CESifo Working Papers

Deserving Poor and the Desirability of Minimum Wage Rules

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Abstract

In this paper we provide a novel justification for the use of minimum wage rules to supplement the optimal tax-and-transfer system. We demonstrate that if labor supply decisions are concentrated along the intensive margin and employment is efficiently rationed, a minimum wage rule can be socially beneficial by serving as a tagging device that targets benefits to the deserving poor, defined as low-skilled workers exhibiting a weak taste for leisure.

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March, 2014

1.   Introduction

Minimum wage rules are commonly used in most OECD countries as a redistributive tool for the benefit of low-skilled workers. Nonetheless, they are highly controversial due to their adverse effect on employment, the magnitude of which has been subjected to ongoing intense empirical debate.[1] The availability of the tax-and-transfer system and other policy instruments to address concerns about earnings inequality raises a fundamental normative question regarding the social desirability of a minimum wage rule as a redistributive tool.

A relatively small strand of the public economics literature investigates whether a minimum wage could be a desirable supplement to the optimal tax-and-transfer system in a competitive labor market environment.[2] This literature is mostly cast in the standard Mirrlees (1971) setting where the focus is on the work-leisure choice at the intensive margin, i.e., in working hours. Two early studies by Allen (1987) and Guesnerie and Roberts (1987) demonstrate that the minimum wage cannot be a useful supplement to an optimal tax-and-transfer system as it fails to block an undesirable labor-supply response to an increase in the generosity of the welfare system. The reason for this is that the minimum wage does not mitigate the relevant binding incentive-compatibility constraint. On the other hand, Boadway and Cuff (2001) show that the possibility of distinguishing between involuntarily and voluntarily unemployed workers by forcing welfare applicants to look for a job and denying unemployment benefits from those who turn down a job

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[1] See Neumark and Wascher (2007) for an elaborate survey.
[2] A different strand of the literature focuses on the efficiency-enhancing role of a minimum wage in the presence of labor market imperfections such as monopsonistic competition [Manning (2003), Cahuc and Laroque (in press)], efficiency wages [Jones (1987), Rebitzer and Taylor (1995)], bargaining models [Cahuc et al. (2001)], signaling models [Lang (1987)], and search models [Flinn (2006), Hungerbühler and Lehmann (2009)].

offer does warrant the use of a minimum wage as a supplement to the tax-and-transfer system. More recently, Lee and Saez (2012) focus on the participation choice at the extensive margin, i.e., the decision whether or not to work at all, in an occupational-choice model with fixed working hours. They show that when rationing is efficient – namely, that the involuntary unemployment triggered by a minimum wage hits the workers with the strongest taste for leisure first – a minimum wage can serve as a desirable supplement to the tax-and-transfer system.

In this paper we offer a novel justification for the use of minimum wage rules to supplement the optimal tax-and-transfer system. Our argument centers on the notion of welfare deservedness that has recently become a key issue in the public discourse about the role of the welfare system. In particular, it focuses on the distinction between the deserving and the undeserving poor. Whereas abundant evidence collected in surveys conducted in the US and Europe shows that society is generally sympathetic toward the unfortunate disabled, the generosity is often conditioned on the poor either working hard or being truly disabled. [3] For instance, Gilens (1999) reports that people are more concerned about the conditions determining which recipients should benefit from social security programs than about the cost of the programs, the main question for taxpayers being not so much "who gets what?" but rather "who deserves what?" In other words, it is not the principle of government support for the truly needy (with its entailed burden on the taxpayers) that is the focus of considerable public resentment, but rather the

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[3] See Heclo (1986), Farkas and Robinson (1996), Gallop Organization (1998), Gilens (1999), Miller (1999), and Fong (2001).

perception that most people receiving welfare are undeserving.[4] These trends are reflected in the 1996 welfare reform in the US and the shift from the Aid to Families with Dependent Children program to the Temporary Assistance for Needy Families program with its emphasis on the work requirement, as well as the significant expansion in recent years of the Earned Income Tax Credit program in the US that conditions welfare on labor market participation.

