-t$, shift the labor demand curve. With a binding minimum wage, $\overline{w}$, there is excess labor supply, which implies that equilibrium employment is determined by labor demand: $L = L^D(\overline{w}, 1-t)$. With a minimum wage, the $c$-composition of employed workers depends on the rationing mechanism, that is, the assignment of workers to employment given excess labor supply. The propositions below do not rely on any particular rationing assumption.

**Elasticity concepts.** The following elasticity concepts play a central role in the results below:

$$\eta_{1-t} = \frac{\partial \log L^D(w, 1-t)}{\partial \log(1-t)}, \qquad \eta_w = -\frac{\partial \log L^D(w, 1-t)}{\partial \log w}, \tag{4}$$

$$\epsilon_{1-t} = \frac{\partial \log \Pi(w, 1-t)}{\partial \log(1-t)}, \qquad \epsilon_w = -\frac{\partial \log \Pi(w, 1-t)}{\partial \log w}. \tag{5}$$

Equation (4) shows labor demand elasticities, $\eta_x$, while equation (5) shows domestic pre-tax profits elasticities, $\epsilon_x$, for $x \in \{1-t, w\}$, both defined to be positive to have an absolute value interpretation.

Three remarks are in order. First, elasticities are defined with partial rather than total derivatives, meaning that the labor demand elasticity $\eta_{1-t}$ and profits elasticity $\epsilon_{1-t}$ with respect to $1-t$ do not incorporate general equilibrium effects in wages. Results below are conditional on a binding minimum wage which, by definition, shuts down general equilibrium forces in wages.[13] Second, DRS and the capital allocation distortion imply that the labor demand elasticity $\eta_{1-t}$ and profit elasticity $\epsilon_{1-t}$ are likely positive and finite, which aligns with recent empirical evidence on corporate tax incidence (Swonder and Vergara, 2024). For this property to hold, one must assume that returns to foreign investment are not fully included in the domestic tax base and that capital expenses cannot be fully deducted. Third, while the results below are expressed as a function of the elasticities described in equations (4) and (5), the four elasticities are likely structurally related and, therefore, it may not be appropriate to interpret them as independent "sufficient statistics." In particular, labor demand elasticities mechanically affect pre-tax profit elasticities, and elasticities for wages and corporate taxes are related through the revenue

[13] Total elasticities for $1-t$ are of the form $dx/d(1-t) = \partial x/\partial(1-t) + (\partial x/\partial w)(\partial w/\partial(1-t))$, for $x \in \{L^D, \Pi\}$, so the direct (micro) effects depicted on equations (4) and (5) are adjusted by the equilibrium (macro) effects on wages.

function $\phi$. After presenting the propositions, I develop an illustrative numerical exercise that imposes a parametric structure on $\phi$ to show the role of these interactions.

**Planner's problem.** I assume the planner does not observe $c$ and is therefore restricted to second-best allocations. The social planner chooses the tax system, $(T_0, T_1, 1-t)$, and the minimum wage, $\overline{w}$, to maximize a (generalized) utilitarian social welfare function (SWF). Given the degenerate wage distribution, the pair $(T_0, T_1)$ defines a non-linear income tax schedule that depends only on earnings. The assumption of a linear corporate tax (instead of, for example, a lump-sum tax on profits) is required to make profit taxation distortionary, and, importantly, it better reflects the implementation of corporate taxation in practice.[14] The SWF is given by:

$$SWF \;=\; (1-L)\omega_L G(y_0) + \omega_L \int_{c\in\mathcal{C}_1} G(y_1 - c)dF(c) + \omega_K G(U^K), \tag{6}$$

where $\mathcal{C}_1 = \{c \in \mathcal{C} : \text{individual is working}\} \subset \mathcal{C}$, and $G$ is an increasing and concave function which, together with the vector $\{\omega_L, \omega_K\}$ of exogenous Pareto weights on workers and capitalists, summarizes social preferences for redistribution. The first, second, and third terms account for the welfare of non-employed workers, employed workers, and the capitalist, respectively. When choosing taxes and the minimum wage, the planner internalizes that the employment rate $L$, capitalists' utility $U^K$, and (if the minimum wage $\overline{w}$ does not bind) the wage $w$ are equilibrium objects endogenous to policy. $\mathcal{C}_1$ is also endogenous to policy choices, so the integration limits incorporate the incentive compatibility constraints. In the absence of a minimum wage, workers are on their labor supply curve and $\mathcal{C}_1 = [0, \Delta y]$. This is not the case with binding minimum wage because the rationing mechanism determines $\mathcal{C}_1$.

Assuming no exogenous expending requirement, the government budget constraint is given by:

$$(1-L)T_0 + LT_1 + t\Pi = 0. \tag{7}$$

Let $\gamma$ be the budget constraint multiplier. The average social marginal welfare weight (WW) of non-employed workers, employed workers, and the capitalist, are defined respectively as:

$$g_0 = \frac{\omega_L G'(y_0)}{\gamma}, \qquad g_1 = \frac{\omega_L \int_{\mathcal{C}_1} G'(y_1 - c)dF(c)}{L\gamma}, \qquad g_k = \frac{\omega_K G'\left(U^K\right)}{\gamma}. \tag{8}$$

WWs represent the social value of the marginal utility of consumption normalized by the social cost of raising public funds, thus measuring the social value of redistributing one dollar uniformly across a group of individuals. At the optimum, the planner is indifferent between giving one more dollar to an individual $i$ or having $g_i$ more dollars of public funds. For the results below, it is also useful to define as $g_1^M$ the

[14] In particular, non-linear taxation of profits has proven challenging because firms can reorganize – for example, by splitting large firms into several small firms – to avoid the progressivity of the corporate tax. See, for example, Onji (2009), Best et al. (2015), Agostini et al. (2018), Bachas and Soto (2021), and Lobel et al. (2024).

WW of the marginally employed worker. This quantity measures the social value of the utility loss of workers who are potentially displaced by the minimum wage.

### 3.2 Characterizing the desirability of the minimum wage

Using this model, I characterize conditions under which complementing the tax system with a minimum wage is welfare-improving. I proceed by perturbing a no-minimum wage allocation with different minimum wage reforms in the spirit of Saez (2001) and Kaplow (2006). Proposition 1 simply perturbs a baseline equilibrium with a minimum wage to characterize all the potential effects of its introduction. Propositions 2 and 3 pair the minimum wage introduction with related tax reforms to better understand the tradeoffs between the minimum wage and the tax system.

**Proposition 1.** *Consider an allocation with (potentially optimal) taxes and no minimum wage. Introducing a binding minimum wage is desirable if:*

$$g_1 L > L\frac{\eta_w}{\overline{w}}\left(g_1^M + \Delta T\right) + g_k(1-t)L + \frac{\Pi}{\overline{w}}\epsilon_w t. \tag{9}$$

The left-hand-side (LHS) of equation (9) represents employed workers' welfare benefit from higher wages, valued by $g_1$. The right-hand-side (RHS) has three terms. The first shows the effects of employment losses (proportional to the wage elasticity of labor demand $\eta_w$) which generates a welfare cost for displaced workers, valued by $g_1^M$, and a fiscal externality that depends on $\Delta T$. If $\Delta T > 0$, the reform reduces income tax revenue. If $\Delta T < 0$, the government saves money by reducing in-work benefits. The second term is the welfare effect on the capitalist, valued by $g_k$. The third term is the negative fiscal externality from reducing corporate tax revenue, which is proportional to the wage elasticity of profits $\epsilon_w$ and the corporate tax rate $t$. Introducing a binding minimum wage is desirable as long as the welfare gain for workers exceeds the associated welfare costs and fiscal externalities.

To better understand the distributional tradeoffs involved in imposing a minimum wage, consider the case where employment effects are negligible. If $\eta_w \to 0$, then $\epsilon_w \to L\overline{w}/\Pi$, and equation (9) reduces to:

$$g_1 > g_k(1-t) + t. \tag{10}$$

Expression (10) shows that the desirability of the minimum wage is not guaranteed even in the absence of employment effects: the minimum wage is desirable as long as the social value of employed workers' utility is larger than the value of the capitalist's welfare and the unit of additional corporate tax revenue. Note that the desirability of the minimum wage depends on the corporate tax since $t$ affects both $g_k$ and the size of the fiscal externality. If $g_k < 1$, the concavity of $G$ implies that the RHS of (10) is increasing in $t$, meaning that the minimum wage is more desirable when corporate taxes are low, both because of larger equity benefits from redistributing profits and smaller corporate tax revenue losses.

**Improving the efficiency of redistribution.** Proposition 1 perturbs the no-minimum wage allocation assuming taxes (optimal or sub-optimal) are fixed. This benchmark helps in developing intuition and is useful from a "sufficient statistics" perspective, but may be too restrictive if alternative reforms that also consider "well-designed" tax changes provide more favorable conditions for introducing a minimum wage. Mimicking a joint optimization procedure, I now focus on reforms that pair the introduction of a minimum wage with tax reforms that hold certain elements of the status quo allocation fixed.

I first study a reform that holds fixed the welfare of employed workers and the capitalist, thus exploring whether the minimum wage enables the social planner to achieve similar redistribution with lower fiscal costs. The reform is as follows. Starting from an allocation with no minimum wage, consider a minimum wage increase paired with an increase in taxes on employed workers of similar magnitude. The labor income tax change generates a positive fiscal effect while leaving employed workers' welfare constant. Consider also a decrease in the corporate tax to compensate the capitalist for the minimum wage increase, so her utility is constant. The corporate tax cut may affect labor demand and corporate tax revenue. Then, the reform will be desirable if these costs do not fully offset the positive fiscal externality on the workers' income tax. The following proposition formalizes this condition.

**Proposition 2.** *Consider an allocation with (potentially optimal) taxes and no minimum wage. Consider the following reform package: (1) an increase in the minimum wage, $d\overline{w} > 0$, (2) an equally-sized increase in the tax for employed workers, $dT_1 = d\overline{w}$, and (3) a corporate tax cut, $d(1-t) > 0$, such that the capitalist is compensated for the minimum wage increase, so $dU^K = 0$. This reform is desirable if:*

$$1 - (1-t) + \frac{\Delta T + g_1^M}{\overline{w}} \left( -\eta_w + \frac{L\overline{w}}{\Pi}\eta_{1-t} \right) + t \left( -\frac{\Pi \epsilon_w}{L\overline{w}} + \epsilon_{1-t} \right) > 0. \tag{11}$$

When the planner is constrained to hold allocations fixed, the minimum wage affects the no-minimum wage allocation through the following channels. The first two terms in equation (11) are the mechanical fiscal externalities. First, there is a per-worker fiscal gain from the increase in $T_1$, normalized to 1. Second, because of the envelope theorem, the corporate tax cut generates a fiscal loss of $1 - t$ per worker because the tax cut exactly compensates for the mechanical increase in labor costs. The third and fourth terms are behavioral effects. The third term represents the costs of employment changes (in terms of fiscal externalities and displaced workers' welfare), whose sign and magnitude depend on the relative size of the negative effect driven by the minimum wage increase (mediated by the wage elasticity of labor demand $\eta_w$) and the positive effect driven by the corporate tax cut (mediated by the elasticity of labor demand with respect to the net-of-corporate rate $\eta_{1-t}$). The fourth term represents the fiscal externality in corporate tax revenue, which increases with the response of profits to wages $\epsilon_w$ but is attenuated by the profit response to taxes $\epsilon_{1-t}$. The relative distortions between the minimum wage and the corporate tax are key for the desirability of the minimum wage introduction since they determine both the sign and magnitude of the behavioral effects.

Proposition 2 can be thought of as a generalization of the results in Lee and Saez (2012) to a setting with profits and distortionary corporate taxation. If there is no corporate taxation, i.e., $t = 0$; no response of profits or labor demand to taxation, i.e., $\eta_{1-t} = \epsilon_{1-t} = 0$; and rationing is efficient (so $g_1^M = 0$), then equation (11) is reduced to $\Delta T < 0$, exactly in line with Lee and Saez (2012) result: the minimum wage can only improve welfare if the underlying tax system considers in-work benefits. With no minimum wage, transfers to workers increase labor supply and therefore decrease the pre-tax wage in general equilibrium (Rothstein, 2010; Gravoueille, 2024; Zurla, 2024). This response implies that in-work benefits also subsidize profits. With a minimum wage, labor supply responses are muted, enabling the planner to more efficiently transfer resources to employed workers. The minimum wage can, therefore, make the transfer more efficient by shifting the incidence of the policy. This mechanism does not work if $\Delta T > 0$: when positive taxes are in place, labor supply shrinks and, therefore, the pre-tax wage increases. Then, the minimum wage does not affect this behavioral response. Proposition 2 incorporates into this intuition the additional effects that arise from the presence of profits and imperfect profit taxation.

**Improving allocations.** Proposition 2 imposes that the welfare of employed workers and the capitalist are held fixed after the minimum wage introduction, constraining the role of the minimum wage to improve welfare only through beneficial fiscal externalities. I now examine whether the minimum wage allows the implementation of preferred allocations, paying particular attention to the possibility of affecting the capitalist's welfare. Concretely, I explore whether the minimum wage may affect the capitalist's welfare in the socially desired direction in cases where it is too costly to do that using the corporate tax.

To this end, I analyze the following reform. As before, I start from an allocation with no minimum wage and consider an increase in the minimum wage paired with an equally-sized increase in taxes on employed workers, so their welfare is fixed. This reform also considers a decrease in the corporate tax but now to compensate labor demand so employment is held fixed. The corporate tax cut may generate welfare costs for the capitalist (if the minimum wage increase is not fully compensated by the corporate tax cut) and affect corporate tax revenue. Then, the reform will be desirable if these costs do not offset the positive fiscal externality on the workers' income tax. The following proposition formalizes this condition.

**Proposition 3.** *Consider an allocation with (potentially optimal) taxes and no minimum wage. Consider the following reform package: (1) an increase in the minimum wage, $d\overline{w} > 0$, (2) an equally-sized increase in the tax for employed workers, $dT_1 = d\overline{w}$, and (3) a corporate tax cut, $d(1-t) > 0$, such that labor demand is compensated for the minimum wage increase, so $dL = 0$. This reform is desirable if:*

$$1 > g_k(1-t) + \frac{\Pi}{L\overline{w}} \left( (1-t)(1-g_k)\frac{\eta_w}{\eta_{1-t}} + t\left(\epsilon_w - \epsilon_{1-t}\frac{\eta_w}{\eta_{1-t}}\right)\right). \tag{12}$$

Proposition 3 reinforces the idea that the minimum wage may complement the tax system when it is relatively less distortionary than the corporate tax, but the economic argument differs from the one stated in Proposition 2. If the corporate tax is highly distortionary, a small corporate tax cut will be sufficient to hold labor demand constant, and the corresponding fiscal externality will therefore be small. In this case, reducing taxation of profits via the corporate tax and instead using the minimum wage to redistribute to workers may increase the efficiency of overall redistribution. On the contrary, if the corporate tax is close to non-distortionary, the corporate tax cut needed to keep labor demand constant after the introduction of the minimum wage will be substantial, making the substitution between the minimum wage and the corporate tax very costly. The importance of the capitalist's welfare also plays a role in governing this effect. If the social value of redistributing profits is large (i.e., $g_k$ is small), the proposed reform is more attractive. Importantly, given that $dL = 0$ by construction in the proposed reform, equation (12) does not depend on $g_1^M$, meaning that it holds for any labor rationing scheme.

To build intuition, note from equation (12) that if the wage elasticity of labor demand $\eta_w$ is positive but labor demand and profits are unresponsive to corporate taxation – i.e., $\eta_{1-t} = \epsilon_{1-t} = 0$ – then the RHS diverges and, therefore, the proposed reform is never desirable. Intuitively, with $\eta_{1-t} \to 0$, the planner is unrestricted in collecting revenue from profits and, therefore, can achieve first-best taxation of corporate profits. In this situation, there is no gain in substituting corporate taxation with the minimum wage. Alternatively, when $\eta_{1-t} > 0$ but the employment effects of the minimum wage are negligible, so $\eta_w \to 0$ and $\epsilon_w \to L\overline{w}/\Pi$, the condition reduces to:

$$(1-t)(1-g_k) > 0. \tag{13}$$

Again, the desirability of the minimum wage is not guaranteed if the employment effects of the minimum wage are zero, as the planner still needs to be willing to redistribute from the capitalist ($g_k < 1$). If taxes are optimized, corporate tax distortions are a sufficient condition for $g_k < 1$. On the contrary, in the absence of corporate tax distortions, $g_k = 1$ under optimal taxes. Then, even if the minimum wage has no employment effects, some distortion from corporate taxation is necessary to justify the reform.

Another way of conceptualizing this result is as follows. Suppose that the planner does not value the capitalist's welfare ($\omega_K = 0$ and, therefore, $g_k = 0$). Then, equation (12) reduces to:

$$1 > \frac{\Pi}{L\overline{w}} \left( \frac{\eta_w}{\eta_{1-t}} (1 - t(1+\epsilon_{1-t})) + t\epsilon_w \right). \tag{14}$$

For efficiency reasons alone, desirability of the minimum wage is increasing in $\epsilon_{1-t}$, decreasing in $\eta_w/\eta_{1-t}$ (provided that $\epsilon_{1-t} < (1-t)/t$, a condition that holds at the optimum with no minimum wage in the numerical simulations below), and decreasing in $\epsilon_w$. In economic terms, if the minimum wage is less distortionary than the corporate tax, it will be efficient to substitute corporate taxes with minimum wages to implement similar allocations for workers with less fiscal costs, provided the planner is allowed to affect the capitalist's welfare. When $\omega_K = 0$, $\eta_w = 0$ implies that the introduction of the minimum wage is desirable as long as $t < 1$, a condition that will hold at the optimum with $\omega_K = 0$ if corporate taxes are distortionary. This analysis shows that optimal policy analyses that depart from the assumption that profits can be taxed away lump-sum are not without loss of generality.

**The role of firm heterogeneity.** The results above show that the relative distortions of the minimum wage and the corporate tax matter for assessing optimal policy. This analysis, however, is limited if firms are homogeneous because the incidence of the two policies is uneven when firms pay different wages. To fix ideas, consider the existence of two industries, with one industry paying higher wages than the other. In this setting, the minimum wage only affects firms in the low-wage industry but the corporate tax affects profits across the board, provided the social planner cannot set industry-specific corporate taxes. This feature may be important for considering the relative merits of corporate taxation and minimum wages if industries that pay the minimum wage differ from those that do not in terms of their responses to corporate taxes. For example, as shown in Table 1, minimum wage workers in the US are concentrated in labor-intensive industries, for which the relative distortions of the minimum wage and the corporate tax may differ from those observed in capital-intensive industries such as manufacturing.

In what follows, I explore the implications of uneven minimum wage and corporate tax incidence for the results presented above. The simple extension of the model I consider introduces heterogeneity in a very stylized fashion. The workers and the firm described above constitute a segmented low-skill labor market of low-skill workers working for a representative firm in a low-skill industry. Denote the low-skill market primitives and equilibrium objects with superscript $l$. Consider a second segmented labor market of high-skill workers working for a representative firm in a high-skill industry with primitives and equilibrium objects denoted with superscript $h$. Because of segmentation, these two industries work as two independent markets, meaning that all behavioral responses and equilibrium relations hold separately by industry. Assume that $w^h > w^l$, so the minimum wage $\overline{w}$ does not bind in the high-skill industry. The planner's policy objects consist of $(T_0, T_1, T_2, t)$ and $\overline{w}$, where $T_1$ are net taxes paid by low-skill employed workers, $T_2$ are net taxes paid by high-skill workers, and $\Delta T_i = T_i - T_0$, for $i = \{1, 2\}$. The key constraint on the planner is that they must impose a uniform linear corporate tax that applies to both industries. From the planner's perspective, industries are therefore connected through the budget constraint, even though workers and firms behave independently.[15]

Firm heterogeneity introduces additional fiscal externalities and welfare considerations for the reforms discussed in Propositions 2 and 3. To see why, recall that these reform packages pair a minimum wage increase with an income tax increase and a corporate tax cut. The changes in the minimum wage and

[15] Because of the segmented markets assumption, the planner's problem does not involve cross-skill or cross-industry incentive compatibility constraints because high-skill workers cannot work in the low-skill industry and vice versa.

the income tax do not affect the high-skill industry, but the corporate tax cut does: it affects high-skill employment, wages, profits, and corporate tax revenue. Formally, in Appendix B.2, I show that the LHS of equations (11) and (12) are augmented by a term proportional to:

$$\frac{d(1-t)}{1-t} \cdot \left( g_2 L^h w^h \mathcal{W}^h_{1-t} + L^h \eta^h_{1-t} \Delta T_2 - (1 - g^h_k)(1-t)\Pi^h + t\Pi^h \epsilon^h_{1-t} \right), \tag{15}$$

where $d(1-t) > 0$ is the size of the corporate tax cut (which varies between propositions), $g_2$ is the WW on high-skill workers, and $\mathcal{W}^h_{1-t} = \partial \log w^h / \partial \log(1-t) > 0$ is the high-skill wage elasticity with respect to the net-of-corporate tax. The first term is a welfare effect on high-skill workers given the change in wages, valued by $g_2$. The second term is a fiscal externality governed by the change in high-skill employment due to higher labor demand, which is positive provided $\Delta T_2 > 0$. The third term is a mechanical negative effect on corporate tax revenue, attenuated by the direct welfare gains to the high-skill capitalist governed by the smaller corporate tax. Finally, the fourth term is the positive behavioral effect on pre-tax profits that attenuates the fiscal cost in corporate tax revenue. The (properly normalized) expression depicted in equation (15) appears in the LHS of equations (11) and (12), so the larger it is, the more likely the proposed reform will be welfare improving.

One important insight that arises from this extension is that minimum wages are more desirable when the corporate tax is highly distortionary in the high-skill industry. This logic likely applies in the US, because corporate tax distortions are empirically larger in capital-intensive industries (see Swonder and Vergara, 2024 for a discussion). Mathematically, the beneficial effects depicted in equation (15) increase with $\eta^h_{1-t}$ and $\epsilon^h_{1-t}$, provided $\Delta T_2 > 0$. The argument goes further when factoring in the potential optimality of baseline taxes. If the corporate tax is highly distortionary in the high-skill industry, the optimal "two-industry-case" corporate tax will be smaller than the optimal "only-low-skill-industry-case" corporate tax because the distortions on the high-skill industry restrict the planner from further increasing the corporate tax to tax the profits of the low-skill industry. The minimum wage, then, helps the planner to relax this constraint, by partially taxing low-skill profits with the minimum wage without affecting the high-skill industry. Then, the minimum wage can work as a industry-specific corporate tax.

### 3.3 Parametric example and numerical illustration

The anaylsis above suffers from three important limitations. First, it ignores structural links between the relevant elasticities, which are all related through the revenue function $\phi$. These structural links may restrict equilibrium relationships in ways that are not evident from the propositions. Second, by treating the reduced-form elasticities as "sufficient statistics," the analysis above is silent on the determinants of the relative distortions of the minimum wage and the corporate tax. Finally, the propositions depend on taxes and WWs which are endogenous when the planner can choose the optimal tax system. Therefore, although the expressions are valid for any tax system, the optimal tax system may also restrict the equilibrium relationships in ways that are not made explicit in the propositions.

To confront these limitations, I numerically study a simple parametric example. This approach allows me to express the elasticities $\eta_w, \epsilon_w, \eta_{1-t}$, and $\epsilon_{1-t}$ as a function of structural primitives. I characterize the optimal tax system under these structural assumptions in the absence of a minimum wage, to then assess whether equations (9), (11), and (12) (augmented by equation (15)) hold in the optimum for different model parametrizations. Appendix B.2 derives the optimality conditions for taxes that are solved numerically. This numerical exercise only illustrates the qualitative mechanics of the model, and therefore, its quantitative predictions should be interpreted with caution.

