Do Estate Taxes Reduce Saving?*

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ABSTRACT

This paper examines the impact of estate taxes on saving in a series of models that posit different motivations for transfers between parents and children. We show that the effects of the tax on saving depend on why donors give bequests. In addition, under each motive examined--bequests as accidents, as exchange, and as altruism--estate taxes can raise net saving by the donor and recipient. Recycling the tax revenue to the donor generally reduces the impact of estate taxes on saving, but still leaves open the possibility that the net saving effect is positive. Because there is no consensus on the correct model of intergenerational transfers, it is impossible to pin down the effect of estate taxation on saving. Nevertheless, our analysis indicates that the widely-held presumption that estate taxes reduce saving is not a general result.

The estate tax is one of the most controversial components of tax policy, but its economic effects are not yet well understood. For example, there appears to be a general presumption that higher estate taxes will reduce saving and aggregate capital accumulation (Kotlikoff and Summers 1981, McCaffery 1994, Stiglitz 1978). If correct, this presumption implies that estate taxation reduces the long-run growth prospects for the economy. Reductions in saving could also affect the distribution of income by reducing the capital-labor ratio, thereby raising the return to capital and reducing wages.

There are a number of reasons to suspect that estate taxes have an important effect on saving. Most importantly, the estate tax places a one-time levy on wealth that is not bequeathed to a spouse or given to charity. There is at least a *prima facie* case that a wealth tax reduces saving. Because it is a tax on capital value and because of interactions with other taxes, the estate tax can impose very high effective tax rates on capital income (Shoven and Wise 1996, Poterba 2000, Gale 2000). In addition, bequests and *inter vivos* transfers plausibly account for half or more of all wealth accumulation in the United States and other countries (Gale and Scholz 1994, Kotlikoff and Summers 1981, Masson and Pestieau 1997, Modigliani 1988). Finally, although the estate tax only directly affects the very wealthiest households, large *inter vivos* transfers, bequests, and wealth are also concentrated among wealthy households (Aaron and Munnell 1992, Carroll 2000, Gale and Scholz 1994, Menchik and David 1983). However, despite these concerns, despite a massive literature on the magnitude, patterns and motives for intergenerational transfers, and despite an even larger literature on the effects of capital income taxation on saving and capital formation, there has been little formal analysis of how the estate tax affects saving and capital accumulation.

To investigate these issues, this paper develops a simple model of a parent and child making life-cycle consumption and saving choices. We use the model to examine how alternative motives for giving transfers influence the effect of the estate tax on the parent's and child's saving. We also consider how different uses of the estate tax revenues affect the results.

Several key findings emerge. First, the effects of estate taxes on saving depend on the donor's motives for bequests and for wealth accumulation. This suggests important links between transfer motives and the impact of estate taxes that might be exploited in future theoretical and empirical work. Second, the response of the potential transfer recipient can materially affect the overall impact of estate taxes on saving. Thus, analysis of the estate tax should consider the saving behavior of both the donor and the recipient. Third, under every transfer motive examined, estate taxes can actually raise net saving by the donor and recipient. This raises doubts about the robustness of what appears to be conventional wisdom that estate taxes always reduce wealth. Fourth, recycling estate tax revenues generally reduces the effect of the tax on saving, but does not necessarily make the effect negative.

We begin by describing the estate tax, reviewing evidence on transfer motives, and examining previous work on estate taxes, inheritances and saving. The next section presents a general model of intergenerational transfers and estate taxes, featuring a parent and child that overlap for two periods. The subsequent sections examine estate taxes and saving in a variety of special cases of the general model that generate different transfer motives and incorporate different uses of the revenues. The last section discusses some interpretations and extensions of the research.

I. Background[1]

The tax base for the unified estate and gift tax is the sum of the value of net wealth held at the time of the taxpayers' death and the value of gifts made (above a $10,000 per recipient per year exemption) while the decedent was alive. Deductions are provided for bequests to a surviving spouse, contributions to charitable organizations, and expenses relating to administration of the estate and the decedent's funeral.

Before 1997, a lifetime tax credit against estate and gift taxes effectively eliminated taxes on the first $600,000 of the estate. The Taxpayer Relief Act of 1997 raised the credit so that the effective exemption will rise to $1 million by 2006 (and also introduced special adjustments for owners of family farms and small businesses). The tax-inclusive tax rate that applies to the first dollar of taxable estate is 37 percent.[2] This statutory rate rises to 55 percent for taxable estates in excess of $3 million, and the effective rate rises to 60 percent for taxable estates between $10 million and $17.18 million, due to a phase-out of the "preference" received from less-than-55 percent tax rates on lower estate amounts.

The estate tax directly affects only the wealthiest households. For example, in 1997 only about 2 percent of decedents had taxable estates, but federal estate and gift tax revenues were almost $20 billion, averaging over $240,000 per taxable estate. Even within the group of estate tax payers, payments are highly concentrated among very large estates. Taxable estates larger than $20 million accounted for less than 1 percent of all taxable returns, but 23 percent of

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1. Information on the estate tax may be found in Joint Committee on Taxation (1998), Gale and Slemrod (2000), or Johnson, Mikow, and Eller (2000).

2. Although the federal gift and estate taxes are said to be unified, the gift tax is imposed on the net-of-tax gift, while the estate tax is imposed on the gross estate.

revenues. Taxable estates in excess of $5 million accounted for 5.5 percent of all taxable returns, but 51 percent of revenues (Gale and Slemrod, 2000, tables 6 and 7.)

A. Motives for Intergenerational Transfers

Previous research has considered several classes of models of intergenerational transfers. In the accidental bequest model, bequests are "accidental" because people face uncertain life spans and die before they can consume all of their wealth. These accidental bequests arise in a life-cycle framework because people are either unwilling or unable to annuitize all of their wealth--perhaps due to annuity market imperfections or uninsurable risks, such as the risk of catastrophic nursing home expenses. Under these assumptions, people will generally have positive asset holdings when they die, even though they do not have a bequest motive.

Accidental bequests may account for a large fraction of aggregate wealth (Abel 1985) and may help to explain puzzling wealth accumulation patterns of the elderly (Davies 1981, Hurd 1987). But substantial evidence from patterns of *inter vivos* giving, life insurance, and annuity choices suggests that some portion of transfers are intended (Bernheim 1991, Gale and Scholz 1994, Kotlikoff 1989, Laitner and Juster 1996, McGarry 1997, Page 1997).[3] The existence of estate planning and tax avoidance techniques further suggests that not all bequests are accidental.

In the pure altruism model (Barro 1974, Becker 1974), parents care about their own consumption and the utility of their children. Parents make transfers and leave bequests until the marginal cost in terms of their own foregone consumption is equal to the marginal benefit to the parents of the increase in their children's consumption. In general, bequests are given

3. Brown (2000), however, shows that the evidence and conclusion in Bernheim (1991) fail to hold up when using data from the Health and Retirement Study.

differentially across children to compensate for differences in endowments or outcomes. Variations of the altruism model with and without a mechanism that allows a parent to commit to a given transfer level are examined in Bruce and Waldman (1990, 1991), Lindbeck and Weibull (1988), and Perozek (1996).

Tomes (1981, 1988) and Becker and Tomes (1979, 1986) provide support for the altruistic model. But other research has rejected three sharp empirical implications of altruism. First, Altonji, Hayashi and Kotlikoff (1992) show that the division of consumption within the family is not independent of the division of income, contrary to the predictions of an altruism model with operative transfers. Second, several studies find that, among families where parents make transfers to children, a one-dollar increase in parents' resources coupled with a one-dollar reduction in children's resources does not raise transfers by a dollar, although it should under altruism (Altonji, Hayashi, and Kotlikoff 1997, Cox 1987, and McGarry and Schoeni 1995).[4] Third, there does not appear to be empirical support for the implication that siblings with lower incomes should receive larger inheritances than siblings with higher incomes (Joulfaian 1992, Menchik 1980, 1988, and Wilhelm 1996). The last rejection is striking because equal division of estates among children appears to be the norm. However, Bernheim and Severinov (2000) show that this norm can arise when parents are altruistic, parental preferences are unobservable, and each child derives utility from his perception of his parents' affection for him relative to his siblings.

A variety of "exchange" models posit that bequests or transfers are the payment for some good or service provided by children. In the strategic bequest model (Bernheim, Shleifer and

4. McGarry (2000) considers a dynamic model of altruism and concludes that this test is mis-specified.

Summers 1985), parents care about their own consumption, their children's utility, and services obtained from children. These services may represent standard market goods (lawn mowing, for example) or more personal items, such as visits, attention, or children's choices regarding marriage, childbearing, education, career, and location of residence. Parents pay for services with bequests rather than *inter vivos* transfers because by delaying payment, parents can control children's actions for a longer period, and extract all of the consumer surplus out of the exchange relationship. In Cox (1987), parents buy services from their children via *inter vivos* gifts, and the exchange may be mutually beneficial. Empirical tests of exchange models have generated mixed results (Bernheim, Shleifer and Summers 1985, Cox 1987, and Perozek 1998).[5]

Kotlikoff and Spivak (1981) offer an alternative exchange model, where parents face uncertain lifetimes and imperfect annuity markets. To insure against outliving their resources, parents essentially buy annuities from their children and pay for the annuities with bequests. The model suffers from the empirical problem that large, ongoing flows of wealth from children to living parents are rarely observed (Gale and Scholz 1994), but that may be due to the sizable annuities that the government already provides in the form of Medicare and Social Security.

Other specifications simply assume that households acquire utility directly from wealth or from the after-tax bequest they leave. This specification is sometimes offered as a structural model. Aaron and Munnell (1992), Bakshi and Chen (1996), and Carroll (2000), for example, argue that (pre-estate-tax) wealth may enter the utility function as a separate argument, above and beyond the conventional consumption goods it can finance, because wealth may also provide

5. The equal division puzzle is a problem for the strategic bequest motive, although Bernheim, Shleifer and Summers (1985) offer a reconciliation.

social status, power, social connections, etc. A related case occurs if households care directly about the size of the after-tax bequest they provide (Blinder 1976, Carroll 2000). Alternatively, the specifications using pre- or post-tax wealth may be thought of as reduced forms consistent with different structural motivations for transfers. Carroll (2000) presents casual evidence consistent with the utility-of-wealth model, but no formal tests of either model exist.

