The Welfare Effects of Debt: Crowding Out and Risk Shifting

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Abstract

Government debt affects people's welfare through two distinct channels: It crowds out capital, and it shifts risk from current to future generations. This study extends Blanchard (2019) analysis of the welfare effects of debt by decomposing his estimates into those two categories. Blanchard estimated the change in average utility under simulations of an overlapping generations model with and without a transfer of wealth from the younger to the older generation. This study decomposes those estimated welfare effects into crowding-out and risk-shifting components and estimates total effects and separate effects of the two components under alternative assumptions about technology and preferences. Even though crowding out can increase welfare under some conditions in overlapping generations models by reducing the overaccumulation of capital, I estimate the crowding-out effect of debt on welfare to be consistently negative. Government debt shifts risk to future generations by giving certainty to current generations that are saving for retirement at the expense of greater risk to future generations. I find the risk-shifting effect of debt on welfare to be positive under Blanchard's assumptions about technology and preferences, and that positive effect partially or fully offsets the cost of crowding out on the total welfare effect of risk-free transfers. Under alternative assumptions—persistent technology shocks and a greater aversion to intergenerational risk—risk-free debt is much more costly than under Blanchard's assumptions, partly because the crowding-out effect is larger and partly because risk shifting has negative rather than positive effects.

Keywords: interest rates, fiscal policy, crowding out, government debt, risk shifting

JEL Classification: E22, E23, E43, E62, H50, H63

1 Introduction

Persistently low government interest rates have led researchers and policymakers to suggest that the welfare effects of rising government debt in the United States and other high-income countries might be smaller than previously thought (Blanchard, 2019; Furman and Summers, 2019). U.S. federal debt is highly liquid and widely viewed as offering a risk-free return. The average nominal interest rate on federal government debt (r) in the United States declined from 6.6 percent in the 1990s to 2.1 percent from 2010 to 2025 (see Figure 1). The growth rate of the economy (g) has fallen as well, but remained higher than r; since 2010, r has averaged 2.8 percent less than g. Although this relationship remains relatively benign for high levels of debt compared to historical experience, the recent increase in rates suggests it is less so than in the previous decade. In a situation in which $r < g$ and the federal budget is in primary balance (that is, governmental noninterest spending is equal to revenues), the ratio of debt to gross domestic product (GDP) will shrink.[2] The U.S. debt-to-GDP ratio has risen in the past two decades even though $r < g$, mainly because of large primary deficits (which result when noninterest spending is higher than revenues). The Congressional Budget Office projects that primary deficits will continue through the next 30 years (Congressional Budget Office, 2026). Even so, spending on interest has remained historically low because of historically low levels of r.

Although government interest rates have declined since 2010, the net marginal rate of return on capital (R) has remained steady over the same period (Congressional Budget Office, 2024, Figure 3). The marginal rate of return on capital is relevant to the welfare effect of higher government debt because one of the main effects of government debt is to crowd out private investment in capital. The marginal rate of return measures the benefits of the capital that is crowded out and thus the welfare cost of reduced investment. Given a steady marginal rate of return coupled with declining growth and risk-free interest rates, the

[2] In CBO's projections, a higher ratio of debt to GDP results in increases in interest rates that ultimately propel r above g by 2031.

difference between the marginal product of capital and the growth rate of the economy has increased, as has the risk premium $(R - r)$.

The gap between r and R leads to the question: which rate matters for the welfare effects of debt? Under the overlapping generations theory developed by Diamond (1965), government debt's main role is to finance transfer payments to older generations. The original OLG model was deterministic and thus did not distinguish between the risk-free rate and the marginal product of capital—in other words, between r and R—leaving unclear implications for a situation in which $r < g < R$. To sort out whether r or R is more important, Blanchard (2019) analyzed the welfare effects of transfers and debt rollovers in a stochastic overlapping generations (OLG) model in which r and R differ. Under his model, a representative household lives two periods—one in which it is young and working and the other in which it is retired and living off investments made when it was young—each equal in length to a generation. Blanchard (2019) found that the effect of a debt-financed transfer program on households' lifetime utility depended on both r and R, and concluded that additional debt either has low welfare costs or might produce small welfare benefits under a situation in which $r < g$.

In this study, I extend the Blanchard (2019) model to estimate two distinct effects on welfare, which I term *crowding out* and *risk shifting*. Crowding out occurs because government debt absorbs private savings that could otherwise be used for private capital investment. Government debt also shifts risk from current to future generations: it takes risk away from current generations by giving them a certain return in their retirement, and places the obligation associated with that certain return on future generations, whose resources to shoulder that burden are uncertain. Shifting risk from current to future generations can be Pareto-improving or have the opposite effects, depending on the persistence of technology shocks and preferences (Falkenheim, 2021).

The distinction between crowding out and risk shifting is important for understanding the policy implications of the results in Blanchard (2019). An increase in debt results in both crowding out and risk shifting, but other policies can produce one outcome without the

other. For example, the government could shift risk without crowding out capital if it issued debt and invested the proceeds in risky assets. Alternatively, the government could achieve crowding out with less risk shifting if it took on obligations that did not shift risk to future generations. Bohn (2008) suggests that a debt obligation whose payments were tied to GDP would shift the burden of repayment to future generations without shifting risk. Types of obligations differ in how much risk they shift: unfunded wage-indexed obligations (such as Social Security benefits) place a burden on future generations just like federal debt but leave a considerable amount of market risk with the beneficiary (Geanakoplos and Zeldes, 2010; Bohn, 2009).

My main strategy for decomposition is to treat a risk-free transfer as a combination of a risky transfer (which achieves crowding out) and a swap (which shifts risk). I replicate the Blanchard (2019) simulations and decompose the welfare effects into crowding-out and risk-shifting components. My findings under the parameters in Blanchard (2019) are that crowding out is costly for welfare if $R > g$ and beneficial if $R < g$. The effects of risk shifting on welfare are usually, but not always, positive.

The welfare effects are larger when I exclude a risk-free endowment that Blanchard (2019) introduced to avoid the possibility of default from the transfer. Without that endowment, the crowding-out effect is more negative, the risk-shifting effect is more positive, and the total effect is more negative.

I also vary assumptions related to risk aversion and the persistence of technology shocks. Under a specification with no risk-free endowment, high aversion to lifetime consumption risk, and persistent technology shocks, the welfare cost of debt is about four times as large as under original assumptions. These findings are consistent with Evans (2020), who shows that the positive welfare effects in Blanchard (2019) depend on the assumption of a large risk-free endowment, and with Hasanhodzic (2020), who finds in a 10-period OLG model that a pay-as-you-go Social Security program makes future generations worse off by the equivalent of a 20 percent loss of consumption.

2 Crowding Out and Risk Shifting in Overlapping Generations Models

The Congressional Budget Office (2026) describes crowding out as follows: "When the federal government borrows in financial markets, it competes with other participants for funds. That competition can crowd out private investment, reducing economic output and income in the long term." That description does not specify whether crowding out has a negative or positive effect on welfare.

Although crowding out of capital might seem to be a negative consequence of government debt, it can theoretically have a positive effect on consumption and welfare. Capital investment can be too high under laissez faire in the classic OLG analysis of Diamond (1965). Given that overaccumulation of capital, government policies that crowd out capital can make all generations better off. Abel et al. (1989) studied whether the U.S. economy had excess capital by comparing the cash flows generated by capital with the level of investment. They showed that if the income from capital exceeds investment, the economy is dynamically efficient and does not suffer from overaccumulation. Using this criterion, they found no evidence of overinvestment in the U.S. economy, implying that crowding out capital would be strictly costly in a deterministic setting.

The Blanchard (2019) model came to a somewhat different conclusion, finding that when $r < g$, either the welfare cost of debt might be low or, in some cases, debt could result in welfare benefits. Decomposing the welfare effects into crowding out and risk shifting may shed light on this discrepancy. The measures in Abel et al. (1989) are designed to detect whether the quantity of capital is too high but not whether there is an efficient level of risk shifting. The Blanchard (2019) analysis incorporates risk shifting largely because its focus is on prices instead of quantities, calibrating a measure of risk aversion to the risk premium—the difference between the marginal product of capital and the risk-free rate.