I consider the two-industry, two-worker case parametrized as follows. The capitalist has access to a Cobb-Douglas revenue function of the form $\phi^s(l,k) = \psi_s \left(l^{1-a_s} k^{a_s}\right)^{b_s}$, where $\psi_s > 0$ is a scalar productivity shifter, $a_s \in (0,1)$ is a measure of capital intensity, and $b_s \in (0,1)$ is a measure of returns to scale, for $s \in \{l, h\}$. In Appendix B.2 I derive the following analytical expressions for the key elasticities:

$$\eta^s_{1-t} = \frac{a_s b_s}{1-b_s}, \qquad \eta^s_w = \frac{1-a_s b_s}{1-b_s}, \qquad \epsilon^s_{1-t} = \frac{a_s b_s}{1-b_s}, \qquad \epsilon^s_w = \frac{(1-a_s)b_s}{1-b_s}. \tag{16}$$

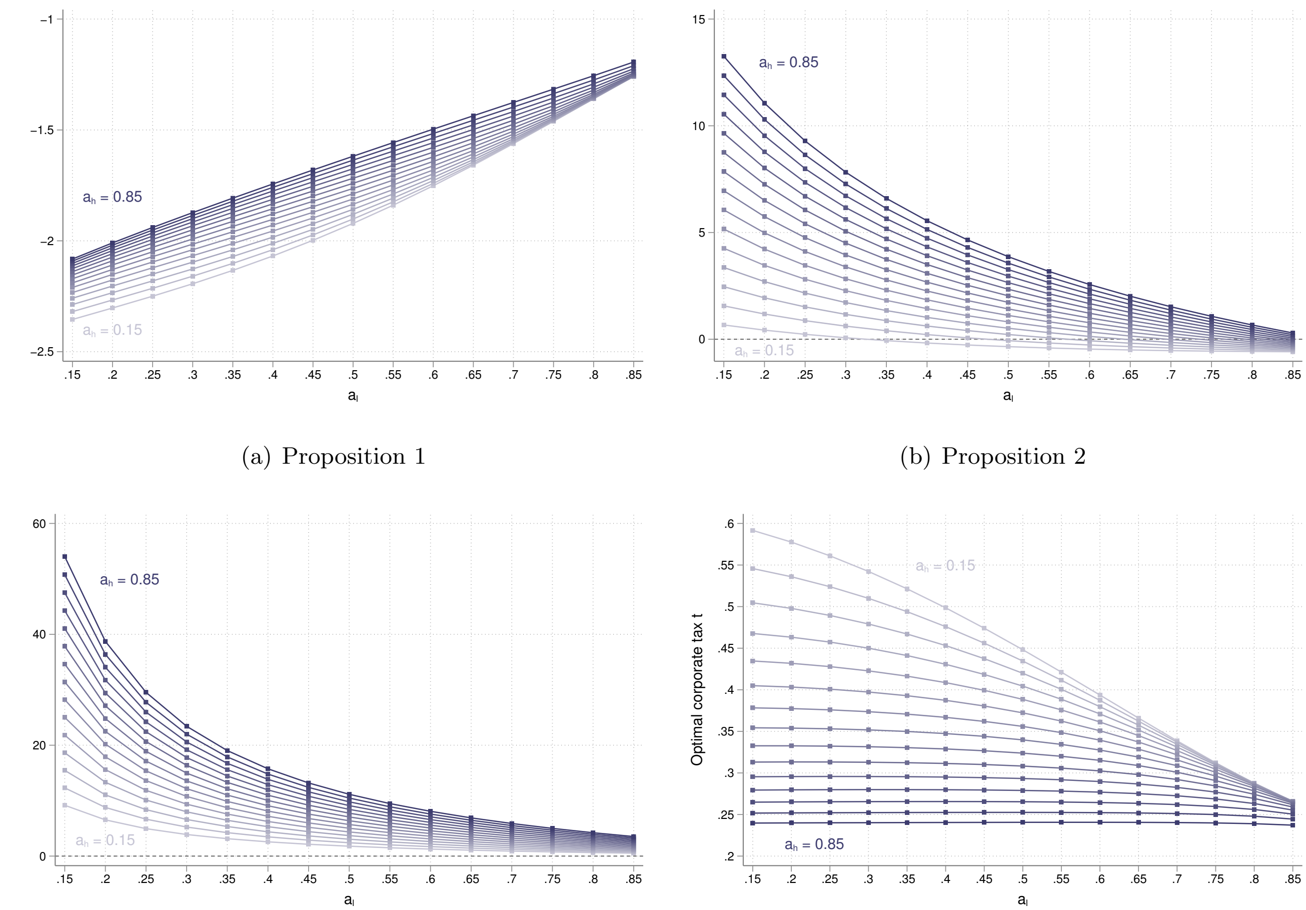
Under this parametrization, the relative distortions between the minimum wage and the corporate tax are mediated by the degree of capital intensity: $(\eta^s_{1-t}, \epsilon^s_{1-t})$ are increasing in $a_s$, while $(\eta^s_w, \epsilon^s_w)$ are decreasing in $a_s$. As discussed above, this prediction is consistent with the recent empirical literature.

Using this structure, I proceed with the following calibration. First, I exogenously set the following parameters and functional forms. Because capital intensity mediates the relative distortions of the policies, the main comparative static of interest concerns $a_s$. Therefore, I solve the model for all combinations $(a_l, a_h) \in \mathcal{A} \times \mathcal{A}$, with $\mathcal{A} = \{0.15, 0.20, ..., 0.80, 0.85\}$. I set $b_l = b_h = 0.79$ following Lamadon et al. (2022). The foreign investment return $r^*_l = r^*_h = r^*$ is set to 4.2%, which comes from applying a global profit net-of-tax rate of 70% (Bachas et al., 2024) to an approximate global pre-tax return of capital of 6% (Piketty and Zucman, 2014).[16] To characterize social preferences, I specify $(\omega_L, \omega_K) = (1,1)$ and $G(.) = \log(.)$. I assume efficient rationing, so $g^M_1 = 0$ in Propositions 1 and 2. This assumption is irrelevant to the assessment of Proposition 3.

The second set of parameters is chosen to match moments under the optimal tax system. I specify the conditional participation cost distribution for a skill level $s$ as $c|s \sim \exp(\lambda_s)$. Then, there are 5 remaining free parameters: $(\lambda_l, \lambda_h, \psi_l, \psi_h, \overline{k})$. For each $(a_l, a_h)$ combination, I calibrate the productivity shifters $(\psi_l, \psi_h)$ to generate equilibrium wages of $(w^l, w^h) = (15, 50)$ under the optimal tax system. The idea is that \$15,000 approximately matches the annual pre-tax earnings of a full-time worker (40 weekly hours) earning the federal hourly minimum wage of \$7.5. The choice of $w^h$ is arbitrary and only meant

[16] This number comes from combining a global capital to global output of 500% and a global capital share of 30%.

Figure 2: Numerical illustration of propositions 1, 2, and 3




(a) Proposition 1

(b) Proposition 2

(c) Proposition 3

(d) Optimal corporate tax, $t^*$

Notes: This figure plots simulations of modified versions of equations (9), (11), and (12) under the calibration scheme described in Section 3.3, properly augmented by the industry-heterogeneity term described in equation (15). Panel (a) concerns Proposition 1. Panel (b) concerns Proposition 2. Panel (c) concerns Proposition 3. In each panel, solutions are computed for different combinations of $(a_l, a_h)$, with $a_l$ varying in the horizontal axis and $a_h$ being represented by different curves, with lighter colors representing smaller values. All simulations are done under the optimal tax system, which is numerically computed using results presented in Appendix B.2. Panel (d) plots the optimal corporate tax rate relevant for each simulation.

to illustrate a high-skill labor market that pays wages far above the minimum wage in equilibrium. Similarly, I choose $(\lambda_l, \lambda_h)$ so the labor supply elasticity equals 0.5 (Chetty et al., 2011) at wages $(15, 50)$ under optimal taxes.[17] Finally, I set the capital stock $\overline{k}_s$ as 1.5 times the optimal domestic capital at the optimum. This parameter is not particularly consequential because it does not affect the first order conditions of the capitalists; it only affects their WWs.

Figure 2 presents the results. Panels (a), (b), and (c) plot the value of modified versions of equations (9), (11), and (12) where all terms are put in the LHS. That is, a positive value in these panels indicates

[17]The labor supply elasticity is given by $f_s(w^s - \Delta T_s)(w^s - \Delta T_s)/F_s(w^s - \Delta T_s)$. Then, $\lambda_s$ solves $\lambda_s \exp(-\lambda_s(w^s - \Delta T_s))(w^s - \Delta T_s)/(1 - \exp(-\lambda_s(w^s - \Delta T_s))) = 0.5$.

that the mathematical condition in the propositions holds. Panel (d) plots the solutions for the optimal corporate tax rate $t^*$ in each case considered. Each point in the plots represents solutions for a particular $(a_l, a_h)$ combination. The x-axis presents the grid of $a_l$, and the different lines represent solutions for different values of $a_h$, from $a_h = 0.15$ (lighter) to $a_h = 0.85$ (darker). The y-axis in Panels (a), (b), and (c) are not comparable since propositions have different normalizations. However, within each panel, the y-axis is a measure of the degree of slack (or lack of) of the condition. In Panel (d), the y-axis measures the optimal tax rate in levels (i.e., taking values between 0 and 1).

Panel (a) of Figure 2 shows that, under this parametrization, it is never desirable to introduce a binding minimum wage when taxes are optimal and not reoptimized to accompany the minimum wage reform. That is, the condition for minimum wage desirability stated in Proposition 1 does not hold in this example when taxes are optimal. Because the distributional tradeoffs are already optimized using the tax system, the hypothetical benefit of the minimum wage is restricted to beneficial fiscal externalities. In this restricted model with little worker heterogeneity, $\Delta T_1^*$ is always positive (there is no EITC policy at the optimum), so both the employment and profit fiscal externalities are negative.[18] Then, the planner does not benefit from mechanically introducing a minimum wage under optimal taxes. Of course, if taxes are suboptimal, Proposition 1 still may hold depending on the underlying tax system.

Panels (b) and (c) of Figure 2 give a different conclusion: re-optimization of the tax system after the introduction of the minimum wage enables the planner to exploit interactions between the policies so that they use the minimum wage to tax profits in the low-skill sector and alleviate corporate tax distortions in the high-skill sector. These panels show that carefully considering interactions between policies may lead to positive gains for the social planner.

Panel (b) of Figure 2 shows the results for Proposition 2. Introducing a minimum wage is desirable unless the affected industry is much more capital-intensive than the unaffected industry ($a_l > a_h$). Intuitively, because sectors' capital intensities differ and corporate tax distortions are increasing in capital intensity, $t^*$ may be *too high* in the capital-intensive sector and *too low* in the labor-intensive sector. When the high-skill sector is relatively more capital intensive, the corporate tax cut that leaves the low-skill capitalist's welfare constant positively affects the high-skill sector by generating a behavioral effect that increases in $a_h$. This behavioral effect attenuates the mechanical loss in corporate tax revenue from introducing a minimum wage, and also generates a positive fiscal externality in high-skill labor income taxes because $\Delta T_2$ is positive and large. Therefore, the aggregate effects of the corporate tax cut are positive. Together with the positive fiscal externality driven by the increase in $T_1$, they make the reform desirable. On the contrary, when the high-skill sector is labor intensive, the corporate tax cut has little effect on its equilibrium, meaning that, if anything, the planner would benefit from increasing the

[18] A standard condition for the EITC to be optimal in models with extensive margin responses is $g_1^l > 1$ (Saez, 2002b; Piketty and Saez, 2013). Since WWs average to one at the optimum in these models, the condition is unlikely to hold with only two skill types unless non-welfarist assumptions on $g_1^l$ are imposed.

corporate tax on the high-skill sector. Because of the higher equilibrium wages, the minimum wage does not contribute to that objective, so the positive effects of the corporate tax cut do not materialize.[19]

The same logic holds and is intensified in Proposition 3 (Panel (c) of Figure 2): in all $(a_l, a_h)$ combinations, the introduction of the minimum wage is desirable, and the net benefit is again increasing in the relative capital intensity of the high-skill sector. Part of the explanation is found in Panel (d) of Figure 2: when the unaffected industry is very capital-intensive, the planner is restricted to implementing relatively low values of $t^*$. In addition to the effect on corporate tax revenue, lower taxes affect the desired levels of profits in terms of optimal redistribution: low-skill profits are inefficiently large, while high-skill profits are inefficiently low. Then, allowing the planner to substitute corporate taxes with a minimum wage allows the planner to optimally affect low-skill profits without distorting the high-skill sector. Unsurprisingly, then, the conditions are relatively more favorable than in Proposition 2: the planner not only has potential benefits in terms of fiscal externalities, but it can also implement more preferred allocations that are infeasible in the absence of a minimum wage.

These simulation results confirm the intuitions developed so far in the formal analysis. When corporate taxes are distortionary, uniform corporate taxes may not optimally redistribute profits in labor-intensive sectors because of their more dramatic consequences for capital-intensive sectors. The minimum wage arises as a useful complement to the optimal tax system when affected industries are particularly labor-intensive. This comparative static is policy relevant in the context of the US economy, where minimum wage sectors are relatively labor-intensive.

# 4 Minimum wage policy in a richer model of the labor market

One shortcoming of the analysis in Section 3 is that it builds from a model that oversimplifies the effects of the minimum wage in the labor market. Empirical studies show that labor market frictions mediate the wage and employment effects of the minimum wage. In addition, firms differ in wages, profits, and exposure to minimum wage policies, and capitalists' entry decisions are likely endogenous.

This section extends the analysis to a richer, non-neoclassical model of the labor market in which firms earn positive profits. This model can accommodate limited employment effects and spillovers to non-minimum wage jobs after minimum wage increases. The decentralized equilibrium of the proposed model remains (constrained) efficient despite the frictions. Hence, the analysis in this section also abstracts from efficiency rationales and maintains the focus on the redistributive properties of the minimum wage.

[19]Two comments follow. First, the positive fiscal externality in terms of low-skill income taxes also decreases with the capital intensity of the low-skill sector since it is proportional to the low-skill employment level. Second, this result shows that the results in Lee and Saez (2012) are presumably overly restrictive since they only allow fiscal externalities regarding EITC savings. In this case, the multiple-sector economy paired with distortionary profit taxes allows for the possibility of revenue gains even if net taxes on low-skill workers are positive, as is the case in this numerical example.

### 4.1 Model of the labor market

As before, the model is static and features two populations: workers and capitalists. Workers now differ on two dimensions: skills and costs of participating in the labor market. For simplicity, I assume workers are either low-skill or high-skill. The representative capitalist is now replaced by a population of capitalists which vary on two dimensions: productivity and technology.

The labor market is no longer perfectly competitive. Labor market interactions are modeled following a directed search approach (Moen, 1997). Capitalists decide whether to create firms based on expected profits. Conditional on creating a firm, they post wages and vacancies, with all vacancies posted at a given wage forming a *sub-market*. Labor markets are segmented, meaning that wages and vacancies are skill-specific. Workers observe wages and vacancies and make their labor market participation and application decisions. In equilibrium, there is a continuum of sub-markets indexed by $m$, characterized by skill-specific wages, $w^s_m$, vacancies, $V^s_m$, and applicants, $L^s_m$, with $s \in \{l, h\}$ indexing skill.

**Matching technology.** There are standard matching frictions in each sub-market. The number of matches within a sub-market is given by the matching function $\mathcal{M}^s(L^s_m, V^s_m)$, with $\mathcal{M}^s$ continuously differentiable, increasing and concave, and possessing constant returns to scale. The matching technology is allowed to be different for low- and high-skill workers.

Under these assumptions, the sub-market skill-specific job-finding rate can be written as:

$$p^s_m = \frac{\mathcal{M}^s(L^s_m, V^s_m)}{L^s_m} = \mathcal{M}^s(1, \theta^s_m) \equiv p^s(\theta^s_m), \tag{17}$$

with $\partial p^s(\theta^s_m)/\partial\theta^s_m \equiv p^s_\theta > 0$, where $\theta^s_m = V^s_m/L^s_m$ is the sub-market skill-specific vacancies to applicants ratio, also denoted as *sub-market tightness*. Intuitively, the higher the ratio of vacancies to applicants, the more likely that an applicant will be matched with one of those vacancies. Likewise, the sub-market skill-specific job-filling rate can be written as:

$$q^s_m = \frac{\mathcal{M}^s(L^s_m, V^s_m)}{V^s_m} = \mathcal{M}^s\left(\frac{1}{\theta^s_m}, 1\right) \equiv q^s(\theta^s_m), \tag{18}$$

with $\partial q^s(\theta^s_m)/\partial\theta^s_m \equiv q^s_\theta < 0$. Intuitively, the lower the ratio of vacancies to applicants, the more likely that the firm will be able to fill the vacancy with a worker. Neither workers nor firms internalize that their behavior affects equilibrium tightness, so they take $p^s_m$ and $q^s_m$ as given when making their decisions.

**Workers.** The population of workers is normalized to 1. Workers' skills are exogenous, and the shares of low- and high-skill workers are given by $\alpha_l$ and $\alpha_h$, respectively, with $\alpha_l + \alpha_h = 1$. As in Section 3, conditional on skill, each worker draws a parameter $c \in \mathcal{C} = [0, C] \subset \mathbb{R}$ that represents the cost of participating in the labor market and is distributed with conditional cdf $F_s$ and pdf $f_s$.

Workers derive (ex-post) utility from the after-tax wage (consumption) net of labor market participation costs. As in Section 3, I focus on extensive margin labor market participation. However, the analysis below differs from that of section 3 in that workers may participate in the labor market but still end up employed or unemployed. The utility of not entering the labor market is $u_0 = y_0 = -T(0)$, where $-T(0) \geq 0$ is a government transfer paid to non-employed individuals, with $T$ the (possibly non-linear) income tax schedule.[20] When entering the labor market, workers apply for jobs. Following Moen (1997), I assume workers can apply to jobs in only one sub-market. Conditional on employment, skill-specific after-tax wages in sub-market $m$ are given by $y^s_m = w^s_m - T(w^s_m)$. Then, the expected utility of entering the labor market for a worker of type $(s, c)$ is given by:

$$u_1(s,c) \quad = \quad \max_m \{p^s_m y^s_m + (1 - p^s_m) y_0\} - c, \tag{19}$$

because workers apply to the sub-market that gives the highest expected after-tax wage, internalizing that the application results in employment with probability $p^s_m$ and unemployment with probability $1 - p^s_m$.

Individuals take the job finding rate $p^s_m$ as given, but it is endogenously determined by aggregate application behavior. This implies that, in equilibrium, all markets yield the same expected utility, i.e., $p^s_{i_1} y^s_{i_1} + (1 - p^s_{i_1}) y_0 = p^s_{i_2} y^s_{i_2} + (1 - p^s_{i_2}) y_0 = \max_m \{p^s_m y^s_m + (1 - p^s_m) y_0\}$, for all pairs $(i_1, i_2)$; otherwise, workers would have incentives to shift their applications toward markets with higher expected values, pushing downward the job-filling probabilities and restoring equilibrium. This means that workers face a tradeoff between wages and employment probabilities: it is more difficult to secure a job in a sub-market that pays higher wages. In what follows, I define $U^s = \max_m \{p^s_m y^s_m + (1 - p^s_m) y_0\}$ so the expected utility of entering the labor market is $u_1(s,c) = U^s - c$. Workers participate in the labor market if $u_1(s,c) \geq u_0 \Leftrightarrow U^s - y_0 \geq c$, which implies that the mass of active workers of skill $s$ is given by $L^s_A = \alpha_s F_s(U^s - y_0)$. The mass of inactive workers is given by $L_I = L^l_I + L^h_I = 1 - L^l_A - L^h_A$. Denote by $L^s_m$ the mass of individuals of skill $s$ applying to jobs in sub-market $m$, so $L^s_A = \int L^s_m dm$. I assume that application decisions conditional on participating in the labor market are independent of $c$.

The expression $U^s = p^s_m y^s_m + (1 - p^s_m) y_0$ implies that $\theta^s_m$ can be written as a function of $w^s_m$ and $U^s$, for all $m$ (Moen, 1997). Formally, $\theta^s_m = \theta^s_m(w^s_m, U^s)$, with $\partial\theta^s_m / \partial w^s_m < 0$ and $\partial\theta^s_m / \partial U^s > 0$.[21] This result simplifies the analysis because it implies that, conditional on wages, equilibrium behavior can be summarized by the scalars $U^s$ without needing to characterize the continuous sequence of $\theta^s_m$.

The fact that $U^s$ is a skill-specific equilibrium object that summarizes complex interactions between wages and applications across sub-markets has an important implication. Although $U^s$ is a function of hard-to-measure endogenous objects, it can be written as a function of easy-to-measure skill-level aggregate moments, which will help below to derive "sufficient statistics" measures of the impacts of

[20]Because the wage distribution is no longer degenerate, the non-linear tax system is now modeled as a function $T(.)$.

[21]Since $U^s = p^s(\theta^s_m)(w^s_m - T(w^s_m)) + (1 - p^s(\theta^s_m)) y_0$, then $dU^s = p^s_\theta d\theta^s_m y^s_m + p^s_m (1 - T'(w^s_m)) dw^s_m$. Recalling that $p^s_\theta > 0$ and asssuming $T'(w^s_m) < 1$ yields the result.

minimum wage increases on workers' welfare. To see why, multiply both sides of $U^s = p^s_m y^s_m + (1 - p^s_m) y_0$ by the sub-market mass of applicants, $L^s_m$, and integrate over $m$. This exercise yields:

$$U^s = \frac{\int E^s_m (w^s_m - T(w^s_m) - y_0) dm}{L^s_A} + y_0 = \frac{\int E^s_m w^s_m dm}{L^s_A} - \frac{\int E^s_m (T(w^s_m) + y_0) dm}{L^s_A} + y_0, \tag{20}$$

where $E^s_m = p^s_m L^s_m$ is the skill-specific employment level in sub-market $m$.

Equation (20) suggests an avenue for empirically measuring the effect of minimum wage changes on the utility benefit of participating in the labor market for workers of skill $s$ without needing to specify the entire structure of the model. The first term represents the average pre-tax wage among active workers: $\int E^s_m w^s_m dm / L^s_A = (1 - \rho^s) \mathbb{E}_m [w^s_m] + \rho^s \cdot 0 = (1 - \rho^s) \mathbb{E}_m [w^s_m]$, with $\rho^s$ the skill-specific unemployment rate, and $\mathbb{E}_m [w^s_m] = \int \nu^s_m w^s_m dm$ the average wage, with $\nu^s_m = E^s_m / \int E^s_m dm$ and $\int \nu^s_m dm = 1$. Note that the regression results displayed in Panel (a) of Figure 1 use exactly this object computed for low-skill workers as the dependent variable. Similarly, the second term represents the average tax liabilities net of transfers among active workers. For low-skill workers, this object can be approximated with the data on income maintenance benefits used as the dependent variable in the regression results displayed in Panel (b) of Figure 1. Both terms include both the employed and the unemployed, so estimations of $dU^s / d\overline{w}$ using equation (20) can comprehensively account for direct and spillover minimum wage effects on participation, wages, and employment. In the public debate, there is an unresolved discussion over the appropriate aggregation of these margins for welfare analysis. By focusing on expected utilities, my proposed framework offers a resolution aggregating labor market effects into a single elasticity.

**Capitalists.** Rather than assuming a fixed (discrete) number of capitalists, I now consider a continuous population normalized to $\mathcal{K}$. Each capitalist draws a parameter $\psi \in \Psi = \left[\underline{\psi}, \overline{\psi}\right] \subset \mathbb{R}^+$ which represents firm productivity. Capitalists also draw a technology $j \in \mathcal{J} = \{1, 2, ..., J\}$, which governs, for example, different firm-level factor shares and returns to scale. Let $o_j$ and $O_j$ be the conditional pdf and cdf of $\psi$ given $j$, respectively. The pmf of $j$ is denoted by $\sigma_j$, with $\sum_{j \in \mathcal{J}} \sigma_j = 1$.

Capitalists observe $(\psi, j)$ and choose whether to create a firm. Firms are price-takers in the output market, with the price of output normalized to 1. Technology (revenue) depends on $\psi$, low- and high-skill workers, $(n^l, n^h)$, and capital, $k$, so a firm of type $(\psi, j)$ that hires $(n^l, n^h)$ workers and employs $k$ capital generates revenue $\phi^j(\psi, n^l, n^h, k)$, with $\phi^j$ twice differentiable, $\phi^j_\psi > 0$, $\phi^j_{n^s} > 0$ and $\phi^j_{n^s n^s} \leq 0$, $\phi^j_k > 0$, and $\phi^j_{kk} < 0$. The cross-derivatives between skills and between labor and capital are left unrestricted.

As in Section 3, capitalists are endowed with a capital stock $\overline{k}$ which they allocate between the domestic firm and a foreign investment opportunity with after-tax return, $r^*$. When setting up a firm, capitalists choose skill-specific wages, $w^s$, and vacancies, $v^s$. While firms take job-filling probabilities as given, they internalize that paying higher wages increases the job-filling probabilities. Using the workers' equilibrium application strategies, I write job-filling probabilities as $\tilde{q}^s(w^s, U^s) = q(\theta^s(w^s, U^s))$, with

$\tilde{q}^s_w = q^s_\theta(\partial\theta^s/\partial w^s) > 0$, so $n^s = \tilde{q}^s(w^s, U^s)v^s$. Posting $v^s$ vacancies has a cost $\eta^s(v^s)$, with $\eta^s_v > 0$ and $\eta^s_{vv} > 0$. Then, the optimization problem of a capitalist that sets up a firm is given by:

$$\max_{w^l, w^h, v^l, v^h, k} \left[(1-t)\pi^j\left(w^l, w^h, v^l, v^h, k; \psi\right)\right] + (\overline{k} - k)r^*, \tag{21}$$

where domestic pre-tax profits for a capitalist of type $(\psi, j)$ are given by revenue net of labor costs:

$$\begin{aligned}\pi^j\left(w^l, w^h, v^l, v^h, k; \psi\right) \quad &= \quad \phi^j\left(\psi, \tilde{q}^l(w^l, U^l)v^l, \tilde{q}^h(w^h, U^h)v^h, k\right) \\ &\quad - \left(w^l\tilde{q}^l(w^l, U^l)v^l + \eta^l(v^l)\right) - \left(w^h\tilde{q}^h(w^h, U^h)v^h + \eta^h(v^h)\right). \end{aligned}\tag{22}$$

Optimized domestic pre-tax profits are given by $\Pi^j(\psi, 1-t) = \max_{w^l, w^h, v^l, v^h} \pi^j\left(w^l, w^h, v^l, v^h, k; \psi\right)$. To establish firms, capitalists pay a fixed cost, $\xi$. When inactive, capitalists receive a lump-sum transfer, $t_0$, and reallocate the optimal capital, $k^j(\psi, 1-t)$, to the foreign investment. Therefore, capitalists of type $(\psi, j)$ create firms when $(1-t)\Pi^j(\psi, 1-t) \geq \xi + t_0 + r^*k^j(\psi, 1-t)$. Since, conditional on $j$, the value function of equation (21) is increasing in $\psi$, the entry rule defines a $j$-specific productivity threshold, $\psi^*_j$, implicitly determined by $(1-t)\Pi^j(\psi^*_j, 1-t) = \xi + t_0 + r^*k^j(\psi^*_j, 1-t)$ such that $j$-type capitalists create firms only if $\psi \geq \psi^*_j$. Consequently, the mass of active capitalists is given by $K_A = \mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j\left(1 - O_j(\psi^*_j)\right)$, and the mass of inactive capitalists is given by $K_I = \mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j O_j(\psi^*_j)$, with $K_A + K_I = \mathcal{K}$.