Each motive above plausibly describes some portion of transfers and draws support from some research, but each motive that has been tested has also been rejected. This suggests that households may be influenced by several motives, or that the importance of each may vary across households.[6] It is worth emphasizing that analysis of the estate tax requires evidence on the motives of the very wealthiest households. But there is even less known about the very wealthy than about the moderately wealthy or middle-class households that are the mainstay of most empirical work on transfers, and relative to other households, the wealthiest households may have different motives, at the margin, for wealth accumulation.[7]

B. Previous analysis of estate taxes, inheritances and saving

The debate about the impact of transfer taxation on saving dates back to Adam Smith and David Ricardo, who thought such taxes reduced capital formation, and Jeremy Bentham and John Stuart Mill, who believed any negative impact was minimal.[8] More recently, Musgrave (1959), Fiekowsky (1966), Brannon (1973), and Pechman (1983) have suggested that substitution of an

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6. Differences in empirical outcomes may also be due in part to data limitations and the difficulty of distinguishing rejection of the underlying behavioral model from rejection of the maintained assumptions needed to generate testable hypotheses.

7. Recent work has only begun to examine the behavior of the very wealthy in detail. See, for example, the papers in Slemrod (2000).

8. See the discussion in Graetz (1983) and McCaffery (1994).

estate tax for a lifetime income tax could generate positive effects on capital formation.

Stiglitz (1978) notes that estate taxes induce income and substitution effects for donors, negative wealth effects for recipients and revenue for governments. He surmises that effects on capital accumulation are likely to be negative, but does not model these effects.

Kotlikoff and Summers (1981) examine the steady-state, partial-equilibrium effects of transfer taxes in an altruism model. Due to separability assumptions, transfer taxes have income effects on lifetime consumption and earnings, but not substitution effects. Income effects are based on the difference between growth rates and interest rates. Using historical averages for these values, they estimate that a one dollar decline in gross transfers reduces the capital stock by about 70 cents, but they do not estimate how transfer taxes affect gross transfer levels.

Excellent surveys by Graetz (1983), Holtz-Eakin (1996) and Masson and Pestieau (1997) discuss how different bequest motives could have differential impacts on the donor's saving, but typically focus on the donor. McCaffery (1994) provides the reasoning behind the view that estate taxes reduce saving.

Despite these previous discussions, there are few formal models of the impact of estate taxation on saving. Caballe (1995) develops an altruism model with endogenous growth, human capital, and bequests and finds that estate taxes reduce the capital stock. A feature of his model, however, is that estate taxes and capital income taxes have identical effects, which appears to be a special case. Kunieda (1989, chapter 3) develops a much simpler model that focuses on donor behavior and obtains similar results.

Carroll (2000) simulates a particular parameterization of the utility-of-bequests model and finds that higher estate taxes reduce donor's saving, but does not examine saving by potential

recipients.[9] Rebelain (1998) examines Ricardian equivalence in a dynamic model with and without strategic interaction among household members. He introduces estate taxes and shows via simulation that, relative to lump sum taxes, estate taxes have higher crowding out effects and higher welfare losses. Laitner (2000) examines the role of estate taxation in a sophisticated overlapping generations simulation model. He finds that the estate tax reduces the steady state concentration of wealth and capital stock.

There are few empirical studies of the estate tax and saving. Kopczuk and Slemrod (2000) use estate tax return data from 1916 to 1996 and find that increases in estate tax rates tend to reduce the amount of wealth held in the largest estates. As they note, this evidence is consistent with higher estate taxes increasing tax avoidance or reducing saving by the donor, but the evidence is somewhat fragile. They also show estate tax rates that prevailed at age 45 (or 10 years before death) are more clearly negatively associated with reported estate size than is the rate prevailing in the year of death.[10]

Several articles examine the behavior of recipients. Recipients of inheritances from estates subject to federal estate taxation tend to be middle-aged, high-income households, and the typical inheritance for these recipients is several times the recipients income (Joulfaian 1998, Wilhelm 1996). Holtz-Eakin, Joulfaian, and Rosen (1993) show that receipt of an inheritance of $350,000 reduces labor force participation rates by 12 percentage points for singles and reduces the

9. In related work, Ihori (1998) examines wealth taxation in intergenerational models with endogenous growth and finds that increased taxes on financial bequests (as opposed to transfers of human capital) alter intragenerational equality, while increased taxes on transfers of human capital have ambiguous effects. Mulligan (1997, chapter 5) shows that progressive estate taxes increase intergenerational mobility of households.

10. Earlier studies by Fiekowski (1966), Southwick (1996), and Chapman, Hariharan, and Southwick (1996) examine the effects of estate taxes on saving.

likelihood of having two workers by 14 percentage points for married couples. Holtz-Eakin, Joulfaian, and Rosen (1993) and Joulfaian and Wilhelm (1994) find small reductions in the labor supply of inheritors who remain in the labor force. Weil (1994) shows that the past or anticipated receipt of an inheritance raises a household's consumption by 4-10 percent, after controlling for income, age, education and other factors. Given the magnitude of typical household saving rates, Weil's results suggest that inheritances substantially reduce a household's saving out of earned income. All of these empirical results suggest that if transfer taxes reduce inheritances, they should raise saving by recipients. However, Holtz-Eakin, Joulfaian, and Rosen (1994a, 1994b) show that receipt of a large inheritance raises the likelihood that a household starts a business and raises the probability of the business surviving and expanding. Thus, to the extent that inheritances relieve liquidity constraints associated with investment, reduced inheritances could reduce saving.[11]

II. A Framework for Analyzing the Effects of Estate Taxes on Saving

This section discusses a simple but general framework for examining estate taxes. The formal model equations and solutions are derived in the Appendix. The model consists of a parent and child, each of whom is alive in the first period. The child survives to the second period with certainty, while the parent survives with probability less than or equal to 1.

The parent derives utility from her own lifetime consumption, and may also care about the well-being of the child or services the child provides to her. The different sources of utility

11. Imbens, Rubin and Sacerdote (1999) show that winning a lottery prize of about $15,000 per year for 20 years has little if any effect on the recipient's labor supply, but winning a prize of $80,000 per year for 20 years significantly reduces labor force participation, hours worked, and labor earnings.

correspond to different transfer motives, as discussed below. The parent receives exogenously determined income in the first period and, if alive, the second period.[12] If the parent is alive in the second period and estate tax revenues are rebated in lump sum manner, she also receives a transfer from the government. The parent's lifetime budget constraint is that the discounted value of her own consumption plus her pre-tax bequest must be no larger than the sum of the discounted value of her exogenous income and any tax rebate. The estate tax is assumed to be proportional with no exempt amount. Given these constraints, the parent maximizes lifetime utility by choosing first-period saving and a planned net-of-tax inheritance to the child in the second period. If the parent dies at the end of the first period, the bequest will in general differ from the planned bequest that would have occurred at the end of the second period.

The child cares about his own consumption, and may also care about services provided to the parent, but does not care directly about the parent. He receives exogenous income in each period and may receive an inheritance in the second period. He maximizes his lifetime utility by choosing consumption in each period subject to a lifetime budget constraint that requires that the discounted value of his consumption not exceed the discounted value of his wages plus the after-tax inheritance received. The determination of services provided to the parent is described in the discussion of the exchange motive below.

Before turning to the analysis of estate taxes, a few comments on the model are warranted. First, our analysis focuses on how estate taxes that are imposed in the second period affect saving in the first period. Second, although we focus on estate taxes, nothing of substance would change if the transfer were labeled a gift and the tax called a gift tax. Third, in the general

12. The second period income is assumed not to be bequeathable if the parent dies at the end of the first period.

framework noted above, the timing of moves by the parent and child has not been specified carefully. The timing will vary across transfer motives, and is described in subsequent sections.

III. Non-Altruistic Models

A. Accidental Bequests

To model accidental bequests, we assume that the parent cares only about her own consumption, and that the parent lives to the second period with probability less than 1. To ensure that the parent does not die with negative wealth, we impose the constraint that parental saving in the first period is non-negative. In this framework, the parent does not intentionally provide a bequest. Thus, if the parent lives to the end of the second period, she bequeaths nothing. However, if she dies at the end of the first period with positive wealth, she will accidentally leave a bequest. Thus, with no estate tax, the expected value of the inheritance received by the child is positive.

Now consider estate taxes. If estate tax revenues are not recycled, an increase in the estate tax rate would have no effect on the parent's saving, but would reduce the expected inheritance received by the child, and thereby raise the child's saving. Thus, raising the estate tax would raise the sum of parent's and child's saving.

If the revenue is recycled to the parent in the second period, the analysis changes somewhat.[13] Relative to the no-tax case, the parent now has higher expected value of second-period income, and therefore of lifetime income, if she lives to the second period. Even though

13. Obviously, if a particular parent dies at the end of period 1, she cannot receive the recycled revenue in period 2. This problem can be easily accommodated by adjusting the model to allow for many families, where some of the parents die at the end of period 1 and the rest live until the end of period 2.

the parent does not know in period 1 whether she will live the full two periods, the increase in second period income contingent on survival causes her to raise consumption in the first period--that is, to reduce saving. The rise in the estate tax reduces the child's expected inheritance for two reasons: first, the higher tax directly reduces the after-tax inheritance flowing from a pre-tax bequest of a given size; second, the reduction in the parent's saving reduces the pre-tax bequest should the parent die at the end of the first-period. Thus, the child's first-period saving rises. As a result, the net effect on first period saving by the parent and child is ambiguous.

B. Bequests as Exchange

In the exchange framework, the parent values a service (or good or action) that the child provides, and the parent purchases the service by promising to bequeath additional funds. For simplicity, we assume the parent survives to the second period with certainty and the parent cares about her own consumption and the services provided by the child, but not the child's well-being.

To simplify further, we assume the child does not care directly about the service provided and that the child must work a fixed number of hours, but can allocate those hours between working at the market wage and providing attention to the parent. Since the child is indifferent between working in the labor market and providing services for the parent, in equilibrium the child will have to receive the same payment from an hour of work and an hour of providing services.

