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Calculating Optimal Nonlinear Taxes Using Censored Income Data

Optimal Doğrusal-Olmayan Vergilerin Sansürlü Gelir Verisi Kullanılarak Hesaplanması

Eren GÜRER[1], Osman KÜÇÜKŞEN[2]

Abstract

Approximating the skill distribution via observed incomes is a central aspect of estimating the optimal redistributive taxes. Emerging economies may exhibit high minimum wage take-up rates, hiding some of the heterogeneity in skill distribution. This paper shows in the context of Turkey that accounting for the minimum wage policy when approximating skills considerably alters the estimates of optimal redistributive income taxes. Once the mass around the minimum wage is treated as left censored, the optimal tax scheme is significantly more redistributive in comparison to assuming no censoring. This is because allocating some of the mass around the minimum wage towards the lower parts of the skill distribution reduces the total skill stock and increases the standard deviation of the distribution. Consequently, the optimal marginal income taxes become higher, especially for the middle-skill group.

Jel Codes: *H21, D31, J31*

Keywords: *Optimal Taxation, Redistribution, Censored Data*

Öz

İşgücü becerilerinin gözlemlenen gelir verisiyle tahmini, optimal geridağıtımcı vergilerin hesaplanmasında merkezi bir role sahiptir. Gelişmekte olan ülkelerde asgari ücretle çalışan işgücü oranının yüksek olması, beceri dağılımındaki farklılıkları gizleyebilmektedir. Bu makale, Türkiye örneği için, asgari ücret uygulamasıyla ortaya çıkan veri sansürlenmesi göz önüne alındığında, hesaplanan optimal geridağıtımcı vergilerin ciddi ölçüde değiştiğini göstermektedir. Asgari ücret civarında kalan gelir verisi, soldan sansürlenmiş olarak kabul edildiğinde hesaplanan optimal vergi rejimi, verinin sansürlenmemiş olduğu varsayımı altında hesaplanan optimal vergi rejimine göre önemli ölçüde daha yüksek bir gelir transferi öngörmektedir. Bu sonucun temel sebebi, sansürlenmiş verinin bir kısmının daha düşük beceri seviyelerine dağıtılması sonucunda tahmin edilen toplam beceri stoğunun azalıp, beceri dağılımındaki standart sapmanın artmasıdır. Buna bağlantılı olarak, optimal marjinal gelir vergileri, özellikle orta gelir grubu için, daha yüksek hesaplanmıştır.

Jel Kodları: *H21, D31, J31*

Anahtar Kelimeler: *Optimal Vergi, Geridağıtım, Sansürlenmiş Veri*

[1] Dr., Orta Doğu Teknik Üniversitesi, egurer@metu.edu.tr, ORCID: 0000-0001-8238-1967

[2] Dr., Hacettepe Üniversitesi, kucuksen@hacettepe.edu.tr, ORCID: 0009-0001-4226-9951

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1. Introduction

There is a vast literature initiated by Mirrlees (1971) that estimates the optimal redistributive income taxes in various settings. It is well-recognized that the underlying skill distribution is a fundamental factor determining the shape and the level of the optimal taxes (Mankiw et al., 2009). The standard methods of approximating the skill distribution rely on the observed distribution of incomes. However, the observed incomes yield a misleading picture of the skill distribution if a sizeable fraction of the population receives the minimum wage. In this study, we show that correcting the skill distribution for the grouping around the minimum wage considerably changes the optimal income tax estimates.

We utilize a standard Mirrleesian model of optimal redistributive income taxation. Individuals that are heterogeneous in earning skills choose intensive margin labor supply. A utilitarian government sets nonlinear labor income taxes in order to maximize social welfare. The government observes the gross incomes of individuals but skills are private information. Thus, a set of incentive compatibility constraints must be employed to ensure that high-skilled individuals do not find it optimal to mimic low-skilled individuals at the equilibrium. Preventing mimicking requires positive marginal income taxes that distort individual labor supply decisions. As a result, the problem of the government exhibits the well-known trade-off between equity and efficiency. Greater marginal income taxes reduce the total labor supply and, thus, the total amount of output, leading to efficiency losses. At the same time, greater marginal income taxes discourage mimicking behavior because it is not preferable for the high-ability individuals to be distorted at the margin. This relaxes the incentive compatibility constraints. As a result, the government can implement a higher amount of redistribution.

The statutory minimum wage policy can hinder the accurate estimation of the underlying skill distribution as the observed income does not necessarily represent skills for low-income individuals. The bias that results from estimating the skill distribution using the observed income with standard econometric techniques can be ignored if the fraction of minimum wage workers is relatively low as in developed countries such as the United States. In the case of Turkey, however, the fraction of minimum wage workers is dramatically higher compared to OECD countries. While, on average, around 8% of full-time workers work at or below the minimum wage in OECD countries (OECD, 2022), in Turkey, this number is above 21%[3] in 2021. We address this problem by estimating the skill distribution by using "maximum likelihood estimation using censored data" (C-MLE) as outlined by Delignette-Muller & Dutang (2015). Taking the "censored nature" of the observed income distribution into account leads to a significant increase in the estimated level of standard deviation and we estimate a considerably lower mean for the skill distribution.