The corresponding value function for active capitalists is given by:

$$U^{Kj}(\psi, 1-t) = (1-t)\Pi^j(\psi, 1-t) + (\overline{k} - k^j(\psi, 1-t))r^* - \xi. \tag{23}$$

The envelope theorem implies that:

$$\frac{\partial U^{Kj}}{\partial(1-t)} = \Pi^j(\psi, 1-t) + (1-t)\left(\frac{\partial\pi^{j*}}{\partial U^l}\frac{\partial U^l}{\partial(1-t)} + \frac{\partial\pi^{j*}}{\partial U^h}\frac{\partial U^h}{\partial(1-t)}\right), \tag{24}$$

where $\partial\pi^{j*}/\partial U^s$ is defined as the partial derivative of equation (22) with respect to $U^s$ (ignoring effects through endogenous variables) evaluated at the optimal decisions. In this case, the welfare effect is not only the mechanical effect because of potential general equilibrium effects that affect job-filling probabilities. For inactive capitalists, $U^{Kj}(\psi, 1-t) = \overline{k}r^* + t_0$, so $\partial U^{Kj}/\partial(1-t) = 0$. Envelope conditions regarding the minimum wage are discussed below.

Conditional on $(\psi, j)$, firms are homogeneous. The solution to the firm's problem can therefore be characterized by functions $w^{sj}(\psi, 1-t)$, $v^{sj}(\psi, 1-t)$, and $k^j(\psi, 1-t)$. Appendix B.3 derives first-order conditions and shows that firm heterogeneity leads to dispersion in wages conditional on skill, with wages *marked down* relative to the marginal productivities. Given $t$, $m$ indexes sub-markets as well as the $(\psi, j)$ values of capitalists that create firms, so $w^s_m = w^{s\widetilde{j}}\left(\widetilde{\psi}, 1-t\right)$, $v^s_m = v^{s\widetilde{j}}\left(\widetilde{\psi}, 1-t\right)$, and

$V_m^s = \mathcal{K} v^{s\widetilde{j}} \left(\widetilde{\psi}, 1-t\right) \sigma_{\widetilde{j}} o_{\widetilde{j}} \left(\widetilde{\psi}\right)$, for some $\left(\widetilde{\psi}, \widetilde{j}\right) \in \left\{(\psi, j) \in \Psi \times \mathcal{J} : \psi \geq \psi_j^*\right\}$.[22]

**Equilibrium.** I formally characterize the labor market equilibrium in Appendix B.3. The equilibrium objects are $U^l$, $U^h$, $\left\{\psi_j^*\right\}_{j=1}^J$, the sub-market skill-specific wages, vacancies, and applicants, $(w_m^s, v_m^s, L_m^s)$, for all $m$ and $s$, and the sequence of capital allocations, $k^j(\psi)$, for all $(\psi, j)$ combinations. The equilibrium objects simultaneously solve (1) worker- and firm-level participation constraints, (2) firms' first order conditions regarding wages, vacancies, and capital, and (3) the across sub-market equilibrium condition that determines the distribution of workers' applications.

**Discussion.** Before introducing a minimum wage, I highlight some properties of the model.

- *Directed search:* Directed search models tend to generate efficient outcomes in terms of search and posting behavior (Moen, 1997; Wright et al., 2021). That is, these models do not exhibit inefficient mixes of applicants and vacancies which can arise in random search models (e.g., Hosios, 1990). In Appendix B.3, I show that the model proposed above maintains this efficiency property. Similar to the analysis in Section 3, this result implies that the policy analysis below focuses on distributional rationales by shutting down Pigouvian motives for policy.[23]

- *Monopsony power:* While search and posting behavior is efficient, the model admits monopsony power through wage-dependent job-filling probabilities that have a similar spirit to the standard monopsony intuition of upward-slopping firm-specific labor supply curves (Robinson, 1933; Card et al., 2018). Firms internalize that paying higher wages leads to more applicants, so wages are *marked down* relative to marginal productivity. Appendix B.3 shows that the standard markdown equation can be derived from the firm's first-order conditions. Firm-specific labor supply elasticities are endogenous and finite because of matching frictions and convex vacancy creation costs.

- *Rationing:* Since workers care about expected utility, I do not need to impose any particular rationing assumption. Allocation of applicants to jobs is assumed to be independent of $c$ (conditional on participation), which, if anything, resembles a uniform rationing assumption. Intuitively, rationing assumptions are second-order for the welfare analysis below because the social planner maximizes the sum of expected utilities, which are ex-ante equal for all workers within a skill type who decide to participate in the labor market, regardless of the final employment status.

- *Low-wage labor markets:* The model's equilibrium is consistent with certain stylized facts about low-wage labor markets. The model features wage dispersion for similar workers (Card et al., 2018;

[22]There could be more than one $(\psi, j)$ pair yielding the same $w_m^s$. In those cases, firms' FOCs imply that they will also post the same vacancies since the functions $q^s$ and $\eta^s$ do not vary with $j$ (see Appendix B.3). For those cases, define $\mathcal{I}(s,m) \subset \left\{(\psi, j) \in \Psi \times \mathcal{J} : \psi \geq \psi_j^*\right\}$ as the set of combinations that optimally post the same wage $w$ for workers of skill $s$, $w_m^s$. Let $\iota$ index elements in $\mathcal{I}(s,m)$. Then, $V_m^s = \mathcal{K} \sum_{\iota \in \mathcal{I}(s,m)} v^{s\widetilde{j}_\iota} \left(\widetilde{\psi}_\iota, 1-t\right) \sigma_{\widetilde{j}_\iota} o_{\widetilde{j}_\iota} \left(\widetilde{\psi}_\iota\right)$.

[23]This logic is also present in Hungerbühler et al. (2006) who explore optimal redistributive labor income taxation in a random search model that imposes the Hossios condition.

Kline, 2024); wage posting rather than bargaining, which has been found to be more prevalent in low-wage jobs (Hall and Krueger, 2012; Caldwell and Harmon, 2019; Lachowska et al., 2022); and can rationalize bunching in the wage distribution at the minimum wage (Cengiz et al., 2019).

**Introducing a minimum wage.** I now introduce a minimum wage, $\overline{w}$, to explore how the model predictions relate to those in the literature. Details on derivations can be found in Appendix B.3.

Assume $\overline{w}$ binds for low-skill workers in the lowest-wage sub-market. An increase in $\overline{w}$ makes minimum wage jobs more attractive, thus attracting new applicants and pushing the sub-market tightness downwards until the across sub-market equilibrium is restored. The decrease in tightness depresses the job-finding probability. Therefore, the overall effect of introducing a minimum wage on expected utility, $dU^l/d\overline{w}$, is ambiguous, depending on whether wage or employment effects dominate. Because expected utility is equal across sub-markets, introducing a minimum wage affects not only the minimum wage sub-market, but also low-skill sub-markets that pay more than the minimum wage. Two forces mediate these spillover effects. First, the change in applicant flows between sub-markets affects employment probabilities in all sub-markets. Second, as discussed below, firms can also respond to changes in applicants by posting different wages and vacancies.[24] Regarding high-skill sub-markets, the model allows for spillovers across worker skill levels, which are mediated by the production function. These spillovers arise because demand for high-skill workers may be contingent on low-skill workers, depending on the structure of $\phi^j$.

As for capitalists, firms for which the minimum wage binds optimize low-skill vacancies, high-skill wages and vacancies, and capital, taking low-skill wages as given. The effect of the minimum wage on low-skill vacancy posting is ambiguous. On one hand, an increase in the minimum wage raises labor costs, decreasing the expected value of posting a vacancy. However, the increase in applicants increases the job-filling probabilities. This effect raises the value of posting a vacancy and helps to attenuate potential disemployment effects. Firms for which the minimum wage does not bind also react by adapting their posted wages and vacancies to changes in their sub-market tightness. The wage spillover has an ambiguous sign but directly depends on the endogenous change in sub-market tightness described above. Wages and vacancies are correlated at the firm and skill level, so when firms change wages, they also change posted vacancies. Then, employment spillovers are also possible in this model.

Minimum wage changes also affect profits. Firms for which the minimum wage binds face a reduction in profits due to mechanical effects and the corresponding reoptimization of the capital allocation problem. Importantly, the general equilibrium effects on applications affect job-filling probabilities, which in turn affects equilibrium profits. This latter effect also affects firms that are not constrained by the minimum wage. The reduction in profits for minimum wage firms leads marginal firms to exit the market. Finally,

[24]Changes in $U^l$ can also affect labor market participation. Recall that $L_A^l = \alpha_l F_l(U^l - y_0)$, so $dL_A^l/d\overline{w} = \alpha_l f_l(U^l - y_0)\left(dU^l/d\overline{w}\right)$. Then, if $dU^l/d\overline{w} > 0$, minimum wage hikes increase labor market participation. The behavioral response, however, is scaled by $f_l(U^l)$, which may be negligible. This may result in important positive impacts on expected utilities for inframarginal workers with modest participation effects at the aggregate level.

the welfare effect on capitalists and the corresponding envelope conditions are less direct than in the model of Section 3 given that wages are choice variables and profits are affected by the general equilibrium effects on job-filling probabilities. The welfare effect is smaller than the profit elasticity because reallocation of domestic capital to the foreign investment attenuates the utility cost driven by smaller domestic profits.

These predictions align with recent evidence on the effects of the minimum wage (Dube and Lindner, 2024). Minimum wage hikes generate positive wage effects with "elusive" disemployment effects (Manning, 2021a). The effect may extend to non-minimum wage jobs, both within and between firms (Cengiz et al., 2019; Dustmann et al., 2022; Engbom and Moser, 2022; Giupponi and Machin, 2024; Vogel, 2025). Finally, Draca et al. (2011), Harasztosi and Lindner (2019), and Drucker et al. (2021) document negative effects on profits. In the model, the main mediator of these responses is the endogenous response of workers' applications to minimum wage changes (and, more generally, to wage differentials across jobs), which attenuate employment responses, generate spillovers to non-minimum wage jobs, and affect profits. Evidence in Holzer et al. (1991) and Escudero et al. (2025) suggest this is an empirically-relevant channel.

### 4.2 Planner's problem and incentive compatibility constraints

I assume that the planner does not observe $(c, \psi, j)$. Following other optimal tax analyses with matching frictions (Hungerbühler et al., 2006; Kroft et al., 2020; Lavecchia, 2020), I assume the planner maximizes a (generalized) utilitarian SWF based on expected utilities:

$$\begin{aligned} SWF &= \left(L_I^l + L_I^h\right)\omega_L G(y_0) + K_I \omega_K G(t_0 + \overline{k}r^*) + \alpha_l \int_0^{U^l - y_0} \omega_L G(U^l - c) dF_l(c) \\ &\quad + \alpha_h \int_0^{U^h - y_0} \omega_L G(U^h - c) dF_h(c) + \mathcal{K} \sum_{j \in \mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} \omega_K G\left(U^{Kj}(\psi, 1-t)\right) dO_j(\psi), \qquad (25) \end{aligned}$$

where $(\overline{w}, T, t_0, t)$ are the policy parameters and $G$ and $(\omega_L, \omega_K)$ are defined as in Section 3. The first two terms of equation (25) represent the utility of inactive workers and capitalists, respectively. The third and fourth terms of equation (25) represent the expected utility of active low- and high-skill workers, respectively. Finally, the last term represents the utility of active capitalists.[25]

The planner maximizes the SWF subject to incentive compatibility constraints and a government budget constraint. Participation constraints are included in the limits of integration because the planner internalizes that the policy parameters affect $U^l$, $U^h$, and $\psi_j^*$ which, in turn, mediate extensive margin responses. Additionally, due to the across sub-market equilibrium condition, the planner internalizes that $U^s$ must be equivalent to equation (20), which disciplines the intensive margin decisions of firms.[26] The

[25] Appendix B.3 provides further intuition by relating equation (25) with the average welfare by group.

[26] This incentive compatibility restriction disciplines wage-setting behavior since it endogenously determines equilibrium job-filling probabilities, restricting the profit maximization problem. Therefore, it plays the role of an analog wage-setting constraint required in random search models (see, for example, equation (16) in Hungerbühler et al., 2006).

planner also internalizes that, for active capitalists, $U^{Kj}(\psi, 1-t)$ is given by equation (23). Finally, the natural extension of the budget constraint defined in equation (7) is given by:

$$\begin{aligned}\left(L_I^l + L_I^h + \rho^l L_A^l + \rho^h L_A^h\right) y_0 + K_I t_0 &= \int \left(E_m^l T(w_m^l) + E_m^h T(w_m^h)\right) dm \\ &\quad + t\mathcal{K} \sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} \Pi^j(\psi, 1-t) dO_j(\psi), \qquad (26)\end{aligned}$$

where $E_m^s = p_m^s L_m^s$ is the mass of employed workers of skill $s$ in sub-market $m$ and $\rho^s$ is the skill-specific unemployment rate. Equation (26) establishes that the transfer paid to individuals with no market income must be funded by the tax collection on employed workers and active capitalists. As in Section 3, if $\gamma$ is the budget constraint multiplier, the WWs of inactive workers, inactive capitalists, active workers of skill type $s$, and active capitalists of type $(\psi, j)$ are defined as $g_0 = \omega_L G'(y_0)/\gamma$, $g_0^K = \omega_K G'(t_0 + \overline{k}r^*)/\gamma$, $g_1^s = \alpha_s \omega_L \int_0^{U^s - y_0} G'(U^s - c) dF_s(c)/\gamma L_A^s$, and $g_\psi^j = \omega_K G'(U^{Kj}(\psi, 1-t))/\gamma$, respectively.

### 4.3 Is the minimum wage desirable?

I now assess the desirability of the minimum wage using the richer model of the labor market described above. The generality of the model, the degree of worker- and firm-level heterogeneity, and the multiple general equilibrium effects that follow a minimum wage increase, prevent me from deriving closed-form results for the planner's solution. Moreover, the perturbation strategy used to derive Propositions 2 and 3 is infeasible in this setting.[27] To overcome this challenge, I derive an analog of Proposition 1 from first principles to describe the overall effects of a minimum wage introduction. This result highlights the additional behavioral and welfare margins that emerge in the extended framework. Furthermore, in the next section, I quantitatively implement a "sufficient statistics" version of the proposition to empirically evaluate whether a minimum wage increase today would be welfare-improving.

The following proposition provides a high-level characterization of the desirability of the minimum wage introduction given a tax system. The result is a function of the following elasticity concepts:

$$\mathcal{E}_E^{s,m} = \frac{d\log E_m^s}{d\log \overline{w}}, \quad \mathcal{E}_W^{s,m} = \frac{d\log w_m^s}{d\log \overline{w}}, \quad \mathcal{E}_L^s = \frac{d\log L_A^s}{d\log \overline{w}}, \qquad (27)$$

$$\mathcal{P}_\Pi^{\psi,j} = \frac{d\log \Pi^j(\psi, 1-t)}{d\log \overline{w}}, \quad \mathcal{P}_k^{\psi,j} = \frac{d\log k^j(\psi, 1-t)}{d\log \overline{w}}, \quad \mathcal{P}_{K_A}^{\psi,j} = \frac{d\log K_A^j}{d\log \overline{w}}. \qquad (28)$$

Elasticities in equation (27) –denoted by $\mathcal{E}$– mediate welfare effects and fiscal externalities related to

[27] To see why, suppose the planner implements a minimum wage increase and an equally-sized increase in the tax for minimum wage workers so their after-tax utility is constant. Propositions 2 and 3 pair this reform with a corporate tax cut that either leaves the capitalist's utility or the minimum wage employment level constant. That corporate tax cut is not defined in this setting because it affects not only the directly exposed capitalists but also the capitalists that pay more than the minimum wage, and given the across sub-market equilibrium condition, that effect feedbacks into the minimum wage sub-market, thus affecting its employment probabilities, and the corresponding utilities of workers and capitalists.

workers' outcomes: employment, wages, and participation. Elasticities in equation (28) –denoted by $\mathcal{P}$– mediate welfare effects and fiscal externalities related to capitalists' outcomes: profits, capital, and number of firms, where $K_A^j$ is the number of active firms with technology $j$, with $\sum_j K_A^j = K_A$. All of these are *macro* elasticities, meaning that they incorporate all general equilibrium effects.[28]

**Proposition 4.** *Consider an allocation with (potentially optimal) taxes and no minimum wage. Introducing a binding minimum wage is desirable if:*

$$
\begin{aligned}
&\textbf{(Wl)} && L_A^l g_1^l \int \frac{E_m^l}{L_A^l}\left(\left(\mathcal{E}_E^{l,m} - \mathcal{E}_L^{l,m}\right)\left(w_m^l - T\left(w_m^l\right) - y_0\right) + w_m^l \mathcal{E}_W^{l,m}\left(1 - T'\left(w_m^l\right)\right)\right) dm \\
&\textbf{(Wh)} && +L_A^h g_1^h \int \frac{E_m^h}{L_A^h}\left(\left(\mathcal{E}_E^{h,m} - \mathcal{E}_L^{h,m}\right)\left(w_m^h - T\left(w_m^h\right) - y_0\right) + w_m^h \mathcal{E}_W^{h,m}\left(1 - T'\left(w_m^h\right)\right)\right) dm \\
&\textbf{(Wk)} && +\mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} g_\psi^j \left((1-t)\Pi^j(\psi, 1-t)\mathcal{P}_\Pi^{\psi,j} - r^* k^j(\psi, 1-t)\mathcal{P}_k^{\psi,j}\right) dO_j(\psi) \\
&\textbf{(Fl)} && +\int \left(E_m^l \mathcal{E}_E^{l,m}\left(T\left(w_m^l\right) + y_0\right) + E_m^l T'\left(w_m^l\right) w_m^l \mathcal{E}_W^{l,m}\right) dm \\
&\textbf{(Fh)} && +\int \left(E_m^h \mathcal{E}_E^{h,m}\left(T\left(w_m^h\right) + y_0\right) + E_m^h T'\left(w_m^h\right) w_m^h \mathcal{E}_W^{h,m}\right) dm \\
&\textbf{(Fk)} && +t\mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} \Pi^j(\psi, 1-t)\mathcal{P}_\Pi^{\psi,j} dO_j(\psi) + \sum_j K_A^j \mathcal{P}_{K_A}^{\psi,j}\left(t\Pi^j(\psi_j^*, 1-t) + t_0\right) > 0 \qquad (29)
\end{aligned}
$$

To highlight the tradeoffs in the planner's problem, terms in equation (29) are grouped between welfare effects and the corresponding fiscal externalities, separately for workers and capitalists.

- *Welfare effects on active workers*: The first line of equation (29) –denoted by **Wl**– summarizes the welfare effects on active low-skill workers, which are mediated by two effects. First, the minimum wage affects the employment probabilities in each sub-market. This effect is governed by $\mathcal{E}_E^{l,m} - \mathcal{E}_L^{l,m}$ because the size of employment relative to labor market participants determines the ex-ante likelihood of securing a job conditional on applying. Second, the minimum wage affects the wage distribution, and, therefore, affects the after-tax payoff of being employed. This effect is governed by $\mathcal{E}_W^{l,m}$. Two comments are in order here. First, the expected utility of labor market participation depends on the complete distribution of effects across sub-markets. Therefore, wage and employment spillovers affect the welfare effect. Second, the minimum wage incentivizes marginal participants to either enter or exit the labor market (depending on the net change in expected utility), but those switches do not have first-order welfare impacts. An envelope logic follows from the fact that marginal participants are initially indifferent between states and, therefore, their welfare is not affected by any potential transition. The second line of equation (29)–denoted by **Wh**–

[28]This distinction between *micro* and *macro* elasticities resembles discussions in related literature, where micro elasticities hold certain aspects of the allocation fixed (in this case, capital), while macro elasticities consider all equilibrium effects (see, for example, Scheuer and Werning, 2017; Landais et al., 2018b,a; Kroft et al., 2020; Lavecchia, 2020).

summarizes the welfare effects on active high-skill workers. The interpretation is analog to line **Wl**.

- *Welfare effects on capitalists*: The third line of equation (29)–denoted by **Wk**– summarizes welfare effects on capitalists, which are governed by $\mathcal{P}_{\Pi}^{\psi,j}$ and $\mathcal{P}_{k}^{\psi,j}$. Capitalists are worse off because introducing a minimum wage reduces their profits. The welfare effect, however, is attenuated by the extra return obtained from the capital that is reallocated abroad. Marginal capitalists may become inactive as a consequence of the minimum wage increase, but an envelope argument implies that marginal firm closures do not have first-order welfare effects because marginal firm-owners are initially indifferent between states.

- *Fiscal externalities of workers*: The fourth line of equation (29)–denoted by **Fl**– summarizes the fiscal externalities of low-skill workers. Changes in wages and employment affect net tax liabilities at each earnings level depending on the structure of the tax system. The fifth line of equation (29)–denoted by **Fh**– summarizes the fiscal externalities for high-skill workers, which has an analog interpretation to line **Fl**. One subtle detail in these expressions is that participation responses do not directly affect the planners' budget because the planner pays transfers to individuals without any market income regardless of whether they are inactive or active but unemployed. In fact, lines **Wl** and **Wh** can be combined with lines **Fl** and **Fh** to form the standard expressions "$dM + dW = (1 - g)dM$" (Saez, 2001) except for the terms reflecting the participation elasticities that inframarginally affect the utility of active workers. This difference arises because workers care about employment probabilities while the planner cares about employment levels.

- *Fiscal externalities of capitalists*: Finally, the sixth line of equation (29)–denoted by **Fk**– summarizes the fiscal externalities for capitalists. The first term is the behavioral effect on corporate tax revenue. The second term measures fiscal externalities driven by firm exits, governed by $\mathcal{P}_{K_A}^{\psi,j}$. While the exit of marginal firm-owners does not generate welfare effects, exits may generate fiscal externalities because these capitalists transition from paying taxes to receiving transfers.

Proposition 4 makes four important contributions relative to the analysis of Section 3. First, it formalizes the role of endogenous participation. Second, by incorporating worker skill heterogeneity, it makes explicit that the minimum wage may affect not only the distribution between workers and capitalists but also the utility distribution between low- and high-skill workers. Third, equation (29) weights labor market effects that occur across the entire distribution of earnings. Therefore, this result incorporates employment and wage spillovers when assessing the desirability of the minimum wage. Fourth, by featuring heterogeneous capitalists, the model highlights the importance of characterizing the full distribution of profits responses. Profit incidence is likely to be heterogeneous across firms with different wage levels and technologies. Because WWs vary by capitalist type, the correlation between profit elasticities and WWs matters for aggregating welfare effects. The welfare cost on capitalists is less relevant for the planner whenever profit responses are concentrated in capitalists with low WWs. Likewise, the fiscal externality is larger when firms with larger profits are the ones with larger responses. This result suggests that empirical evidence on the heterogeneous impacts of minimum wages on firm profits is an important avenue of future research (e.g., Drucker et al., 2021; Rao and Risch, 2024).

Note that the main intuition about the relationship between the minimum wage and the corporate tax developed in the previous section remains valid. The minimum wage is more likely to be desirable when the corporate tax is low because, in this case, the welfare gains of redistributing profits are relatively high and the negative fiscal externalities on corporate tax revenue are relatively low.

# 5 Sufficient statistics analysis

Proposition 4 specifies a condition for the desirability of a minimum wage increase given a tax system. The expression in equation (29), however, depends on multiple reduced-form objects that are specific to particular sub-markets and may be difficult to estimate. In this section, I show how Proposition 4 can be quantified using easy-to-estimate elasticities aggregated at the worker-skill level. I illustrate this feature by using the reduced-form estimates of Section 2 to parametrize equation (29) and assess whether increasing the minimum wage in the US today is socially desirable. The exercise follows a "sufficient statistics" logic valid under the current tax system, in the spirit of Chetty (2009) and Kleven (2021).

My approach leverages the skill-specific worker welfare expressions $U^s$ implied by the structural model. The welfare effects of increasing the minimum wage on workers specified in Proposition 4 –$\mathbf{Wl}$ and $\mathbf{Wh}$ in equation (29)– come from first differentiating the objects $U^s$ of the SWF with respect to the minimum wage, then using the model's structure and equilibrium to express results in terms of macro elasticities discussed above. However, in the previous section, I showed that the expected utility of workers $U^s$ can also be written in terms of aggregate skill-level moments that are easy to estimate. Specifically, equation (20) shows that $dU^s/d\overline{w}$ can be recovered from the reduced-form estimates presented in Section 2 to directly measure changes in worker welfare from increases in the minimum wage without needing to identify objects at the sub-market level. Together with empirical counterparts of the capitalist welfare terms and the different fiscal externalities, this exercise can show whether the conditions for the desirability of minimum wage increases given in Proposition 4 are met in the data.