Decomposing welfare effects into crowding out and risk shifting also highlights the

limitations of large-scale heterogeneous OLG models, which tend not to incorporate aggregate uncertainty (Congressional Budget Office, 2019). Such models generally do not assume uncertainty at the aggregate level and thus are not well-suited to estimating the effects of intergenerational risk sharing. In general, they incorporate many more than two overlapping generations and multiple categories of households within each generation. Those features make large-scale OLG models suitable for studying the distributional effects of fiscal policies, both within and across generations, but that same richness in detail makes it difficult for them to handle the computational burden of aggregate uncertainty. To limit that burden, most large-scale OLG models portray individual households as facing uncertainty in their own income but not in aggregate income, such that all risk is idiosyncratic and risk shifting occurs entirely within generations rather than between them. In contrast, the model in this study features one representative household per generation that faces systematic risk.

3 Decomposing the Effect of Intergenerational Transfers on Lifetime Utility

The model assumes that each generation has a lifetime utility that is a weighted average of utility between their youth and old age:

$$U = (1 - \beta)U(C_{1t}) + \beta\,\mathbb{E}_t[U(C_{2t+1})] \tag{3.1}$$

where $\beta \in (0, 1)$ is the weight on utility in old age in period t. Consumption is C_{1t} in youth and C_{2t+1} in old age:

$$C_{1t} = W_t - K_{t+1} - D_t \tag{3.2}$$

$$C_{2t} = (1 + R_{t+1})K_{t+1} + D_{t+1} \tag{3.3}$$

where W_t denotes wages, K_{t+1} savings invested in capital, R_{t+1} the net return on capital, D_t the transfer made to the older generation, and D_{t+1} the transfer received in old age.

The derivative of lifetime utility with respect to D has two components—a direct effect (dU_{at}) and an indirect effect (dU_{bt}) operating through changes in relative prices.[3] The direct effect is:

$$dU_{at} = -\beta r \, \mathbb{E}_t[U'(C_{2t+1})] \, dD \tag{3.4}$$

where r denotes the net risk-free interest rate. When $r < 0$ (equivalently, $r < g$ in the zero-growth case), the direct welfare effect of higher transfers is positive.

I assume that D_t is a function of two parameters: D_V, the size of the variable (risky) transfer, and D_S, the size of the swap of a risky transfer for a fixed transfer:

$$D_t = D_V \frac{A_t}{\bar{A}} + D_S \left(1 - \frac{A_t}{\bar{A}}\right) \tag{3.5}$$

The direct effect decomposes as $dU_{at} = dU_{Vt} + dU_{St}$, where dU_{Vt} is the partial derivative with respect to the risky transfer and dU_{St} is the partial derivative with respect to the swap. Setting $D_V = D_S = D$ replicates the fixed transfer from Blanchard (2019).

The partial derivative measuring the effect of the risky transfer is (see Appendix A):

$$dU_{Vt} = \beta \, \mathbb{E}_t[(1 + R_{t+1})U'(C_{2t+1})]\left(\frac{1}{1+\bar{R}} - \frac{A_t}{\bar{A}}\right) dD_V \tag{3.6}$$

This partial derivative is negative when $\frac{1}{1+\bar{R}} < \frac{A_t}{\bar{A}}$, which holds on average because $R > 0$.

The partial derivative with respect to the swap is:

$$dU_{St} = \beta \, \mathbb{E}_t[U'(C_{2t+1})]\left\{1 + \frac{A_t}{\bar{A}} - (1+r)\left(\frac{\bar{R}+2}{1+\bar{R}}\right)\right\} dD_S \tag{3.7}$$

This partial derivative is smaller the lower the value of r and the higher the value of R, so the direct benefit of a swap increases with the risk premium $(R - r)$.

[3] For the expression of dU_{bt}, see Blanchard (2019), Section II.

4 Simulations With Risky and Risk-Free Transfers

I decompose the welfare effects of intergenerational transfers into crowding-out and risk-shifting components by separately simulating the effect of risky and risk-free transfers. I also develop more general versions of the technology shocks and preferences in Blanchard (2019).

4.1 Notation

Each generation lives two periods. One period represents a generation, set to 25 years. The generation born at time t consumes C_{1t} when young and C_{2t+1} when retired.

Production. The production function is stochastic with A_t as the level of productivity. I focus mainly on Cobb-Douglas production but also consider the linear case:

$$\begin{aligned} \text{Cobb-Douglas:} \quad & f(K_t, N_t) = A_t K_t^b N_t^{1-b} \\ \text{Linear:} \quad & f(K_t, N_t) = A_t \left[bK_t + (1-b)N_t \right] \end{aligned}$$

where K_t is capital, N_t effective labor, b capital's share of output, and g the growth rate of N_t. I define $k_t \equiv K_t/N_t$. In competitive equilibrium:

$$\begin{aligned} \text{Cobb-Douglas:} \quad & W_t = (1-b)A_t k_t^b, \quad 1 + R_t = bN_t A_t k_t^{b-1} \\ \text{Linear:} \quad & W_t = (1-b)A_t, \quad 1 + R_t = bA_t \end{aligned}$$

Technology. The path of technology follows an autoregressive process:

$$\log A_{t+1} = \mu + \rho(\log A_t - \mu) + \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0, \sigma^2) \tag{4.1}$$

where μ is the long-run mean of $\log A_t$ and ρ determines shock persistence. Blanchard sets $\rho = 0$ (white noise), which is treated as a special case here. The conditional expectation of

A_{t+1} is:

$$\mathbb{E}_t[A_{t+1}] = e^{\mu+\rho(\log A_t-\mu)+\sigma^2/2} \tag{4.2}$$

Endowment. Following Blanchard, I assume that the young receive a risk-free endowment X_t equal to mean wages in period $t+1$:[4]

$$X_t = \overline{W_{t+1}} = (1-b)N_t\left(\frac{R}{b}\right)^{\frac{b}{b-1}}(\mathbb{E}_t[A_{t+1}])^{\frac{1}{1-b}} \tag{4.3}$$

I include this endowment in initial simulations for comparability with Blanchard, then forgo it in the remainder because it is not necessary to make the transfer feasible.[5]

Transfers. I simulate the model under three scenarios: (1) without a transfer, (2) with a risky transfer, and (3) with a risk-free transfer. The risk-free transfer is defined as:

$$D_{t+1,\text{risk-free}} = \alpha\,\overline{W_{t+1}} \tag{4.4}$$

where α is calibrated so the transfer equals 20 percent of steady-state capital on average. The risky transfer is:

$$D_{t+1,\text{risky}} = D_{t+1,\text{risk-free}}\,\frac{A_{t+1}}{\mathbb{E}[A_{t+1}]} \tag{4.5}$$

and the swap exchanges $D_{t+1,\text{risky}}$ for $D_{t+1,\text{risk-free}}$.

Utility. I assume a generalized Epstein-Weil-Zin[6] utility function:

$$U_t\Big(C_{1t}, \mathbb{E}_t\Big[C_{2t+1}^{1-\gamma}\Big]\,\Big|\beta\Big) = C_{1t}^{1-\beta}\left(\mathbb{E}_t\left[\frac{C_{2t+1}^{1-\gamma}}{1-\gamma}\right]\right)^{\beta} \tag{4.6}$$

[4]Blanchard estimated mean wages initially on the basis of this formula and then developed a more precise estimate from steady-state simulations. I forgo that second step because I examine cases where $\rho \neq 0$.

[5]Evans et al. (2013) found some risk of default on such a transfer. However, my simulations without the endowment did not produce any infeasible cases: the transfer is set to 20 percent of average steady-state capital, approximately one-tenth of steady-state wages, and actual wages never fell below that threshold even following sequences of low productivity draws.

