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RESPONSIBILITY AND REDISTRIBUTION: THE CASE OF FIRST BEST TAXATION

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Abstract

It is not straightforward to define the ethics of responsibility in cases where the consequences of changes in factors within our control are partly determined by factors beyond our control. In this paper, we suggest that one plausible view is to keep us responsible for the parts of the consequences that are independent of the factors beyond our control. Within the framework of a first best taxation problem, we present and characterise a redistributive mechanism that both satisfies this interpretation of the ethics of responsibility and the ethics of compensation within a broad class of economic environments. However, on a general basis, even this weaker version of the ethics of responsibility is not compatible with the ethics of compensation, and we report an impossibility result that clarifies the source of this conflict.

KEYWORDS: redistribution, responsibility, compensation

JEL Classification: D63, D71, D31, I32.

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1 Introduction

The ethics of responsibility, saying that society should *not* indemnify people against outcomes that are consequences of causes that are within their control (Roemer (1993, p. 147)), has been assigned a prominent part in recent egalitarian reasoning.[1] However, as is by now well-known, this idea is not easily combined with the other main aspect of egalitarian reasoning, to wit the ethics of compensation, which states that society should eliminate inequalities due to factors that are beyond the control of people. In a remarkable series of papers, it has been argued that the ethics of responsibility and the ethics of compensation are not compatible on a general basis, and hence that we often have to make trade-offs between these two principles in the design of egalitarian institutions.[2]

I will suggest a slightly different picture of this problem. In my view, the basic problem is not how to make trade-offs between the ethics of compensation and the ethics of responsibility in certain cases, but rather how to define the ethics of responsibility on a general basis. There are competing plausible interpretations of the ethics of responsibility, and not all of them are as incompatible with the ethics of compensation as suggested by the present literature. In particular, as I show in this paper, there exists one interpretation of the ethics of responsibility that can be reconciled with the ethics of compensation in a rather general framework. According to this interpretation, the agents should be responsible for the consequences that are *independent* of factors beyond their control, but not necssarily for all of the consequences following a change in the factors within their control. However, on a general basis, even this weaker version of the ethics of responsibility is not compatible with the ethics of compensation, and we report an impossibility result that clarifies the source of this conflict.

The arguments will be illustrated in the context of first best taxation, where we assume that effort and talent determine the pre-tax income of individuals. Only effort can be controlled by the individual, and thus our purpose will be to establish

[1]For critical reviews of parts of this literature, see Fleurbaey (1995a) and Anderson (1999). Notice that the concept of responsibility does not have to be assigned to an agent on the basis of control, but can also be assigned on the basis of delegation (see Fleurbaey (1995a,b). In this paper, we refer to control as the basis of responsibility, but the arguments could as well be reformulated within a framework where we have responsibility by delegation.

[2]See Bossert (1995), Fleurbaey (1994, 1995b, 1995c),and Bossert and Fleurbaey (1996).

a redistributive mechanism that eliminates the effects of talent (the ethics of compensation) but not of effort (the ethics of responsibility). In Section 2, we outline the standard view of the literature on this problem, whereas in Section 3 we suggest a somewhat different approach to the ethics of responsibility. On the basis of this discussion, we suggest a condition that (in our view) any reasonable interpretation of the ethics of responsibility should satisfy, and in Section 4 we prove that this condition contributes to a characterisation of a particular redistributive mechanism in a broad class of economic environments. This redistributive mechanism assigns to each agent a transfer that equals the part of the consequences of his choice of effort which is independent of talent and moreover a uniform transfer which reflects that everyone has a right to an equal share of the amount of resources produced by the common pool of talent. Within a broad class of economic environments, the outlined redistributive mechanism is closely related to the class of *egalitarian-equivalent* mechanisms considered by Bossert and Fleurbaey (1996). In fact, in these cases it supports the same post-tax income distribution as the egalitarian-equivalent mechanism defined by the talent of the agent that has the lowest marginal productivity of effort. However, on a more general basis, the suggested mechanism violates the minimal condition imposed on the ethics of responsibility, and in Section 4 we prove that this is also the case for any other mechanism satisfying the ethics of compensation.

In Section 5, we outline an alternative defence of the suggested mechanism. Section 6 contains concluding remarks.

2 The problem

It turns out that even if we agree on how to make a distinction between relevant and irrelevant factors, it is not straightforward to design a redistributive scheme that satisfies both the ethics of responsibility and the ethics of compensation. This is well-known, but it will be instructive for the rest of the discussion to illustrate the problem in a very simple two-person case.

Assume we have one talented person and one person with low talent, who can either exercise high or low effort. Figure 1 gives their pre-tax income, as a function of effort.

Effort

		High	*Low*
Talent	*High*	100	20
	Low	80	0

Figure 1. Pre-tax income (situation A)

Our aim is now to design a redistributive scheme that compensates for differences in talent but not for differences in effort. In doing this, we assume that there are no efficiency losses from taxation.

The redistributive scheme has to cover four cases, as presented in Figure 2.

	Low Talent		
		High Effort	*Low Effort*
High Talent	*High Effort*	Case 1	Case 2
	Low Effort	Case 3	Case 4

Figure 2. The relevant cases

Let us first look at Case 1 and Case 4, where both persons exercise the same amount of effort and hence only differ in talent. By the ethics of compensation, talent is an irrelevant factor that cannot justify any inequalities. Thus, in these cases, the redistributive scheme must assign the same amount of income to the two persons. This is the principle of *full compensation* (Bossert and Fleurbaey (1996, p. 346)).

Equal Income for Equal Effort: If two persons exercise the same effort, then they receive the same post-tax income.

To evaluate Case 2 and Case 3, where people exercise different levels of effort, it is instructive to compare these cases to Case 4. The only difference between Case 2 (Case 3) and Case 4 is that the more talented (less talented) exercise more effort, and hence it has been argued that according to the ethics of responsibility the agent should bear the consequences.

