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Heinrich Heine Universität Düsseldorf

IMPRINT

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Published by:
Heinrich-Heine-University Düsseldorf,
Düsseldorf Institute for Competition Economics (DICE),
Universitätsstraße 1, 40225 Düsseldorf, Germany
www.dice.hhu.de

Editor:
Prof. Dr. Hans-Theo Normann
Düsseldorf Institute for Competition Economics (DICE)
Tel +49 (0) 211-81-15125, E-Mail normann@dice.hhu.de

ISSN 2190-9938 (online) / ISBN 978-3-86304-426-8

Subsistence Consumption and Inflation Heterogeneity: Implications for Monetary Policy Transmission in a HANK Model*

Ulrike Neyer† Daniel Stempel‡ Alexandra Stevens§

September 2025

Abstract

Households differ in their consumption baskets and inflation rates along the wealth and income distribution. We use German data to show that subsistence consumption is a main driver of these differences: the share of subsistence consumption in overall consumption is significantly higher for households at the lower end of the wealth and income distribution. We construct a price index for subsistence consumption and show that this price index exhibits larger volatility than the price indices constructed for the average consumption basket and the basket of households with average and high income. We then set up a Heterogeneous Agent New Keynesian (HANK) model that incorporates these facts to analyze the consequences of different consumption baskets and inflation heterogeneity for monetary policy transmission. We find that heterogeneous consumption baskets across households weaken monetary policy transmission. This is due to the heterogeneous responses of inflation rates to monetary policy shocks across households, larger labor supply heterogeneity, and a novel indirect transmission channel of monetary policy operating through the real value of subsistence consumption.

JEL classification: E12, E21, E31, E32, E52.

Keywords: HANK model, inflation heterogeneity, inequality, monetary policy transmission, subsistence consumption.

*We thank participants of conferences and seminars organized by Heinrich Heine University Düsseldorf for many helpful comments and remarks.

†Heinrich Heine University Düsseldorf, Department of Economics, Universitätsstraße 1, 40225 Düsseldorf, Germany, email: ulrike.neyer@hhu.de.

‡Corresponding Author, Heinrich Heine University Düsseldorf, Department of Economics, Universitätsstraße 1, 40225 Düsseldorf, Germany, email: daniel.stempel@hhu.de.

§Heinrich Heine University Düsseldorf, Department of Economics, Universitätsstraße 1, 40225 Düsseldorf, Germany, email: alexandra.stevens@hhu.de.

1 Introduction

Households differ along several dimensions such as their income and wealth. Textbook New Keynesian models do not take this into account but assume a representative household (Representative Agent New Keynesian (RANK) models). In order to shed light on the role of income and wealth heterogeneity for business fluctuations and the transmission of monetary policy, a quickly emerging strand of literature develops Heterogeneous Agent New Keynesian (HANK) models. However, the well-established fact that consumption baskets also differ along the income and wealth distribution – which implies that households may experience differing inflation rates – has not yet been extensively discussed within this framework despite its potential relevance for monetary policy. To underscore this relevance, we first document some notable fundamentals regarding the heterogeneity of consumption baskets and inflation rates across households, specifically focusing on the role of subsistence consumption. We use German data to show that subsistence consumption, on average, accounts for almost 44% of households' consumption expenditures, with large heterogeneity depending on income (ranging from 21% to almost 87%). Furthermore, we find that the price index associated with subsistence consumption exhibits significantly higher volatility than indices associated with the average consumption basket or the one of households with relatively high income, and that the inflation differential of the subsistence price index to the other indices is sizeable with values up to 2.16 percentage points (pp).

Against this background, we analyze the impact of differing consumption baskets and inflation rates along the income and wealth distribution on the transmission of monetary policy. We develop a HANK model that incorporates the aforementioned stylized facts and find that differing consumption baskets have a weakening effect on the transmission of monetary policy.