Thus, with exchange-motivated bequests, the parent saves in period 1 to finance second period consumption and to purchase services from the child. The estate tax is simply a tax on those purchases. The effect of the estate tax on the parent's first-period saving depends on the parent's price elasticity of demand for services. If the demand for services is inelastic, then a

higher estate tax raises total parental expenditure on services, and the parent's saving rises. If demand is elastic, a higher estate tax rate will reduce the gross estate and reduce parental saving in the first period.

If the revenue is not recycled, the relevant price elasticity above is based on an uncompensated demand curve. If the revenue is recycled, the same intuition applies, but the relevant price elasticity is now derived from a situation where the parent is compensated in lump sum for the tax payments made. Revenue recycling will raise the parent's lifetime income compared to when revenue is not recycled. This will raise the parent's consumption of all normal goods. Thus, if first period consumption is normal, the parent's first-period saving will fall by more (rise by less) under revenue recycling than when revenue is not recycled.

Empirically, the demand for attention is more likely to be inelastic if the attention provided is child-specific and few suitable market substitutes are available. Demand is likely to be more elastic when there are market substitutes for the service provided by the child.[14]

We have focussed on the parent's saving in response to changes in the estate tax rate. As in Bernheim, Shleifer and Summers (1985), the discussion above assumes that the parent is able to extract all of the surplus from the transaction with the child, and therefore, in equilibrium, the child is indifferent on the margin between providing the service and working in the labor market. These assumptions also imply that the child's total resources, and therefore the child's saving, do not change as the estate tax or the transfer from the parent changes.

In an earlier version of this paper (Gale and Perozek 2000), we examine models where

14. This point is related to a result derived by Cox (1987), who focuses on the role of the parent's income elasticity of demand for services provided by children in attempting to distinguish between altruism and exchange motives.

parents obtain utility from after-tax bequests (Blinder 1976, Carroll 2000) or from the act of giving itself (Andreoni 1989). The effects of estate taxes on saving in these models are very similar to those obtained when bequests are a means of exchange. In all three cases, the parent derives utility from the after-tax bequest--without regard to the child's utility--and the effects of estate taxes depend on the elasticity of the parent's total (pre-tax) bequest with respect to the tax rate.

IV. Altruism Models

To model purely altruistic preferences we assume the parent cares about her own consumption and the well-being of the child, but not the size of the transfer per se. For simplicity, we assume that neither the parent nor the child cares about services provided by the child, and that the parent lives to the second period with certainty.

In a dynamic setting, altruistic parents may face a Samaritan's Dilemma. Specifically, if the parent does not have a credible mechanism for committing to transfer levels independent of the child's outcome, and if the child's outcome depends on the child's behavior, then a selfish child will consume more in the first period than he would if the parent could commit to a transfer scheme. The child knows that the resulting reduction in his own wealth will be at least partially compensated by an increased transfer from the parent.

We first examine the altruism model when parents possess the power to commit to the level of future transfers. This simpler model establishes the benchmark for the efficient solution. Then we compare those results with the solution to the model when parents cannot commit to a future transfer level.

A. Altruism with Commitment Power

When the parent can credibly commit to future transfer levels, the analysis is straightforward. First, because the child cannot manipulate the parent's transfer, the child maximizes his own lifetime utility, taking the transfer as given. Then, knowing the child's saving as a function of the transfer, the parent chooses first-period saving and the second-period transfer to maximize her lifetime utility. In effect, if a transfer is given, the parent chooses the distribution of family resources that maximizes her lifetime utility.

In this theoretical framework, the effect of the estate tax is ambiguous; the tax reduces the parent's saving and raises the child's saving (see the Appendix). To gain further insights, we specify a numerical model. For each person i (i=parent, child), we assume the within-period utility function is isoelastic, i.e. $u_i(c) = c^{1-\gamma}/(1-\gamma)$, and lifetime utility is additively separable. We also assume the time preference rate is zero, and parents value their child's utility at half the level of their own utility. We parameterize income by assuming that $W_{p1}=50$, $W_{p2}=20$, $W_{k1}=10$, and $W_{k2}=40$, where W_{ij} gives the exogenous income of person i in period j (= 1 or 2). These income values imply that family resources in the two periods are equal, which implies the efficient level of family saving is zero.[15] The coefficient of relative risk aversion, γ, is set to 3.

With these assumptions, the effects of higher estate tax rates, with and without revenue recycling, are shown in figures 1-4. We first examine the effects with no revenue recycling (shown by the solid lines in figures 1-4.) As the estate tax rate rises, the net-of-tax inheritance

15. The income values can be thought of as representing the second and third of three periods of the parent's life--i.e., the parent's middle-age and retirement period--and the first and second of three periods of the child's life--young adulthood, and then middle age. This would justify the downward sloping profile for the parent and the upward sloping profile for the child, although those slopes are not necessary to establish the results in the paper. It may seem counterfactual that the child has fewer lifetime resources than the parent, but this condition, or a very large value of θ, is necessary, under the assumptions of the model, to generate positive transfers from the parent to the child.

falls, and vanishes at a tax-exclusive rate of about 27 percent (figure 1). Raising the estate tax rate also raises the child's saving (figure 2) and reduces the parent's saving (figure 3).

Figure 4 shows the main result of this section, the impact of the estate tax on family saving. When the tax rate is zero, total family saving is zero. As the tax rate rises, family saving first increases and then decreases until the transfer is no longer operative, at which point family saving returns to zero. Hence, for a range of tax rates between 0 and t*, where t* is the rate at which saving peaks, increases in the tax raise family saving. Moreover, with this parameterization, every positive tax rate produces a level of saving at least as high as a zero tax rate does.

Although the quantitative effects shown in figure 4 are quite small, the intuition behind the qualitative patterns is worth pursuing. Calculations in the Appendix show that, under the assumptions above, as the estate tax rate changes, family saving changes according to:

$$ds / dt = (B/2) (\epsilon_{Bt} + 1), \quad (1)$$

where the s is the sum of the parent's and child's saving, B is the pre-tax bequest, $\epsilon_{Bt} = (dB/dt)*(t/B)$ and represents the elasticity of the gross bequest with respect to the estate tax rate, and t is estate tax rate. Equation (1) shows that the sign of the effect on saving of increasing the estate tax rate depends on the elasticity of gross (pre-tax) bequests with respect to the tax rate. When the elasticity is greater than negative one, the derivative is positive--that is, raising the estate tax rate *raises* saving. Evaluated at t=0, the elasticity has to be greater than negative one, since t enters the numerator of the elasticity. As a result, equation (1) implies that starting from a zero estate tax rate, raising the tax rate by a small amount will raise family saving. This finding explains the initial increase in saving shown in figure 4. Simulations confirm that as t rises, ϵ_{Bt}

falls in value, reaching a value of -1 at $t = t^*$, where t^* is defined above.

The results with revenue recycling are shown by the dashed lines in figures 1-4. Whether the revenue is returned to the parent in the second period or not has very little quantitative influence on the results in figures 1-3. Relative to the no-recycling case, recycling raises the inheritance (figure 1), reduces first-period saving by the child (figure 2), and reduces first-period saving by the parent (figure 3).

In contrast, revenue recycling has a major effect on the qualitative results for overall family saving (figure 4). With recycling, the estate tax is completely neutral with respect to family saving. Because the parent can effectively choose family saving, she will choose the level of saving that is efficient given the distribution of resources over time. But when tax revenues are recycled to the parent, total resources available to the family in each period are the same as in the no-tax case. Thus, family saving is the same as in the no-tax case.

B. Altruism without Commitment Power

When the parent cannot commit to future transfer levels, parental altruism provides an incentive for the child to undersave in the first period, where "undersave" is defined relative to the case with commitment described above. As described in the Appendix, the absence of commitment changes the ordering of moves and the nature of the maximization problem. The key difference is that when the parent has no commitment power, the child can manipulate the size of the transfer by consuming more in the first period than is optimal from the parent's perspective. In particular, as the child's second period wealth rises, the parent's preferred transfer falls. This decline acts like a tax on the child's wealth, so that the child chooses to save less than he would in the commitment case, where the transfer is fixed given the exogenous distribution of family

income.

Theoretical analysis (see the Appendix) shows that when parents lack commitment power, higher estate taxes lead to higher saving by the parent and lower saving by the child; the net effect of the tax increase on total saving is indeterminate. Thus, we turn again to numerical solutions, using the same parameterization as in the commitment case described above.

We focus first on the results with no revenue recycling (the solid lines in figures 5-8). Figure 5 shows that the net-of-tax inheritance falls as the tax rate rises when there is no commitment power. Comparison of figures 1 and 5 shows that the net-of-tax inheritance is much larger when there is no commitment power. At a tax rate of zero, the inheritance is about twice as large when there is no commitment, and it remains operative until the tax rate rises to about 36 percent, compared to 27 percent in the commitment case, using the same parameter values.

Figure 6 shows that when there is no commitment power, the child's saving rises as the estate tax rate rises. Comparison of figures 2 and 6 shows that the child saves much less when there is no commitment power, demonstrating the disincentive effects on saving of the parent's policy to reduce her transfer as the child's saving rises.

Figure 7 shows that the parent's saving unambiguously declines as the tax rate rises when there is no commitment power. However, relative to the case with commitment shown in figure 3, parents save slightly more in the no-commitment case for low tax rates and slightly less for higher tax rates. The intuition for this result stems from Bruce and Waldman (1990). In the absence of commitment mechanisms, parents are either forced by the opportunistic behavior of their children to give more than they would with full commitment or they must find some way to make credible the threat not to give more. One way to make the threat credible is simply to

consume the resources themselves. As the estate tax rate rises, the relative costs of using this threat mechanism decline, so that parental consumption rises relative to the full-commitment case as the estate tax rises.

