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The Optimal Subsidy to Private Transfers Under Moral Hazard

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Private income transfers are increasingly viewed as an alternative to government income transfers such as social insurance and foreign aid. This paper models the incentive effects of government-subsidized private transfers and finds that although there is a significant welfare benefit to subsidizing private transfers, there is also a significant welfare cost. It is shown analytically, as well as through simulations, that the optimal subsidy to private transfers falls when the market reaction is taken into consideration. [JEL D64, D82, H21]

Recently, governments have become more interested in using private, nonmarket income transfers to supplement or substitute for government income transfers. The motivations for this include fiscal necessity, the belief that the private sector can allocate resources more efficiently than the government sector, and the negative effects of government transfer programs on their recipients' behavior.[1] Although private nonmarket transfers are driven by individual altruism, they can be manipulated by the government through the use of subsidies and taxes. Such an approach may be a more cost-effective way for governments to deliver social insurance, foreign aid, or debt relief, for example.

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[1]See Kopits (1997) and Tanzi (2000).

An essential question raised by this interest in private transfers is the size of the optimal subsidy. There is an established argument in the economics literature that private transfers ought to be subsidized because they give utility to both the giver and the recipient of the transfer.[2] But this analysis has not recognized that nonmarket income transfers generally function as insurance against income risk. Income risk is endogenous risk, in that the level of the risk a person or country faces depends on the actions taken by the individual.[3] A nation's income risk, for example, depends on the fiscal, monetary, and development policy actions chosen by the government. Insurance provided in the presence of endogenous risk is subject to moral hazard problems, which can be seen by tracing the effects of the insurance through the affected market. This suggests that the optimal subsidy to private nonmarket income transfers needs to take into consideration the market reaction to the moral hazard problems created by the transfers.

In this paper, we calculate the optimal subsidy to private nonmarket income transfers in the presence of endogenous risk. We develop a simple model of altruistic transfers subject to endogenous labor market risk and show that the optimal subsidy depends on the degree of altruism of those making the transfers and the strength of the market's reaction to the moral hazard problem. It is possible, in the presence of endogenous risk, that the optimal subsidy to private nonmarket income transfers can be so low as to be negative—that is, to be a tax.

I. Model

We begin with an economy populated by two types of individuals: benefactors and recipients. Benefactors are paired with recipients, toward whom they feel altruistic. That is, the recipient's utility is an argument in the benefactor's utility function.[4] Recipients' utility is a function of only their own consumption and effort. We assume that altruism is asymmetric only for the sake of clarity. Making altruism reciprocal and symmetric will not change the qualitative results.[5]

We assume that the benefactor's utility function is additively separable and is given by:

$$U_b\big(y_b, u_r(y_r)\big) = u_b(y_b) + \beta u_r(y_r),$$

where y_b denotes the benefactor's income, y_r the recipient's income, $u_r\ (y_r)$ the recipient's utility, and $0 \leq \beta \leq 1$ is the altruism factor. We assume that the utility function $u(.)$ is identical across agents, with $u_i' > 0$ and $u_i'' < 0$ for $i = b,r$.

[2]See Stiglitz (1987), Friedman (1988), and Kaplow (1995, 1998).

[3]See Kaplow (1989) and Chami (1996), in the context of insurance markets.

[4]Alternatively, we could view private transfers as motivated by the "warm glow" that giving imparts to benefactors, as is discussed in Atkinson (1976) and Andreoni (1990). This specification places the transfer itself in the benefactor's utility function so that utility is given by $U_b(y_b, g)$. Doing so would not alter any of the results. See Atkinson (1976, p. 15).

[5]See Bernheim and Stark (1988) and Stark (1993) for the argument that symmetric altruism does not completely resolve conflicts between paired agents.

We incorporate risk into the model by specifying the process that determines the recipient's income. Suppose that the recipients enter the labor market for a single period and supply labor to firms. Output can be high (x_H) or low (x_L). The probability that the low-output state occurs is $P(e)$, where e denotes the worker's effort, which is unobservable to both the firm and the benefactor; we assume $P' < 0$ and $P'' > 0$. Wages are y_L in state L and y_H in state H, where $y_L < y_H$. The difference in wages across states of nature reflects a moral hazard in the labor market. Also, risk aversion on the part of recipients implies that $y_L > x_L$ and $y_H < x_H$.

