Self-Selection, Optimal Income Taxation, and Redistribution**

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Abstract

This paper makes a pedagogical contribution to optimal income taxation. Using a very simple model adapted from Akerlof (1978), we demonstrate a key result in the approach to public economics and welfare economics pioneered by Nobel Laureate James Mirrlees. We show how incomplete information, in addition to the need to preserve incentives, acts as a limit to a government’s redistributive power. The model and technical analysis allow us to easily handle three self-selection constraints in a manner that is accessible to students with knowledge of only intermediate microeconomics and elementary algebra. The diagrammatic exposition allows us to present interesting and insightful results.

Keywords: efficient, incomplete information, income taxation, redistribution, self-selection.

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1. Introduction

The idea that incomplete information is a limit to a government’s ability to redistribute income is the cornerstone of what one might call the new public economics pioneered by Mirrlees (1971). This literature and the implications of the Mirrlees’ approach are thoroughly reviewed and discussed in Boadway (1997, 1998).\(^1\) Boadway (1997, p. 753-754) observes that this “… approach to the theory of economic policy, which is grounded on the importance of imperfect information as a constraint on public policy, has changed the very nature of public economic research and its implications for economic policy and the role of government.”

The technical and formal analyses of the results in this literature are typically accessible to only graduate students and \(\text{probably}\) to advanced undergraduates. The purpose of this paper is to demonstrate, at a very elementary level, the result that incomplete information, in addition to the need to preserve incentives, is a limit to a government’s ability to redistribute income. The model and technical analysis allow us to easily handle three self-selection constraints in a manner that is accessible to students with knowledge of only intermediate microeconomics and elementary algebra. We also demonstrate other interesting results.

The next section presents a simple model of taxation and redistribution. Section 3 extends the model. Section 4 concludes the paper.

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\(^1\) The survey in Boadway (1987, 1988) is non-technical and mentions William Vickrey’s important contribution to this literature. Stiglitz (1987) presents a technical analysis. Boadway (1987, 1998) refers to this literature as the “Mirrlees’ approach” or the “information-based approach to public policy” and Stiglitz (1987) calls it the “new new welfare economics”. What one may call the “old welfare economics” or “old public economics” assumed complete information leading to the conclusion that one could separate issues of distribution from efficiency (i.e., the second welfare theorem). As we shall see in a subsequent footnote, the second welfare theorem is significantly weakened in world of incomplete information. See Boadway (1997) for a good discussion of this point.
2. The Basic Model

In this section, we consider a very simple two-job-two-type model as a stepping stone to a three-job-three-type model. There are two types of jobs in a society: a low-skill job called job L and high-skill job called H. People are free to choose either L or H but not both. There are high-ability people who can work in L or H. Low-ability people can only work in L. If a low-ability person works in a job L, her income is \( Y_{LL} \). If a high-ability person works in job L, her income is \( Y_{HL} \). If a high-ability person works in job H, her income is \( Y_{HH} \). There are \( N_H \) high-ability people and \( N_L \) low-ability people. Assume that if a high-ability person is indifferent between working in L or H, then she will choose to work in H. Also we assume that \( Y_{HH} > Y_{HL} > Y_{LL} > 0 \).

The government knows all the information indicated above but does not know the identity of high-ability agents or low-ability agents. That is, the government knows the aggregate distribution of characteristics but does not know individual characteristics. It is in this sense that the government has incomplete information.

This basic model is similar to the model in section A of Akerlof (1978), where there are only two types of jobs: difficult and easy jobs, and two types of workers: skilled and unskilled workers. Skilled workers may work in either job but unskilled workers can only work in the easy job. Indeed, this paper could be seen as an argument for using the simple model in section A of Akerlof (1978) to illustrate the significance of the Mirrlees approach to undergraduate students with knowledge of only intermediate microeconomics and elementary algebra. However, the model in this paper is simpler
We assume that the government wants to redistribute income from the high-ability types (i.e., the rich) to the low-ability types (i.e., the poor). If individuals have identical utility functions which are increasing and strictly concave in income, then the pre-redistributive marginal utility of a dollar is higher for the low-ability agents than it is for the high-ability agents. Then a government with a utilitarian social welfare function may want to redistribute income from the rich to the poor. We do not have such a justification in our model. Indeed, we not specify a formal Bergson-Samuelson type objective function for a government. However, one need not specify an explicit and formal social welfare function to in order to justify redistribution. For example, a government may want to redistribute income because it has some degree of aversion to inequality (see, Boadway and Keen, 2000). Also, an incumbent government may engage in the redistribution of income from the rich to the poor in order to win the next election or strengthen its political power, if the poor are in the majority.