I illustrate this feature of the model using the reduced-form results of Section 2 and Appendix A to assess whether increasing the minimum wage in the US today would improve welfare. The effects of state-level minimum wage reforms on the average low-skill workers' earnings including the unemployed (Panel (a) of Figure 1) correspond to estimates of the pre-tax component of $dU^l/d\overline{w}$, specified by the first term in equation (20). Likewise, the effects of minimum wage reforms on income maintenance benefits (Panel (b) of Figure 1) can proxy for the corresponding low-skill worker fiscal externalities, whose welfare impacts correspond to the second term in equation (20). Similarly, the documented effects on profits per establishment (Panel (c) of Figure 1) can be used to proxy the theoretical profit effects of a minimum wage increase $d\Pi^j(\psi, 1-t)/d\overline{w}$ for exposed industries, which Proposition 4 shows are relevant for computing welfare effects and fiscal externalities. Finally, the lack of detectable effects on high-skill workers' outcomes, profits of non-exposed industries, and the number of establishments –documented in Section 2 and Appendix A– suggests that we may abstract from the welfare and fiscal externality effects on high-skill workers –lines **Wh** and **Fh** in equation (29)– and the extensive-margin capitalist fiscal externality –second term in line **Fk** in equation (29).

Formally, let $U^l$ be decomposed between a pre-tax component and a tax liability component following equation (20), $U^l = U^l_{\text{pre}} + U^l_{\text{post}}$, where $U^l_{\text{pre}}$ is the (annualized) average pre-tax wage of low-skill workers including the unemployed and $U^l_{\text{post}}$ are the total income maintenance benefits received by low-skill workers. Similarly, let $\Pi^{\text{exp}}$ be the pre-tax profits in exposed industries with a corresponding WW of $g_K^{\text{exp}}$. Because I lack estimates for capital responses, I assume that the capital supply effects of the minimum wage $\mathcal{P}_k^{\psi,j}$ are zero in exposed industries. This assumption is conservative because, holding profit elasticities constant, capital reallocation attenuates the welfare costs of minimum wage changes for capitalists. Moreover, the assumption may be justified in that exposed industries have lower rates of capital mobility by virtue of their labor intensity.

From Table 2, I can recover the semi-elasticities $\epsilon_{U_{\text{pre}}} = d\log U^l_{\text{pre}}/d\overline{w} = 0.015$ (Column (3) of Panel (a)), $\epsilon_{U_{\text{post}}} = d\log U^l_{\text{post}} = 0.05$ (Column (9) of Panel (a)), and $\epsilon_{\Pi^{\text{exp}}} = d\log \Pi^{\text{exp}}/d\overline{w} = -0.063$ (Column (3) of Panel (b)). Under these restrictions, Proposition 4 can be written as:

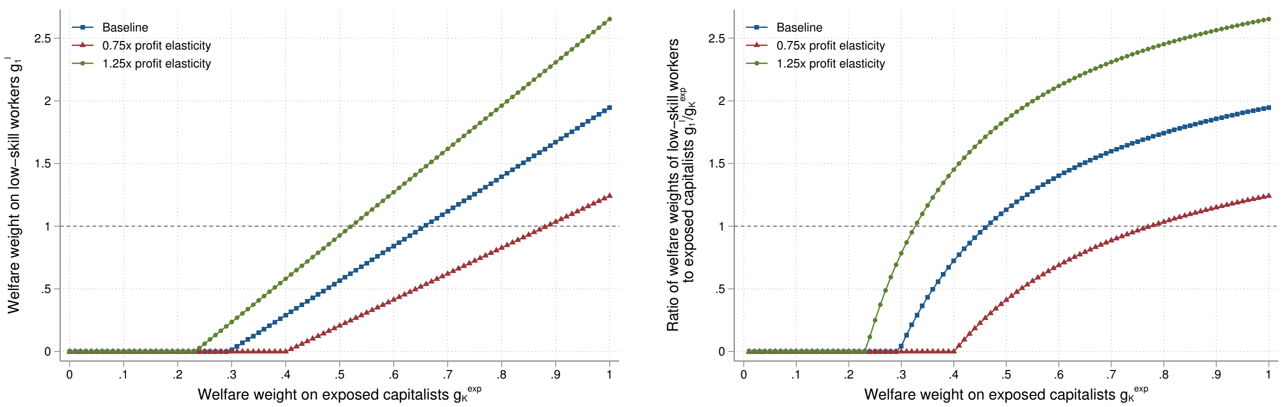
$$\underbrace{L^l_A \cdot (0.015 \cdot U^l_{\text{pre}} - 0.05 \cdot U_{\text{post}})^l \cdot g^l_1 - K^{\text{exp}} \cdot 0.063 \cdot (1-t) \cdot \Pi^{\text{exp}} \cdot g_K^{\text{exp}}}_{\text{Welfare effects} \approx \mathbf{Wl} + \mathbf{Wk}} + \underbrace{L^l_A \cdot 0.05 \cdot U^l_{\text{post}} - K^{\text{exp}} \cdot t \cdot 0.063 \cdot \Pi^{\text{exp}}}_{\text{Fiscal externalities} \approx \mathbf{Fl+Fk}} > 0, \tag{30}$$

where $K^{\text{exp}}$ is the number of exposed capitalists. Equation (30) says that the minimum wage increase has two welfare effects: a positive effect on low-skill workers from the increase in aggregate post-tax incomes and a negative effect on capitalists from the aggregate decrease in post-tax profits. It also has two fiscal externalities: a fiscal gain from lower transfers and a fiscal cost from lower corporate tax revenue.

Equation (30) can be calibrated as follows. First, aggregates $(L^l_A \cdot U^l_{\text{pre}}, L^l_A \cdot U^l_{\text{post}}, K^{\text{exp}} \cdot \Pi^{\text{exp}})$ are observed in the data. I consider population-weighted averages across states for the year 2019.[29] Second, I set $t = 21\%$ (the current statutory rate in the US). Finally, relative WWs are characterized using an inverse-optimum logic (Bourguignon and Spadaro, 2012; Hendren, 2020). For a given value of $g_K^{\text{exp}}$, I

[29] $L^l_A \cdot U^l_{\text{pre}}$ comes from multiplying the annualized average pre-tax sufficient statistic by the working-age population and the share of low-skill workers. $L^l_A \cdot U^l_{\text{post}}$ and $K^{\text{exp}} \cdot \Pi^{\text{exp}}$ are observed directly in the raw data.

Figure 3: Sufficient statistics analysis: Minimum welfare weights that justify the minimum wage increase




(a) Minimum welfare weight on low-skill workers

(b) Minimum ratio of welfare weights of low-skill workers to exposed capitalists

Notes: These figures plot the results of the sufficient statistics calibration exercise. Panel (a) plots the minimum welfare weight on low-skill workers $g_l^1$ to justify the minimum wage increase as a function of the welfare weight on exposed capitalists $g_K^{\text{exp}}$, while Panel (b) displays results in terms of the welfare weight ratio $g_1^l/g_k^{\text{exp}}$. In each panel, the blue curve represents computations using the baseline profit elasticity, while the red curve presents computations using a smaller value (75% of the baseline estimate) and the green curve presents computations using a larger value (125% of the baseline estimate).

compute the minimum WW on low-skill workers that would justify increasing the minimum wage (i.e., the value of $g_1^l$ such that equation (30) holds with equality). I compute this critical value for a fine grid for $g_K^{\text{exp}} \in [0, 1]$ to assess the sensitivity of the analysis to this parameter.

Figure 3 shows the results. Panel (a) plots the critical WW on active low-skilled workers $g_1^l$ as a function of the WW on exposed capitalists $g_K^{\text{exp}}$, while Panel (b) reports the results in terms of the critical ratio of these two quantities $g_1^l/g_K^{\text{exp}}$. In each panel, the blue curve uses the baseline estimate for the effect of minimum wages on profits. When $g_K^{\text{exp}} < 0.3$, any positive WW on active low-skill workers makes a minimum wage increase desirable. When $g_K^{\text{exp}} \geq 0.3$, the model restricts social preferences to justify the policy. The critical WW on low-skill workers $g_1^l$ increases linearly with the WW on capitalists $g_K^{\text{exp}}$. If active low-skill workers are valued as the average agent in the economy, i.e., $g_1^l = 1$, then the WW on capitalists $g_K^{\text{exp}}$ must be at most 0.65 to justify a minimum wage increase. Otherwise, welfare costs from profit reductions combined with the negative fiscal externality make the minimum wage increase undesirable. When exposed capitalists are valued as the average agent in the economy, i.e., $g_K^{\text{exp}} = 1$, then the planner must value active low-skill workers' utility almost twice as much to justify the policy.

Because the profit effect estimate reported in Section 2 is imprecise, I assess the robustness of the calibration to different values. Within each panel, the red curve considers a lower responsiveness of profits $(0.75 \cdot \epsilon_{\Pi}\text{exp})$ while the blue curve considers a higher one $(1.25 \cdot \epsilon_{\Pi}\text{exp})$. Although results change in the expected direction –given a welfare effect on workers, the desirability of the minimum wage decreases with the profit effect– the calibration suggests that orders of magnitude to assess the desirability of the minimum wage remain in a comparable range. In the scenario with a large profit response to the minimum wage and a large WW on exposed capitalists, the WW ratio between active low-skill workers and exposed capitalists necessary to justify a small increase in the minimum wage reaches about 2.7.

How large is the ratio $g_1^l/g_K^{\text{exp}}$ empirically? Using the values displayed in Table 1, we see that the average post-tax profit per establishment in exposed industries is more than 6.5 times larger than the average annual post-tax incomes of low-skill workers. If we assume that the SWF is logarithmic, $G(.) = \log(.)$, this implies that $g_1^l/g_K^{\text{exp}} \approx 6.6$, which substantially exceeds the critical welfare ratio ranges depicted in Panel (b) of Figure 3. This result suggests the scope for achieving distributional gains by increasing the minimum wage in the US is sizable.

This simple analysis foregrounds distributional considerations in assessing the minimum wage desirability. Gains for low-skill workers are of similar magnitude to losses for exposed capitalists, and the net fiscal externality (fiscal savings in transfers minus fiscal losses in corporate tax revenue) is negative but small. Therefore, in the absence of preferences for redistribution, the policy is close to breaking even. However, when redistributive preferences arise, the change in profits only affects the fiscal externality but plays a negligible role in determining welfare effects. In this scenario, increasing the minimum wage becomes desirable because the effects on winners and losers align with the planner's preferences. Therefore, the welfare gains more than compensate for the associated fiscal costs.[30]

## 6 Conclusion

Despite its ubiquity, the desirability of the minimum wage has been a controversial policy question for decades. The large and growing evidence of its effects on wages, employment, and other relevant outcomes (such as profits) has encouraged economists to conceptually revisit its role as a tool for governments intending to redistribute resources. Potential complementarities between tax efficiency and minimum wages are a central consideration in this debate. This paper aims to contribute to this discussion.

While the debate has mainly compared the minimum wage to tax-based transfers for low-income workers, such as the EITC, this paper finds that the desirability of the minimum wage can be motivated by its role in redistributing firm profits. The analysis uncovers the relevance of the relatively overlooked interaction between the minimum wage and corporate tax policy. Event study evidence suggests that the tradeoff analyzed in this paper is empirically relevant. Using two theoretical frameworks, this paper finds that the desirability of the minimum wage increases when corporate taxes are distortionary. When

[30]This analysis has several caveats that could be improved in future research with better microdata. First, it abstracts from within-capitalist heterogeneity. Second, it provides a coarse approximation of the worker-level fiscal externalities that could be expanded into different margins. Third, it uses the statutory corporate tax, which could overestimate the capitalist-level fiscal externality if effective taxes are smaller due to deductions and tax avoidance strategies.

industries exposed to minimum wage workers are particularly labor-intensive – as is the case in the US – the desirability of the minimum wage is enhanced, as it allows industry-specific corporate taxation that taxes more heavily labor-intensive services with the minimum wage while allowing decreases in general corporate taxes that especially benefit capital-intensive industries. A simple sufficient statistics analysis reveals that increasing the minimum wage in the US today could lead to sizable distributional gains.

The theoretical analysis shows that empirical estimates of the profit effects of the minimum wage are key for assessing its desirability. Understanding heterogeneity in the impact of the minimum wage across the firm-type distribution would be particularly informative. Is the profit incidence of the minimum wage concentrated in small firms owned by relatively low earners, or does it affect large, profitable firms? This question carries implications for the appropriate relative welfare weights on exposed capitalists and active low-skill workers, which are revealed to be key by the sufficient statistics analysis.

The theoretical analysis could also be extended in multiple directions. First, I work with efficient frameworks to focus on the redistributive properties of the minimum wage. Related literature has studied rationales for the minimum wage to solve market inefficiencies such as inefficient monopsony power or misallocation. Extending the optimal policy framework to allow for labor market inefficiencies can shed light on policy tradeoffs or complementarities when dealing with both objectives simultaneously. Second, income tax schedules are not perfectly enforced and are costly to administrate because of tax evasion, tax avoidance, and imperfect benefit take-up (Slemrod, 2019). A more general analysis should consider the relative enforcement and administrative costs of the two instruments (Clemens and Strain, 2022; Stansbury, 2025). This extension appears particularly relevant given the tax avoidance opportunities facilitated by the differential tax systems and enforcement across business organizational forms.[31] Third, national minimum wages may coexist with industry- or region-specific minimum wages. My results provide a first-order approximation to understand the rationale of such schemes. The analysis, however, is incomplete because heterogeneous minimum wages may induce additional behavioral responses in terms of, for example, location decisions of firms and households. A comprehensive assessment of these schemes would require modeling these additional distortions. Finally, the model could be extended to include additional margins of adjustment to the minimum wage, for example, the pass-through of minimum wages to output prices and their effects on worker- and firm-level productivity (Dube and Lindner, 2024). Likewise, the model might be extended to include dynamics, informality, and non-wage amenities. These extensions may illuminate additional distributional tradeoffs relevant to the optimal policy problem.

[31] Abstracting from tax evasion also rules out additional complementarities between the minimum wage and the tax system. For example, if workers underreport their incomes, then the minimum wage can increase tax collection by setting a floor on reported labor income (Bíró et al., 2022; Feinmann et al., 2024).

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Minimum Wages and Optimal Redistribution:

The Role of Firm Profits

**Online Appendix**

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# A Empirical appendix

This appendix provides more details on the empirical results presented in Section 2. I also present additional results not presented in the main text.

**Events.** Following Cengiz et al. (2019, 2022), a state-by-year minimum wage is defined as the maximum between the statutory values of the federal and state minimum wages throughout the calendar year. Nominal values are transformed to 2016 dollars using the R-CPI-U-RS index including all items. An event is defined as a state-level hourly minimum wage increase above the federal minimum wage of at least \$0.25 (in 2016 dollars) in a state with at least 2% of the employed population affected, where the affected population is computed using the NBER Merged Outgoing Rotation Group of the CPS (henceforth, CPS-MORG). This is done by computing employment counts by wage bins and checking whether, on average, the previous year's share of workers with wages below the new minimum wage is above 2%. These restrictions are imposed to focus on minimum wage increases that are likely to affect the labor market. Small state-level or binding federal minimum wage increases are not recorded as events, however, regressions control for small state-level and federal minimum wage increases. Following Cengiz et al. (2019, 2022), controls for small state-level and binding federal minimum wage increases are included as follows. Let $\hat{t}$ be the year in which the small state-level or binding federal minimum wage increase takes place. Then, define $Early_t = 1\{t \in \{\hat{t}-3, \hat{t}-2\}\}$, $Pre_t = 1\{t = \hat{t}-1\}$ and $Post_t = 1\{t \in \{\hat{t}, \hat{t}+1, \hat{t}+2, \hat{t}+3, \hat{t}+4\}\}$, and let $Small_i$ and $Fed_i$ be indicators of states that face small state-level and binding federal minimum wage increases, respectively. Then $X_{it}$ in regressions (1) and (2) includes all the interactions between $\{Early_t, Pre_t, Post_t\} \times \{Small_i, Fed_i\}$ for each event separately. I also restrict the attention to events where treated states do not experience other events in the three years previous to the event and whose timing allows me to observe the outcomes from three years before to four years after. This results in 50 valid state-level events, whose time distribution is plotted in Figure A.1. Table A.1 displays the list of the considered events with their corresponding treated states.

**Data.** I use the CPS-MORG data to compute average pre-tax hourly wages and the Basic CPS monthly files to compute employment rates, average weekly hours, and participation rates at the state-by-year-by-skill level. Low-skill (high-skill) workers are defined as not having (having) a college degree. Hourly wages are either directly reported or indirectly computed by dividing reported weekly earnings by weekly hours worked. I drop individuals aged 15 or less, self-employed individuals, and veterans. Nominal wages are transformed to 2016 dollars using the R-CPI-U-RS index including all items. Observations whose hourly wage is computed using imputed data (on wages, earnings, and/or hours) are excluded to minimize the scope for measurement error. To avoid distorting low-skill workers' statistics with non-affected individuals at the top of the wage distribution, I restrict the low-skill workers' sample to workers that are either out of the labor force, unemployed, or in the bottom half of the wage distribution when employed. I test how results change when considering different wage percentile thresholds.

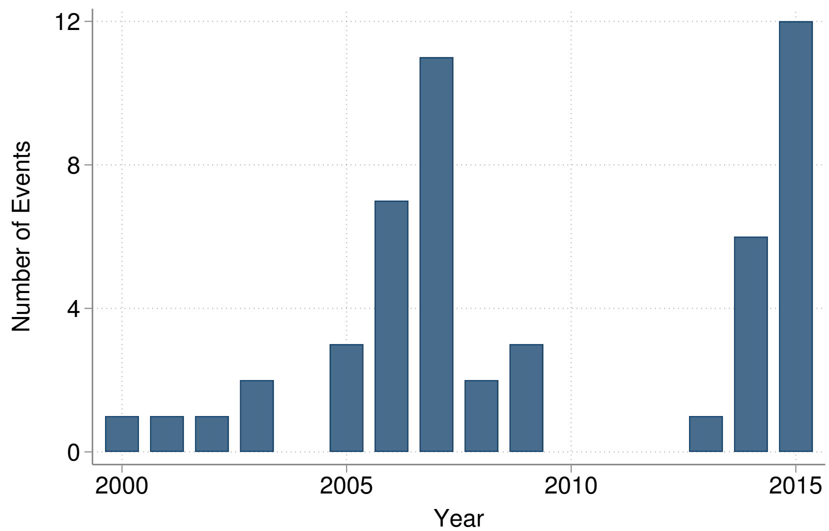
Regarding fiscal variables at the state-by-year level, I use data from the Bureau of Economic Analysis (BEA) regional accounts. I consider income maintenance benefits, medical benefits, and gross federal income tax liabilities. The BEA definition of income maintenance benefits is as follows: "Income maintenance benefits consist largely of Supplemental Security Income (SSI) benefits, Earned Income Tax Credit (EITC), Additional Child Tax Credit, Supplemental Nutrition Assistance Program (SNAP) benefits, family assistance, and other income maintenance benefits, including general assistance." Medical benefits consider both Medicaid and Medicare programs.

For computing average profits per establishment at the industry-by-state-by-year level using state-level aggregates, I use the Gross Operating Surplus (GOS) estimates from the BEA regional accounts as a proxy of state-level aggregate profits and divide them by the average number of private establishments reported in the QCEW data files. The BEA definition of gross operating surplus is as follows: "Value derived as a residual for most industries after subtracting total intermediate inputs, compensation of employees, and taxes on production and imports less subsidies from total industry output. Gross operating surplus includes consumption of fixed capital (CFC), proprietors' income, corporate profits, and business current transfer payments (net)." Nominal profits are transformed to 2016 dollars using the R-CPI-U-RS index including all items. I consider 25 industries that have a relatively large coverage across states and years (when an industry has low representation in a given state-year cell, the BEA and QCEW do not report aggregates for privacy reasons). Noting that minimum wage workers are not evenly distributed across industries, I group industries into two large groups: exposed and non-exposed industries. Exposed industries mainly include food and accommodation, retail trade, and low-skill health services. I exclude agriculture and mining. I also exclude construction and finance since they experienced particularly abnormal profit dynamics around the 2009 financial crisis. Manufacturing industries include SIC codes 41, 43, 44, 46, 50, 54, 56, and 57, that is, nonmetallic mineral products, fabricated metal products, machinery, electrical equipment, food and beverages and tobacco, printing and related support activities, chemical manufacturing, and plastics and rubber products. Exposed services include SIC codes 9, 19, 21, 27, 28, and 34, that is, retail trade, ambulatory health services, nursing and residential care facilities, food, accommodation, and social services and other services. Non-exposed services include SIC codes 8, 10, 11, 13, 14, 15, 16, 17, 20, 24, and 25, that is, wholesale trade, transport, information, real estate, professional services, management of businesses, administrative support, educational services, hospitals, arts, and recreation industries. While fiscal effects are proportional to the effect on profits, I also use data on taxes on production and imports net of subsidies reported on the BEA regional accounts at the industry-level, and data on business and dividend income reported in the state-level Statistics of Income (SOI) tables to test for additional fiscal externalities. Within-industry labor shares are computed using state-by-industry BEA data on GOS, taxes on production and imports net of subsidies, and compensation of employees. The standard computation is Labor Share = Compensation of employees / (GOS + taxes on production and imports net of subsidies + compensation of employees).

**Structure of figures and tables.** Figure A.1 shows the time distribution of the 50 events considered and Table A.1 presents a detailed list of the events considered. Figure A.2 shows the "first-stage", that is, the event study using the real hourly minimum wage as the dependent variable. Figure A.3 shows event studies for low- and high-skill workers for the average pre-tax wage including the unemployed (wage times employment). Figure A.4 shows results for wages and employment, and Figure A.5 shows results for hours and participation, for both low- and high-skill workers. Tables A.2, A.3, and A.4 show the pooled difference-in-difference estimates related to Figures A.3, A.4, and A.5, omitting the values presented in the main text. Figure A.6 presents a heterogeneity analysis for the low-skill workers' estimates. Figure A.7 tests the robustness of the low-skill workers' estimates to the choice of the wage percentile to truncate the sample. Figure A.8 shows the event studies for different worker-level fiscal externalities. Table A.5 presents related pooled difference-in-difference results, omitting the values presented in the main text. Figure A.9 shows event studies for profit per establishment and number of establishments for exposed and non-exposed industries. Figure A.10 shows event studies for additional firm-level fiscal externalities. Table A.6 shows the pooled difference-in-difference estimates related to Figures A.9 and A.10, omitting the values presented in the main text. Finally, Figure A.11 shows events studies for the labor share for exposed and non-exposed industries.

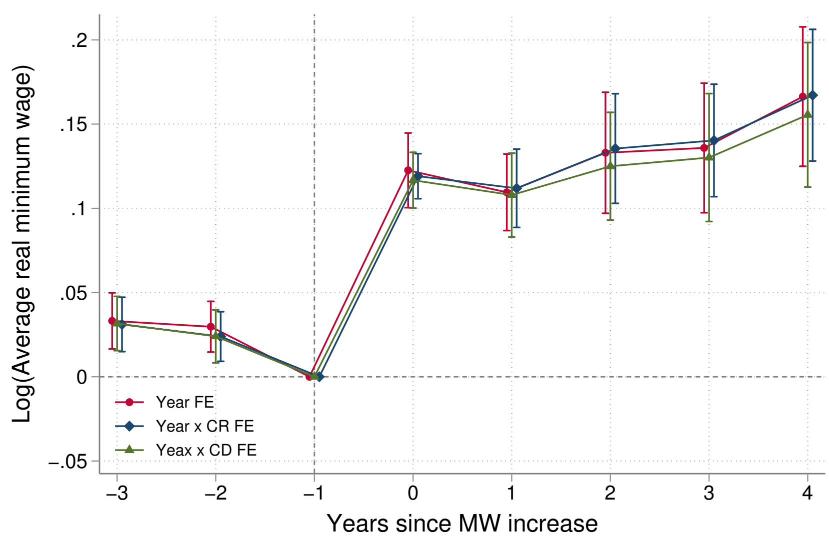
## A.1 Additional figures and tables

Figure A.1: State-level events by year



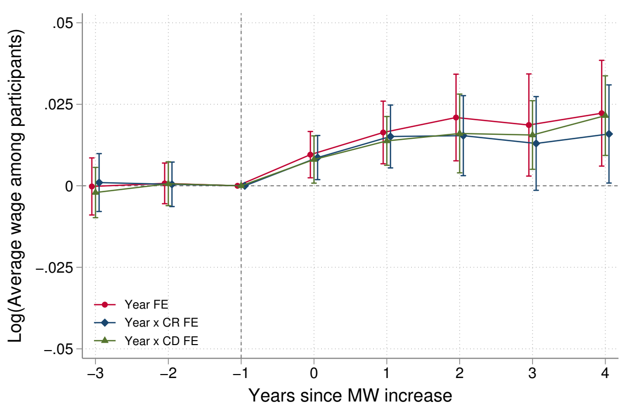

Notes: This figure plots the annual frequency of state-level minimum wage increases classified as events following Cengiz et al. (2019, 2022). Data on minimum wages is taken from Vaghul and Zipperer (2016). A state-level hourly minimum wage increase above the federal level is classified as an event if the increase is of at least \$0.25 (in 2016 dollars) in a state with at least 2% of the working population affected, where the affected population is computed using the NBER Merged Outgoing Rotation Group of the CPS, treated states do not experience other events in the three years previous to the event, and the event-timing allows to observe the outcomes from three years before to four years after.