When the distribution of income is assumed to be censored from the left and the skill distribution is parameterized accordingly, the government finds it optimal to set higher marginal income taxes and implement a greater amount of redistribution. The intuition behind this result derives from the standard equity-efficiency considerations. The noncensored model simply assumes that the skills of a large mass of individuals around the

[3] Own calculations. Source: Household Labor Force Survey (HLFS), TURKSTAT, 2021.

minimum wage are alike. As a result, the social planner is less willing to distort the labor supply choices of this mass at the margin for redistribution. On the contrary, the censored model recognizes that the minimum wage does not accurately reflect the skills of the entire set of individuals earning it. Once a portion of individuals is scattered towards the lower parts of the skill distribution, the mass around the minimum wage shrinks and the dispersion in the skill distribution increases. Thus, increasing the extent of redistribution via distortive marginal income taxes becomes optimal.

This study is mainly related to the methodological discussions around appropriately identifying the skill distribution for optimal redistributive income tax simulations.[4] There are two approaches that are frequently employed for approximating the distribution of skills. The first approach simply utilizes gross hourly wages as a proxy of the skills of individuals (Mankiw et al., 2009). The second approach estimates skills using the first-order condition of the individual utility maximization problem and the actual tax rates (Saez, 2001). While the present study follows the latter approach, this choice is not relevant to our main results. Ultimately, both approaches exploit the data on observed incomes and our purpose is to illustrate that high minimum wage take-up rates lead to a misleading representation of the skill distribution.

While there are several studies examining the features of taxes in developing economies (Gordon & Li, 2009; Piketty & Qian, 2009; Besley & Persson, 2014), the majority of the optimal taxation literature focuses on developed economies. Articles studying optimal taxation in developing economies are scarce but some examples exist. Auriol & Warlters (2005), for example, argue that higher entry costs to the formal sector in developing economies could be a deliberate government policy. As the entry costs to the formal sector increase, firms operating in the formal sector possess increasingly more market power and become more profitable. As a result, the governments can utilize higher profit tax rates and confiscate some of the profits at low administrative costs. Avdiu (2019) suggests that low income and capital taxes observed in developing economies may not be inefficient. Product markets in developing economies exhibit higher markups that distort labor supply via the substitution effects. Consequently, it is optimal to decrease other sorts of distortive taxes. The current study also relates to this literature in the sense that it investigates the features of optimal redistributive income taxes in the setting of a developing economy. Moreover, there are no studies estimating the optimal redistributive income taxes in Turkey to the best of our knowledge. Hence, this paper can also be seen as a first step toward filling this gap.

The remainder of this paper proceeds as follows. Section 2 presents the Mirrleesian optimal redistributive income tax model. Section 3 describes the alternative approaches for approximating the skill distribution and their implications on optimal income tax estimates. Section 4 concludes.

[4] The main result of the present paper also resonates with Kanbur & Tuomala (1994) which finds that the optimal marginal income tax rates increase in the standard deviation of the skill distribution.

2. The Model

2.1. Individuals

There is a unit continuum of individuals indexed by their abilities (i.e., hourly wage rates) denoted by n distributed over the support $[\underline{n}, \overline{n}]$ according to the probability distribution function $f(n)$. Labor supply decisions are allowed along the intensive margin. Working individuals of ability n supply labor, l_n, to earn gross labor income $y_n = nl_n$. They pay a non-linear labor income tax, $T(y_n)$, and consume their net income $c_n = y_n - T(y_n)$.

Individuals derive positive utility from consumption and negative utility from labor supply. Utility of an individual with an ability level n reads:

$$u_n = v(c_n) - h(l_n) \tag{1}$$

where $v'(.) > 0$, $v''(.) < 0$ and $h'(.) > 0$, $h''(.) > 0$. The first-order condition of the individual's utility maximization problem yields an expression via which the optimal marginal income tax rates can be recovered:

$$T'(y_n) = 1 - \frac{h'(l_n)}{v'(c_n)} \frac{1}{n}. \tag{2}$$

2.2. Government

The government is utilitarian and maximizes the following objective function by choosing individual allocations c_n and y_n:

$$\int_{\underline{n}}^{\overline{n}} W(u_n) f(n) dn \tag{3}$$

where $W(.)$ denotes a social welfare function that determines the inequality aversion of the government. In the rest of this study, we assume a linear social welfare function: $W(u_n) = u_n$. Because our purpose is merely illustrating the differences in the optimal income tax schemes with different assumptions for the underlying skill distribution, the choice of social welfare function is not relevant to fundamental results. The concavity of $v(.)$ ensures that the social planner has some preference for redistribution.

The budget constraint of the government can be written as:

$$\int_{\underline{n}}^{\overline{n}} T(y_n) f(n) dn = \int_{\underline{n}}^{\overline{n}} (y_n - c_n) f(n) dn = 0. \tag{4}$$

The information structure of the model is standard Mirrleesian. The government observes gross incomes but not abilities. Therefore, implementing ability-specific non-linear taxes is not possible. Taxes must be conditioned on observable gross labor incomes. As a result, the incentive compatibility of resulting allocations must be ensured by the following set of constraints:

$$v(c_n) - h(y_n/n) \geq v(c_{n'}) - h(y_{n'}/n) \tag{5}$$

where n' represents any individual who possesses a level of ability different than n. Therefore, the incentive compatibility constraints ensure that individuals do not find it optimal to mimic each other at the equilibrium.