Figure 8 shows that, when there is no commitment power, total saving rises as the estate tax rises. Comparison of figures 4 and 8 shows that the level of family saving is lower when the parent does not have commitment power. However, the marginal effect on saving of raising the estate tax rate is larger in absolute value when there is no commitment power. This result can be illustrated by examining extreme cases. When t=1 (actually, when t is as low as .37 using the parameters specified), there is no operative bequest in either model, so saving will be the same in both. However, when t=0, there is less saving in the no-commitment model because of the Samaritan's Dilemma. Thus, the effect on saving of raising t (from 0 to 1) must be larger in the no-commitment model. The intuition is that, in the absence of credible parental commitment, the estate tax provides a way of credibly making it more difficult for the parent to give transfers. This forces the child to raise saving by more, for a given increase in the estate tax, in the no-commitment case than in the commitment case.

Given the absence of commitment power, whether the revenue is recycled does not have a very large effect on any of the results. Because the tax revenue is refunded to the parent in the second period, the parent's second period income is higher than in the case where the revenue is not recycled. As a result, the parent saves less in the first period (figure 7). In addition, the parent gives a larger transfer (figure 5), which reduces the child's saving (figure 6). This implies that total saving by the parent and the child is lower with revenue recycling (figure 8) than without. Nevertheless, the main qualitative result is the same: over a range of tax rates, increases

in the estate tax raise total saving by the parent and child.

V. Discussion

Our analysis generates three central conclusions: the effects of estate taxes on saving depend crucially on transfer motives; the overall effects require analysis of both the donor and the potential recipient; and in a surprising number of cases, higher estate taxes appear to raise saving. This section discusses implications and extensions of these findings.

The central role of transfer motives should not be surprising. Motives for intergenerational transfers play an important role in several other topics in public finance, including the effects of government debt (Barro 1989, Bernheim 1989), the effects of subsidies for charitable giving (Andreoni 1989), the appropriate treatment of gifts and bequests under a consumption tax (Fried 1999, Metcalf 1995), and the effects of consumption taxes (Johnson, Diamond, and Zodrow 1997).

The effects of estate taxes vary across transfer motives because different motives make the effects hinge on completely different behavioral responses. Under the exchange motive, for example, the price elasticity of demand for children's services is the key variable. Under altruism, the effects will vary depending on the level of commitment power that the parent possesses. An implication of this finding is that all behavioral and efficiency aspects of the estate tax should depend in some degree on transfer motives. Kaplow (1995, 1997, 2000) shows that the efficiency effects of transfer taxes vary with motives for giving. Our models confirm and extend those results. For example, when parents lack commitment power, it can be shown that the parent can achieve a higher level of lifetime utility at certain values of $t>0$ than when $t=0$. To understand

why, recall that with altruism and no commitment power, the child saves too little. The estate tax raises the cost of giving a second period transfer. It provides, if not a commitment device, at least an increase in the marginal cost of giving the transfer, which reduces the size of the transfer, causes the child to raise saving, and thus helps to offset the inefficient behavior induced by the lack of commitment power.

Transfer motives will also affect the impact of the estate tax on the cost of capital. Poterba (2000) models the impact of the estate tax on the donor's cost of capital by adding to the standard cost of capital formula the product of the statutory estate tax rate times the donor's one-period mortality risk. It is not clear, however, which if any transfer motives would generate that formula. Under accidental bequests, the estate tax has no impact on how the donor perceives the cost of capital. Under the exchange motive, the estate tax acts as an excise tax on parental purchases of children's services. This imposes a constant cost per service requested, and the cost is independent of when the parent dies. Likewise, under altruism, the parent is concerned about the child's lifetime well-being. Since the parent knows she will die at some point, it is not clear how or why the parent's mortality risk should enter the cost of capital formula. In any case, the relation between the estate tax, bequest motives, and the donor's cost of capital merits further investigation, especially given the extraordinary amount of attention given in policy debates to the effects of the estate tax on small businesses and entrepreneurship. Transfer motives will also affect the economic incidence of the estate tax, the impact on labor supply and on the distribution of wealth.

Our second central finding is that the overall effects of estate taxes depend critically on the recipient's response as well as the donor's. As described above, many previous analyses examine

the impact on either the donor or the recipient. A large portion of the policy debate focuses only on the effect on donor's saving. Our results, however, suggest that the overall impact may be different in magnitude and direction than the effect just on donors.

Our third and perhaps most striking finding is that under several different circumstances, higher tax rates on estates can raise saving. The results are strongest when tax revenues are not recycled. Under these circumstances, higher estate tax rates generate higher net family saving among the affected families if bequests are accidental. If bequests are motivated by exchange, the effect is ambiguous but plausibly positive, since there are often few good substitutes for a child's attention. When bequests are altruistic and parents have commitment power, our simulations and parameter values generate positive effects of higher estate taxes for a range of tax rates, and family saving with a positive tax rate is never below saving with no tax. When bequests are altruistic and parents lack commitment power, family saving rises with increases in the estate tax rates.

Partly, the effects noted above occur because of the assumption that revenue is not recycled to the donor or recipient.[16] When the revenue is not recycled, higher estate taxes impose substitution and income effects. The income effects reduce family consumption in both periods and therefore raise saving in the first period. But the results without recycling are still of interest, especially for policy purposes. Virtually all proposed revisions or abolitions of the estate tax do not involve compensating adjustments for the families involved; rather, they involve significant shifts in the distribution of tax burdens across income classes (see Gale and Slemrod, 2000).

16. The implicit assumption is that the revenue is spent by the government on a public good that enters the parent's and child's utility function in a separable manner.

Thus, the policy debate about the effects of estate taxes focuses on the effects of uncompensated estate tax changes. This paper shows that such changes can lead to net increases in saving by the affected donors and recipients under all of the transfer motives considered above.

We also show that, in the presence of revenue recycling, the effects on saving are less likely to be positive. This should not be surprising, since recycling the revenue removes the negative income effect and the reduction in first-period consumption it causes. Nevertheless, even with revenue recycling the results are far from the conventional wisdom that estate taxes always reduce saving. With accidental and exchange-motivated bequests, the effects are ambiguous. With altruistic bequests and commitment power, the estate tax is neutral with respect to family saving. And when parents face a Samaritan's Dilemma, the effects of higher estate taxes remain positive.

Our modeling strategy has followed earlier work, including Altonji, Hayashi, and Kotlikoff (1997), Bernheim, Shleifer and Summers (1985), Bernheim and Severinov (1998), Bruce and Waldman (1990, 1991), Cox (1987, 1990) in examining the effects of transfers among one generation of parents and one generation of children. This allowed us to examine estate taxes in models that have been commonly used to examine transfer motives. Examining models with a series of overlapping generations is an important next step. In addition, the model might usefully be extended to consider general equilibrium effects (Stiglitz 1978, Laitner 2000), tax avoidance possibilities, interactions between *inter vivos* gifts, bequests, and estate and gift taxes (McGarry 2000), and other motives for transfers and wealth accumulation (Bernheim and Severinov 2000, Curry and Davies 1998, Pollak 1988, Frank 1997, and Kinsley 1988).

Appendix

This Appendix provides the formal modeling that generates the results discussed in the text of the paper. We model the behavior of a parent and child, each of whom is alive in the first period. The child survives to period 2 with certainty, while the parent survives with probability q <=1. The parent derives utility from her own consumption, and may also care about the well-being of the child (U_k), or about an action (a) taken by the child--this action may be thought of as services provided by the child to the parent. The parent's degree of altruism is θ, and the discount factor is β. The parent receives exogenously determined income in the first period and, if alive, the second period, denoted W_{p1} and W_{p2}, respectively. The parent may also receive a transfer from the government (T) in the second period if the estate tax revenue is rebated. Given a flat, tax-inclusive tax rate t on bequests to children (with no exempt amount), the parent chooses saving (s_p) in the first period and a planned net-of-tax inheritance (I) to the child in the second period to maximize lifetime utility U_p:

$$(1) \qquad Max_{s_p, I} \quad U_p = u_p(c_{p1}) + \beta q\, u_p(c_{p2}, a) + \theta\, U_k(c_{k1}, c_{k2}, a)$$

subject to:

$$c_{p1} = W_{p1} - s_p$$

$$c_{p2} = W_{p2} + T + (1+r)s_p - \frac{I}{1-t}$$

The constraints imply that first period consumption (c_{p1}) equals first period resources (W_{p1}) less saving, and second period consumption (c_{p2}) equals second period resources (W_{p2} +T+(1+r)s_p) less the total cost of the transfer I/(1-t), where I is the after-tax inheritance received by the child.

The child receives endowments of W_{k1} and W_{k2} and chooses first-period saving (s_k) and a

second-period action (a) to maximize lifetime utility U_k:

$$(2) \qquad Max_{s_k,\ a} \qquad U_k(c_{k1}, c_{k2}, a) \ = \ u_k(c_{k1}) \ + \ \beta E[u_k(c_{k2},\ a)]$$

subject to:

$$c_{k1} \ = \ W_{k1} \ - \ s_k$$

$$c_{k2} \ = \ W_{k2} \ + \ (1+r)\, s_k \ + \ (1-Q)\, I \ + \ Q(1+r)(1-t)\, s_p$$

$$Q \ = \ \begin{cases} 0 \ \textit{with probability} \ q \\ 1 \ \textit{with probability} \ 1-q \end{cases}$$

The constraints imply that first period consumption (c_{k1}) equals income (W_{k1}) less saving (s_k), and second period consumption (c_{k2}) equals the sum of income (W_{k2}), accumulated first-period saving $(1+r)s_k$, the intended after-tax inheritance (I), and--if the parent does not survive to the second period--the parent's accumulated saving intended for her own second period consumption, net of the estate tax: $(1+r)(1-t)s_p$.

In equilibrium, the parent chooses s_p^* and I^*, while the child chooses s_k^* and a^*. Each maximizes lifetime utility subject to the resource constraints above and the constraints of the game, which will change as motivations for transfers change. For simplicity, and without loss of generality, we assume the return on saving and the rate of time preference equal 0 ($r=0$ and $\beta=1$), and the second period transfer is operative ($I>0$).

