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Inflation's Impact on American Households

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Studying Inflation's Impacts

Our proposed paper is unique. It would study the extremely diverse financial impacts of inflation on American households, but from an economically appropriate, remaining lifetime spending perspective. The subject is timely given the post-COVID surge in inflation. As is well known, inflation harms those living on fixed incomes. It also hurts lenders while helping borrowers. If unanticipated, inflation can lower, at least temporarily, real wages.[1] And it can raise average tax rates if, as in the U.S., the fiscal system is not fully inflation-indexed. Yet none of inflation's impacts are one and done. They continue through time, depending on the precise magnitude, length, and course of inflation.

Our paper would use The Fiscal Analyzer (TFA) to study inflation's differential impacts on the remaining lifetime spending (henceforth, lifetime spending) of respondents to the 2019 Survey of Consumer Finances (SCF). TFA is a highly detailed life-cycle, consumption-smoothing research tool that incorporates all major federal and state fiscal policies. TFA's default consumption-smoothing behavior is Leontief. Households desire a constant living standard per household member as they age. But TFA accommodates any specified age-living standard profile with the caveat that cash-flow constraints override preferences.

The TFA and its earlier incarnation, Economic Security Planner (ESPlanner), have been used to study U.S. inequality and fiscal progressivity (Auerbach et al. 2023), marginal taxation of Americans' labor supply (Altig et al. 2020), marriage taxation (Ilin et al. 2022), Social Security benefit collection decisions (Altig et al. 2023), Americans' retirement decisions (Auerbach et al. 2017b), economics' approach to financial planning (Kotlikoff 2008), the adequacy of Americans' life insurances holdings and saving (Bernheim et al. 2003; Gokhale and Kotlikoff 2002; Bernheim

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[1]This is arguably true for the U.S.: Fred data (https://fred.stlouisfed.org/series/LES1252881600Q) show a 4 percent decline in median real weekly earnings since Q2 2020.

et al. 2006), lifetime tax benefits from using retirement accounts (Gokhale and Kotlikoff 2003), and the rate of retirement saving implied by consumption smoothing (Bernheim et al. 2000).[2]

Clearly, inflation is a dynamic process. Hence, intertemporal analysis is central to examining its impact. To appreciate the intertemporal factors, consider a single retiree, Joe. Let's assume that Joe has a fixed (non-inflation-indexed) pension, collects Social Security benefits, withdraws annually from his IRA, holds most of his assets in long-term Treasuries, participates in Medicare, and pays alimony to his former spouse.

Even temporary inflation will permanently reduce Joe's real pension income flow plus his real alimony obligations. It may expose Joe to higher taxes on his Social Security benefits since neither of the thresholds determining the extent of this taxation is inflation-indexed. Joe's current or future real Medicare premiums may also rise since the top IRMAA bracket is not inflation-indexed. Then there are Joe's bonds, whose prices will decline depending on their maturity as well as the expected duration of inflation and its magnitude. Joe's equities and other financial assets may also be impacted.[3]

Moreover, the impact on Joe's path of net taxes will differ if his bonds are held as regular assets or are held in Roth IRAs or Roth 401(k)s. The timing of Joe's withdrawals also comes into play. The reason, of course, is federal and state income taxation of nominal, not real asset income. This means that Joe's investment of current and future saving will, in the face of inflation, earn higher nominal yields with both the inflation and real components of the return subject to taxation.

Then there are the *Additional Medicare Tax* levied on labor income and the Medicare Surtax (NIIT) levied on assets. The income thresholds, beyond which these two little known taxes are activated, are fixed in nominal terms. With sufficiently high and persistent inflation, Joe will cross the NIIT threshold, 85-percent Social Security taxation bracket threshold, and the Medicare Part B premium top bracket. Once these tax thresholds are crossed, their associated real tax burdens will continue to rise. In short, everything about inflation's impact on Joe is jointly intertemporal.