The literature on the optimal design of tax-and-transfer systems has by and large overlooked the issue of welfare deservedness, adopting instead a traditional welfarist approach. There are, however, notable exceptions. Besley and Coate (1992a) develop the concept of statistical stigma, where welfare claimants who are believed to lack the values of self-reliance and willingness to work hard suffer from stigma costs. Besley and Coate (1992b) and (1995) investigate the optimal design of income maintenance programs assuming that the government objective is to alleviate poverty rather than to maximize social welfare. Effectively, this eliminates disutility from work from the government objective and may be interpreted to reflect the conservative view that high disutility from work is an indication of a socially unacceptable laziness that should not be incorporated into the social welfare calculus. In such a context, Besley and Coate show that workfare can be used as an effective screening tool to target transfers to low-skilled workers. In a related article, Cuff (2000), employing a framework where individuals differ both along the skill dimension and in their work-leisure preferences, demonstrates that when the government objective is to maximize the well-being of the deserving poor, defined as

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[4] For example, according to one poll cited in Gilens (1999), 74% of the public agrees that the criteria for welfare are not strong enough but only 3% reports that they would oppose a 1% sales tax increase aimed at funding help to the poor.

low-skill workers exhibiting a weak taste for leisure, work requirements can be a desirable supplement to the optimal tax-and-transfer system. Further, Saez (2002) discusses the possibility of assigning a lower marginal social weight to unemployed low-skilled workers than to their employed low-skilled counterparts, which also reflects the conservative view of a government willing to support those deserving, but not the lazy poor. Saez shows that in such a case, providing wage subsidies to low-income workers (that is, levying a negative marginal income tax, as in the Earned Income Tax Credit program in the US), is always socially desirable.

We employ a standard Mirrleesian setting where workers differ in their earnings abilities and make choices along the intensive margin. As in Cuff (2000), we also allow workers to differ in their work-leisure preferences. Assuming that the government maximizes a social welfare function that exhibits a sufficiently pronounced bias toward the deserving poor, we show that a minimum wage rule is a desirable supplement to the optimal tax-and-transfer system. The rationale derives from the screening role played by the minimum wage rule in targeting transfers toward the deserving poor which together with the efficient rationing implies that the entire incidence of the involuntary underemployment triggered by the introduction of the minimum wage rule falls on the undeserving poor. Efficient rationing enables the government to use the underemployment status as an indicator on which transfers can be conditioned. Put differently, a minimum wage serves as a tagging device [in the spirit of Akerlof (1978)] ensuring that the extra transfers offered by the government to the low-skilled workers will be exclusively targeted toward the deserving poor rather than being accorded to all poor across the board.

2.   The Model

Consider an economy with low- and high-skilled workers that produce a single consumption good whose price is unity. The mass of each skill group is unity. The output X of the productive sector is given by

$$(1) \qquad X = F(N^l, N^h),$$

where N^l and N^h denote the total working hours of low- and high-skilled workers, respectively. The function F is increasing, has constant returns to scale, and exhibits diminishing marginal productivity in the input of each skill level.

Let c denote consumption and n working hours. The utility of a high-skilled worker (indexed by superscript h) is given by $u^h \equiv c^h - g(n^h)$, where $g' > 0$ and $g'' < 0$. The utility of low-skilled workers depends on their taste for leisure. For a fraction $\alpha \in (0,1)$ of the low-skilled workers (indexed by superscript d) the utility is given by $u^d \equiv c^d - g(n^d)$. For the remaining $1 - \alpha$ of the low-skilled workers (indexed by superscript u) the utility is given by $u^u \equiv c^u - kg(n^u)$, where $k>1$. That is, type u low-skilled workers incur a higher disutility (both total and marginal) from work relative to their type d low-skilled counterparts for the same working hours supplied, which expresses a stronger taste for leisure. We follow Besley and Coate (1992a) and Cuff (2000) in interpreting type u workers' higher disutility from work as a sign of their "laziness". Accordingly, we will often refer to type d workers as "deserving poor" and to type u workers as "undeserving poor".