[6]See Epstein and Zin (1989) and Weil (1990).

where γ represents aversion to consumption risk in old age. The social welfare function aggregates utility across generations:

$$\text{Welfare}(\chi) = \sum_{t=1}^{T} \frac{1}{1-\chi} \left(U_t\Big(C_{1t}, \mathbb{E}_t\Big[C_{2t+1}^{1-\gamma}\Big] \,\Big|\beta\Big)\right)^{1-\chi} \tag{4.7}$$

where χ measures aversion to the risk that a generation will be born into a lifetime of low consumption, but not the risk that the generation will face uncertainty within its lifetime. The parameter χ affects the trade-off between the utility of different generations under a social planner's decisions: the higher the value of χ, the more costly is variance between the lifetime consumption of different generations, because it relates to the risk of being born into an inferior set of choices rather than the risk that one's choices will turn out badly. When $\chi = 1$, the social welfare function reduces to the logarithmic specification used in Blanchard:

$$\text{Welfare}(1) = \sum_{t=1}^{T} \left[(1-\beta) \log C_{1t} + \frac{\beta}{1-\gamma} \log \mathbb{E}_t\Big[C_{2t+1}^{1-\gamma}\Big] \right] \tag{4.8}$$

Savings and Consumption. The Euler equation is:

$$(1-\beta)\frac{1}{C_{1t}} = \beta \, \frac{\mathbb{E}_t\Big[R_{t+1} C_{2,t+1}^{-\gamma}\Big]}{\mathbb{E}_t\Big[C_{2,t+1}^{1-\gamma}\Big]} \tag{4.9}$$

The budget constraints are:

$$C_{1t} = N_t W_t + X_t - D_t - K_{t+1} \tag{4.10}$$

$$C_{2t+1} = D_{t+1} + b N_{t+1} A_{t+1} k_{t+1}^{b} \tag{4.11}$$

4.2 Calibration

Following Blanchard, I calibrate the model to different target values of the annual risk-free interest rate r and the annual marginal product of capital R (see Table 1). Because a generation lasts 25 years, I raise annual rates to the power of 25. The mean value of $\log A_t$,

μ, is set to 3 for the Cobb-Douglas function and calibrated to R in the linear version.[7] The growth rate g is set to 0 except in one sensitivity analysis. Capital's share $b = 1/3$ and $\sigma = 0.2$ follow Blanchard. The risk aversion parameter γ is calibrated as:

$$\gamma = \frac{\log R - \log r}{\sigma^2} \tag{4.12}$$

4.3 Simulation of Steady State Without and With Transfers

Following calibration, I simulate the steady-state economy under three conditions—no transfer, a risky transfer, and a risk-free transfer—holding all parameters fixed:

1. A baseline without any transfer;
2. One with the risky transfer $D_{t+1,\text{risky}}$ defined in equation (4.5);
3. One with the risk-free transfer $D_{t+1,\text{risk-free}}$ defined in equation (4.4).

The estimated effect of crowding out on welfare equals the difference in utility between simulations (2) and (1). The estimated effect of risk shifting equals the difference between simulations (3) and (2). The total welfare effect is the difference between simulations (3) and (1), comparable to Blanchard's estimates.

5 Simulation Results

The simulations produce estimates of total welfare effects that replicate Figure 9 in Blanchard (2019) (see Figure 2). Both r and R are important in determining the welfare effect of a transfer. The effect of crowding out on welfare is a function of only R and is negative as long as $R > 0$. The risk-shifting effect is more heavily influenced by r and is positive in all cases,

[7] I rely on the publicly available computer code for Blanchard (`http://doi.org/10.3886/E112856V1`), which I adapted and translated from MATLAB into Python for this study. Code is posted at `www.cbo.gov/publication/58849`.

offsetting the negative effect of crowding out under both Cobb-Douglas and linear production (see Figures 3 and 4).

The welfare effects have the same sign and are larger without the risk-free endowment. The effects of crowding out on welfare are more negative, the risk-shifting effects are more positive, and the total effect is more negative (see Figure 5). The endowment may make the transfer less costly by raising household income and thus the amount needed to save for old age, raising the potential for overaccumulation of capital and lowering the welfare cost of policies that counter that overaccumulation.

The analysis suggests that the crowding out associated with debt is costly and that the risk-shifting properties of debt tend to partially offset that cost.[8] Under that finding, high structural deficits, as projected in the United States, come at a significant cost, at least relative to a policy that issues an equal amount of debt but invests it in financial assets. These findings also confirm that risk shifting accounts for the difference between the findings in Blanchard (2019) that additional debt has low cost and the results in Abel et al. (1989) that the level of capital is not excessive.

6 Welfare Effects Under Alternative Preferences and Persistent Shocks

Shifting risk to future generations can be Pareto-efficient if those generations are either less exposed to the risks facing current generations or less averse to them. If technology shocks are permanent, as discussed in Falkenheim (2021), future generations will be as exposed to them as current generations. Whether future generations are averse to those risks depends on how unhappy they are likely to be if born into a relatively unfavorable economy. With those considerations in mind, I study three variations beyond excluding the

[8]These conclusions do not apply to cyclical deficits. The model implicitly assumes that demand is always sufficient to reach maximal employment and thus has no implication for fiscal policy's role in supporting aggregate demand.

risk-free endowment: alternative preferences that make intergenerational inequality more costly, persistent technology shocks, and positive economic growth.

6.1 Alternative Preferences

The preferences in Blanchard (2019) represent the special case $\chi = 1$ of equation (4.7). As discussed in Falkenheim (2021), the parameter χ enters the social planner's optimization but does not affect each generation's individual choices. It represents how much better off each generation might have been had it been born into a different opportunity set, as opposed to how its choices turn out within the opportunity set it actually has. The relative values of γ (aversion to individual consumption risk) and χ determine whether within-generation risk or across-generation inequality is more important for social welfare. When $\chi > \gamma$, inequality between generations is more costly than risk within the lifetime of a single generation. The value of γ is calibrated to the risk premium—the difference between the marginal return on capital and the risk-free rate—and is greater than 1 in most cases. Thus, the simulations in Blanchard (2019) and those earlier in this study generally assume that mitigating within-generation retirement risk is more important than smoothing aggregate consumption fluctuations between generations. I examine a contrasting case with a high value of χ, where the social planner is highly averse to intergenerational inequality.

6.2 Persistent Technology Shocks

In the baseline model, technology shocks are temporary ($\rho = 0$). Falkenheim (2021) highlights the persistence of shocks as a key determinant of the direction of optimal risk transfer: under temporary shocks, Pareto-efficient policy transfers risk from current to future generations; under permanent shocks, the opposite holds. I consider $\rho = 0.9$, so that technology shocks are nearly permanent.

6.3 Results

Assumptions about preferences and technology critically determine the estimated welfare effects. Under a high value of χ, the welfare effect of debt is uniformly more negative than under the logarithmic ($\chi = 1$) specification (see Figure 6). Under that logarithmic specification, persistent technology shocks alone do not change the welfare effects (see Figure 7). However, the welfare cost of debt is higher under a combination of high χ and high ρ than under either alone (see Figure 8). In other words, debt is costliest under a combination of persistent technology shocks that affect future generations more heavily and preferences that make future generations more sensitive to those risks. Excluding the endowment, raising χ, and setting $\rho = 0.9$ raises the welfare cost of debt by a factor of about four relative to Blanchard (2019) (see Figure 9). Under those assumptions, risk shifting is almost always costly—instead of offsetting the negative welfare effects of crowding out, it adds to them (see Figure 10).

6.4 Positive Economic Growth

Following Blanchard (2019), the preceding analysis set $g = 0$ and used R and r to represent excesses of the marginal product of capital and risk-free rate over the growth rate, $(R - g)$ and $(r - g)$. Steady-state welfare effects for any given levels of $(R - g)$ and $(r - g)$ are slightly more negative when $g > 0$ than when $g = 0$ (see Figure 11). To calibrate to target values of $(R - g)$ and $(r - g)$, the parameter β rises with g, raising savings and offsetting the effect of growth in effective labor on the capital-to-labor ratio.

The analysis in this study, following Blanchard (2019), compares utility in the steady state after transition has taken place and does not consider effects on the utility of current generations or other generations in the relatively near future on the transition path to a new steady state. Although different growth rates may not produce much difference in steady-state welfare effects (holding $(R - g)$ and $(r - g)$ constant), they may have different implications for the trade-off between higher consumption in the near term and lower consumption in the

long run. Under the model in this study, higher growth rates can come from increases in population growth or in the growth of the level of effective labor per worker, which represents the trend of growth in technological productivity.

Under higher growth in technological productivity, the per capita consumption of future generations will be relatively high, so their marginal utility will be relatively low. Saddling those generations with more debt will have a smaller negative effect on their utility if growth is positive than if it is zero. More growth thus implies that an increase in debt will have lower costs to future generations, partially offsetting the benefits to current generations.

7 Conclusion

This paper estimates the welfare effects of government debt by decomposing them into crowding-out and risk-shifting components. I find that while crowding out is consistently costly in a calibrated overlapping generations model, the risk-shifting properties of debt can partially or fully offset these costs under certain assumptions about technology and preferences. However, this offset disappears or even reverses under more realistic assumptions of persistent technology shocks and higher aversion to intergenerational inequality.

