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AN EXPLANATION OF INEFFICIENT REDISTRIBUTION: TRANSFERS INSURE COHESIVE GROUPS

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Abstract

Redistributive policies often sustain inefficient economic sectors. Economists routinely argue that governments should let the sectors collapse, and compensate the affected agents. We explain why governments may instead prefer the inefficient redistribution. If income shocks in a given sector are more correlated than in the rest of the economy, and redistribution is related to individuals' income, then by sustaining a sector, the government is also providing its agents with insurance. The agents would lose this insurance if they relocate to another sector. Government transfers to sectors with correlated incomes are therefore worth more than their monetary value. A preliminary analysis of the publicly-available data suggests that indeed agents in sectors that receive transfers are subject to more correlated income shocks. Our results imply that buying out inefficient sectors may not be the second-best policy when agents cannot fully insure themselves (markets are incomplete).

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An Explanation of Inefficient Redistribution: Transfers Insure Cohesive groups *

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1 Introduction

Redistributive policies are ubiquitous. An important puzzle in political economy is why these policies often take inefficient forms, costing society much more than recipients' benefits.

A typical example is the transfer that a protected industry receives from a tariff on international trade, or from subsidies to production. The monetary value of received transfers is small, compared to the total loss from the distortions introduced by the policy. For example, Huffbauer and Elliot (1994) calculate that tariffs for the 21 most heavily protected industries in the US cost consumers $32.3 billion. After substracting the producers' gains and tariff revenues, the net cost for the economy as a whole is $10.7 billion.[1] The puzzle, as stated for example by Rodrik (1994) or Dixit and Londregan (1995), is why the government does not give a lump-sum grant to the agents in the industry, thus avoiding the inefficiencies of the indirect transfer.

We provide an explanation for this puzzle. First, we observe that transfers and redistribution result from agents' political activities, and that an agent is more likely to engage in political demands when she receives a negative shock. Second, if individual shocks are highly correlated, our first observation implies that the group is "cohesive" in its demands—an individual is unlikely to be alone in demanding a transfer after a negative shock. As a result, a group where individual shocks are highly correlated will receive relatively high transfers when any given individual is poor, and low transfers when she is rich. Thus individuals in groups with correlated shocks—in cohesive groups, that is—are better insured than others.

There is then a value to being in a cohesive group that is not captured by the calculations in the previous literature. To buy out an individual from a cohesive group,

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[1] This follows Dixit and Londregan (1995).

one must give her more than the expected transfer she would receive by remaining in the group: one must compensate her for the insurance she loses when, engaged in other economic activities, she belongs to less cohesive groups. In other words, it may be cheap for a government to give a certain level of utility to members of a group if they engage in an activity that, while inefficient, is subject to correlated individual shocks.

Our explanation of the puzzle has a clear testable implication: The data should show a positive relation between correlation of incomes and positive transfers. A preliminary look at the publicly available US data suggests that this is indeed the case (see Section 5). Our explanation also implies, albeit indirectly, a positive relation between factor specificity and transfers. The empirical literature is seemingly in line with this second implication.

In addition to saying that the calculation in the puzzle ignores an insurance value, our observations suggest an interesting possibility. If the need for government insurance is due to a market failure—financial markets are incomplete—the second-best policy is not known. It is possible that inefficient transfers are second best. And it is not necessarily true that substituting sectoral subsidies for a one-time lump-sum grant is a Pareto improvement. This runs counter to some widely-held convictions in economics, but it is a consequence of the explanation we put forward in this paper. Our paper focuses on the political mechanism behind cohesion and transfers, not on the trade-off of economic inefficiencies. Thus we cannot determine the nature of the second-best policy.

In one sense, our explanation of the puzzle is quite basic, or primitive. Any explanation that is not based on a specific assumption about government behavior must, by revealed preference, imply that the expected value of transfers would not be enough to compensate their recipients; if it were enough, the explanation would require a model of why the government cannot implement the pareto improvement. The next step is to find the source of additional value. Arguably, insurance value comes rather naturally to mind as a source.

We show that our observations are true in two simple and standard models of redistribution. The first is Lindbeck and Weibull's (1987) model of redistribution with probabilistic voting. The second is a model where agents' demands contribute to a group public good. The models abstract away from the details of the economy—indeed economic outcomes are exogenous—and were chosen to focus on the political mechanisms behind redistribution. The two models contain completely different mechanisms, each with some strengths and weaknesses. We present both to show how our observations apply very widely.

We now proceed to discuss three papers closely related to ours.

Acemoglu and Robinson (2001) present a model where farmers favor policies that induce more agents to enter farming, because they gain more political power in the future. Their explanation requires that larger groups obtain larger *per capita* transfers. Acemoglu and Robinson explain why incumbent farmers favor the inefficient entry-inducing policy over a non-distortionary lump-sum transfer. But their model does not explain—nor does it claim to explain—the stated puzzle: a government would still benefit from buying out the incumbent farmers by giving them the present value of the transfers they would obtain with the larger group size. Interestingly, Acemoglu and Robinson's explanation implies that sectors with larger specificity of factors receive smaller transfers—our explanation has, if anything, the opposite testable implication (we discuss this issue in more detail in Section 5).