Specific Objectives

Our goal is measuring the average net cost of inflation facing American households as well as the distribution of these net costs across households. We're interested in the impacts of both unexpected and expected inflation when inflation is temporary, permanent, or when it follows

[2]These eleven TFA- or ESPlanner-based studies – almost one every two years – have been well received by the profession. Two of the studies appeared in the AER, one in the JPE, and one is currently under consideration at the JPE. Three of the studies appeared in the NBER's *Tax Policy and the Economy*. Interest in this research reflects TFA's and, earlier, ESPlanner's special capacities for highly detailed intertemporal analysis. The flip side of the coin, TFA's major shortcoming, is its inability to study behavioral responses in accordance with lifetime utility or, indeed, expected lifetime utility maximization. Incorporating behavioral response is, however, underway based on Kotlikoff's current work with German economists Johannes Brumm and Christopher Krause. This work will permit TFA to go beyond the assumption of Leontief preferences by maximizing general consumption-leisure utility functions, albeit via global search. Global search is necessitated by the non-convexity of intertemporal budgets imparted by the U.S. fiscal system's myriad tax and benefit provisions. Fortunately, as detailed below, this non-convexity does not raise non-uniqueness issues for TFA's algorithm. TFA's computation engine has been run literally millions of times with not a single occurrence of this problem. Non uniqueness of TFA's solutions would present as either sensitivity of the result to initial conditions or in the algorithm's inability to converge.

[3]Unfortunately, certain key data, such as the maturity structure of bond holdings, are not recorded in the SCF. Obviously, a 30-year bond's price is more sensitive than a 2-year bond's price to inflation-induced increases in the term structure of interest rates. But there are data on the aggregate maturity structure that one can use to impute respondents' bond-maturity structures. These and other imputations permit a reasonably clear picture of the impacts on lifetime spending of alternative inflation scenarios.

the pattern set in historical episodes, including inflation in the seventies and eighties and our post-COVID inflationary experience.

Our impact measure is the change in a household's present expected value of lifetime spending. "Expectation" references calculating the weighted average change in lifetime spending across all survivor paths a household could experience. For a 50 year-old married couple, a survivor path would, for example, be the head dying in eight years and their spouse dying in 32 years. To be clear, survivor paths don't assume that households know in advance when they will die. Instead, per Yaari (1965), a household's planning horizon is based on the household's maximum age of life – the last year to which a head or spouse/partner could live. Hence, survivor paths reference how the household will fare if its members die prematurely, given they are appropriately planning for maximum longevity.[4]

Spending references both discretionary and non-discretionary spending. Non discretionary spending includes non-financial housing costs and imputed rent on owner-occupied dwellings. It also includes government benefits provided on an in-kind basis, particularly as Medicare and Medicaid benefits. And it includes involuntary bequests, net of estate taxes, arising when a household's last survivor dies prior to reaching their maximum age of life.

The Fiscal Analyzer

TFA is a life-cycle, consumption-smoothing tool that incorporates borrowing constraints and all major federal and state fiscal policies. These policies are listed in table 1. But TFA's fiscal analysis is far more extensive than the table suggests since most benefit programs are state-specific. For example, there is not one, but 51 different Medicaid programs – one for each state and the District of Columbia. All told, TFA incorporates the precise details of over 500 strictly federal, strictly state, and federal, but state-specific fiscal tax and benefit programs.[5]

TFA's Algorithm

TFA forms its calculations using three dynamic programs. One program does consumption smoothing subject to borrowing constraints. Its objective is smoothing households' living standards. "Living standard" references discretionary spending per household member with adjustments for economies of shared living and the relative cost of children. A second dynamic program calculates annual household taxes and benefits. The third dynamic program calculates the life insurance, subject to a non-negativity constraint, needed to maintain the household's living standard if survivors live to their maximum ages of life. A key byproduct of TFA's life insurance algorithm is determining the lifetime spending and net taxes of households along each survivor path.

The programs run sequentially with each transmitting its results to the other two. Processing

[4] As Yaari (1965) spelled out, uncertain longevity makes maximum lifespan the correct planning horizon. But households that aren't infinitely risk averse will deliberately plan to lower their living standards as they age, i.e., they will gamble and spend more when young knowing the chance of living to or close to their maximum age is remote. Our analysis will consider different planned age-living standard profiles, which TFA is readily able to handle.