> "The ethics of responsibility usually conveys the idea that society (or the so-called 'social planner') should let the agents exercise their responsibility and bear the consequences of such exercise, without trying to distort their outcomes in a particular way and with particular incentives" (Fleurbaey (1995d, p. 685).

This is the principle of *no compensation* (Bossert and Fleurbaey (1996, p. 349).

Individual Monotonicity in Effort: A change in total pre-tax income due to a change in one agent's effort only affects this person's post-tax income.

As a consequence, for the two-person case presented in Figure 1, we have the following redistributive scheme.

Low Talent

High Talent		*High Effort*	*Low Effort*
	High Effort	90,90	90,10
	Low Effort	10,90	10,10

Figure 3. The redistributive scheme (situation A)

In this situation, there is no conflict between the two suggested principles, and the redistributive scheme guarantees both persons equal opportunities (see Fleurbaey (1995a), Bossert (1995), and Bossert and Fleurbaey (1996))

This harmony is due to the fact the gain in pre-tax income following an increase in effort is *independent* of talent. Otherwise, the two principles of no compensation and full compensation are not compatible. In our simple two-person example, we can illustrate this by looking at a world slightly different from the one presented in Figure 1.

Effort

Talent		*High*	*Low*
	High	100	20
	Low	70	0

Figure 4. Pre-tax income (situation B)

In this case, if we apply the principle of full compensation on Case 4 and then the principle of no compensation when moving from Case 4 to Case 3 and from Case 3 to Case 1, we get the following redistributive scheme.

Low Talent

High Talent		*High Effort*	*Low Effort*
	High Effort	90,80	
	Low Effort	10,80	10,10

Figure 5. Redistributive scheme 1 (situation B)

As is easily seen, the redistributive scheme in Figure 5 violates the principle of full compensation in Case 1. Hence, we have a problem.

3 The Ethics of Responsibility

In the context of an additively separable pre-tax income function, the principle of *Individual Monotonicity in Effort* seems to be an indisputable part of the ethics of responsibility. The change in pre-tax income caused by a change in effort is independent of talent, and hence *completely* within the control of the agent. However, the situation is more problematic when we lack additive separability. On the basis of control, a talented person can be held responsible for *exercising high effort,* but *not* for *being a talented person* exercising high effort. Hence, from the ethics of responsibility, it follows that the talented person should bear the consequences of exercising high effort per se, but not necessarily that it should bear the consequences of exersising high effort as a talented person.

But what are the consequences of exercising high effort per se? Obviously, in the face of non-separability, there is no clear answer to this question. In order to make the ethics of responsibility operational, however we need a standard for measuring these consequences. One possibility is of course to follow the framework underlying *Individual Monotonicity in Effort,* where people are responsible for all of the consequences that follow from an increase in effort. However, in our view, an equally plausible approach is to keep people responsible for the consequences of changed effort that would take place *independent* of their talent. If two persons exercise the same increase in effort, then any difference in consequences is due to talent. These differences are beyond their control, and hence it can be argued that they should not be considered part of the ethics of responsibility.

Notice that this is *not* to mix the ethics of responsibility with the ethics of compensation. The outlined argum his effort. As a consequence, he gains 70 in pre-tax income. *Independent of talent*, an increase in effort would imply at least a gain of this size, and hence it seems indisputable to let the person be responsible for this change. On the other hand, when we move from Case 3 to Case 1, the more talented person increases his effort and by that gains 80 in pre-tax income. In this case, it can be argued that to keep the person responsible for all of this is to overlook the fact that he gains so much *because* he is more talented. If the more talented was the less talented, he would gain 70, and the more talented cannot be held responsible for the fact that he or she is more talented. Consequently, it can be argued that all that follows from the the ethics of responsibility in this case is that the more talented keeps 70. Whether or not he should keep the remaining 10 as well becomes an issue of compensation.

However, a violation of *Individual Monotonicity in Effort* may imply that equally talented people pay different amounts of taxes (or receive different subsidies). Hence, it may violate the following version of the ethics of responsibility (see Bossert and Fleurbaey (1996, p. 348)):

Equal Transfer for Equal Talent: Equally talented people should pay the same amount of tax (or receive the same subsidy).

Some may find this troublesome, arguing that in these cases the implications of the ethics of responsibility should be obvious. The only difference between two talented people would be the difference in effort they exercise, and hence it seems hard to deny that it follows from the ethics of responsibility that they should bear the consequences of any differences in this respect. But the same argument applies again. Look at the case with two talented persons, one exercising high effort and the other exercising low effort. Both persons can be held responsible for their *effort levels*, but none of them can be held responsible for the fact that they are *talented persons.* Hence, it follows from the ethics of responsibility that we should hold them responsible for any consequences following from differences in effort levels, but not necessarily for all of the consequences following from the fact that these differences in effort levels take place in the context of talented persons. Consequently, given this interpretations of the ethics of responsibility, we may allow for differences in tax levels among equally talented persons.

In sum, I suggest that it is far from obvious how to define the ethics of responsibility in the context of a non-separable pre-tax income function. However, I will argue that some restrictions can be placed on the set of plausible definitions. First, any plausible view of the ethics of responsibility should *at least* hold the agents responsible for the actual consequences that are independent of talent. Second, the agents should not be held responsible for *more* than the actual consequences following an increase in effort. In my view, these restrictions follow naturally from our understanding of the idea of being responsible for something. At the one hand, it seems unreasonable to be held responsible for more than what you have caused by your choices (the second restriction); at the other hand, if the consequences of your choices are partly beyond your control, then it seems reasonable to restrict your responsibility (the first restriction).

The two restrictions allow for a very broad view on the ethics of responsibility, including the position represented by *Individual Monotonicity in Effort.* However, in the next section, I will prove that in combination with the ethics of compensation this framework supports a particular redistributive mechanism.