The model includes a multi-good and -sector structure. Households consume non-essential and essential goods. We endogenously derive different household consumption baskets and, thus, inflation heterogeneity by introducing a subsistence level on essential good consumption. We compare the transmission of a monetary policy in a standard HANK model, a two-sector HANK model with homogeneous consumption baskets (TS

HANK), and a two-sector HANK model with heterogeneous consumption baskets (HB HANK).

The weakened monetary policy transmission in the HB HANK model is due to various causes. First, the subsistence level pushes up labor supply in steady state. After a monetary policy shock, however, this implies that households choose to forego parts of their additional consumption opportunities to supply relatively less labor than in the standard and the TS HANK models after an expansionary monetary policy shock. Second, a novel indirect transmission channel[1] of monetary policy operating through the relative price of essential goods emerges. The real value of subsistence consumption increases as the price of essential goods increases more than the average price level. Thus, the increase in household expenditures do not fully translate into more consumption but is partly absorbed by the increase in the relative price of subsistence consumption. This implies that, third, households are affected differently by inflation. The share of essential goods in the consumption basket of low-income/low-wealth households is higher implying a stronger decrease in purchasing power. As these are the households with the highest marginal propensity to consume (MPC), the decrease in their purchasing power has a particularly weakening effect on monetary policy transmission. Overall, these results imply that monetary policy needs to react more strongly to achieve the same output effects.

This paper contributes to the following strands of literature. First, we contribute to the literature that combines the incomplete-market, heterogeneous agent model based on Bewley (1987), Hugget (1993), and Aiyagari (1994) with New Keynesian frictions. This literature includes, for instance, Oh and Reis (2012), Gornemann et al. (2016), McKay et al. (2016), McKay and Reis (2016), Kaplan et al. (2018), Luetticke (2021), and Bayer et al. (2024). The standard assumption in the HANK literature is that households face uninsurable idiosyncratic risk and borrowing constraints due to financial market incompleteness, leading to income and wealth heterogeneity. Recent studies consider further dimensions of household heterogeneity. Clayton et al. (2019) and Cravino et al. (2020) study the distributional consequences of heterogeneous sectoral price rigidities in the transmission of monetary policy. In their models, households consume different types of goods

[1] Direct effects of monetary policy refer to changes in output due to intertemporal substitution. Indirect effects, conversely, operate through changes in labor demand and, thus, household income.

depending on their income or education levels, and sectors differ in their degree of price rigidities. Differential exposure to price rigidities then leads to inflation heterogeneity after shocks, which has distributional consequences. Our paper complements the work of Clayton et al. (2019) and Cravino et al. (2020) by introducing household heterogeneity in income and wealth, a multi-firm structure producing different types of goods (essential and non-essential), and a subsistence level on essential goods. These extensions deliver, first, rich inflation heterogeneity along the income and wealth distribution and, second, new insights on the transmission of monetary policy, which leads us to our next contribution.

The second contribution concerns the literature that studies the transmission of monetary policy in HANK models focusing on the decomposition into direct and indirect effects. Respective examples are Kaplan et al. (2018) and Auclert et al. (2024). Kaplan et al. (2018) find that household heterogeneity changes the transmission mechanism and decompose the effects of monetary policy into direct and indirect effects. The authors show that the indirect effects of monetary policy outweigh the direct effects. Auclert et al. (2024) study the transmission of monetary policy in HANK using the sequence-space Jacobian method introduced by Auclert et al. (2021) and find similar results. Our paper complements these works by studying monetary policy transmission under consumption basket and inflation heterogeneity using the sequence-space Jacobian method. We find an indirect transmission channel operating through the relative price of essential goods, which is absent in standard HANK models.

The reminder of this paper is organized as follows. Section 2 provides some fundamentals on inflation heterogeneity and subsistence consumption. Section 3 states the model. Section 4 describes the solution method and the calibration strategy. Section 5 presents the steady state results and analyzes monetary policy transmission. Section 6 concludes.