The distinction between crowding out and risk shifting has important policy implications. While an increase in standard government debt results in both effects, other policy instruments could potentially achieve different outcomes. For example, a debt obligation whose payments are tied to GDP—as suggested by Bohn (2008)—would shift the burden of repayment to future generations without necessarily shifting the same amount of risk. Similarly, different types of social insurance obligations vary in how much market risk they leave with beneficiaries.

These results suggest that the welfare costs of rising public debt depend not just on the level of interest rates relative to growth, but on the specific design of the debt instruments and the underlying risk structure of the economy. Future work could extend this analysis to a multi-period OLG model or incorporate more complex interactions between fiscal and

monetary policy.

Figures

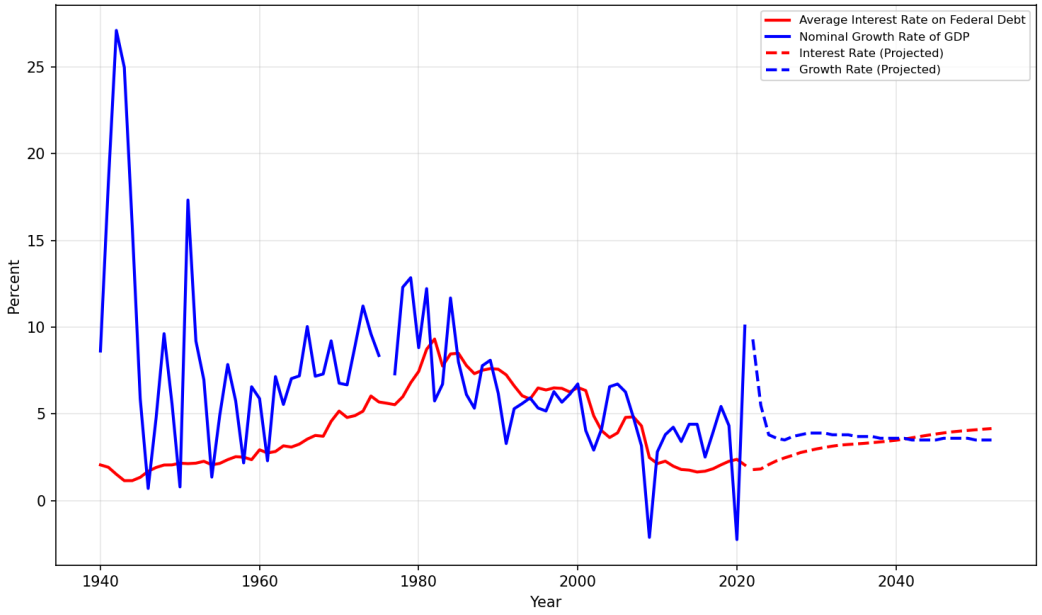


Figure 1: Nominal Growth Rate of the U.S. Economy and Effective Interest Rate on Federal Debt (Percent)

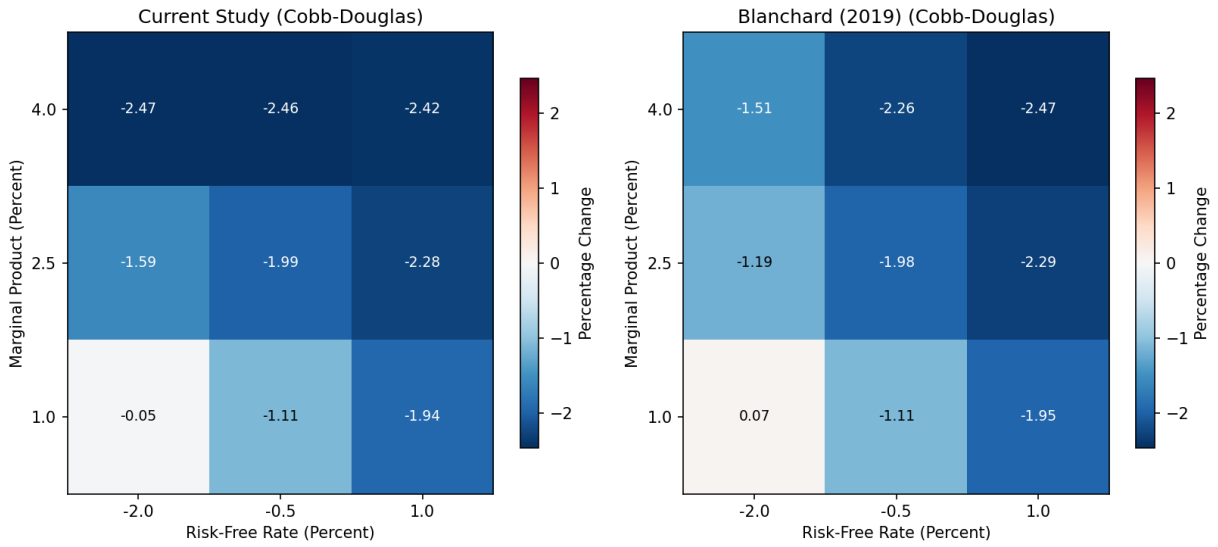


Figure 2: Effects of a 20 Percent Transfer on Lifetime Utility: Comparison with Blanchard (2019) (Percentage change)

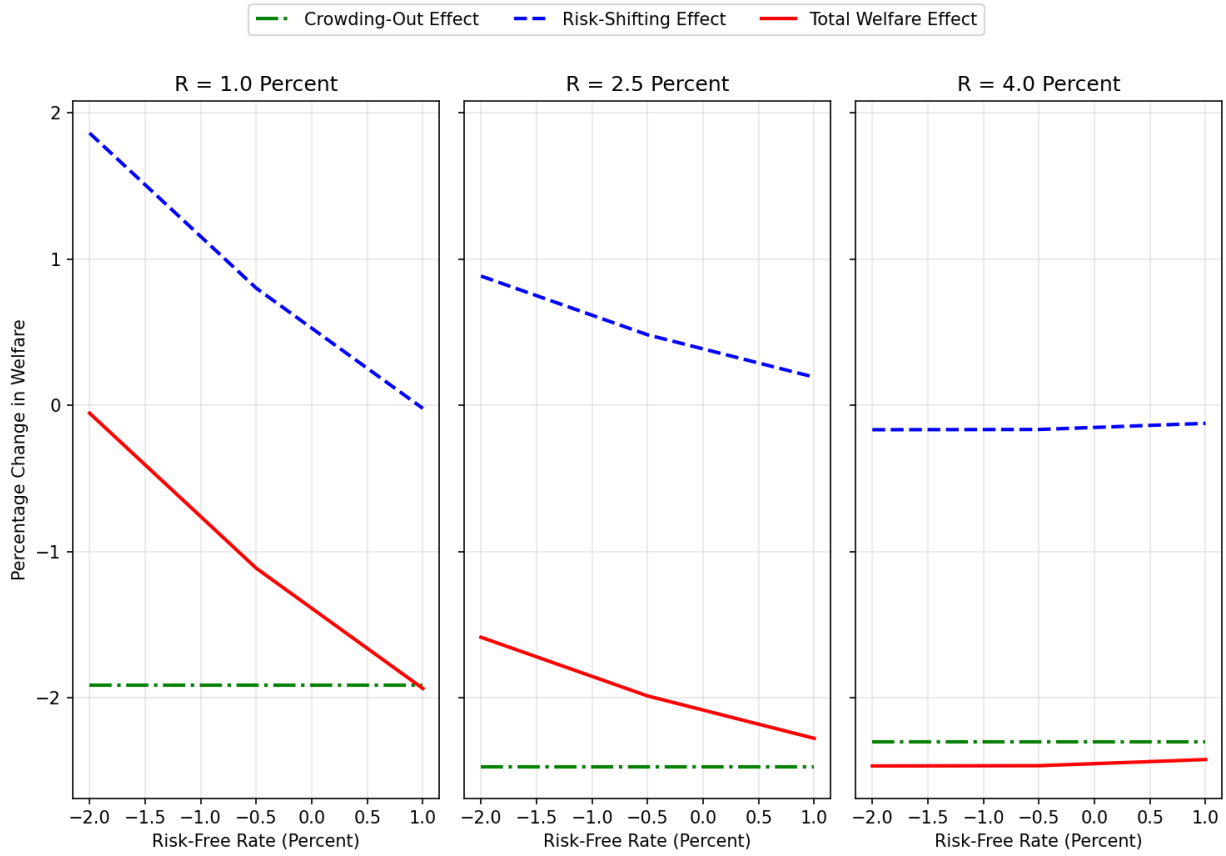


Figure 3: Effects of a 20 Percent Transfer on Lifetime Utility Under a Cobb-Douglas Production Function, Without Endowment (Percentage change)