4 Analysis

Consider a society with a population $N = \{1, ..., n\}$, $n > 4$, where agent i's effort is e_i and his talent t_i. We assume that $e_i, t_i \in \Re$, where $\Re$ is the set of real numbers.[3] Let $a_i = \left\{a_i^E = e_i, a_i^T = t_i\right\}$ be a characteristics vector of i, $a = \{a_1, ..., a_n\}$ a characteristics profile of society (which can be partitioned into $a^E = \left\{a_1^E, ..., a_n^E\right\}$ and $a^T = \left\{a_1^T, ..., a_n^T\right\}$), $\subseteq \Re^2$ the set of all possible characteristics vectors (where $_E$ is the set of all possible effort levels and $_T$ the set of all possible talents), and $^n \subseteq \Re^{2n}$ the set of all possible characteristics profiles. Let $\tilde{}^n \subset {}^n$ be the set of admissible characteristics profiles, where for any $a, \tilde{a} \in \tilde{}^n$, $a^T = \tilde{a}^T$. In other words, we do not consider interprofile conditions with respect to talent,[4] but assume that there is a single charcteristics profile of talent in society. This profile, however, can be any profile within the set of possible profiles. We impose no other restrictions on the set of permissible characteristics vectors and profiles.

The income function $f : \quad \rightarrow \Re$ is assumed to be strictly increasing in both arguments. The income function is additively separable if and only if there exist functions $g : \ _E \rightarrow \Re$ and $h : \ _T \rightarrow \Re$ such that $f(e, t) = g(e) + h(t)$, $\forall e, t \in$

[3] Hence, we do not consider the multidimensional version of this problem: see Bossert and Fleurbaey (1996).

[4] See Bossert (1995)

$\Re$. Moreover, define $\min a^E = \min(a_1^E, ..., a_n^E)$ and for any $e^1, e^2 \in \Re$,where $e^2 \geq e^1$, $\min \Delta(a^T, e^2, e^1) = \min([f(a_1^T, e^2) - f(a_1^T, e^1)],..., f(a_n^T, e^2) - f(a_n^T, e^1)])$. Finally, an efficient redistribution function F: $\tilde{\ }^n \to \Re^n$ satisfies the feasibility condition $\sum_{i=1}^n F_i(a) = \sum_{i=1}^n f(a_i)$, $\forall a \in \tilde{\ }^n$.

At the outset, let us have a look at the following redistributive mechanism, which is only well-defined if we have additive separability in the pre-tax income function.

$F_k^0(a) = g(a_k^E) + \frac{1}{n}\sum_{i=1}^n h(a_i^T)$, $\forall a \in \tilde{\ }^n$, $\forall k \in N$.

Bossert (1995) shows that F^0 is the only mechanism that satisfies the following two conditions.

Equal Income for Equal Effort (EINEE): $\forall a \in \tilde{\ }^n$, $\forall i, j \in N$, $a_i^E = a_j^E \to F_i(a) = F_j(a)$.

Individual Monotonicity (IM): $\forall a, \tilde{a} \in \tilde{\ }^n$, $\forall k \in N$, $a_j^E = \tilde{a}_j^E$, $\forall j \neq k \to F_j(a) = F_j(\tilde{a})$.

Hence, unless f is additively separable, we have an impossibility result.

Theorem 1 *An efficient redistribution mechanism F satisfies EINEE and IM if and only if f is additively separable, and $F = F^0$.*

Proof. See Bossert (1995) and Bossert and Fleurbaey (1996). ■

When presenting this result, Bossert remarks that: "For income functions f that are additively separable,..., F^0 seems very plausible. If the effects of relevant and irrelevant characteristics on income can be separated, it seems only natural to assign the entire income portion due to relevant characteristics to each agent, and divide the total income due to irrelevant characteristics equally among agents" (Bossert (1995, p. 4))."

However, notice that the fact that we know that f is additively separable does not necessarily imply that we can separate *all* of the effects of relevant and irrelevant characteristics on income. By way of illustration, consider *Figure 6.*

		Effort	
		High	*Low*
Talent	*High*	100	80
	Low	80	60

Figure 6. Pre-tax income (situation C)

In Situation C, the pre-tax income function is additively separable. But how should we separate the effects of effort and talent on income? Should we choose alternative A or alternative B in Figure 7?

A

	High	*Low*
Talent	20	0
Effort	80	60

B

	High	*Low*
Talent	80	60
Effort	20	0

Figure 7. Alternative ways of separating the effects of effort and talent on income (Situation C).

Alternative A assigns almost all of the effects to effort, whereas the opposite is the case in Alternative B. What is correct? It does not necessarily follow any answer from the fact that the pre-tax income function is additively separable, because both separations provide a *representation* of f. More importantly, for the purpose of choosing a redistributive mechanism, it really does not matter in the context of F^0. In both cases, we end up with the the same post-tax distribution of income.

Remark 1 *For any additively separable income function $f(e,t) = g^*(e) + h^*(t)$, where $g^*(e) = g(e) + \epsilon$ and $h^*(t) = h(t) - \epsilon$, $\epsilon \in \Re$, F^0 is invariant to the choice of ϵ.*

The proof is trivial (and hence omitted). But still the observation is of some interest, because it highlights the representational nature of F^0. The appealing redistributive mechanism satisfying *EINEE* and *IM* can always be represented by F^0, but that does not imply that the numbers assigned to the effects of talent and effort in F^0 should be given complete substantive interpretation. What matters is that the consequences of any difference in effort are independent of talent, which will be reflected for every possible choice of g and h .

When facing an additive separable pre-tax income function, we would get the same distribution of resources by applying the following efficient redistributive scheme.

$F_k^{MIN}(a) := \min \Delta(a^T, a_k^E, \min a^E) + \frac{1}{n}\sum_{i=1}^{n}(f(a_i) - \min \Delta(a^T, a_i^E, \min a^E))$, $\forall a \in \tilde{\ }^n$, $\forall k \in N$, This redistribution function consists of two parts: the first part dealing with the ethics of responsibility and the second part with the ethics of compensation. Every agent receives a transfer which equals the part of the consequences of his choice of effort that is *independent of talent* and, moreover, a uniform transfer which reflects that everyone has a right to an equal share of the amount of resources produced by the common pool of talent.

