The B.E. Journal of Economic Analysis & Policy

Contributions

Volume 9, *Issue* 1 2009 *Article* 51

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Recommended Citation
Miki Malul and Israel Luski (2009) "The Optimal Policy Combination of the Minimum Wage and the Earned Income Tax Credit," *The B.E. Journal of Economic Analysis & Policy*: Vol. 9: Iss. 1 (Contributions), Article 51.
Available at: http://www.bepress.com/bejeap/vol9/iss1/art51

The Optimal Policy Combination of the Minimum Wage and the Earned Income Tax Credit*

Miki Malul and Israel Luski

Abstract

This paper evaluates the consequences of minimum wage (MW) and earned income tax credit (EITC) in a model with heterogeneous costs of investment in human capital. Our model studies the effects of a MW and an EITC on employment, productivity, and total output for two types of groups: those with a low cost of acquiring human capital and a long horizon of earnings (Type Ys); and those with a high cost of acquiring human capital and a short horizon of earnings (Type Os). We assume that Type Ys consider investing in human capital while Type Os have a certain predetermined level of human capital and do not consider changing it. Our model suggests that a government might consider imposing a MW exclusively for Type Y individuals and an EITC exclusively for Type O individuals. Some of the best effects of each policy would therefore be obtained and some of the worst consequences would be avoided.

KEYWORDS: minimum wage (MW), earned income tax credit (EITC), human capital

*We would like to thank the editor, Caroline Hoxby, and the anonymous referees for their comments and suggestions that helped us to greatly improve our paper.

1 Introduction

Minimum wage (MW) and earned income tax credit (EITC) policies affect not only wages and employment, but also incentives to acquire education and training (hereafter, "human capital"). Because the cost of acquiring human capital varies across individuals, we might expect the impacts of a MW or an EITC to vary across people with different costs and different horizons over which to earn the returns from human capital.

This paper presents a theoretical framework to understand the impact of a MW and an EITC on human capital acquisition, employment, production, and income distribution.

For simplicity, we divide the population into two groups: those with a low cost of acquiring human capital and a long horizon of earnings (Type Ys) and those with a high cost of acquiring human capital and a short horizon of earnings (Type Os). We assume that Type Ys consider investing in human capital while Type Os have a certain predetermined level of human capital and do not consider changing it. It is natural to think of the Type Ys as young people and the Type Os as old people because young people are thought to have an easier time learning new things and they have more expected years of work in front of them. Nevertheless, there are undoubtedly young people for whom learning is very hard or whose life expectancy is low, and there are also older people for whom learning is easy and life expectancy is long. Hereafter, we stay with the Type Y versus Type O distinction for clarity, recognizing that real people fit along a spectrum. Readers, however, may wish to keep in mind the young versus old intuition.

Following Agell and Lommerud (1997), we assume that individuals make two decisions: how much human capital to acquire and whether to join the workforce. Their decisions are a function of their individual costs of acquiring human capital and labor market conditions (the probability of employment, the wage, and the educational requirements for each job). Both a MW and an EITC affect labor market conditions, and therefore may change an individual's decisions regarding human capital investments and employment.

We show that policies like an EITC or a MW, when they are applied to the entire population can have adverse effects on one group but largely beneficial effects on the other. This finding suggests that conditioning such policies on a person's type (Type Y versus Type O in the model; combinations of age, health, and educability in practice) may improve social welfare.

Because we are interested in the effects of a MW and an EITC on human capital, we analyze their long-run impacts. This is somewhat in contrast to the existing literature, which tends to examine the short-run effects of these policies on the wages and employment of low-skilled workers.

The short-run effects of a MW are controversial. Stigler (1946) makes the classic argument that imposing a binding MW in a perfectly competitive market increases unemployment among low-skilled workers. Most of the literature follows the theory he presents, although some have argued that a MW can be efficient if it counteracts employers' monopsony power. More recently, Lee and Saez (2008) argue that, if there is efficient rationing of jobs when a MW is imposed, then imposing a MW can be socially optimal in combination with other social transfer programs. (Efficient rationing requires that, when the smaller number of MW jobs are allocated among the larger number of workers seeking them, the jobs are allocated to the workers with the greatest surplus from working. It is unclear how such efficient rationing would arise since employers do not know individuals' surplus and surplus is not the same as productivity.) The empirical literature on minimum wages is large and often contested. See, for instance, Card and Kruger (1994) and Neumark and Wascher (2006).

There is a limited range of empirical literature that discusses whether a MW affects human capital acquisition. Neumark and Wascher (2003), for instance, find that imposing a higher MW increases the probability of teenagers dropping out of high school. Arulampalam et al. (2004) and Pischke (2004) find evidence that a MW increases on-the-job training, presumably because employers offer on-the-job training to raise the productivity of their workers to the wage that they are mandated to pay. Mattila (1978) and Cahuc and Michel (1996) find a positive correlation between an area's MW and its population's educational attainment, although this evidence cannot be considered causal.

An EITC is an alternative policy for reducing poverty. An EITC transfers no money to non-workers, but it gives workers with very low earnings a negative marginal income tax rate, and it gradually phases out the transfer for workers with higher earnings. Most studies (for instance, Blundell and Hoynes, 2001) find that an EITC increases employment, but the magnitude of the impact depends on the specific rules by which the EITC is implemented (see Eissa and Hoynes, 2004). Saez's (2002) analysis of the optimal combination of an EITC and negative income tax suggests that an EITC is more likely to be optimal when behavioral labor supply responses are mainly on the participation margin (employment versus non-employment), as opposed to the hours of work margin among those who work.

