The Fisher Channel According to HANK:
Unexpected Inflation and the Missing Recession*

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WORK IN PROGRESS

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Abstract

I show that the wealth redistribution from savers to borrowers, triggered by the recent inflationary episode, has been one important factor behind the remarkable strength of the U.S. economy in the aftermath of the pandemic. Unexpected inflation reduced the real value of households' debts. Using a Heterogeneous Agent New Keynesian (HANK) model calibrated to match to match the empirical distribution of nominal exposures and their covariance with marginal propensities to consume (MPCs), I find that this wealth transfer increased aggregate consumption and contributed to inflation persistence. I provide empirical support for these findings using billions of household-level transactions obtained from a U.S. fintech company, as well as county-level consumption and nominal exposures data. Finally, I demonstrate that the Fisher channel significantly amplifies monetary policy's effectiveness in HANK and revisit the role of nominal rigidities in shaping that effectiveness.

Keywords: Inflation, Redistribution, Household Heterogeneity, Net Nominal Positions, Consumption, HANK, Monetary Policy, Alternative Data, Fintech.

JEL Codes: D12, D14, D31, E21, E52, E58

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1 Introduction

Over the course of 2022, as the Federal Reserve began raising rates at the fastest pace in four decades, many economists across the financial sector, central banks, and academia anticipated an imminent recession.[1] However, not only did a recession fail to materialize, but the U.S. economy also recorded robust growth, with real personal consumption expenditures increasing by more than 3% in both 2023 and 2024.

In this paper, I propose that wealth transfer from nominal creditors to debtors driven by unexpected inflation helped sustain aggregate demand during the post-pandemic period. This idea dates back to Fisher (1933): unexpected inflation reduces the real value of nominal claims (that is, assets or liabilities with a fixed face value, such as bonds or fixed-rate mortgages). If debtors have a higher marginal propensity to consume (MPC) than creditors (Tobin, 1982), then such a redistribution raises aggregate demand.

In Pallotti (2022), I showed that U.S. households have accumulated substantial nominal assets and liabilities over the past four decades. As first noted by Doepke and Schneider (2006), these nominal positions are distributed asymmetrically across the population. Wealthier, middle-aged, and elderly households hold most of the nominal assets, such as bonds and deposits, while nominal liabilities -especially fixed-rate mortgages - are more prevalent among the young middle class.[2] Consequently, unexpected inflation redistributes wealth away from the former group and toward the latter.

The seminal work by Auclert (2019) incorporated Tobin (1982)'s insight into a Heterogeneous Agent New Keynesian (HANK) framework, in the broader context of the distributional consequences of monetary policy. In this paper, I build a HANK model specifically designed to match key empirical evidence on the Fisher channel, namely the

[1]For example, a Bloomberg article predicted a 100% likelihood of a recession in 2023 (link). A survey of academics by the Initiative on Global Markets indicated that, as of June 2022, 70% of respondents believed a recession would start before the end of 2023, with an additional 10% expecting it by 2024Q2 (link). During the press conference following the December 2023 FOMC meeting, Fed Chair Jay Powell reflected on these predictions: "So I think forecasters generally, if you go back a year, were very broadly forecasting a recession for this year (...) that includes Fed forecasters and really essentially all forecasters (...)."

[2]In the United States, unlike in some countries (e.g. the UK or Spain), more than 90% of outstanding mortgages in 2021 were fixed-rate for the entire loan duration.

distribution of net nominal positions (NNP) across households[3] and the empirical covariance between NNP and MPC - a sufficient statistic in Auclert (2019) that standard HANK models have so far struggled to match.

I then use this HANK model to analyze how the "inflation shock" that began in 2021 has affected aggregate consumption via wealth redistribution. According to the model, shifting wealth from households with lower MPCs to those with higher MPCs through unexpected inflation boosted aggregate consumption by around 0.5 percentage points in the first year, gradually diminishing thereafter. Through a standard New Keynesian Phillips curve, inflation also rose endogenously by about 0.3 percentage points in the first year, with a similar decay over time. Thus, in a HANK model that matches some key empirical moments for the Fisher channel, unexpected inflation can "feed on itself," even when monetary policy follows a standard Taylor rule.

Empirical evidence supports the model's prediction about consumption responses. I use big-data transactions from a U.S. fintech company, initially encompassing inflows and outflows in bank accounts for millions of households over 2019–2023. After selecting a balanced panel of about 680,000 households based on transaction frequency, I obtain a sample that very closely aligns with official aggregates (e.g. U.S. retail sales and personal income) and distributional characteristics (such as the share of mortgagors in the Survey of Consumer Finances). During the recent inflationary period, I find that mortgagors have grown their consumption by 1% more than the rest of the US population, with tight confidence intervals, in line with the predictions of the model.

As additional evidence, I conduct a cross-county analysis similar to Mian et al. (2013), using county-level spending data from Chetty et al. (2020) alongside data on nominal assets and liabilities from the New York Fed and the IRS Statistics of Income. Once again, counties with more negative net nominal positions - especially those carrying more nominal debt - showed relatively stronger consumption growth after the onset of the inflation shock, although these results are not statistically significant.

Finally, I move beyond the current inflationary episode to examine the implications of the Fisher channel for monetary policy. I uncover two main findings. First, the presence

[3] NNP is defined as the market value of nominal assets minus the market value of nominal liabilities.

of an active Fisher channel substantially amplifies the effectiveness of monetary policy, making a standard monetary policy shock nearly 50% more powerful. This arises because unexpected inflation following a policy shock transfers wealth from richer, low-MPC households to indebted, high-MPC households. Second, the degree of nominal rigidities proves less central for monetary policy's effectiveness. In standard models, higher nominal rigidities strengthen monetary policy by increasing the impact of policy shocks on the real interest rate. However, the Fisher channel introduces an offsetting effect: when prices are stickier, inflation responds less on impact, reducing the wealth transfer between low-MPC creditors and high-MPC debtors. In my model, the real-rate channel still dominates, so the conventional result holds: stronger nominal rigidity generally increases policy effectiveness. Nevertheless, the Fisher channel quantitatively narrows substantially the gap in outcomes across different levels of nominal rigidity. Moreoever, at the zero lower bound (ZLB), both the real-rate channel and the Fisher channel act in the same direction, thereby substantially reinforcing the "paradox of flexibility" described by Eggertsson and Krugman (2012).

My model builds on a standard HANK framework, in which households face idiosyncratic risk and a borrowing constraint. Agents save and borrow in one account comprising long-term nominal claims whose maturity aligns with the average duration of nominal positions in the economy. I also follow an emerging convention in the HANK literature, adopting a sticky-wage, flexible-price specification as in Auclert et al. (2024). Under this assumption, the real wage always follows productivity, allowing me to abstract from the impact of inflation on the split between labor and capital income (Lorenzoni and Werning, 2023) and thus focus solely on how unexpected inflation redistributes nominal wealth. As I show in the paper, this modeling choice broadly reflects recent U.S. experience, where nominal wages largely kept pace with the price level during the latest inflationary episode, unlike in other countries.[4]

Of course, in the model, inflation is an endogenous variable. Recent work has proposed various structural shocks as drivers of the post-pandemic inflation surge, including both

[4] In some cases, nominal wage growth exceeded the rise in prices, especially for lower-income groups (Autor et al., 2023).

supply- and demand-side factors (e.g., Bernanke and Blanchard, 2023; Dao et al., 2024; Giannone and Primiceri, 2024). However, since I focus on how the wealth redistribution caused by unexpected inflation affected aggregate demand, it is not strictly necessary for my research question to identify the exact combination of the primitive structural shocks that moved inflation in the first place. Instead, in my model, I introduce a shock to the unit of account that replicates the unanticipated rise in the price level observed in 2021-2022, reducing the real value of nominal claims and reallocating resources from asset-rich households to indebted ones. By examining the impulse response of consumption and inflation to this *wealth redistribution* shock, I isolate the Fisher channel's contribution to aggregate consumption - relative to a counterfactual where households had only real assets. This approach allows me to concentrate on the redistributive effects of inflation stemming from nominal positions, without necessarily taking a stance on the specific structural origins of the inflation surge.

Building on Schnorpfeil et al. (2023), who show that households may be only partially aware of the debt-devaluing effect of inflation, I extend the my HANK model to incorporate a form of cognitive discounting for gains and losses on long-term nominal claims (e.g., fixed-rate mortgages). This behavioral friction dampens the initial consumption response yet imparts a more persistent stimulus to aggregate demand over time.

Literature Review This paper builds on some of the very first HANK models that included nominal assets, such as Auclert (2019) and Luetticke (2021). Most of the subsequent HANK literature employs either one-period real assets or continuous-time framework (Kaplan et al., 2018), where inflation plays no redistributive role. Recent exceptions include Yang (2022), Kaplan et al. (2023) and Angeletos et al. (2024), which consider the redistributive impacts of unexpected inflation. Relative to these studies, I develop a model that closely replicates both the distribution of net nominal positions and the covariance between NNP and marginal propensities to consume - a sufficient statistics in Auclert (2019) to evaluate the impact of the Fisher channel on aggregate consumption within a very broad class of environments. I then apply this framework to the specific case of the latest U.S. inflation episode, and test the modelâs consumption implications using high-frequency fintech data (as in Diamond and Moretti, 2021; Buda et al., 2023), highlighting the value of alternative data sources for macroeconomic modeling.

Structure of the paper Section 2 presents the HANK model. Section 3 uses it to examine how the wealth redistribution propagated to aggregate consumption and inflation. Section 4 evaluates the strength of the Fisher channel empirically, using both household-level fintech data and county-level data. Section 5 investigates the role of the Fisher channel in amplifying monetary policy and reassesses the importance of nominal rigidities. Section 6 concludes.

2 The Model

Households face idiosyncratic risk and are constrained in their borrowing capacity, deriving utility from consumption and leisure. They save and borrow into a long-term nominal assets modeled as in Woodford (2001): at price Q_t, the asset provides a stream of nominal payments $1, \delta, \delta^2, \ldots$.

The household's problem is given by:

$$\max_{\{c_{it}\}_{t=0}^{\infty}} \mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t \left(u(c_{it}) - v(N_t) \right) \right]$$

$$\text{subject to} \quad P_t c_{it} + Q_t \Lambda_{it} = (1+\delta) Q_t \Lambda_{i,t-1} + z_{it}, \quad \forall t \tag{1}$$

$$Q_t \Lambda_t \geqslant \underline{a} P_t, \quad \forall t \tag{2}$$

where c_t is consumption, Λ_t is the amount of nominal claims and Q_t their price. Net labor income $z_{i,t}$ is given by:

$$z_{i,t} = \tau_t (W_t e_{i,t} N_t)^{1-\theta} \tag{3}$$

Where τ_t is the intercept of the retention function, W_t is the nominal wage, $e_{i,t}$ is household-level productivity and θ is the progressivity parameter. As shown by Heathcote et al. (2017), this rule can approximate particularly well the existing tax structure in the US. Following a convention in the HANK literature (e.g. Auclert et al. (2018)), hours worked N_t are chosen by unions and taken by the household as given, as described below.

The borrowing limit a in equation 2 is defined in real terms, so that unexpected inflation effectively relaxes the borrowing constraint. This as a natural starting point, as any more elaborate borrowing constrained defined e.g. in terms of debt-to-income ratio (as in e.g. Paz-Pardo (2021)), or collateral value (as in e.g. Iacoviello (2005)) will also relax when nominal incomes and/or house prices approximately follow the evolution of the price level. As discussed in appendix A.2, this has been broadly the case during the latest inflationary episode in the US. Moreover, in my calibration outlined below I will have virtually no households at the borrowing constraint in the steady state, which makes this particular modeling choice of the borrowing limit relatively unimportant in terms of the implications of the model for aggregate consumption.

Given the expected path of nominal interest rate i_t, the price of the long-term bond Q_t is pinned down by a no-arbitrage condition:

$$Q_t = \frac{1 + \delta \mathbb{E}_t[Q_{t+1}]}{(1 + i_t)}$$

The ex-post real interest rate r_t faced by households is then simply given by the Fisher equation $1 + r_t = \frac{(1+i_{t-1})}{(1+\pi_t)} = \frac{(1+\delta Q_t)}{Q_{t-1}} \frac{1}{1+\pi_t}$. Finally, the utility function belongs to the constant elasticity of substitution (CES) family with intertemporal elasticity σ, i.e. $u(c) = \frac{c^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}}$, while the disutility function from work has a Frisch elasticity of labor supply ϕ, i.e. $v(N) = N^{1+\frac{1}{\phi}}$.