2 Some Notable Fundamentals on Inflation Heterogeneity and Subsistence Consumption

There are two obvious, necessary conditions that need to be met for inflation heterogeneity to occur across households: Households need to consume different consumption baskets, and goods need to differ in their price development. Both of these phenomena are well documented in the literature, see Hobijn et al. (2009), Kaplan and Schulhofer-Wohl (2017), Jaravel (2019), Argente and Lee (2021), Neyer and Stempel (2025) for the United States and Gürer and Weichenrieder (2020) for Europe. Here, we focus on the relationship between consumption patterns, inflation heterogeneity, and subsistence consumption.

Throughout this section, we refer to German data on income and consumption expenditures of one-person households in 2018. This data is particularly useful due to the availability of official data on the subsistence level of consumption and detailed data on consumption baskets of households.[2] This data allows us to compare the consumption behavior of households consuming at the subsistence level, calculated to be 9000€, with that of households spending more on consumption due to a higher income (see Table 1). The subsistence consumption basket assigns a large weight to food and non-alcoholic beverages and to housing, water, electricity, gas and other fuels (over 68% of all expenditures), whereas the share of food and housing decreases and the share of goods and services like transport (vehicles, travel) or restaurant and accommodation services increases in income.

This implies that the relevance of the subsistence level decreases in income (and thereby consumption expenditures, see Figure 1a). On average, the subsistence level accounts for 43.96% of households' consumption expenditures. As income increases, this share decreases to 21.04% for households with a net income above 5000€ per month. To get a better overview of the income distribution of households, Figure 1b reports the share of households in different net-income categories. The reported income categories do not exactly match the ones from the SIE (see Footnote 2) but are fairly comparable, giving a first impression of the relevance of the subsistence level across households. For instance, 18.20% of households report a net income of 900€ or less. From the SIE data on the consumption basket of households with this level of income, we can infer that 86.71% of consumption expenditures of these households are used to cover the subsistence level. Similarly, the share of the subsistence level in the consumption expenditures of households

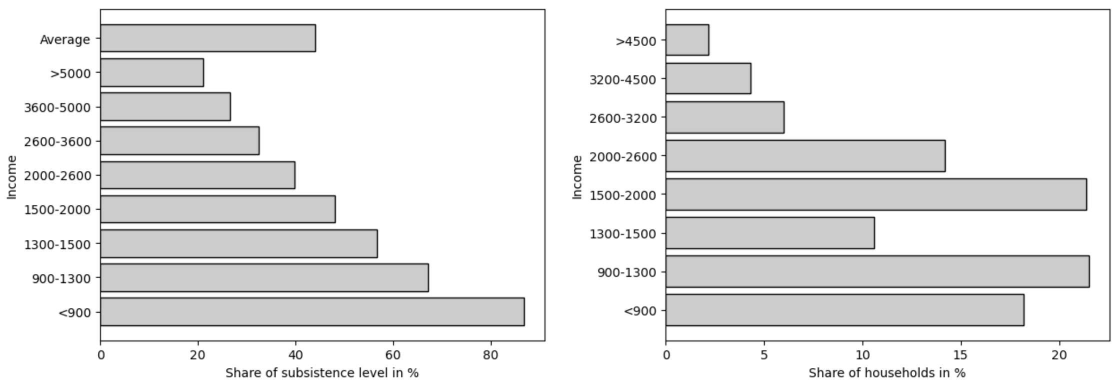
[2]The German parliament publishes an annual report on the subsistence level of consumption. This report provides a breakdown into baseline expenditures, costs of housing, and costs of heating. The Federal Ministry of Labour and Social Affairs (FMLSA) publishes an additional breakdown of the baseline expenditures into further categories. This breakdown is based on the survey of income and expenditure (SIE). The Federal Statistical Office publishes the SIE every five years. Currently, the SIE from 2018 is still in use to calculate the subsistence level of consumption. Thus, we refer to income and consumption data for 2018 throughout the entire section. Furthermore, we focus on the twelve main expenditure categories defined in Table 1. See Appendix A for details.

with an income between 900€ and 1300€ is 67.14% (panel a), which affects an additional 21.50% of households considered (panel b).