Various other papers have analyzed which combination of a MW and an EITC is optimal. As mentioned above, Lee and Saez (2008) conclude that combining a MW with an EITC is optimal if there is efficient rationing of jobs. Boadway and Cuff (2001) argue that a MW can enhance social welfare when combined with an income-tax-transfer system because the combination can, under certain conditions, decrease unemployment.

Our paper makes a distinct contribution to studies on a MW and an EITC because we theoretically examine the implications of a MW and an EITC specifically in relation to human capital acquisition. We believe that this is an important channel that can substantially affect the optimality of these policies. To the best of our knowledge, no previous work has attempted to distinguish between how these policies affect people with a low cost of acquiring human capital and a long horizon (Type Ys) and those with the opposite characteristics (Type Os).

2 A Model of How Minimum Wage and Earned Income Tax Credit Affects Human Capital Acquisition and Employment

Every individual makes two decisions: whether to join the work force and how much to invest in human capital. The individual's optimal decisions are affected by the costs of acquiring human capital, by labor market conditions, and by the length of his time horizon. We therefore divide the population into two groups. Type Y workers have a low cost of acquiring human capital and a long horizon over which to earn returns. Type O workers have the opposite, that is, a high cost of acquiring human capital and a short horizon over which to earn returns. In fact, we will assume without loss of generality that Type O workers' costs of acquiring human capital are so great and their time horizon so short that they will never invest in human capital.

2.1 The Labor Market Model: Assumptions and Notation

The professional level of an individual, e_i, is determined by his investment in human capital, the minimum value of which is assumed to be 0 (corresponding to compulsory schooling). Type Y workers consider raising their professional level by investing time and money in human capital, but Type O workers do not consider changing their professional level. The value of a worker's output, y_i, is a function of his professional level. For simplicity, we assume that $y_i = e_i$.

The worker's wage we identify as: w_i. The ratio between the wage and the worker's output is determined by the level of competitiveness in the labor market. The wage is determined in a bargaining process between the employer and his employee. The outcome of the bargaining process is a ratio, λ, such that the wage satisfies $w_i = \lambda e_i$ (we assume that λ is equal for all workers). λ can be interpreted as the level of competitiveness of the labor market: $\lambda = 1$ indicates a perfectly competitive market, and a lower λ indicates a less competitive market. We analyze the model for two assumptions regarding the level of competition: perfect and imperfect competition.

Each individual is characterized by a parameter μ_i which determines his ability to acquire human capital. Type Y individuals can achieve a professional level, e_i, by investing:

$$\frac{1}{2\mu_i} e_i^2$$

in human capital. Observe that individuals with a high value of μ_i face low costs of acquiring human capital and vice versa.

Type O individuals are locked into their current professional level e_i. B denotes the utility of an unemployed individual, which is a function of utility from leisure and income from sources such as unemployment benefits, other income transfer payments, and savings. We assume that a firm will employ a worker only if $y_i \geq w_i$.

2.2 Individuals' Decisions Regarding Working and Acquiring Human Capital

2.2.1 Type O Workers

A Type O individual has no human capital investment decision to make, so his utility maximization problem requires him only to choose between working or staying out of the work force. His maximization problem is:

$$\max_L U_i = Lw_i + (1-L)B \tag{1}$$

The value of L is 1 if the individual decides to work and 0 otherwise. His wage is $w_i = \lambda e_i$. Thus, the Type O individual decides to work if $\lambda e_i \geq B$, which is true when his professional level satisfies:

$$\frac{B}{\lambda} \leq e_i .$$

Figure 1: Type O Work Decision in Competitive (a) and Noncompetitive (b) Markets

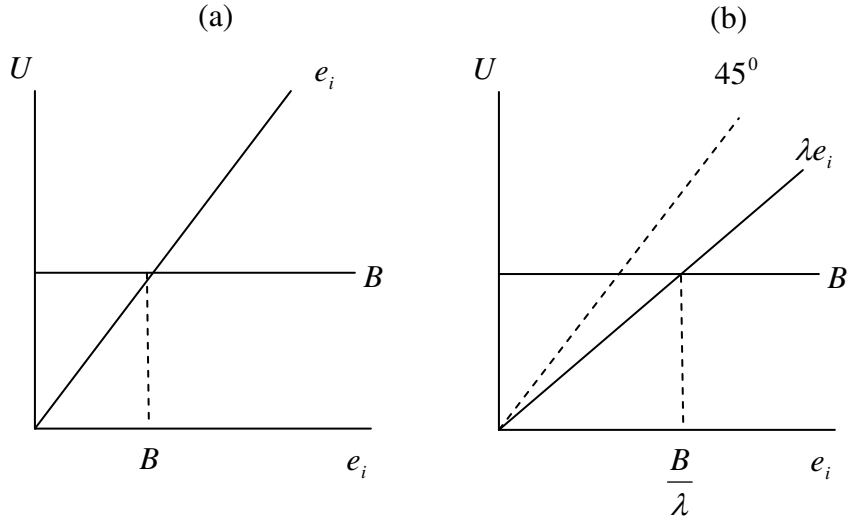


Figure 1 shows that in a competitive labor market, the level of employment is higher than in the noncompetitive market because the employee's wage for the same professional level is higher in a competitive market, which motivates a less-skilled worker to choose more labor and less leisure.