Competitive labor and output markets dictate that y_L and y_H will maximize expected profits, while competition drives expected profits to zero. Hence,

$$E\pi(y_L, y_H; e) = P(e)x_L + (1 - P(e))x_H - \left[P(e)y_L + (1 - P(e))y_H\right] = 0. \quad (1)$$

The recipient's expected utility is

$$EU_r = Pu_{rL} + (1 - P)u_{rH} - v(e),$$

where $v(e)$ is a strictly convex function reflecting the recipient's disutility of effort and u_{rL} and u_{rH} are defined as above. The recipient chooses effort to maximize utility. The first-order condition for the recipient is

$$P'\left[u_{rL} - u_{rH}\right] - v'(e) = 0, \quad (2)$$

which gives $e^* = e(y_L, y_H, g)$.

It is easy to show[6] that $\partial e^*/\partial y_L < 0$, while $\partial e^*/\partial y_H > 0$. The impact of private transfers on the optimal choice of effort by the recipient is

$$e_g^* \equiv \frac{\partial e^*}{\partial g} = -\frac{P'\left[u'_{rL} - u'_{rH}\right]}{P''\left[u_{rL} - u_{rH}\right] - v''(e)} < 0. \quad (3)$$

Equation (3) shows that the transfer essentially provides insurance against low output, so the recipient reduces the effort he puts into avoiding the low-output state. In other words, the recipient uses the income from the transfer to effectively purchase a reduction in labor effort.[7] This reflects the moral hazard problem between the benefactor and the recipient.

The benefactor's expected utility, EU_b, is

$$EU_b = u(c_b) + \beta\left[Pu_{rL} + (1 - P)u_{rH} - v(e)\right],$$

where $c_b = y_b - g$ is the benefactor's net consumption, y_b is her (exogenous) income, and g is the transfer to her beneficiary (the recipient). The benefactor

[6]Please refer to the appendix for details.

[7]Holtz-Eakin, Joulfian, and Rosen (1993) show, in an empirical study, that labor supply and labor force participation drop as a result of large inheritances.

decides how much to give to the recipient as a transfer.[8] The first-order condition for the private transfer decision is[9]

$$-u'_b + \beta\left\{\left[P'\left(u_{rL} - u_{rH}\right) - v'\left(e^*\right)\right]e^*_g + \left[Pu'_{rL} + (1-P)u'_{rH}\right]\right\} = 0,$$

and, using the envelope condition to substitute out condition (2), the above condition reduces to

$$-u'_b + \beta\left[Pu'_{rL} + (1-P)u'_{rH}\right] = 0, \tag{4}$$

which yields $g^* = g(y_b, y_L, y_H; e^*, \beta)$. It is straightforward to show that higher altruism leads to higher transfers, $g^*_\beta \equiv \partial g^*/\partial\beta > 0$, and that higher wages in either state lead to lower transfers:

$$g^*_L \equiv \partial g^*/\partial y_L < 0, \text{ and } g^*_H \equiv \partial g^*/\partial y_H < 0.$$[10]

We now move to the market reaction to private transfers. We have shown that greater altruism on the part of givers (benefactors) leads to larger transfers, reduced labor effort, and a higher probability of realizing the low-output state, which implies lower expected profits for firms. Since expected profits are lower, firms must reduce costs by lowering expected wages. But they must also adjust the relationship between the high wage and low wage in order to motivate the recipients to put forth greater effort. Given that the expected wage must be lower, we focus our analysis on wage dispersion. In other words, given e^*, g^*, and the conditions already derived, we examine the impact of increases in β on y_H/y_L.

To analyze the impact of altruism on wage dispersion, we differentiate the zero-profit condition with respect to β:

$$\frac{d\left[\dfrac{y_L - x_L}{x_H - y_H}\right]}{d\beta} = -\frac{P'}{P^2}\frac{\partial e^*\left(g^*(\beta)\right)}{\partial\beta} < 0,$$

where, as we have shown previously, $\partial e^*/\partial g < 0$ while $\partial g^*/\partial\beta > 0$. Since risk aversion on the part of the recipient implies that $y_L > x_L$ and $y_H < x_H$, an increase in β moves the state-contingent wages y_L and y_H further apart. Thus, greater altruism results in lower expected wages and greater wage dispersion. The givers' altruism toward the recipients exacerbates the moral hazard problem that already exists between recipients and firms. In other words, private transfers impose a negative externality on the labor market.

[8]Our specification assumes that transfers are chosen and distributed before any other outcomes are realized. Delaying the choice and distribution of transfers until after other outcomes are realized strengthens our results by inducing the Samaritan's dilemma. See Buchanan (1975), Bruce and Waldman (1990), and Chami (1996).