The preferences of individuals are standard and respect Spence-Mirrlees single-crossing condition[5]. Under this condition, one can follow the so-called first-order approach (Ebert, 1992) and replace the incentive compatibility constraints with the following differential equation provided that the resulting gross and net incomes monotonously increase in ability:[6]

$$\frac{du_n}{dn} = \frac{h'(l_n)l_n}{n}. \tag{6}$$

Equation (6) essentially represents the law of motion between the indirect utilities of individuals with different abilities.

3. Quantitative Implementation

Calibration of the model involves the description of the functional forms and estimation of the skill distribution. While we follow the literature for choosing functional forms, for the latter, we consider two scenarios: (i) The observed income represents true individual skill and (ii) individual skills are censored by the minimum wage level. Then, we calculate the optimal tax and transfer scheme by solving the government's welfare maximization problem for both cases.

3.1. Functional Forms

We use the following functional form for the utility function given in equation (1):

$$u_n = \frac{c_n^{1-\gamma}}{1-\gamma} - \frac{l_n^{1+1/\varepsilon}}{1+1/\varepsilon} \tag{7}$$

where γ governs the concavity of the utility from consumption and ε represents the Frisch elasticity of the labor supply. In quantitative experiments, we set $\gamma = 0.8$ as in Jacquet et al., (2013) which is slightly below the value used in Saez (2001). The Frisch elasticity of labor supply is set to a value that is commonly employed in the literature: $\varepsilon = 0.33$. This value is estimated by Chetty (2012) and utilized in many studies such as Hansen (2021).

We follow the standard optimal redistributive taxation literature and assume that the initial 95% of skills follows a lognormal distribution and that there is a Pareto tail at the top 5% (e.g., Saez (2001)). The mass around the minimum wage belongs to the bottom 95%. Thus, implications of utilizing the censored vs. the noncensored model will be evident in the parameters of the lognormal distribution. The next section describes the censored and the noncensored models in further detail. We inherit the Pareto parameter, $p = 1.6$, from the estimates for the U.S. (Saez & Stantcheva, 2018). The choice of the Pareto parameter is

[5] Spence-Mirrlees single-crossing condition implies that the negative of the marginal rate of substitution between y_n and c_n, i.e., $-MRS_{y_n,c_n} = \frac{h\prime(l_n)}{v\prime(c_n)}\frac{1}{n}$ declines in n.

[6] Results of the numerical simulations are examined to ensure the monotonicity of the optimal allocations.

inconsequential for our main results since the censoring occurs around the minimum wage. Necessary adjustments are made to ensure that the resulting skill distribution, $f(n)$, is continuous and it integrates to unity.

3.2. Estimating the Skill Distribution

The individual maximization problem can be written such that l_n is the choice variable:

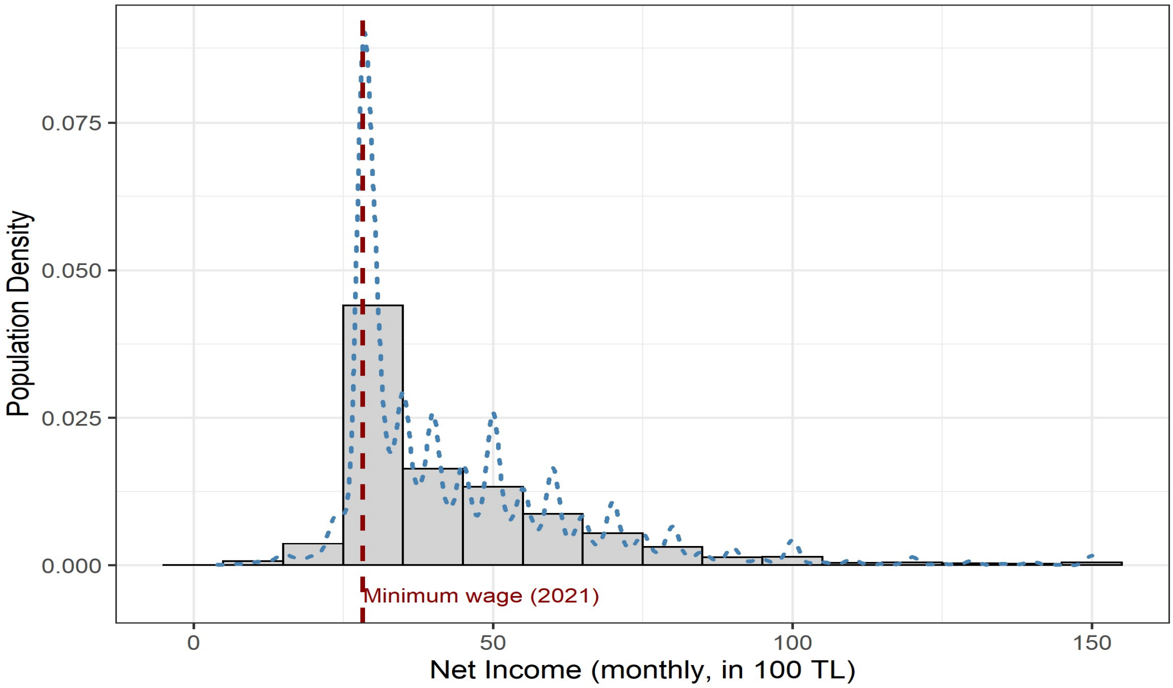
$$\max_{l_n}\left\{\frac{(l_n n - T(l_n n))^{1-\gamma}}{1-\gamma} - \frac{l_n^{1+1/\varepsilon}}{1+1/\varepsilon}\right\}. \tag{8}$$