2.2.2 Type Y Workers

Following Agell and Lommerud, we assume that to maximize utility, a Type Y individual jointly determines his professional level, e_i, and labor market participation, *L*. If the individual does not work, investment in human capital has no benefit; hence all individuals who do not enter the labor market set $e_i = 0$. Since the cost of acquiring human capital to achieve a professional level of e_i is

$$\frac{1}{2\mu_i} e_i^2 ,$$

each Type Y individual maximizes the following utility function:

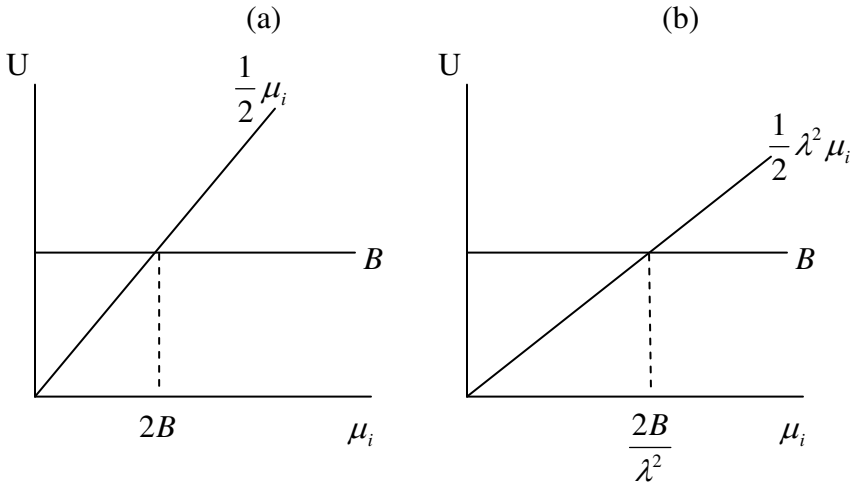
$$\max_{e_i, L} U = L(w_i - 0.5 * \frac{1}{\mu_i} e_i^2) + (1 - L)B \qquad (2)$$

The value of the utility of an individual who works, (*L*=1), and chooses professional level optimally is $\frac{1}{2}\lambda^2 \mu_i$, while one who stays out of work receives a utility level of *B*. Therefore, an individual works if his ability satisfies:

$$\mu_i \geq \frac{2B}{\lambda^2}.$$

Individuals whose ability does not satisfy this criterion (in other words $\mu_i < \frac{2B}{\lambda^2}$) do not work and choose the lowest possible professional level ($e_i = 0$).

Figure 2: Type Y Work Decision in Competitive (a) and Noncompetitive (b) Markets



The competitiveness of the labor market has a similar effect on Type Y workers as on Type O workers. Figure 2 shows that the more competitive the market is, the greater the number of workers who prefer to work and invest in human capital.

2.3 The Impact of a MW on Individual Decisions

First, for a noncompetitive labor market, let us consider the effect of a MW on the ratio of a workers wage to his product (λ). Recall that λ is determined by a bargaining process between the employee and employer, and the outcome of this process depends on the worker's alternatives (alternative employment possibilities, the availability of other sources of income, and so on) and the employer's alternatives (such as moving production to other countries). The less attractive the workers' alternatives are and the more attractive the employers' alternatives are, the smaller λ is.

We assume that the MW changes the outcome of the bargaining in the following way. Let w_m be the level of the newly imposed MW. We assume that

there is no change in wage above the new MW (i.e., $w_i = \lambda e_i > w_m$). Workers with a sufficiently high professional level (a wage of w_i that satisfies $\lambda w_m < w_i = \lambda e_i < w_m$) continue to be employed and receive the MW (λ becomes larger). We base this assumption—of how the MW affects the wage—on Flinn's (2002) Nash bargaining-based model. In his model, the MW increases the bargaining power of the workers in the vicinity of the MW.

2.3.1 The Impact of a MW on Type O Workers

The effects of imposing a MW on Type O individuals who have a fixed professional level are summarized in the following propositions.

Proposition 1*: Imposing an effective MW (which is above the lowest wage that prevailed before the imposition of the MW) in a perfectly competitive labor market reduces the employment of Type O people.*

Proof: In a perfectly competitive market, for each $w_m > B$, employment decreases. Each worker whose professional level is in the range $B < e_i < w_m$ becomes unemployed because the firm does not find paying the worker a MW profitable. Because we assume that these workers cannot change their professional level, there is no way for them to be employed again (this also can be seen in Figure 3). *Q.E.D.*

Proposition 2: *Imposing an effective MW in an imperfectly competitive labor market reduces the employment of Type O people if the level of the MW satisfies the following condition:*

$$w_m > \frac{B}{\lambda}.$$

In contrast, their employment is increased if the level of the MW satisfies the following condition:

$$w_m < \frac{B}{\lambda}.$$

Proof: In an imperfectly competitive market, for the MW level that satisfies:

$$w_m > \frac{B}{\lambda}$$

employment decreases.