We will now look at different ways of characterising this redistributive mechanism. First, we introduce the restriction on the ethics of responsibility that it should never give a compensation smaller than the consequences that are *independent* of talent or larger than the actual increase in pre-tax income of the agent in question.

Restricted Compensation (RC): For any $j \in N$ *and* $a, \tilde{a} \in \tilde{}^{\,n}$, *where* $\tilde{a}_j^E > a_j^E$ *and* $a_i = \tilde{a}_i$, $\forall i \neq j$, $f(\tilde{a}_j)$ - $f(a_j) \geq F_j(\tilde{a})$ - $F_j(a) \geq \min \Delta(a^T, \tilde{a}_j^E, a_j^E)$.

In the formal analysis, a much weaker version of *RC* is sufficient.

Weakly Restricted Compensation (WRC): For any $j \in N$ *and* $a, \tilde{a} \in \tilde{}^{\,n}$, *where* $\tilde{a}_j^E > a_j^E$ *and* $a_i = \tilde{a}_i$, $\forall i \neq j$, $f(\tilde{a}_j)$ - $f(a_j) = \min \Delta(a^T, \tilde{a}_j^E, a_j^E) \rightarrow F_j(\tilde{a})$ - $F_j(a) = \min \Delta(a^T, \tilde{a}_j^E, a_j^E)$.

When studying the implications of *WRC*, we need to introduce the following restriction on the income function f. We will say that f is *regular* if and only if for any $t^1, t^2 \in \Re$ and any e^1,e^2,$e^3 \in \Re$, where $e^3 > e^2 > e^1$, $f(t^1, e^2)$ - $f(t^1, e^1)$ $> f(t^2, e^2)$ - $f(t^2, e^1) \rightarrow f(t^1, e^3)$ - $f(t^1, e^2) \geq f(t^2, e^3)$ - $f(t^2, e^2)$.[5] In many cases, this condition should be considered acceptable. By way of illustration, it is common to assume (for example in labour markets) that the marginal productivity of the more talented is higher than of the less talented for every effort level. However, the regularity condition does not rule out the opposite case. What it rules out is that there is a change in the ranking of marginal productivity at a certain effort level.

In any case, the regularity condition is needed in order to avoid an impossibility result for the framework of *EINEE* and *RC.*

Theorem 2 *A redistribution mechanism F satisfies EINEE and WRC if and only if f is regular and F=*F^{MIN}.

[5] Of course, additive separability implies that f is regular. But there is no equivalence. There are many non-separable pre-tax income functions that are regular.

Proof. (1) We will first prove that there does not exist any F satisfying *EINEE* and *WRC* if f is not regular. In this case, there exist $t^1, t^2 \in \Re$ and $e^1, e^2, e^3 \in \Re$ such that $f(t^1, e^2)$ - $f(t^1, e^1) > f(t^2, e^2)$ - $f(t^2, e^1)$ and $f(t^1, e^3)$ - $f(t^1, e^2) < f(t^2, e^3)$ - $f(t^2, e^2)$.

(2) Suppose $f(t^1, e^3)$ - $f(t^1, e^1) \geq f(t^2, e^3)$ - $f(t^2, e^1)$. In this case, consider $a \in \tilde{}^{n}$, where for some $k \in N$, $a_k^T = t^2$, $a_i^T = t^1$, $\forall i \neq k$, and $a_i^E = e^2$, $\forall i \in N$. By *EINEE*, $F_i(a) = F_k(a)$, $\forall i \in N$. Consider $\tilde{a} \in \tilde{}^{n}$, where for some $j \in N$, $\tilde{a}_j^E = e^3$ and $\tilde{a}_i = a_i$, $\forall i \neq j$. By the assumption in (1), $f(\tilde{a}_j)$ - $f(a_j) = \min \Delta(a^T, e^3, e^2)$. Hence, by *WRC*, $F_j(\tilde{a})$ - $F_j(a) = f(\tilde{a}_j)$ - $f(a_j)$. Consider now $\tilde{\tilde{a}} \in \tilde{}^{n}$, where $\tilde{\tilde{a}}_k^E = e^1$ and $\tilde{\tilde{a}}_i = \tilde{a}_i$, $\forall i \neq k$. By the assumption in (1), $f(\tilde{a}_k)$ - $f(\tilde{\tilde{a}}_k) = \min \Delta(a^T, e^2, e^1)$. Hence, by *WRC*, $F_k(\tilde{a})$ - $F_k(\tilde{\tilde{a}}) = f(\tilde{a}_k)$ - $f(\tilde{\tilde{a}}_k)$. Consequently, $F_j(\tilde{\tilde{a}})$ - $F_k(\tilde{\tilde{a}}) = \min \Delta(a^T, e^2, e^1)$ + $\min \Delta(a^T, e^3, e^2)$. Finally, consider $\tilde{\tilde{\tilde{a}}} \in \tilde{}^{n}$, where $\tilde{\tilde{\tilde{a}}}_k^E = e^3$ and $\tilde{\tilde{\tilde{a}}}_i = \tilde{\tilde{a}}_i$, $\forall i \neq j$. By the supposition in the first sentence of (2), $f(\tilde{\tilde{\tilde{a}}}_k)$ - $f(\tilde{\tilde{a}}_k) = \min \Delta(a^T, e^3, e^1)$. Hence, by *WRC*, $F_k(\tilde{\tilde{\tilde{a}}})$ - $F_k(\tilde{\tilde{a}}) = f(\tilde{\tilde{\tilde{a}}}_k)$ - $f(\tilde{\tilde{a}}_k) = [f(t^2, e^3)$ - $f(t^2, e^2)] + \min \Delta(a^T, e^2, e^1)$. Consequently, $F_j(\tilde{\tilde{\tilde{a}}}) = F_j(\tilde{\tilde{a}}) = F_k(\tilde{\tilde{a}}) + \min \Delta(a^T, e^2, e^1) + \min \Delta(a^T, e^3, e^2) < F_k(\tilde{\tilde{\tilde{a}}})$. However, this violates *EINEE*, and hence the supposition in the first sentence of (2) is not possible.