The total labor supply of the high-skilled workers is given by $N^h = n^h$, and the total labor supply of the low-skilled workers by $N^l = \alpha n^d + (1 - \alpha) n^u$. Assuming a competitive labor market, each worker is paid the value of his marginal product. Accordingly, the wage rate is $w^h \equiv \partial F(N^l, N^h)/\partial N^h$ for high-skilled workers and $w^l \equiv \partial F(N^l, N^h)/\partial N^l$ for low-skilled workers. We assume that $w^h > w^l$.

3. The Government Problem

The government seeks to maximize social welfare which is given by

(2) $W \equiv V(u^h) + \beta V(u^d) + (1 - \beta) V(u^u),$

where $V' > 0$, $V'' < 0$, and $\beta \in [\alpha, 1]$. The strict concavity of V reflects the inequality-aversion exhibited by the government. The parameter β measures the extent to which welfare-deservedness matters for the government: the higher the value of β, the stronger is its bias toward the deserving poor. The conventional case is captured by $\beta = \alpha$ where each group is weighted according to its size in the population. Having $\beta > \alpha$ implies that the government assigns the deserving poor more weight than their size in the population and the undeserving poor correspondingly less weight. This reflects the general public's resentment of individuals who seem unwilling to exert an adequate, i.e., socially acceptable, level of effort in the labor market and instead choose to rely on the generosity of the welfare system. In the extreme case where $\beta = 1$, the government completely "launders out" the undeserving poor from the welfare calculus by weighting the entire low-skilled population as if it were comprised of only the deserving poor.

4. The Benchmark Regime: No Minimum Wage

As is customary in the literature, we represent a nonlinear tax-and-transfer system as a triplet of consumption-work bundles (c^i, n^i), where $i = h, d, u$, that satisfy both a revenue constraint and a set of incentive-compatibility constraints. Formally, the government maximizes the welfare (2) subject to both the revenue constraint

(3) $F(N^l, N^h) \geq c^h + \alpha c^d + (1 - \alpha) c^u$,

and the six incentive-compatibility constraints IC^{ij} which state that for each different pair of worker types (i, j), where $i, j = h, d, u$ and $i \neq j$, a worker of type i has no incentive to mimic a worker of type j, i.e.,

(4) $c^i - k^i g(n^i) \geq c^j - k^j g\left(\frac{n^j w^j}{w^i}\right)$,

where $k^h = k^d = 1$, $k^u = k$ and $w^d = w^u = w^l$.

We follow Mirrlees (1971) in assuming that skill levels are private information and thus unobserved by the government. We also assume that the optimal solution is separating so that each type of worker receives a distinct consumption-work bundle. In particular, we focus on cases where the government assigns a relatively large weight to welfare-deservedness. We now prove:

Lemma: If β is sufficiently large, in the optimal solution for the government problem only the revenue constraint and the two incentive-compatibility constraints IC^{hd} and IC^{ud} are binding.

Proof: See Appendix A.

The fact that in the optimal solution the downward incentive-compatibility constraint IC^{hd} is binding, namely, a high-skilled worker is indifferent between choosing his intended bundle and mimicking a low-skilled deserving worker, is usual in the

literature. However, the fact that the upward incentive-compatibility constraint IC^{ud} is also binding, namely, a low-skilled undeserving worker, who has the lowest level of utility in the society, is indifferent between choosing his intended bundle and mimicking a low-skilled deserving worker, is unusual. That IC^{ud} is binding is caused by the inherent bias of the government toward the deserving poor. Indeed, numerical simulations show that it may even be desirable to levy a negative marginal tax rate on the deserving poor in order to make mimicking by the undeserving poor less attractive as the latter would have to work more hours to be eligible for the more generous transfer.[5]