Only workers with a professional level that satisfies $e_i > w_m$ are employed. Workers with a professional level in the range $\frac{B}{\lambda} < e_i < w_m$ are laid off as their output is less than the MW.
Setting the MW level so that:

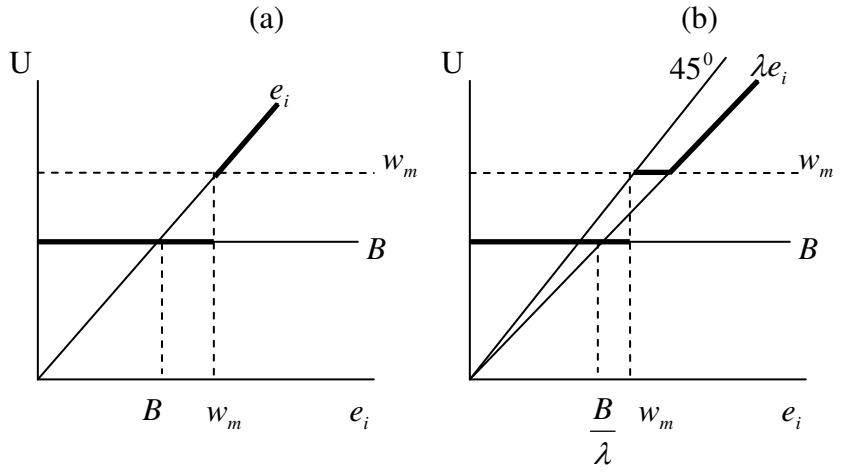
$$B < w_m < \frac{B}{\lambda}$$

raises the rate of employment, and thus any worker with a professional level of:

$$\frac{B}{\lambda} > e_i > w_m$$

is employed, while before the imposition of the MW this worker preferred to be unemployed. The intuition for this result is simple: the MW increases the wage for individuals with a professional level in the relevant vicinity of the MW, encouraging work. For these individuals, the wage is equal to the MW. *Q.E.D.*

Figure 3: The Impact of a MW on Type O Individuals in a Competitive (a) and Noncompetitive (b) Market



In Figure 3, the dashed vertical lines indicate the thresholds at which individuals switch from employment to unemployment. Figure 3 shows that when:

$$w_m > \frac{B}{\lambda}$$

the MW decreases the employment of Type O individuals in a competitive market as well as in a noncompetitive market. In a competitive market, unemployment occurs to a relatively great extent and is indicated by the demarcated interval

between B and w_m. However, in a noncompetitive market, less unemployment occurs, due to employers' willingness to increase the wage (increase the λ) and still employ the workers with professional level that is higher or equal to the MW. The unemployment is reflected by the demarcated interval between $\frac{B}{\lambda}$ and w_m.

2.3.2 The Impact of a MW on Type Y Workers

Imposing a MW may change a Type Y individual's optimal professional level. A Type Y worker who faces layoff as a result of imposing a MW may raise his professional level by increasing his investment in human capital. A Type Y worker facing a MW maximizes:

$$U = L(\max(\lambda\, e_i - \frac{1}{2\mu_i} e_i^{\,2}), (w_m - \frac{1}{2\mu_i} w_m^{\,2})) + (1-L)B \qquad (3)$$

e_i, L

The MW changes the structure of a Type Y person's problem because now, in addition to the previous choice between employment and unemployment, the individual must choose whether to keep his current level of investment in human capital or raise it. The first expression:

$$(\lambda\, e_i - \frac{1}{2\mu_i} e_i^{\,2})$$

is the utility of a Type Y worker who chooses to acquire sufficient human capital so that he is beyond the impact of the MW. The second expression:

$$(w_m - \frac{1}{2\mu_i} w_m^{\,2})$$

is the utility for a Type Y worker who works and receives the MW. The third expression (B) is the utility of an individual who stays out of the work force.

Proposition 3*: Imposing an effective MW in an imperfectly competitive labor market increases Type Y individuals' employment if it satisfies:*

$$w_m < \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2},$$

and reduces it if

$$w_m > \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2}.$$

Proof: Maximization of the above utility function gives us the following results:

1. Individuals whose ability satisfies $\mu_i > \overline{\mu}$ where:

$$\overline{\mu} = \frac{w_m(1+\sqrt{1-\lambda^2})}{\lambda^2})$$

(in a perfectly competitive market, $\overline{\mu} = w_m$) do not change their behavior as a result of an imposed MW.

2. Individuals whose μ_i satisfies $\mu_i < \underline{\mu}$ where:

$$\underline{\mu} = \frac{w_m{}^2}{2(w_m - B)}$$

choose to be unemployed.

3. Individuals whose ability satisfies $\underline{\mu} \le \mu_i \le \overline{\mu}$ choose to work, to receive the MW and to invest in human capital the minimal amount required in order to be employable. Their cost of investment in human capital is:

$$\frac{1}{2\mu_i} w_m{}^2,$$

and their professional level is $e_m = w_m$.

The threshold for employment with the MW is $\underline{\mu}$. If we compare it to the threshold before the imposition of the MW, which is