Figure A.2: First stage: Real minimum wage increase after the event

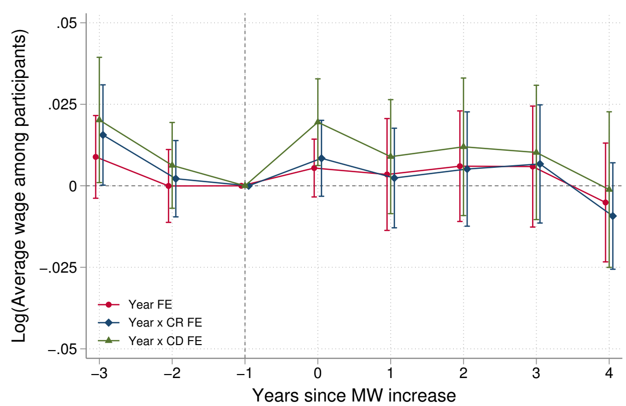



Notes: This figure plots the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals using the log real hourly minimum wage as the dependent variable. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. The different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

Figure A.3: Effects of state-level minimum wage reforms on low- and high-skill workers (average pre-tax wage including the unemployed)



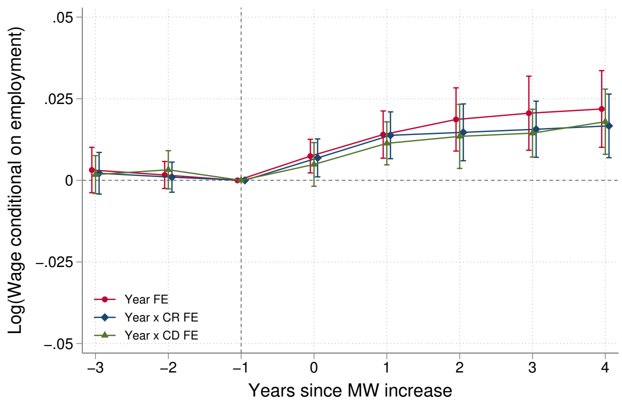

(a) Low-skill workers



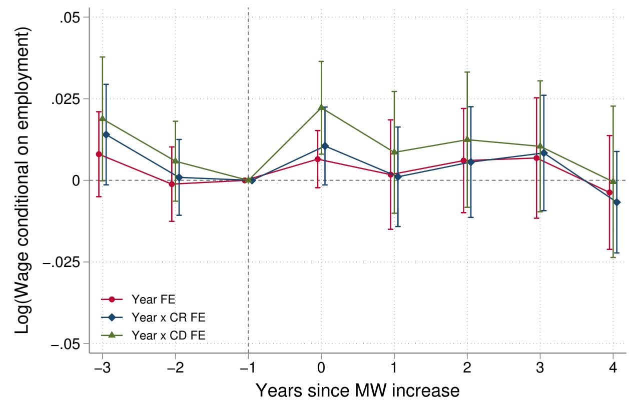

(b) High-skill workers

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log of the average pre-tax wage of active low-skill workers including the unemployed as the dependent variable. Panel (b) uses the log of the average pre-tax wage of active high-skill workers including the unemployed as the dependent variable. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

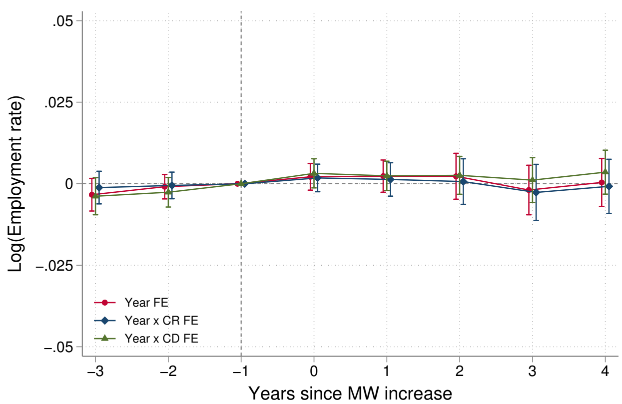
Figure A.4: Effects of state-level minimum wage reforms on low- and high-skill workers (wages and employment)



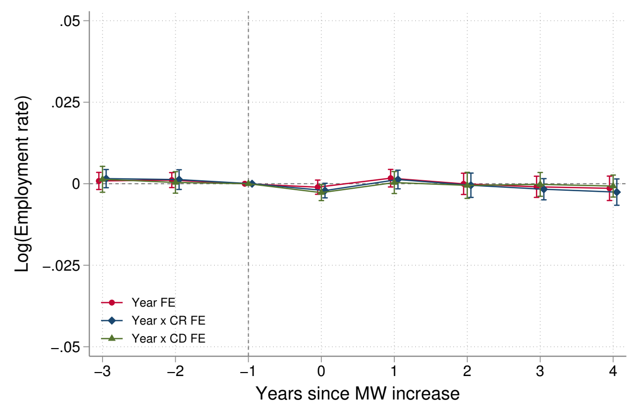

(a) Low-skill workers - Wage conditional on employment




(b) High-skill workers - Wage conditional on employment



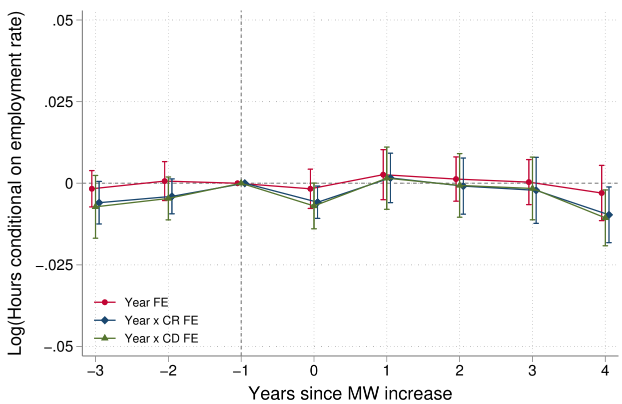

(c) Low-skill workers - Employment rate



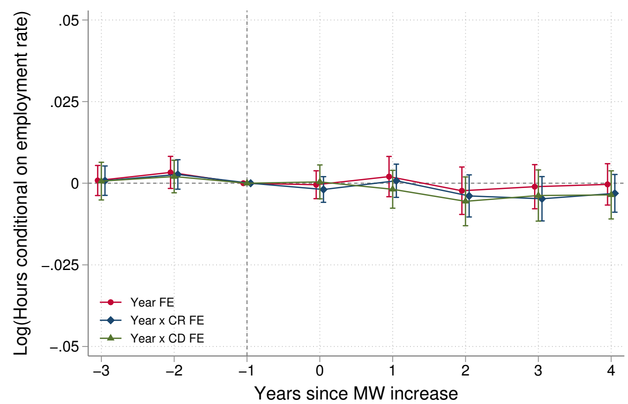

(d) High-skill workers - Employment rate

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log of the average pre-tax wage of low-skill workers conditional on employment as the dependent variable. Panel (b) uses the log of the average pre-tax wage of high-skill workers conditional on employment as the dependent variable. Panel (c) uses the log of the employment rate of low-skill workers as the dependent variable. Panel (d) uses the log of the employment rate of high-skill workers. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

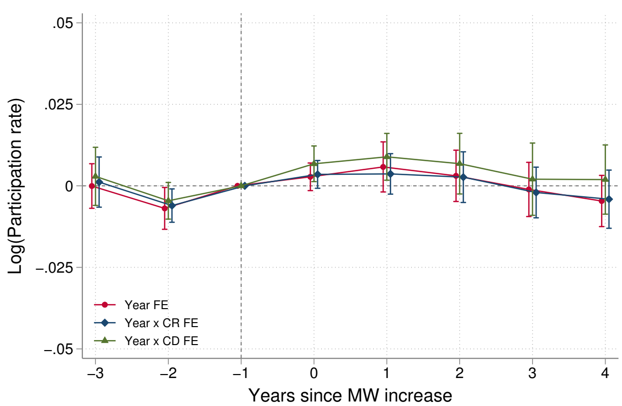
Figure A.5: Effects of state-level minimum wage reforms on low- and high-skill workers (hours and participation)



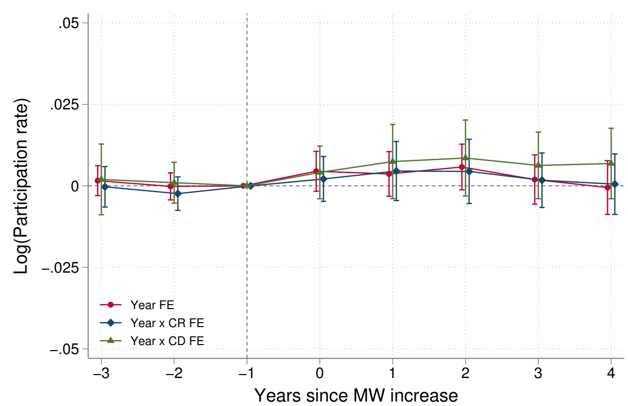

(a) Low-skill workers - Hours worked conditional on employment




(b) High-skill workers - Hours worked conditional on employment



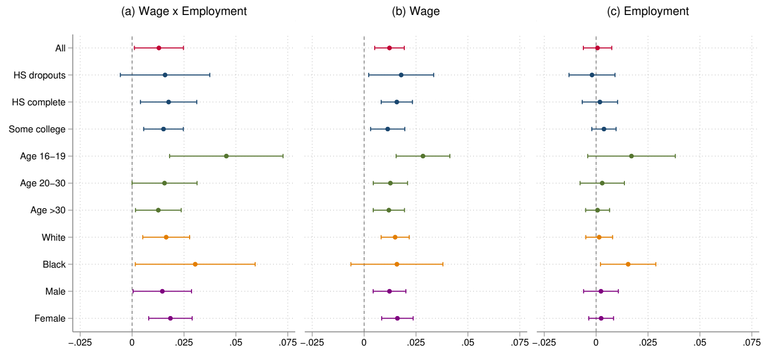

(c) Low-skill workers - Participation rate



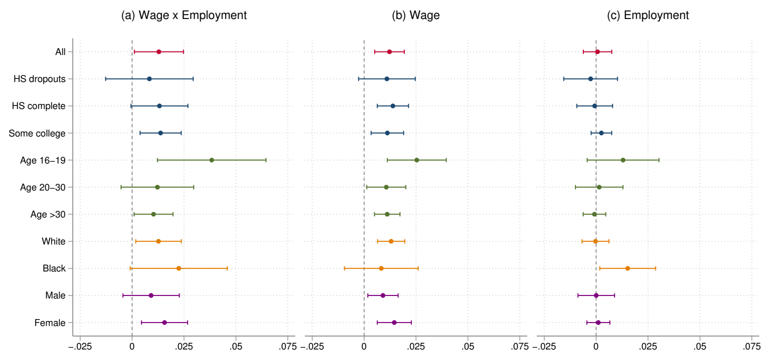

(d) High-skill workers - Participation rate

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log of the average weekly hours worked by low-skill workers conditional on employment as the dependent variable. Panel (b) uses the log of the average weekly hours worked by high-skill workers conditional on employment as the dependent variable. Panel (c) uses the log of the participation rate of low-skill workers as the dependent variable. Panel (d) uses the log of the participation rate of high-skill workers. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

Figure A.6: Minimum wage effects on low-skill workers: Heterogeneity




(a) Year fixed effects

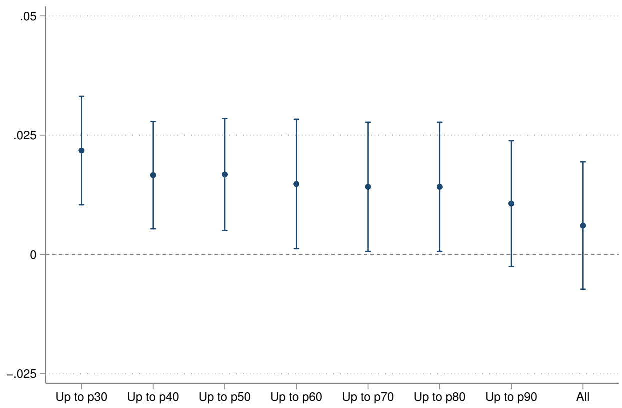



(b) Census region-by-year fixed effects

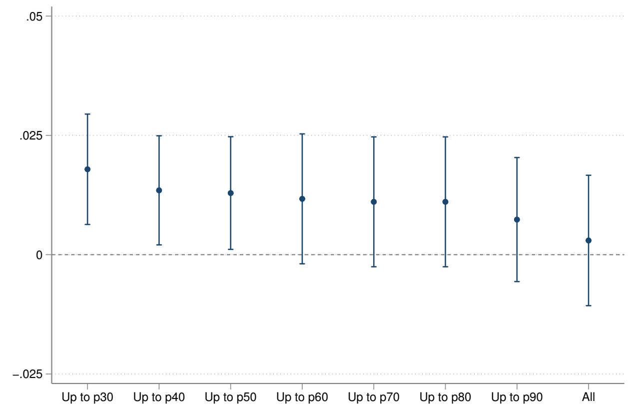

(c) Census division-by-year fixed effects

Notes: These figures plot the estimated $\beta$ coefficient with its corresponding 95% confidence intervals from equation (**??**) for different groups of low-skill workers and different dependent variables. Panel (a) uses the average pre-tax wage of active low-skill workers including the unemployed as the dependent variable. Panel (b) uses the average pre-tax hourly wage of low-skill workers conditional on employment as the dependent variable. Panel (c) uses the average employment rate of low-skill workers as the dependent variable. Red coefficients reproduce the analysis with the complete sample. Blue coefficients split low-skill workers by education (high-school dropouts, high-school complete, and college incomplete). Green coefficients split low-skill workers by age (16-19, 20-30, and more than 30). Orange coefficients split low-skill workers by race (white and black). Purple coefficients split low-skill workers by sex (male and female). The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Each panel corresponds to different time fixed effects. Panel (a) year fixed effects. Panel (b) uses census region-by-year fixed effects. Panel (c) uses census division-by-year fixed effects.

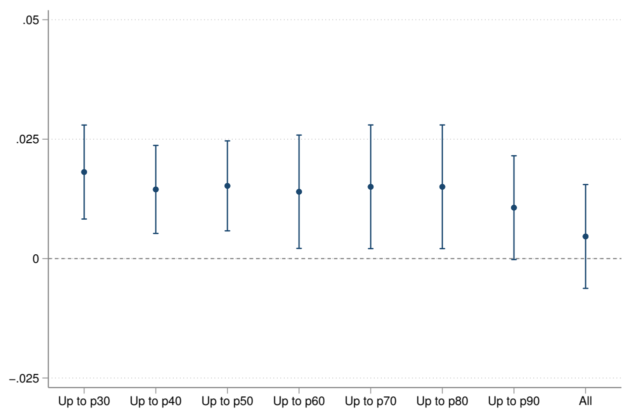
Figure A.7: Minimum wage effects on low-skill workers' welfare: change in percentile considered




(a) Year fixed effects



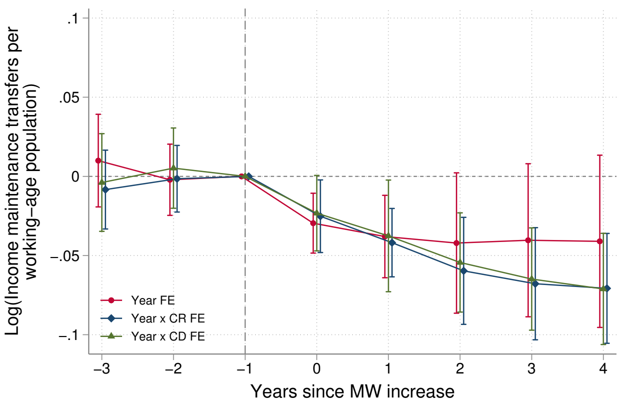

(b) Census region-by-year fixed effects



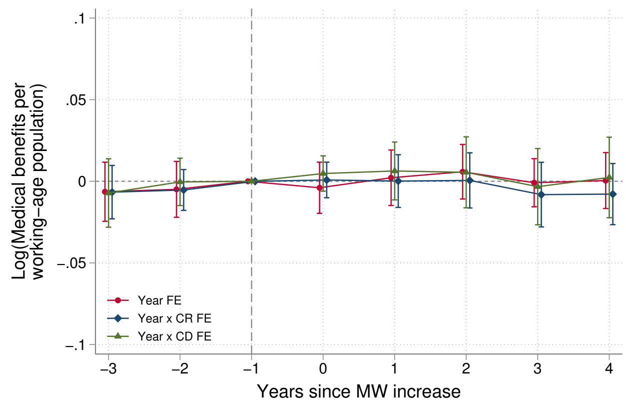

(c) Census division-by-year fixed effects

Notes: These figures plot the estimated $\beta$ coefficient with its corresponding 95% confidence intervals from equation (**??**) using the average pre-tax wage of active low-skill workers including the unemployed as the dependent variable. Each coefficient comes from a different regression where the dependent variable is computed using different percentiles to truncate the sample of employed low-skill workers when computing the average wage. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Each panel corresponds to different time fixed effects. Panel (a) year fixed effects. Panel (b) uses census region-by-year fixed effects. Panel (c) uses census division-by-year fixed effects.

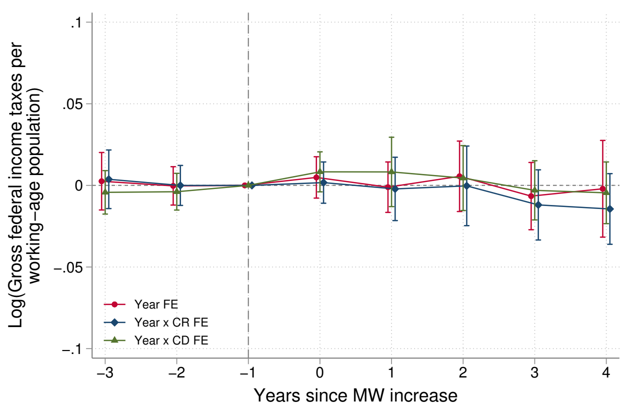
Figure A.8: Worker-level fiscal externalities after minimum wage increases




(a) Income maintenance benefits



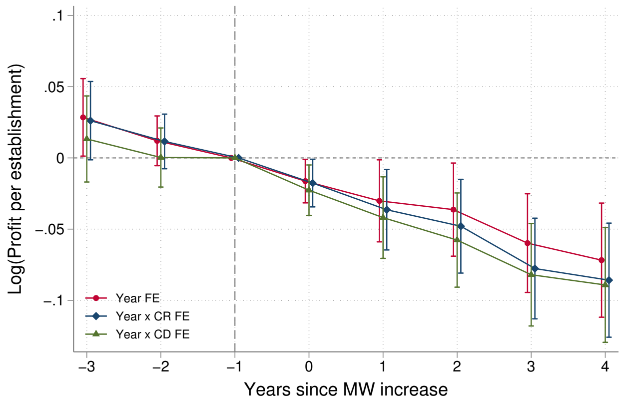

(b) Medical benefits



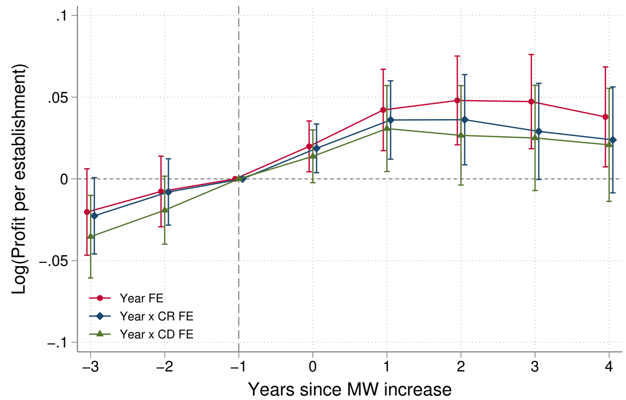

(c) Gross federal income taxes

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log income maintenance benefits per working-age population as the dependent variable. Panel (b) uses the log medical benefits per working-age population as the dependent variable. Panel (c) uses the log gross federal income taxes per working-age population as the dependent variable. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Exposed industries include food and accommodation, retail trade, and low-skill health services. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

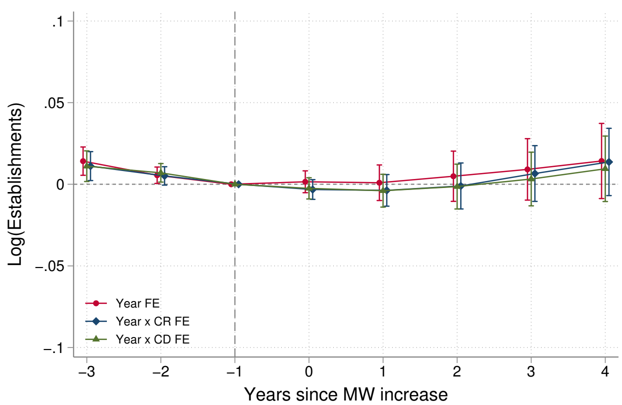
Figure A.9: Effects of state-level minimum wage reforms on profits and establishments



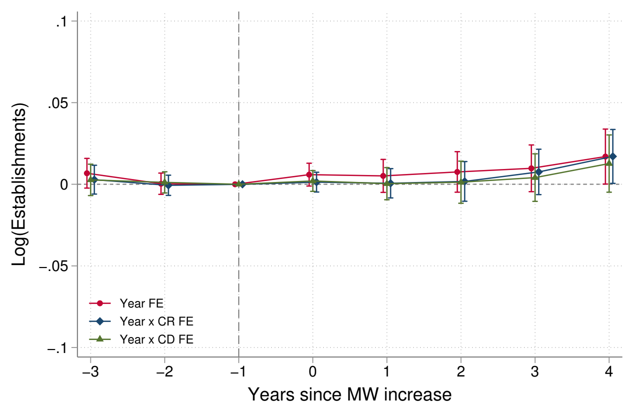

(a) Exposed industries - Profit per establishment




(b) Non-exposed industries - Profit per establishment



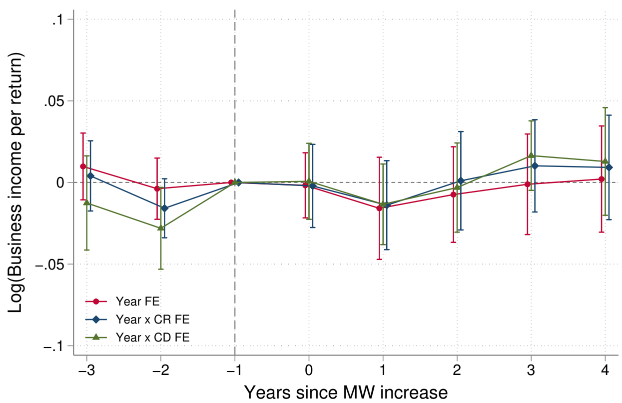

(c) Exposed industries - Establishments



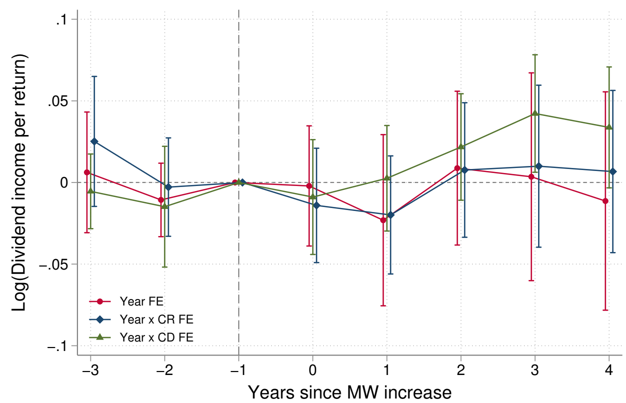

(d) Non-exposed industries - Establishments

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log profit per establishment in exposed industries as the dependent variable. Panel (b) uses the log profit per establishment in non-exposed industries as the dependent variable. Panel (c) uses the log of the number of establishments in exposed industries as the dependent variable. Panel (d) uses the log of the number of establishments in non-exposed industries as the dependent variable. The analysis is at the state-by-industry-by-year level, standard errors are clustered at the state-by-industry level, and regressions are weighted by the average pre-event industry-by-state employment. Exposed industries include food and accommodation, retail trade, and low-skill health services. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

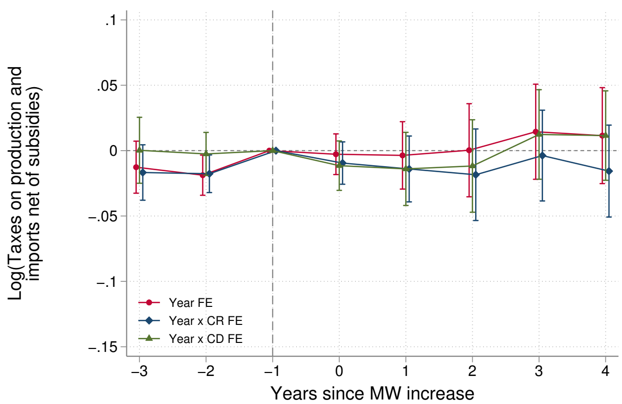
Figure A.10: Additional firm-level fiscal externalities



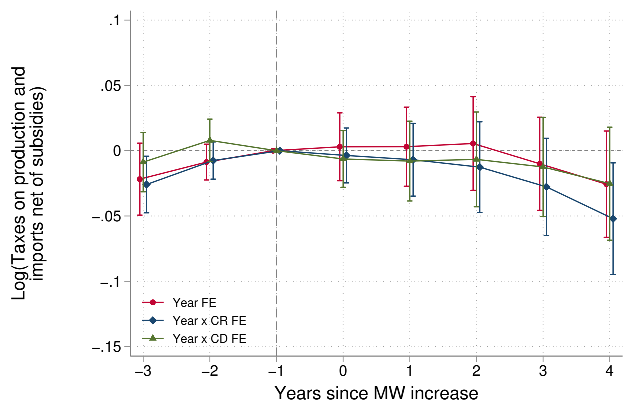

(a) Business income per tax return




(b) Dividend income per tax return



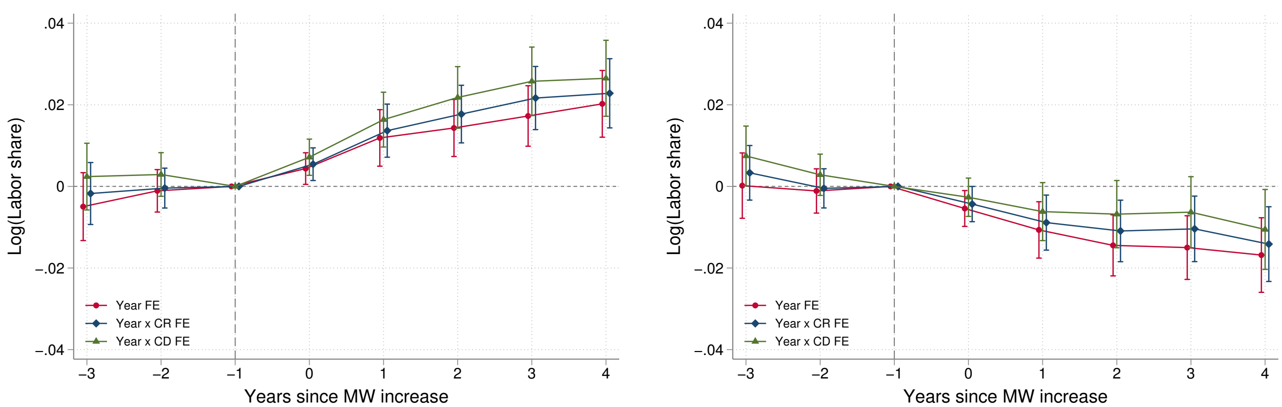

(c) Exposed industries - Taxes on production and imports net of subsidies




(d) Non-exposed industries - Taxes on production and imports net of subsidies

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log business income per tax return as the dependent variable. Panel (b) uses the log dividend income per tax return as the dependent variable. Panel (c) uses the log taxes on production and imports net of subsidies in exposed industries as the dependent variable. Panel (d) uses the log taxes on production and imports net of subsidies in non-exposed industries as the dependent variable. In Panels (a) and (b), the analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. In Panels (c) and (d), the analysis is at the state-by-industry-by-year level, standard errors are clustered at the state-by-industry level, and regressions are weighted by the average pre-period state-by-industry-by-year employment. Exposed industries include food and accommodation, retail trade, and low-skill health services. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

Figure A.11: Effects of state-level minimum wage reforms on the labor share




(a) Exposed industries - Labor share

(b) Non-exposed industries - Labor share

Notes: These figures plot the estimated $\beta_\tau$ coefficients of equation (**??**) with their corresponding 95% confidence intervals. Panel (a) uses the log labor share in exposed industries as the dependent variable. Panel (b) uses the log labor share in non-exposed industries as the dependent variable. The analysis is at the state-by-industry-by-year level, standard errors are clustered at the state-by-industry level, and regressions are weighted by the average pre-event industry-by-state employment. Exposed industries include food and accommodation, retail trade, and low-skill health services. In each figure, the different series correspond to different time fixed effects. Red series use year fixed effects. Blue series use census region-by-year fixed effects. Green series use census division-by-year fixed effects.