Dixit and Londregan (1995) argue that, if the government cannot commit to future transfers, individual farmers will prefer to remain farmers and not incur the costs of relocating to another sector. In their model, which builds on the political competition models of Lindbeck and Weibull (1987) and Dixit and Londregan (1996), the transfers are such that farmers who relocate are taxed to subsidize farmers who do not relocate. Dixit and Londregan's explanation relies on the farmers being in a coordination failure, each individually failing to internalize the social gains from the relocation of the group. Our explanation of the puzzle relies on quite different mechanisms; we view it as complementary to Dixit and Londregan's. We should mention, though, that it may be possible for a government to break the coordination failure in the model by offering farmers a *conditional* buy-out offer—a buy-out offer that only comes in place if most farmers accept (offers of this kind are used in corporate take overs, for example).

Coate and Morris (1995) consider policies that may or may not be inefficient, and show that the government may use these policies, even when it knows they are inefficient, because they benefit an interest group in a covert way. Coate and Morris explain policies whose inefficiency is uncertain. The puzzle we try to explain, as stated in the literature, refers to unambiguously inefficient policies. Coate and Morris deal with essentially a different phenomenon than our puzzle.[2]

The rest of the paper is as follows: In Sections 2 and 3 we show that redistributive transfers have an insurance value above the value of the expected transfer, both in a probabilistic voting model in which competing parties offer redistributive policy proposals to gain votes (Section 2) and in a collective action model in which competing sectors contribute effort in demand of redistributive transfers (Section 3). We investigate the size of the insurance effect in Section 4, presenting some numerical examples. In Section 5 we discuss two testable implications derived from the model . Conclusions and an appendix with technical proofs omitted from the text complete the paper.

2 Redistribution in a probabilistic voting model

We shall first demonstrate that the relation between cohesion and insurance exists in Lindbeck and Weibull's (1987) model of redistribution.

[2]Dixit and Londregan (1995) and Acemoglu and Robinson (2001) make the same point about Coate and Morris (1995).

In Lindbeck and Weibull's model, two parties compete for votes by offering transfers—in a sense they "buy" votes. Crucially, a voter is more willing to sell her vote when she is poor than when she is rich, so transfers are more effective, and therefore higher, when they are given to a poor group. As a result, insurance is naturally built into Lindbeck and Weibull's model. In fact, the model can be interpreted as one of a benevolent government who wants to insure voters by means of redistributive transfers.[3] We calculate the insurance-value of these redistributive transfers.

We consider two groups of voters, I_A and I_B. There is a continuum of voters in each group; assume that $I_m = [0,1]$, $m = A, B$.[4]

Voters are identical, with one exception: the voters in group A receive perfectly correlated wealth-shocks, while those in group B receive independent wealth-shocks. The marginal distribution of wealth is the same for all voters, but the joint distribution is different across groups. Concretely, individual wealth, w_i, is drawn from a distribution G, for both groups. The difference is that the w_i in group A are "perfectly correlated" while the w_i in group B are independent. In other words: If $i, i' \in I_A$ and $w_i = w$ then $w_{i'} = w$. While if $i, i' \in I_B$ then the event $w_i = w$ has no information about the realization of $w_{i'}$.

There are two political parties, Y and Z. We assume (following Lindbeck and Weibull) that voters have some intrinsic preference for one of the parties, but parties do not know this preference.

Each voter i derives utility from consumption, c_i, and from which party is in office. Voter i's utility is

$$\begin{cases} v(c_i) + a_i \text{ if Y wins} \\ v(c_i) + b_i \text{ if Z wins.} \end{cases}$$

The numbers a_i and b_i reflect the voter's preference for parties Y and Z.

A voter's consumption is given by her wealth and a government transfer, which can be negative or positive. Each party j promises transfers t_m^j to the individuals of group m. So, if party j wins, voter i of group m consumes $c_i = w_i + t_m^j$. Substitute c_i in voter i's utility, and we conclude that i votes for party Y if

$$b_i - a_i < v(w_i + t_m^Y) - v(w_i + t_m^Z).$$

The parties do not know the values of $b_i - a_i$. But they believe each $b_i - a_i$ is independently and identically distributed according to some distribution F. Then the probability that some voter $i \in I_m$ votes for Y is

$$F\left[v(w_i + t_m^Y) - v(w_i + t_m^Z)\right].$$

[3]See Persson and Tabellini (2000) and Grossman and Helpman (2001) for a discussion of this model, and Hillman (1982) for a contrast between social welfare and political support concerns for enacting redistributive policies.

[4]We depart from Lindbeck and Weibull (1987) in assuming a continuum of voters. They have an arbitrary number of groups, with a finite number of voters in each. Our assumption is analytically convenient, but we do not believe it drives the substance of our results.

The timing of Lindbeck and Weibull's political game is as follows:

1. Wealth levels are realized.
2. Each party $j = \{Y, Z\}$ offers per-capita transfers (t_A^j, t_B^j). The transfers must be balanced, so $t_A^j + t_B^j = 0$. Each party's objective is to maximize the expected number of votes it receives.
3. Elections are held.

Note that the parties learn the voters' wealth. But since they cannot make individual transfers—only group transfers—they only condition their transfers on the realized wealth of group-A voters. The distribution of group-B voters' wealth is G.