The first-order condition writes:

$$n = y_n^{\frac{1/\varepsilon}{1+1/\varepsilon}} c_n^{\frac{\gamma}{1+1/\varepsilon}} \left(\frac{1}{1-T'(y_n)}\right)^{\frac{1}{1+1/\varepsilon}}. \tag{9}$$

Individual skill levels can be estimated via equation (9), i.e., by the method proposed by Saez (2001), utilizing observed incomes, actual tax rates, and imposing assumptions on γ and ε. We use the 2021 wave of the Household Labor Force Survey (HLFS) data provided by TURKSTAT. The sample is restricted to full-time workers aged between 15 and 65, who have been working for at least 9 months, and who are registered with The Social Security Institution (SGK). The bar chart in Figure 1 presents the masses of individuals that belong to the associated monthly net earnings intervals. As evident in Figure 1, the fraction of individuals that have monthly earnings below the minimum wage is rather low. Because our sample is restricted to those who work full time and are registered to the Social Security Institution, we suppose that individuals who report earnings below the statutory minimum wage represent reporting errors. Accordingly, we consider the monthly income distribution and any estimation of skills based on the observed incomes as censored from left, around the statutory minimum wage. In 2021, the statutory monthly net minimum wage is 2825,90 TL. There are no individuals who report monthly earning that is identical to the statutory minimum wage, once again, possibly due to reporting error. Hence, we consider all the individuals who report a monthly earning below 3000 TL as minimum wage workers in the censored model. Our calculations suggest that the fraction of individuals who earn minimum wage is above 21% in 2021.

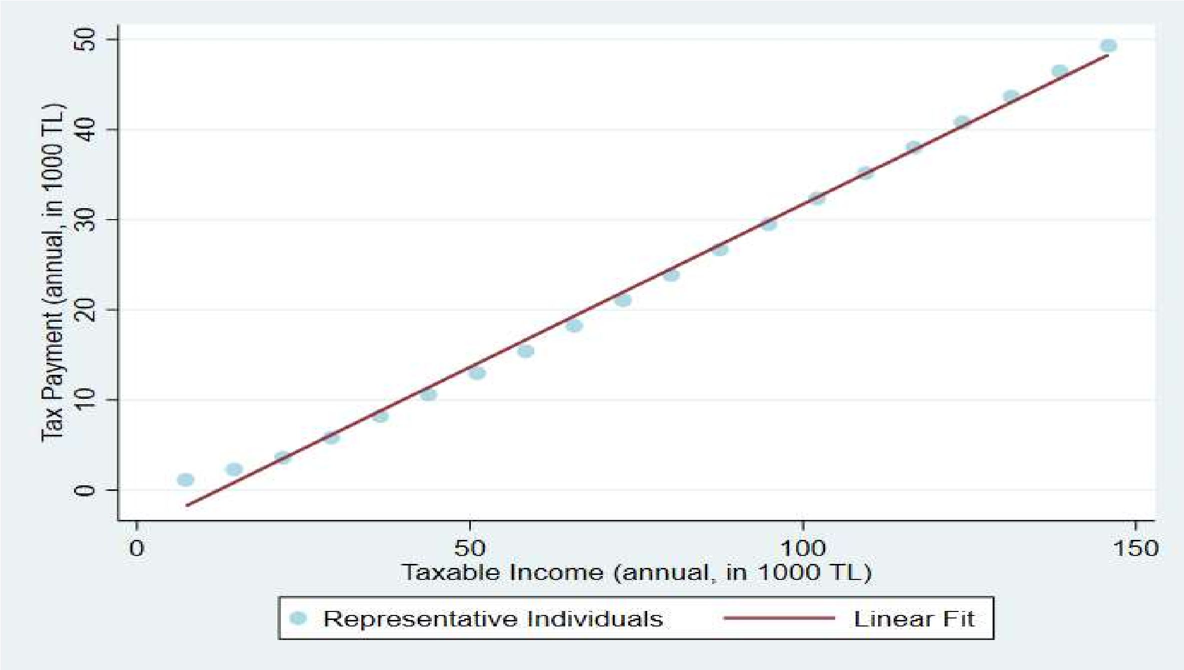
Figure 1: Distribution of Net Incomes



Own calculations. Source: Household Labor Force Survey, TURKSTAT, 2021.

To obtain the individual skill levels, n, we need to observe both gross incomes, y_n, and disposable incomes, c_n. Publicly available datasets in Turkey provide information for the latter but not for the former. Note that, as the tax function links gross and net income, observing either suffices as long as the tax function is known. We utilize the OECD TaxBEN model to approximate the income tax system in Turkey. Our TaxBEN sample consists of single individuals without children working full time. We simulate the net and gross incomes of twenty individuals each of which represents the group of people who earn a certain fraction of median income with 10 percentage point intervals, i.e., from 10% to 200% of median income in Turkey during 2021. Subsequently, we regress the tax liabilities of twenty representative individuals on their gross incomes. The results of this regression suggest that the tax system can be represented with a flat tax of 36.13% and a demogrant of 4.413 TL. Figure 2 illustrates this regression. As evident from Figure 2, the flat tax combined with the demogrant approximates the taxes in Turkey rather well.