[9]Alternatively, we could choose to make the transfer state-contingent, so that it is g_L in the low-output state and g_H in the high-output state. Doing so does not affect any of the qualitative results presented below. See, for example, Chami (1998).

[10]Please refer to the appendix for details.

The market responds to the negative externality in private transfers by increasing the dispersion between the high wage and the low wage. This creates an increase in the recipient's market income risk, which is inefficient.

A social planner would take the change in risk allocation into consideration when choosing the socially optimal transfer. Assume that the social planner chooses g, y_L, and y_H in order to maximize the social objective function

$$u_b + (1+\beta)EU_r,$$

subject to e argmax $E(U_r)$ according to (2) and (y_L, y_H) argmax π, according to (1).

First, consider the planner's choice of transfer. Differentiating the social planner's objective function with respect to the transfer yields[11]

$$-u_b' + (1+\beta)\left\{\left(P'\left[u_{rL} - u_{rH}\right] - v'(e^*)\right) e_g^* + Pu_{rL}'\left[1 + \frac{\partial y_L^*}{\partial g}\right] + (1-P)u_{rH}'\right\}, \tag{5}$$

where

$$\frac{\partial y_L^*}{\partial g} = -\left(x_H - y_H\right)\frac{P'e_g^*}{P^2} < 0.$$

It is easy to prove that the social planner chooses a smaller transfer in this case, relative to the case in which the risk is exogenous[12]: $g_{sp}^* < g_E^*$, where g_E^* is the optimal transfer that the social planner chooses when risk is exogenous and g_{sp}^* is the optimal subsidy when risk is endogenous.

This result is driven by the market's response to the introduction of endogenous risk and the accompanying negative externality. The social planner takes into account the market reaction to the negative externality caused by private transfers, which is the depressive effect of transfers on y_L. This reaction to the negative externality at least partially offsets the positive externality embodied in the double counting of recipient utility in the social planner's objective function. Thus the optimal transfer is reduced.

The question raised by this result is how much the welfare effects of the negative externality offset the double-counting effect. Which effect dominates? In order to answer this question, we compare the optimal subsidies from the exogenous risk and endogenous risk models. Suppose that transfers are subsidized at rate s, where the subsidy is financed by a lump-sum tax that is taken as given by individuals, as in Kaplow (1995, 1998). This reduces the benefactor's cost of making a transfer of size g to $(1 - s)g$. The optimal subsidy is the one that would induce the benefactor to behave like the social planner with respect to the choice of private transfers. The first-order condition in this case is

$$-u_b'(1-s) + \beta u_r' = 0. \tag{6}$$

[11]See Arnott and Stiglitz (1991) for a similar treatment in the insurance market.

[12]See Chami and Fullenkamp (2000) for a complete discussion of the exogenous risk case.

The subsidy that would induce the benefactor to behave like the social planner is one that would make the benefactor's first-order condition (6) equivalent to the social planner's first-order condition,

$$-u_b'(y_b - g) + (1+\beta)u_r'(y_r + g) = 0.$$

Solving for this s under exogenous uncertainty yields[13]

$$s^* = \frac{1}{1+\beta}.$$

Now we derive the optimal subsidy in the endogenous risk case. First, we rewrite the social planner's first-order condition (5) using the envelope condition to substitute out condition (2). Doing so gives

$$-u_b' + (1+\beta)\left[Pu_{rL}'\left(1+\frac{\partial y_L^*}{\partial g}\right) + (1-P)u_{rH}'\right] = 0. \tag{7}$$

We know that owing to the moral hazard in the labor market, the recipient is not fully insured, so that $u_{rH} > u_{rL}$ and $(1-P)u_{rH}' < Pu_{rL}'$. We also know that $\partial y^*L / \partial g < 0$. The benefactor's first-order condition for subsidized private transfers is

$$-(1-s)u_b' + \beta\left[Pu_{rL}' + (1-P)u_{rH}'\right] = 0.$$

Solving for the optimal subsidy using (7) yields

$$s^* = \frac{1}{1+\beta} + \beta P \frac{u_{rL}'}{u_b'}\frac{\partial y_L^*}{\partial g}. \tag{8}$$

Note that the optimal subsidy in the endogenous risk case has two terms. The first term, $1/(1+\beta)$, which is positive, is equal to the subsidy from the exogenous risk case. The additional term, which is negative, represents the market response to the negative externality. As β increases, the first term decreases and the second term becomes more negative. The interaction of altruism and the response of the market to private transfers will determine whether the optimal subsidy is positive, zero, or negative (a tax).[14] The higher the level of altruism, and the stronger the market response to private transfers, the lower the subsidy will be.