Given wealth w for group-A voters, the expected number of votes for Y in group A is

$$\int_0^1 F\left[v(w + t_A^Y) - v(w + t_A^Z)\right] di = F\left[v(w + t_A^Y) - v(w + t_A^Z)\right].$$

While the expected number of votes for Y in group B is

$$\int_0^1 F\left[v(\tilde{w} + t_B^Y) - v(\tilde{w} + t_B^Z)\right] dG(\tilde{w}).$$

Given wealth w for the group-A voters, party Y wants to maximize (and Z minimize)

$$F\left[v(w + t_A^Y) - v(w + t_A^Z)\right] + \int_0^1 F\left[v(\tilde{w} + t_B^Y) - v(\tilde{w} + t_B^Z)\right] dG(\tilde{w})$$

We make the following additional assumptions. Let $v : \mathbf{R}_+ \to \mathbf{R}$ be increasing, continuously differentiable, strictly concave, and satisfy $\lim_{x \to 0} v'(x) = \infty$. Let the distribution function F be differentiable, with convex and compact support, and strictly positive density on its support.

Proposition 1. *(Lindbeck and Weibull, 1987) There is a unique Nash equilibrium. This equilibrium is symmetric, and both parties propose the vector of per-capita transfers (t_A^*, t_B^*) that equates the marginal utility of wealth for group-A voters to the average marginal utility of wealth for B-group voters:*

$$v'(w + t_A^*(w)) = \int_0^1 v'(\tilde{w} + t_B^*(w)) dG(\tilde{w})$$

Let T_m be the expected equilibrium transfers to an individual that belongs to group m. That is, $T_m = \int t_m^*(w) dG(w)$, $m = A, B$.

Lemma 2. *The Nash equilibrium transfers t^* satisfy:*

1. $\mathbf{E}v(w_A + t_A^*(w_A)) > \mathbf{E}v(w_A + T_A)$, *and*

2. $\mathbf{E}v(w_B + t_B^*(w_B)) < \mathbf{E}v(w_B + T_B)$.

The proof of Lemma 2, and of all other results in the paper, is in the appendix.

Belonging to group A is better than receiving the expected transfer that accrue to group-A members, while belonging to group B is worse than receiving the expected transfer that accrue to group-B members. The intuition behind the result is straightforward: group-A voters receive positive transfers when they are poor, and pay transfers when they are rich, while the transfers that a group-B voter receives do not depend on their own wealth, but on that of group-A members. For B members, transfers are a mean-preserving spread over T_B. Since voters are risk averse the result follows.

Proposition 3. *If the expected transfer T_A for group-A voters is positive, then any voter would prefer to be a member of group-A than to receive T_A for sure and then become a group-B voter. Formally:*

$$\mathbf{E}v(w_A + t_A^*(w_A)) > \mathbf{E}v(w_B + T_A + t_B^*(w_B)).$$

Proposition 2 shows that being a member of group A is more valuable than the expected value of group-A transfers. If the government wanted to buy out members of group A, converting them into members of group B and offering them a compensation for the relocation, it would have to offer more than the expected value of the transfers that group A currently receives.

The model we have developed demonstrates the insurance value of transfers to cohesive groups. But the mechanism driving transfers may not be the one usually associated to inefficient transfers. In Lindbeck and Weibull's (1987) probabilistic voting model, the government initiates the drive for redistribution, seeking out voters that would support the party in exchange for transfers. Recipients of transfers merely accept them and vote for the party that makes the best offer. To explain, inefficient transfers, such as tariffs, quotas and subsidies, it may be more reasonable to assume that the government acts in response to requests made by individuals.

In the next section we study one such model, and demonstrate that the same effect is present: transfers to cohesive groups have an insurance value that makes them more valuable than their expected present value. The model is also more tractable, and gives us an idea of the magnitude of the insurance value.

3 Redistribution in a collective-action model

We now consider a model where the government reacts to pressure from two different groups of workers. We shall prove that our claim that "cohesion provides insurance," holds in this model.

We let the society be composed of two groups, A and B, and suppose there is a countably-infinite number of workers in each.[5] We assume that wealth in group A is perfectly correlated, so all A-workers will have the same level of wealth, while group-B individuals' wealth is uncorrelated. The state of the world is the realization of the A-workers' wealth. Hence, there are two equally likely states of the world: $\theta = w$ and $\theta = W$, where $0 < w < W$. In state θ, each A-worker has wealth θ, while half the B workers have wealth w (in the sequel, are "poor") and half have W (are "rich"). We assume that θ is known to all agents.

The government implements group transfers, as it is unable to target transfers to individuals. The transfers depend on how much "lobbying effort" individuals put in. Each worker chooses her individual level of effort from some interval $[0, K]$ of feasible efforts. Let $e_A(\theta)$ be the average effort made by A-workers in state θ. If $(e_i^A(\theta))_{i=1}^{\infty}$ is the list of efforts by A-workers, then

$$e_A(\theta) = \lim_{n\to\infty} \frac{1}{n} \sum_{i=1}^{n} e_i^A(\theta).$$

We shall only deal with symmetric effort profiles, where $e_i^A = e_A$ for all i. Similarly, let $e_w(\theta)$ be the average effort made by B-workers with wealth w (poor) and $e_W(\theta)$ be the average effort made by B-workers with wealth W (rich). Let $e_B(\theta)$ denote the average of $e_w(\theta)$ and $e_W(\theta)$. We let

$$\mathbf{e} = (e_A(W), e_A(w), e_w(W), e_w(w), e_W(W), e_W(w))$$

denote the effort profile that determines transfers.