5.   The Desirability of a Minimum Wage

A binding minimum wage sets a lower bound for the wage rate that can be paid to the low-skilled workers. Thus, a minimum wage effectively determines an upper bound for the number of hours worked by minimum-wage earners, which results in an excess supply of these workers. Rationing therefore ensues. We follow Lee and Saez (2012) by assuming that such rationing is efficient in that the low-skilled workers who are forced to involuntarily reduce their working hours in response to the minimum wage are those with the least surplus from working (i.e., with the strongest taste for leisure).[6]

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[5] The same logic underlies the finding in Cuff (2000) that welfare may be improved by an unproductive workfare program that serves as a screening tool to separate between the deserving and undeserving poor.

[6] For empirical evidence supporting the assumption of efficient rationing, see Neumark and Wascher (2007) who show that the employment effect of a minimum wage is strongest amongst teenagers and secondary earners that are likely to have a lower surplus. For more direct evidence, see Luttmer (2007) who shows that reservation wages do not increase in response to an increase in the minimum wage; namely, the increase in the level of the minimum wage does not cause misallocation of workers in the sense that workers with a higher reservation wage displace equally-skilled workers with a lower reservation wage. Thus, the evidence indicates that those workers who value their job the least (have a relatively high reservation wage) tend to lose their jobs due to a minimum wage increase. Notice that in our framework efficient rationing entails underemployment, i.e., a reduction of the working hours, rather than unemployment.

We turn next to show that the government can enhance welfare by introducing a minimum wage as a supplement to the tax-and-transfer system.

Proposition: When β is sufficiently large, supplementing the optimal tax-and-transfer system with a minimum wage is socially desirable under efficient rationing.

Proof: See Appendix B.

The rationale of the proposition is as follows. As shown in the lemma, in the absence of a minimum wage, due to the bias in the social welfare function toward the deserving poor, the incentive-compatibility constraint IC^{ud} associated with the undeserving poor would be binding. This puts a constraint on the government's redistributive capacity. In particular, increasing the transfer given to the deserving poor would violate the underserving poor's incentive-compatibility constraint. Introducing a minimum wage, presuming efficient rationing, blocks this undesirable supply-side response. Efficient rationing implies that the entire incidence of involuntary underemployment induced by the introduction of a minimum wage falls on the undeserving poor. Namely, the underserving poor will be forced to work less than what they would prefer given the tax schedule in place. Consequently, a minimum wage serves to relax the incentive-compatibility constraint IC^{ud}, allowing the government to offer more generous transfers to the deserving poor and thereby enhancing redistribution and welfare.[7] The minimum wage is essentially playing a tagging role [in the sense of Akerlof (1978)] by ensuring that the extra transfer offered

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[7] As acknowledged by the previous literature and noted by Lee and Saez (2012), implementing a tax-and-transfer system requires that the government observe the incomes of the workers, whereas implementing a minimum wage requires that individuals' wage rates are observable. This apparent informational inconsistency contrasts with the common practice of simultaneously imposing an income tax and a minimum wage. Lee and Saez provide a realistic explanation, which hinges on self-enforcement that relies on a combination of whistle blowing by underpaid workers and an ex-post costly verification of wages by the government. This ensures that although the government cannot directly observe wages, firms nonetheless comply with the minimum wage. We follow this line of reasoning and consider the simultaneous implementation of an income tax and a minimum wage.

to the low-skilled workers will be fully targeted to those considered deserving, rather than being accorded across the board to all low-skilled workers.