(3) Suppose $f(t^1, e^3)$ - $f(t^1, e^1) < f(t^2, e^3)$ - $f(t^2, e^1)$. By the same line of reasoning as in (2), we can show that this supposition is not possible. The only difference is that we in this case consider a $\tilde{\tilde{\tilde{a}}} \in \tilde{}^{n}$, where $\tilde{\tilde{\tilde{a}}}_j^E = e^1$ and $\tilde{\tilde{\tilde{a}}}_i = \tilde{\tilde{a}}_i$, $\forall i \neq j$. Hence, if f is not regular, then there does not exist an F satisfying *EINEE* and *WRC.*

(4) We will now prove that if f is regular and F satisfies *EINEE* and *WRC*, then $F = F^{MIN}$, i.e. for any $a \in \tilde{}^{n}$, $F_i(a) = F_i^{MIN}(a)$, $\forall i \in N$. In this case, the fact that f is regular implies that there exists an $l \in N$ such that for any $e^1, e^2 \in \Re$, where $e^2 > e^1$, $f(a_l^T, e^2)$ - $f(a_l^T, e^1) = \min \Delta(a^T, e^2, e^1)$. Now consider $\tilde{a} \in \tilde{}^{n}$, where $\tilde{a}_l^E = \min a^E$ and $\tilde{a}_i = a_i$, $\forall i \neq l$. By *WRC* and the fact that f is regular, we have that $F_l(a)$ - $F_l(\tilde{a}) = \min \Delta(a^T, a_l, \min \tilde{a}^E) = f(a_l)$ - $f(\tilde{a}_l)$ and $F_i(\tilde{a}) = F_i(a)$, $\forall i \neq l$.

(5) Suppose there exists $k \in N$ such that $F_k(\tilde{a})$ - $F_l(\tilde{a}) \neq \min \Delta(a^T, \tilde{a}_k, \min \tilde{a}^E = \tilde{a}_l)$. Consider $\tilde{\tilde{a}}$, where $\tilde{\tilde{a}}_l^E = \tilde{a}_k$ and $\tilde{\tilde{a}}_i = \tilde{a}_i$, $\forall i \neq l$. By *RC* and the fact that f is regular, $F_l(\tilde{\tilde{a}}) = F_l(\tilde{a}) + \min \Delta(a^T, \tilde{a}_l, \min \tilde{a}^R = \tilde{a}_l)$ and $F_i(\tilde{\tilde{a}}) = F_i(\tilde{a})$, $\forall i \neq l$. But then it follows from the supposition in the first sentence of (5) that $F_l(\tilde{\tilde{a}}) \neq F_k(\tilde{\tilde{a}})$, which violates *EINEE*. Hence, the supposition cannot be correct.

(6) By (5) it follows that $F_i(\tilde{a})$ - $F_l(\tilde{a}) = \min \Delta(a^T, \tilde{a}_i, \min \tilde{a}^E = \tilde{a}_l)$, $\forall i \in N$. F

is efficient, and hence $F_l(\tilde{a}) = \sum_{i=1}^{n} f(\tilde{a}_i)$ - $\sum_{i\neq l} F_i(\tilde{a}) = \sum_{i=1}^{n} f(\tilde{a}_i)$ - $\sum_{i\neq l}[F_l(\tilde{a}) + \min \Delta(a^T, \tilde{a}_i, \min \tilde{a}^E = \tilde{a}_l)]$. If we take into account that $\min \Delta(a^T, \tilde{a}_l, \min \tilde{a}^E = \tilde{a}_l) = 0$ and reorganize, we find that $F_l(\tilde{a}) = \frac{1}{n}\sum_{i=1}^{n}[f(\tilde{a}_i)$ - $\min \Delta(a^T, \tilde{a}_i, \min \tilde{a}^E)]$. Moreover, we know from (4) that $f(\tilde{a}_l) = f(a_l)$ - $\min \Delta(a^T, a_l, \min a^E)$, $f(a_i) = f(\tilde{a}_i)$, $\forall i \neq l$, and $\min \tilde{a}^E = \min a^E$. Hence, $F_l(\tilde{a}) = \frac{1}{n}\sum_{i=1}^{n}[f(a_i)$ - $\min \Delta(a^T, a_i, \min a^E)]$. Consequently, taking into account that $F_i(\tilde{a}) = F_i(a)$, $\forall i \neq l$ (from (4)), we find that $F_i(a) = \min \Delta(a^T, a_i, \min a^E) + \frac{1}{n}\sum_{i=1}^{n}[f(a_i)$ - $\min \Delta(a^T, a_i, \min a^E)]$. Moreover, from (4) it follows that $F_l(a)$ - $F_l(\tilde{a}) = \min \Delta(a^T, \tilde{a}_l, \min \tilde{a}^E)$, and then this part of the proof is completed by taking into account that $F_l(\tilde{a}) = \frac{1}{n}\sum_{i=1}^{n}[f(a_i)$ - $\min \Delta(a^T, a_i, \min a^E)]$.

(7) It is easily seen that F^{MIN} satisfies *EINEE.* If f is regular, it also follows straightforwardly that F^{MIN} satisfies WRC (and RC). ■

Hence, if we accept RC (or WRC) as a minimal condition on the ethics of responsibility, we either face an impossibility result or a characterisation result. If f is not regular, then there does not exist any plausible version of the ethics of responsibility that is compatible with the ethics of compensation. However, in all cases where f is regular, we have a *unique* redistributive mechanism that both satisfies the ethics of compensation and a plausible version of the ethics of responsibility.