Category	Subsistence	Average	> 5000€
Food and non-alcoholic beverages	19.18%	10.66%	6.20%
Alcoholic beverages and tobacco	0.00%	1.76%	1.29%
Clothing and footwear	4.59%	3.92%	3.79%
Housing, water, electricity, gas and other fuels	49.48%	38.76%	31.59%
Furniture, lighting equipment, appliances etc.	3.37%	4.39%	5.25%
Health	2.11%	4.22%	10.35%
Transport	4.96%	11.71%	13.55%
Communication	4.88%	2.99%	2.02%
Recreation, entertainment and culture	5.39%	10.95%	12.04%
Education	0.20%	0.47%	0.51%
Restaurant and accommodation services	1.44%	5.80%	7.52%
Miscellaneous goods and services	4.41%	4.39%	5.89%

Table 1: Consumption Baskets of German One-Person Households.

Notes. Average refers to the average basket reported by one-person households. > 5000€ refers to one-person households earning more than 5000€. Data source: German Parliament; FMLSA; SIE. See Footnote 2 for details.

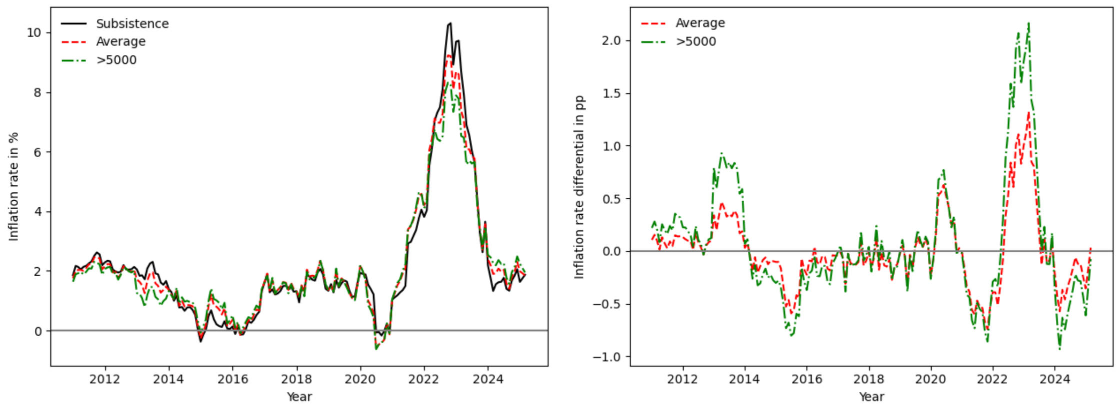


(a) (b)

Figure 1: Subsistence Level Share in Overall Consumption and Distribution of One-Person Households Among Different Levels of Income in €.

Notes. Data sources: German Parliament; FMLSA; SIE; Micro Census. See Footnote 2 for details.

In order to relate these different consumption baskets and the differing relevance of subsistence consumption to inflation, we collect data on the inflation rate of the German consumer price index (CPI) and its subcategories from January 2010 to March 2025 from the German Federal Statistical Office. These subcategories match the twelve expenditure categories of the SIE. We calculate the monthly year-on-year inflation rate of each category and aggregate them by weighting the inflation rate of each category with the respective weight shown in Table 1. The corresponding inflation rate development is displayed in Figure 2a. Generally, there is a high positive correlation between the inflation rate implied by the subsistence consumption basket and the one calculated for the average basket (0.99) and the basket of households with an income above 5000€ (0.97). There are considerable differences in the volatility of each inflation rate, however.



(a) Inflation Development of Selected Consumption Baskets.

(b) Inflation Differential of Subsistence Consumption Basket from Selected Baskets.

Figure 2: Inflation (Differential) Development of Selected Consumption Baskets.