Assuming that the variation in the cost of labor is substantial (that is, k is large), we can provide a positive foundation for the assumption of efficient rationing. Suppose that the rationing of working hours is determined by a simple queuing process, where: (1) each worker decides whether or not to participate; (2) each participating worker is randomly assigned a position in a queue; and (3) rationing is implemented on a first-come-first-served basis. In such a setting, there exists equilibrium where all type d workers will choose to participate whereas all type u will opt out. The reason is that the expected time cost associated with queuing would be much lower for workers of type d than of type u. In equilibrium, type d workers will strictly prefer to participate whereas type u workers will weakly prefer to opt out. With k sufficiently large, the queuing time satisfying the above two incentive-compatibility constraints could be fairly short. Thus, rationing would be virtually efficient.[8]

It is worth noting the reason for the difference between our finding about the desirability of a minimum wage and the negative result in Allen (1987) and Guesnerie and Roberts (1987), suggesting that a minimum wage cannot be a useful supplement to the optimal tax-and-transfer system. In these two early studies, the downward incentive-compatibility constraint is binding; that is, the high-skilled workers are indifferent between whether or not to mimic the low-skilled workers. In contrast, due to the notion of welfare-deservedness, in our setting the upward incentive-compatibility constraint is also binding; that is, the undeserving poor are indifferent between whether or not to mimic the

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[8] A large k reflects substantial differences in labor market outcomes between the deserving and undeserving poor and may be the source of the widely documented public concern that a growing share of welfare claimants are undeserving.

deserving poor. It is the latter binding constraint combined with the efficient rationing of underemployment that renders the minimum wage a desirable supplement to the optimal tax-and-transfer system.[9]

6.   Conclusion

Assuming that labor supply decisions are concentrated along the extensive margin and efficient rationing of employment, Lee and Saez (2012) demonstrate that a minimum wage can block the supply-side response to an increase in the generosity of the welfare state and thereby help to enhance welfare. In the current paper, we extend their result to an environment with deserving and undeserving poor and where labor-supply decisions are concentrated along the intensive margin. In contrast to the early studies by Allen (1987) and Guesnerie and Roberts (1987), we show that a minimum wage rule can be socially beneficial by serving as a tagging device that targets benefits to the deserving poor.

The growing popularity of work requirements (workfare) as a precondition for eligibility of welfare transfers as well as the use of wage subsidies (earned income tax credit) reflect the public's prevalent perception that the welfare system should target those who are truly deserving; namely, those showing strong commitment to work or being truly disabled. While policy tools such as workfare and wage subsidies may indeed serve the purpose of screening between the deserving and the undeserving poor, in the current study we

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[9] Allen (1987) assumes a proportional reduction in working hours of all low-skilled workers, which is efficient due his assumption that low-skilled workers are homogenous. Alternatively, Marceau and Boadway (1994) assume that low-skilled workers are heterogeneous and that a minimum wage rule triggers unemployment (as opposed to underemployment). In that case, a minimum wage may be desirable if the government supplements the income-tax schedule with an unemployment-insurance scheme.

demonstrate that minimum wage can further enhance the government capacity to target

benefits toward the deserving poor.

Appendix A

Proof of the Lemma

We let $\beta = 1$. Our argument will extend to the case of sufficiently large values of β by continuity considerations. First, we will characterize the optimal solution taking into account only the incentive-compatibility constraints IC^{hd}, IC^{dh}, IC^{du} and IC^{ud}. Afterwards, we will verify that conditions IC^{hu} and IC^{uh} hold as strict inequalities. Our proof will proceed in several steps:

Claim 1: The revenue constraint is binding.

Proof: Suppose, by way of contradiction, that the revenue constraint holds as a strict inequality. Consider the following small perturbation to the presumed optimal solution. Let $\tilde{c}^i = c^i + \varepsilon$, where $\varepsilon > 0$, for $i = h$, d, u. By continuity considerations, the revenue constraint is maintained and none of the incentive-compatibility constraints is violated. As the perturbation yields an increase in social welfare, we obtain the desired contradiction.

Claim 2: The incentive-compatibility constraint IC^{ud} is binding.

Proof: Suppose, by way of contradiction, that IC^{ud} holds as a strict inequality. Consider the following small perturbation to the presumed optimal solution:

$\tilde{c}^h = c^h + \varepsilon,$

$\tilde{c}^d = c^d + \varepsilon,$

$\tilde{c}^u = c^u - \delta,$

where $\varepsilon, \delta > 0$ and satisfy $(1 - \alpha)\delta = (1 + \alpha)\varepsilon$.