[5] TFA wasn't built overnight. Its construction began in 1993 with the founding of Kotlikoff's Economic Security Planning (ESP) company, which produces economics-based financial planning software. TFA uses ESP's MaxiFi Planner computation engine. But its fiscal framework is far more extensive. Although ESP is a private company, it has and continues to do substantial economic/academic research. Over the years, this research has been supported by grants from the National Institute of Aging, the Sloan Foundation, Boston University, the National Center for Policy Analysis, the Searle Family Trust, and ESP itself. ESP's largest funding source in recent years is the Federal Reserve Bank of Atlanta. Thanks to these institutions' support, TFA's extensive code reflects tens of thousands of hours of professional software engineering. Note also, that this paper would be a joint research project with the Atlanta Fed.

Table 1: List of Tax and Transfer Programs Included in TFA

Taxes	Personal Income Tax (federal and state)
	Corporate Income Tax (federal and state)
	FICA Tax (federal)
	Sales Taxes (state)
	Medicare Part B Premiums (federal)
	Estate and Gift Tax (federal)
Transfer Programs	Earned Income Tax Credit (federal and state)
	Child Tax Credit (federal)
	Social Security Benefits (federal)
	Supplemental Security Income (SSI) (federal)
	Supplemental Nutritional Assistance Program (SNAP) (federal and state)
	Temporary Assistance for Needy Families (TANF) (federal and state)
	Medicaid (federal and state)
	Medicare (federal)
	The Affordable Care Act (ACA) (federal and state)
	Section 8 Housing Vouchers (state and county)
	Energy Assistance (state)
	Childcare Assistance (state and county)

Note: Section 8 Housing benefits and Childcare Assistance are also county-specific. ACA subsidies are also ZIP-code-specific. TFA lacks data on county or ZIP codes needed to calculate benefits based on county or ZIP code.

continues until the three programs precisely converge to mutually consistent solutions. Dynamic programming of intertemporal consumption choice based on kinked functions that arise from borrowing constraints introduces interpolation error that compounds as one programs back in time. TFA uses a sparse grid method to solve its fundamentally deterministic problem.[6]

TFA's Main Imputations and Benchmarking

As detailed in Auerbach et al. (2023), TFA forecasts and backcasts SCF respondent labor earnings based on age-earnings profiles calculated from past surveys of the Current Population Survey (CPS). It uses successive waves of the American Community Survey (ACS) to impute retirement ages. It uses data from the Annual Social and Economic Supplement to the CPS to impute benefit take-up rates. It follows Auerbach et al. (2017a) in assigning survival probabilities to respondents based on their Social Security earnings records. And it uses ACS data to allocate SCF households' state residences based on their characteristics.

The sum of any respondent household's state-specific weights equals the household's total SCF weight. All results are weighted using state-specific results and our constructed state-specific household weights. Obtaining the results that need to be properly weighted requires running TFA over the entire SCF sample 51 times, assuming in each run that the entire sample lives in a particular state. Fortunately, we process observations in parallel.

[6]TFA is not open source due to its reliance on ESP's computation engine. But the tool is available for use by academics upon request. To date, more than a dozen economists (two foreign) in academe and the Federal Reserve have used TFA for research, including modifying its source code as needed. The accuracy of TFA's algorithm is easy to check. There are eight ways to confirm that TFA's calculations are correct. First, the present value of lifetime discretionary spending (including terminal bequests) equals, to the dollar, human plus non-human wealth less the present value of fixed spending less the present value of net taxes (including estate taxes). Second, the household's living standard, measured in today's dollars, is constant through time unless the household faces cash-flow constraints or TFA is told to adjust discretionary spending through time to match a specified age-living standard profile. For example, we could specify a 1 percent annual decline starting at 75. Third, the household's difference in regular assets between years t and t+1 equals its saving in year t, i.e., flow and stock measures of saving must be equal. Fourth, terminal regular assets are zero apart from specified desired bequests, reserve funds, and funeral expenses. Fifth, regular assets are zero in the year before the household's borrowing constraint is relieved. Sixth, non-negative life insurance amounts are, to the dollar, what survivors need to maintain their living standard through their maximum ages of life. Seventh, lifetime budget balance holds to the dollar for all survivor outcomes. Eighth, all tax and benefit amounts are correctly calculated.