Supply On the supply side, I follow a convention in the HANK literature by adopting sticky wages and flexible prices. As emphasized by Auclert et al. (2023) and Broer et al. (2020), this combination of sticky wages and flexible prices is more in line with empirical evidence, as it does not feature countercyclical profits as well as large income effects on labor supply.[5] Specifically, there is a representative firm that produces output with a

[5]As well known, both of these features are typical of flexible wages, sticky price versions of New Keynesian models.

technology which is linear in labor N_t and productivity A_t

$$Y_t = A_t N_t$$

Solving the firm problem yields $\frac{W_t}{P_t} = A_t$: the real wage thus follows productivity, which is constant in the rest of the paper.[6] In other words, price inflation and nominal wage inflation are the same at all times.[7] A constant real wage and no profits are conceptually appealing for my purpose as they allow the model to abstract away from any redistributional effect of unexpected inflation stemming from differential impacts on profits versus labor income (see, e.g. Lorenzoni and Werning (2023)). As discussed in section A.2, the real wage has indeed remained approximately constant in the US during the latest inflationary episode, and it actually increased for the bottom half of the distribution (Autor et al. (2023)).

Sticky wages Wages are set by unions subject to a quadratic costs a la Rotemberg (1982). Appendix A.1 describes the union problem following Auclert et al. (2018), which extends to the heterogeneous agent setting the standard microfoundation of sticky wages from Erceg et al. (2000), showing that it leads in equilibrium to the New Keynesian Wage Phillips Curve (NKWPC) for wage inflation π_t^w:

$$\pi_t^w(1+\pi_t^w) = \kappa^w \left(\mu^w \frac{\gamma N_t^{1/\phi}}{(C_t^*)^{-\sigma}(1-\theta)(Y_t - T_t)/N_t} - 1 \right) + \beta \pi_{t+1}^w (1+\pi_{t+1}^w) \tag{4}$$

Where κ^w denotes the slope of the NKWPC, which is in turn a function of the elasticity of substitution across different union tasks and the costs of adjusting wages, as documented in section A.1. μ^w is the mark-up applied by unions, $T_t = w_t N_t - \int z_{it} di$ are total taxes collected by the government, and C_t^* is a virtual consumption aggregator that captures the aggregate wealth effect on labor supply, defined as:

$$C_t^* = \left(\int \frac{e_{it}^{1-\theta}}{\int e_{it}^{1-\theta} di} c_{it}^{-\sigma} di \right)^{-\frac{1}{\sigma}}$$

[6]The firm problem here is simply given by $\max_{N_t} P_t A_t N_t - W_t N_t$.

[7]As way to see it, $\frac{W_t(1+\pi_t^w)}{P_t(1+\pi_t)} = A_t(1+g_{At})$, take logs and obtain $\pi_t^w - \pi_t = g_{At} = 0$.

Monetary Policy The monetary authority follows a standard Taylor rule for setting the nominal interest rate i_t:

$$i_t = r^* + \phi \mathbb{E}\pi_t + \epsilon_t \tag{5}$$

Where r^* is the steady state real interest rate, ϕ is the coefficient on inflation, and ϵ_t a monetary policy shock.[8]

Government The government issues long-term nominal debt B_t held by the household sector. In the benchmark version of the model, I assume that government adjust government spending G_t in response to shocks that move its debt level away from the steady state, with a coefficient γ_G, in order to satisfy the standard government budget constraint, $T_t + B_{t+1} = G_t + (1 + r_t)B_t$:

$$G_t = G_{ss} - \gamma_G(B_t - B_{ss}) \tag{6}$$

With γ_G=1 in equation 6, we have balance budget, while for $r < \gamma_G < 1$ debt gradually converges back to its steady state.

Equilibrium Given initial values for government debt B_{t-1}, nominal wage W_{t-1}, price level P_{t-1}, a distribution of households over skills e and assets Λ such that the economy starts from its steady state, a general equilibrium is a path for prices $\{P_t,\ W_t,\ \pi_t,\ \pi_t^w,\ r_t,\ i_t\}$ and aggregates $\{Y_t,\ N_t,\ C_t,\ B_t,\ G_t,\ T_t\}$ such that households optimize, unions optimize, the representative firm optimizes, monetary policy follows the Taylor rule 5, the government satisties its budget constraint and 6, and markets clear:

$$Y_t = \int c_{it} di + G_t \tag{7}$$

$$B_t = \int \Lambda_{it} di \tag{8}$$

[8]For simplicity and in keeping with most of the HANK literature, I assume inflation in the steady state to be 0.

2.1 Calibration

I calibrate the model at a yearly frequency, following conventions in the literature for most of the parameters. The main deviation from the literature consist in relaxing the borrowing constraint to account for mortgage debt, as typical HANK models are calibrated to account only for consumer credit. Table 1 reports all the parameter values.

Households Both the intertemporal elasticity of substitution σ and the Frisch elasticity of labor supply θ have values well within the ranges of empirical estimates at 0.5 (see also Auclert et al. (2021)). The income process faced by households is also standard and follows an AR(1) process with persistence ρ_e of 0.91 and a standard deviation of the earnings σ_e at 0.92, as in e.g. Auclert and Rognlie (2018). I discretize this process using Rouwenhorst method on a grid of 11 points for e_{it}.

In order to match the empirical distribution of net nominal positions, I set the borrowing limit $\underline{a}$ to 1, which is the average yearly income in the economy. This is a deviation from the literature, as $\underline{a}$ is typically calibrated to zero or to the average quarterly income (see e.g. Kaplan et al. (2018)). The standard calibration in HANK has been motivated by focusing on consumer credit: here, my emphasis in on matching the empirical distribution of NNP, which include also mortgages. The real return is 5% per year as in Auclert et al. (2018). While high, this allows me to match the distribution of the NNP better, as well as hitting perfectly the covariance between MPC and NNP. The discount factor β clears the asset market at 0.85. Finally, the bond decay parameter δ is set at 0.8 to match the average duration of nominal positions at the end of 2020, which was approximately 4.5 years (Pallotti (2022)).

Supply I set wage markup to 1.1 and the coefficient for wage rigidity to 0.05 following standard values in the literature based on Grigsby et al. (2021).

Policy Government spending represents 20% of GDP. The level of government debt in the steady state is also at 20% of GDP, as it acts as a counterpart to the aggregate Net Nominal Position of the household sector, which was 20% of GDP at the start of the inflation episode (as in Pallotti (2022)). As my focus here is on the redistribution within the household sector, I prefer to capture the distribution of NNP across households and their aggregate position well, rather the actual NNP of the government (which is lower in the data, as foreigners also hold U.S. nominal debt).[9] The responsiveness of government spending to deviation of its debt level from the steady state γ_G is set conservatively at 0.1, implying a small but quite persistent response. Once again, the rationale behind this choice is to limit as much as possible the influence of government actions on the implications of the model for consumption, as my primary focus here is the redistribution of wealth across households. The coefficient for tax progressivity is 0.18, as in Heathcote et al. (2017). Finally, the coefficient on expected inflation in the Taylor rule is set to 1.25.

Solution method I use 500 points on a grid for assets, solving the household problem through the endogenous grid method. The model is solved using the Sequence Space Jacobian method from Auclert et al. (2021).

Table 1: Calibration parameters for the model.

Parameter	Description	Value	Parameter	Description	Value
σ	IES	0.5	κ_w	Slope of wage Phillips curve	0.05
v	Frisch	0.5	μ_w	Wage markup	1.1
$\underline{a}$	Borrowing constraint	-1	ϕ	Taylor Rule coefficient	1.25
θ	Tax progressivity	0.18	B	Public Debt to GDP	0.2
ρ_e	Autocorrelation of earnings	0.91	G	Government spending	0.2
σ_e	Std of log earnings	0.92	γ_G	G response	0.1
β	Discount Factor	0.85	$r*$	Eq. real rate	0.05
δ	Bond decay	0.80	π_{ss}	Steady-state inflation	0

2.1.1 Results

Table 2 reports percentiles of the distribution of the net nominal position over labor market income in the model against the ones from the 2019 Survey of Consumer Finances (SCF), following the methodology in Pallotti (2022) in order to compute both the direct

[9]As shown in Pallotti (2022), the rest of the world plays a significant role in financing the large NNP of the government in the US. As my model is a closed economy, I currently abstract from the wealth redistribution from the rest of the world towards the U.S. following unexpected inflation.

and indirect nominal positions in the SCF.[10] Overall, the matching is quite accurate. Both distributions switch from negative to positive NNP between the 50th and the 75th percentiles, and have similar value in the left tail as well as to some extent in the right tail, despite the well known difficulty for the one-account HANK model to capture the very wealthy (e.g. Castaneda et al. (2003)). This relatively good performance in the right tail of the NNP distribution of my model is also driven by the fact that the NNP distribution is not as skewed as the one for overall wealth, which includes also housing, stocks and other real assets.

Table 2: Net nominal positions in the data and in the model

NNP Quantiles			Consumption CDF
Pct	Data	Model	Model
0.01	-6.8	-7.2	0.0%
0.05	-3.6	-4.8	0.8%
0.1	-2.5	-3.5	2.3%
0.25	-1.1	-2.3	8.7%
0.5	-0.1	-0.9	25.3%
0.75	0.4	0.5	51.3%
0.9	2.2	2.0	74.3%
0.95	4.1	2.9	84.7%
0.99	10	4.6	95.7%

Net nominal position over household annual labor income in the 2019 SCF vs. in the model. Cumulative distribution function of consumption in the model.

Most importantly, the model can perfectly match the empirical covariance between NNP and MPC at -0.072, which is the most precise estimate among the ones in Auclert (2019). As shown in Auclert (2019), within a very general class of models, this covariance is a sufficient statistics to predict the impact on aggregate consumption of a wealth redistribution stemming from a one-off shock to the price level.

[10] As in Doepke and Schneider (2006), I take include nominal positions that are directly held in household portfolios (e.g. mortgages or bonds) as well as those held through investments intermediaries, such as bonds held by a mutual funds where households are shareholders. Moreover, I also take into account indirect nominal positions arising from the households' ownership of equity in firms, which have nominal assets or liabilities on their balance sheets. For details, see Pallotti (2022).

Matching well the distribution of NNP as well as the covariance between NNP and MPC comes at the cost of having virtually no people at the borrowing constraint, and thus a lower average MPC in the model, which is 21% per year - in the low range of the empirical estimates. The intertemporal Keynesian cross Auclert et al. (2018) is therefore less powerful in this model relative to a baseline HANK, and the propagation to the broader economy of any initial impulse to aggregate demand can be interpreted as a lower bound.

3 Wealth Redistribution and its Propagation

I use the model to examine how the wealth redistribution resulting from an inflation shock propagates to aggregate variables, specifically consumption and inflation. I measure the latest inflation shock by comparing the expected path for the price level from the Survey of Professional Forecasters at the end of 2020 with the actual evolution of the price level - which was around 10% higher by the end of 2022.[11]

This shock to the price level has been arguably due to several factors: supply chain disruptions, generous transfers from the government to households, or monetary policy remaining accommodative even after inflation started to exceed 2% year-on-year in April 2021, among others (e.g. Giannone and Primiceri (2024), Bernanke and Blanchard (2023), Dao et al. (2024). Since my interest lies solely in how the redistributive effects implied by this inflation shock (due to the presence of nominal assets and liabilities) propagated to the rest of the economy, it is not strictly necessary to specify within the model the exact combination of underlying structural shocks that caused this spike in the price level in the first place.

Instead, in the model, I directly shock the wealth distribution by simulating a change in the unit of account equal in magnitude to the surprise inflation observed over 2021 and 2022. Through the lens of the model, the only effect comes from the net nominal position Λ becoming less valuable in terms of real consumption c, redistributing resources away from asset-rich households and towards indebted ones. Another equivalent way of

[11] Figure 12 shows the actual and expected paths for the price level as of December 2020.

modeling the change in the unit of account is a one-off MIT shock as a wealth tax, θ_π, on wealth holdings Λ, which results in negative outlays for creditors and a positive subsidy to debtors and to the government (which has a negative net nominal position).

A possible interpretation the impulse response function (IRFs) of consumption and inflation to this wealth redistribution is to compare a *real-asset* economy, hit by the same combination of primitive structural shocks that moved inflation in the first place, to a *nominal-asset* economy where these primitive shocks also had redistributive effects due to the unexpected inflation they generated. In turn, these redistributive effects transmitted to aggregate consumption and inflation according to the IRFs shown below.

Of course, it is entirely feasible within the model to generate inflation (and thus wealth redistribution) also through some primitive structural shocks. We will look at the example of monetary policy shock thorugh the lens of the model in Section 5.