Figure 2: Approximation of The Turkish Tax System In 2021



It is rather straightforward to see that skill levels can be retrieved by using the first-order condition given in equation (9) and the estimated tax function. To estimate the skill distribution, $f(n)$, we follow two approaches: First, we ignore the censoring nature of the minimum wage policy and use the maximum likelihood estimation (MLE) to estimate the mean and the standard deviation of the lognormal distribution. Second, we use the insight that the true skill level is censored by the minimum wage policy. As mentioned above, we label observations who report monthly earnings below 3000 TL as censored and implement a modified version of the maximum likelihood estimation (C-MLE) using the procedure explained in Delignette-Muller & Dutang (2015).

The estimation results are reported in Table 1. The top panel reports the MLE estimates of the mean and the standard deviation of the lognormal distribution whereas the bottom panel contains the estimated values for the censored model. We observe that the censored model produces a considerably lower mean and a significantly higher standard deviation for the lognormal distribution.

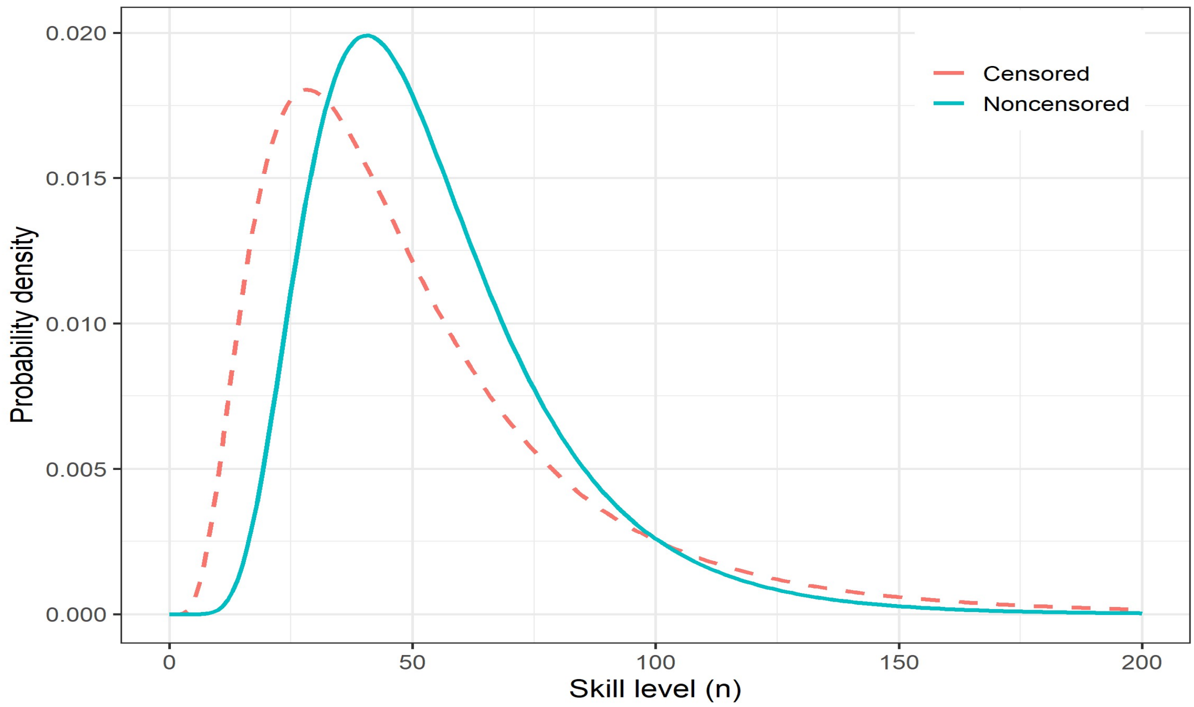
Table 1: Maximum Likelihood Estimates of The Lognormal Distribution

Parameter	Estimate	Standard error
	Noncensored	
Mean (μ)	3.90220	0.00045
Standard deviation (σ)	0.44724	0.00032
	Censored	
Mean (μ)	3.74977	0.00070
Standard deviation (σ)	0.63685	0.00061

Note: Own calculations. Source: TURKSTAT, HLFS, 2021. Results for the noncensored model are reported at the top panel. The parameter estimates for the censored model are documented at the bottom panel.

Figure 3 depicts the estimated probability distribution functions both for the censored and the noncensored models. The skill distribution obtained via the censored model differs from the one obtained via the noncensored model in two major ways. First, the distribution peaks earlier in the censored model and this peak is less pronounced. Second, and relatedly, the mass of individuals at the lower skill levels is larger under the censored model.