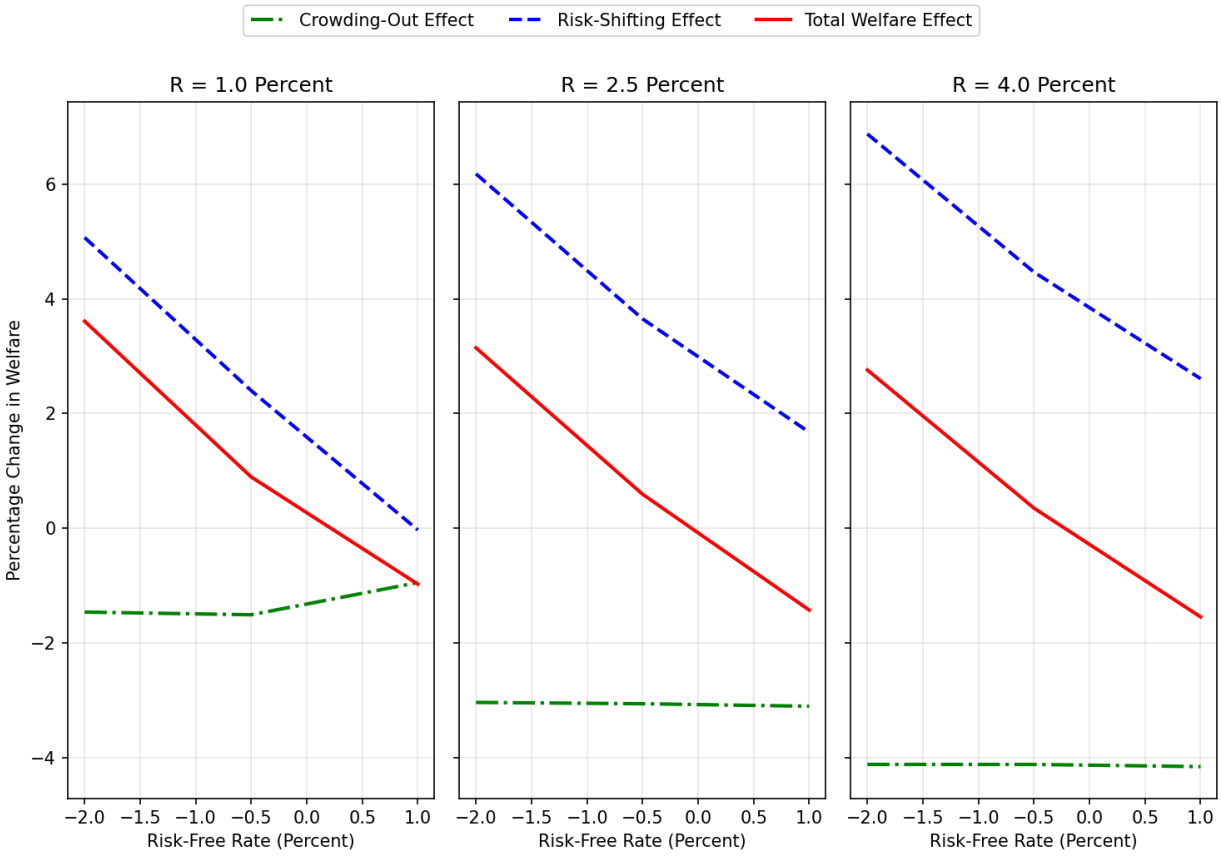


Figure 4: Effects of a 20 Percent Transfer on Lifetime Utility Under a Linear Production Function, Without Endowment (Percentage change)

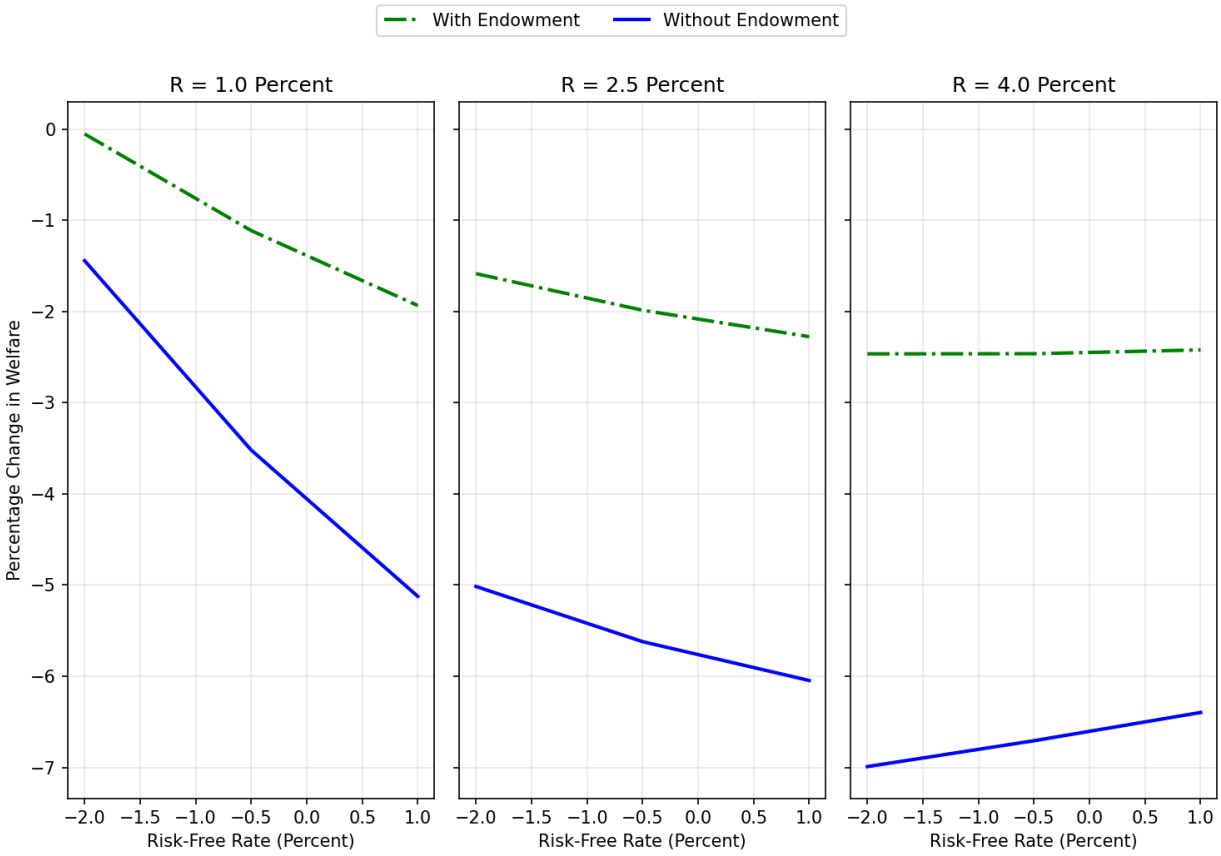


Figure 5: Effects of a 20 Percent Transfer on Lifetime Utility, With and Without Risk-Free Endowment (Percentage change)