3.1 Impact on aggregates

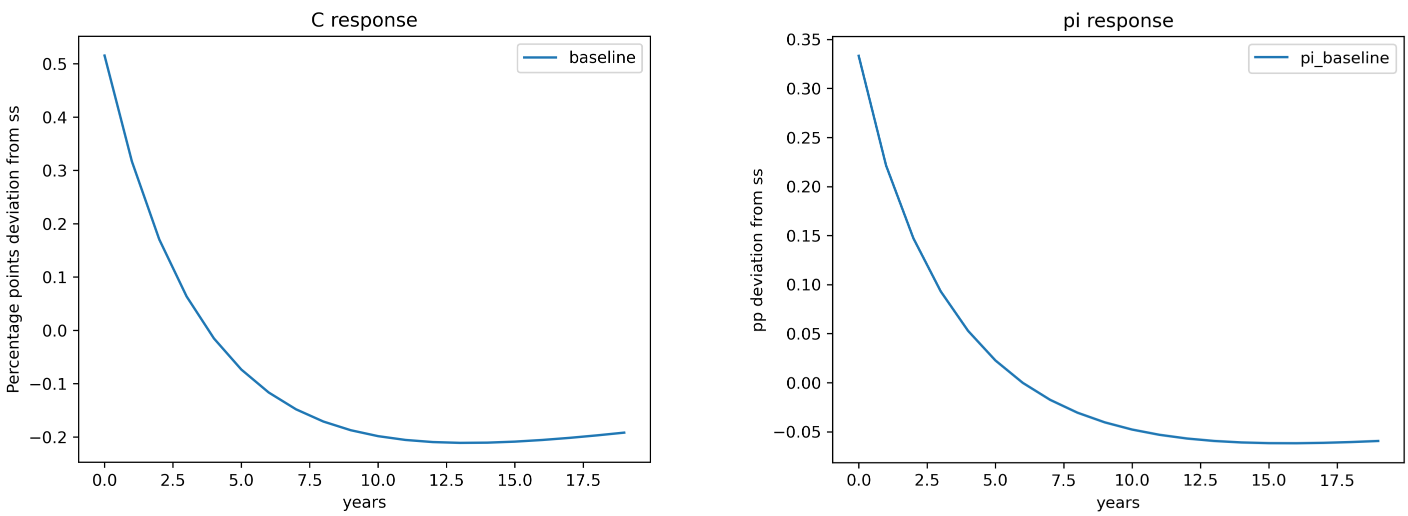


Figure 1: Impulse response functions (IRFs) of consumption and inflation to the wealth redistribution generated by the 2021-2022 inflation shock in the United States according to my HANK model with nominal assets, matching the empirical NNP distribution and the covariance between NNP and MPC in the data.

The right panel of figure 1 depicts the response of aggregate consumption to the inflation shock described above. Consumption rises by 0.5% in the first year and then begins to slowly decline back toward the steady state, ultimately undershooting it. Similarly, through the NKWPC 4, inflation rises by 0.3 pp in the first year, slowly decaying afterwards, as reported in the left panel of figure 1. In this sense, an inflationary shock in a HANK model featuring nominal wealth redistribution tends to ”feed on itself”.

Figure 2 sheds light on the various channels within the model behind the aggregate increase in consumption. The direct impact of the shock (blue dotted line) is initially expansionary, as it redistributes resources from households with low MPC to those with high MPC. After a few years, the direct response of consumption to the shock turns negative. This is due to the fact that while households close to the borrowing constraint have a higher MPC and initially raise their consumption substantially, wealthier households behave more in line with the Permanent Income Hypothesis (Friedman, 1957), cutting their consumption permanently by an amount close to the annuity value of the negative wealth shock. Over time, the consumption behavior of the rich dominates the initial spending spree of indebted households, also because the household sector as a whole has a positive net nominal position.

The initial positive direct effect raises output in the economy (the blue line in the left panel of figure 2), which further boosts consumption through the intertemporal Keynesian cross (Auclert et al., 2018), as shown by the dotted orange line in the right panel of figure 2. Output increases initially also thanks to a small but persistent rise in government spending due to devaluation of its nominal debt as per equation 6, shown by the green line in the left panel of Figure 2.

The increase in output from both consumption and government spending pushes up inflation according to the New Keynesian Wage Phillips Curve (Equation 4). This rise in inflation due to the wealth redistribution triggers a monetary policy response, raising nominal interest rates according to the Taylor rule (Equation 5) of around 40 basis points, as reported in the left panel of Figure 2. The ex-post real interest rate is negative in the first period, both because of the unexpected inflation and because the price of the long-term bond unexpectedly falls - due to discounting the higher future path of nominal interest rates.

As the negative direct effect on consumption after a few years begins to dominate the positive general equilibrium effect from the intertemporal Keynesian cross, consumption

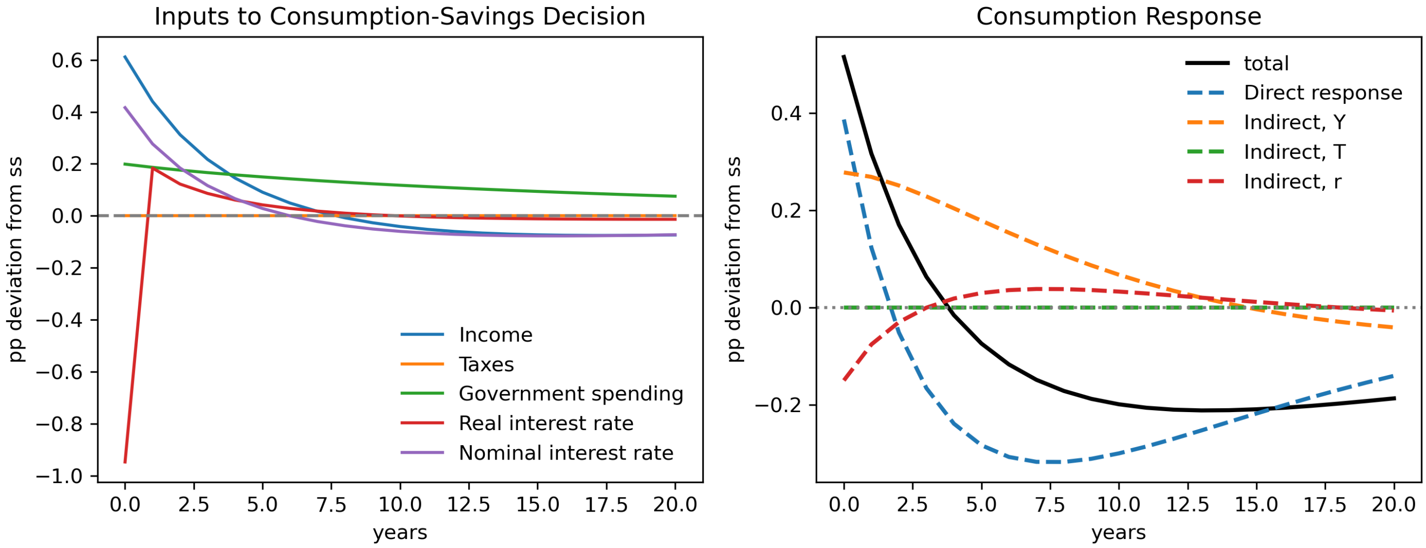


Figure 2: Decomposition of the net effect on consumption reported in the left panel of figure 1 into the direct impact of the redistributive shock, the feedback loop from income to consumption through the intertemporal Keynesian cross, as well as the reactions of government spending and interest rates in the model. Left panel reports the IRFs of the inputs to the household problem, right panel reports each input transmission to aggregate consumption.

and inflation undershoot their steady-state values. Consequently, monetary policy starts to cut interest rates (marginally) and consumption converges back to its equilibrium level from below. The model suggests that while the effects of wealth redistribution on aggregate quantities are very small after a few years, they are nevertheless very long-lasting, as it takes a several years for the wealth distribution to return back to its ergodic state.

3.1.1 Behavioural frictions

In the simulation discussed above, I assumed that households perfectly understood that unexpected inflation implied a reduction in the present value of their nominal assets or liabilities. However, using data for Germany, Schnorpfeil et al. (2023) show that households are often unaware of the reduction in the real value of their nominal debt induced by the Fisher effect. This is particularly relevant for long-term nominal positions, like mortgages or Treasuries, where the reduction in the real value of cash flows from these instruments happens over long time horizons, and it thus may not be immediately apparent to some households.

To capture this potential friction in the model, I shift from simulating a one-off wealth redistribution to simulating the same wealth over time (retaining the same present value). Concretely, I introduce an inflation tax $\theta_{\pi,t}$ on nominal assets and liabilities that phases off completely after d years.

$$\theta_{\pi,t} = \begin{cases} \frac{\gamma_\pi}{d} & \text{for } t < d \\ 0 & \text{for } t \geqslant d \end{cases}$$

Here, γ_π represents the overall inflation shock described above, and d is the average duration of net nominal positions as of the end of 2020 (five years, as in Pallotti (2022)). Households with negative net nominal positions Λ receive a subsidy equal to $\theta_{\pi,t}\Lambda$, while households with positive net nominal positions have to pay the equivalent tax. This simulates a reduction in the negative cash flow implied by a mixture of short and long term nominal debt, or in the positive cash flow implied by a mixture of short and long-term nominal positions. This tax lasts only d periods, and households form their expectations about the future values of this tax under cognitive discounting, following Gabaix (2020):

$$E_t^B[\theta_{\pi,t+1}] = \theta_{\pi,ss} + \tilde{m} E_t[\theta_{\pi,t+1}] \tag{9}$$

Here, $\theta_{\pi,ss}$ is the steady-state value of this tax, which is zero. The parameter $\tilde{m}$ governs the degree of cognitive discounting regarding the future values of this tax, or in other words the myopia of these households with respect to the future reduction in the value of their nominal assets and liabilities. For $\tilde{m} = 0$, households are fully myopic and every reduction in the real value of their nominal assets or liabilities comes to them as a surprise each period t . For $\tilde{m} \to 1$, the model gets closer to the case of rational expectations in the previous section, where households perfectly anticipate the reduction in the present value of all their future nominal cash flows.[12]

Figure 3 reports the impulse response functions (IRFs) for consumption and inflation

[12]There is a subtlety that makes the exercise in the previous section not perfectly comparable to the current one with $\tilde{m} = 1$, which is that when $\tilde{m} = 1$ households perfectly understand that their future nominal assets, not just their current ones, will be devalued by the tax $\theta_{\pi,t}$, which ceteris paribus encourages them to save less and consume more.

in the model for varying degrees of $\tilde{m}$. For $\tilde{m}$ close to one, the effect is similar to the rational expectations case. As we decrease $\tilde{m}$ towards zero, the response of consumption becomes less pronounced on impact but more persistent over time. This occurs because indebted households adjust their consumption positively every time they realize their liabilities have actually a lower value than they expected - without (or only partially) anticipating that this is going to happen again over the next periods. The response of inflation for lower $\tilde{m}$ is more persistent - though broadly similar on impact, since the unions are fully rational and forecast the cumulative deviation of consumption from its steady state when setting wages.

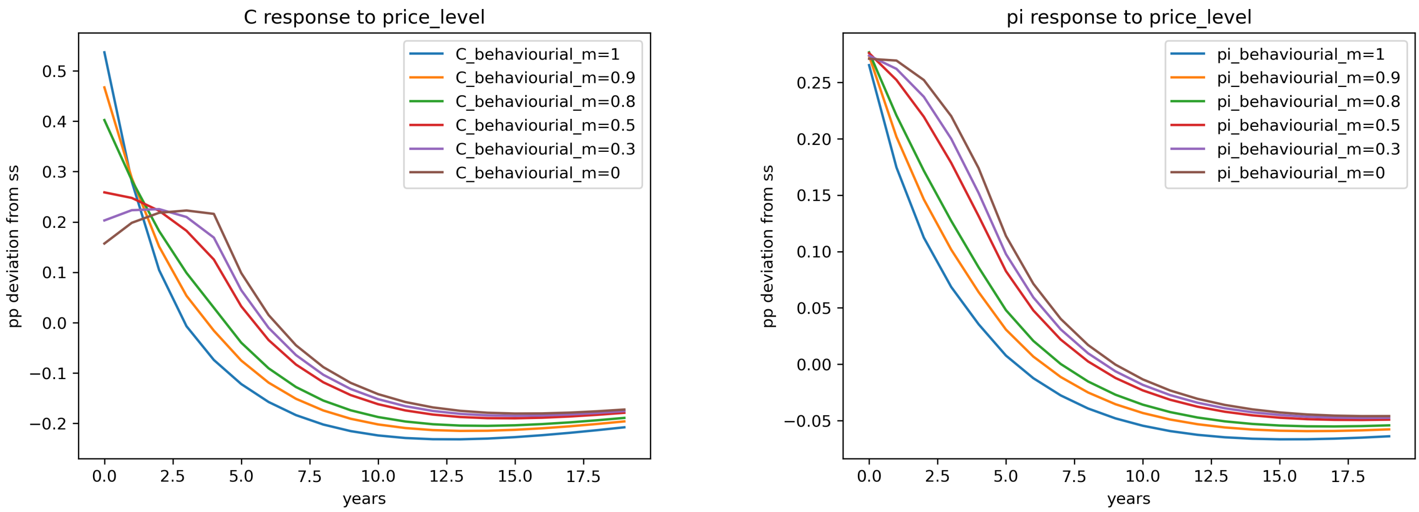


Figure 3: Impulse response functions (IRFs) of consumption and inflation to the wealth redistribution generated by the inflation shock when households exhibit cognitive discounting with respect to the reduction in the real value of their long-term assets and liabilities. A lower $\tilde{m}$ implies more myopia, as in Equation 9.