2.1 Analysis of the Basic Model

Clearly, the efficient allocation is for all low-ability people to work in L and all high-ability people to work in H. Note that this is efficient because if any high-ability person works in job L, the aggregate income of the economy will be lower than the aggregate income in the allocation where all high-ability people work in job H.

Another simple model in this literature is Nichols and Zeckhauser (1982). However, the self-selection constraints are not explicitly written since the bulk of the analysis is graphical. Furthermore, the behavior of the self-selection constraint as transfers change does not lend itself to a straightforward diagrammatic analysis. Finally, the framework in Akerlof (1978) allows us to extend our model to three different groups with three self-selection constraints.

Suppose the government wants to redistribute income from high-ability people (i.e., the rich) to low-ability people (i.e., the poor). If a worker chooses job H, the government can correctly infer that she is a high-ability person. Therefore, the government’s problem is to set up a self-selection mechanism such that all high-ability agents have the incentive to work in job H (i.e., will self-select into job H). The government would then tax those in job H because they would have revealed their ability through their choice of job.

The government’s goal is to maximize the transfer to a representative low-ability (poor) person while simultaneously preserving incentives (i.e., keeping high-ability people in job H). This is equivalent to maximizing aggregate tax revenue by taxing high-ability people while preserving incentives. We can think of the solution to this problem in the following steps:

(a) The government announces a tax, T, per worker in job H

(b) Based on T, high-ability agents decide to work in L or H

(c) The government collects total tax revenue

(d) The tax revenue is shared equally among all workers in job L.

To simplify the analysis, we assume that high-ability people cannot change their labor supply or hide their income in job H in response to the tax on their income. The only possible disincentive effect of government taxation is that it may cause a high-ability person to switch to job L and earn a lower income. These are assumptions are consistent

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4 Maximization of tax revenue as an objective for governments is the basis of the famous Laffer curve and has been used by Stowhase and Taxler (2005), Keen and Kotsogiannis (2003), and Sanchez and Joel (1993). But, of course, governments have different reasons for maximizing tax revenue and some of the reasons have nothing to do with the welfare of their citizens.
with the model in Akerlof (1978). In addition, there are no administrative or monitoring costs of redistribution.

Note that if a high-ability person chooses to work in job H, her post-tax income is $Y_{HH} - T$. Now consider an equilibrium in which all high-ability agents are in job H. If a high-ability agent switches to job L, her post tax-transfer income, given that all other high-ability agents are in job H, is

$$Y_{HL} + \frac{(N_H - 1)T}{N_L + 1}$$

(1)

Note that the expression in (1) takes into account the fact that a high-ability person who switches to job L is also entitled to the transfers given to all workers in job L because her identity is not known. This is where the incompleteness of the government’s information kicks in.\(^5\)

Typically, $N_H$ and $N_L$ will be very large relative to a single person. Hence, given that each agent is atomistic in this economy, we can use the following approximations:

$N_L + 1 \approx N_L$ and $N_H - 1 \approx N_H$. Therefore, a high-ability person will choose job H, if

$$Y_{HH} - T \geq Y_{HL} + \frac{N_H T}{N_L}$$

(2)

The expression in (2) is called the self-selection constraint or the incentive-compatibility constraint.