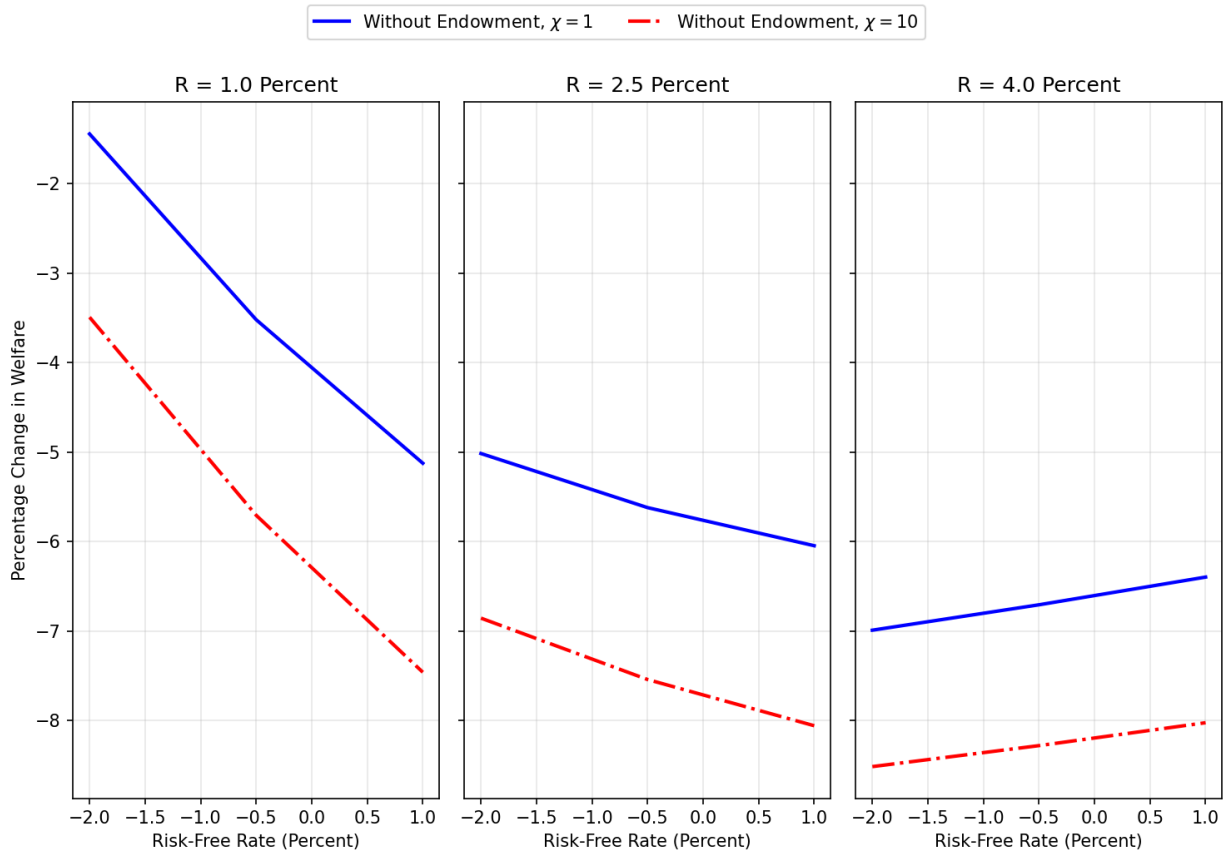


Figure 6: Effects of a 20 Percent Transfer on Lifetime Utility by Level of Aversion to Intergenerational Risk (Percentage change)

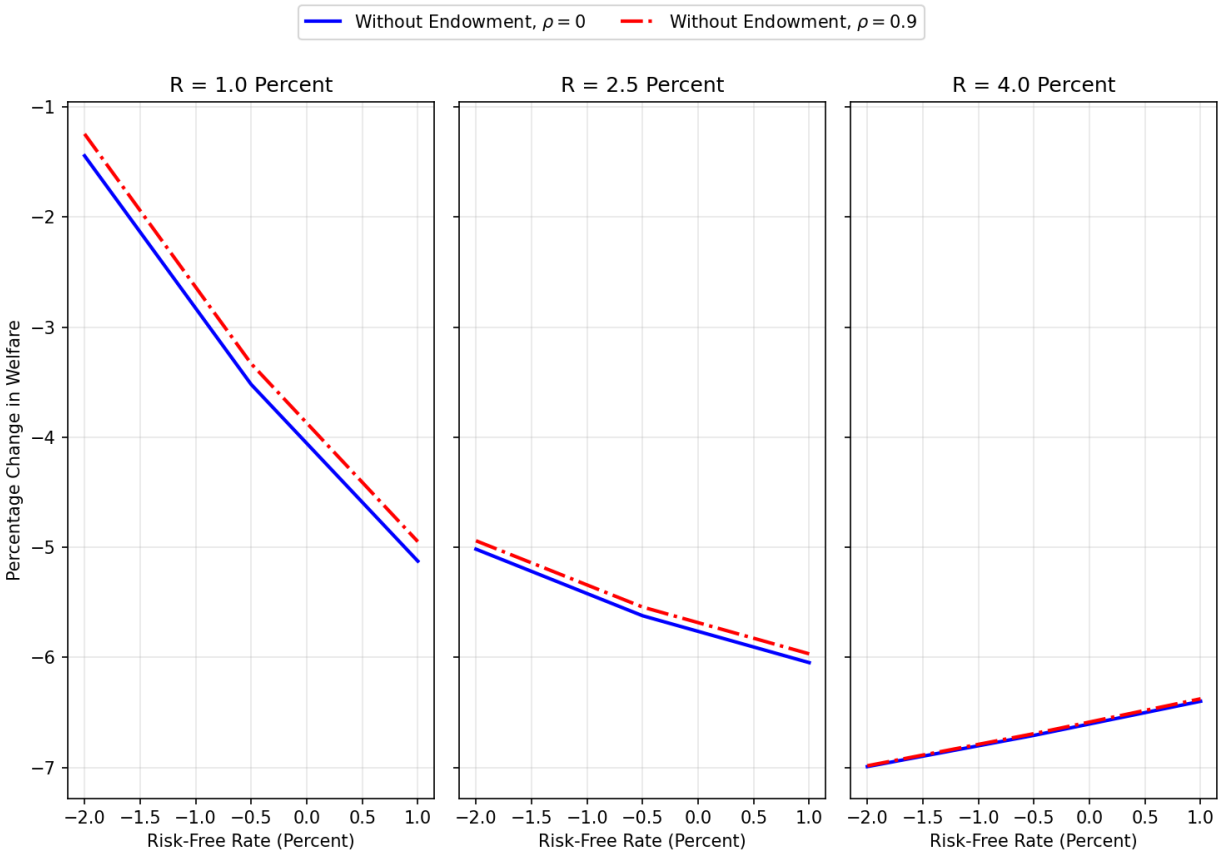


Figure 7: Effects of a 20 Percent Transfer on Lifetime Utility by Level of Persistence of Technology Shocks (Percentage change)