The government reacts to the demands for transfers, setting a per-capita transfer according to the difference in the per-capita amount of effort that each group exerts. Note that, in contrast to Section 2, we do not model the government's decision. Transfers are an exogenous function of average efforts.

For $j = A, B$, we let $t_j(e_A - e_B)$ denote the per-capita transfer to j-workers. We assume that t_j is smooth, and

- (Monotonicity) $t_A(x)$ is a monotone increasing function;
- (Budget Balance) $t_A(x) + t_B(x) = 0$;
- (Symmetry) $t_j(-x) = -t_j(x)$.

Let T_j denote the expected transfer to j-workers. So

$$\begin{aligned} T_A &= \frac{1}{2} t_A \left(e_A(W) - \frac{1}{2} e_w(W) - \frac{1}{2} e_W(W) \right) \\ &+ \frac{1}{2} t_A \left(e_A(w) - \frac{1}{2} e_w(w) - \frac{1}{2} e_W(w) \right), \end{aligned}$$

[5] We could work with a continuum in each group; we'd need to add a measurability assumption.

and $T_B = -T_A$. When an effort profile $\mathbf{e}$ is understood, we write

$$\tau_A(\theta) = t_A\left(e_A(\theta) - e_B(\theta)\right)$$

for the transfers that A's receive in state θ. We do not make the dependence of τ on $\mathbf{e}$ explicit. By budget balance, B workers receive $\tau_B(\theta) = -\tau_A(\theta)$.

We assume that the utility to a worker with wealth $\tilde{w}$ who exerts effort $\tilde{e}$ and receives transfer $\tilde{t}$ is

$$v(\tilde{w} + \tilde{t}) - h(\tilde{e}, \tilde{w}),$$

where v is a smooth, increasing, and concave function measuring utility over final wealth, and h is a smooth function measuring the disutility of effort. Assume that h is strictly convex in e.

Workers face a collective-action problem: transfers to a group are a public good.[6] The problem is particularly severe because there is an infinite number of workers in each group. An individual's effort does not affect the group-average, and thus individual contributions of effort do not affect the transfers anyone receives.

We abstract from the collective-action problem by assuming that, for low levels of wealth, small amounts of effort give positive utility—or rather negative cost. Formally,

$$\lim_{e_i \to 0} \frac{\partial h(e_i, w)}{\partial e_i} < 0.$$

Assume also that $\frac{\partial h(K,w)}{\partial e_i} > 0$, for all $\tilde{w}$, so that optimal effort is in the interior of $[0, K]$.

Finally, we need rich agents to put in less effort than poor agents: assume that $\frac{\partial}{\partial e_i} h(\tilde{e}, \tilde{w})$ is increasing in $\tilde{w}$ for any $(\tilde{e}, \tilde{w})$.

Lemma 4. *If* $\mathbf{e} = (e_A(W), e_A(w), e_w(W), e_w(w), e_W(W), e_W(w))$ *is a symmetric effort profile where each individual's effort is optimal, then*

1. $\mathbf{E}_\theta\left[v\left(\theta + \tau(\theta)\right) - h(e_A(\theta), \theta)\right] > \mathbf{E}_\theta\left[v\left(\theta + T_A\right) - h(e_A(\theta), \theta)\right]$, *and*
2. $\mathbf{E}_\theta\left[v\left(\tilde{w} - \tau(\theta)\right) - h(e_{\tilde{w}}(\theta), \tilde{w})\right] < \mathbf{E}_\theta\left[v\left(\tilde{w} + T_B\right) - h(e_{\tilde{w}}(\theta), \tilde{w})\right]$, *for* $\tilde{w} \in \{w, W\}$.

As in the probabilistic voting model, for A-workers the equilibrium efforts and resulting transfers are better than to receive the expected transfer for sure, exerting the same effort; whereas, B members would be better off receiving the expected transfer for sure instead of the transfers that result from the equilibrium efforts. The A-workers are better off because they receive positive transfers when they are poor and pay them when they are rich. B-workers are worse off because the equilibrium transfers, compared to the expected transfers, result in a mean-preserving spread of wealth that, given their risk aversion, reduces their utility.

Further, we obtain:

[6]Sandler (1992) surveys the collective-action literature after the seminal work of Olson (1965). For a more closely related model in which collective action is undertaken to counter similar action by competing groups, see Esteban and Ray (2001).

Proposition 5. *An A-worker is better off than a B-worker who receives the expected transfer that accrues to A-workers in addition to the actual transfer to B-workers.*

Proposition 5 implies that an A worker would not want to switch to Sector B in exchange for the expected transfers to A workers as compensation for switching sectors. Agents are small and cannot individually affect transfers, so an agent who switches would only compare her situation with that of a B worker–the fact that she changes sectors does not affect the outcome.

The sector with correlated shocks finds itself insured against negative shocks. Whenever any of its members is poor, all of the workers in the sector are poor, all of them exert large efforts and receive positive transfers. Workers in the other sector do not have such insurance: Actual transfers are not correlated with their need for the transfer. As a result, workers in the sector with correlated shocks prefer to stay in this sector, where they can count on co-workers' effort to help them get transfers when they need them most, than to receive their expected transfer and be "bought out", relocating to a sector that provides no insurance in the form of redistributive transfers.