Figure 3: Estimated Lognormal Distribution Functions

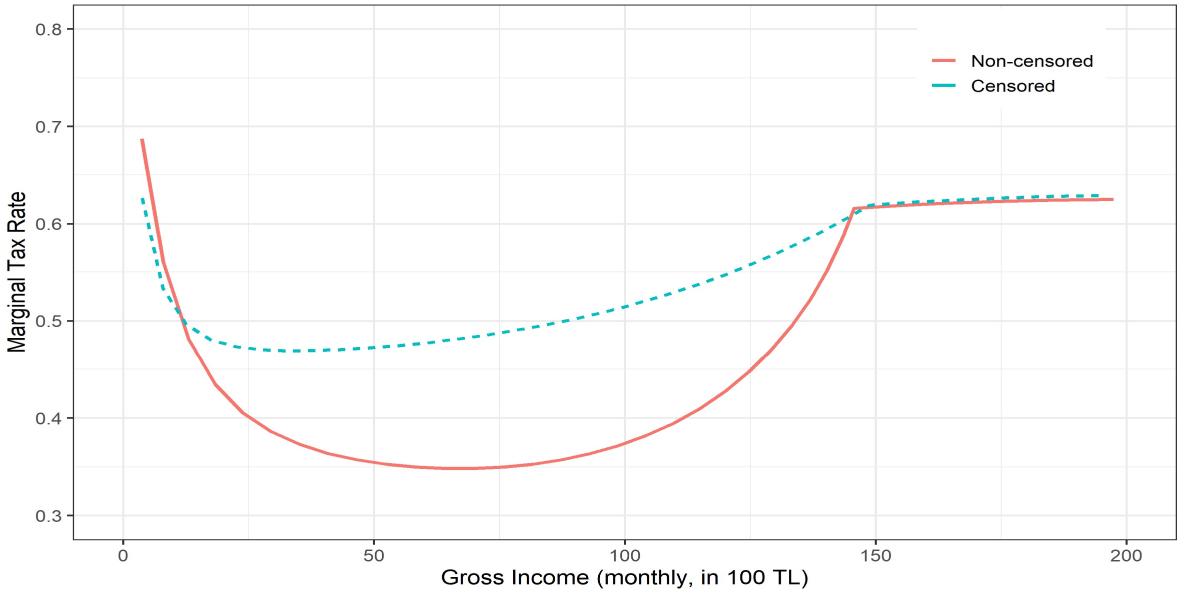


3.3. Optimal Nonlinear Taxes

The main objective of this section is to describe the implications of model choice, i.e., the censored vs. the noncensored model, on the optimal marginal income taxes. Figure 4 suggests that the optimal marginal income taxes follow a U-shape irrespective of the model selection. This outcome derives from the social planner's equity-efficiency considerations and it is rather standard when the underlying skill distribution is assumed lognormal appended with a Pareto tail. See, for example, Saez (2001), Mankiw et al., (2009) and Jacobs (2013). An excellent description of the intuition behind the U-shaped optimal marginal income taxes can be found in Jacobs (2013). Nevertheless, we provide a brief explanation of the U-shape below.

At the bottom of the distribution, there is a small mass of individuals that exhibits low skill levels. Thus, the social planner is not concerned about distorting those individuals' labor supply at the margin. At the same time, high marginal income taxes at the bottom of the distribution is especially helpful for the purposes of redistribution because the incomes of the majority of the population is above that point. Towards the middle skill level, the social planner reduces marginal income taxes in order to incentivize the large mass of individuals at the middle of the distribution, i.e., efficiency concerns outweigh equity concerns. Towards the upper-end of the distribution, the optimal marginal income taxes rise once again. This is because the Pareto tail indicates that there exists a reasonably sized group who earns high levels of income. The greater levels of labor supply distortions, compared to those imposed on the middle skill groups, are worthwhile given the equity benefits.

Figure 4: The Optimal Marginal Tax Rates



The optimal marginal income tax estimates obtained via the noncensored model start at rates higher than that of the censored model. Towards the middle-skill groups, the noncensored model requires a decline in optimal marginal taxes that is considerably sharper. The censored model allows for higher optimal marginal income taxes for a broader group of skills and, therefore, is associated with a higher level of redistribution.

The intuition behind this finding is as follows. As evident in Figure 3, the noncensored model assumes that the number of individuals in the low-skill groups is rather small but there is a large mass of middle-skilled individuals. Consequently, the social planner imposes high marginal income taxes at the bottom of the distribution for the purpose of redistribution. On the other hand, the output of the middle-skill group is of crucial importance for efficiency considerations given their large mass. Hence, there is a pronounced decline in the marginal income taxes towards the middle of the skill distribution.