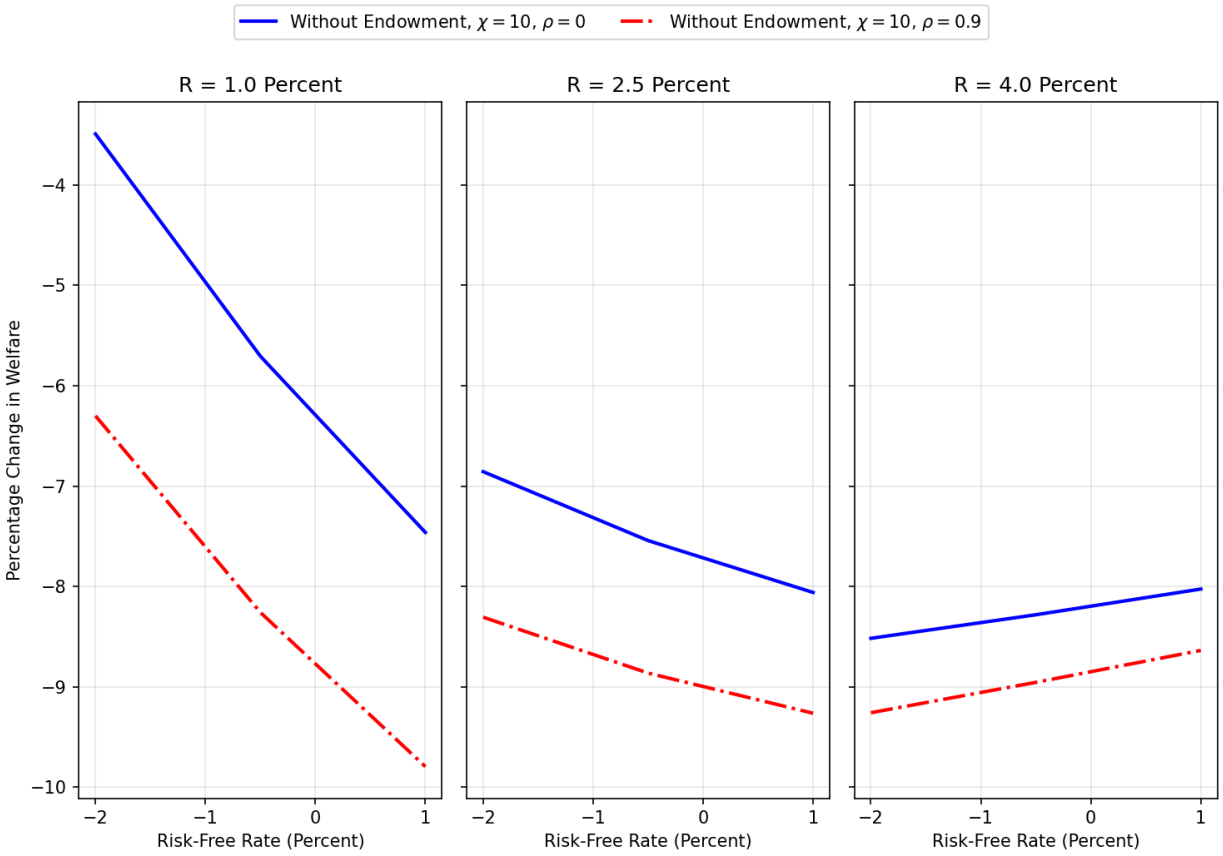


Figure 8: Effects of a 20 Percent Transfer on Lifetime Utility by Level of Persistence of Technology Shocks Under High Aversion to Intergenerational Risk (Percentage change)

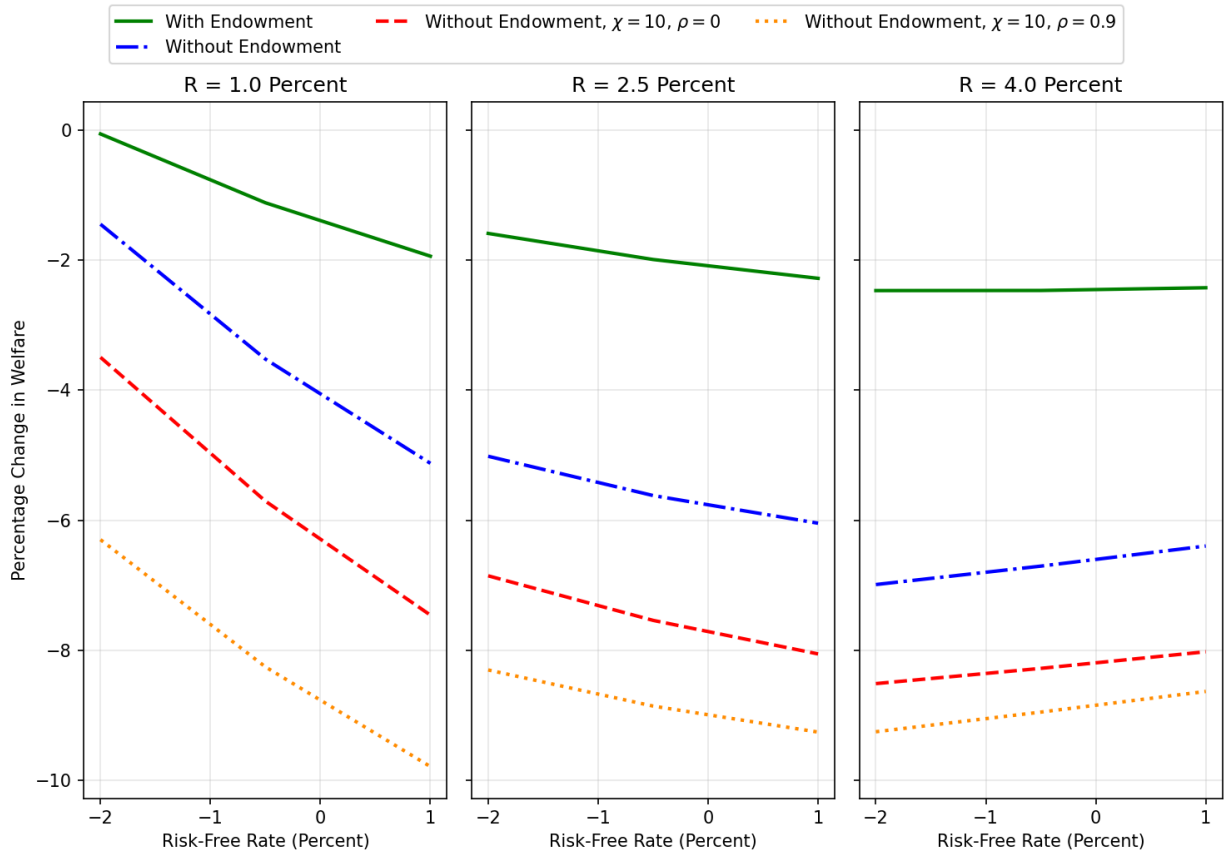


Figure 9: Effects of Transfers on Lifetime Utility Under Different Assumptions (Percentage change)

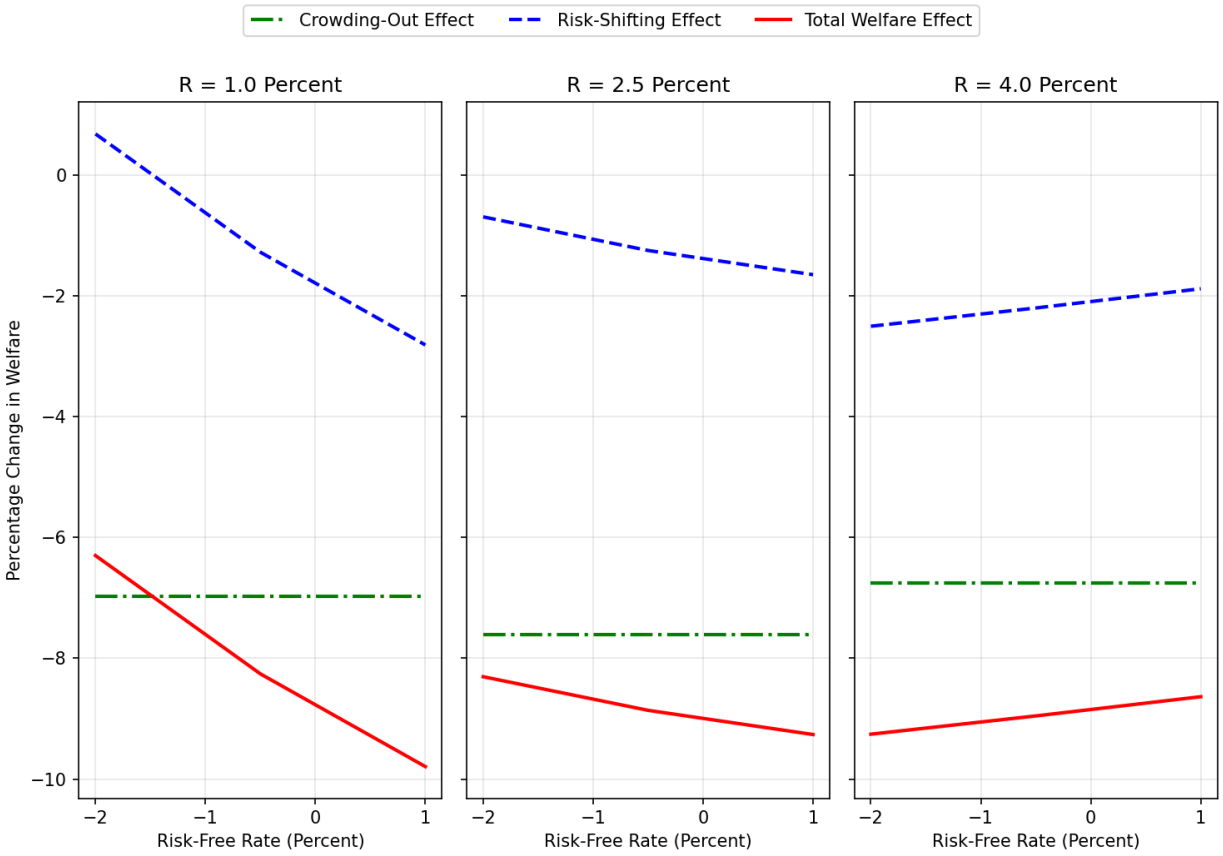


Figure 10: Decomposition of Effects on Lifetime Utility Without Endowment, With Higher Persistence of Technology Shocks and High Aversion to Intergenerational Risk (Percentage change)