We proceed to discuss one feature of the result: in the model, expected transfers are zero. We have assumed that all agents have the same cost function $h(\tilde{e}, \tilde{w})$. Hence, given wealth, the efforts chosen by agents of different sectors is the same. An agent exerts high effort if she is rich and A-workers and B-workers alike are rich with probability equal to one half. As a result, with a cost function h symmetric to all agents, the expected average effort is the same in both sectors and the expected transfers are zero.

The model has the advantage that it lets us focus on the insurance value of transfers, but one may wonder how non-zero transfers can be accommodated. One accommodation involves introducing inefficiencies in one sector, we discuss this in Section 4. Here we discuss a second possibility.

Non-zero expected transfers can occur if we allow for heterogeneity in cost functions. In fact, we can justify any level of expected transfers with the right quadratic costs. When $T_A > 0$, so expected transfers to group A are positive, our results still hold: If the effort of any given agent is decreasing in wealth (the cross-partial derivative of h is positive), Lemma 4 is true. And the proof of Proposition 5 goes through, as long as $T_A > 0$. Note that $T_A > 0$ is the case we are interested in, as we are trying to explain situations where net recipients of transfers cannot be bought out.

We then find an interesting implication; the result is stronger than Proposition 5 suggests. A B-worker's expected transfer is $T_B = -T_A$, while the expected transfer for an A-worker is T_A. The difference is $2T_A$. Paying an agent $2T_A$ for switching sectors would not be enough compensation, because in sector A positive transfers accrue when the agent is poor and the transfer brings higher utility, whereas in sector B the value of the transfer is uncorrelated with the wealth of the agent. Hence, not only T_A, but $2T_A$, is insufficient compensation for an A-worker.

4 The Size of the Insurance Effect

In this section we argue that the insurance effect we have identified can be relatively large, so a government may need substantial additional resources to buy out members of a transfer-receiving group. The results are mostly numerical in nature and we do not claim they are much more than suggestive.

We shall develop a special case of the model in Section 3, for which we can calculate the compensation that would be needed to buy out a member of group A. Suppose that utility is logarithmic, so $v(x) = \log(x)$, and that the possible levels of wealth are $w = (1 - \sigma)$ and $W = (1 + \sigma)$. Here, σ^2 is the variance of wealth.

Suppose the cost of effort is such that the optimal choice of effort is $e^{\tilde{w}} = \eta - \delta \tilde{w}$ (for example if $h(e, \tilde{w})$ is quadratic), with $\eta, \delta > 0$. Further, suppose that transfers are linear: $t_A(\mathbf{e}) = \beta(e_A - e_B)$, with $\beta > 0$. Then we obtain,

$$\begin{aligned} t_A(w) &= \beta \left[\frac{1}{2}(\eta - \delta(1-\sigma)) - \frac{1}{2}(\eta - \delta(1+\sigma)) \right] \\ &= -\beta\delta/2 \left[(1-\sigma) - (1+\sigma) \right] \\ &= \gamma\sigma, \end{aligned}$$

where $\gamma = -\beta\delta$. Similarly, $t(W) = -\gamma\sigma$

Suppose first that $\gamma = 1$, so that a member of group A receives a transfer of $t(w) = \sigma$ when $\theta = w$ and $t(W) = -\sigma$ when $\theta = W$. Note that this is a situation where transfers fully insure A-workers.

We then obtain that compensation needed to leave an A worker indifferent between the A and B sectors is

$$C(\sigma^2) = \sqrt{2\sigma^2 + \sqrt{4(\sigma^2)^2 + 1}} - 1$$

(see the Appendix for the calculations).

We can then get an idea of the magnitude of $C(\sigma^2)$ for small values of σ^2. Of course, $C(\sigma^2) \to 0$ as $\sigma^2 \to 0$. But note that

$$\lim_{\sigma^2 \to 0} \frac{C(\sigma^2)}{\sigma^2} = \left. \frac{\partial C(\sigma^2)}{\partial \sigma^2} \right|_{\sigma^2 = 0} = 1.$$

So $C(\sigma^2) \sim \sigma^2$ for small σ^2.

In many sectors, a compensation of σ^2% of expected income seems to be significant. It is an asymptotic result, though, and it may overestimate the compensation, as it needs to compensate for fully-insuring transfers. Consider the numerical calculations in the first two rows in Table 1.

Calculations are for $\sigma = 0.3$; C is the compensation needed to buy out a sector-A agent. When she is fully insured ($\gamma = 1$), the compensation needed to buy out a

	$t_A(w)$	$t_A(W)$	T_A	C	$C/t_A(w)$
Full insurance	0.30	−0.30	0	0.093	31%
40% insurance	0.12	−0.12	0	0.037	31%
40% insurance	0.14	−0.10	0.02	0.028	20%
One-way subsidy	0.12	0	0.06	0.137	115%

Table 1: Calculations for $\sigma = 0.3$; C is the compensation needed to buy out a sector-A agent.

sector-A agent is 31% of the transfer she receives in the bad state. When she is only 40% insured ($\gamma = 0.4$), she gets a transfer of 0.12 after a shock of 0.3. The necessary compensation for the agent to give up the advantage of this reduced form of insurance is—naturally—smaller, but still represents approximately 31% of transfers.