\(^5\) However, if the government can observe incomes, then it can identify a high-ability person in job L, given that $Y_{HL} \neq Y_{LL}$. One way of getting round this problem is to assume, as in for example Besley and Coate (1991), that the government cannot observe incomes. Another way is to define, as in Akerlof (1978), a non-pecuniary cost to high-ability types of working in job H stemming from the greater effort required in job H relative to job L. If $\theta > 0$ is the monetary equivalent of this cost, then this is a gain to a high-ability type who works in job L. So we may write $Y_{HL} = Y_{LL} + \theta$, where $\theta$ is a component of income that is not observed by the government and is included in the self selection constraint. I thank a referee for this point.
The maximum tax that the government can collect from a person in job H must solve (2) with equality. This gives

\[ T_{\text{max}} = \frac{N_L (Y_{HH} - Y_{HL})}{N_L + N_H} \tag{3} \]

If the government were to set a tax greater than \( T_{\text{max}} \), then all high-ability agents will switch to job L, leaving no income to be redistributed to the low-ability agents. Therefore, the need to preserve incentives restrains the government from setting a tax beyond \( T_{\text{max}} \). Notice also that \( T_{\text{max}} \) is decreasing in \( Y_{HL} \). Hence the size of agents’ outside options constrains a government’s redistributive ability.

Let us compare this maximum tax with the maximum tax that the government can collect, if it has complete information. Under complete information, the government knows the identity of high-ability and low-ability agents. Therefore, unlike the case of incomplete information, a high-ability person who works in job L will not get the transfer on the right-hand-side of the expression in (2). Indeed, she will not get any transfer from the government since her identity is known. Given complete information, a reasonable objective for the government is to equalize post-tax incomes while preserving Pareto efficiency. Thus, we require

\[ Y_{HH} - T = Y_{LL} + \frac{N_H T}{N_L} \tag{4} \]

This gives a maximum tax of

\[ T^c = \frac{N_L (Y_{HH} - Y_{LL})}{N_L + N_H} \tag{5} \]

\[ \text{Notice that } Y_{HH} - T > Y_{HL} - T \text{ holds for any } T. \text{ So equalizing income under complete information is consistent with keeping high-ability workers in job H.} \]
Given $Y_{HL} > Y_{LL}$, it follows that $T^c > T^{\text{max}}$. Hence the government can engage in more income redistribution under complete information. It is in this sense that incomplete information acts as a limit on the government’s ability to redistribute income.

We have demonstrated two results. First, by comparing the maximum tax that the government can impose on high-ability agents when it has complete information with the maximum tax when it has incomplete information, we were able to show how incomplete information acts as a constraint on the government’s redistribute ability. Second, we showed how the need to preserve incentives also limits the government’s redistributive ability (i.e., the tax on a high-ability person cannot exceed $T^{\text{max}}$).

Boadway (1997, p. 759) describes these core results of the Mirrlees approach as follows:

“[R]econciling the redistributive objective with the selection requirement constitutes the nub of the policy problem. The more one tries to redistribute to the less well off, the more attractive the consumption-income bundle of the less well off becomes to the better off. Policy must be designed to prevent the better off from ‘mimicking’ the less well off. This is the so-called incentive or self-selection constraint and constitutes the limit to redistribution.”

Akerlof (1978, p. 11) illustrates this basic trade-off between redistribution and efficiency as follows:

“As taxes are raised and incomes are redistributed, there is a gain in welfare, because income is distributed to those who have greater need of it (higher marginal utility). But this gain must be balanced against a loss: as tax rates rise in relatively productive jobs and as subsidies rise in relatively unproductive jobs, workers are less willing to take the productive (and more willing to take the unproductive) jobs. Such switching, per se, results in a loss in $U$ (i.e., aggregate utility) because each worker is choosing the amount of work, or the kind of job, which maximizes his private utility rather than the amount of work or kind of job which maximizes social utility. In general, the redistributive gains versus the deadweight losses caused by tax/transfer-induced job switching is the major tradeoff in the theory of optimal income taxes and welfare payments…” Italics mine
3. An Extension of the Basic Model

Retain all the information above. Let’s complicate the model a little bit. In particular, suppose there is a third job. Call this job M. Let this be a medium-ability job. Let be there a medium-ability group of people who can work in either job L or job M but not job H. In addition to the information above, low-ability people cannot work in job M. Assume that a medium-ability person who is indifferent between L and M, will work in M.

Suppose that $N_k > 0$ is the number of $k$-ability people, $k = L, M, H$. Let $Y_{kj}$ be the pre tax-transfer income of a $k$-ability person who works in job $j$, $j = L, M, H$ and $k = L, M, H$. In addition to the restrictions in the basic model, the following restrictions are imposed: $Y_{HH} > Y_{HM} > Y_{HL} > Y_{LL}$, $Y_{MM} > Y_{ML} > Y_{LL}$, and $Y_{HM} > Y_{MM}$.