By continuity considerations IC^{ud} is maintained. Moreover, neither the revenue constraint nor any of the other incentive-compatibility constraints is violated. The

suggested perturbation yields an increase in social welfare, as no weight is assigned to the undeserving workers (whose level of consumption is reduced). We thus obtain the desired contradiction.

Claim 3: The incentive-compatibility constraint IC^{hd} is binding.

Proof: Suppose, by way of contradiction, that the constraint holds as a strict inequality. Consider the following small perturbation to the presumed optimal solution:

$$\tilde{c}^h = c^h - \varepsilon,$$

$$\tilde{c}^d = c^d + \varepsilon,$$

$$\tilde{c}^u = c^u + \varepsilon,$$

where $\varepsilon > 0$.

By continuity considerations, IC^{hd} is maintained. Moreover, neither the revenue constraint nor any of the other incentive-compatibility constraints is violated. By virtue of IC^{hd} being binding, assuming that $n^d > 0$, as $w^h > w^l$ and g is increasing, it follows that $c^h - g(n^h) > c^d - g(n^d)$. Thus, by the strict concavity of V, the suggested small perturbation yields an increase in social welfare. We thus obtain the desired contradiction.

Claim 4: The incentive-compatibility constraint IC^{dh} is nonbinding.

Proof: Suppose, by way of contradiction, that IC^{dh} is binding. Then:

(A1) $\quad c^d - g(n^d) = c^h - g\left(\frac{n^h w^h}{w^l}\right).$

By virtue of Claim 3, constraint IC^{hd} is binding, hence:

(A2) $\quad c^h - g(n^h) = c^d - g\left(\frac{n^d w^l}{w^h}\right).$

Subtracting (A1) from (A2) yields:

(A3) $g\left(\frac{n^h w^h}{w^l}\right) - g(n^h) = g(n^d) - g\left(\frac{n^d w^l}{w^h}\right)$

$\Longleftrightarrow H\left(\frac{n w^h}{w^l}\right) = H(n^d),$

where $H(n) \equiv g(n) - g(\frac{n w^l}{w^h})$. Differentiation of H with respect to n yields:

(A4) $H' = g'(n) - g'\left(\frac{n w^l}{w^h}\right)\frac{w^l}{w^h} > 0,$

where the inequality sign follows from the strict convexity of g and the fact that $w^h > w^l$. It follows from (A3) that $n^h w^h / w^l = n^d$, which violates our presumption of no bunching.

Corollary 1: $\frac{n^h w^h}{w^l} > n^d$.

Proof: By virtue of Claim 4, constraint IC^{dh} is nonbinding, hence:

(A5) $c^d - g(n^d) > c^h - g\left(\frac{n^h w^h}{w^l}\right).$

Subtracting condition (A5) from (A2), which follows from Claim 3, yields:

(A6) $g\left(\frac{n^h w^h}{w^l}\right) - g(n^h) > g(n^d) - g\left(\frac{n w^l}{w^h}\right)$

$\Longleftrightarrow H\left(\frac{n^h w^h}{w^l}\right) > H(n^d).$

The result follows from the fact that $H' > 0$ (proved in Claim 4).

Claim 5: The incentive-compatibility constraint IC^{du} is nonbinding.

Proof: Suppose, by way of contradiction, that IC^{du} is binding. It then follows that

(A7) $c^d - g(n^d) = c^u - g(n^u).$

By virtue of Claim 2, the constraint IC^{ud} is binding, hence

(A8) $c^u - kg(n^u) = c^d - kg(n^d).$

Subtracting (A8) from (A7) yields:

(A9) $g(n^u) = g(n^d).$

As g is increasing, it follows that $n^u = n^d$, which violates our presumption of no bunching.

Corollary 2: $n^d > n^u$.