4 Empirical Evidence

A key prediction of the model is that households with nominal debt should increase their consumption, relative to a counterfactual where they had no nominal liabilities. I test this empirically using data from a fintech company in the US where I can identify households who have been paying down a mortgage throughout the inflationary shock. I then repeat the same exercise using publicly available data, leveraging variation at the county level.

4.1 Fintech data

The dataset covers almost 100 billion transactions for more than 45 million unique users from January 2010 to October 2023.[13] The fintech company supplying the data offers a financial platform to U.S. banks, allowing the banks' customers to get a comprehensive view of their financial situation.

The dataset contains all inflows (e.g., salaries, transfers, refunds) and outflows (e.g., direct debits, credit card spending, cash withdrawals, mortgage payments) for all the bank accounts that each user registers for the services provided by the fintech. Although it is not possible to exclude the presence of additional accounts of the users outside the sample, the platform itself is designed to provide users with a full picture of their finances, thereby incentivizing them to add all relevant accounts. Consequently, I treat each user as representing a household unit for the rest of my analysis.

Sample selection To abstract from potential biases due to households entering or exiting the sample at different times, I construct a panel of users who remain continuously active. My benchmark sample consists of households that performed at least 50 transactions every month throughout the period of interest. Although this selection may be restrictive, it allows me to match the fraction of households paying down a mortgage (as discussed below) and still yields a final panel of almost 700,000 users from January 2019 to October 2023.[14] In Section B.3, I explore how relaxing this monthly transaction threshold (to 25, 10, or even 1 transaction per month) affects the results. Qualitatively, the findings remain robust. The quantitative magnitudes tend to be larger when the threshold is lower. At the same time, the sample as deviates more from the actual fraction of mortgagors in the population.

Lastly, I restrict the sample to transactions in U.S. dollars, and I follow the fintech's algorithm to remove outliers and duplicates.

[13] The exact numbers for the whole sample are 97,869,791,714 transactions and 45,302,620 unique account holders.

[14] The exact number is 687,382.

Tracking US Aggregates The data align closely with official U.S. consumption statistics. Figure 4 shows a comparison between U.S. Census monthly retail sales data with credit and debit card expenditures extracted from the fintech data, showing a correspondence at a monthly frequency. There is reasonable alignment also with Personal Consumption Expenditures (PCE) from the Bureau of Economic Analysis (BEA), even though some items like owners' equivalent rent or government-financed purchases (e.g., Medicaid) are absent from the fintech data by design, as they do not involve monetary transactions (see figure 16 and figure 17 in the appendix).

Figure 5 similarly illustrates that total inflows in the fintech data closely track the evolution of personal income from the BEA. Discrepancies appear to be driven essentially by seasonal adjustment in the official series and the unadjusted nature of the fintech flows. Overall, these comparisons underscore that the fintech data reliably capture the trends in U.S. consumption and income.

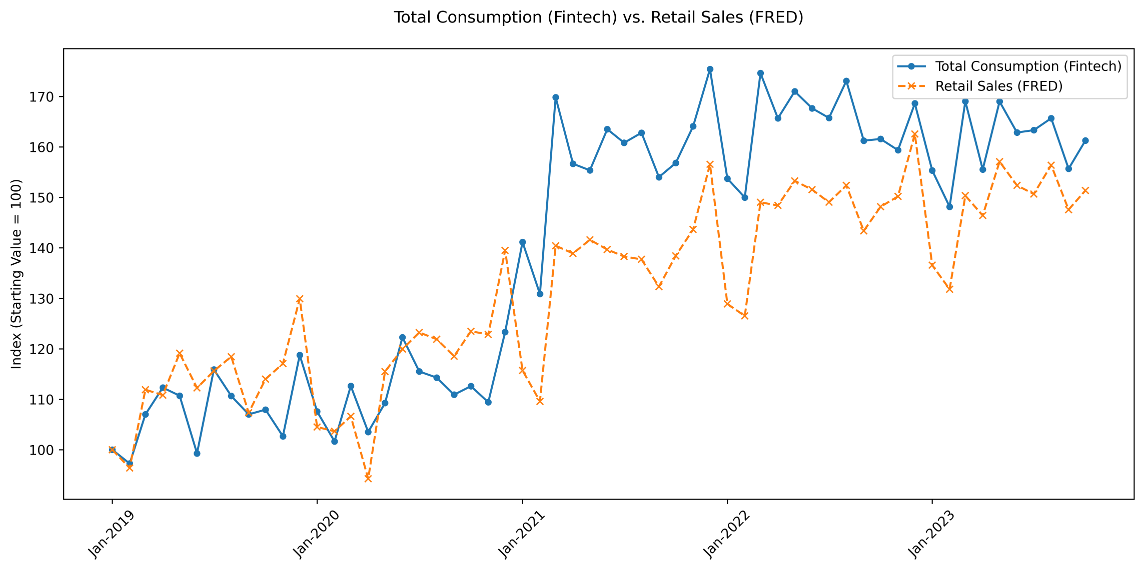


Figure 4: Comparison of consumption outflows in the fintech data with U.S. Retail Sales, from January 2019 to October 2023. The fintech sample includes users with at least 50 transactions per month, yielding about 700,000 households. Both series are indexed to 100 in January 2019. The fintech consumption categories included here based on the platform internal classification are: 'Restaurants', 'Entertainment/Recreation', 'Groceries', 'Electronics/General Merchandise', 'Automotive/Fuel', 'Utilities', 'Cable/Satellite/Telecom', 'Education', 'Rent', 'Travel', 'Healthcare/Medical', 'Postage/Shipping', 'Gifts', 'Pets/Pet Care'.

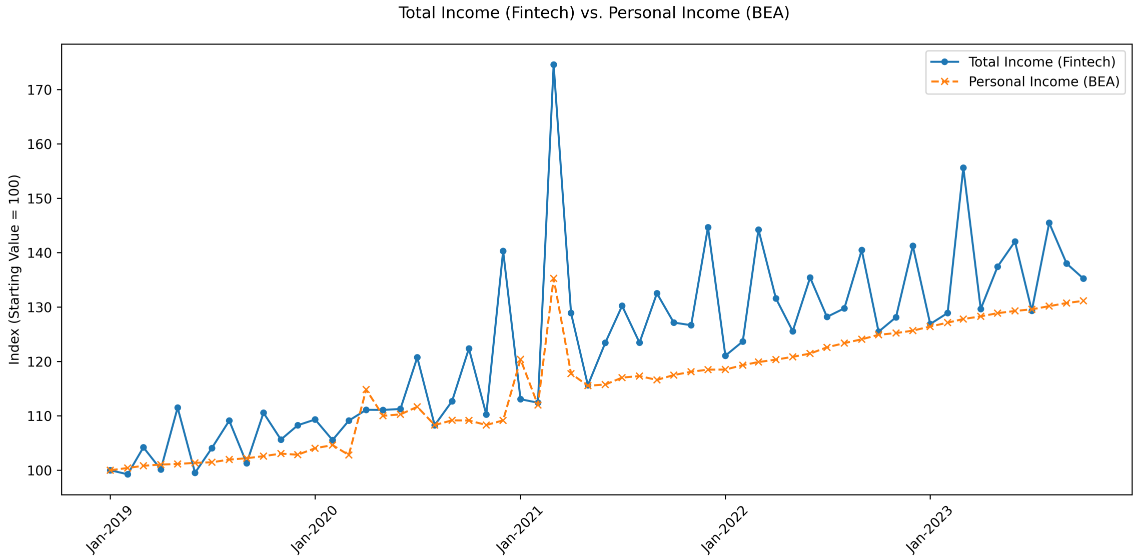


Figure 5: Comparison of total income inflows in the fintech data (not seasonally adjusted) with official U.S. Personal Income (BEA) (seasonally adjusted) from January 2019 to October 2023. The fintech sample includes users with at least 50 transactions per month, yielding about 700,000 households. Both series are indexed to 100 in January 2019.

Mortgagors A key advantage of these data is that one can identify households who are paying down a mortgage. Specifically, I use the fintech' internal algorithm, which classifies transactions based on their descriptions and counterparties, to isolate mortgage-related payments. Among those flagged as mortgage payments, I only retain those exceeding $200 to limit the inclusion of unrelated or incidental charges. Figure 6 shows that the fraction of households marked as mortgagors in my core sample almost perfectly matches the fractions from the 2019 and 2022 Survey of Consumer Finance (SCF).

4.1.1 Empirical evidence

To estimate how inflation affects households' spending growth depending on their nominal liabilities, I begin by regressing the growth in consumption of household i on an indicator M_i for those who continuously pay a mortgage over the sample period,[15] as well as on other controls X_i:

[15] Since I cannot observe the outstanding principal balance, restricting the sample to households that consistently make mortgage payments during the inflationary episode helps exclude borrowers who might have fully repaid their mortgage within the period, thus having little nominal debt.

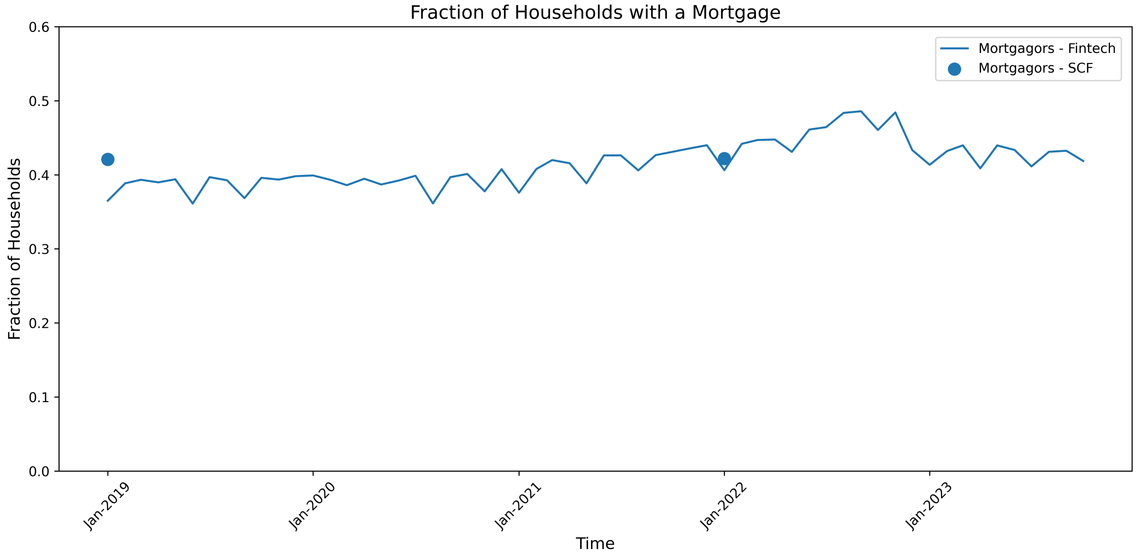


Figure 6: Fraction of households paying down a mortgage each month in the fintech data (January 2019–October 2023) versus the fraction of households carrying mortgage debt in the 2019 and 2022 SCF. The fintech sample includes users with at least 50 transactions per month, yielding about 700,000 households.

$$\Delta \log(C)_i = \alpha \; + \; \beta_1 \, M_i \; + \; \boldsymbol{\beta}_2 \mathbf{X}_i \; + \; \epsilon_i. \tag{10}$$

Given the daily volatility of the fintech data, I measure consumption growth as $\Delta \log(C)_i = \log\big(\overline{C_{i,t}}\big) - \log\big(\overline{C_{i,s}}\big)$, where $\overline{C_{i,t}}$ is average household i consumption over period t. Figure 21 (in Section B.3) shows that inflation began exceeding 2% in March 2021, surpassing 5% by June 2021. Around this time, the rise in inflation also gained substantial media coverage, as evidenced by Google trends data (Figure 22). For the benchmark analysis, I define the starting point t as June–July 2021 and the end point s as September–October 2023 (the latest period available).[16]

The vector of controls $\mathbf{X}_i$ includes state fixed effects (based on household residence), household-level income growth, and indicator variables for seven income classes defined by the fintech algorithm.