Continue to assume that the government does not know the identity of a worker (i.e., the government does not know whether a person is low, medium, or high ability). Again a Pareto efficient allocation requires that a low-ability person works in job L, a medium-ability person works in job M, and a high-ability person works in job H. In this allocation, those in job H will be the high-income group, job M workers will be the middle-income group, and job L workers will be the low-income group.

By following a similar analysis as before, we shall find the optimal taxes $T_M$ and $T_H$ that the government can impose on workers in job M and job H respectively such that (a) the Pareto efficient allocation of workers to jobs is preserved, (b) the government maximizes its tax revenue, $R$, and (c) the total tax revenue is shared equally among all workers in job L.
3.1 High-ability agents cannot work in job M

For now, suppose that high-ability people can choose to work in either job L or H but not job M. In this three-job-three-type case, we need to recognize that when a high-ability person decides to deviate from job H to L, she has to take into account the transfers that will accrue to those in job L from the taxes collected from those in jobs H and M. The same argument applies to a medium-ability person.

Then the self-selection constraints for medium-ability and high-ability people are respectively

\[ Y_{MM} - T_M \geq Y_{ML} + \frac{N_H T_H + N_M T_M}{N_L} \]  \hspace{1cm} (6)

and

\[ Y_{HH} - T_H \geq Y_{HL} + \frac{N_M T_M + N_H T_H}{N_L} \]  \hspace{1cm} (7)

Formally, the government solves the problem:

\[ \text{Max}_{T_M, T_H} \ R = N_M T_M + N_H T_H, \]

subject to the self-selection constraints given by (6) and (7).

Assuming that (6) and (7) hold with strict equality and rewriting these equations gives

\[ T_M = \frac{(Y_{MM} - Y_{ML}) N_L}{N_L + N_M} - \frac{N_H}{N_L + N_M} T_H \] \hspace{1cm} (6a)

and

\[ T_M = \frac{(Y_{HH} - Y_{HL}) N_L}{N_M} - \frac{N_H + N_L}{N_M} T_H \] \hspace{1cm} (7a)
In figure 1, $T_M$ is on the vertical axis and $T_H$ is on the horizontal axis. The line $hH$ represents the self-selection constraint for a high-ability person, *when this constraint holds with strict equality*. This is equation (7a). The line $mM$ is similarly defined for a medium-ability person. The slope of the $hH$ line is $-(N_H + N_L)/N_M$ and the slope of the $mM$ line is $-N_H/(N_M + N_L)$. Since the origin (i.e., $T_M = T_H = 0$) satisfies both self-selection constraints, it follows that the set of points which satisfy *both* (3) and (4) is represented by the area $0HAm$ in figure 1.

For a given level of $R$, we can generate the locus of the combinations of $T_M$ and $T_H$ which give the same aggregate revenue. This gives an iso-revenue line similar to an indifference curve in consumer theory or an isoquant in producer theory. These iso-revenue lines, shown in figure 1, are downward-sloping straight lines with slope $-N_H/N_M$. Clearly, $(N_H + N_L)/N_M > N_H/N_M > N_H/(N_M + N_L)$. Hence, any iso-revenue curve is steeper than the $mM$ line but flatter than the $hH$ line.

We want to attain the highest iso-revenue line, given that the set of feasible points is the area $0HAm$. Clearly, the maximum tax revenue occurs where the iso-revenue line $R^*$ goes through the point $A$ (a kink). At point $A$, the iso-revenue lines $hH$ and $mM$ intersect (i.e., $T_H = T_H^*$ and $T_M = T_M^*$). Hence the maximum tax revenue is $R^* = T_H^* + T_M^*$. Both self-selection constraints bind.

Note that since equations (6) and (7) hold with strict equality, it follows that $Y_{MM} - T_M^* - Y_{ML} = Y_{HH} - T_H^* - Y_{HL}$. This gives

$$T_H^* - T_M^* = (Y_{HH} - Y_{HL}) - (Y_{MM} - Y_{ML}).$$

Therefore, $T_H^* - T_M^*$ has an ambiguous sign.