Notes. Data sources: consumption baskets: German Parliament; FMLSA; SIE; inflation rates of expenditure categories: Federal Statistical Office. See Footnote 2 for details.

The inflation rate implied by subsistence consumption exhibits the highest volatility of all three baskets (2.20 compared to 2.03 of the average and 1.86 of the above-5000€ baskets, respectively). This fact is underscored by (at times large) fluctuations of the inflation differential of the subsistence consumption basket's inflation rate and the average and the above-5000€ basket's inflation rates shown in Figure 2b. The differential to the average basket's inflation rate is generally smaller than the differential to the above-5000€ basket's inflation rate. They are sizeable in both cases, however, with values up to 1.32 and 2.16 pp, respectively.

These results indicate that prices of goods in categories with a large weight in the subsistence consumption basket may adjust more often. Literature examining price adjustments of different good categories confirm this suspicion. Dedola et al. (2024) show that, on average, the frequency of price adjustments for food was roughly twice that of non-energy industrial goods (NEIGs) or of services in Germany, Estonia, Spain, France, Italy, Latvia, and Lithuania between 2015 and 2023. Gautier et al. (2024) also report a much higher frequency of food-price adjustments (especially of unprocessed foods) in comparison to NEIGs and services in eleven euro area countries[3] between 2010 and 2019.[4] In addition, their results indicate a larger response of prices of high-frequency good categories to monetary policy shocks than of low-frequency categories. This is in line with Cravino et al. (2020), who show that the response of the inflation rate experienced by high-income households to a monetary policy shock is about one third smaller than the response of middle-income households' inflation rates in the United States. In particular, this is due to a larger degree of price stickiness of goods consumed by households with higher income. Ampudia et al. (2023) confirm this result for several euro-area countries.[5] The fact that monetary policy affects prices of goods that are consumed by households with lower income more strongly is of particular relevance for our analysis as we examine monetary policy transmission.

Overall, we establish that subsistence consumption does not only have an impact on the heterogeneity of consumption baskets across households but also affects households' inflation rates. In the following Section, we present a HANK model incorporating the presented fundamentals.

3 HANK Model

We extend the one-asset HANK model presented in Auclert et al. (2021). In particular, we introduce a multi-sector structure and heterogeneous consumption baskets across households. The model economy is populated by households, intermediate good producers, retail firms, and the government. Households supply labor and consume two types of

[3]Austria, Belgium, France, Germany, Greece, Italy, Latvia, Lithuania, Luxembourg, Slovakia, and Spain.

[4]On average across countries they find a factor between three and ten, depending on the specification. Results depend on which categories are compared, on the use of average or median values, and on the inclusion or exclusion of sales.

[5]In particular, they show that differences in consumption baskets across households imply that high-income households' inflation rates respond less to monetary policy shocks. They additionally show that adjustments in shopping behavior lead inflation rates of high-income households to respond more to monetary policy shocks. As our analysis focuses different consumption patterns and subsistence consumption, we emphasize the former finding.

goods, essential and non-essential goods. They face a subsistence level on essential-good consumption and uninsurable idiosyncratic risk which they can self-insure through saving. Intermediate good producers use labor to produce goods in a competitive market. Monopolistically competitive retail firms aggregate intermediate goods into essential or non-essential goods and face price rigidities. The fiscal authority raises taxes and issues bonds. Monetary policy follows a standard Taylor rule. Our model allows for a tractable comparison of a standard HANK model, a two-sector HANK model, and a two-sector HANK model with heterogeneous consumption baskets across households. We present the full HB HANK model and address the necessary assumptions for the standard and TS HANK models throughout this Section.

3.1 Households

Time is discrete and indexed by t = 0,1 ... The economy is populated by a continuum of ex-ante identical households indexed by i $\in [0, \infty]$. Households face idiosyncratic labor productivity risk. Labor productivity η_t follows an exogenous Markov process with constant transition probabilities. Financial markets are incomplete and households cannot fully insure against the idiosyncratic productivity risk. Thus, households are ex-post heterogeneous in income, wealth and, therefore, consumption baskets, depending on the history of realizations of idiosyncratic labor productivity shocks. The uninsurable idiosyncratic risk is the main source of this household heterogeneity.