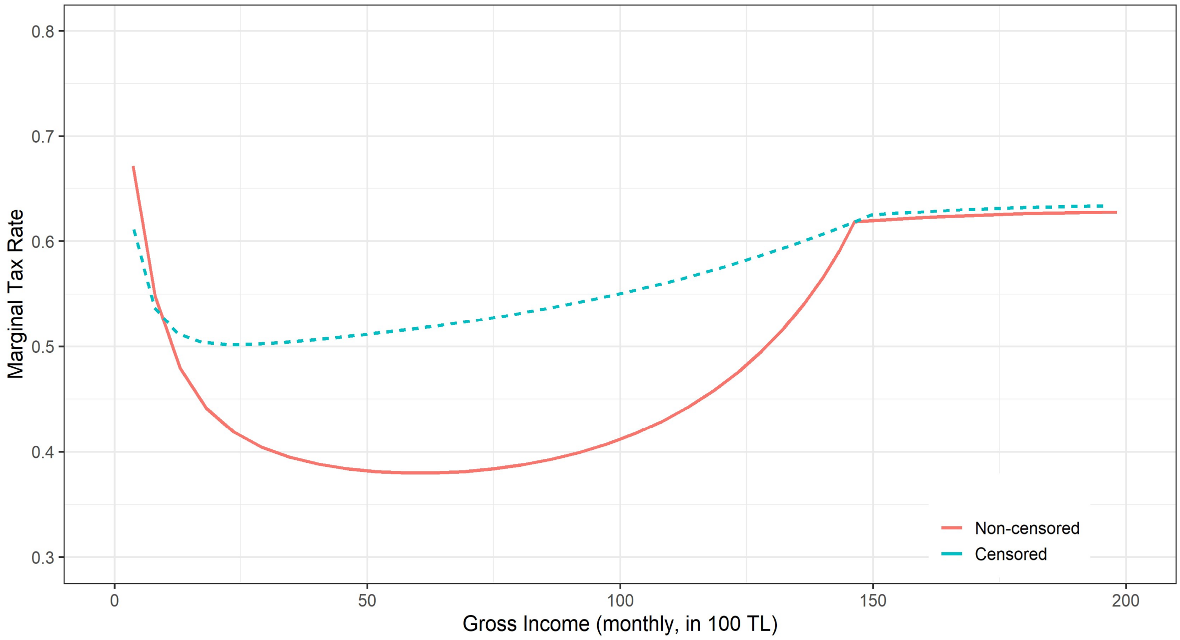
The censored model recognizes that the statutory minimum wage does not represent the true skill levels of all the individuals who earn such wages. Equipped with the information that the sample is censored from the left, the model distributes some of the mass to lower skill groups. As a result, distortive taxes start at lower rates with the censored model but they remain higher at the rest of the skill distribution and implement a greater level of redistribution.

Another interpretation of our results via the parameters of the implied lognormal distributions exists. The skill distribution obtained through the censored model is associated with a lower mean and a higher standard deviation. This implies that the total stock of skill in the population is lower and there is a greater level of inherent skill inequality. Therefore, it is optimal to impose higher marginal income taxes and apply a greater level of redistribution.

3.4. Robustness

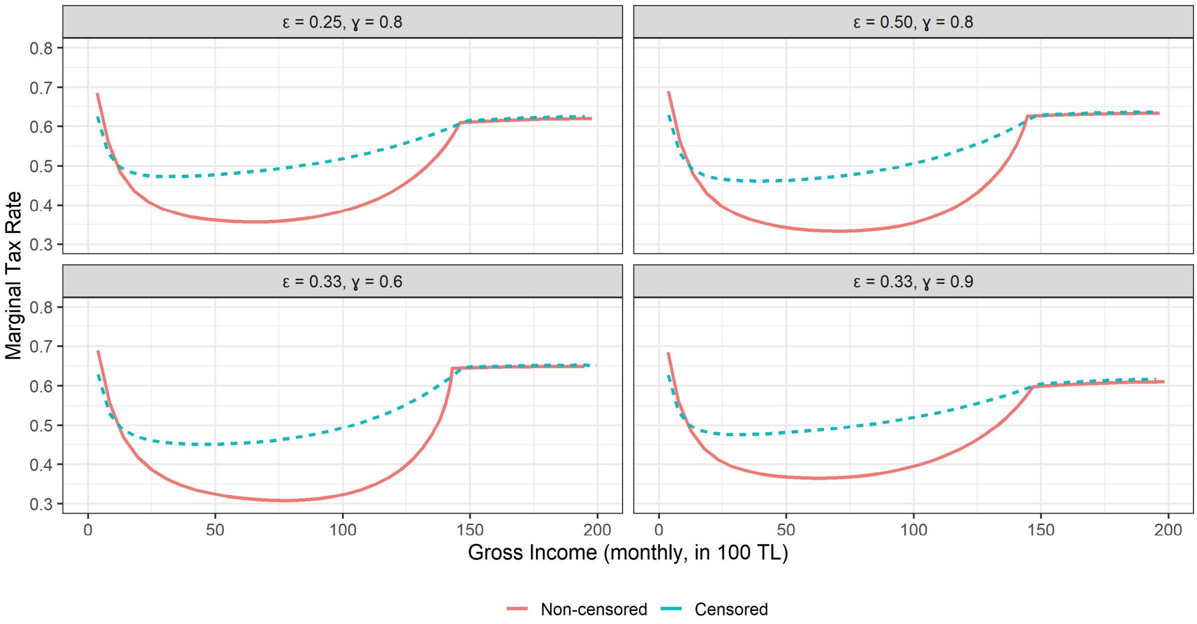
In the previous section, we exclude informal workers (i.e., workers that are unregistered to the social security system) from our analyses as the parsimonious model that we employ does not account for informality. To test whether the inclusion of informal workers changes our fundamental results, we repeat the same experiment by extending the sample to include informal workers. Figure 5 plots the resulting optimal marginal tax rates both for the censored and the noncensored models. As it is clear, including informal workers does not change our results.

Figure 5: The Optimal Marginal Tax Rates with informal workers



The parameters of the utility function are essential for optimal taxation as they directly influence the extent of the above-mentioned equity-efficiency trade-off. Estimating these parameters; namely, γ and ε, for the Turkish economy is beyond the scope of this paper and, therefore, we use standard values that are employed in the literature. We conjecture that changing the values of γ and ε should not affect our main results as they have to be updated for both the censored and the noncensored models. To validate this prediction, we repeat our main experiment by varying the values of γ and ε one-by-one. Figure 6 plots the optimal marginal tax rates for chosen parameter values. At the top panel, we fix $\gamma = 0.8$ and repeat the experiment for $\varepsilon = \{0.25, 0.5\}$. The bottom panel repeats the same robustness check for $\gamma = \{0.6, 0.9\}$ while ε is kept at its benchmark value which is 0.33.