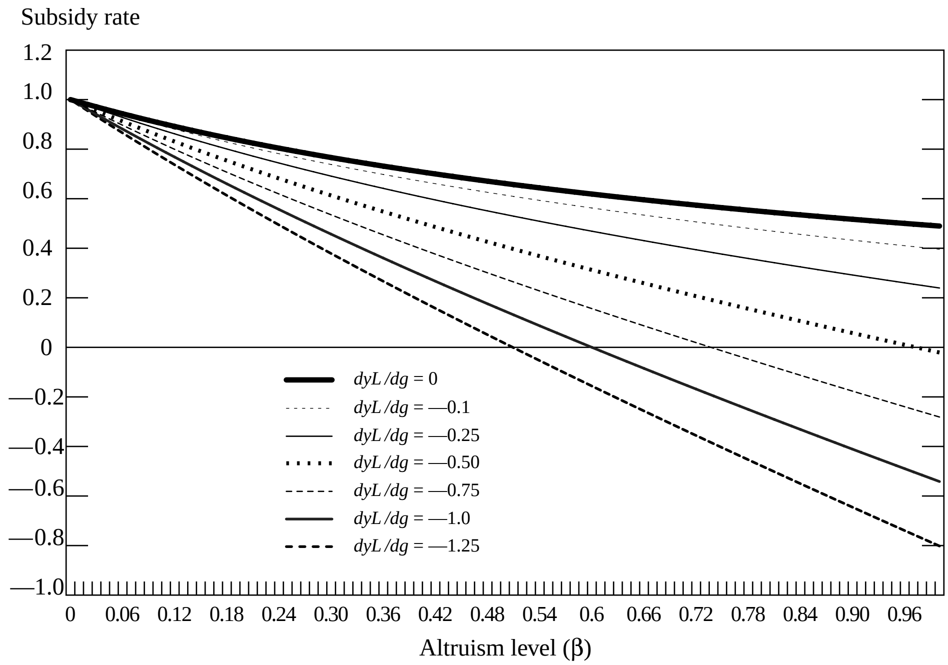
II. Calibration and Policy Implications

A useful way to demonstrate the effect of endogenous risk on optimal private transfers is to perform a simple calibration exercise that calculates the size of the optimal subsidy under various parameter values. Figure 1 shows the optimal

[13]This is also the optimal subsidy under certainty. See Kaplow (1995).

[14]Alternatively, using a social welfare function of the form $u_b + EU_r$ alters the result, in that the subsidy unambiguously becomes a tax.

Figure 1. Optimal Gift Subsidy as Altruism and Market Reaction to Gift Giving Vary



subsidy in equation (8) as a function of the altruism parameter β, for varying choices of the market response to private transfers, $\partial y_L^* / \partial g$. Each line in the figure corresponds to a progressively higher magnitude of $\partial y_L^* / \partial g$, beginning with the certainty or exogenous risk case of $\partial y_L^* / \partial g = 0$, which corresponds to the subsidy calculated by Kaplow (1995). The remaining parameters P and u_r' / u_b' are held constant over all calculations.[15]

Figure 1 demonstrates the response of the optimal subsidy to the presence of endogenous risk. As the market response to private transfers increases, representing a greater presence of endogenous risk, the optimal subsidy falls further below the benchmark. The market response in the figure varies from 0 to –1.25, with a value of –1.0 indicating that, at the margin, the market reduces the wage in the bad state by

[15]These parameters were calculated as follows. The probability of realizing a bad output state was calculated as the average time the United States spent in recession relative to time it spent in expansion during 1945–96, using the National Bureau of Economic Research's business cycle dates. This number, about $\frac{1}{6}$, represents the probability that any given month will be a recessionary month. The ratio of marginal utilities was calculated using the constant-relative-risk-aversion (CRRA) utility function $u(c) = c^{1-\gamma}/(1-\gamma)$ with the risk-aversion parameter γ set equal to four. This value corresponds to estimates in the finance literature and represents a moderate level of risk aversion. The marginal utility of the recipient was calculated assuming a consumption level equal to the twentieth percentile of annual U.S. household income ($14,768), while the marginal utility of the benefactor was calculated assuming a consumption level equal to the median annual U.S. household income ($35,492). These statistics are from United States, Bureau of the Census (1998).

one dollar for every dollar of transfer made. The figure shows that the subsidy function is bounded away from zero for all values of β as long as the market response to transfers stays between 0 and –0.5. For sufficiently high values of β and $\partial y_L^* / \partial g$, however, the optimal subsidy does become a tax. Generally speaking, it seems that it would require a very strong market response and a very high degree of altruism for the subsidy to become a tax.[16] But the optimal subsidy including the market response does decline significantly, relative to the subsidy that ignores the market response.