Reviewing Prior Studies

Our proposed study would review the full literature covering inflation's welfare impacts. Here's a minor sample. Fischer and Modigliani (1978) is an early paper emphasizing that inflation's costs depend on the degree and timing of its anticipation. Monnin (2014) and Galli and Hoeven (2001) report a U-shaped relationship between long-run inflation and income inequality. Monnin (2014) report that when inflation is expected and government transfers are inflation-indexed, lower-income households tend to receive a larger share of their income from transfers. And Minarik (1978) emphasizes that homeowners with fixed-rate mortgages are less vulnerable to inflation.

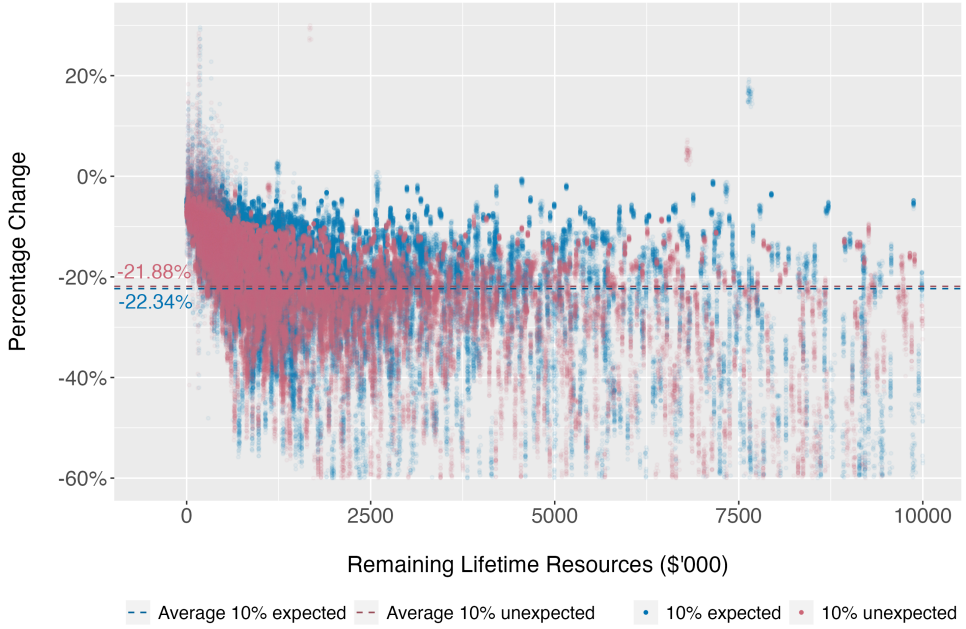
Preliminary Findings

Figures 1a through **??** present results of two initial analyses – permanent increases in inflation from zero to five percent and ten percent, respectively. Each figure provides results assuming the increases are either expected or unexpected.

Figure 1a: Percentage Change in Remaining Lifetime Spending, 5% Inflation, Ages 20-79



Figure 1b: Percentage Change in Remaining Lifetime Spending, 10% Inflation, Ages 20-79



In the expected (as of the current period) inflation runs, wages, assets, but not mortgages and other other nominal liabilities, are assumed to be unaffected by inflation. This treatment assumes that nominal interest rates as well as nominal wages adjust immediately to the new level of inflation, keeping their real values unchanged. It also treats, simply for purposes of illustration, assets as cash that can be immediately invested at the permanently higher nominal rate. However, the expected runs assume nominal liabilities were contracted in the past and don't adjust. In the unexpected runs, we assume it takes a year for nominal wages and nominal interest rates to adjust. Hence, unexpected inflation, in this very special example, spells permanent declines in the values of real assets and real wages.