Results Table 3 shows estimates from regression (10) increasing the number of controls. The first column uses all controls: as we move to the right side of the table, these controls

[16]This timing choice also avoids conflating the effects of inflation with the direct impact of the final round of COVID-related stimulus checks, which were distributed in March 2021. However, results are robust to shifting the start or end dates of the inflationary period, as reported in section B.3.

are progressively excluded. In my preferred specification, over the inflationary period, the consumption growth of households with a mortgage has been on average 1 percentage point higher than those without. The data however also allow for investigating heterogeneous effects among mortgagors, for example by income. In particular, I categorize households into seven income classes using the platform's internal algorithm and interact the mortgage indicator M_i with each income class k:

$$\Delta \log(C)_i = \alpha \;+\; \sum_{k=1}^{7} \gamma_k \big[\; M_i \times \mathbb{I}\{\text{income class} = k\}\big] \;+\; \boldsymbol{\beta}_2 \mathbf{X}_i \;+\; \epsilon_i. \tag{11}$$

Table 4 reports the resulting estimates of γ_k for each income class. Looking at point estimates, mortgagors in the lowest income bracket show a large negative differential, whereas those in the upper income classes exhibited much larger consumption growth when they had a mortgage, relative to households without.

Table 3: Mortgagors and Spending Growth

	(1)	(2)	(3)	(4)
M	0.0125 [0.011, 0.014]	0.0119 [0.011, 0.013]	0.0048 [0.003, 0.006]	0.0046 [0.003, 0.006]
Income FE.	✓	✓		
State FE	✓		✓	
N	680,204	680,204	680,204	680,204
R^2	0.013	0.012	0.001	0

Results of regression 10 of consumption growth from June-July 2021 to September-October 2023. Brackets contain 95% confidence intervals. The fintech sample includes users with at least 50 transactions per month.

Robustness Section B.3 in the appendix relaxes the sample criteria, reducing the transaction threshold to 25, 10, or even 1 transaction per month. These less restrictive filters expand the sample up to 4.2 million households (for the 1-transaction threshold), strengthening statistical precision. The magnitude of the point estimates also tends to increase, suggesting that mortgagors in a broader sample (with less frequent transactors) have even

Table 4: Mortgagors and Spending Growth by Income Class

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
γ_k	-0.29	0.29	0.30	0.31	0.31	0.31	0.31
	[-0.61, 0.02]	[-0.036, 0.594]	[-0.010 , 0.617]	[-0.003, 0.624]	[-0.004, 0.622]	[-0.004, 0.622]	[-0.011, 0.615]
Income FE	✓	✓	✓	✓	✓	✓	✓
State FE	✓	✓	✓	✓	✓	✓	✓
N	680,204	680,204	680,204	680,204	680,204	680,204	680,204
R^2	0.013	0.013	0.013	0.013	0.013	0.013	0.013

Results of regression 11 of consumption growth from June-July 2021 to September-October 2023, where a mortgage indicator M_i is interacted with seven fintech-defined income classes ($k = 1, \ldots, 7$). Brackets contain 95% confidence intervals. The fintech sample includes users with at least 50 transactions per month.

higher spending growth - up to 5% more than non-mortgagors in some specifications. However, this broader sample no longer matches the population fraction of mortgagors, which declines up to about 20%.

Similar considerations hold when adjusting the sample start and end dates, with the overall patterns and estimated coefficients remaining broadly stable.

4.2 Cross-county evidence

Moving to cross-county evidence, I use real-time credit and debit card expenditures at the county level provided by Affinity Solutions and made publicly available by Chetty et al. (2020). Figure 19 in the appendix presents the time series for the US and compares it with aggregate expenditures from BEA data, showing reasonable alignment. Figure 18 contains an example of the data for the county of Dutchess, NY.

I complement these data on expenditures by constructing a new measure of net nominal position at the county level. I follow a separate procedure for assets and liabilities. For nominal assets, I start from the total nominal assets held by US domestic households as computed in Pallotti (2022), and then assign it proportionally across counties based on each county share of yearly interest income over national interest income - both reported by the IRS Statistics of Income.[17] For nominal liabilities, I use the debt-to-income ratio

[17] I thus abstract away from differences in maturity structure of nominal positions across counties and adopt a risk-neutral approach with respect to differential exposure to default risk, assuming this is fully reflected in interest income.

for each county as of the start of the inflation episode in 2021 Q1, reported by the NY FED, and scale it by income at the county level reported by the IRS Statistics of Income.[18]

The net nominal position of county j is therefore simply:

$$NNP_j = \mathrm{NA}\,\frac{I_j}{I} - \mathrm{DTI}_j\,Y_j, \tag{12}$$

Where NA represents total nominal assets held by U.S. households, I_j yearly interest income in county j, DTI_j and Y_j respectively the debt-to-income ratio and yearly income of county j.

Regression I follow the same approach as in section 4.1.1, regressing the change in consumption at the county level during the inflationary shock on a measure of the county-level NNPs at the start of the period. I scale county-level NNP by its income Y_j. As the daily or weekly values are extremely volatile, as before I take an average of June and July 2021 as a starting point of the inflation episode and of August and September 2023 as the endpoint.[19] The results are robust to alternative specifications for the time interval. Equation 13 below describes my empirical strategy:

$$\Delta \log\big(C_j\big) = \alpha + \beta_1 \frac{\mathrm{NNP}_j}{Y_j} + \boldsymbol{\beta}_2 \mathbf{X}_j + \varepsilon_j, \tag{13}$$

I control for a number of confounding factors X_j which may have been relevant to determine the county-level spending growth over the inflationary shock. These include state-level fixed effect, industry composition at the county level (defined as the share in employment for each NAICS 2-digit sectors) and the level of employment in each county at the start of the inflation episode (an average over the first two months, as above).

Results Table 5 reports the results. Consistently with the theory, counties with a more negative NNP tended to exhibit higher spending growth following the onset of the inflationary trend. As before, the first column uses all controls: moving to the right side of the table, these controls are progressively excluded. The magnitude of the coefficient

[18] Figure 20 in the appendix illustrates the variation in the debt-to-income ratios at the county level.

[19] Data are seasonally adjusted as in Chetty et al. (2020).

shrinks, and the sign flips once the analysis is not limited to within-State variation and does not control for industry composition.

Table 6 decomposes the NNP/Y at the county level into nominal assets and liabilities, again gradually excluding controls moving to the right side of the table. Consistently with the theory, counties with more nominal debt have seen a larger consumption response - with the estimate close to being statistically significant. The effect of nominal assets is much less precisely estimated, and the point estimate is slightly above zero, in contrast with the theory.

Table 5: NNP and Spending Growth at the county level

	(1)	(2)	(3)	(4)
NNP/Y	-0.2866	-0.1018	0.1476	0.6640
	(0.459)	(0.385)	(0.295)	(0.300)
State FE	✓	✓	✓	
Industry Comp.	✓	✓		
Employment	✓			
N	952	1607	1607	1607
R^2	0.447	0.394	0.371	0.007

Results of regression 13 of consumption growth from June-July 2021 to August-September 2023 on NNP/Y (net nominal position relative to income) plus controls, all at the county level. Controls include state-level fixed effect, industry composition at the county level (defined as the share in employment for each NAICS 2-digit sectors) and the level of employment in each county at the start of the inflation episode.

Table 6: Nominal assets and liabilities and spending growth at the county level

	(1)	(2)	(3)	(4)
NL/Y	0.7193	0.4640	0.0683	-0.1168
	(0.691)	(0.574)	(0.351)	(0.678)
NA/Y	0.1300	0.277	0.4600	-1.2669
	(0.736)	(0.679)	(0.795)	(0.525)
State FE	✓	✓	✓	
Industry Comp.	✓	✓		
Employment	✓			
N	952	1607	1607	1607
R^2	0.448	0.394	0.372	0.011

Results of regression 13 of consumption growth from June-July 2021 to August-September 2023 on NL/Y and NA/Y (respectively, nominal liabilities and nominal assets relative to income) plus controls, all at the county level. Controls include state-level fixed effect, industry composition at the county level (defined as the share in employment for each NAICS 2-digit sectors) and the level of employment in each county at the start of the inflation episode.

5 Implications for Monetary Policy

The previous two sections focused on the importance of the Fisher channel in the context of the surprising strength of aggregate demand in the US post-pandemic. In this section, I move beyond the current inflationary episode - studying monetary policy in my HANK model featuring a quantitatively disciplined Fisher channel.

Monetary policy shocks I start by simulating a standard 25 bps expansionary shock with persistence $\rho = 0.7$ as in Kaplan et al. (2018).[20] I trace out the IRFs of consumption and inflation when households and the government have nominal assets, as in my model, and then contrast those IRFs with the case in which all assets are real - as in most baseline HANK models, where unexpected inflation has no redistributive impacts.

[20] The path for the monetary policy shock is reported in figure 14 in the appendix.

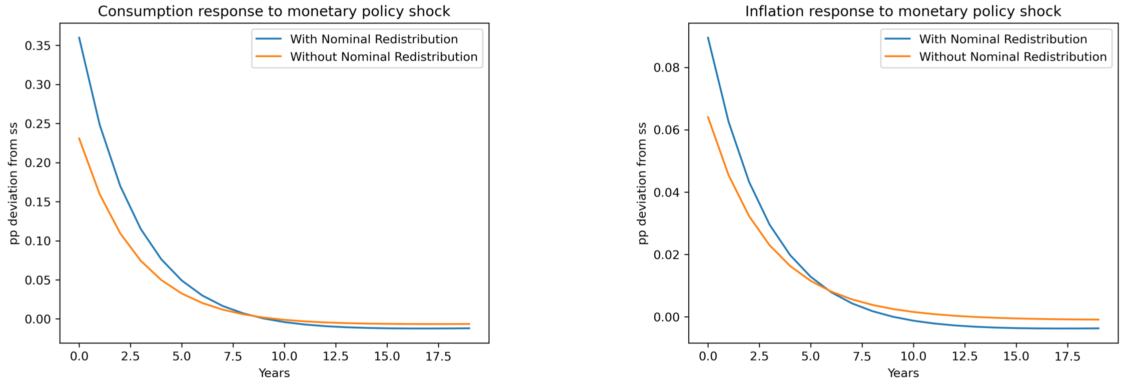


Figure 7: Impulse response functions of consumption and inflation to a standard monetary policy shock with and without an active Fisher channel in the model. In the model with nominal assets, monetary policy is around 50% more powerful as it also induces unexpected wealth redistribution across households.

Figure 7 reports the results. The left panel shows that an active Fisher channel makes monetary policy almost 50% more powerful on impact in its transmission to consumption. The intuition is the same as in the previous section: a persistent monetary policy shock generates some unexpected inflation (reported in the right panel of figure 7) which redistributes resources from wealthy households towards indebted ones with a higher MPC. In turn, this also generates more inflation thorough the standard New Keynesian Wage Phillips Curve 4.[21]

Increasing the degree of activeness of monetary policy through a higher coefficient on inflation in the Taylor rule 5 reduces the differences across models with nominal and real assets. Intuitively, in the case of an expansionary monetary shock, the systematic component of monetary policy in case of an higher Taylor coefficient responds more aggressively in the model with nominal assets to counteract the inflationary impact stemming from the Fisher channel. In turn, this limits the differences across the model with nominal and the one with real assets.