Proof: By virtue of Claim 5, the constraint IC^{du} is nonbinding, hence:

(A10) $c^d - g(n^d) > c^u - g(n^u)$.

Subtracting (A8), which follows from Claim 2, from (A10), yields:

(A11) $(k-1)g(n^d) > (k-1)g(n^u)$.

The claim follows, as g is increasing and $k>1$.

Our final steps would be to verify that the two incentive-compatibility constraints IC^{hu} and IC^{uh} are satisfied.

Claim 6: The incentive-compatibility constraint IC^{hu} holds.

Proof: Suppose, by way of contradiction, that IC^{hu} is violated. Thus:

(A12) $c^h - g(n^h) < c^u - g(\frac{n^u w^l}{w^h})$.

Subtracting (A2), which follows from Claim 3, from (A12), yields:

(A13) $c^d - g\left(\frac{n^d w^l}{w^h}\right) < c^u - g\left(\frac{n^u w^l}{w^h}\right)$.

Subtracting (A8), which follows from Claim 2, from (A13), yields:

(A14) $kg(n^d) - g\left(\frac{n^d w^l}{w^h}\right) < kg(n^u) - g\left(\frac{n^u w^l}{w^h}\right)$

$\Leftrightarrow B(n^d) < B(n^u)$,

where $B(n) \equiv kg(n) - g(\frac{n w^l}{w^h})$.

Differentiation of B with respect to n yields:

(A15) $B' = kg'(n) - \frac{w^l}{w^h}g'\left(\frac{n w^l}{w^h}\right) > 0$,

where the inequality sign follows from the strict convexity of g and the fact that both $k > 1$ and $w^h > w^l$. It therefore follows from (A14) that $n^u > n^d$, which violates corollary 2.

Corollary 3: The incentive-compatibility constraint IC^{hu} is nonbinding.

Proof: Repeating the steps of the proof of Claim 6, presuming IC^{hu} holds as an equality, yields: $B(n^d) = B(n^u)$. As $B' > 0$, it follows that $n^d = n^u$. This violates our presumption of no bunching.

Claim 7: The incentive-compatibility constraint IC^{uh} holds.

Proof: Suppose, by way of contradiction, that IC^{uh} is violated. Hence:

(A16) $c^u - kg(l^u) < c^h - kg\left(\frac{l^h w^h}{w^l}\right).$

Subtracting (A8), which follows from Claim 2, from (A16), yields:

(A17) $c^d - kg(n^d) < c^h - kg\left(\frac{n^h w^h}{w^l}\right).$

Subtracting (A17) from (A5), which follows from Claim 4, yields:

(A18) $(k - 1)g(n^d) > (k - 1)g(\frac{n^h w^h}{w^l}).$

As $k>1$ and g is increasing, it follows that $n^h w^h / w^l < n^d$. This violates Corollary 1.

Corollary 4: The incentive-compatibility constraint IC^{uh} is nonbinding.

Proof: Repeating the steps of the proof of Claim 7, presuming IC^{uh} holds as an equality, yields: $(k - 1)g(n^d) > (k - 1)g(\frac{n^h w^h}{w^l}).$

As $k>1$ and g is increasing, it follows that $n^h w^h / w^l < n^d$. This violates Corollary 1.

This completes our proof.

Appendix B

Proof of the Proposition

We let $\beta = 1$. Our argument will extend to the case of sufficiently large values of β by continuity considerations. Suppose that there is no minimum wage in place and let the triplet (c_*^i, n_*^i), where $i = h$, d, u, denote the optimal income tax schedule that maximizes the welfare (2) subject to the revenue constraint (3) and the incentive-compatibility constraints (4). Consider now the following small perturbation to the presumed optimal solution:

$$\tilde{c}^h = c_*^h + \varepsilon,$$

$$\tilde{c}^d = c_*^d + \varepsilon,$$

$$\tilde{c}^u = c_*^u - \delta,$$

where $\varepsilon, \delta > 0$ and $(1 - \alpha)\delta = (1 + \alpha)\varepsilon$.