Figures 1a and 1b plot the percentage lifetime spending changes against remaining lifetime resources. They show, via dotted lines, average impacts across the entire sample for each hypothetical. With expected permanent inflation at five percent, the mean is negative, equaling -11.4 percent. With ten percent expected permanent inflation, the loss averages -22.3 percent. When inflation is unexpected, the loss is even larger in the five percent case, at -12.6 percent. In the ten percent case, the loss is marginally smaller, at -21.9 percent. The expected means would clearly be zero, were the financial and fiscal system inflation neutral, i.e., fully indexed to inflation. Since expected inflation, as modeled in these cases, serves only to reduce real liabilities, the negative averages suggest that permanent inflation, even at a modest level, represents the potential for a significant tax on the household sector. When inflation is unexpected, the assumed one-time, but still permanent losses in wealth and real wages, deliver an even larger mean loss in the five percent case.

The magnitudes of the mean losses in these hypotheticals are striking. But even more surprising is the remarkable heterogeneity in inflation impacts. This heterogeity is exceptionally large for low- and middle-income households. Our task is to decompose, in fine detail, the financial and fiscal sources of these and other results that adopt different assumptions about impacts through time on asset values, real wages, and net taxes.

$While figures 1a and 1b combine the impacts on households' resources and net taxes on the vertical axis, figures ?? a$
$3.97 percent, in the five and ten percent inflation cases, respectively. It is notable that, regardless of inflation being$

We want to reiterate that these findings are highly preliminary. Households experiencing very large positive or negative changes in lifetime spending under different inflation scenarios must be used as case studies to explain the precise forces at play. The findings will also be modified *substantially* as we make adjustments for the maturity structure of SCF respondents' fixed income assets, properly factor-in inflation's impact on their equity holdings, incorporate the path of real-wage recovery in the case this adjustment is not immediate, and take account of other factors left out of this illustration. These adjustments may, on balance, reinforce our findings that inflation comes with a significant economic cost. The main driver may well be changes in net taxes.

Our paper's initial focus will be on isolating pure fiscal impacts by assuming, in the expected inflation simulations, that all liabilities as well as assets are indexed to inflation. Absent the fiscal system, this will, as we've already tested, leave all households entirely unaffected by inflation.

The proposed paper will begin with a test case involving financial-market and fiscal policy neutrality to assure readers that the model is producing no lifetime spending changes for any household. Next, we'll keep the financial system neutral and clarify the non-neutrality of the fiscal system. This section will decompose aggregate fiscal effects into specific components by making certain aspects of the current system neutral on a one-by-one basis. It will also entail walking the reader through enough household-respondent case studies to ensure readers that our fiscal findings are highly detailed and accurate. Third, we'll turn off the fiscal system and explore different non-neutrality assumptions concerning the financial system. And fourth, we'll combine the non-neutralities of both sectors.

We expect that key findings of the figures presented here will remain: first, permanent inflation, whether expected or unexpected, comes with a major average economic cost. Second, those costs are highly disperse, significantly exacerbating horizontal inequality and changing vertical inequality. As the figures show, inflation's impact can differ dramatically across households with essentially identical levels of remaining lifetime resources. We'll also decompose our findings by household characteristics, particularly age, race, and marital status. Clearly, the economy's shifting from one year to the next to a permanently higher inflation rate is posited simply to test and clearly explain key elements of inflation's impact. Once we've explored these hypotheticals, we'll consider temporary, but fixed inflation rates and paths of inflation that mimic those we're now experiencing, as well as those experienced during prior inflationary episodes, particularly during and after the seventies.

Financial Winners and Losers

One major challenge is to recognize and implement no free lunch and no free loss conditions. Thus, if inflation reduces, as it does, real mortgage liabilities, we need to adjust the assets of mortgage lenders appropriately, such that winners are offset, generally, dollar for dollar, by losers. The same zero-sum consideration applies to all other posited non-fiscal inflationary impacts. Permanent or temporary reductions in real wages translate into gains to employers barring inflation-induced reductions in national income. Such macro effects are additional issues we'll need to seriously consider. These gains need to be appropriately redistributed within TFA to holders of equity and owners of proprietorships and partnerships.

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