Nominal Rigidities and the Effectivness of Monetary Policy In my model, varying the degree of nominal rigidity produces two opposing effects with respect to the impact

[21] As noticed in section 3.1, the smaller but more persistent cut to consumption by wealthy households - who behave more according to the permanent income hypothesis (Friedman (1957)) - dominates over time the temporary spike in consumption of indebted households. The aggregate consumption IRFs to an expansionary monetary policy shocks therefore mildly undershoots its real-assets counterpart at long horizons.

of monetary policy shocks on consumption. On the one hand, reducing the degree of nominal rigidities implies that the real interest rate responds less to a monetary policy shock, decreasing the effectiveness of monetary policy - in line with conventional wisdom. On the other hand, in my model, less nominal rigidities also lead to a stronger reaction of inflation on impact, which leads to more wealth redistribution from low MPC households to high MPC ones, thus increasing the positive impact of an expansionary monetary policy shock on consumption.[22]

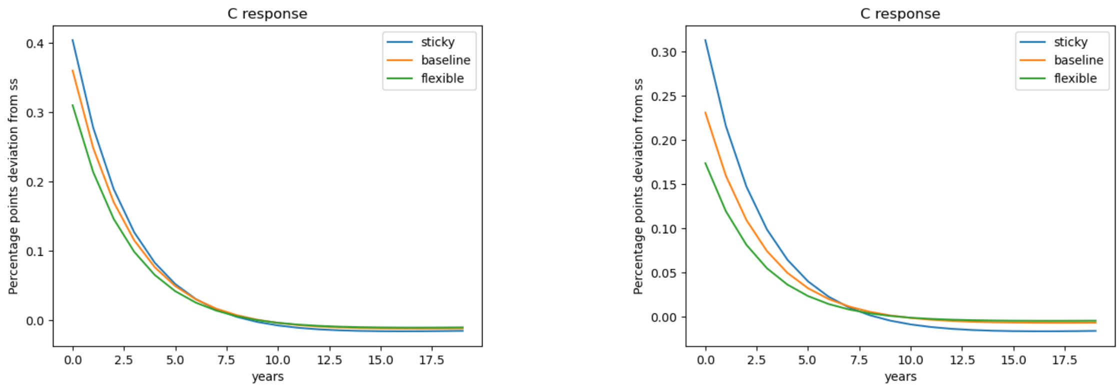
In my benchmark calibration of the model, the first channel through the real-rate still quantitatively dominates the opposing force arising from the Fisher channel. Therefore, consistent with conventional wisdom, monetary policy is still more effective the higher the degree of nominal rigidities. However, the Fisher channel still plays a significant quantitative role in dampening the differences across levels of nominal stickiness.

Figure 8 visualizes this point. The left panel shows the IRF of consumption in my benchmark model to the same monetary policy shock as the one in the previous paragraph, for different calibrations of the slope of the New Keynesian Wage Phillips Curve - i.e. the parameter κ_w in equation 4. Monetary policy is more effective the stickier nominal wages are, but the differences between IRFs are relatively small, due to the counterbalancing effect of the Fisher channel. The right panel of Figure 8 shows the same IRFs of consumption across the same values of κ_w, but in a model with only real assets. The differences in consumption IRFs across different values of κ_w are now much larger due to the absence of the Fisher channel. As discussed in the previous paragraph, the absence of the Fisher channel also dampens the overall impact of monetary policy on consumption.

For some extreme parameterizations of the model that overstate the covariance between the marginal propensity to consume (MPC) and net nominal positions (NNP), the Fisher channel actually dominates the conventional impact of monetary policy on the real interest rate. This generates a "paradox of flexibility" whereby monetary policy has larger real effects the smaller the degree of nominal rigidity in the model. However, this paradox arises from a different mechanism than the one emphasized by Eggertsson and Krugman (2012), which operates through the effects of unexpected inflation in lowering

[22] Clearly, the reverse applies to contractionary shocks.

the real interest rate when the nominal rate is stuck at the zero lower bound (ZLB). In my model, when monetary policy is stuck at the ZLB and the economy faces a demand shock, the Fisher channel will add to the real-rate channel, making the paradox of flexibility identified by Eggertsson and Krugman (2012) more pronounced.



Model with Fisher Channel **Model without Fisher Channel**

Figure 8: Impulse response functions of consumption to a standard monetary policy shock for different degrees of nominal rigidity in the model. Left panel: benchmark model with nominal assets; right panel: model with real assets, where there is no redistribution of wealth generated by inflation. Sticky: $\kappa_w = 0.05$; baseline: $\kappa_w = 0.10$; flexible: $\kappa_w = 0.15$.

6 Conclusions

This paper extends the standard HANK framework to incorporate nominal assets and liabilities in a way that matches the observed distribution of net nominal positions (NNP) and their covariance with households' marginal propensities to consume. By doing so, it highlights the quantitative relevance of the Fisher channel for macroeconomic outcomes - an effect first emphasized by Auclert (2019) but often overlooked in the broader HANK literature, which typically assumed one-period real assets or continuous-time structures where inflationary redistributions do not arise.

The principal finding is that the wealth redistribution from nominal creditors to debtors generated by the unexpected inflation shock in the United States raised aggregate consumption by about 0.5% on impact, with positive effects persisting for several years. This mechanism is in line with fintech-based evidence on household transactions: mortgagors, who stand to benefit most from the devaluation of nominal debts, increased their consumption significantly more than non-mortgagors over the inflationary period. A complementary cross-county analysis provides additional support, showing that areas with relatively higher nominal debt experienced stronger consumption growth after the inflation shock.

Turning to policy implications, the model suggests that the Fisher channel makes monetary policy substantially more powerful: unexpected inflation redistributes resources to indebted, high-MPC households, thereby amplifying consumption responses to monetary policy shocks by around 50% under a conventional Taylor rule. Moreover, the effectiveness of monetary policy becomes less reliant on price stickiness, since redistribution operates even in an environment of completely flexible prices. In fact, at the zero lower bound, the Fisher channel magnifies the "paradox of flexibility" (Eggertsson and Krugman, 2012).

Overall, this analysis underscores the importance of nominal exposure heterogeneity in shaping how unexpected inflation transmits through the macroeconomy. By integrating distributional evidence into a tractable HANK framework, the paper demonstrates that ignoring the redistributive consequences of unexpected inflation can lead economists and policymakers to misjudge the resilience of aggregate demand in response to an inflationary shock, as well as the operation of monetary policy.

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Appendix A Model

A.1 Unions

This sections describes the key steps behind the New Keynesian Wage Phillips Curve ??. It recaps the crucial steps in Auclert et al. (2018), referring to that paper for further details. In the spirit of Erceg et al. (2000), each worker belongs to a union k, which employs a fully representative sample of the population. Each union aggregates individual tasks into $N_{kt} = \int e_{it} n_{ikt} di$. These tasks are combined by a competitive labor packer into aggregate employment according to

$$N_t = \int \left(N_{kt}^{\frac{\epsilon-1}{\epsilon}} dk \right)^{\frac{\epsilon}{\epsilon-1}}$$

and sold to firms at price W_t.

Adjusting wages has quadratic costs that feed in directly in the utility function. Each union sets a common wage W_{kt} for each efficient unit of labor provided by its members and (for simplicity) asks each member to work the same amount of hours, so $N_{kt} = n_{ikt}$.[23]

W_{kt} is set by each union in order to maximize the average utility of its members:

$$\max_{W_{k,t}} \sum_{\tau \geqslant 0} \beta^{\tau+T} \left(\int \{u(c_{i,t+\tau}) - v(m_{i,t+\tau})\} \, d\psi_{i,t+\tau} - \frac{\psi}{2} \left(\frac{W_{k,t+\tau}}{W_{k,t+\tau-1}} - 1 \right)^2 \right)$$

where $\psi_{i,t+\tau}$ is the density of households, $-\frac{\psi}{2} \int \left(\frac{W_{kt}}{W_{kt-1}} - 1 \right)^2 dk$ is the quadratic cost of adjusting wages, and the maximization is subject to the demand curve for labor:

$$N_{kt} = \left(\frac{W_{kt}}{W_t} \right)^{-\epsilon} N_t$$

Where $W_t = \left(\int W_{kt}^{1-\epsilon} dk \right)^{\frac{1}{1-\epsilon}}$ is the price index for aggregate employment services.

Taking the first-order condition wrt to $W_{k,t}$, applying the envelope theorem whereby $\frac{\partial c_{it}}{\partial W_{kt}} = \frac{\partial z_{it}}{\partial W_{kt}}$ (recalling the definition of z_{it} from 3), recognizing that all unions are identical and thus in equilibrium $W_{kt} = W_t$, defining wage inflation $\pi^w = \frac{W_t}{W_{t-1}} - 1$ and rearranging as in Auclert et al. (2018) we arrive at the New Keynesian Wage Phillips Curve:

$$\pi_t^w (1 + \pi_t^w) = \frac{\epsilon}{\psi} \int N_t \left(v'(n_{it}) - \frac{\epsilon - 1}{\epsilon} \frac{\partial z_{it}}{\partial n_{it}} u'(c_{it}) \right) di + \beta \pi_{t+1}^w (1 + \pi_{t+1}^w) \tag{14}$$

According to 14, the unions set higher wages whenever the marginal rate of substitution between hours and consumption is above the marginal income from extra hour (after tax), marked down by ϵ.

Which in unions set higher wages when the average of marginal rates of substitution between hours and consumption for households ($v'_{n_{it}}/u'_{c_{it}}$) exceeds a marked-down average of marginal after-tax income from extra hours.

Equation 14 can be rewritten in terms of aggregates by noticing that in equilibrium since $n_{it} = N_{kt} = N_t$ we have:

[23] As noted by Auclert et al. (2018), a more general rule $n_{it} = n(e_{it}) N_t =$ would be equivalent to redefine the e_{it} including the function n.

$$\frac{\partial z_{it}}{\partial n_{it}} = (1-\theta)\tau_{it} e_{it}^{1-\theta}\left(\frac{W_t}{P_t}\right)^{1-\theta} N_t^{-\theta} = (1-\theta)\frac{e_{it}^{1-\theta}}{\int e_{it} di}\frac{Z_t}{N_t}$$

And therefore:

$$\pi_t^w(1+\pi_t^w) = \frac{\epsilon}{\psi}\left(N_t v'(N_t) - \frac{\epsilon-1}{\epsilon}(1-\theta)Z_t u'(C_t^*)\right) + \beta\pi_{t+1}^w(1+\pi_{t+1}^w)$$

Where $u'(C_t^*)$ is defined as

$$u'(C_t^*) = \int \frac{e_{it}^{1-\theta}u'(c_{it})}{\int e_{it}^{1-\theta} di} di$$

Substituting in for the utility function, we get equation Finally, I specify the utility function from the constant elasticity of substitution (CES) family with intertemporal elasticity σ, $u(c) = \frac{c^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}}$, and disutility from work with Frisch elasticity of labor supply ϕ as $v(N) = \gamma N^{1+\frac{1}{\phi}}$.

A.2 Inflation, nominal wages and house prices

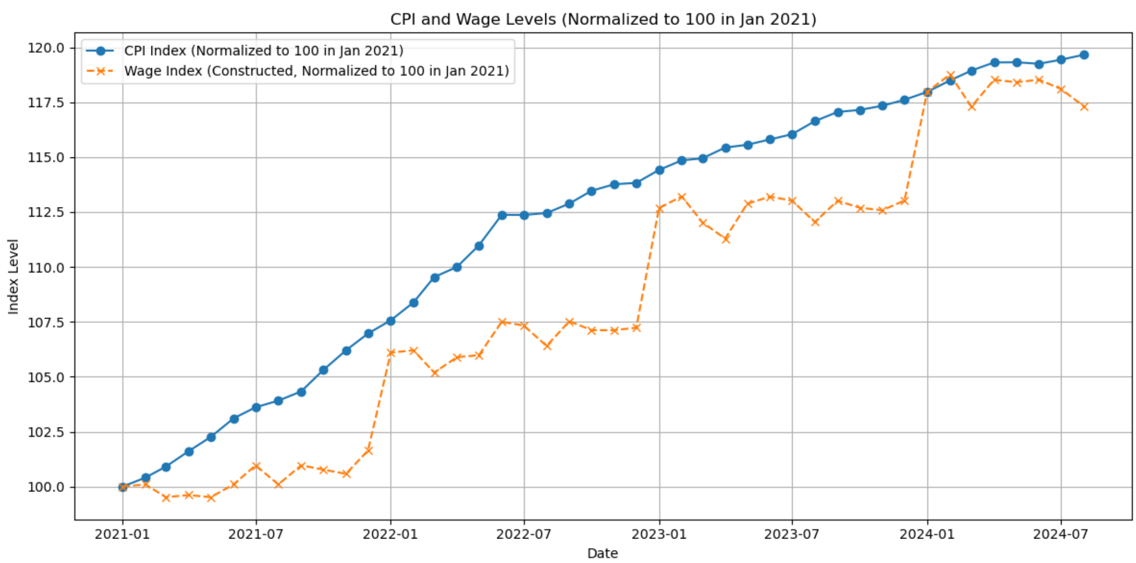

Figure 9: Price-level path for CPI and nominal wages from the Atlanta Fed Wage Tracker, normalized to 100 as of December 2020.

A.3 Inflation shock

The figure below report the difference in the expected path of inflation and its actual realization from December 2020. The cumulated difference until December 2022 (the devaluation used in the paper) has been 10%.