$$\frac{2B}{\lambda^2},$$

we can see that for

$$w_m < \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2},$$

$\underline{\mu}$ is lower than

$$\frac{2B}{\lambda^2}.$$

Thus, the MW increases employment. However, for

$$w_m > \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2},$$

$\underline{\mu}$ is higher than

$$\frac{2B}{\lambda^2}.$$

Thus, the MW decreases employment. *Q.E.D.*

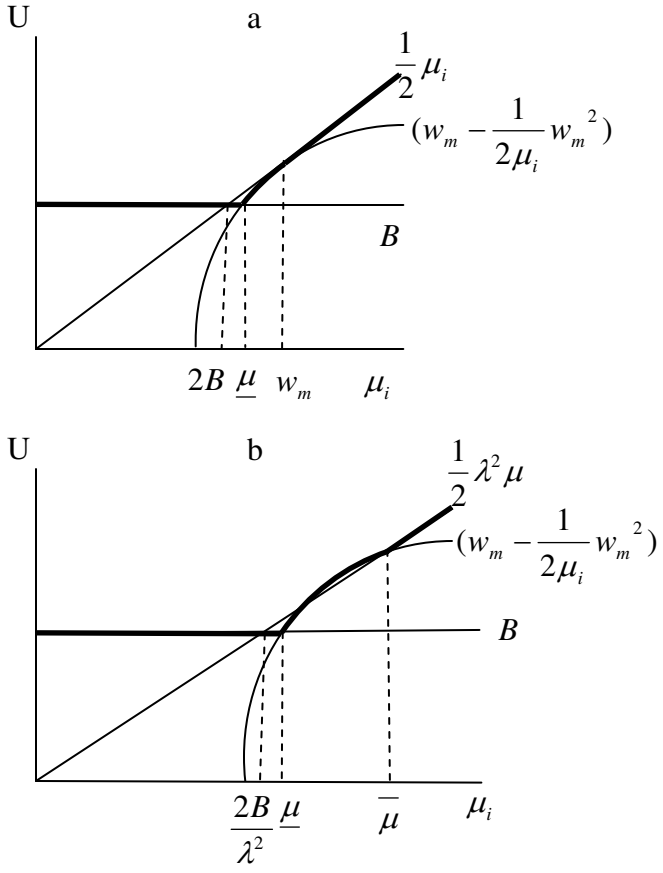
Proposition 4: *Imposing an effective MW in a perfectly competitive labor market reduces the employment of Type Y people. However, this reduction is moderate*

(in relation to the reduction for Type O people) because some Type Y workers raise their professional level.

Proof: The same conditions as in a noncompetitive market hold in a perfectly competitive market. The MW leads to unemployment for individuals whose ability is in the range $2B < \mu_i < \underline{\mu}$. However, the individuals whose ability satisfies $\underline{\mu} < \mu_i < w_m$ choose to increase their professional level, increasing their productivity so that firms choose to hire them at the MW. In contrast, all Type O individuals whose professional level is below the MW are laid off when it is imposed. Thus, the MW causes less unemployment for Type Y individuals than for Type O individuals. *Q.E.D.*

Intuitively, the ability of Type Y individuals to change their professional level allows them to "defend themselves" against the unemployment consequences of the MW.

Figure 4: The Impact of a MW on Type Y Individuals in Competitive (a) and Noncompetitive (b) Markets



In Figure 4(a), we assume an effective MW is higher than 2*B*, and we show that such a MW decreases employment. Type Y individuals' response to the MW (changing their professional level) is such that any individual whose μ_i is in the interval $\underline{\mu} < \mu_i < w_m$ is prevented from becoming unemployed. This can be seen in the curved line in this interval.

Figure 4(b) shows that, similarly, in noncompetitive markets the ability of Type Y individuals to raise their professional level allows them to remain employed even under a relatively high MW (we assume that

$$w_m > \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2}).$$

Therefore, unemployment is relatively low in this case.

Proposition 5*: In both perfectly competitive and noncompetitive labor markets, there exist parameters such that an effective MW increases the total professional level of all Type Y individuals.*

Proof: Imposing a MW causes the following changes in the professional level of the Type Y individuals:

Case 1: Imposing a MW that satisfies:

$$w_m > \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2}$$

(2*B* in a perfectly competitive labor market) causes the following changes in the professional level of Type Y people:

1. Workers whose ability is in the range:

$$\underline{\mu} < \mu_i < \frac{w_m}{\lambda}$$

(for a competitive labor market, $\underline{\mu} < \mu_i < w_m$) increase their investment in human capital so that their professional level is w_m.

2. Workers whose ability is in the range:

$$\frac{w_m}{\lambda} < \mu_i < \overline{\mu}$$

decrease their investment in human capital, so their professional level is w_m (this case is only relevant to a noncompetitive market).

3. Workers whose ability is in the range:

$$\frac{2B}{\lambda^2} < \mu_i < \underline{\mu}$$

(in a competitive labor market, $2B < \mu_i < \underline{\mu}$) are laid off and decrease their professional level to a minimum.

Case 2: Imposing a MW that satisfies:

$$w_m < \frac{2B(1+\sqrt{1-\lambda^2})}{\lambda^2}$$

in an imperfectly competitive labor market (this case does not hold for a perfectly competitive market) causes the following changes in the professional level of Type Y people:

1. Workers whose ability is in the range:

$$\frac{2B}{\lambda^2} > \mu_i > \underline{\mu}$$

join the work force and increase their professional level.

2. Workers whose ability satisfies:

$$\frac{2B}{\lambda^2} < \mu_i < \frac{w_m}{\lambda}$$

increase their professional level as well.

3. Workers whose ability satisfies:

$$\frac{w_m}{\lambda} < \mu_i < \overline{\mu}$$

decrease their professional level.

It can be seen that in a competitive labor market, the professional level of each individual in the range $\underline{\mu} < \mu_i < w_m$ increases by $w_m - \mu_i$, while, for individuals in the range $2B < \mu_i < \underline{\mu}$, the professional level decreases by μ_i. Thus, the total professional level of all Type Y individuals increases for certain values of the model's parameters and level of the MW.