The period utility function of household i is specified as

$$u(c_t^i, h_t^i) = \frac{(c_t^i)^{1-\sigma}}{1-\sigma} - \chi \frac{(h_t^i)^{1+\varphi}}{1+\varphi}, \quad (1)$$

where c_t^i denotes the consumption and h_t^i are hours worked. The parameter $\sigma \geq 1$ determines the inverse intertemporal elasticity of substitution and $\varphi \geq 0$ captures the inverse of the Frisch labor supply elasticity. $\chi \geq 0$ scales disutility of labor supply.

There are two types h = 1,2 of goods in our economy. Type-1 goods are interpreted as essential goods such as food or housing. Type-2 goods are non-essential goods. The composition of the households consumption baskets varies according to the proportion of these goods, with $c^i_{h,t}$ being the consumption of type-h good. The overall consumption index is given by

$$c^i_t \equiv \left(\gamma^{\frac{1}{\upsilon_c}} \left(c^i_{1,t} - C^*\right)^{\frac{\upsilon_c - 1}{\upsilon_c}} + (1-\gamma)^{\frac{1}{\upsilon_c}} \, c^i_{2,t}{}^{\frac{\upsilon_c - 1}{\upsilon_c}}\right)^{\frac{\upsilon_c}{\upsilon_c - 1}}, \tag{2}$$

where γ determines the share of $c^i_{1,t}$ in the overall consumption index and υ_c determines the elasticity of substitution between essential and non-essential goods (see equation (3). C^* is a subsistence level on consumption of essential goods. The subsistence level has to be met at all times, and only excess consumption, i.e., consumption above the subsistence level (c^i_t) is relevant for household utility. Note that this index embeds both the standard HANK model as well as the TS HANK model. If $C^* = 0$ and if both types of goods exhibit the same characteristics (in particular, the same price rigidities, we will discuss this later), we will receive the standard HANK model. If $C^* = 0$ and good characteristics differ, we will arrive at the TS HANK model.

The elasticity of substitution between essential and non-essential goods is given by

$$\epsilon^i_{C,t} \equiv \begin{cases} \upsilon_C \left[1 - \dfrac{(1-\gamma)^{\frac{1}{\upsilon_C}} \frac{C^*_1}{c^i_{1,t}}}{\gamma^{\frac{1}{\upsilon_C}} \left(\frac{c^i_{1,t} - C^*_1}{c^i_{2,t}}\right)^{\frac{\upsilon_C - 1}{\upsilon_C}} + (1-\gamma)^{\frac{1}{\upsilon_C}}}\right] & \text{if } C^* > 0, \\ \upsilon_C & \text{if } C^* = 0, \end{cases} \tag{3}$$

where $0 < \epsilon^i_{C,t} \leq \upsilon_C$, based on Baumgärtner et al. (2017). For $C^* = 0$, equation (2) represents a constant elasticity of substitution (CES) index with υ_C denoting the elasticity of substitution between essential and non-essential goods. For $C^* > 0$, the elasticity of substitution decreases in the share of the subsistence level in a household's consumption basket. As the relevance of the subsistence level decreases, the elasticity of substitution increases and the household can substitute essential and non-essential goods better.