Accidental Bequests

To model accidental bequests, we assume the parent cares only about her own consumption and lives to the second period with probability $q<1$. To ensure that the parent dies with non- negative wealth, we require parental saving to be non-negative. In the absence of formal or family annuity markets, the parent chooses saving to maximize lifetime utility:

$$(3) \qquad Max_{s_p} \quad U_p = u_p(c_{p1}) + q\,u_p(c_{p2})$$

$$subject\ to:$$

$$c_{p1} = W_{p1} - s_p$$

$$c_{p2} = W_{p2} + T + s_p$$

and the parent will choose saving to satisfy

$$(4) \qquad \frac{\frac{\delta u_p}{\delta c_{p1}}}{\frac{\delta u_p}{\delta c_{p2}}} \geq q\,; \qquad s_p \geq 0$$

When there is no revenue recycling (T=0), the estate tax has no effect on the parent's saving. Although the parent has no intended transfer, she will leave a positive bequest if she dies at the end of the first period. Hence, with probability 1-q the parent will leave an estate of size s_p at the end of the first period, of which the child will inherit $(1-t)s_p$. The child's saving thus depends on the parent's saving and the estate tax rate, and he will choose s_k to maximize lifetime utility:

$$(5) \qquad Max_{s_k} \quad U_k = u_k(c_{k1}) + E[u_k(c_{k2})]$$

$$subject\ to:$$

$$c_{k1} = W_{k1} - s_k$$

$$c_{k2} = W_{k2} + s_k + Q(1-t)s_p$$

$$Q = \begin{cases} 0 \ with\ probability\ q \\ 1 \ with\ probability\ 1-q \end{cases}$$

Intuitively, if the parent saves nothing, the child's saving is unaffected by estate taxes. If the parent's saving is positive, expected inheritances will be positive, but will be reduced by estate

taxes. Thus, higher estate tax rates reduce the expected inheritance.

Formally, the child chooses saving (s_k) to satisfy

$$(6) \qquad F(s_k,\ t) \ = \ -\frac{\delta u_k}{\delta c_{k1}} \ + \ (1-q)\frac{\delta u_k}{\delta (c_{k2}|Q=1)} \ + \ q\frac{\delta u_k}{\delta (c_{k2}|Q=0)} \ = \ 0$$

and, by the implicit function theorem, the child's saving increases as the estate tax increases:

$$(7) \qquad \frac{\delta s_k}{\delta t} \ = \ \frac{(1-q)\, u^{//}(c_{k2}|Q=1)\, s_p}{u^{//}(c_{k1}) \ + \ E[u^{//}(c_{k2})]} \ > \ 0$$

The outcome is ambiguous when estate tax revenue from deceased parents is recycled to parents who survive for two periods. The transfer raises second-period and lifetime resources of surviving parents. Consequently, all parents will consume more and thus save less in the first period, relative to the case with no recycling. Formally, the parent maximizes (3) with $T = t(1-q)s_p$. This yields the same first order condition as (4). Totally differentiating shows that higher estate taxes reduces the parent's saving:

$$(8) \qquad \frac{\delta s_p}{\delta t} \ = \ \frac{-q\, u^{//}(c_{p2})\, s_p\, (1-q)}{u^{//}(c_{p1}) \ + \ q\, u^{//}(c_{p2})\, (1+t(1-q))} \ \leq \ 0$$

As before, the child maximizes expected utility conditional on the expected inheritance, with the optimal choices satisfying (6). With T>0, however, the child recognizes that an increase

in the tax not only reduces the after-tax inheritance, but also reduces the gross estate s_p. Formally,

$$(9) \qquad \frac{\delta s_k}{\delta t} = \frac{-(1-q)\,u''(c_{k2}|Q=1)\,(-s_p + (1-t)\frac{\delta s_p}{\delta t})}{u''(c_{k1}) + E[u''(c_{k2})]} > 0$$

Equation (9) is identical to (7) except for the added term $(1\text{-}t)\partial s_p/\partial t$, which is equal to zero when there is no revenue recycling.

Bequests as Exchange

In the exchange framework, the parent values the child's attention (a) and purchases attention by promising to bequeath additional funds. For simplicity, we assume the parent survives to the second period with certainty (q=1) and the parent is not altruistic ($\theta = 0$).

To simplify further, we assume the child does not care directly about the action a. Also, the child must work H hours, but can allocate those hours between working at the market wage, ω ($= W_{k2}/H$) per hour, and providing attention to the parent at a net wage of ω_a per hour. Since the child is indifferent between working in the labor market and working for the parent, the equilibrium price of attention ω_a will equal the market wage ω. Thus, for each hour of attention the parent requests and the child provides, the child will receive an additional ω_a in after-tax inheritances. However, due to the estate tax, the parent pays--i.e., has to accumulate in wealth--an amount equal to $p_a = \omega_a/(1\text{-}t)$ to obtain an hour of attention.

The model is solved as follows. The parent solves the second period problem by choosing a to maximize second period utility given s_p and the second-period budget constraint:

$$(10) \qquad Max_a \quad u(c_{p2},\ a)$$

$$subject\ to:$$

$$c_{p2} = W_{p2} + T + s_p - p_a a.$$

The parent's demand for attention, a^*, must satisfy the first-order condition:

$$(11) \qquad \frac{\delta u}{\delta c_{p2}} \frac{\delta c_{p2}}{\delta a} + \frac{\delta u}{\delta a} \leq 0; \quad a \geq 0.$$

If a>0, then in the first period the parent chooses s_p to maximize:

$$(12) \qquad Max_{s_p} \quad u(c_{p1}) + u(c_{p2},\ a(s_p))$$

$$subject\ to$$
$$c_{p1} = W_{p1} - s_p$$
$$c_{p2} = W_{p2} + T + s_p - p_a a(s_p)$$
$$a(s_p) = a^*(s_p,\ T)$$

and therefore, with no revenue recycling satisfies

$$(13) \qquad F(s_p,\ a) = -\frac{\delta u}{\delta c_{p1}} + \frac{\delta u}{\delta c_{p2}}[1 - p_a \frac{\delta a^*}{\delta s_p}] + \frac{\delta u}{\delta a^*} \frac{\delta a^*}{\delta s_p} = 0$$

which reduces to the following expression if a>0:

$$(14) \qquad F(s_p,\ t) = -\frac{\delta u}{\delta c_{p1}} + \frac{\delta u}{\delta c_{p2}} = 0.$$

To solve for the effect of the estate tax on parental saving, note that:

$$(15) \qquad \frac{\delta s_p}{\delta t} = \frac{\delta s_p}{\delta p_a}\frac{\delta p_a}{\delta t}$$

where

$$\frac{\delta p_a}{\delta t} = \frac{\omega_a}{(1-t)^2} > 0.$$

Since the second term in (15) is positive, we only need to solve for $\partial s_p/\partial p_a$, which is given by:

$$(16) \qquad \frac{\delta s_p}{\delta p_a} = -\frac{\frac{\delta F}{\delta p_a}}{\frac{\delta F}{\delta s_p}} = \frac{u''(c_{p2})a^*[\frac{p_a}{a^*}\frac{\delta a^*}{\delta p_a} + 1]}{u''(c_{p1}) + u''(c_{p2})[1 - p_a\frac{\delta a^*}{\delta s_p}]} \gtrless 0.$$

The denominator is the second order condition and is therefore negative. Thus, the sign of $\partial s_p/\partial p_a$ depends only on the sign of

$$[\frac{p_a}{a^*}\frac{\delta a^*}{\delta p_a} + 1]$$

That is, the price elasticity of demand for attention determines the effect of the tax on saving.

When revenues are recycled, the problem is only slightly different. The parent's total resources do not change as the tax rate changes. This leaves only the substitution effect, implying that the parent purchases less attention as the tax rate and the price of attention rise. Whether total expenditure on attention falls, though, depends on the compensated elasticity of demand for

attention. The formal analysis is sufficiently similar to that described above that we omit the details.

Altruism with Commitment Power

To model altruism, we assume the child's utility enters the parent's utility function with weight $\theta > 0$, neither the parent nor the child cares about the action the child takes, and the parent lives to the second period with certainty. With commitment power, the model is solved in the following order. First, because the child cannot manipulate the parent's transfer, the child takes the transfer as given and chooses saving to maximize his lifetime utility,

$$(17) \qquad \underset{s_k}{Max} \quad u_k(c_{k1}) + u_k(c_{k2})$$

subject to:

$$(18) \qquad c_{k1} = W_{k1} - s_k$$

$$(19) \qquad c_{k2} = W_{k2} + s_k + I$$

The child's optimal saving, $s_k^*(I)$, given the after-tax transfer I, satisfies the first order condition:

$$(20) \qquad -\frac{\delta u_k}{\delta c_{k1}} + \frac{\delta u_k}{\delta c_{k2}} = 0$$

That is, the child chooses saving to smooth consumption over the two periods.

Knowing the child's saving function, $s_k^*(I)$, the parent chooses first-period saving (s_p) and the second-period transfer (I) to maximize lifetime utility:

$$\underset{I,\, s_p}{Max}\ u_p(c_{p1}) + u_p(c_{p2}) + \theta\{u_k(c_{k1}) + u_k(c_{k2})\}$$

subject to:

(21) $$c_{p1} = W_{p1} - s_p$$

(22) $$c_{p2} = W_{p2} + T + s_p - I/(1-t)$$

$$c_{k1} = W_{k1} - s_k^*(I)$$

$$c_{k2} = W_{k2} + s_k^*(I) + I$$

The parent's choice of the transfer (I) and saving (s_p) must satisfy the first order conditions:

(23) $$\frac{\delta}{\delta s_p} = -\frac{\delta u_p}{\delta c_{p1}} + \frac{\delta u_p}{\delta c_{p2}} = 0$$

$$\frac{\delta}{\delta I} = -\frac{1}{1-t}\frac{\delta u_p}{\delta c_{p2}} + \theta\frac{\delta u_k}{\delta c_{k2}} \le 0; \quad I \ge 0$$

In this framework, the effect of the tax on total saving is ambiguous. To gain further insights, we assume that the utility function is isolelastic, i.e. $u_i(c) = c^{1-\gamma}/(1-\gamma)$, i=p,k. Under these assumptions, if $I > 0$, optimal transfers and saving are given by:

(24) $$s_p^* = \frac{1}{2(1+\alpha)}[(2+\alpha)W_{p1} - \alpha(W_{p2} + T) - \frac{\alpha}{(1-t)}(W_{k1} + W_{k2})$$

(25) $$I^* = \frac{1}{(1+\alpha)}[(1-t)(W_{p1} + W_{p2} + T) - \alpha(W_{k1} + W_{k2})]$$

(26) $$s_k^* = \frac{1}{2(1+\alpha)}[(1+2\alpha)W_{k1} - W_{k2} - (1-t)(W_{p1} + W_{p2} + T)$$

$$\text{where } \alpha = \theta^{-\frac{1}{\gamma}}(1-t)^{\frac{\gamma-1}{\gamma}}$$

Given these expressions, with no revenue recycling (T=0), it is straightforward, if tedious, to show

that increases in the estate tax rate reduce inheritances and the parent's saving and raise the child's saving, and have a generally ambiguous effect on family saving. However, with revenue recycling, the estate tax is neutral with respect to family saving.