Figure 6: The Optimal Marginal Tax Rates for alternative parameter values



The alternative calibration of the preferences changes the optimal marginal tax rates as expected. Increasing ε leads to a stronger response of labor supply and, thus, is associated with larger efficiency costs. Consequently, the optimal level of redistribution decreases with higher levels of ε. A higher value of γ, on the other hand, increases the concavity of the utility from consumption. As a result, the equity motive becomes more prominent and a higher level of redistribution becomes optimal. Nevertheless, changes in the optimal tax regime do not affect our main result as the implications of γ and ε on the optimal taxation are similar for the censored and the noncensored models.

4. Conclusion

A crucial factor that determines the shape and the level of optimal redistributive income taxes is the underlying skill distribution. The standard methods of approximating the skill distribution rely on the observed distribution of incomes. However, this approach may yield misleading results if a significant proportion of the population receives the minimum wage as in Turkey. We address this problem by using "maximum likelihood estimation using censored data" (C-MLE) to estimate the skill distribution. Taking into account the "censored nature" of the observed income distribution leads to a significant increase in the estimated level of standard deviation and a considerably lower mean for the skill distribution.

Utilizing a standard intensive margin Mirrleesian optimal redistributive income tax model, we study the implications of accounting for this censoring on optimal tax estimates. If we assume that the income distribution is censored from the left and we parameterize the skill distribution accordingly, then the government deems it best to impose higher marginal income taxes and increase the level of redistribution. In the noncensored model, it is assumed that individuals earning the minimum wage are similarly skilled. Thus, the utilitarian government is less willing to distort the labor supply decisions of this group for the purpose of redistribution. Conversely, the censored model acknowledges that the minimum wage is not an accurate indicator of the skills possessed by all those who earn it. As a result, when a portion of the population is spread out towards the lower end of the skill distribution, the number of middle-skilled individuals decreases and inequality in the skill distribution increases. Therefore, it is considered optimal to use higher levels of redistribution through progressive income taxes that distort labor supply decisions.

This study has an important policy implication. Approximating the skill distribution is of crucial importance for determining the progressivity of taxation and spending policies. If the policy maker assumes that minimum wage truly represents the skill levels of all the individuals earning such income, it would infer that there is a very large mass of middle-skilled individuals. As a result, the policy maker may prefer lower than usual tax rates for the middle skill group and this would considerably reduce the tax revenue of the government. Consequently, the level of social transfers would be lower than optimal. On the other hand, accounting for the minimum wage policy when approximating skill distribution implies that the policy maker should prefer adopting higher tax rates and a higher level of social transfers. Overall, our results suggest that any study and policy recommendation that is related to the income redistribution must consider the censoring nature of the statutory minimum wage policy on the distribution of skills.

Some limitations of our study are worth noting. First, the extensive margin labor supply responses are absent in the model. Second, some of the calibration parameters, such as the Pareto parameter, the Frisch elasticity of labor supply, and the concavity parameter of the subtility of consumption, are inherited from the existing literature. Whereas we provide robustness checks with respect to some of them, estimating these parameters using Turkish data is essential to produce more precise estimates of optimal redistributive taxes. Third, this study assumes that all the individuals exhibit the same level of labor supply elasticity. While this assumption is challenged by the empirical studies, it is commonly employed in the literature on optimal income taxation in order to avoid double-screening.

As mentioned in the introduction, this study is a first step toward estimating the optimal redistributive income taxes in Turkey. In future work, the authors plan to improve the estimates by incorporating the extensive margin decisions into the model and by rigorously calibrating the model. Equipped with such estimates, a thorough comparison of the existing Turkish labor income tax system to the optimal tax rates can be made.

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Çıkar Beyanı: Yazarlar arasında çıkar çatışması yoktur.

Etik Beyanı: Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara uyulduğunu yazarlar beyan eder. Aksi bir durumun tespiti halinde Fiscaoeconomia Dergisinin hiçbir sorumluluğu olmayıp, tüm sorumluluk çalışmanın yazarlarına aittir.

Yazar Katkısı: Yazarların katkısı aşağıdaki gibidir;

Giriş: Eren Gürer ve Osman Küçükşen

Model: Eren Gürer

İşgücü Beceri Dağılımının Tahmini: Osman Küçükşen

Sonuçların Yorumlanması: Eren Gürer ve Osman Küçükşen

Sonuç: Eren Gürer ve Osman Küçükşen

Eren Gürer'in katkı oranı: 50%. Osman Küçükşen'in katkı oranı: 50%.

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Author Contributions: author contributions are below;

Introduction: Eren Gürer and Osman Küçükşen

Model: Eren Gürer

Skill Distribution Estimation: Osman Küçükşen

Interpretation of the Results: Eren Gürer and Osman Küçükşen

Conclusion: Eren Gürer and Osman Küçükşen

Eren Gürer's contribution rate: 50%, Osman Küçükşen's contribution rate: 50%.