In addition, suppose that the government is setting a binding minimum wage denoted by $\bar{w}$, which satisfies $\partial F(\alpha n_*^d + (1 - \alpha)n_*^u, n_*^h)/\partial N^l = \bar{w}$. That is, the minimum wage is set at the level of the low-skill equilibrium wage rate obtained under the optimal income tax schedule in the absence of a minimum wage. By construction, neither the revenue constraint nor any of the incentive-compatibility constraints IC^{hd}, IC^{hu}, IC^{dh} and IC^{du} is violated. Furthermore, by virtue of Corollary 4 (see the proof to the lemma) IC^{uh} is nonbinding and hence remains satisfied by continuity. Notice, that IC^{ud}, which is binding under the optimal tax regime, is violated by the suggested perturbation, as the undeserving poor would want to mimic their deserving counterparts. However, we now demonstrate that the binding minimum wage blocks this mimicking.

By virtue of IC^{du} and IC^{ud}, the introduction of a binding minimum wage results in involuntary underemployment. To see this, notice that the deserving and undeserving poor are willing to work n_*^d hours as both types strictly prefer the bundle (c_*^d, n_*^d) to any other bundle. This implies that the total labor supply of the low-skilled workers is given by n_*^d. However, the total labor demand for low-skilled workers is given by $\alpha n_*^d + (1-\alpha)n_*^u < n_*^d$, where the inequality follows from the fact that $n_*^d > n_*^u$ (see Corollary 2 in the proof of the lemma).

The excess supply implies the need for rationing. The efficient rationing implies that the entire incidence of underemployment will fall on the undeserving poor. That is, in response to the introduction of the minimum wage the undeserving poor will become underemployed and only work n_*^u hours, whereas the deserving poor will continue to work n_*^d hours. To see this, notice that by virtue of the quasi-linear utility functions, it follows that a necessary and sufficient condition for a rationing rule to be efficient is that it maximizes the total surplus (S) of the low-skilled workers, which is given by

(B1) $\quad S \equiv [N^l \overline{w} - (\alpha - x^d)g(n_*^d) - x^d g(n_*^u) - (1 - \alpha - x^u)kg(n_*^d)$

$\quad\quad\quad -x^u kg(n_*^u)],$

where $N^l \equiv \alpha n_*^d + (1-\alpha)n_*^u$, subject to the constraint

(B2) $\quad (1 - x^d - x^u)n_*^d + (x^d + x^u)n_*^u = N^l,$

where $0 \le x^d \le \alpha$ and, $0 \le x^u \le 1 - \alpha$.[10]

Rearranging (B2) yields:

(B2') $\quad x^u = (1 - \alpha) - x^d.$

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[10] Maximizing the sum of utilities is a sufficient condition for attaining a *Pareto* efficient allocation under any utility specification. Quasi-linearity implies that this is also a necessary condition due to the linearity of the frontier of the utility possibility set.

Substituting for x^u from (B2') into (B1) and re-arranging yields:

(B3) $S = [N^l \overline{w} - (\alpha - x^d)g(n_*^d) - x^d g(n_*^u) - x^d k g(n_*^d) - (1 - \alpha - x^d)kg(n_*^u)].$

Differentiating (B3) with respect to x^d yields, upon re-arrangement,

(B4) $\frac{\partial S}{\partial x^d} = -(k-1)[g(n_*^d) - g(n_*^u)] < 0,$

where the inequality follows as $n_*^d > n_*^u$ (by virtue of Corollary 2 in the proof of the lemma), g is increasing and $k>1$. We therefore conclude that $x^d = 0$ and, by virtue of (B2'), $x^u = 1 - \alpha$. Thus, the entire incidence of under-employment falls on the undeserving poor who are unable to mimic their deserving counterparts.

The suggested perturbation yields an increase in social welfare, as no weight is assigned to the undeserving poor. This concludes the proof.

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