In a noncompetitive market in both Case 1 and Case 2, the MW increases the professional level of individuals whose ability is in the range:

$$\underline{\mu} < \mu_i < \frac{w_m}{\lambda},$$

and it decreases the professional level of those whose ability is in the range:

$$\frac{w_m}{\lambda} < \mu_i < \overline{\mu}.$$

In addition, in the first case, those who are laid off when the MW is imposed decrease their professional level to zero, and, in the second case, those who join the working group increase their professional level from zero to the MW level. Thus, the total professional level for the Type Y group increases for certain values of the model's parameters and level of the MW (this holds for both Case 1 and Case 2). *Q.E.D.*

If we focus on *employed* individuals in a competitive market, we can see that the average professional level of the working population increases for two reasons. First, low professional level individuals leave the labor market because they are not sufficiently productive to earn the MW. Second, individuals whose ability satisfies the condition $\underline{\mu} < \mu_i < w_m$ choose to increase their professional level so that firms will be willing to hire them at w_m. Individuals with high abilities $\mu_i > \overline{\mu}$ continue to be employed, and their professional level remains unchanged. In the noncompetitive scenario, the impact on the average professional level of Type Ys who work is ambiguous. In addition to the positive impact upon the professional level that is similar to the competitive scenario, the individuals whose abilities are in the range:

$$\frac{w_m}{\lambda} < \mu_i < \overline{\mu}$$

decrease their professional level from $\lambda\mu_i$ to w_m as in that range the marginal return to a marginal increase in professional level is zero.

2.3.3 The Impact of Raising the MW on Employment and Professional Level

In most developed countries, a MW already exists, and the policy debate focuses on changing a MW level. In this section, we therefore study the impact of a marginal change in the MW on employment and professional level.

Proposition 6*: A marginal rise of the MW decreases employment of Type Y individuals in a competitive market; however, for a noncompetitive market, the effect depends upon the initial level of the MW.*

Proof: Let w_{m1} be the current level of the MW with the government considering raising it to w_{m2} $\left(w_{m2} > w_{m1}\right)$. Raising the MW causes the following changes:

1. For a competitive labor market, raising the MW decreases employment as the threshold for employment increases ($\underline{\mu}_{m2} > \underline{\mu}_{m1}$).
2. For a noncompetitive market:

a. If $w_{m1} > 2B$, an increase in the MW reduces employment, as ($\underline{\mu}_{m2} > \underline{\mu}_{m1}$). Thus, any individual with ability in the range $\underline{\mu}_{m2} \geq \mu_i \geq \underline{\mu}_{m1}$ is laid off.

b. If $w_{m1} < 2B$, we get: $\underline{\mu}_{m2} < \underline{\mu}_{m1}$, thus all of the individuals with ability in the range $\underline{\mu}_{m2} < \mu_i < \underline{\mu}_{m1}$ join the employees group. *Q.E.D.*

Following Proposition 6, we analyze the affect of a marginal rise of the MW on the professional level of Type Y workers:

1. For $w_{m1} > 2B$
   a. Individuals with $\mu_i < \underline{\mu}_{m1}$ are not affected by the change in the MW.
   b. Individuals with abilities $\underline{\mu}_{m1} \leq \mu_i \leq \underline{\mu}_{m2}$ decrease their professional level to a minimum, as they prefer unemployment to employment and investing in human capital.
   c. Individuals with abilities $\underline{\mu}_{m2} \leq \mu_i \leq \overline{\mu}_{m1}$ increase their professional level from w_{m1} to w_{m2} to ensure that they are productive enough to be hired under the new MW law.
   d. Individuals with abilities $\overline{\mu}_{m1} \leq \mu_i \leq \overline{\mu}_{m2}$ decrease their professional level from $e_i = \lambda\ \mu_i$ to w_{m2}.
   e. Those with abilities higher than $\overline{\mu}_{m2}$ are not affected by the change in the MW.

   For a perfectly competitive market, subgroups a,b and e act as in the noncompetitive case. In the perfectly competitive case, individuals in subgroups c and d increase their professional level from w_{m1} to w_{m2}.

2. For $w_{m1} < 2B$ (which is relevant only for a noncompetitive market):
   a. Individuals with $\mu_i < \underline{\mu}_{m2}$ are not affected by the change in the MW.
   b. Individuals with abilities $\underline{\mu}_{m2} \leq \mu_i \leq \underline{\mu}_{m1}$ increase their professional level from 0 to w_{m2}.
   c. Individuals with abilities $\underline{\mu}_{m1} \leq \mu_i \leq \overline{\mu}_{m1}$ increase their professional level from w_{m1} to w_{m2}.
   d. Individuals with abilities $\overline{\mu}_{m1} \leq \mu_i \leq \overline{\mu}_{m2}$ decrease their professional level from $e_i = \lambda\ \mu_i$ to w_{m2}.
   e. Those with abilities higher than $\overline{\mu}_{m2}$ are not affected by the change in the MW.

In summary, the impact of raising the MW on acquiring human capital depends on the initial level of the MW, the distribution of the individuals' abilities, as well as other parameters.

2.4 An EITC

In this section, we study the impact of an EITC, which is an earnings subsidy that a person receives *if* he works. We use a stylized version of an EITC that provides a worker with a negative tax (transfer income) of max $\{\Gamma - \alpha w_i, 0\}$ where $\alpha<1$. That is, an individual receives a subsidy from the government that is decreasing in his pre-EITC wage. When the wage of the individual reaches $\frac{\Gamma}{\alpha}$, the EITC becomes zero.

Readers familiar with the U.S. EITC will see that the stylized EITC we analyze only captures the "phase-out" range of the U.S. EITC. The stylized EITC nevertheless captures the important features of the policy. The same simplification is used by Saez (2002).

We make two assumptions that ensure that the EITC we consider is interesting. First, we assume that the EITC is not so high that working at a 0 wage is more attractive than not working ($\Gamma < B$). Second, we assume that the EITC is sufficiently generous that it could influence employment decisions. In particular we assume that the maximum wage at which one receives any EITC is greater than the value of not working ($\frac{\Gamma}{\alpha} > B$).