To understand these results, note that with isoelastic utility and a zero time preference rate, (20) implies that $c_{k1} = c_{k2}$. Substituting these values into (18) and (19) and rearranging yields

(27) $$s_k^* = \tfrac{1}{2} (W_{k1} - W_{k2} - I^*(t))$$

Similarly, for the parent, equations (21) and (22) imply that

(28) $$s_p^* = \tfrac{1}{2} (W_{p1} - W_{p2} - T^*(t) + I^*(t)/(1-t))$$

Setting T=o and taking the derivatives of (27) and (28) with respect to t, noting that $B^*=I^*(t)/(1-t)$, adding the results, and rearranging yields:

(29) $$d(s_p + s_k) / dt = (B/2) (\epsilon_{Bt} + 1),$$

where $\epsilon_{Bt} = (dB/dt)*(t/B)$ and represents the elasticity of the gross bequest with respect to the estate tax rate.

However, with revenue recycling,

(30) $$T^* = t (I^*/(1-t).$$

Differentiating (27), (28) and (30) with respect to t, and substituting the third derivative into the formula for the second yields the result that $d(s_p + s_k)/dt = 0$.

Altruism without Commitment Power

When the parent cannot commit to future transfer levels, the model is solved by backward induction. The parent takes the government transfer T as exogenous. In the second period, the parent observes the financial status of the child, $W_{k2} + s_k$, and chooses I:

$$(31) \quad \underset{I}{Max} \quad u_p(c_{p2}) + \theta u_k(c_{k2})$$

subject to:

$$c_{p2} = W_{p2} + T + s_p - I/(1-t)$$

$$c_{k2} = W_{k2} + s_k + I$$

The optimal I^* satisfies the first-order condition:

$$(32) \qquad -\frac{1}{1-t}\frac{\delta u_p}{\delta c_{p2}} + \theta\frac{\delta u_k}{\delta c_{k2}} \leq 0; \quad I \geq 0$$

given the child's saving and the parent's saving. If I>0, then:

$$(33) \qquad \frac{\delta I^*}{\delta s_k} = \frac{-\theta u_k''(c_{k2})}{\frac{u_p''(c_{p2})}{(1-t)^2} + \theta u_k''(c_{k2})} < 0$$

and

$$(34) \qquad \left|\frac{\delta I^*}{\delta s_k}\right| < 1$$

Equations (33) and (34) illustrate the disincentive effects of the altruistic transfer policy on the child's saving. If the child saves an additional dollar, the transfer is reduced by $|\delta I^*/\delta s_k|$. This implicit tax leads the child to over consume in the first period relative to the efficient solution described above.

Next, the child takes the parent's transfer policy $I^*(s_k)$ as given and chooses saving, s_k, to maximize lifetime utility:

$$(35) \qquad \underset{s_k}{Max} \quad u_k(c_{k1}) + u_k(c_{k2})$$

subject to:

$$c_{k1} = W_{k1} - s_k$$
$$c_{k2} = W_{k2} + s_k + I^*(s_k)$$

The child's optimal saving, s_k^*, satisfies the first order condition:

$$(36) \qquad -\frac{\delta u_k}{\delta c_{k1}} + \frac{\delta u_k}{\delta c_{k2}}(1 + \frac{\delta I^*}{\delta s_k}) = 0$$

After the child chooses saving, the parent chooses s_p, given $s_k(s_p)$ and $I^*(s_p, s_k(s_p))$, to maximize lifetime utility,

$$(37) \qquad \underset{s_p}{Max} \; u_p(c_{p1}) + u_p(c_{p2}) + \theta\{u_k(c_{k1}) + u_k(c_{k2})\}$$

subject to:

$$c_{p1} = W_{p1} - s_p$$
$$c_{p2} = W_{p2} + T + s_p - I^*(s_p, s_k(s_p))/(1-t)$$
$$c_{k1} = W_{k1} - s_k^*(s_p)$$
$$c_{k2} = W_{k2} + s_k^*(s_p) + I^*(s_p, s_k(s_p))$$

which implies

$$(38) \qquad -\frac{\delta u_p}{\delta c_{p1}} + \frac{\delta u_p}{\delta c_{p2}}[1 - \frac{1}{(1-t)}(\frac{\delta I^*}{\delta s_p} + \frac{\delta I^*}{\delta s_k}\frac{\delta s_k}{\delta s_p})] + \theta\frac{\delta u_k}{\delta c_{k2}}\frac{\delta I^*}{\delta s_p} = 0$$

When revenue is recycled, the condition that $T^* = t\, I^*/(1-t)$ is imposed at this point. No analytic solutions are available. Simulations are discussed in the text.

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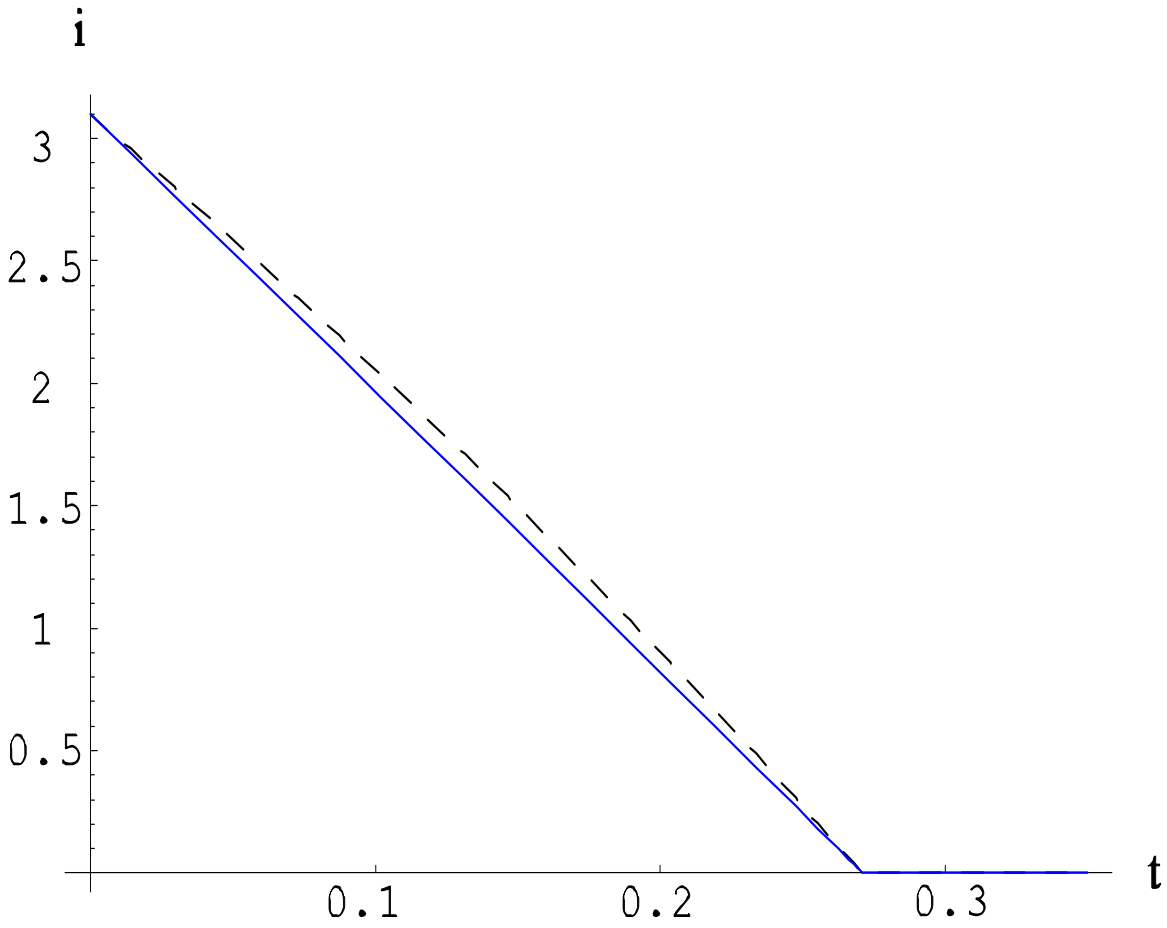
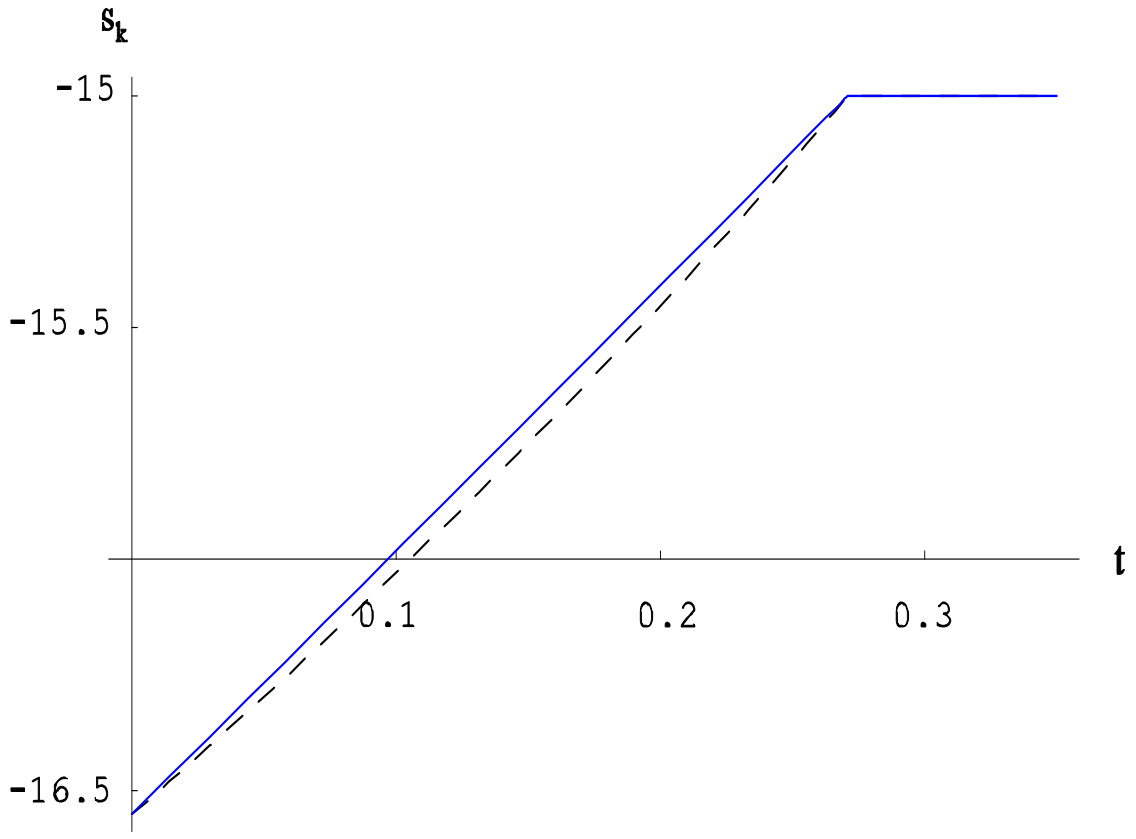
Figure 1:
Inheritance Under Altruism With Commitment Power