Table A.1: List of Events

| State | Events (year) | Total | State | Events (year) | Total |
|---|---|---|---|---|---|
| Alabama | - | 0 | Montana | 2007 | 1 |
| Alaska | 2003, 2015 | 2 | Nebraska | 2015 | 1 |
| Arizona | 2007 | 1 | Nevada | 2006 | 1 |
| Arkansas | 2006, 2015 | 2 | New Hampshire | - | 0 |
| California | 2007, 2014 | 2 | New Jersey | 2006, 2014 | 2 |
| Colorado | 2007, 2015 | 2 | New Mexico | 2008 | 1 |
| Connecticut | 2009, 2015 | 2 | New York | 2005, 2013 | 2 |
| Delaware | 2000, 2007, 2014 | 3 | North Carolina | 2007 | 1 |
| District of Columbia | 2014 | 1 | North Dakota | - | 0 |
| Florida | 2005, 2009 | 2 | Ohio | 2007 | 1 |
| Georgia | - | 0 | Oklahoma | - | 0 |
| Hawaii | 2002, 2015 | 2 | Oregon | 2003 | 1 |
| Idaho | - | 0 | Pennsylvania | 2007 | 1 |
| Illinois | 2005 | 1 | Rhode Island | 2006, 2015 | 2 |
| Indiana | - | 0 | South Carolina | - | 0 |
| Iowa | 2008 | 1 | South Dakota | 2015 | 1 |
| Kansas | - | 0 | Tennessee | - | 0 |
| Kentucky | - | 0 | Texas | - | 0 |
| Louisiana | - | 0 | Utah | - | 0 |
| Maine | - | 0 | Vermont | 2009, 2015 | 2 |
| Maryland | 2015 | 1 | Virginia | - | 0 |
| Massachusetts | 2001, 2007, 2015 | 3 | Washington | 2007 | 1 |
| Michigan | 2006, 2014 | 2 | West Virginia | 2006, 2015 | 2 |
| Minnesota | 2014 | 1 | Wisconsin | 2006 | 1 |
| Mississippi | - | 0 | Wyoming | - | 0 |
| Missouri | 2007 | 1 | | | |

Notes: This table details the list of events considered in the event-studies. Data on minimum wages is taken from Vaghul and Zipperer (2016). A state-level hourly minimum wage increase above the federal level is classified as an event if the increase is of at least \$0.25 (in 2016 dollars) in a state with at least 2% of the working population affected, where the affected population is computed using the NBER Merged Outgoing Rotation Group of the CPS, treated states do not experience other events in the three years previous to the event, and the event-timing allows to observe the outcomes from three years before to four years after.

Table A.2: Difference-in-difference results: Different margins for low-skill workers

| *Dependent variable*: | Wages | | | Employment | | | Hours | | | Participation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\hat{\beta}$ | 0.014 | 0.012 | 0.011 | 0.002 | 0.001 | 0.005 | 0.000 | -0.000 | -0.000 | 0.003 | 0.002 | 0.006 |
| | (0.003) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) |
| Year FE | Y | N | N | Y | N | N | Y | N | N | Y | N | N |
| Year x CR FE | N | Y | N | N | Y | N | N | Y | N | N | Y | N |
| Year x CD FE | N | N | Y | N | N | Y | N | N | Y | N | N | Y |
| Obs. | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 |
| Events | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| *Elasticity estimate*: | | | | | | | | | | | | |
| First stage ($\Delta \log \text{MW}$) | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 |
| | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) |
| F-test | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 |
| Second stage (elasticity) | 0.126 | 0.104 | 0.096 | 0.022 | 0.006 | 0.043 | 0.000 | -0.004 | -0.002 | 0.029 | 0.020 | 0.053 |
| | (0.027) | (0.023) | (0.028) | (0.030) | (0.029) | (0.024) | (0.021) | (0.025) | (0.031) | (0.027) | (0.029) | (0.046) |

Notes: This table shows the estimated $\beta$ coefficient from equation (**??**) with corresponding standard errors reported in parentheses. All columns represent different regressions using different dependent variables (all in logarithms) and fixed effects. All variables are computed for low-skill workers, who are defined as workers without a college degree. Columns (1) to (3) use the average wage conditional on employment as the dependent variable. Columns (4) to (6) use the employment rate as the dependent variable. Columns (7) to (9) use the average weekly hours worked conditional on employment as the dependent variable. Columns (10) to (12) use the labor force participation rate as a dependent variable. Year FE means that the regression includes year-by-event fixed effects. Year x CR FE means that the regression includes census region-by-year-by-event fixed effects. Year x CD FE means that the regression includes census division-by-year-by-event fixed effects. $\Delta \log \text{MW}$ is the average change in the log of the real state-level minimum wage across events as estimated from an analog of equation (**??**) that uses $\log \text{MW}_{ite}$ as the dependent variable. The implied elasticity is computed by dividing the point estimate by $\Delta \log \text{MW}$, which corresponds to the second stage of the instrumental variables estimation. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Outcome variables are computed using data from the CPS (MORG and Basic Monthly files).

Table A.3: Difference-in-difference results: Average pre-tax wage of high-skill workers (including the unemployed)

| *Dependent variable:* | Pre-tax wage (including 0s) (high-skill workers) | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| $\hat{\beta}$ | 0.000 | -0.003 | 0.002 |
| | (0.007) | (0.006) | (0.008) |
| Year FE | Y | N | N |
| Year x CR FE | N | Y | N |
| Year x CD FE | N | N | Y |
| Obs. | 10,300 | 10,300 | 9,653 |
| Events | 50 | 50 | 50 |
| *Elasticity estimate*: | | | |
| First stage ($\Delta \log \mathrm{MW}$) | 0.114 | 0.117 | 0.109 |
| | (0.013) | (0.013) | (0.012) |
| F-test | 80.039 | 83.904 | 88.700 |
| Second stage (elasticity) | 0.002 | -0.026 | 0.015 |
| | (0.062) | (0.050) | (0.077) |

Notes: This table shows the estimated $\beta$ coefficient from equation (2) with corresponding standard errors reported in parentheses. The dependent variable is the average pre-tax wage of high-skill workers including the unemployed, which equals the average wage conditional on employment times the employment rate. All columns represent different regressions. Year FE means that the regression includes year-by-event fixed effects. Year x CR FE means that the regression includes census region-by-year-by-event fixed effects. Year x CD FE means that the regression includes census division-by-year-by-event fixed effects. $\Delta \log \mathrm{MW}$ is the average change in the log of the real state-level minimum wage across events as estimated from an analog of equation (**??**) that uses $\log \mathrm{MW}_{ite}$ as the dependent variable. The implied elasticity is computed by dividing the point estimate by $\Delta \log \mathrm{MW}$, which corresponds to the second stage of the instrumental variables estimation. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Outcome variables are computed using data from the CPS (MORG and Basic Monthly files).

Table A.4: Difference-in-difference results: Different margins for high-skill workers

| *Dependent variable*: | Wages | | | Employment | | | Hours | | | Participation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| $\hat{\beta}$ | 0.001 | -0.001 | 0.003 | -0.001 | -0.002 | -0.001 | -0.002 | -0.004 | -0.004 | 0.003 | 0.003 | 0.006 |
| | (0.007) | (0.006) | (0.008) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) | (0.004) |
| Year FE | Y | N | N | Y | N | N | Y | N | N | Y | N | N |
| Year x CR FE | N | Y | N | N | Y | N | N | Y | N | N | Y | N |
| Year x CD FE | N | N | Y | N | N | Y | N | N | Y | N | N | Y |
| Obs. | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 |
| Events | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| *Elasticity estimate*: | | | | | | | | | | | | |
| First stage ($\Delta \log \mathrm{MW}$) | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 |
| | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) |
| F-test | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 |
| Second stage (elasticity) | 0.012 | -0.008 | 0.028 | -0.009 | -0.018 | -0.013 | -0.015 | -0.031 | -0.032 | 0.023 | 0.029 | 0.051 |
| | (0.059) | (0.049) | (0.074) | (0.012) | (0.011) | (0.012) | (0.019) | (0.017) | (0.023) | (0.028) | (0.030) | (0.042) |

Notes: This table shows the estimated $\beta$ coefficient from equation (**??**) with corresponding standard errors reported in parentheses. All columns represent different regressions using different dependent variables (all in logarithms) and fixed effects. All variables are computed for high-skill workers, who are defined as workers with a college degree. Columns (1) to (3) use the average wage conditional on employment as the dependent variable. Columns (4) to (6) use the employment rate as the dependent variable. Columns (7) to (9) use the average weekly hours worked conditional on employment as the dependent variable. Columns (10) to (12) use the labor force participation rate as a dependent variable. Year FE means that the regression includes year-by-event fixed effects. Year x CR FE means that the regression includes census region-by-year-by-event fixed effects. Year x CD FE means that the regression includes census division-by-year-by-event fixed effects. $\Delta \log \mathrm{MW}$ is the average change in the log of the real state-level minimum wage across events as estimated from an analog of equation (**??**) that uses $\log \mathrm{MW}_{ite}$ as the dependent variable. The implied elasticity is computed by dividing the point estimate by $\Delta \log \mathrm{MW}$, which corresponds to the second stage of the instrumental variables estimation. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Outcome variables are computed using data from the CPS (MORG and Basic Monthly files).

Table A.5: Difference-in-difference results: Additional fiscal externalities

| *Dependent variable:* | Medical benefits (per working-age ind.) | | | Gross federal income taxes (per working-age ind.) | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\hat{\beta}$ | 0.004 | 0.001 | 0.006 | -0.000 | -0.006 | 0.005 |
| | (0.009) | (0.009) | (0.009) | (0.009) | (0.009) | (0.008) |
| Year FE | Y | N | N | Y | N | N |
| Year x CR FE | N | Y | N | N | Y | N |
| Year x CD FE | N | N | Y | N | N | Y |
| Obs. | 10,300 | 10,300 | 9,653 | 10,300 | 10,300 | 9,653 |
| Events | 50 | 50 | 50 | 50 | 50 | 50 |
| *Elasticity estimate*: | | | | | | |
| First stage ($\Delta \log \text{MW}$) | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 |
| | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) |
| F-test | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 |
| Second stage (elasticity) | 0.034 | 0.008 | 0.051 | -0.003 | -0.055 | 0.049 |
| | (0.077) | (0.075) | (0.085) | (0.082) | (0.079) | (0.077) |

Notes: This table shows the estimated $\beta$ coefficient from equation (2) with corresponding standard errors reported in parentheses. All columns represent different regressions using different dependent variables (all in logarithms) and fixed effects. Columns (1) to (3) use the total medical benefits per working-age individual as the dependent variable. Columns (4) to (6) use the gross federal income taxes per working-wage individual as the dependent variable. Year FE means that the regression includes year-by-event fixed effects. Year x CR FE means that the regression includes census region-by-year-by-event fixed effects. Year x CD FE means that the regression includes census division-by-year-by-event fixed effects. $\Delta \log \text{MW}$ is the average change in the log of the real state-level minimum wage across events as estimated from an analog of equation (**??**) that uses $\log \text{MW}_{ite}$ as the dependent variable. The implied elasticity is computed by dividing the point estimate by $\Delta \log \text{MW}$, which corresponds to the second stage of the instrumental variables estimation. The analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. Outcome variables are computed using data from the BEA regional accounts.

Table A.6: Difference-in-difference results: Additional effects on firms and capital income

| *Dependent variable:* | Business income (per inc. tax return) | | | Dividend income per return (per inc. tax return) | | | Net taxes on prod. and imports (exposed industries) | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| $\hat{\beta}$ | -0.006 | 0.004 | 0.016 | -0.004 | -0.010 | 0.023 | 0.014 | -0.001 | -0.002 |
| | (0.014) | (0.016) | (0.017) | (0.026) | (0.025) | (0.015) | (0.017) | (0.016) | (0.016) |
| Year FE | Y | N | N | Y | N | N | Y | N | N |
| Year x CR FE | N | Y | N | N | Y | N | N | Y | N |
| Year x CD FE | N | N | Y | N | N | Y | N | N | Y |
| Obs. | 7,733 | 7,733 | 7,275 | 7,733 | 7,733 | 7,275 | 255,488 | 255,488 | 255,488 |
| Events | 38 | 38 | 38 | 38 | 38 | 38 | 50 | 50 | 50 |
| *Elasticity estimate*: | | | | | | | | | |
| First stage ($\Delta \log \text{MW}$) | 0.114 | 0.117 | 0.109 | 0.114 | 0.117 | 0.109 | 0.116 | 0.121 | 0.114 |
| | (0.013) | (0.013) | (0.012) | (0.013) | (0.013) | (0.012) | (0.012) | (0.012) | (0.010) |
| F-test | 80.039 | 83.904 | 88.700 | 80.039 | 83.904 | 88.700 | 97.718 | 108.492 | 120.718 |
| Second stage (elasticity) | -0.025 | 0.047 | 0.141 | -0.019 | -0.054 | 0.203 | 0.119 | -0.008 | -0.017 |
| | (0.111) | (0.120) | (0.135) | (0.213) | (0.194) | (0.124) | (0.148) | (0.135) | (0.142) |

Notes: This table shows the estimated $\beta$ coefficient from equation (**??**) with corresponding standard errors reported in parentheses. All columns represent different regressions using different dependent variables (all in logarithms) and fixed effects. Columns (1) to (3) use total business income per income tax return as the dependent variable. Columns (4) to (6) use total dividend income per income tax return as the dependent variable. Columns (7) to (9) use total taxes on production and imports net of subsidies as the dependent variable. SOI data is only observed until 2018, so columns (1) to (6) omit events that happened in 2015. Year FE means that the regression includes year-by-event fixed effects. Year x CR FE means that the regression includes census region-by-year-by-event fixed effects. Year x CD FE means that the regression includes census division-by-year-by-event fixed effects. $\Delta \log \text{MW}$ is the average change in the log of the real state-level minimum wage across events as estimated from an analog of equation (**??**) that uses $\log \text{MW}_{ite}$ as the dependent variable. The implied elasticity is computed by dividing the point estimate by $\Delta \log \text{MW}$, which corresponds to the second stage of the instrumental variables estimation. In Columns (1) to (6), the analysis is at the state-by-year level, standard errors are clustered at the state level, and regressions are weighted by state-by-year average population. In Columns (7) to (9), the analysis is at the state-by-industry-by-year level, standard errors are clustered at the state-by-industry level, and regressions are weighted by the average pre-period state-by-industry-by-year employment. Outcome variables are computed using data from the SOI state-level tables and the BEA regional accounts.

# B Theory appendix

## B.1 Proofs of propositions

**Proposition 1.** Let the minimum wage increase be equal to $d\overline{w} > 0$. $d\overline{w}$ generates welfare effects and fiscal externalities. First, the minimum wage increase generates a welfare effect on employed workers equal to $g_1 L d\overline{w}$. Second, $d\overline{w}$ generates a welfare loss for marginally displaced workers, equal to:

$$g_1^M \frac{\partial L}{\partial \overline{w}} d\overline{w} = -L g_1^M \frac{\eta_w}{\overline{w}} d\overline{w}. \tag{B.1}$$

Third, $d\overline{w}$ generates a welfare loss for capitalists equal to:

$$g_k \frac{\partial U^k}{\partial \overline{w}} d\overline{w} = -g_k (1-t) L d\overline{w}, \tag{B.2}$$

where I used the envelope theorem. In terms of fiscal externalities, first, there is a change in income tax collection proportional to the behavioral responses in employment:

$$\frac{\partial L}{\partial \overline{w}} \Delta T d\overline{w} = -L \frac{\eta_w}{\overline{w}} \Delta T d\overline{w}. \tag{B.3}$$

Finally, the behavioral response in domestic pre-tax profits generates a fiscal loss in corporate tax revenue:

$$t \frac{\partial \Pi}{\partial \overline{w}} d\overline{w} = -t \frac{\Pi}{\overline{w}} \epsilon_w d\overline{w}. \tag{B.4}$$

The minimum wage increase is desirable if the sum of all effects is positive. Adding all these effects yields equation (9).

**Proposition 2.** The reform package does not affect $T_0$. The welfare of employed workers is unaffected since $d(w - T_1) = d\overline{w} - d\overline{w} = 0$. Then, there are no changes in labor supply. Also, by design, the capitalist's welfare is unaffected since $d(1-t)$ is chosen such that $d\left[U^k\right] = 0$. Finally, the reform package affects labor demand and, therefore, equilibrium employment. Changes in employment may generate welfare effects depending on the rationing assumption. In addition, the reform package generates three fiscal effects. The net effect determines the desirability of the reform package.

First, there are fiscal savings driven by the change in the tax for employed workers, $dT_1$. This fiscal effect is equal to $Ld\overline{w}$.

Second, changes in employment generate a fiscal externality that depends on the relative tax liabilities between employed and unemployed workers. This fiscal effect is equal to $dL\Delta T$. If employment falls, and the earnings of the employed workers are taxed ($T_1 > T_0$), this fiscal externality is costly for the social planner, and vice versa. The employment effect also generates a welfare cost equal to $dLg_1^M$. Note that:

$$dL = \frac{\partial L^D}{\partial \overline{w}} d\overline{w} + \frac{\partial L^D}{\partial (1-t)} d(1-t) = L\left(-\frac{\eta_w}{\overline{w}} d\overline{w} + \frac{\eta_{1-t}}{1-t} d(1-t)\right). \tag{B.5}$$

Third, there is a fiscal cost in corporate tax revenue driven by the tax cut $dt$. Corporate tax revenue is given by $t\Pi$. Then, the corporate tax revenue cost is given by:

$$\begin{aligned} d\left[t\Pi\right] &= -d(1-t)\Pi + td\Pi, \\ &= -d(1-t)\Pi + t\left(\frac{\partial \Pi}{\partial \overline{w}} d\overline{w} + \frac{\partial \Pi}{\partial (1-t)} d(1-t)\right), \\ &= -d(1-t)\Pi + t\left(-\frac{\Pi}{\overline{w}}\epsilon_w d\overline{w} + \frac{\Pi}{1-t}\epsilon_{1-t} d(1-t)\right). \end{aligned} \tag{B.6}$$

The reform is desirable if:

$$\begin{aligned} & Ld\overline{w} + L\left(-\frac{\eta_w}{\overline{w}} d\overline{w} + \frac{\eta_{1-t}}{1-t} d(1-t)\right)(\Delta T + g_1^M) \\ & -d(1-t)\Pi + t\left(-\frac{\Pi}{\overline{w}}\epsilon_w d\overline{w} + \frac{\Pi}{1-t}\epsilon_{1-t} d(1-t)\right) \quad > \quad 0. \end{aligned} \tag{B.7}$$

Recall that $d(1-t)$ is chosen such that $d\left[U^k\right] = 0$. Using the envelope theorem:

$$d\left[U^k\right] = d(1-t)\Pi - (1-t)Ld\overline{w} = 0, \tag{B.8}$$

which implies that $d(1-t)\Pi = (1-t)Ld\overline{w}$.

Then, condition (B.7) plus algebra can be written as:

$$\frac{\Delta T + g_1^M}{\overline{w}}\left(-\eta_w + \frac{L\overline{w}}{\Pi}\eta_{1-t}\right) + t\left(1 - \frac{\Pi\epsilon_w}{L\overline{w}} + \epsilon_{1-t}\right) > 0. \tag{B.9}$$

**Proposition 3.** The reform package does not affect $T_0$. The welfare of employed workers is unaffected since $d(w - T_1) = d\overline{w} - d\overline{w} = 0$. Then, there are no changes in labor supply. Also, by design, employment is unaffected since $d(1-t)$ is chosen such that labor demand is constant. Then, the reform generates three effects: two fiscal effects and a welfare effect on the capitalist.

First, there are fiscal savings driven by the change in the tax for employed workers, $dT_1$. This fiscal effect is equal to $Ld\overline{w}$.

Second, there is a fiscal cost in corporate tax revenue driven by the tax cut $d(1-t)$ and the minimum wage change $d\overline{w}$. Corporate tax revenue is given by $t\Pi$. Then, the fiscal externality is given by:

$$\begin{aligned} d\left[t\Pi\right] &= -d(1-t)\Pi + td\Pi, \\ &= -d(1-t)\Pi + t\left(\frac{\partial \Pi}{\partial \overline{w}}d\overline{w} + \frac{\partial \Pi}{\partial(1-t)}d(1-t)\right), \\ &= -d(1-t)\Pi + t\left(-\frac{\Pi}{\overline{w}}\epsilon_w d\overline{w} + \frac{\Pi}{1-t}\epsilon_{1-t}d(1-t)\right). \end{aligned} \tag{B.10}$$

Third, there is a welfare effect on capitalists valued in $g_k$:

$$g_k dU^k = g_k\left[d(1-t)\Pi - (1-t)Ld\overline{w}\right], \tag{B.11}$$

where I used the envelope theorem.