2.4.1 The Impact of an EITC on Type O Workers

Imposing an EITC on Type 0 workers increases the wage of those who work and who have a relatively low professional level. These higher wages increase their incentive to be employed.

Proposition 7*: An EITC increases the employment of Type O workers, and this affect is higher in a noncompetitive market.*

Proof: It can be seen that an EITC could increase employment among Type O individuals in both competitive market and noncompetitive markets. Under an EITC, each individual whose professional level satisfies the condition:

$$\underline{e}^{EITC} = \frac{B - \Gamma}{\lambda(1-\alpha)} < e_i < \frac{B}{\lambda}$$

begins to work because of the EITC. The EITC increases both the employment of these individuals and their wages.

For the individuals whose abilities satisfy the condition:

$$\overline{e^{EITC}} = \frac{\Gamma}{\lambda\alpha} < e_i ,$$

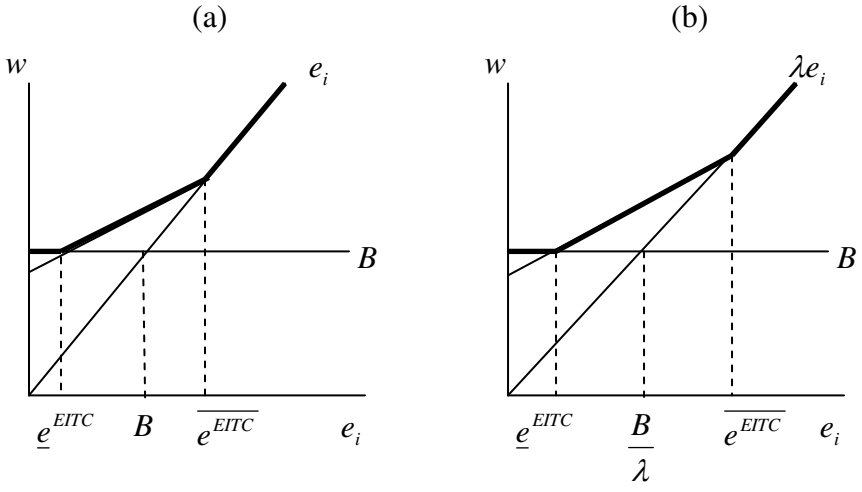
the EITC is not relevant. Figure 5 illustrates these results. As we can see from the equation above and from Figure 5, the direction of the impact on employment is the same in both market structures. Employment increases by

$$\frac{1}{\lambda}(B - \frac{B-\Gamma}{1-\alpha}) ,$$

which is higher in the noncompetitive structure. *Q.E.D.*

If we compare these results to the effect of a MW on Type O individuals, it can be seen that the EITC has a better effect both in terms of employment and in terms of total product. This holds for both competitive and non-competitive markets.

Figure 5: The Impact of an EITC on Type O Individuals in Competitive (a) and Noncompetitive (b) Markets



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2.4.2 The Impact of an EITC on Type Y Workers

Each Type Y worker chooses whether to remain at the same professional level or to opt for a lower professional level, a lower wage, and supplemental income from an EITC.

The worker maximizes the following utility function:

$$\max U = L(\max(\lambda\ e_i - \frac{1}{2\mu_i} e_i^2), (\lambda e_i + \Gamma - \alpha\lambda e_i - \frac{1}{2\mu_i} e_i^2)) + (1-L)B$$

e_i, L

An individual who prefers to receive the EITC chooses the professional level $e_i = (1-\alpha)\lambda\mu_i$, which is less than the professional level that the same individual would choose without an EITC system ($e_i = \lambda\mu_i$). Therefore, we can rewrite the maximization problem as:

$$\max U = L(\max(\frac{1}{2} * \lambda^2 \mu_i), (\Gamma + \frac{1}{2}\lambda^2 (1-\alpha)^2 \mu_i)) + (1-L)B \quad (4)$$

e_i, L

Solving this problem leads to the following proposition.

Proposition 8*: An EITC increases employment of Type Y individuals, and this effect is higher in a noncompetitive market.*

Proof: An EITC where $\Gamma < B$ and $\frac{\Gamma}{\alpha} > B$ produces the following effects on Type Y workers.

1. Any worker whose μ_i satisfies:

$$\mu_i > \bar{\mu}^{EITC} = \frac{2\Gamma}{\lambda^2 (1-(1-\alpha)^2)}$$

   is not affected by the EITC.

2. Any worker whose μ_i satisfies:

$$\frac{2B}{\lambda^2} \le \mu_i \le \bar{\mu}^{EITC}$$

   remains at work, but at a lower professional level.

3. People whose μ_i satisfies:

$$\underline{\mu}^{EITC} = \frac{2(B-\Gamma)}{\lambda^2 (1-\alpha)^2} \le \mu_i \le \frac{2B}{\lambda^2},$$

   and who were previously out of the labor force, now decide to work and to gain the professional level that is necessary to be employed.

Therefore, implementation of an effective EITC increases employment, as individuals with the ability:

$$\underline{\mu}^{EITC} \le \mu_i \le \frac{2B}{\lambda^2}$$

join the work force. The employment increases by

$$\frac{2}{\lambda^2}(B-\frac{B-\Gamma}{(1-\alpha)^2}),$$

which is higher for the noncompetitive case. *Q.E.D.*

Proposition 9*: In both competitive and non-competitive markets, there exist parameter values for which the EITC reduces the professional level of Type Y workers.*

Proof: The professional level of Type Y workers changes for two reasons. First, individuals who decide to join the labor force as a result of the EITC raise their professional level. Second, there is a decrease in the professional level for workers who choose to enjoy the EITC (individuals whose ability satisfies:

$$\frac{2B}{\lambda^2} \le \mu_i \le \bar{\mu}^{EITC});$$

This result is illustrated in Figure 6.