We noted in Section 3 that, as a result of the model's symmetry, expected transfers were zero. We generate here a positive expected transfer to group A by assuming that A-worker's wealth is smaller than B-workers', which is akin to assuming that the A sector is inefficient. The calculations are in the third row of the table. We let the wealth level in sector A be $\theta - \alpha$ and we set $\alpha = 0.05$. Wealth in sector A is either 0.65 if $\theta = w$ or 1.25 if $\theta = W$, for an expected wealth of 0.95. Whereas, a worker in the more efficient sector B has a wealth of 0.7 or 1.3 with equal probability, for an expected wealth of 1.

If the government could implement individual redistributive policies (a first best in the absence of moral hazard) or if the government did not implement any sort of redistribution, every agent would prefer to locate in the more productive sector B.

Nevertheless, sectoral redistribution in the form of subsidies provides an insurance value to the A workers, and in this example the value is high enough so that A-workers do not want to change sectors. Their expected post-transfer wealth in the inefficient sector A is only 0.97, whereas if they switched sectors receiving T_A as compensation, their expected wealth would rise to 1. But, changing sectors would entail a loss of the insurance provided by the subsidies, and the rise in expected wealth is not enough to compensate for the loss of the insurance. Only a compensation well in excess (40% above or more) of T_A would motivate the agent to abandon the less efficient sector and relocate to a more productive sector where her wealth would be higher in expectation.

Finally, in the fourth row of Table 1, we present a calculation of C when transfers are asymmetric (see the discussion at the end of Section 3). The calculation has wealth distributions like the first calculations, so there is no inefficiency. The asymmetric transfers are explained by differences in costs. Note that, again, the compensation needed is significant, even compared to the eventual transfer, $t(w)$.

5 Testable Implications

The main implication of our results is that we should observe a higher correlation of individual income in the sectors that receive transfers. The US data on household incomes in different sectors is in line with this implication: Incomes in agriculture, the textile industry, and the steel industry are more highly correlated than the average sector. We also discuss the possible link between factor specificity and redistributive transfers.

5.1 Within-period correlation of household income.

A higher correlation of incomes in a sector implies that we will observe less variance of income in our sample of households of the sector. It may be clear intuitively that this is true, but it also follows from some simple calculations: Suppose $(X_1, \dots X_n)$ is a sample from some population random variable X, with variance σ^2, and such that each pair X_i and X_j has correlation ρ. Then, using S^2 to denote the sample variance, it turns out that the expected sample variance is:

$$ES^2 = \left(\frac{n^2 - n + 2}{n^2}\right)(1 - \rho)\,\sigma^2$$

(we omit the trivial, but cumbersome, derivation). Thus there is a negative relation between correlation and dispersion around the sample mean. Our theory implies a smaller dispersion of incomes in the sectors that receive transfers.

We study household-income data from 1968 to 2003 in the US.[7] We focus on three sectors, which the literature identifies as recipients of transfers (Hufbauer and Elliott, 1994): agriculture, textiles, and steel. We use the industrial classification of the 1950 Census Bureau, for which there are 146 sectors in the economy.[8]

We calculate the standard deviation of individual income for each sector and year, first deflating incomes by the average economy-wide income. The deflation makes data across years comparable, and attenuates aggregate shocks. We then compute the average, across years, standard deviation in the three sectors of interest. The following table presents the results, and the average economy-wide standard deviation.

The numbers in the table are consistent with our models' testable implication.

Are the deviations significantly lower than average? To compare the deviations of income in agriculture, textiles and steel to those in the other sectors in the economy,

[7]Current Population Survey data (Bureau of Labor Statistics), obtained from the Integrated Public Use Microdata Series provided by Minnesota Population Center at the University of Minnesota. Overall sample size is about 2.6 million observations; in Agriculture, for example, we have about 2,500 on average per year. The data is available in `http://www.hss.caltech.edu/~jon/`.

[8]In the classification, our three sectors are "Agriculture," "Apparel and accessories," and "Blast furnaces, steel works and rolling mills."

Sector	Std. dev.	Percentile
Agriculture	0.63	33
Textiles	0.54	7
Steel	0.51	3
Average sector	0.67	

Table 2: Standard deviation of sectoral income.

we order the sectors (after weighting them by size) according to their income deviations, and we find the percentiles at which agriculture, textile and steel locate in the resulting distribution. The numbers are in the second column of the table, and confirm that there is less dispersion in these three sectors than in most other sectors.[9] The result is clearest for textiles and steel, for which less than 7% and 3%, respectively, of the sectors have smaller deviations.

We note that we would prefer to compare individual correlations in income to the somewhat indirect method of comparing standard deviations. But the data needed for computing individual correlations is not in the public domain.

5.2 Factor specificity.

Factors of production specific to a sector are factors that are used predominantly in one sector, and cannot easily be relocated to another sector. Our theory implies—somewhat indirectly—that sectors with specific factors should be prone to receiving transfers. The implication is in line with much of the previous literature, such as Baldwin (1989), Brainard and Verdier (1994) or Alt, Frieden, Gilligan, Rodrik, and Rogowski (1996). On the other hand, the model in Acemoglu and Robinson (2001) predicts that sectors with less specific factors are more prone to receiving transfers. Acemoglu and Robinson also present a different reading of the previous evidence, and argue that it does not contradict their model. The most recent and complete empirical analysis of the question we know of is Zahariadis (2001), who studies 13 OECD countries and concludes that factor specificity has a significant positive effect on the amount of sectoral transfers.

In our theory, the positive effect of factor specificity on transfers has two possible sources.