III. Conclusion

In this paper, we have calculated an optimal subsidy to private nonmarket income transfers in the presence of endogenous risk, and we have shown through simulation that the presence of endogenous risk can dramatically lower the optimal subsidy, relative to the case in which endogenous risk is ignored. This result has important implications for those governments who wish to subsidize private income transfers in order to supplement or replace government income-transfer programs. Subsidy rates should take the market's reaction to private income transfers into consideration. This means that careful measurement of the market reaction to private transfers should be an essential part of choosing the subsidy rate.

APPENDIX

This appendix derives and signs the partial derivatives governing the responses of effort and transfers mentioned in the text.

Effort

From the first-order condition for the recipient, equation (2), we obtain:

$$e_g^* \equiv e_1^* \equiv \frac{\partial e^*}{\partial g} = -\frac{\left(u'_{rL} - u'_{rH}\right)P'}{\left(u_{rL} - u_{rH}\right)P'' - v''} < 0$$

$$e_2^* \equiv \frac{\partial e^*}{\partial y_L} = -\frac{u'_{rL}P'}{\left(u_{rL} - u_{rH}\right)P'' - v''} < 0$$

$$e_3^* \equiv \frac{\partial e^*}{\partial y_H} = -\frac{-u'_{rH}P'}{\left(u_{rL} - u_{rH}\right)P'' - v''} > 0.$$

Private Transfers

To find the derivatives of private transfers with respect to altruism and wages, we first find and sign the denominator of the partial derivatives. Writing out the second-order condition for the benefactor's choice of transfer gives

$$\Delta \equiv \frac{\partial^2 EU_b}{(\partial g)^2} = u''_b + \beta\left\{P'(e^*)\left[u'_{rL} - u'_{rH}\right]e_1^* + P(e^*)\left[\beta u''_{rL}\right] + \left(1 - P(e^*)\right)\left[\beta u''_{rH}\right]\right\}.$$

[16]Large gifts from parents to children (more than \$10,000 per year) are taxed in the United States. Perhaps this is a special case in which the altruism level is high enough, and the market response great enough, to justify such a tax.

Rearranging terms, we have

$$\frac{\partial^2 EU_b}{(\partial g)^2} = \beta P u'_{rL}\left\{\frac{P' e_1^*}{P} + \frac{u''_{rL}}{u'_{rL}}\right\} - P' e_1^* u'_{rH} + u''_b + \beta(1-P)u''_{rH}.$$

Note that all the terms except the one in braces are negative. Thus, a sufficient condition for the concavity of the benefactor's surplus function is

$$\textit{Assumption 1:}\quad \frac{-u''_{rL}}{u'_{rL}} > \frac{P' e_i^*}{P},\ \text{ where } i = 1, 2.$$

The above assumption implies that a sufficient condition for an interior solution to the benefactor's problem is that the beneficiary be sufficiently risk averse, such that the direct impact of a change in his wealth on his marginal utility of income, in the bad state, exceeds the indirect impact of wealth on the probability of a low output occurring through its effect on the beneficiary's effort.

To sign the derivative of g^* with respect to β, differentiate the first-order condition for the benefactor (4):

$$\frac{dg^*}{d\beta} = \frac{-\left[P u'_{rL} + (1-P)u'_{rH}\right]}{\Delta} > 0.$$

Similarly, for the derivative of g^* with respect to y_H, we have

$$\frac{\partial g^*}{\partial y_H} = \frac{-\beta\left[(1-P)u''_{rH} + (u'_{rL} - u'_{rH})P' e_3^*\right]}{\Delta} < 0.$$

Finally, for the derivative of g^* with respect to y_L, we have, using the above concavity assumption,

$$\frac{\partial g^*}{\partial y_L} = \frac{-\beta\left[P u''_{rL} + (u'_{rL} - u'_{rH})P' e_2^*\right]}{\Delta} < 0.$$

REFERENCES

Andreoni, James, 1988, "Privately Provided Public Goods in a Large Economy: The Limits of Altruism," *Journal of Public Economics*, Vol. 35 (February), pp. 57–73.