Of course, inflation expectations adjusted (gradually) upwards over the course of the episode. However, as most nominal assets and liabilites are long term claims, with an average duration of 4.5 years, any adjustment of inflation expectations after December 2020 - which reduces the

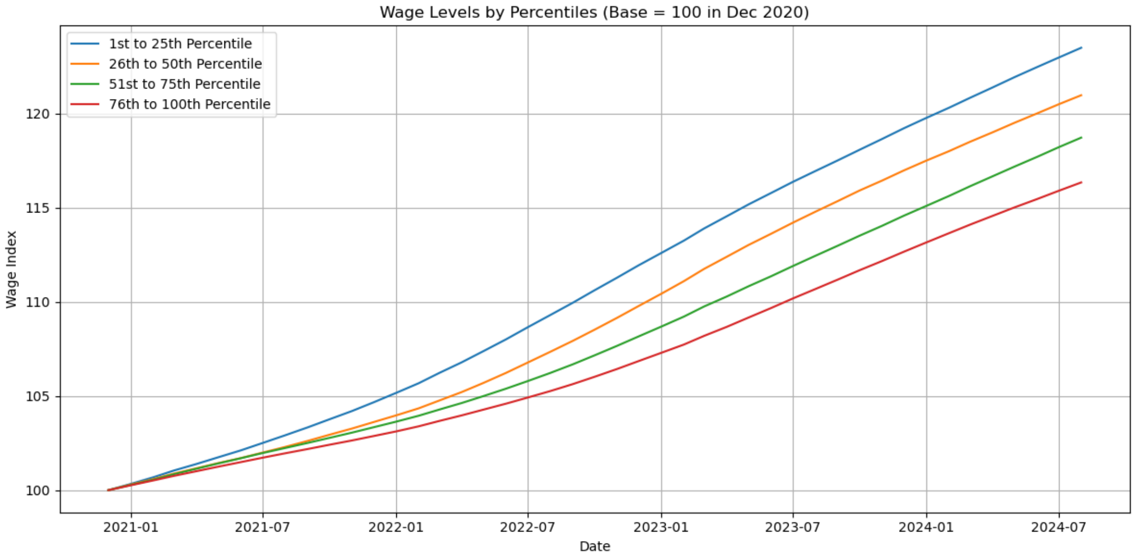

Figure 10: Path for nominal wages constructed from 12-Month Moving Averages Growth Rates from teh Atlanta Fed Wage Tracker for quartiles of the wage distribution, normalized to 100 as of December 2020.

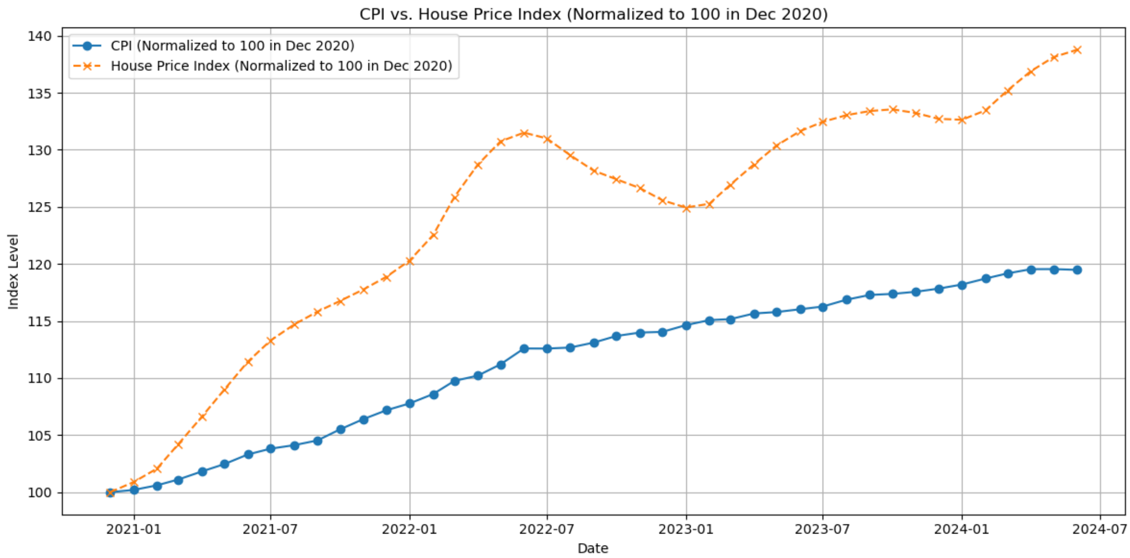

Figure 11: Price-level path for CPI and the Case-Shiller U.S. National Home Price Index from Standard & Poors, normalized to 100 as of December 2020.

extent of the actual surprise - does not really affect the devaluation of the stream of payments implied in long-term nominal assets or liabilities, such as Treasuries or fixed-rate mortgages. It does affect short-term ones, like deposits or consumer-credit, in case they are reinvested/refinanced at higher nominal rates.

As monetary policy started to gradually raise interest rates over the course of 2022, this could slightly overstate the actual devaluation faced by short-term nominal assets and liabilities over the period, reducing the actual amount of redistribution. However, this effect should be quantitatively small given the high average duration of nominal assets and liabilities and the fact that most of the rise in interest rates happened towards the end of 2022 and afterwards. Moreover, figure 13 shows that this gap between historically expected and actual evolution of inflation continued well into 2023-2024, adding (at the time of writing) an additional 2.5 pp, which then understate the actual amount of redistribution.

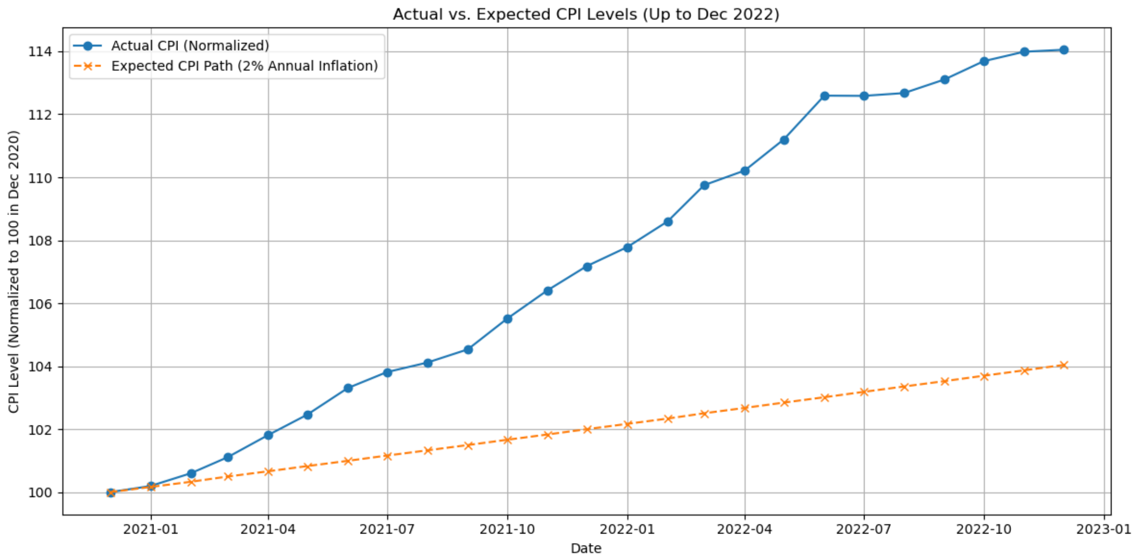

Figure 12: Actual and expected price-level path for CPI from December 2020 to December 2022. Expectations according to the Survey of Professional Forecasters as of December 2020.

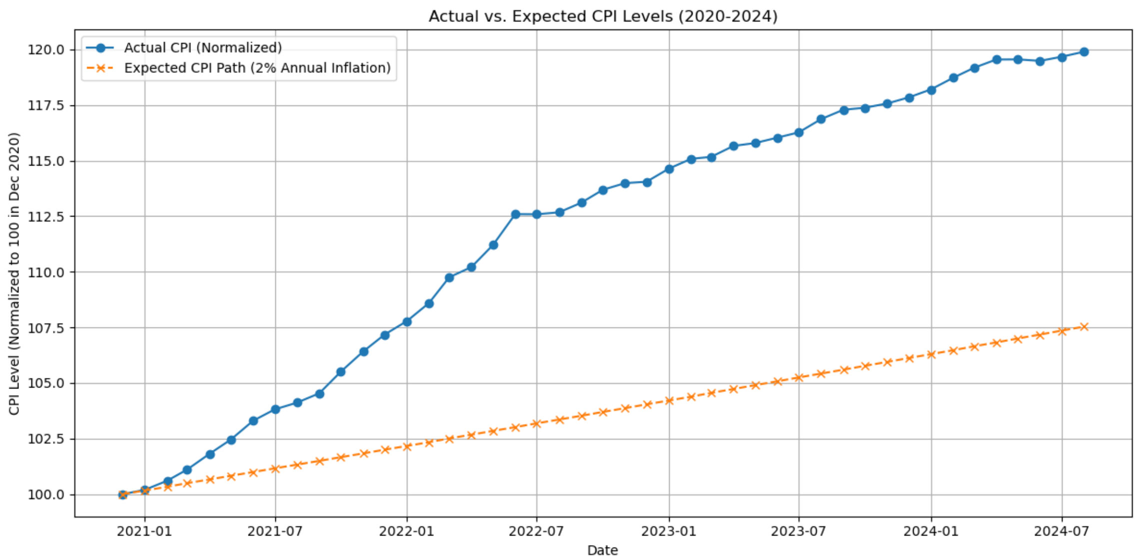

Figure 13: Actual and expected price-level path for CPI from December 2020 to August 2024. Expectations according to the Survey of Professional Forecasters as of December 2020.

A.4 Structural shocks

A.5 Policy implications and the paradox of flexibility

Appendix B Empirical Evidence

B.1 Data sources

B.2 Fintech data vs US official aggregates

B.3 Robustness

Table 7: Mortgage debt and Spending Growth

	(1)	(2)	(3)	(4)
M	0.0513	0.0457	0.0242	0.0238
	[0.05, 0.052]	[0.044, 0.047]	[0.023, 0.25]	[0.023, 0.25]
Income FE.	✓	✓		
State FE	✓		✓	
N	3.4mn	4.2mn	3.4mn	4.2mn
R^2	0.008	0.006	0.002	0

Results of regression 10 of consumption growth from June-July 2021 to September-October 2023. Brackets contain 95% confidence intervals. The fintech sample includes users with at least 1 transaction per month.

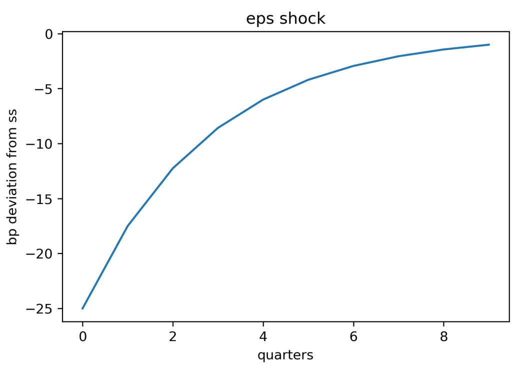

Figure 14: Monetary policy shock with persistence $\rho = 0.7$ as in Kaplan et al. (2018)

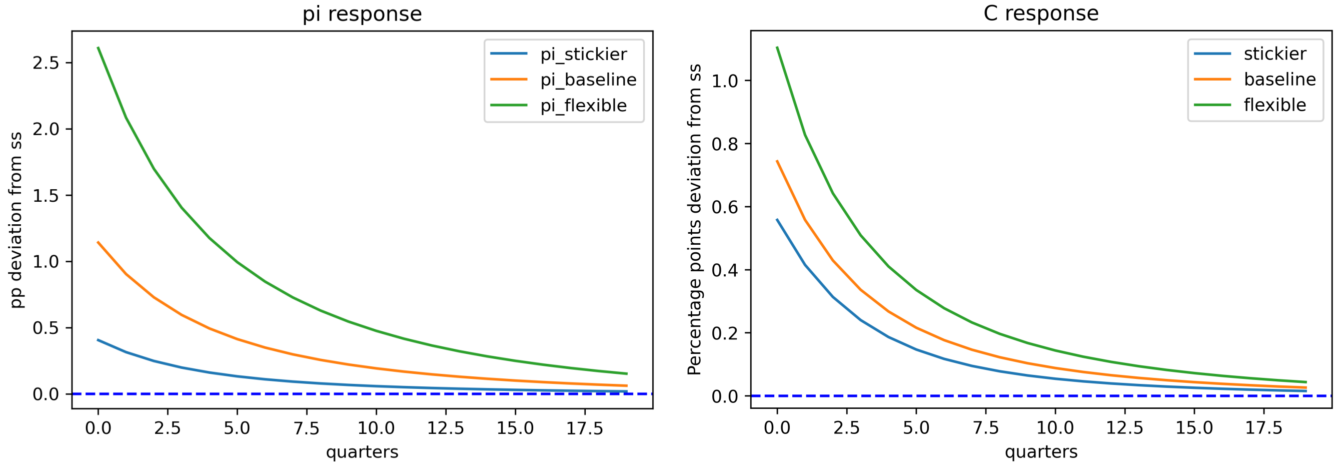

Figure 15: Monetary policy shock and the response of consummption and inflation in the model with extreme parameterization of the Fisher Channel. Stickier: $\kappa = 0.01$, baseline: $\kappa = 0.05$, flexible: $\kappa = 0.1$.