First, it is plausible that some specific factors also represent a large fraction of the incomes in their respective sectors. For example, skilled labor is often both specific, and an important line in the industry's cost structure. In that case, shocks to the sector (or to the factor) will result in a high correlation of the incomes in the sector. Our theory then implies that the sector is "expensive to buy out;" hence, we should observe that sectors with specific factors receive transfers.

[9] If the reader is concerned about scale effects, we note that we get qualitatively the same results when we use the coefficient of variation instead of the standard deviation.

Our first source is a direct consequence of the theory, under the additional assumption about the importance of the specific factors in a sector. Our second source is possibly more general, but has a less direct relation to our theory: it focuses on the insurance value of the transfers to sectors who suffer asymmetric shocks, rather than to sectors with correlated income.

A sector which employs a specific factor will be subject to income shocks caused by fluctuations in the productivity or cost of this factor. These need not be correlated with the costs or productivity of the factors employed in other sectors. Thus, we expect a sector with specific factors to have income shocks that are less correlated with the general state of the economy than the income shocks of sectors which all rely in the same common factors of production.

Suppose there are three sectors with a representative worker in each sector. Sectors A and B use the same common factor and obtain the same income, whereas sector C uses a specific factor. Income is high or low. Following our collective action in model 2, agents with a low income put more effort in demand of transfers. Suppose that transfers to a given sector depend on the difference between the effort the sector exerts and the average effort of all sectors. In periods were income is the same in all sectors there is no redistribution. When sectors A and B get high income and C gets low income, the average effort in the economy is relatively low, but C's effort is high, so C gets a high positive transfer and A and B get small negative transfers. When sectors A and B get low income and C gets high income, the average effort in the economy is relatively high, since only C puts a low effort. C pays a large transfer split in two small transfers to A and B. The expected transfers are zero for each sector and all three sectors receive an insurance benefit from the flow of transfers, but sector C receives the highest transfers in absolute terms and benefits the most.

The flow of transfers depends on the relative state of each sector. A sector with asymmetric shocks will request transfers when the overall economy is in better conditions to grant them and as a result sectors with asymmetric shocks become more likely targets of redistributive transfers with an insurance purpose.

6 Conclusion

Redistributive policies, such as subsidies and tariffs, distort the incentives to locate resources efficiently in the most productive sectors of the economy. It is a well-known puzzle why governments fail to redistribute wealth using lump-sum transfers, which do not introduce such distortion.

We have provided an explanation for this puzzle: State-dependent subsidies to a sector with high income correlation provide an insurance value to the members of the sector which is superior to the value of the expected transfer. To provide the same level of welfare with a lump-sum grant, the government would have to finance an additional compensation for members of cohesive groups. We have provided some preliminary calculation—suggestive at best—that the compensation can in practice be quite important. An important task for future research is to calibrate a model to reproduce actual transfers and income distributions, and then estimate the needed compensation.

We have also discussed the testable implications of this model. The most straightforward implication is that, in sectors that receive transfers, income correlation ought to be high. Again, we have presented some suggestive evidence that this is the case. Researchers with the necessary econometric skills, and access to individual-level data, should be able to provide a better, and more rigorous, test of our explanation.

Appendix: Proofs

The appendix presents the proofs of our results, in the order they appear in the paper.

Proof of Lemma 2

To save on notation, let $x(w) = t_A^*(w) = -t_B^*(w)$ and $T = T_A$. Rewriting the equation in Proposition 1,

$$v'(w + x(w)) = \int_0^1 v'(\tilde{w} - x(w))dG(\tilde{w}). \tag{1}$$

Since v' is decreasing, $x(w)$ is monotone decreasing. Then there is $\overline{w}$ such that if $w \leq \overline{w}$ then $x(w) \geq T$ and if $w \geq \overline{w}$ then $x(w) \leq T$.

First, if $w \leq \overline{w}$,

$$v(w + x(w)) - v(w + T) = \int_T^{x(w)} v'(w + s)ds \geq v'(w + x(w)) \left[x(w) - T\right]$$

and if $w \geq \overline{w}$ then

$$\left|v(w + x(w)) - v(w + T)\right| = \int_{x(w)}^T v'(w + s)ds \leq v'(w + x(w)) \left|x(w) - T\right|.$$

So, either way,

$$v(w + x(w)) - v(w + T) \geq v'(w + x(w)) \left[x(w) - T\right]. \tag{2}$$

Then

$$\begin{aligned}
\int v(w+x(w)) - v(w+T)dG(w) &\geq \int v'(w+x(w))\left[x(w)-T\right]dG(w) \\
&= \int\int v'(\tilde{w}-x(w))dG(\tilde{w})\left[x(w)-T\right]dG(w) \\
&= \int l(\tilde{x})\left[\tilde{x}-T\right]dH(\tilde{x}) \\
&> 0.
\end{aligned}$$

Were the first inequality follows from Equation 2. The first equality is from Equation 1. The second equality comes from letting H be the distribution of the random variable $x(w)$, and

$$l(x) = \int v'(\tilde{w}-x)dG(\tilde{w}).$$

Now, the last inequality follows because l is a positive, strictly monotone increasing function and $\int [\tilde{x}-T]\, dH(x) = 0$ by a standard argument in probability theory. So this proves that $\mathbf{E}v(w_A + t_A^*(w_A)) > \mathbf{E}v(w_A + T_A)$.