In fact, the mechanism characterised in Theorem 2 is closely related to a member of the class of *egalitarian-equivalent* mechanisms considered by Bossert and Fleurbaey (1996).[6] This class can be defined as follows:

$F_k^{EE}(a) := f(\hat{a}^T, a_k^E) + \frac{1}{n}\sum_{i=1}^{n}(f(a_i) - f(\hat{a}^T, a_k^E))$, $\forall a \in \tilde{\ }^n$, $\forall k \in N$,

where $\hat{a}^T$ is defined as the reference talent. As remarked by Bossert and Fleurbaey (1996, p. 344), "the choice of a particular reference vector is an important issue". They do not attempt to solve this problem, but suggests a mechanism that can be applied once this decision has been made. In this respect, our result supplements their analysis, because Theorem 2 provides a characterisation of a mechanism that is equivalent to a member of this class when f is regular.[7]

Remark 2 F^{MIN} *supports the same post-tax income distribution as the egalitarian-equivalent mechanism defined by the reference talent to the agent who has the lowest*

[6] See also Fleurbaey (1995).

[7] See also Sprumont (1997).

marginal productivity of effort (though not necessarily the least talented in the profile) if and only if f is regular.

Proof. The only-if part is trivial. If f is regular, then there exists an $l \in N$ such that for any $e^1, e^2 \in \Re$, where $e^2 > e^1$, $f(a_l^T, e^2)$ - $f(a_l^T, e^1) = \min \Delta(a^T, e^2, e^1)$. In this case, as is easily seen, F^{MIN} equals the member of the class of egalitarian-equivalent mechanisms with a_l^T as the reference talent. ■

It can be instructive to compare Theorem 2 with the characterisation of egalitarian-equivalent mechanisms in Bossert and Fleurbaey (1996, Theorem 1). First, Bossert and Fleurbaey (1996) work within a more general framework that allows for multi-dimensional characteristics of talent and effort, whereas we assume (as Sprumont (1997)) that talent and effort are real variables. Second, Bossert and Fleurbaey (1996) rely on an interprofile version of the ethics of compensation (with respect to talent), contrary to our single profile framework. Third, they do not impose any restrictions on f. In particular, they do not demand that f is regular. Finally, they impose a less specific version of the ethics of responsibility, which demands no transfers between agents if everyone has the same level of talent (equal to the reference talent). This is also implied by *RC*, which in addition imposes restrictions on the ethics of responsibility in cases where the agents' talent differ. In sum, roughly speaking Bossert and Fleurbaey (1996) provide a very general interprofile characterisation of the class of egalitarian-equivalent mechanisms, whereas we attain a single profile characterisation of a mechanism equivalent to a particular member of this class by adding some restrictions on the pre-tax income function and on the ethics of responsibility.

5 An Alternative Characterisation

We will now suggest an alternative characterisation of F^{MIN}. For this purpose, we impose a restriction on how an increase in effort by some agent should influence *other* agents post-tax income.

No Negative Effect on Others (NNEO): For any $j \in N$ and $a, \tilde{a} \in \tilde{\ }^n$, where $\tilde{a}_j^E > a_j^E$ and $a_i = \tilde{a}_i$, $\forall i \neq j$, $F_i(\tilde{a}) \geq F_i(a)$, $\forall i \in N$.

There is a close relationship between *NNEO* and *RC.* If *NNEO* is satisfied, then it follows that no one will receive a larger increase in post-tax income than the actual increase in pre-tax income following an increase in effort (which also is implied by *RC*). However, in one respect, *NNEO* is stronger than *RC*, because it imposes restrictions on how an increase in effort by some agent should influence other agents post-tax income. On the other hand, *NNEO* does not place any other restrictions on the set of admissible schemes of compensation. In particular, it does not demand that the agent receives at least the increase in pre-tax income that is independent of talent, and hence in this respect it is weaker than *RC.*

Also in the case of *NNEO*, we have to impose restrictions on f in order to establish a link to F^{MIN}.

Remark 3 *F^{MIN} satisfies NNEO if and only if f is regular.*

Proof. The if part of the remark is trivial, and hence we will only prove the only-if part.

(1) If f is not regular, then there exist $t^1, t^2 \in \Re$ and $e^1, e^2, e^3 \in \Re$ such that $f(t^1, e^2)$ - $f(t^1, e^1) > f(t^2, e^2)$ - $f(t^2, e^1)$ and $f(t^1, e^3)$ - $f(t^1, e^2) < f(t^2, e^3)$ - $f(t^2, e^2)$.

(2) Consider $a, \tilde{a} \in {}^{\sim n}$, where for some $k \in N$, $a_k = \{t^1, e^2\}$, $\tilde{a}_k = \{t^1, e^3\}$, and $a_i = \{t^2, e^1\}$, $\forall i \neq k$. In this case, $F_i(a) = \frac{1}{n}\left[\sum_{i=1}^{n} f(a_i) - \min \Delta(a^T, e^2, e^1)\right] < F_i(\tilde{a}) = \frac{1}{n}\left[\sum_{i=1}^{n} f(\hat{a}_i) - \min \Delta(a^T, e^3, e^1)\right]$, $\forall i \neq k$, which violates *NNEO.* ■

However, *EINEE* and *NNEO* does not characterise F^{MIN} when f is regular. By way of illustration, the efficient and strictly egalitarian redistributive mechanism assigning an equal amount of the resources to each individual in all cases satisfies both conditions. But this condition is completely insensitive to differences in effort, and hence of no interest for our purpose. Thus, the interesting question is whether there exists any other mechanism satisfying both *EINEE* and *NNEO* that is more sensitive to differences in effort than F^{MIN} .

In order to answer this question, we have to clarify what it means that F is more sensitive to differences in effort than F^1. At the outset, two alternative definitions might be considered.