The reform is desirable if:

$$\begin{aligned} & Ld\overline{w} - d(1-t)\Pi + t\left(-\frac{\Pi}{\overline{w}}\epsilon_w d\overline{w} + \frac{\Pi}{1-t}\epsilon_{1-t}d(1-t)\right) + g_k\left[d(1-t)\Pi - (1-t)Ld\overline{w}\right] > 0 \quad \text{(B.12)} \\ \Leftrightarrow \quad & Ld\overline{w}\left(1-(1-t)g_k\right) - d(1-t)\Pi(1-g_k) + t\left(-\frac{\Pi}{\overline{w}}\epsilon_w d\overline{w} + \frac{\Pi}{(1-t)}\epsilon_{1-t}d(1-t)\right) > 0. \quad \text{(B.13)} \end{aligned}$$

Recall that $d(1-t)$ is chosen such that $dL = 0$. Then:

$$\begin{aligned} dL &= \frac{\partial L}{\partial \overline{w}}d\overline{w} + \frac{\partial L}{\partial(1-t)}d(1-t), \\ &= -L\frac{\eta_w}{\overline{w}}d\overline{w} + L\frac{\eta_{1-t}}{1-t}d(1-t) = 0, \end{aligned} \tag{B.14}$$

which implies that:

$$d(1-t) = \frac{(1-t)\eta_w}{\overline{w}\eta_{1-t}}d\overline{w}. \tag{B.15}$$

Then, condition (B.13) plus algebra can be written as:

$$1-(1-t)g_k > \frac{\Pi}{L\overline{w}}\left((1-t)(1-g_k)\frac{\eta_w}{\eta_{1-t}} + t\left(\epsilon_w - \epsilon_{1-t}\frac{\eta_w}{\eta_{1-t}}\right)\right). \tag{B.16}$$

**Proposition 4.** Using $\rho^s L_A^s = L_a^s - \int E_m^s dm$ and $L_I^l + L_I^h + L_A^l + L_A^h = 1$, I can write the Lagrangian of the planner as follows:

$$
\begin{aligned}
\mathcal{L} \;=\;& \left(L_I^l + L_I^h\right)\omega_L G\left(y_0\right) + K_I \omega_K G\left(t_0 + \overline{k}r^*\right) + \alpha_l \int_0^{U^l - y_0} \omega_L G\left(U^l - c\right) dF_l(c) \\
&+\alpha_h \int_0^{U^h - y_0} \omega_L G\left(U^h - c\right) dF_h(c) + \mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} \omega_K G\left(U^{Kj}(\psi, 1-t)\right) dO_j(\psi) \\
&+\gamma\left[\int \left(E_m^l\left(T\left(w_m^l\right) + y_0\right) + E_m^h\left(T\left(w_m^h\right) + y_0\right)\right) dm \right.\\
&\left. +t\mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*} \overline{\psi}\Pi^j(\psi, 1-t) dO_j(\psi) - y_0 - t_0 K_I \right]. \qquad \text{(B.17)}
\end{aligned}
$$

Introducing a minimum wage is desirable if $d\mathcal{L}/d\overline{w} > 0$. The total derivative is given by:

$$
\begin{aligned}
\frac{d\mathcal{L}}{d\overline{w}} \;=\;& \left(\frac{dL_I^l}{d\overline{w}} + \frac{dL_I^h}{d\overline{w}}\right)\omega_L G\left(y_0\right) + \frac{dK_I}{d\overline{w}}\omega_K G\left(t_0 + \overline{k}r^*\right) \\
&+\alpha_l \int_0^{U^l - y_0} \omega_L G'\left(U^l - c\right) \frac{dU^l}{d\overline{w}} dF_l(c) + \alpha_l \omega_L G(y_0) f_l\left(U^l - y_0\right)\frac{dU^l}{d\overline{w}} \\
&+\alpha_h \int_0^{U^h - y_0} \omega_L G'\left(U^h - c\right) \frac{dU^h}{d\overline{w}} dF_h(c) + \alpha_h \omega_L G(y_0) f_h\left(U^h - y_0\right)\frac{dU^l}{d\overline{w}} \\
&+\mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} \omega_K G'\left(U^{Kj}(\psi, 1-t)\right) \frac{dU^{Kj}(\psi, 1-t)}{d\overline{w}} dO_j(\psi) \\
&-\mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \omega_K G\left(U^{Kj}(\psi_j^*, 1-t)\right) o_j(\psi_j^*)\frac{d\psi_j^*}{d\overline{w}} \\
&+\gamma\left[\int \left(\frac{dE_m^l}{d\overline{w}}\left(T\left(w_m^l\right) + y_0\right) + E_m^l T'\left(w_m^l\right)\frac{dw_m^l}{d\overline{w}}\right) dm \right.\\
&+\int \left(\frac{dE_m^h}{d\overline{w}}\left(T\left(w_m^h\right) + y_0\right) + E_m^h T'\left(w_m^h\right)\frac{dw_m^h}{d\overline{w}}\right) dm \\
&\left. +t\mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j \int_{\psi_j^*}^{\overline{\psi}} \frac{d\Pi^j(\psi, 1-t)}{d\overline{w}} dO_j(\psi) - t\mathcal{K}\sum_{j} \sigma_j \Pi^j(\psi_j^*, 1-t) o_j(\psi_j^*)\frac{d\psi_j^*}{d\overline{w}} - t_0\frac{dK_I}{d\overline{w}}\right]. \qquad \text{(B.18)}
\end{aligned}
$$

Note that $L_I^s = \alpha_s - L_A^s = \alpha_s\left(1 - F_l(U^l - y_0)\right)$. Then, $dL_I^s = -\alpha_s f_l(U^s - y_0)(dU^s/d\overline{w})$. Then, the first two terms in the first line cancel out with the second terms on the second and third lines. Similarly, note that $K_I = \mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j O_j(\psi_j^*)$ so $dK_I/d\overline{w} = \mathcal{K}\sum_{j\in\mathcal{J}} \sigma_j o_j(\psi_j^*)(d\psi_j^*/d\overline{w})$. Noting that $U^{Kj}(\psi_j^*, 1-t) = t_0 + \overline{k}r^*$, then the second term in the first line cancels out with the fifth line. Defining $dK_I^j/d\overline{w} = \sigma_j o_j(\psi_j^*)(d\psi_j^*/d\overline{w})$, so $\sum_j (dK_I^j/d\overline{w}) = dK_I/\overline{w}$, noting that $dK_A^j = -dK_I^j$, and using the WWs definitions, we have that:

$$\begin{aligned}\frac{1}{\gamma}\frac{d\mathcal{L}}{d\overline{w}} &= L_A^l g_1^l \frac{dU^l}{d\overline{w}} + L_A^h g_1^h \frac{dU^h}{d\overline{w}} + \mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j \int_{\psi_j^*}^{\overline{\psi}} g_\psi^j \frac{dU^{Kj}(\psi,1-t)}{d\overline{w}} dO_j(\psi) \\ &+ \int \left( \frac{dE_m^l}{d\overline{w}} \left( T\left(w_m^l\right) + y_0 \right) + E_m^l T'\left(w_m^l\right) \frac{dw_m^l}{d\overline{w}} \right) dm \\ &+ \int \left( \frac{dE_m^h}{d\overline{w}} \left( T\left(w_m^h\right) + y_0 \right) + E_m^h T'\left(w_m^h\right) \frac{dw_m^h}{d\overline{w}} \right) dm \\ &+ t\mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j \int_{\psi_j^*}^{\overline{\psi}} \frac{d\Pi^j(\psi,1-t)}{d\overline{w}} dO_j(\psi) + \sum_j \frac{dK_A^j}{d\overline{w}} \left( t\Pi^j(\psi_j^*,1-t) + t_0 \right). \end{aligned} \tag{B.19}$$

Differentiating equation (20) yields:

$$\begin{aligned} L_A^s \frac{dU^s}{d\overline{w}} &= \int \left( \frac{dE_m^s}{d\overline{w}} \left( w_m^s - T\left(w_m^s\right) - y_0 \right) + E_m^s \frac{dw_m^s}{d\overline{w}} \left( 1 - T'\left(w_m^s\right) \right) \right) dm \\ &- \frac{1}{L_A^s}\frac{dL_A^s}{d\overline{w}} \int E_m^s \left( w_m^s - T\left(w_m^s\right) - y_0 \right) dm. \end{aligned} \tag{B.20}$$

Using the elasticity concepts defined in equations (27) and (28), the expression equals:

$$\begin{aligned} \overline{w} L_A^s \frac{dU^s}{d\overline{w}} &= \int \left( E_m^s \mathcal{E}_E^{s,m} \left( w_m^s - T\left(w_m^s\right) - y_0 \right) + E_m^s w_m^s \mathcal{E}_W^{s,m} \left( 1 - T'\left(w_m^s\right) \right) \right) dm \\ &- \mathcal{E}_L^s \int E_m^s \left( w_m^s - T\left(w_m^s\right) - y_0 \right) dm. \end{aligned} \tag{B.21}$$

Also, in Appendix B.3 below, I show that:

$$\begin{aligned} \frac{dU^{Kj}(\psi,1-t)}{d\overline{w}} &= (1-t)\left( \frac{d\Pi^j(\psi,1-t)}{d\overline{w}} - \frac{r^*}{1-t}\frac{dk^j(\psi,1-t)}{d\overline{w}} \right), \\ &= (1-t)\frac{\Pi^j(\psi,1-t)}{\overline{w}}\mathcal{P}_\Pi^{\psi,j} - r^* \frac{k^j(\psi,1-t)}{\overline{w}}\mathcal{P}_k^{\psi,j}. \end{aligned} \tag{B.22}$$

Replacing these expressions in equation (B.19) yields:

$$\begin{aligned}
\frac{\overline{w}}{\gamma}\frac{d\mathcal{L}}{d\overline{w}} \quad = \quad & L_A^l g_1^l \int \frac{E_m^l}{L_A^l}\left((\mathcal{E}_E^{l,m}-\mathcal{E}_L^{l,m})\left(w_m^l - T\left(w_m^l\right)-y_0\right)+w_m^l\mathcal{E}_W^{l,m}\left(1-T'\left(w_m^l\right)\right)\right)dm \\
&+L_A^h g_1^h \int \frac{E_m^h}{L_A^h}\left((\mathcal{E}_E^{h,m}-\mathcal{E}_L^{h,m})\left(w_m^h - T\left(w_m^h\right)-y_0\right)+w_m^h\mathcal{E}_W^{h,m}\left(1-T'\left(w_m^h\right)\right)\right)dm \\
&+\mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j\int_{\psi_j^*}^{\overline{\psi}} g_\psi^j\left((1-t)\Pi^j(\psi,1-t)\mathcal{P}_\Pi^{\psi,j}-r^*k^j(\psi,1-t)\mathcal{P}_k^{\psi,j}\right)dO_j(\psi) \\
&+\int\left(E_m^l\mathcal{E}_E^{l,m}\left(T\left(w_m^l\right)+y_0\right)+E_m^l T'\left(w_m^l\right)w_m^l\mathcal{E}_W^{l,m}\right)dm \\
&+\int\left(E_m^h\mathcal{E}_E^{h,m}\left(T\left(w_m^h\right)+y_0\right)+E_m^h T'\left(w_m^h\right)w_m^h\mathcal{E}_W^{h,m}\right)dm \\
&+t\mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j\int_{\psi_j^*}^{\overline{\psi}}\Pi^j(\psi,1-t)\mathcal{P}_\Pi^{\psi,j}dO_j(\psi)+\sum_j K_A^j\mathcal{P}_{K_A}^{\psi,j}\left(t\Pi^j(\psi_j^*,1-t)+t_0\right). \qquad \text{(B.23)}
\end{aligned}$$

Noting that $\operatorname{sgn}(d\mathcal{L}/d\overline{w}) = \operatorname{sgn}(\overline{w}/\gamma)(d\mathcal{L}/d\overline{w})$ completes the proof.

## B.2 Additional results (Section 3)

**Additional terms in the two-skill two-industry model.** Consider a corporate tax cut $d(1-t)>0$. The corporate tax cut will generate an increase in high-skill labor demand. The increase in labor demand generates both an increase in high-skill employment and high-skill wages:

$$dL^h = \frac{\partial L^h}{\partial(1-t)}d(1-t) = \frac{L^h\eta_{1-t}^h}{1-t}d(1-t), \qquad dw^h = \frac{\partial w^h}{\partial(1-t)}d(1-t) = \frac{w^h\mathcal{W}_{1-t}^h}{1-t}d(1-t). \qquad \text{(B.24)}$$

By differentiating the labor market clearing condition, we can get a structural representation of $\mathcal{W}_{1-t}^h$ as a function of labor demand and labor supply elasticities (see the derivation of optimal taxes below). The employment effect does not generate a welfare effect on high-skill workers because of the envelope theorem (marginal high-skill workers are initially indifferent between states). The wage effect, however, generates a welfare effect on inframarginal high-skill employed workers equal to $g_2L^hdw^h$. The employment effect, however, generates a fiscal externality, since marginal workers switch from paying $T_0$ to paying $T_2$. The fiscal externality is, therefore, given by $dL^h\Delta T_2$.

The corporate tax cut also affects the capitalist's welfare and the corporate tax revenue. Formally:

$$dU^{k_h} = \Pi^h d(1-t), \qquad d[t\Pi^h] = -\Pi^h d(1-t) + td\Pi^h = -\Pi^h d(1-t) + \frac{t\Pi^h\epsilon_{1-t}^h}{1-t}d(1-t). \qquad \text{(B.25)}$$

The welfare effect is simplified by the envelope theorem, and valued in $g_k^h$. The fiscal externality contains both a mechanical effect from the smaller taxes and a behavioral effect from the pre-tax profit responses.

The sum of all these terms leads to equation (15). These effects are incorporated in the proposition as follows. For Proposition 2, we set $d(1-t) = (1-t)L^l d\overline{w}/\Pi^l$ and normalize the expression by $1/L^l d\overline{w}$. For Proposition 3, we set $d(1-t) = (1-t)\eta_w^l d\overline{w}/\overline{w}\eta_{1-t}^l$ and normalize the expression by $1/L^l d\overline{w}$.

**Closed-form solutions for the Cobb-Douglas case.** Consider the case where $\phi(l,k) = \psi\left(l^{1-a}k_l^a\right)^b = \psi l^\alpha k^\beta$, with $\alpha+\beta = b < 1$. The first-order-conditions of the capitalist are given by:

$$\begin{aligned} \psi\alpha l^{\alpha-1}k^\beta &= w, && \text{(B.26)} \\ (1-t)\psi\beta l^\alpha k^{\beta-1} &= r^*, && \text{(B.27)} \end{aligned}$$

which implies that:

$$k = l\left[\frac{w(1-t)\beta}{\alpha r^*}\right] \equiv l\Omega(w, 1-t). \tag{B.28}$$

Solving for $L^D(w,1-t)$ yields:

$$L^D(w,1-t) \quad = \quad \psi^{\frac{1}{1-\alpha-\beta}}\left(\frac{\alpha}{w}\right)^{\frac{1-\beta}{1-\alpha-\beta}}\left(\frac{(1-t)\beta}{r^*}\right)^{\frac{\beta}{1-\alpha-\beta}}. \tag{B.29}$$

Note that:

$$\begin{aligned} \Pi(w,1-t) &= \phi\left(L^D(w,1-t), L^D(w,1-t)\Omega(w,1-t)\right) - wL^D(w,1-t), \\ &= \psi L^D(w,1-t)^{\alpha+\beta}\Omega(w,1-t)^\beta - wL^D(w,1-t), \\ &= L^D(w,1-t)\left[\psi L(w,1-t)^{\alpha+\beta-1}\Omega(w,1-t)^\beta - w\right], \\ &= L^D(w,1-t)\left[\psi\frac{1}{\psi}\left(\frac{w}{\alpha}\right)^{1-\beta}\left(\frac{r^*}{(1-t)\beta}\right)^\beta\left[\frac{w(1-t)\beta}{\alpha r^*}\right]^\beta - w\right], \\ &= L^D(w,1-t)w\frac{1-\alpha}{\alpha}. && \text{(B.30)} \end{aligned}$$

This implies that:

$$\begin{aligned} \log L^D(w,1-t) &= A_L - \frac{1-\beta}{1-\alpha-\beta}\log w + \frac{\beta}{1-\alpha-\beta}\log(1-t), && \text{(B.31)} \\ \log\Pi(w,1-t) &= \log L^D(w,1-t) + \log w + \log\left(\frac{1-\alpha}{\alpha}\right), && \text{(B.32)} \end{aligned}$$

where $A_L = \log\left(\psi^{\frac{1}{1-\alpha-\beta}}\alpha^{\frac{1-\beta}{1-\alpha-\beta}}\left(\frac{\beta}{r^*}\right)^{\frac{\beta}{1-\alpha-\beta}}\right)$. It follows that:

$$\eta_w = \frac{1-\beta}{1-\alpha-\beta} = \frac{1-ab}{1-b}, \tag{B.33}$$

$$\eta_{1-t} = \frac{\beta}{1-\alpha-\beta} = \frac{ab}{1-b}, \tag{B.34}$$

$$\begin{aligned}\epsilon_w &= \eta_w - 1 \\ &= \frac{\alpha}{1-\alpha-\beta} = \frac{(1-a)b}{1-b},\end{aligned} \tag{B.35}$$

$$\begin{aligned}\epsilon_{1-t} &= \eta_{1-t} \\ &= \frac{\beta}{1-\alpha-\beta} = \frac{ab}{1-b},\end{aligned} \tag{B.36}$$

$$\frac{\Pi}{Lw} = \frac{1-\alpha}{\alpha} = \frac{1-(1-a)b}{(1-a)b}. \tag{B.37}$$

**Optimal taxes with no minimum wage.** The Lagrangian is given by:

$$\begin{aligned}\mathcal{L}(T_0, \Delta T_1, \Delta T_2, 1-t, \gamma) &= (2 - L^l - L^h)\omega_L G(-T_0) + \int_0^{w^l - \Delta T_1} \omega_L G(w^l - \Delta T_1 - T_0 - c) dF_l(c) \\ &\quad \int_0^{w^h - \Delta T_2} \omega_L G(w^h - \Delta T_2 - T_0 - c) dF_h(c) + \omega_K G(U^{K_l}) + \omega_K G(U^{K_h}) \\ &\quad + \gamma\left[2T_0 + L^l \Delta T_1 + L^h \Delta T_2 + t(\Pi^l + \Pi^h)\right].\end{aligned} \tag{B.38}$$

Conditional on $(\Delta T_1, \Delta T_2)$, $T_0$ does not affect labor supply and, therefore, employment or wages. Then:

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial T_0} &= -(2 - L^l - L^h)\omega_L G'(-T_0) - \omega_L \int_0^{w^l - \Delta T_1} G'(w^l - \Delta T_1 - T_0 - c) dF_l(c) \\ &\quad - \omega_L \int_0^{w^h - \Delta T_2} G'(w^h - \Delta T_2 - T_0 - c) dF_h(c) + 2\gamma = 0,\end{aligned} \tag{B.39}$$

which can be rewritten as $(2 - L^l - L^h)g_0 + L^l g_1 + L^h g_2 = 2$.

The FOC w.r.t. $\Delta T_1$ is given by:

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial \Delta T_1} &= -\frac{\partial L^l}{\partial \Delta T_1}\omega_L G(-T_0) + \omega_L G(-T_0) f_l(w^l - \Delta T_1)\left(\frac{\partial w^l}{\partial \Delta T_1} - 1\right) \\ &\quad + \int_0^{w^l - \Delta T_1} \omega_L G'(w^l - \Delta T_1 - T_0 - c) dF_l(c)\left(\frac{\partial w^l}{\partial \Delta T_1} - 1\right) \\ &\quad - \omega_K G'(U^{K_l})(1-t)L^l \frac{\partial w^l}{\partial \Delta T_1} + \gamma \frac{\partial L^l}{\partial \Delta T_1}\Delta T_1 + \gamma L^l + \gamma t \frac{\partial \Pi^l}{\partial w^l}\frac{\partial w^l}{\partial \Delta T_1} = 0,\end{aligned} \tag{B.40}$$

where I used the envelope theorem on $U^{K_l}$. Since $L^l = F_l(w^l - \Delta T_1)$, $\partial L^l / \partial \Delta T_1 = f_l(w^l - \Delta T_1)(\partial w^l / \partial \Delta T_1 -$

1). Then, the two first terms cancel and the FOC can be written as:

$$\frac{\partial \mathcal{L}}{\partial \Delta T_1} = L^l g_1 \left( \frac{\partial w^l}{\partial \Delta T_1} - 1 \right) - g_k^l (1-t) L^l \frac{\partial w^l}{\partial \Delta T_1} - \frac{L^l \eta_w^l}{w^l} \frac{\partial w^l}{\partial \Delta T_1} \Delta T_1 + L^l - t \frac{\Pi^l \epsilon_w^l}{w^l} \frac{\partial w^l}{\partial \Delta T_1} = 0 \quad (B.41)$$

Because of labor market segmentation, a similar argument yields:

$$\frac{\partial \mathcal{L}}{\partial \Delta T_2} = L^h g_2 \left( \frac{\partial w^h}{\partial \Delta T_2} - 1 \right) - g_k^h (1-t) L^h \frac{\partial w^h}{\partial \Delta T_2} - \frac{L^h \eta_w^h}{w^h} \frac{\partial w^h}{\partial \Delta T_2} \Delta T_2 + L^h - t \frac{\Pi^h \epsilon_w^h}{w^h} \frac{\partial w^h}{\partial \Delta T_2} = 0 \quad (B.42)$$

The FOC w.r.t. $(1-t)$ is given by:

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial (1-t)} = & -\frac{\partial L^l}{\partial (1-t)} \omega_L G(-T_0) + \omega_L G(-T_0) f_l(w^l - \Delta T_1) \frac{\partial w^l}{\partial (1-t)} \\
& + \int_0^{w^l - \Delta T_1} \omega_L G'(w^l - \Delta T_1 - T_0 - c) dF_l(c) \frac{\partial w^l}{\partial (1-t)} \\
& - \frac{\partial L^h}{\partial (1-t)} \omega_L G(-T_0) + \omega_L G(-T_0) f_h(w^h - \Delta T_2) \frac{\partial w^h}{\partial (1-t)} \\
& + \int_0^{w^h - \Delta T_2} \omega_L G'(w^h - \Delta T_2 - T_0 - c) dF_h(c) \frac{\partial w^h}{\partial (1-t)} \\
& + \omega_K G'(U^{K_l}) \left( \Pi^l - (1-t) L^l \frac{\partial w^l}{\partial (1-t)} \right) + \omega_K G'(U^{K_h}) \left( \Pi^h - (1-t) L^h \frac{\partial w^h}{\partial (1-t)} \right) \\
& + \gamma \frac{\partial L^l}{\partial (1-t)} \Delta T_1 + \gamma \frac{\partial L^h}{\partial (1-t)} \Delta T_2 - \gamma (\Pi^l + \Pi^h) \\
& + \gamma t \left( \frac{\partial \Pi^l}{\partial (1-t)} + \frac{\partial \Pi^l}{\partial w^l} \frac{\partial w^l}{\partial (1-t)} + \frac{\partial \Pi^h}{\partial (1-t)} + \frac{\partial \Pi^h}{\partial w^h} \frac{\partial w^h}{\partial (1-t)} \right) = 0, \qquad (B.43)
\end{aligned}$$

where I used the envelope theorem on $U^{K_s}$. Since $L^l = F_l(w^l - \Delta T_1)$ and $L^h = F_h(w^h - \Delta T_2)$, $\partial L^l / \partial (1-t) = f_l(w^l - \Delta T_1)(\partial w^l / \partial (1-t))$ and $\partial L^h / \partial (1-t) = f_h(w^h - \Delta T_2)(\partial w^h / \partial (1-t))$. Then, the FOC can be written as:

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial (1-t)} = & L^l g_1 \frac{\partial w^l}{\partial (1-t)} + L^h g_2 \frac{\partial w^h}{\partial (1-t)} + g_k^l \left( \Pi^l - (1-t) L^l \frac{\partial w^l}{\partial (1-t)} \right) + g_k^h \left( \Pi^h - (1-t) L^h \frac{\partial w^h}{\partial (1-t)} \right) \\
& + \left( \frac{L^l \eta_{1-t}^l}{1-t} - \frac{L^l \eta_w^l}{w^l} \frac{\partial w^l}{\partial (1-t)} \right) \Delta T_1 + \left( \frac{L^h \eta_{1-t}^h}{1-t} - \frac{L^h \eta_w^h}{w^h} \frac{\partial w^h}{\partial (1-t)} \right) \Delta T_2 \\
& - \Pi^l - \Pi^h + t \left( \frac{\Pi^l \epsilon_{1-t}^l}{1-t} - \frac{\Pi^l \epsilon_w^l}{w^l} \frac{\partial w^l}{\partial (1-t)} + \frac{\Pi^h \epsilon_{1-t}^h}{1-t} - \frac{\Pi^h \epsilon_w^h}{w^h} \frac{\partial w^h}{\partial (1-t)} \right) = 0. \qquad (B.44)
\end{aligned}$$

Note that $F_l(w^l - \Delta T_1) = L_l^D(w^l, 1-t)$. Then:

$$f_l(w^l - \Delta T_1) \left( dw^l - d\Delta T_1 \right) = \frac{\partial L_l^D}{\partial w^l} dw^l + \frac{\partial L_l^D}{\partial (1-t)} d(1-t). \qquad (B.45)$$

It follows that:

$$\frac{\partial w^l}{\partial \Delta T_1} = \frac{f_l(w^l - \Delta T_1)}{f_s(w^l - \Delta T_1) + \frac{\eta_w^l L^l}{w^l}} > 0, \tag{B.46}$$

$$\frac{\partial w^l}{\partial (1-t)} = \frac{\frac{L^l \eta_{1-t}^l}{1-t}}{f_l(w^l - \Delta T_1) + \frac{\eta_w^l L^l}{w^l}} > 0. \tag{B.47}$$

Similar expressions can be written for $\partial w^h/\partial \Delta T_2$ and $\partial w^h/\partial(1-t)$.

## B.3 Additional results (Section 4)

**Firm's problem.** To simplify exposition, I omit the superscript $j$ from revenue and profit functions. The first-order conditions of firms are given by:

$$w^s : \qquad (\phi_s - w^s)\, \tilde{q}_w^s = \tilde{q}^s, \tag{B.48}$$

$$v^s : \qquad (\phi_s - w^s)\, \tilde{q}^s = \eta_v^s, \tag{B.49}$$

$$k : \qquad (1-t)\phi_k = r^*, \tag{B.50}$$

for $s \in \{l, h\}$, where $\phi_s = \partial \phi / \partial n^s$ and arguments are omitted from functions to simplify notation. Is direct from the FOCs that wages are below the marginal productivities, that is, that $\phi_s > w^s$. Moreover, defining the firm-specific labor supply elasticity as $\varepsilon^s = (\partial n^s/\partial w^s)\,(w^s/n^s) = \widetilde{q}_w^s w^s/\widetilde{q}^s$, we can rearrange equation (B.48) and write $\phi_s/w_s = 1/\varepsilon^s + 1$, which is the standard markdown equation (Robinson, 1933). In this model, $\varepsilon^s$ is endogenous and finite because of the matching frictions.