The statement for group B is immediate because v is concave, and w_A and w_B are independent. ∎

Proof of Proposition 3

The result follows from Lemma 2, because

$$\begin{aligned}
\mathbf{E}v(w_A + T_A) &\geq \mathbf{E}v(w_A) \\
&\geq \mathbf{E}v(w_B - T_B + t_B^*(w_A)) \\
&= \mathbf{E}v(w_B + T_A + t_B^*(w_2)).
\end{aligned}$$

Where the first inequality is implied by $T_A \geq 0$. The second inequality is because the distributions of w_A and w_B are the same, so $\mathbf{E}v(w_A) = \mathbf{E}v(w_B)$. And $-T_B + t_B^*(w_1)$ is a mean-preserving spread over w_B. The final equality follows from $T_A + T_B = 0$. ∎

Proof of Lemma 4

Since h is strictly convex, there is a unique solution to each agent's maximization problem. If the solution is interior, it satisfies

$$\frac{\partial h(e,\tilde{w})}{\partial e} = 0.$$

Denote the solution when $\tilde{w} = w$ by e^w and $\tilde{w} = W$ by e^W. Since $\frac{\partial h(e,w)}{\partial e} < 0$ for small enough e, and the cross-partial derivative of h is positive, we know that $e^W < e^w$.

Note that $e_A(w) = e^w$, and $e_B(w) = \frac{e^w+e^W}{2}$, while $e_A(W) = e^W$, and $e_B(W) = \frac{e^w+e^W}{2}$. So $\tau_A(w) = t_A(\frac{e^w-e^W}{2})$ and $\tau_A(W) = t_A(\frac{e^W-e^w}{2})$. Thus $0 < \tau_A(w) = -\tau_A(W)$. Note that $T_A = T_B = 0$.[10]

Since v is concave,

$$v\left(w + t_A(\frac{e^w - e^W}{2})\right) + v\left(W - t_A(\frac{e^w - e^W}{2})\right) > v(w) + v(W).$$

The first statement in the lemma follows.

Similarly,

$$v\left(w_i + t_B(\frac{e^w - e^W}{2})\right) + v\left(w_i - t_B(\frac{e^w - e^W}{2})\right) > v(w_i) + v(w_i),$$

implies the second statement. ∎

Proof of Proposition 5

Note first that the expected disutility of effort of an A worker is the same as that of a B worker: using the notation from Lemma 4, for an A worker it is $h(e^w, w)$ in state $\theta = w$ and $h(e^W, W)$ in state $\theta = W$, while for a B worker it is $h(e^w, w)$ when her wealth is w and $h(e^W, W)$ when it is W (recall from the proof of Lemma 4 that $T_A = 0$).

Hence the comparison of expected utilities only involves comparing expected utilities over final wealth. For an A worker, expected utility is

$$\frac{1}{2}v\left(w + t_A(\frac{e^w - e^W}{2})\right) + \frac{1}{2}v\left(W - t_A(\frac{e^w - e^W}{2})\right)$$

which, since v is concave, is larger than $\frac{1}{2}v(w) + \frac{1}{2}v(W)$

For a B worker, on the other hand, it is

$$\frac{1}{4}v\left(w + T_A + t_B(\frac{e^w - e^W}{2})\right) + \frac{1}{4}v\left(w + T_A - t_B(\frac{e^w - e^W}{2})\right)$$
$$+\frac{1}{4}v\left(W + T_A + t_B(\frac{e^w - e^W}{2})\right) + \frac{1}{4}v\left(W + T_A - t_B(\frac{e^w - e^W}{2})\right).$$

Since $T_A = 0$ and v is concave, the above expression is smaller than $\frac{1}{2}v(w) + \frac{1}{2}v(W)$. But we proved that a A worker's utility is larger than $\frac{1}{2}v(w) + \frac{1}{2}v(W)$. ∎

[10]As discussed at the end of Section 3, $T_A = T_B = 0$ is a consequence of the homogeneity of the function $h(e_i, w_i)$. If we let the (dis)utility of effort vary accross individuals according to $h_i(e_i, w_i)$, then T_A could be positive or negative, Lemma 4 would hold, and the following Proposition 5 would hold if $T_A > 0$.

Calculations from Section 4

The following calculation explain the result about the limit of $C(\sigma^2)/\sigma^2$ as $\sigma^2 \to 0$.

Indifference requires that C satisfies

$$\begin{aligned} 1 &= ((1-\sigma)+\sigma)^2((1+\sigma)-\sigma)^2 \\ &= ((1-\sigma)+\sigma+C)((1-\sigma)-\sigma+C) \\ &\quad ((1+\sigma)+\sigma+C)((1+\sigma)-\sigma+C) \\ &= (1-2\sigma+C)(1+C)^2(1+2\sigma+C). \end{aligned}$$

Let $\rho = 1+T$. We obtain $1 = \rho^2(\rho^2-(2\sigma)^2)$. Solving this quadratic equation for ρ^2 gives the resulting $C(\sigma^2)$ as its positive root. The formula is in the text.

The derivative of C is

$$\frac{\partial C(\sigma^2)}{\partial \sigma^2} = \frac{1}{2}\left(2\sigma^2+\sqrt{4\sigma^2+1}\right)^{-1/2}\left(2+\frac{1}{2}(4\sigma^2+1)^{-1/2}8\sigma^2\right),$$

which gives the result.

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