Definition 1 *F is more sensitive to differences in effort than F^1 iff for any $a \in {}^{\sim n}$ and $j, k \in N$, where $a_j^E > a_k^E$, $F_j(a)$ - $F_k(a) \geq F_j^1(a)$ - $F_k^1(a)$ and there exist $\tilde{a} \in {}^{\sim n}$, $l, m \in N$ where $\tilde{a}_l^E > \tilde{a}_m^E$ and $F_l(\tilde{a})$ - $F_m(\tilde{a}) > F_l^1(a)$ - $F_m^1(a)$.*

Definition 2 *F is more sensitive to differences in effort than F^1 iff for any $a, \tilde{a} \in \tilde{\ }^n$ and $j \in N$, where $a_j^E > \tilde{a}_j^E$, $F_j(a)$ - $F_j(\tilde{a}) \geq F_j^1(a)$ - $F_j^1(\tilde{a})$ and there exist $\tilde{\tilde{a}}, \tilde{\tilde{\tilde{a}}} \in \tilde{\ }^n$, $k \in N$ where $\tilde{\tilde{a}}_k^E > \tilde{\tilde{\tilde{a}}}_k^E$ and $F_k(\tilde{\tilde{a}})$ - $F_k(\tilde{\tilde{\tilde{a}}}) > F_k^1(\tilde{\tilde{a}})$ - $F_k^1(\tilde{\tilde{\tilde{a}}})$.*

However, it turns out that *Definition 2* is implausible within our framework, as reported in the following remark.

Remark 4 *According to Definition 2, there does not exist any efficient F satisfying EINEE that is more sensitive to differences in effort than the strictly egalitarian redistributive mechanism.*

Proof. By feasibility, for any F different from strict egalitarianism, there exist $a \in \tilde{\ }^n$, $k \in N$ such that $F_k(a) < F_k^{SE}(a)$. Consider $\tilde{a} \in \tilde{\ }^n$, where $a_k^E > \tilde{a}_k^E = \tilde{a}_i^E$, $\forall i \in N$. By *EINEE* and the fact that F and F^{SE} are efficient, we have that $F_i^{SE}(\tilde{a}) = F_i(\tilde{a}), \forall i \in N$. Hence, $F_k^{SE}(a)$ - $F_k^{SE}(\tilde{a}) > F_k(a)$ - $F_k(\tilde{a})$, and the result follows. ■

Obviously, any other F should be considered more sensitive to differences in effort than strict egalitarianism, which is in line with *Definition 1*. Hence, we will only pay attention to *Definition 1* in the rest of the analysis.

Theorem 3 *If f is regular, then there does not exist any efficient F satisfying EINEE and NNEO that is more sensitive than F^{MIN} to differences in effort (according to Definition 1).*

Proof. (1) Suppose there exists an F satisfying *EINEE* and *NNEO*, where for some $a \in \tilde{\ }^n$ and $j, k \in N$, where $a_j^E > a_k^E : F_j(a)$ - $F_k(a) > F_j^{MIN}(a)$ - $F_k^{MIN}(a)$. By the assumption of regularity, there exists an $l \in N$ such that for every $e^1, e^2 \in \Re$, where $e^2 > e^1$, $\min \Delta(a^T, e^2, e^1) = f(a_l^T, e^2)$ - $f(a_l^T, e^1)$. Hence, by the definition of F^{MIN}, we have that $F_j(a)$ - $F_k(a) > f(a_l^T, a_j^E)$ - $f(a_l^T, a_k^E)$.

(2) Suppose $a_l^E \square a_k^E$. Consider $\tilde{a} \in \tilde{\ }^n$, where $a_i = \tilde{a}_i$, $\forall i \neq l$ and $\tilde{a}_l^E = a_k^E$. By *NNEO*, $F_i(\tilde{a}) \geq F_i(a)$, $\forall i \in N$.

(3) Suppose there exists $i \neq l$, $F_i(\tilde{a}) > F_i(a)$. Then, by (2) and the fact that F is efficient, $F_l(\tilde{a})$ - $F_l(a) < f(\tilde{a}_l)$ - $f(a_l) = \min \Delta(a^T, a_k^E, a_l^E)$. Moreover, by *EINEE*, $F_l(\tilde{a}) = F_k(\tilde{a}) \geq F_k(a)$. Hence, $F_k(a)$ - $F_l(a) < \min \Delta(a^T, a_k^E, a_l^E)$. Hence, if the

supposition in (3) is correct, then F is not more sensitive to differences in effort than F^{MIN}.

(4) Suppose $F_i(\tilde{a}) = F_i(a)$, $\forall i \neq l$. Then by the assumption in (1), $F_j(\tilde{a})$ - $F_k(\tilde{a})$ = $F_j(\tilde{a})$ - $F_l(\tilde{a}) > f(a_l^T, a_j^E)$ - $f(a_l^T, a_k^E)$. Consider $\tilde{\tilde{a}} \in \tilde{\ }^n$, where $\tilde{\tilde{a}}_i = \tilde{a}_i$, $\forall i \neq l$ and $\tilde{\tilde{a}}_l^E = \tilde{\tilde{a}}_j^E$. By *NNEO*, $F_i(\tilde{\tilde{a}}) \geq F_i(\tilde{a})$, $\forall i \in N$. Hence, taking into account that F is efficient, $F_l(\tilde{\tilde{a}})$ - $F_l(\tilde{a})$ □ $f(a_l^T, a_j^E)$ - $f(a_l^T, a_k^E) < F_j(\tilde{a})$ - $F_l(\tilde{a})$. Consequently, $F_l(\tilde{\tilde{a}}) < F_j(\tilde{a}) < F_j(\tilde{\tilde{a}})$, which violates *EINEE*. Hence, if F satisfies *EINEE*, then the supposition in (4) is not possible. Moreover, taking into account (3), it follows that neither the supposition in (2) is possible.