High-ability types pay a higher tax than medium-ability types if the loss in gross income
from switching to job L is larger for high-ability types than it is for medium-ability types. That is, if \((Y_{HH} - Y_{HL}) > (Y_{MM} - Y_{ML})\). This accords with intuition.

Suppose the government maintains the tax, \(T_M^*\), but sets a tax for workers in job H that is higher than the tax, \(T_H^*\). Are low-ability people (i.e., the poor) better off? The answer is no. To see this, note that if the government keeps \(T_M^*\) but sets a tax higher than \(T_H^*\), then all workers in job H will now move to job L. Aggregate tax revenue will fall and there will now be a smaller tax revenue to be shared among more workers in L. This will make the low-ability workers worse off. Hence, by not choosing a tax rate to keep the high-ability workers in job H, the government makes the low-ability workers worse off than would have been the case if it had respected incentives. The lesson is that a government which tries to redistribute too much through excessive taxation might paradoxically end up having a smaller national pie for redistribution. Hence the need to preserve incentives (efficiency) acts as limit to the government’s ability to redistribute income.

Suppose instead that the government knew the identity of high-ability, medium-ability, and low-ability workers, even if they do not reveal their identity through their choices of jobs. Again, the key thing here is to recognize that if the government knows the ability of everyone, then a person who deviates to job L but is not a low-ability person cannot fool the government by collecting the transfer intended for low-ability workers. Again assuming that the government equalizes post-tax income when it has complete information requires that

\[
Y_{MM} - T_M = Y_{LL} + \frac{N_H T_H + N_M T_M}{N_L}
\]  \( (8) \)
and

\[ Y_{HH} - T_H = Y_{LL} + \frac{N_MT_M + N_HT_H}{N_L}, \]  

(9)

The expression on the right hand side of (8) and (9) is the post-tax-transfer income of a low-ability person. We can rewrite (8) and (9) as

\[ T_M = \frac{(Y_{MM} - Y_{LL})N_L}{N_L + N_M} - \frac{N_H}{N_L + N_M} T_H \]  

(8a)

and

\[ T_M = \frac{(Y_{HH} - Y_{LL})N_L}{N_M} - \frac{N_H + N_L}{N_M} T_H \]  

(9a)

Comparing equations (6a) to (8a) and (7a) to (9a), we see that equations (6a) and (8a) have the same slope and (7a) and (9a) also have the same slope. However, (8a) and (9a) have higher positive intercepts. Hence, if one were to draw the lines represented by (8a) and (9a) in figure 1, they will be parallel outward shifts of the hH and mM lines.

Therefore, under complete information, the government can attain a higher iso-revenue line than it can under incomplete information. This establishes the point that the redistributive power of the government is limited under incomplete information. \(^7\)

Notice that by shifting the hH and mM lines downward and varying their slopes accordingly, we can find a point of intersection between these lines where \(T_M < 0\) but

\(^7\) According to the second welfare theorem, a planner should be able to implement any Pareto efficient allocation as a competitive equilibrium (under certain conditions). Notice that this implies that, under certain conditions, any distribution of income which is consistent with Pareto efficiency can be attained. However, since the set of Pareto efficient distributions of income under incomplete information is only a subset of the set of Pareto efficient distributions of income under complete information, it follows that the second welfare theorem does not hold when the government has incomplete information.
T_H > 0. In this case, medium-ability types are given a subsidy to stay in job M and only high-ability types pay taxes. However, the subsidy to those in job M relaxes the self-selection constraint for high-ability types and allows the government to raise more tax revenue compared to the case of imposing a tax on job M workers. This case occurs when the intercept of the mM line (i.e., Y_{MM} – Y_{ML}) is sufficiently small and the intercept of the hH line (i.e., Y_{HH} – Y_{HL}) is sufficiently high. Clearly if job L is sufficiently attractive to medium-ability types but not so attractive to high-ability types, then it is not surprising that to keep medium-ability types in job M, a subsidy may have to be paid to them.