The total change in the professional level of the workers depends on the values of the parameters of the model. For certain parameter values, an EITC decreases the total amount of professional level and even decreases the total product of the economy.[1] *Q.E.D.*

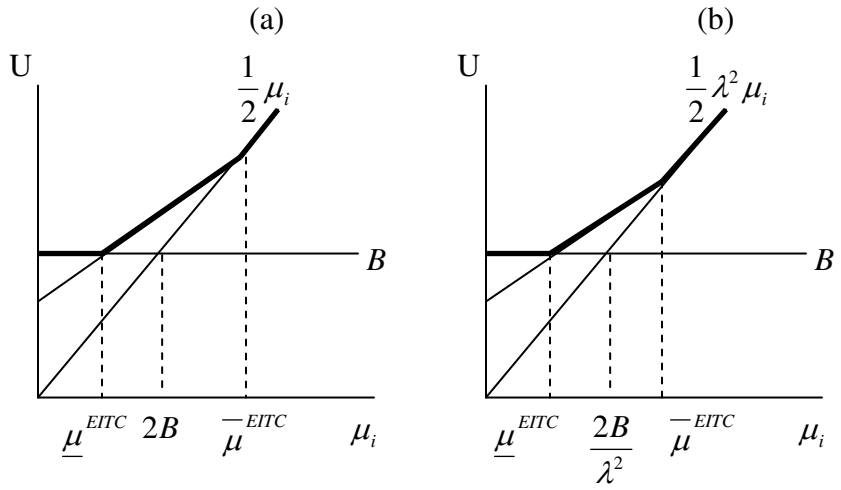
The EITC decreases the average productivity of *working* individuals for two reasons. First, all of the workers whose abilities are in the range:

$$\frac{2B}{\lambda^2} \le \mu_i \le \bar{\mu}^{EITC}$$

decrease their professional level. Second, workers who join the labor force because of the EITC also choose a relatively low professional level.

[1] We ignore the tax burden of an EITC. It is reasonable to assume that some of the positive impact of an EITC on production is offset by the negative effect of the tax burden on the economy.

Figure 6: The Impact of an EITC on Type Y Individuals in Competitive (a) and Noncompetitive (b) Markets



3 Comparing the MW and EITC Policies

For Type O individuals, an EITC leads to higher employment and total product compared to a MW. This stems mainly from the fact that the Type O workers do not have the tools that would make them employable if their professional level is lower than a MW. An EITC allows the Type O workers to enjoy a high level of income, and increased employment.

For Type Y individuals, a MW can increase the wage for the individuals at the bottom of the wage distribution without leading to severe unemployment. This occurs because Type Y individuals have a "defense" against the unemployment consequences of a MW: an increased professional level. Individuals who face unemployment as a result of the MW can make themselves employable by investing in human capital. The increase in the average professional level of working Type Ys might be thought to be a desirable outcome in itself.

For Type Y individuals, the EITC reduces the incentive to invest in human capital. This is because of the implicit tax created by the "phase out" of the EITC subsidy. The decrease in the professional level of the Type Y group reduces the average product of the work force. As for the impact on employment, the EITC increases employment for Type Y workers as well as for Type O workers. However, an EITC must be financed and therefore creates an excess burden from taxation that could lead to an adverse affect on employment. Since the marginal excess burden is increasing in the square of the tax rate, a government might use an EITC only with the group on whom it has the most unambiguously positive effects—the Type O group.

4 Conclusions

This paper evaluates the consequences of a MW and an EITC in a model with heterogeneous costs of investment in human capital. Our model studies the effect of a MW and an EITC on employment, productivity, and total output for two types of workers: those with a sufficiently low cost of acquiring human capital and a sufficiently long horizon that they consider investing in human capital (Type Ys) and those with the opposite characteristics, who do not considering investing in human capital (Type Os). The model shows that imposing a MW on Type O workers reduces their employment and their product, possibly substantially. However, the model indicates that imposing a MW can increase the professional level, employment, and total product of Type Y workers. This is because a MW creates an incentive for Type Y workers to increase their human capital. In addition, raising the MW actually raises the wage for some workers at a low professional level, and the higher wage causes some individuals to select employment over unemployment. In short, a MW has substantially greater net benefits for Type Y individuals than for Type O individuals.

In our model, while an EITC increases employment, it has a negative impact on human capital investment as well as the total product of Type Y workers. This is because an EITC reduces the incentive of Type Y workers to acquire human capital. For Type O individuals, an EITC raises employment and total product, allowing this group to realize greater income without harming productivity.

To summarize, our model suggests that a government might consider imposing a MW exclusively for Type Y individuals and an EITC exclusively for Type O individuals. Some of the best effects of each policy would therefore be obtained and some of the worst consequences would be avoided. Also, the tax associated with financing an EITC that applies only to Type Os would be smaller, generating a small excess burden of taxation on the economy.

It is not impractical for a government to condition its MW and EITC policies according to individuals' types because Type Ys and Type Os do have practical proxies. Age, for instance, which is the most important determinant of a person's work horizon, is known to the government. Governments already try to observe disabling health conditions, which might cause a young person to have the work horizon of an old person. Capacity to learn new things is, of course, much harder for a government to observe but it is reasonable to think that younger persons' minds are more malleable.

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