Combining the FOCs of $w^s$ and $v^s$ yields $\tilde{q}^{s2} = \eta_v^s \tilde{q}_w^s$. Differentiating and rearranging terms yields:

$$\frac{dw^s}{dv^s} = \frac{\eta_{vv}^s \tilde{q}_w^s}{2\tilde{q}^s \tilde{q}_w^s - \eta_v^s \tilde{q}_{ww}^s} > 0, \tag{B.51}$$

provided $\tilde{q}^s_{ww} < 0$.[1] Also, differentiating equation (B.49) yields:

$$(d\phi_s - dw^s)\,\tilde{q}^s + (\phi_s - w^s)\,\tilde{q}^s_w dw^s \quad = \quad \eta^s_{vv} dv^s. \tag{B.52}$$

Note that:

$$d\phi_s \quad = \quad \phi_{ss}\left(\tilde{q}^s_w dw^s v^s + \tilde{q}^s dv^s\right) + \phi_{s,-s}\cdot\left(\tilde{q}^{-s}_w \cdot dw^{-s}\cdot v^{-s} + \tilde{q}^{-s}\cdot dv^{-s}\right), \tag{B.53}$$

where $-s$ is the other skill type. Replacing equations (B.48) and (B.53) in equation (B.52), yields:

$$\left(\phi_{ss}\cdot\left[\tilde{q}^s_w\cdot dw^s\cdot v^s + \tilde{q}^s\cdot dv^s\right] + \phi_{sj}\cdot\left[\tilde{q}^j_w\cdot dw^j\cdot v^j + \tilde{q}^j\cdot dv^j\right]\right)\cdot\tilde{q}^s = \eta^s_{vv}\cdot dv^s. \tag{B.54}$$

Rearranging terms gives:

$$\frac{dv^s}{dv^{-s}} \quad = \quad \left[\phi_{s,-s}\left(\tilde{q}^{-s}_w\cdot\frac{dw^{-s}}{dv^{-s}}v^{-s} + \tilde{q}^{-s}\right)\right]^{-1}\left[\frac{\eta^s_{vv}}{\psi\tilde{q}^s} - \phi_{ss}\left(\tilde{q}^s_w\frac{dw^s}{dv^s}v^s + \tilde{q}^s\right)\right], \tag{B.55}$$

which, given equation (B.51), implies that $\operatorname{sgn}\left(dv^s/dv^{-s}\right) = \operatorname{sgn}\phi_{s,-s}$.

**Notion of equilibrium.** Define by $\Gamma : \left\{(\psi, j)\in\Psi\times\mathcal{J} : \psi\geq\psi^*_j\right\}\to[\underline{m},\overline{m}]$ the function that maps active firm types to equilibrium wages that are indexed by sub-markets. The pre-image of $\Gamma$ does not need to be single-valued (i.e., $\Gamma$ is not necessarily a one-to-one function) since different $(\psi, j)$ types may generate similar $w^s$ values. Since matching functions and vacancy costs do not vary with $j$, then it follows from the FOCs of the firm that whenever two firms post the same wage, they also post the same vacancies. Then, given $\Gamma$, we can index wages and vacancies by $m$ or $(\psi, j)$ pairs. For each pair $(s, m)$, let $I(s,m)\subset\left\{(\psi, j)\in\Psi\times\mathcal{J} : \psi\geq\psi^*_j\right\}$ be the (possibly singleton) set of $(\psi, j)$ pairs that induce the same wage, $w^s$. Let $\iota$ be the index of elements within that set. An equilibrium of the model is given by:

$$\left\{U^l, U^h, \left\{\psi^*_j\right\}^J_{j=1}, \left\{v^s_m\right\}_{s\in\{l,h\}, m\in[\underline{m},\overline{m}]}, \left\{w^s_m\right\}_{s\in\{l,h\}, m\in[\underline{m},\overline{m}]}, \left\{L^s_m\right\}_{s\in\{l,h\}, m\in[\underline{m},\overline{m}]}, \left\{k^j(\psi)\right\}^J_{j=1,\psi\in\Psi}\right\} \tag{B.56}$$

[1] Ignoring the skill superscripts, note that $\tilde{q}_w = q_\theta(\partial\theta/\partial w)$, which is positive in equilibrium since $U$ is fixed. Then:

$$\tilde{q}_{ww} = q_{\theta\theta}\left(\frac{\partial\theta}{\partial w}\right)^2 + q_\theta\frac{\partial^2\theta}{\partial w^2}.$$

In principle, the sign of $\tilde{q}_{ww}$ is ambiguous, since $q_{\theta\theta} > 0$ and $\partial^2\theta/\partial w^2 > 0$. I assume that the second term dominates so $\tilde{q}_{ww} < 0$. If $\mathcal{M}(L,V) = L^\delta V^{1-\delta}$, $\operatorname{sgn}\left[\tilde{q}_{ww}\right] = \operatorname{sgn}\left[\frac{-(1-T'(w))^2}{1-\delta} - T''(w)\right]$, so the condition holds as long as the tax system is not "too concave". For the result above, $\tilde{q}_{ww} < 0$ is a sufficient but not necessary condition, that is, $\tilde{q}_{ww}$ is allowed to be *moderately* positive, which is plausible since the opposite forces in $\tilde{q}_{ww}$ are interrelated. $q_{\theta\theta} > 0$ follows from the concavity and constant returns to scale of the matching function. To see why $\partial^2\theta/\partial w^2 > 0$, recall that $dU = p_\theta d\theta_m(w_m - T(w_m) - y_0) + p_m(1-T'(w))dw_m$. Setting $dU = 0$ and differentiating again yields:

$$0 \quad = \quad \left(y_m p_{\theta\theta}\frac{\partial\theta_m}{\partial w_m} + 2p_\theta(1-T'(w_m))\right)\frac{\partial\theta_m}{\partial w_m} + p_\theta y_m\frac{\partial^2\theta_m}{\partial w_m^2} - p_m T''(w_m),$$

which implies that $\partial^2\theta/\partial w^2 > 0$ as long as the tax system is not "too concave".

where $[\underline{m}, \overline{m}]$ is the mass of active sub-markets that are mapped from the distribution of active types $(\psi, j)$ such that $\psi \in [\psi_j^*, \overline{\psi}]$. The equilibrium objects solve the following equations:

- **Firm optimality**: we can partition the set $\{k^j(\psi)\}$ into values for $\psi \in [\underline{\psi}, \psi_j^*)$ and $\psi \in [\psi_j^*, \overline{\psi}]$. For the first set, we fix $k^j(\psi) = 0$. For the second set, we define $k_m$ analogously to $(w_m^s, v_m^s)$. Then, the set $(v_m^l, v_m^h, w_m^l, w_m^h, k_m)$ solves the FOCs of firms of type $(\psi, j) \in \Gamma^{-1}(m)$ (equations (B.48)-(B.50)), taking $\{\psi_j^*\}$, $U^l$, and $U^h$ as given, for all $m \in [\underline{m}, \overline{m}]$.

- **Capitalists' participation constraint**: the vector $\psi_j^*$ solves:

$$(1-t)\pi^j \left( w^{lj}(\psi_j^*), w^{hj}(\psi_j^*), v^{lj}(\psi_j^*), v^{hj}(\psi_j^*), k^j(\psi_j^*); \psi_j^* \right) - r^* k^j(\psi) = \xi + t_0,$$

  taking $\{(v_m^l, v_m^h, w_m^l, w_m^h)\}$, $\{k^j(\psi)\}$, $U^l$, and $U^h$ as given, for all $j \in \mathcal{J}$, where $x^j(\psi)$ are mapped to $x_m$ as described above, for $x \in \{w^l, w^h, v^l, v^h, k\}$.

- **Across sub-markets equilibrium condition**: the set $L_m^s$ solves $U^s = p_m^s y_m^s + (1-p_m^s) y_0$, taking $U^l$, $U^h$, $v_m^s$, and $w_m^s$ as given, for $s \in \{l, h\}$ and for all $m \in [\underline{m}, \overline{m}]$, where $y_m^s = w_m^s - T(w_m^s)$ and $p_m^s = p^s(\theta_m^s) = p^s \left( \frac{\mathcal{K} v_m^s \sum_{\iota \in \mathcal{I}(s,m)} \sigma_{j_\iota} o_{j_\iota}(\psi_\iota)}{L_m^s} \right)$.

- **Workers' participation constraint**: $U^s$ solves $\int L_m^s dm = F_s(U^s - y_0)$, taking $\{L_m^s\}$ as given, for $s \in \{l, h\}$.

**Efficiency properties of the decentralized equilibrium.** Without loss of generality, consider a case where there is a unique skill type and a unique $j$-type; the argument naturally extends given the segmented markets assumption and the fixed portions $\alpha_s$ and $\sigma_j$ of types. A social planner who only cares about efficiency decides on sequences of vacancies, applicants, and capital to maximize the total output net of costs for firms and workers (including opportunity costs), internalizing the existence of matching frictions. The objective function is given by:

$$\mathcal{V} \;=\; \mathcal{K} \int_{\psi^*}^{\overline{\psi}} \left[ \phi(\psi, n, k_\psi) - \eta(v_\psi) - \xi - k_\psi r^* \right] dO(\psi) - \alpha \int_0^{c^*} c dF(c), \tag{B.57}$$

and the restrictions are given by:

$$n \;=\; q\left( \frac{\mathcal{K} v_\psi o(\psi)}{L_\psi} \right) v_\psi, \tag{B.58}$$

$$\int_{\psi^*}^{\overline{\psi}} L_\psi d\psi \;=\; \alpha F(c^*), \tag{B.59}$$

where $\{c^*, \psi^*\}$ are the thresholds for workers and firms to enter the labor market, and $\{v_\psi, k_\psi, L_\psi\}$ are the sequences of vacancies, capital, and applicants, with $\theta_\psi = (\mathcal{K} v_\psi o(\psi))/L_\psi$. The planner chooses $\{c^*, \psi^*\}$ and $\{v_\psi, k_\psi, L_\psi\}$ to maximize (B.57) subject to (B.58) (matches are endogenous to the number of applicants and vacancies) and (B.59) (the distribution of applicants across firms has to be consistent with the number of active workers). The Lagrangian is given by:

$$\begin{aligned}\mathcal{L} &= \mathcal{K}\int_{\psi^*}^{\overline{\psi}}\left[\phi\left(\psi, q\left(\frac{\mathcal{K}v_\psi o(\psi)}{L_\psi}\right)v_\psi, k_\psi\right) - \eta(v_\psi) - \xi - k_\psi r^*\right]dO(\psi) \\ &\quad -\alpha\int_0^{c^*} c dF(c) + \mu\left[\alpha F(c^*) - \int_{\psi^*}^{\overline{\psi}} L_\psi d\psi\right], \end{aligned} \tag{B.60}$$

where $\mu$ is the multiplier. The first order conditions with respect to $v_\psi$, $k_\psi$, $L_\psi$, and $c^*$ are given by:

$$v_\psi : \qquad \phi_n\left(q_\theta\theta_\psi + q\right) = \eta_v, \tag{B.61}$$

$$k_\psi : \qquad \phi_k = r^*, \tag{B.62}$$

$$L_\psi : \qquad -\theta_\psi^2 q_\theta \phi_n = \mu, \tag{B.63}$$

$$c^* : \qquad -\alpha c^* f(c^*) + \mu\alpha f(c^*) = 0. \tag{B.64}$$

First, we note that equation (B.62) coincides with the decentralized first order condition for capital when $t = 0$ (see equation (B.50)). Then, the decentralized equilibrium is efficient in terms of capital.

Equation (B.64) implies that $\mu = c^*$. Using that and combining equations (B.61) and (B.63) yields:

$$q\phi_n - \frac{c^*}{\theta_\psi} = \eta_v. \tag{B.65}$$

To assess the efficiency of vacancy posting decisions and application decisions, I check whether equation (B.65) is consistent with the decentralized equilibrium. In the absence of taxes, the threshold for workers' entry is given by $U = p(\theta_\psi)w_\psi$, which holds for any $\psi$. We also know, from the properties of the matching function, that $p(\theta_\psi) = \theta_\psi q(\theta_\psi)$. Replacing in equation (B.65) yields $q\left(\phi_n - w_\psi\right) = \eta_v$, which coincides with the decentralized first order condition of the firms for vacancies (see equation (B.49)). Then, the decentralized equilibrium is efficient in terms of vacancy postings and applications.

The first order condition with respect to $\psi^*$ is given by:

$$\psi^* : \qquad -\mathcal{K}\left(\phi\left(\psi^*, q\left(\theta_{\psi^*}\right)v_{\psi^*}, k_{\psi^*}\right) - \eta\left(v_{\psi^*}\right) - \xi - k_{\psi^*}r^*\right)o\left(\psi^*\right) - \mu L_{\psi^*} = 0. \tag{B.66}$$

Equation (B.66) can be written as:

$$\phi\left(\psi^*, q\left(\theta_{\psi^*}\right)v_{\psi^*}, k_{\psi^*}\right) - \eta\left(v_{\psi^*}\right) - \frac{\mu L_{\psi^*}}{\mathcal{K}o\left(\psi^*\right)} = \xi + k_\psi r^*. \tag{B.67}$$

Note that $\mu L_{\psi^*}/\mathcal{K}o\left(\psi^*\right) = c^* v_{\psi^*}/\theta_{\psi^*}$. Then, $c^* = p\left(\theta_{\psi^*}\right)w_{\psi^*}$ and $p(\theta_{\psi^*}) = \theta_{\psi^*}q(\theta_{\psi^*})$ imply that $c^* v_{\psi^*}/\theta_{\psi^*} = w_{\psi^*}q(\theta_{\psi^*})v_{\psi^*}$, which implies that equation (B.66) is equivalent to $\Pi\left(\psi^*\right) = \xi + k_\psi r^*$, which coincides with the decentralized equilibrium in the absence of taxes. Therefore, the decentralized equilibrium is efficient. $\square$

**Responses to changes in the minimum wage.** I first analyze the effects of minimum wage changes on worker-level objects. Consider first the sub-population of low-skill workers. In equilibrium, $U^l = p^l(\theta^l_m)y^l_m + (1-p^l(\theta^l_m))y_0$, for all sub-markets $m$. Let $i_1$ be the sub-market for which the minimum wage is binding, so $w^l_{i_1} = \overline{w}$. Differentiating yields:

$$\frac{dU^l}{d\overline{w}} \quad = \quad p^l_\theta \frac{d\theta^l_{i_1}}{d\overline{w}}(\overline{w} - T(\overline{w}) - y_0) + p^l(\theta^l_{i_1})(1 - T'(\overline{w})). \tag{B.68}$$

Since $p^s(\theta^l_{i_1}) > 0$, and assuming $T'(\overline{w}) < 1$, $dU^l/d\overline{w} = d\theta^l_{i_1}/d\overline{w} = 0$ is not a feasible solution to equation (B.68). This implies that changes in $\overline{w}$ necessarily affect the equilibrium values of $U^l$, $\theta^l_{i_1}$, or both.

An increase in the minimum wage mechanically makes minimum wage jobs more attractive for low-skill workers. This effect is captured by the second term in the right-hand-side of equation (B.68). The increased attractiveness attracts new applicants toward minimum-wage sub-markets thus pushing $\theta^l_{i_1}$ downwards until the across sub-market equilibrium is restored. This decreases the employment probability, as captured by the first term in the right-hand-side of equation (B.68). The overall effect is ambiguous, depending on whether the wage or the employment effects dominate.

Changes in $\overline{w}$ also affect low-skill sub-markets for which the minimum wage is not binding. Let $i_2$ be a sub-market for which the minimum wage is not binding, so $w^l_{i_2} > \overline{w}$. Differentiating yields:

$$\frac{dU^l}{d\overline{w}} \quad = \quad p^l_\theta \frac{d\theta^l_{i_2}}{d\overline{w}}(w^l_{i_2} - T(w^l_{i_2}) - y_0) + p^l(\theta^l_{i_2})(1 - T'(w^l_{i_2}))\frac{dw^l_{i_2}}{d\overline{w}}. \tag{B.69}$$

Equation (B.68) suggests that the left-hand-side of equation (B.69) is unlikely to be zero, implying that $\theta^l_{i_2}$ or $w^l_{i_2}$ or both are possibly affected by changes in the minimum wage. There are two forces that mediate this spillover. First, the change in applicant flows between sub-markets and from in and out of the labor force affects the employment probabilities of all sub-markets until the equilibrium condition of equal expected utilities is restored. This effect is captured by the first term in the right-hand-side of equation (B.69). Second, firms can also respond to changes in applicants. The potential wage response is captured in the second term in the right-hand-side of equation (B.69). Changes in vacancy posting implicitly enter the terms $d\theta^l_m/d\overline{w}$ of equations (B.68) and (B.69). The overall effect is also ambiguous.

Changes in $U^l$ also affect labor market participation. Recall that $L^l_A = \alpha_l F_l(U^l - y_0)$, so $dL^l_A/d\overline{w} = \alpha_l f_l(U^l - y_0)\left(dU^l/d\overline{w}\right)$. Then, if $dU^l/d\overline{w} > 0$, minimum wage hikes increase labor market participation. The behavioral response, however, is scaled by $f_l(U^l)$, which may be negligible. This may result in positive impacts on expected utilities with modest participation effects at the aggregate level.

Now consider the sub-population of high-skill workers. If $\min_m\{w^h_m\} > \overline{w}$, equilibrium effects for high-skill workers take the form of equation (B.69). In this model, effects in high-skill sub-markets are mediated by the production function, since demand for high-skill workers depends on low-skill workers through $\phi^j$. Then, this model may induce within-firm spillovers explained by a technological force: changes in low-skill markets affect high-skill posting, thus affecting high-skill workers' application decisions.

To see the effect of the minimum wage on firms' decisions, note that the five first-order conditions (equations (B.48) and (B.49) for $s = \{l, h\}$, and equation (B.50)) hold for firms for which the minimum wage is not binding, while equation (B.48) no longer holds for firms for which the minimum wage is binding. Then, for firms that operate in sub-markets with $w^l_m > \overline{w}$, it is sufficient to verify the reaction of one of the five endogenous variables to changes in the minimum wage and use the within-firm correlations to predict reactions in the other variables. For firms that operate in sub-markets where $w^l_m = \overline{w}$, it is necessary to first compute the change in low-skill vacancies and then infer the changes in high-skill vacancies and wages using the within-firm between-skill correlations that still hold for the firm. As above, I omit superscripts $j$ to simplify notation.

In both cases, it is easier to work with equation (B.49) for $s = l$. When the minimum wage is not binding, totally differentiating the first-order condition yields:

$$\begin{aligned}\left(\left[\phi_{ll}\left(q^l_\theta d\theta^l v^l + q^l dv^l\right) + \phi_{lh}\left(q^h_\theta d\theta^h v^h + q^h dv^h\right) + \phi_{lk} dk\right] - dw^l\right) q^l & \\ +(\phi_l - w^l) q^l_\theta d\theta^l &= \eta^l_{vv} dv^l, \end{aligned} \tag{B.70}$$

where I omitted sub-market sub-indices to simplify the notation. Rearranging terms gives:

$$dw^l\left[\frac{dv^l}{dw^l}\left(\eta^l_{vv} - \phi_{ll} q^{l2} - \phi_{lh} q^h q^l \frac{dv^h}{dv^l}\right) - \frac{dk}{dw^l}\phi_{lk} q^l + q^l\right] = d\theta^l q^l_\theta \left[(\phi_l - w^l) + \phi_{ll} v^l q^l\right] + d\theta^h q^h_\theta \phi_{lh} q^l. \tag{B.71}$$

Note that the sign and magnitude of $dw^l/d\overline{w}$ depend on $d\theta^l/d\overline{w}$. With the variation in wages, it is possible to predict variation in vacancies (and, therefore, firm size) and spillovers to high-skill workers. Capital may amplify or attenuate the effect depending on whether capital and low-skill labor are complements or substitutes.

When the minimum wage is binding, totally differentiating the first-order condition yields:

$$\begin{aligned}\left(\left[\phi_{ll}\left(q^l_\theta d\theta^l v^l + q^l dv^l\right) + \phi_{lh}\left(q^h_\theta d\theta^h v^h + q^h dv^h\right) + \phi_{lk} dk\right] - d\overline{w}\right) q^l & \\ +(\phi_l - \overline{w}) q^l_\theta d\theta^l &= \eta^l_{vv} dv^l, \end{aligned} \tag{B.72}$$

where I omitted sub-market sub-indices to simplify the notation. Rearranging terms gives:

$$\begin{aligned}\frac{dv^l}{d\overline{w}}\left(\eta^l_{vv} - \phi_{ll} q^{l2} - \phi_{lh} q^h q^l \frac{dv^h}{dv^l}\right) &= \frac{d\theta^l}{d\overline{w}} q^l_\theta \left[(\phi_l - \overline{w}) + \phi_{ll} v^l q^l\right] \\ &\quad + \frac{d\theta^h}{d\overline{w}} q^h_\theta \phi_{lh} q^l + \frac{dk}{d\overline{w}} \phi_{lk} q^l - q^l. \end{aligned} \tag{B.73}$$

The sign and magnitude depend on the reaction on equilibrium sub-market tightness. However, note that the first-order effect is decreasing in productivity since $\phi_l$ is decreasing in $\psi$ and $(\phi_l - \overline{w}) \to 0$ as $\overline{w}$ increases. That is, among firms that pay the minimum wage, the least productive ones are more likely to decrease their vacancies, and therefore shrink and eventually exit the market (conditional on $j$, omitted here for simplicity).

The effect of the minimum wage on the utility of inactive capitalists is zero. Using the envelope theorem, the effect of the minimum wage on the utility of active capitalists that are constrained by the minimum wage is given by:

$$\frac{\partial U^K}{\partial \overline{w}} = (1-t)\frac{\partial \Pi(\psi, 1-t)}{\partial \overline{w}} = (1-t)\left(q_\theta^l\left[\frac{\partial \theta^l}{\partial \overline{w}} + \frac{\partial \theta^l}{\partial U^l}\frac{\partial U^l}{\partial \overline{w}}\right]v^l(\phi_l - \overline{w}) - v^l q^l\right). \tag{B.74}$$

This effect is possibly negative given that the first-order condition with respect to low-skill wages holds with inequality and is stronger for less productive firms. When $\overline{w} = w^l$, the first order condition holds with equality and therefore:

$$\left.\frac{\partial U^K}{\partial \overline{w}}\right|_{\overline{w}=w^l} = (1-t)q_\theta^l \frac{\partial \theta^l}{\partial U^l}\frac{\partial U^l}{\partial \overline{w}}v^l(\phi_l - w^l). \tag{B.75}$$

This latter expression also coincides with the utility effect on active capitalists that are not constrained by the minimum wage, since they face indirect effects mediated by the effect on job-filling probabilities.

Note that the effect on capitalists' utility relies on a micro-elasticity of profits that ignores effects on the capital allocation problem because of the envelope theorem. For computing the fiscal externality, the envelope theorem no longer holds, since only domestic profits enter the tax base and, therefore, capital flows to the foreign investment can generate a first-order effect. Concretely, for constrained capitalists:

$$\frac{d\Pi(\psi, 1-t)}{d\overline{w}} = \frac{\partial \Pi(\psi, 1-t)}{\partial \overline{w}} + \frac{r^*}{1-t}\frac{\partial k(\psi)}{\partial \overline{w}}. \tag{B.76}$$

Then, the macro elasticities of profits are relevant for the fiscal externality, while micro elasticities are relevant for measuring impacts on capitalists' utility. Micro elasticities can be recovered by adjusting macro elasticities for domestic capital responses.

**More intuition on the SWF.** The average social value of the expected utility of active workers of skill $s$ is $\int_0^{U^s-y_0}\omega_L G(U^s - c)d\tilde{F}_s(c)$, where $\tilde{F}_s(c) = F_s(c)/F_s(U^s - y_0)$. Then, the total value is given by $L_A^s \int_0^{U^s-y_0}\omega_L G(U^s - c)d\tilde{F}_s(c)$, which yields the expressions of equation (25) noting that $L_A^s = \alpha_s F(U^s - y_0)$. The average social value of the utility of capitalists of type $j$ is $\int_{\psi_j^*}^{\overline{\psi}}\omega_k G((1-t)\Pi^j(\psi, t) - \xi)d\tilde{O}_j(\psi)$, with $\tilde{O}_j(\psi) = O_j(\psi)/(1 - O_j(\psi^*))$. Then, their total value is $K_A^j \int_{\psi_j^*}^{\overline{\psi}}\omega_k G((1-t)\Pi^j(\psi, t) - \xi)d\tilde{O}_j(\psi) = \mathcal{K}\int_{\psi_j^*}^{\overline{\psi}}\omega_k G((1-t)\Pi^j(\psi, t) - \xi)dO_j(\psi)$, since $K_A^j = 1 - O_j(\psi_j^*)$. Aggregating across types yields $\mathcal{K}\sum_{j\in\mathcal{J}}\sigma_j \int_{\psi_j^*}^{\overline{\psi}}\omega_k G((1-t)\Pi^j(\psi, t) - \xi)dO_j(\psi)$.

## Appendix Bibliography

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