3.2 High-ability agents can work in job M

Now suppose that high-ability people can work in all three jobs and the government has incomplete information. This adds a third self-selection constraint to the analysis. That is, in addition to job L, we have to discourage the high-ability people from working in job M. This requires that Y_{HH} – T_H ≥ Y_{HM} – T_M. Assuming that this constraint holds with equality gives

\[ T_M = -(Y_{HH} - Y_{HM}) + T_H \]  \hspace{1cm} (10)

Given that high-ability types can now work in job M, are the taxes T_M^* and T_H^* still optimal taxes? Note that given these taxes, a high-ability person has no incentive to work in job L. If T_M^* ≥ T_H^*, then a high-ability person has no incentive to work in job M, so T_M^* and T_H^* are optimal.

The more interesting case is T_M^* < T_H^*. Given T_M^* < T_H^*, a high-ability person has the incentive to switch to job M in order to pay a lower tax. The gain of this switch is
$T^*_H - T^*_M \equiv \Delta_T > 0$. However, the cost of this switch is the loss of income equal to $Y_{HH} - Y_{HM}$. Therefore, a high-ability person will not switch to job M, if $Y_{HH} - Y_{HM} \geq \Delta_T$.

It follows that $T^*_M$ and $T^*_H$ are the optimal taxes if $Y_{HM} \leq Y_{HH} - \Delta_T$. Noting that $T^*_H - T^*_M = (Y_{HH} - Y_{HL}) - (Y_{MM} - Y_{ML})$, we can rewrite $Y_{HM} \leq Y_{HH} - \Delta_T$ as $(Y_{HM} - Y_{HL}) - (Y_{MM} - Y_{ML}) \leq 0$.

The result in the preceding paragraph can be demonstrated diagrammatically. To see this, refer to figure 2 where equation (10) is represented by the line ZZ. The ZZ line is an upward-sloping line with a negative intercept (i.e., $- (Y_{HH} - Y_{HM})$). If $Y_{HH} - Y_{HM}$ is sufficiently high, then the ZZ line will be below the point $(T^*_M, T^*_H)$. In this case, $(T^*_M, T^*_H)$ are still the optimal taxes. The constraint given by the ZZ line does not bind.

Interestingly, the condition $Y_{HH} - Y_{HM} \geq \Delta_T$ obtained above is consistent with $Y_{HH} - Y_{HM}$ being sufficiently high.

Given $\Delta_T > 0$, suppose $Y_{HM} > Y_{HH} - \Delta_T$, then either $T^*_M$ or $T^*_H$ or both are no longer optimal. To prevent a high-ability person from switching to job M, we must make job M less attractive or job H more attractive.\(^8\) Note that $Y_{HM} > Y_{HH} - \Delta_T$ can be rewritten as $Y_{HH} - Y_{HM} < \Delta_T$. This gives $(Y_{HM} - Y_{HL}) - (Y_{MM} - Y_{ML}) > 0$ which requires that $Y_{HM}$ be sufficiently high. That means that the negative intercept, $-(Y_{HH} - Y_{HM})$, of the ZZ line is sufficiently close to the origin. In this case, the ZZ line will intersect the mM line above the point $(T^*_M, T^*_H)$ as shown in figure 3. The optimal pair of taxes $(\tilde{T}_M, \tilde{T}_H)$ occurs at the point of intersection between the mM and ZZ lines, where

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\(^8\) Notice that increasing both taxes will violate the self-selection constraints in (6) and (7). Reducing both taxes also not optimal as our diagrammatic exposition shows.
\( \tilde{T}_M > T_M^* \) and \( \tilde{T}_H < T_H^* \). The revenue collected is represented by the iso-revenue line \( R^{**} \) which is lower than the revenue when high-ability types could not work in job M. In this case, the constraints given by ZZ and mM bind but the hH constraint does not bind.\(^9\)

The result that \( \tilde{T}_H < T_H^* \) is interesting. It shows that when the high-ability people have more outside options (i.e., can work in job M in addition to job L) and these options are sufficiently attractive (i.e., \( Y_{HM} > Y_{HH} - \Delta_T \)), then the government must impose lower taxes on them compared to the scenario under which they had fewer options (i.e., can only work in job L). Therefore, government tax policy must take into account the options available to economic agents. For example, a tax on capital must consider whether agents can invest their capital outside the shores of the country. Another example is that a tax by the US government on basketball players, football players, doctors, actors, etc must take into account whether these professionals can sell their services in other countries.