———, 1990, "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving," *Economic Journal*, Vol. 100 (June), pp. 464–77.

Arnott, Richard, and Joseph E. Stiglitz, 1991, "Moral Hazard and Nonmarket Institutions: Dysfunctional Crowding Out or Peer Monitoring?" *American Economic Review*, Vol. 81 (March), pp. 179–90.

Atkinson, Anthony B., 1976, "The Income Tax Treatment of Charitable Contributions," in *Public and Urban Economics: Essays in Honor of William S. Vickery*, ed. by Ronald E. Grieson (Lexington, Massachusetts: D.C. Heath), pp. 13–29.

Beito, David T., 2000, *From Mutual Aid to the Welfare State: Fraternal Societies and Social Services, 1890–1967* (Chapel Hill: University of North Carolina).

Bernheim, B. Douglas, and Oded Stark, 1988, "Altruism Within the Family Reconsidered: Do Nice Guys Finish Last?" *American Economic Review*, Vol. 78 (December), pp. 1034–45.

Bruce, Neil, and Michael Waldman, 1990, "The Rotten Kid Theorem Meets the Samaritan's Dilemma," *Quarterly Journal of Economics,* Vol. 105 (February), pp. 155–65.

———, 1991, "Transfers in Kind: Why They Can Be Efficient and Nonpaternalistic," *American Economic Review,* Vol. 81 (December), pp. 1345–51.

Buchanan, James M., 1975, "The Samaritan's Dilemma," in *Altruism, Morality and Economic Theory,* ed. by Edmund S. Phelps (New York: Russell Sage Foundation).

Chami, Ralph, 1996, "King Lear's Dilemma: Precommitment Versus the Last Word," *Economics Letters,* Vol. 52 (August), pp. 171–76.

———, 1998, "Private Income Transfers and Market Incentives," *Economica,* Vol. 65 (November), pp. 557–80.

———, and Connel Fullenkamp, 2000, "Should Subsidized Private Transfers Replace Government Social Insurance?" IMF Working Paper 00/150 (Washington: International Monetary Fund).

Coate, Stephen, 1995, "Altruism, the Samaritan's Dilemma, and Government Transfer Policy," *American Economic Review,* Vol. 85 (March), pp. 46–57.

Cox, Donald, 1999, "Informal Networks, Institutions and the 'Soap Opera' Constraint," working paper (Chestnut Hill, Massachusetts: Boston College).

Cutler, David M., and Jonathan Gruber, 1996, "Does Public Insurance Crowd Out Private Insurance?" *Quarterly Journal of Economics,* Vol. 111 (May), pp. 391–430.

Friedman, David D., 1988, "Does Altruism Produce Efficient Outcomes?: Marshall Versus Kaldor," *Journal of Legal Studies,* Vol. 17 (January), pp. 1–13.

Holtz-Eakin, Douglas, David Joulfaian, and Harvey S. Rosen, 1993, "The Carnegie Conjecture: Some Empirical Evidence," *Quarterly Journal of Economics,* Vol. 108 (May), pp. 413–35.

Kaplow, Louis, 1989, "Incentives and Government Relief for Risk," NBER Working Paper No. 3005 (Cambridge, Massachusetts: National Bureau of Economic Research).

———, 1995, "A Note on Subsidizing Gifts," *Journal of Public Economics,* Vol. 58 (November), pp. 469–77.

———, 1998, "Tax Policy and Gifts," *American Economic Review,* Vol. 88 (May), pp. 283–88.

Kopits, George, 1997, "Are Europe's Social Security Finances Compatible with EMU?" IMF Paper on Policy Analysis and Assessment 97/3 (Washington: International Monetary Fund).

Stark, Oded, 1993, "Nonmarket Transfers and Altruism," *European Economic Review,* Vol. 37 (October), pp. 1413–24.

Stiglitz, Joseph E., 1987, "Pareto Efficient and Optimal Taxation and the New Welfare Economics," in *Handbook of Public Economics, Vol. II,* ed. by Alan J. Auerbach and Martin Feldstein (Amsterdam and New York: North-Holland).

Tanzi, Vito, 2000, "Globalization and the Future of Social Protection," IMF Working Paper 00/12 (Washington: International Monetary Fund).

United States, Bureau of the Census, 1998, *Money Income in the United States* (Washington: Government Printing Office).