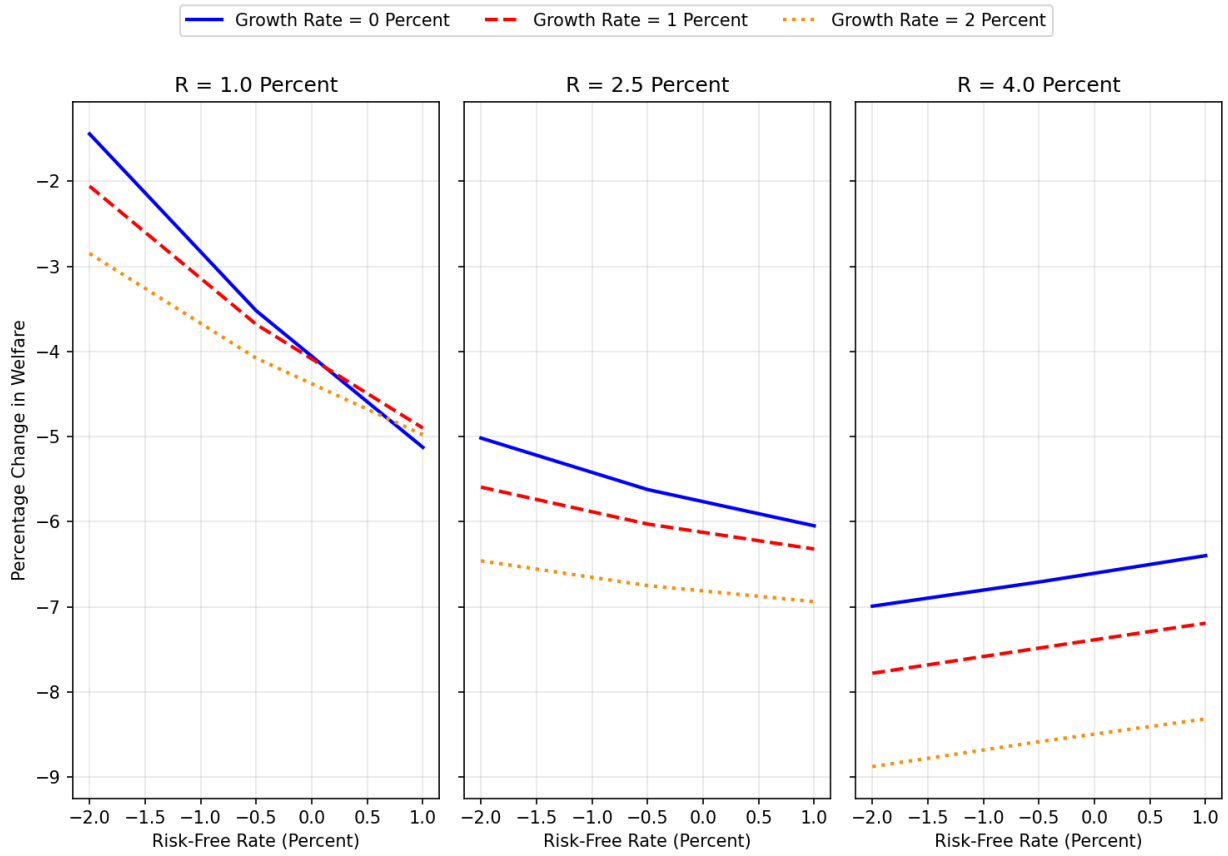


Figure 11: Effects of a 20 Percent Transfer on Lifetime Utility, by Growth Rate (Percentage change)

Table

Table 1: Process for Calibrating Parameters in This Analysis

Parameter	**Definition**	**Process for Setting Value**
Calibration Targets		
r	Net risk-free interest rate	Calibrated to -0.02, 0.005, and 0.02
R	Net marginal product of capital	Calibrated to 0.01, 0.025, and 0.04
Exogenous Parameters		
g	Growth rate in effective labor	Set to 0 except in sensitivity analysis
μ	Expected log of TFP (A_t)	Set to 3 (Cobb-Douglas); calibrated to R (linear)
σ	Standard deviation of $\log A_t$	Set to 0.2 following Blanchard (2019)
b	Capital's share of income	Set to 1/3 following Blanchard (2019)
χ	Aversion to risk in lifetime consumption	Set to 1 (base); 10 (sensitivity analysis)
Calibrated Parameters		
γ	Aversion to consumption risk in old age	Set by formula as function of σ, R, and r
β	Weight on utility in old age	Calibrated from steady-state simulation (Cobb-Douglas); set to 0.325 following Blanchard (2019) (linear)
α	Transfer as share of steady-state wages	Calibrated from steady-state simulation

A Calculation of Derivatives With Respect to Transfers and Swaps

Blanchard (2019) found that the derivative of lifetime utility with respect to the size of the transfer is:

$$\begin{aligned} dU = &\{-(1-\beta)U'(C_{1t}) + \beta\,\mathbb{E}_t[U'(C_{2t+1})]\}\,dD \\ &+ \{(1-\beta)U'(C_{1t})\,dW_t + \beta K_{t+1}\mathbb{E}_t[U'(C_{2t+1})]\,dR_{t+1}\} \end{aligned} \tag{A.1}$$

He defined the first term as dU_a (direct effect) and the second as dU_b (indirect effect through relative prices). Under the Euler equation for the risk-free rate,

$$(1-\beta)U'(C_{1t}) = (1+r)\beta\,\mathbb{E}_t[U'(C_{2t+1})] \tag{A.2}$$

the direct term simplifies to:

$$-r\beta\,\mathbb{E}_t[U'(C_{2t+1})]\,dD \tag{A.3}$$

The derivative of lifetime utility with respect to the size of a risky transfer D_V is:

$$\begin{aligned} dU = &\left\{-(1-\beta)\frac{A_t}{\bar{A}}U'(C_{1t}) + \beta\,\mathbb{E}_t\left[\frac{A_{t+1}}{\bar{A}}U'(C_{2t+1})\right]\right\}dD_V \\ &+ \{(1-\beta)U'(C_{1t})\,dW_t + \beta K_{t+1}\mathbb{E}_t[U'(C_{2t+1})]\,dR_{t+1}\} \end{aligned} \tag{A.4}$$

The indirect effect is the same as for a risk-free transfer. Given that $1 + R_{t+1} = bA_{t+1}K_{t+1}^{b-1}$, I define $1 + \bar{R} \equiv b\bar{A}K_{t+1}^{b-1}$ and note that $A_t/\bar{A} = (1+R_{t+1})/(1+\bar{R})$. Applying the Euler equation $(1-\beta)U'(C_{1t}) = \beta\,\mathbb{E}_t[(1+R_{t+1})U'(C_{2t+1})]$, the direct effect becomes:

$$\beta\,\mathbb{E}_t[(1+R_{t+1})U'(C_{2t+1})]\left[\frac{1}{1+\bar{R}} - \frac{A_t}{\bar{A}}\right]dD_V \tag{A.5}$$

Since a risky transfer and a swap combine to make a risk-free transfer, $dU_{St} = dU_{at} - dU_{Vt}$.

The direct effect of a swap on lifetime utility is:

$$\beta\Big\{-r\,\mathbb{E}_t[U'(C_{2t+1})] - \mathbb{E}_t[(1+R_{t+1})U'(C_{2t+1})]\Big[\frac{1}{1+\bar{R}} - \frac{A_t}{\bar{A}}\Big]\Big\}\,dD_S \tag{A.6}$$

Using $\mathbb{E}_t[(1+R_{t+1})U'(C_{2t+1})] = (1+r)\,\mathbb{E}_t[U'(C_{2t+1})]$, this simplifies to:

$$\begin{aligned} &= \beta\,\mathbb{E}_t[U'(C_{2t+1})]\Big\{-r-(1+r)\Big[\frac{1}{1+\bar{R}} - \frac{A_t}{\bar{A}}\Big]\Big\} \\ &= \beta\,\mathbb{E}_t[U'(C_{2t+1})]\Big\{1+\frac{A_t}{\bar{A}} - (1+r)\Big(\frac{\bar{R}+2}{1+\bar{R}}\Big)\Big\} \end{aligned} \tag{A.7}$$

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