There is also another possibility. Suppose \( Y_{HH} - Y_{HM} \) is very close to zero and \( (\tilde{T}_M, \tilde{T}_H) \) are the optimal taxes. Now if \( Y_{HH} - Y_{HM} \) is close to the zero, then the ZZ line constraint (i.e., equation (10)) requires that \( \tilde{T}_M - \tilde{T}_H \) be close to zero. The need to set \( T_H \) almost equal to \( T_M \) ties the government’s hands in terms of how much it can extract from high-ability types. However, if \( (Y_{HH} - Y_{HL}) \) is sufficiently higher than \( (Y_{MM} - Y_{ML}) \), then the government may want to free itself from this restriction (i.e., \( T_M = T_H \)) and instead set an arbitrarily high \( T_M \) to make job M unattractive to both high-ability and medium-ability types but set a reasonably high \( T_H \) to keep the high-ability types in job H. The per capita transfers to all workers in job L will then be higher

\(^9\) I thank the referees for asking me to explore this case.
than it is in the Pareto efficient case. Aggregate income is not maximized since medium-
ability types now work in job $L$.\(^{10}\)

Formally, the government sets $T_H$ to satisfy $Y_{HH} - T_H \geq Y_{HL} + N_H T_H / (N_L + N_M)$, given an arbitrarily high $T_M$. The optimal $T_H$ satisfies this self-selection constraint with equality. This gives

$$\hat{T}_H = \frac{N_L + N_M}{N} (Y_{HH} - Y_{HL}) \quad (11)$$

where $N \equiv N_L + N_M + N_H$. Total revenue is $N_H \hat{T}_H$.

Note that $(\tilde{T}_M, \tilde{T}_H)$ is obtained by solving equations (6a) and (10) simultaneously. This gives

$$\tilde{T}_H = \frac{N_L}{N} (Y_{MM} - Y_{ML}) + \frac{N_L + N_M}{N} (Y_{HH} - Y_{HM}) \quad (12)$$

As $(Y_{HH} - Y_{HM}) \to 0$, $\tilde{T}_M - \tilde{T}_H \to 0$ given equation (10). So total revenue is approximately equal to $\tilde{T}_H (N_H + N_M)$. Then the government will sacrifice efficiency if

$$N_H \hat{T}_H / (N_L + N_M) - (N_M + N_H) \tilde{T}_H / N_L > 0 \quad (13)$$

Note that $N_H / (N_L + N_M) < (N_M + N_H) / N_L$. However, $(Y_{HH} - Y_{HM}) \to 0$ and

$\Delta_T = (Y_{HH} - Y_{HL}) - (Y_{MM} - Y_{ML}) > 0$ imply that $\hat{T}_H > \tilde{T}_H$. Hence, (13) will hold if $(Y_{HH} - Y_{HL}) - (Y_{MM} - Y_{ML})$ is sufficiently large.

In a first-best world (i.e., the government has complete information), the government would not sacrifice efficiency in order to improve the welfare of the low-ability people. Improving their welfare through transfers requires the maximization of aggregate output. However, in a second-best world, (i.e., the government has incomplete

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\(^{10}\) My thanks are due to a referee for asking me to explore this issue.
information), it is possible that the government can improve the welfare of the low-ability people by sacrificing efficiency. Note that by setting a very high tax in the medium-ability job, the government effectively destroys this job. Hence, we now have only two jobs with three ability types. The bigger is the difference between $Y_{HH}$ and $Y_{HL}$, the bigger is the tax revenue that the government can collect from the high-ability workers. On the other hand, the smaller is the difference between $Y_{MM} - Y_{ML}$, the smaller is the tax revenue that the government can collect from medium-ability people. Hence, it may be efficient for the government to collect tax revenue from only high-ability people if $Y_{HH} - Y_{HL}$ is sufficiently bigger than $Y_{MM} - Y_{ML}$. This is the intuition for the analysis in the preceding paragraph. And in this case, high-ability types are worse off relative to the Pareto efficient case.