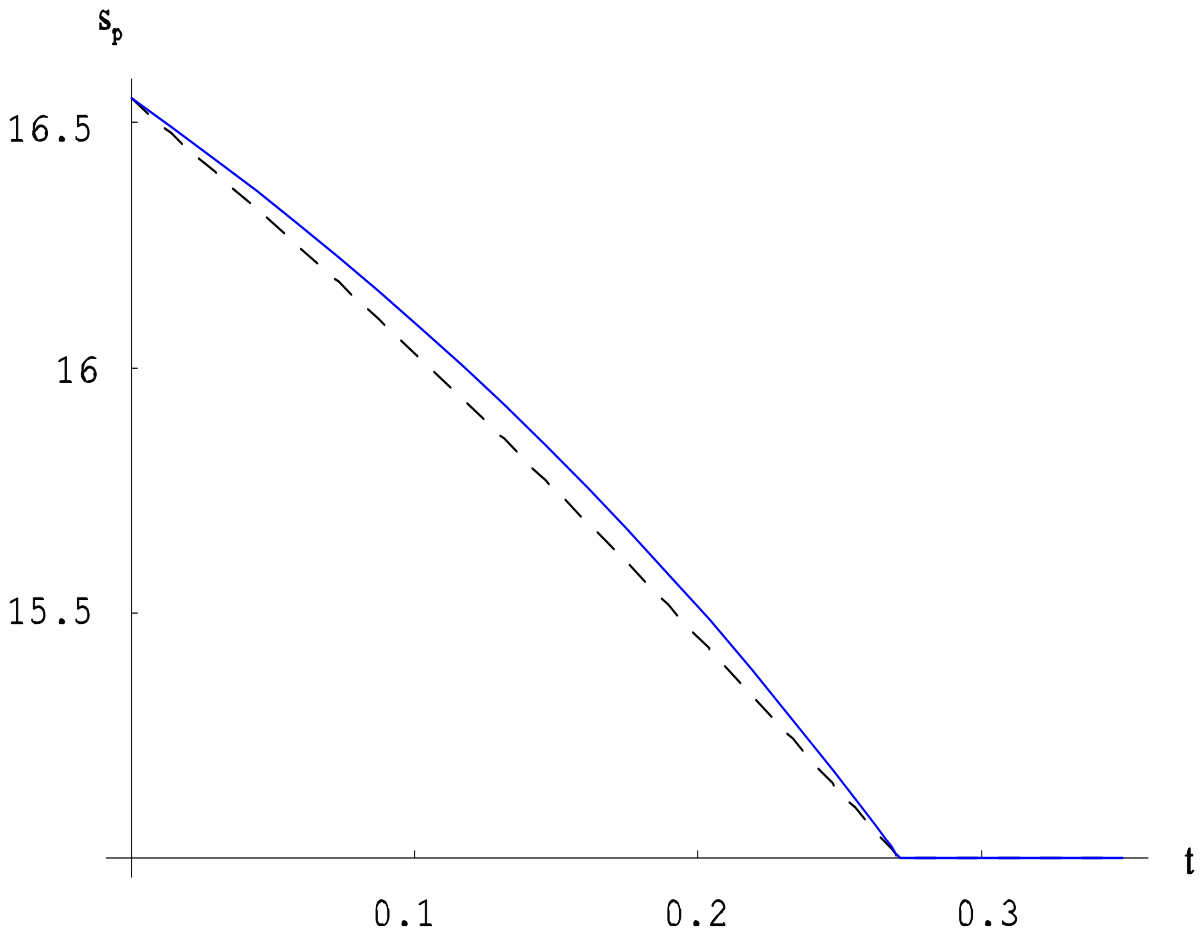
—— No revenue returned
- - -Revenue returned to parent in second period

Figure 2:
Child's Saving Under Altruism With Commitment Power



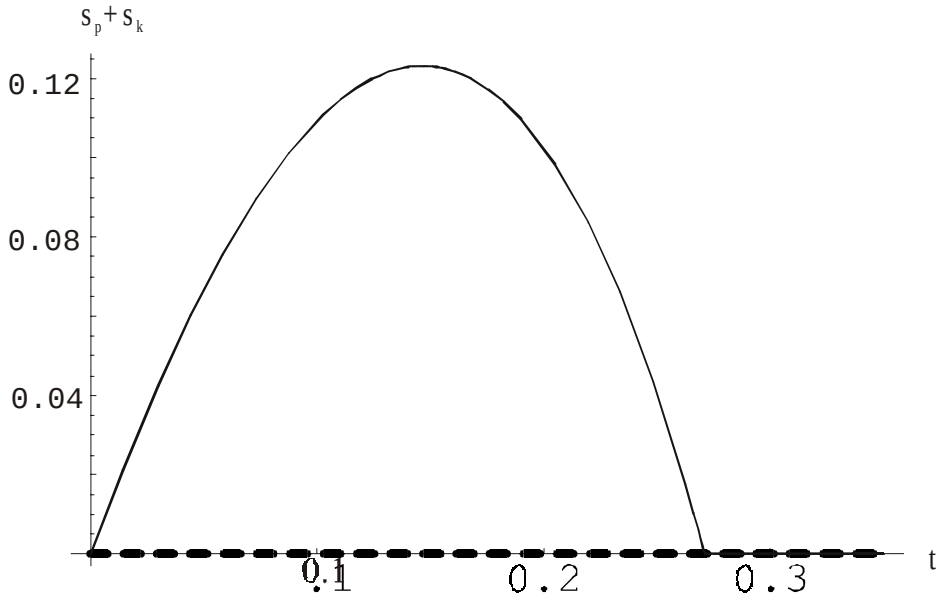
—— No revenue returned
- - -Revenue returned to parent in second period

Figure 3:
Parent's Saving Under Altruism With Commitment Power



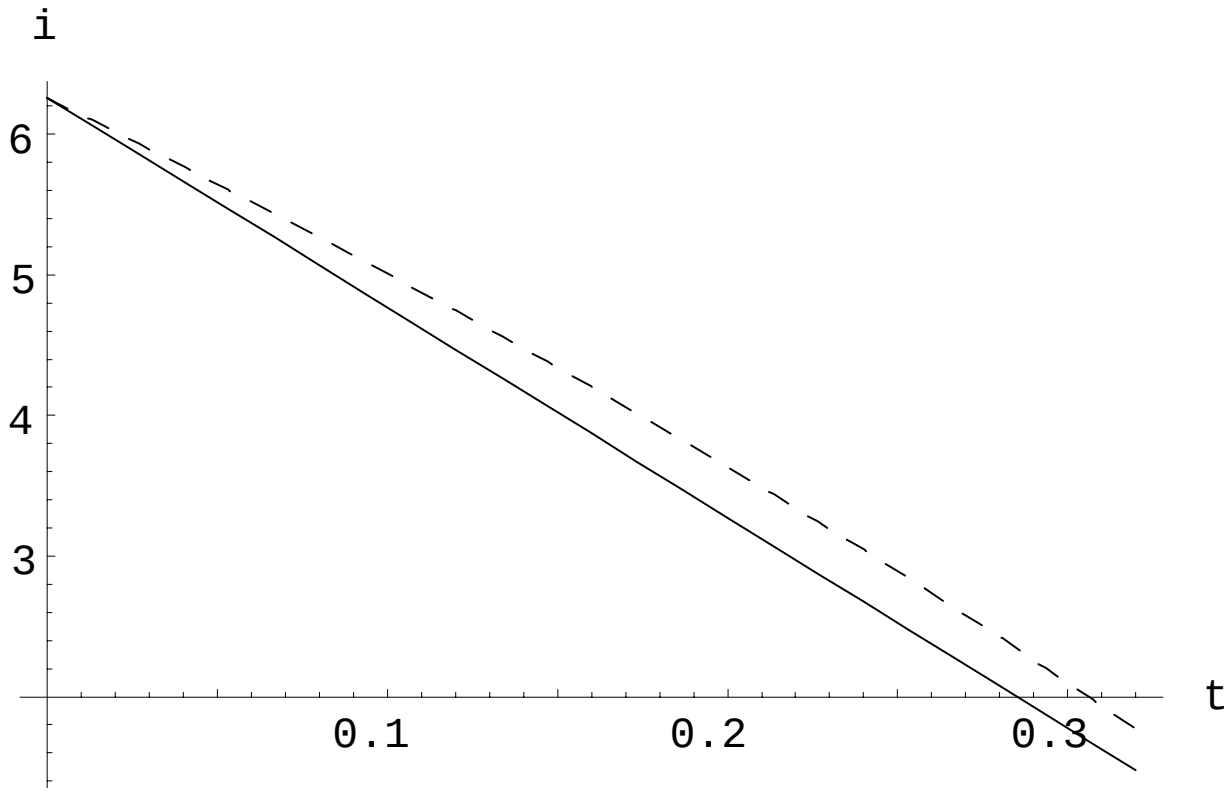
—— No revenue returned
- - -Revenue returned to parent in second period