Table 8: Mortgage debt and Spending Growth by Income Class

	(1)	(2)	(3)	(4)	(5)	(6)
γ_k	-0.037 [-0.06, -0.014]	0.074 [0.05, 0.098]	0.09 [0.067, 0.114]	0.088 [0.064, 0.111]	0.089 [0.066, 0.112]	0.082 [0.058, 0.10
Income FE.	✓	✓	✓	✓	✓	✓
State FE	✓	✓	✓	✓	✓	✓
N	3.4mn	3.4mn	3.4mn	3.4mn	3.4mn	3.4mn
R^2	0.01	0.01	0.01	0.01	0.01	0.01

Results of regression 11 of consumption growth from June-July 2021 to September-October 2023, where a mortgage indicator M_i is interacted with seven fintech-defined income classes ($k = 1, \ldots, 7$). Brackets contain 95% confidence intervals. The fintech sample includes users with at least 1 transaction per month.

B.4 Alternative time intervals

B.5 Additional figures

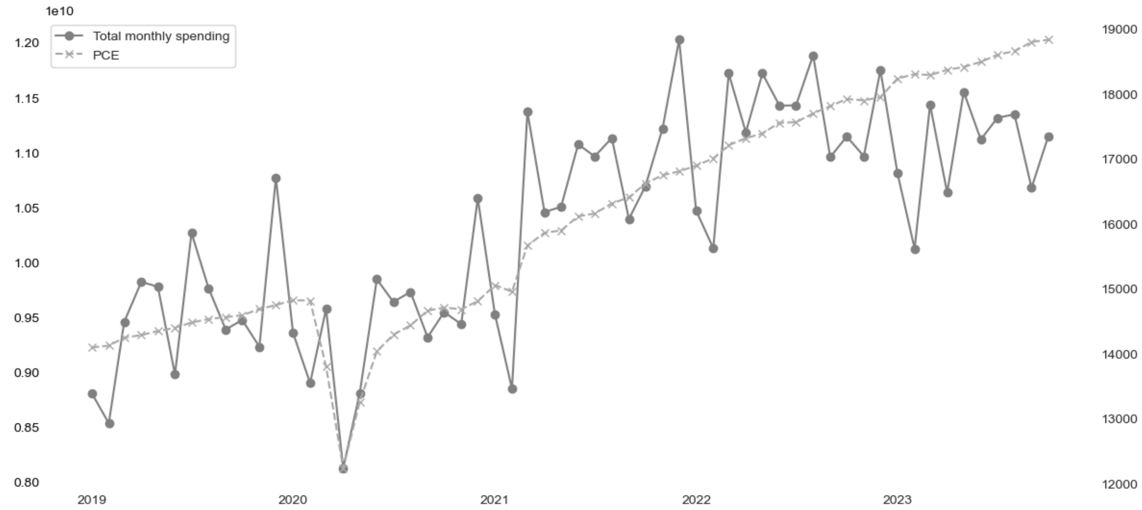

Figure 16: Comparison of official US Personal Consumption Expenditures data with fintech-based aggregate expenditures, January 2019 to October 2023. Note: data for US PCE are seasonally adjusted

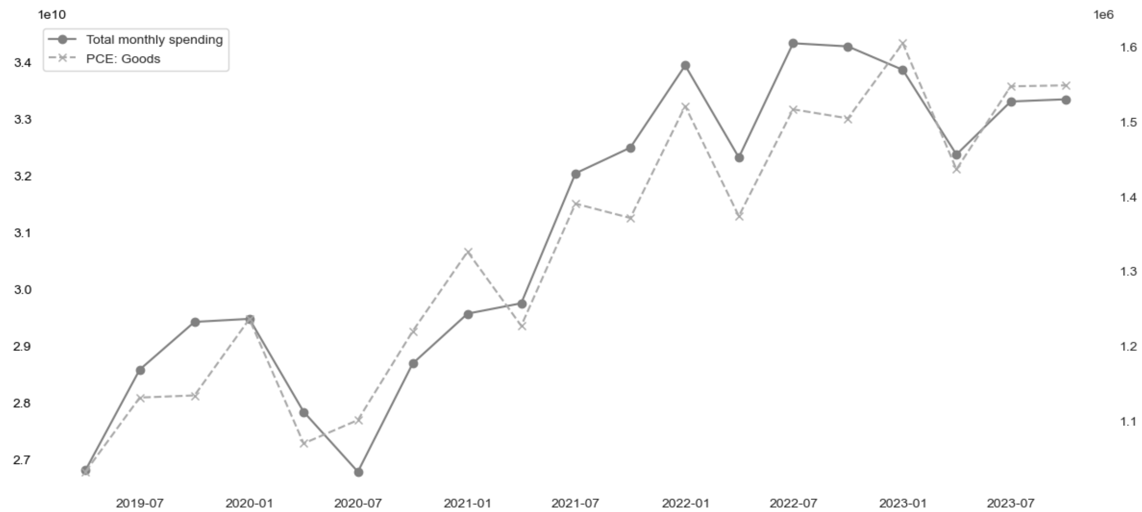

Figure 17: Comparison of official US Personal Consumption Expenditures on Goods with fintech-based aggregate expenditures, January 2019 to October 2023. Note: data for US PCE are seasonally adjusted and quarterly.

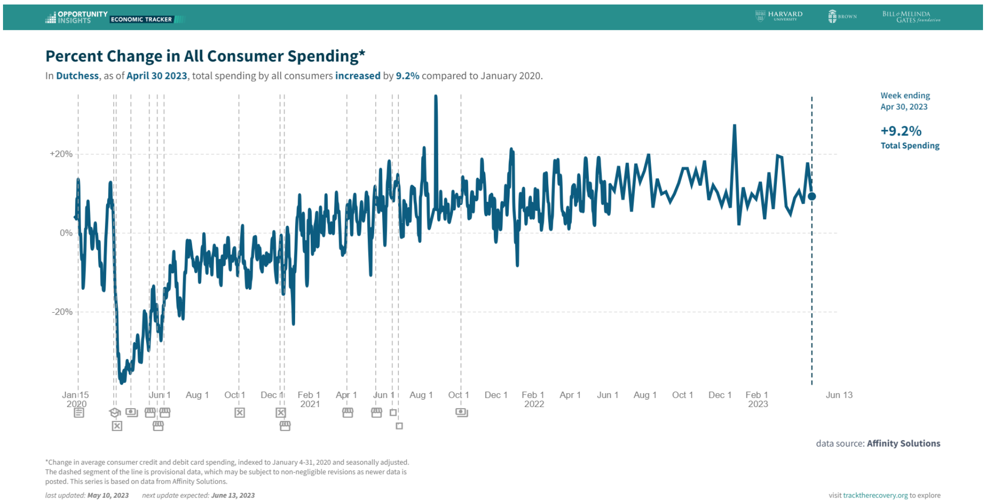

Figure 18: Example for the county of Dutchess of credit and debit card spending from January 1st 2020 to April 30th 2023. Source: https://tracktherecovery.org/.

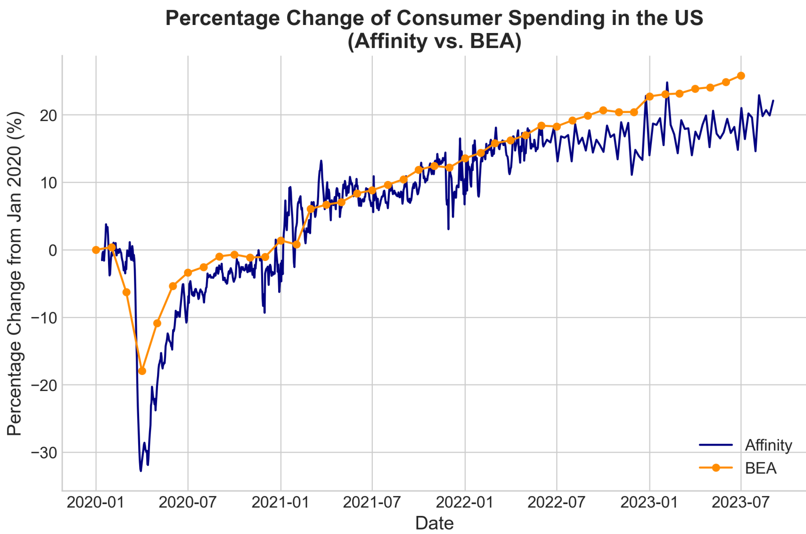

Figure 19: Total consumer spending in the US - Affinity versus BEA Personal Consumption Expenditures.

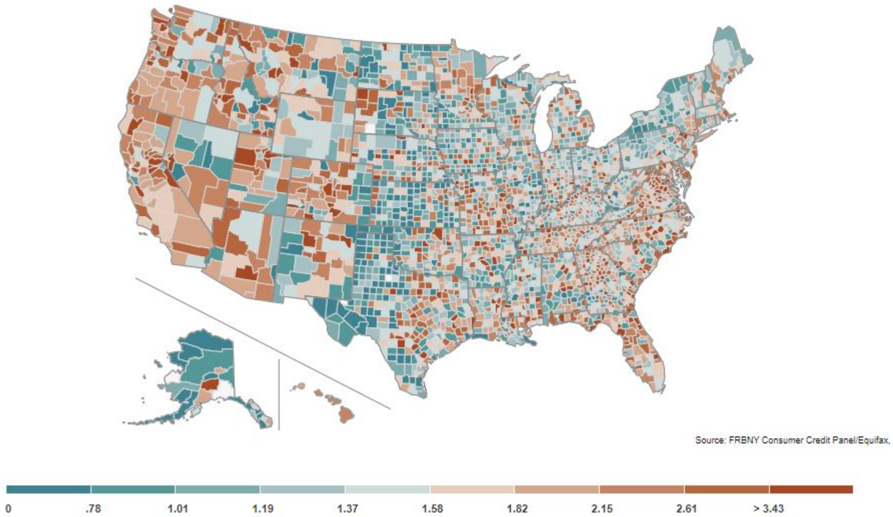

Figure 20: Debt to income ratio for US counties. Source: Federal Reserve of New York.

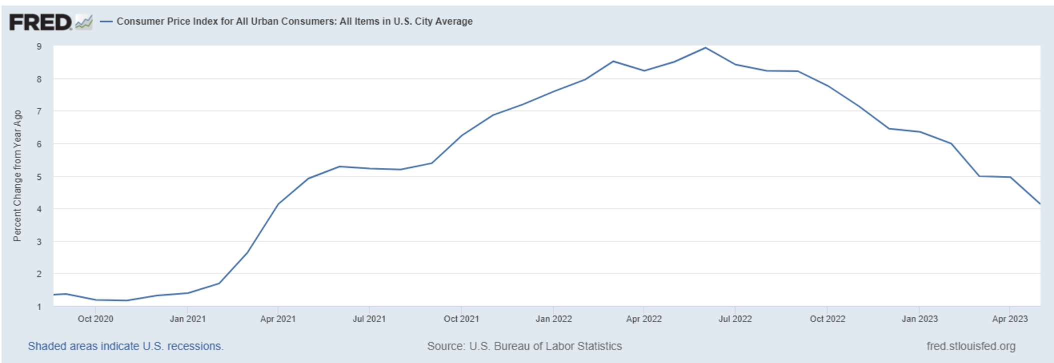

Figure 21: CPI for the US. Source: Fred.

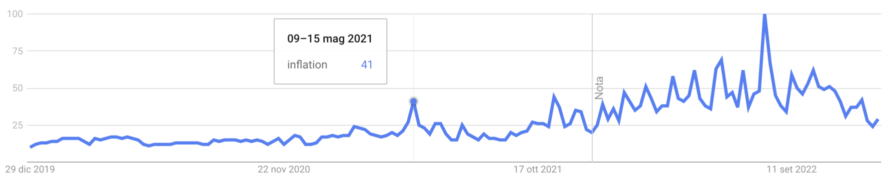

Figure 22: Google searches for inflation in the US. Source: Google Trends.