**Further Remarks**

In our model, we assume that the government cannot force people to work in a particular job even if it has complete information. For example, the government cannot force high-ability people to work in job H and extract much more from them nor can it ban them from working in job L. If the government had these powers, it could engage in even more redistribution to the extent of making the low-ability workers richer than the high-ability after taxes and transfers. But even so, we must be careful for you can force a horse to the river but you cannot force her/him to drink. Although, we do not consider labor supply in our model, it is conceivable that the high-ability workers could reduce their supply of labor if they were forced to work in job H resulting in earnings far below $Y_{HH}$. There are other efficiency costs of excessive taxation. For example, to force people
to do things against their will, resources must be spent to monitor them. This will be another efficiency cost of forcing high-ability workers to work in job H. This explains why the efficiency costs of coercive systems like slavery, dictatorships, and authoritarian regimes etc are high. These institutions are not only immoral but they are also grossly inefficient unless a group of people can be perpetually socialized to accept them.

The information-based approach to public policy can also explain the form of government redistribution. In particular, it can explain why governments may use restricted form of transfers like in-kind transfers than cash transfers. This point was first made by Nichols and Zeckhauser (1982). As an example, suppose the low-ability people have other characteristics which are not shared by medium-ability or high-ability people. For example, suppose they are all diabetics. Then the government can use part of the tax revenue to run free treatment centers for diabetics.\textsuperscript{11} This relaxes the self-selection constraints since the non-targeted group (i.e., the medium-ability and high-ability people) will not avail themselves of this in-kind transfer.\textsuperscript{12} Hence, the government can redistribute more to the low-ability people through in-kind transfers rather than using cash transfers. There is, however, a limit to this form of redistribution. This is because there are deadweight losses from in-kind transfers, since the government might provide too much of the commodity relative to what the recipients would have consumed with a cash transfer. Indeed, as Boadway (1997) argues these deadweight losses are necessary to relax the self-selection constraints because they make the consumption bundle of low-

\textsuperscript{11}Indeed, this characteristic of the low-ability people which helps the government to target them more efficiently is what Akerlof (1978) refers to as a “tag”. See Blackorby and Donaldson (1988) for a model which uses health status as a tag.

\textsuperscript{12} As Boadway (1997, p. 761) notes the standard test for efficiency of policy instruments in the information-based approach to public policy is “… how, if at all, do they serve to relax the self-selection constraints?” Thus, the ability of in-kind transfers like education and health services to relax self-selection constraints explains why they may be preferred to cash transfers.
ability people less attractive to high-ability people. Hence the deadweight loss of in-kind redistribution must be balanced against the benefits of increased redistribution stemming from in-kind transfers. Nichols and Zeckhauser (1982) demonstrate how deadweight losses are necessary to relax self-selection constraints even in a model where transfers are in cash. The deadweight loss of a cash transfer arises in their model because a targeted recipient of a cash transfer is only eligible, if he earns below a threshold level of income. However, to satisfy the self-selection constraint for a non-targeted high-ability person, this threshold income must be set lower than what the targeted recipient would have liked to earn. Thus, a distortion must be introduced in the targeted recipient’s labor supply choice. A sufficiently low-threshold income is unattractive to the non-targeted high-ability person, since the loss of earned income is more costly to him than it is to the low-ability targeted person.

4. Conclusion

We have used a simple model adapted from Akerlof (1978) to illustrate a key result in the approach to public economics and redistributive taxation pioneered by the Nobel laureate James Mirrlees. We demonstrated, at a very elementary level, the result that incomplete information and the need to preserve incentives limit a government’s redistributive power. The analysis shows, at a very elementary level, that if self-selection constraints are respected, then redistribution will have no effect on efficiency and if they are violated, then redistribution will have an adverse effect on efficiency. However, there are situations in which redistribution can actually enhance efficiency or lead to an
increase in aggregate output. We also showed that the size of agents’ outside option constrains a government’s redistributive ability.

Our goal was to present a pedagogical model and analyses which could be easily understood by undergraduate students with only knowledge of intermediate microeconomics and elementary algebra. We hope instructors and students in economics courses like welfare economics, health economics, microeconomics, and of course public economics will find it useful.

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13 This issue is outside the scope of this paper. The reader may refer to Boadway and Keen (2000).
Figure 1: Optimal tax solution when high-ability types cannot work in job M
Figure 2: Optimal tax solution when high-ability types can work in job M and

\[ Y_{HM} \leq Y_{HH} - \Delta_T \]
Figure 3: Optimal tax solution when high-ability types can work in job M and

\[ Y_{HM} > Y_{HH} - \Delta T \]
References