(5) Suppose $a_l^E > a_k^E$. Consider $\tilde{a} \in \tilde{\ }^n$, where $a_i = \tilde{a}_i$, $\forall i \neq l$ and $\tilde{a}_l^E = a_k^E$. By *NNEO*, $F_i(\tilde{a})$ □ $F_i(a)$, $\forall i \in N$. By exactly the same line of reasoning as in (3) and (4), we can now complete the proof by showing that the supposition in (5) is not possible. ■

Hence, if we want to stay within the framework of *EINEE* and *NNEO*, there does not exist a redistributive mechanism that is more sensitive to differences in effort than F^{MIN}. On the other hand, if we drop either *EINEE* or *NNEO*, there are many options. Of course, if we drop *EINEE,* the natural reward scheme (where post-tax and pre-tax incomes are equal) would be one candidate. Moreover, any other egalitarian-equivalent mechanism than the one being equivalent to F^{MIN} when f is regular is more sensitive to differences in effort than F^{MIN}. But these mechanisms violate *NNEO.*

Theorem 3 does not state that F^{MIN} is more sensitive to differences in effort than any other F satisfying the conditions of the theorem.[8] However, such a result can be reported if we add the following restriction to our framework.

Equal Premium for Extra Effort (EPEE): $\forall a, \tilde{a} \in {}^{\sim n}$, $\forall i, j, k, l \in N$, $a_i^E = \hat{a}_k^E$ & $a_j^E = \tilde{a}_l^E \rightarrow F_i(a)$ - $F_j(a) = F_k(\tilde{a})$ - $F_l(\tilde{a})$.

If f is not additively separable, then *EPEE* is in direct conflict with *IM.* Hence, contrary to *RC, EPEE* should not be considered a minimal condition on any plausible view of the ethics of responsibility, but rather a condition reflecting one possible interpretation of this idea. *EPPE* captures the view that the ethics of responsibility

[8]Actually, I have not been able to come up with any redistributive mechansim F satisfying *EINEE* and *NDIE* that is more sensitive than F^{MIN} to differences in effort. Hence, it might be the case that Theorem 3 can be strengthened in this respect.

does not justify the claim that the premium paid for extra effort depends on talent (which, of course, cannot be justified by the ethics of compensation either), because talent is not within the control of the agent.

Many redistributive mechanisms satisfy *EPEE,* among them strict egalitarianism. Within our extended framework, however F^{MIN} is the redistributive mechanism that is most sensitive to differences in effort.

Theorem 4 *If f is regular, then F^{MIN} is more sensitive to differences in effort (according to Definition 1) than any other F satisfying EINEE, NNEO, and EPEE.*

Proof. (1) Suppose there exists an F satisfying *EINEE, NNEO*, and *EPEE* such that for some $a \in \tilde{\ }^{n}$ and $j, k \in N$, where $a_j^E > a_k^E$, $F_j(a)$ - $F_k(a) > F_j^{MIN}(a)$ - $F_k^{MIN}(a)$. If f is regular, then there exists an $l \in N$ such that for every $e^1, e^2 \in \Re$, where $e^2 > e^1$, $\min \Delta(a^T, e^2, e^1) = f(a_l^T, e^2)$ - $f(a_l^T, e^1)$. By the definition of F^{MIN}, $F_j(a)$ - $F_k(a) > f(a_l^T, a_j^E)$ - $f(a_l^T, a_k^E)$.

(2) Consider some $\tilde{a} \in \tilde{\ }^{n}$, where $\tilde{a}_i^E = a_k^E$, $\forall i \in N$. By *EINEE,* $F_j(\tilde{a})$ $= F_k(\tilde{a})$, $\forall j, k \in N$. Consider some $\tilde{\tilde{a}} \in \tilde{\ }^{n}$, where $a_i^E = \tilde{\tilde{a}}_i^E$, $\forall i \neq l$ and $\tilde{\tilde{a}}_l^E = a_j^E$. By *NNEO,* $F_i(\tilde{\tilde{a}}) \geq F_i(\tilde{a})$, $\forall i \in N$. Moreover, $\sum_{i=1}^n f(\tilde{\tilde{a}}_i)$ - $\sum_{i=1}^n f(\tilde{a}_i)$ $= \min \Delta(a^T, a_j^E, a_k^E)$. Hence, by *NNEO,* $F_l(\tilde{\tilde{a}})$ - $F_l(\tilde{a})$ $\square$ $\min \Delta(a^T, a_j^E, a_k^E)$. Consequently, $F_l(\tilde{\tilde{a}})$ - $F_i(\tilde{\tilde{a}})$ $\square$ $\min \Delta(a^T, a_j^E, a_k^E)$, $\forall i \neq l$. By *EPEE*, $F_j(a)$ - $F_k(a) = F_l(\tilde{\tilde{a}})$ - $F_i(\tilde{\tilde{a}})$ $\square$ $\min \Delta(a^T, a_j^E, a_k^E)$. Hence the supposition in (1) is not possible, and the result follows. ■

6 Conclusion

It is not straightforward to define the ethics of responsibility in cases where the consequences of changes in factors within our control are partly determined by factors beyond our control. In this paper, we suggest that one plausible view is to keep us responsible for the parts of the consequences that are independent of the factors beyond our control, and we present and characterise a redistributive mechanism that satisfies this interpretation of the ethics of responsibility.

Even for the redistributive mechanism outlined in this paper, it will be the case that some people gain more than others in post-tax income from an increase in effort. But this will not produce any unjustifiable inequalities, because the premium assigned to extra effort will be independent of talent. Hence, everyone gains when a person with high productivity increases effort, and as a result the inequalities in post-tax income only reflects differences in effort. As remarked by Rawls (1971, p. 102), the natural distribution of talent is neither just nor unjust, but simply a natural fact. What is just and unjust is the way institutions deal with these facts. I suggest that in the case of first best taxation, (within a broad class of economic environments) we can deal with these facts in a way that satisfies both the ethics of compensation and a plausible version of the ethics of responsibility.

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