Figure 4:
Total Family Saving Under Altruism With Commitment Power



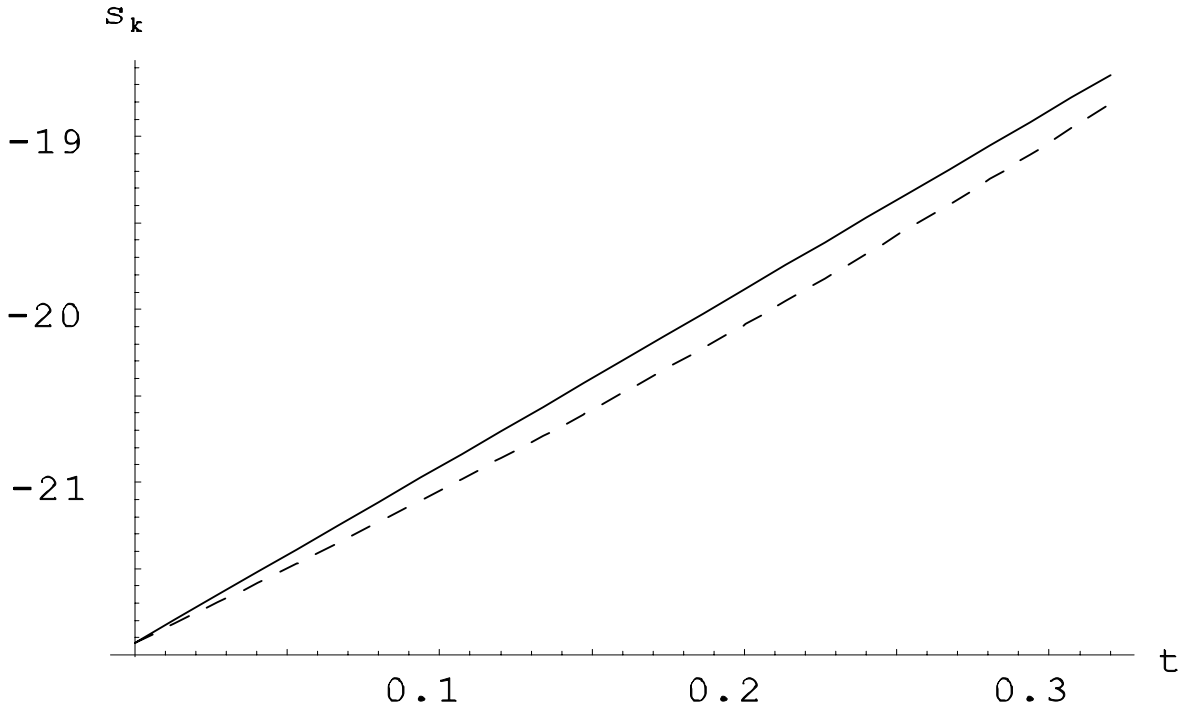
— No revenue returned
- - -Revenue returned to parent in second period

Figure 5:
Inheritance Under Altruism Without Commitment Power



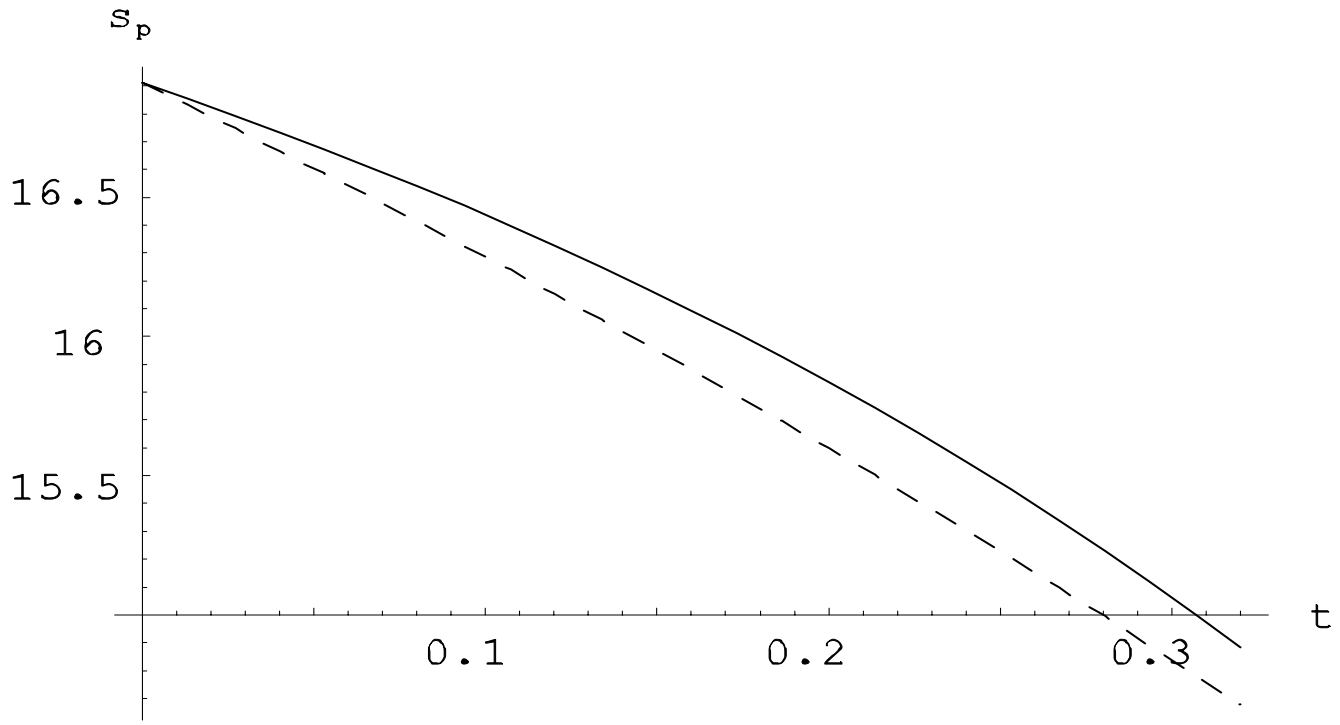
— No revenue returned
- - -Revenue returned to parent in second period

Figure 6:
Child's Saving Under Altruism Without Commitment Power



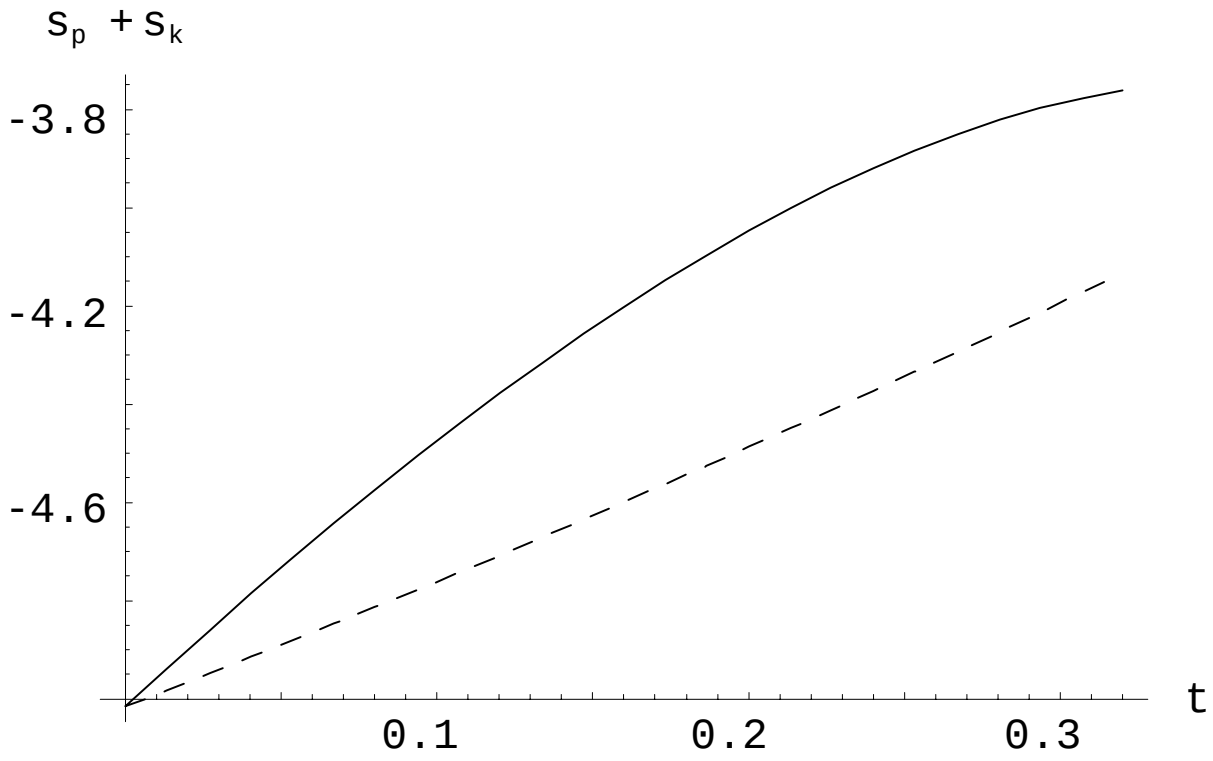
—— No revenue returned
- - -Revenue returned to parent in second period

Figure 7:
Parent's Saving Under Altruism Without Commitment Power



— No revenue returned
- - -Revenue returned to parent in second period

Figure 8:
Total Family Saving Under Altruism Without Commitment Power



—— No revenue returned
- - -Revenue returned to parent in second period