The consumption indices $c_{h,t}^i$ are constant elasticity of substitution functions over all varieties $k \in [0,\ s]$ and $j \in [s,\ 1]$, where s denotes the share of type-1 goods producing firms. The indices are given by

$$c_{1,t}^i \equiv \left(\int_0^s {c_{k,t}^i}^{\frac{\epsilon-1}{\epsilon}} dk\right)^{\frac{\epsilon}{\epsilon-1}} \quad , \quad c_{2,t}^i \equiv \left(\int_s^1 {c_{j,t}^i}^{\frac{\epsilon-1}{\epsilon}} dj\right)^{\frac{\epsilon}{\epsilon-1}} , \tag{4}$$

where ϵ is the elasticity of substitution between the varieties. The optimal consumption of a variety within each goods type is given by

$$c_{k,t}^i = \left(\frac{P_{k,t}}{P_{1,t}}\right)^{-\epsilon} c_{1,t}^i \quad , \quad c_{j,t}^i = \left(\frac{P_{j,t}}{P_{2,t}}\right)^{-\epsilon} c_{2,t}^i, \tag{5}$$

where $P_{1,t} \equiv (\int_0^s P_{k,t}^{1-\epsilon} dk)^{\frac{1}{1-\epsilon}}$ and $P_{2,t} \equiv (\int_s^1 P_{j,t}^{1-\epsilon} dj)^{\frac{1}{1-\epsilon}}$ are the price indices of type-1 and type-2 goods, respectively.

The optimal consumption of type-1 and type-2 goods is given by

$$c_{1,t}^i = \left(\frac{P_{1,t}}{P_{c,t}}\right)^{-\upsilon_c} \gamma c_t^i + C^* \quad , \quad c_{2,t}^i = \left(\frac{P_{2,t}}{P_{c,t}}\right)^{-\upsilon_c} (1-\gamma)\, c_t^i, \tag{6}$$

with $P_{c,t} \equiv (\gamma P_{1,t}^{1-\upsilon_c} + (1-\gamma) P_{2,t}^{1-\upsilon_c})^{\frac{1}{1-\upsilon_c}}$ being the price index of utility-relevant excess consumption. Note that, if $P_{1,t} = P_{2,t} = P_{c,t}$ and $C^* = 0$, we will receive the standard HANK model. If $P_{1,t} \neq P_{2,t}$ and $C^* = 0$, we will receive the TS HANK model. Price developments are determined by retail firms, which are discussed in Section 3.2.

Households are endowed with initial wealth a_{-1}^i and an initial labor productivity status η_0^i. They maximize the expected discounted lifetime utility subject to their budget and borrowing constraint by choosing consumption c_t^i, hours worked h_t^i, and savings a_t^i. The Bellman equation and constraints are given by

$$V_t\left(\eta_t^i, a_{t-1}^i\right) = \max_{c_t^i, h_t^i, a_t^i} \left\{u(c_t^i, h_t^i) + \beta \mathbb{E}_t V_{t+1}\left(\eta_{t+1}^i, a_t^i\right)\right\}, \tag{7}$$

$$c_t^i + \frac{P_{1,t}}{P_{c,t}} C^* + a_t^i = (1+r_t) a_{t-1}^i + h_t^i w_t \eta_t^i - t_t^i\left(\eta_t^i\right) + d_t^i\left(\eta_t^i\right), \tag{8}$$

$$a_t^i \geq 0, \tag{9}$$

where $\beta \in (0,1)$ is a discount factor and r_t is the real interest rate. The variable w_t denotes economy-wide hourly real wage, η_t^i is the idiosyncratic labor productivity shock and $d_t^i\left(\eta_t^i\right)$ are dividends from the ownership of firms with $d_{t,\eta_t^i}^i > 0$. Taxes paid are given by

$$T_t \equiv \int t_t^i\left(\eta_t^i\right) l(a_{t-1}^i, \eta_t^i) di, \tag{10}$$

with $t_{t,\eta_t^i}^i > 0$ and $l(a_{t-1}^i, \eta_t^i)$ being defined as the distribution of households across productivity states. Both taxes and dividends are collected/distributed according to households' productivity.

The borrowing constraint (9) implies that savings must remain greater than an exogenous threshold normalized to zero. Real consumption expenditures ce_t^i can separately be denoted as

$$ce_t^i = c_t^i + \frac{P_{1,t}}{P_{c,t}} C^*. \tag{11}$$

Importantly, real consumption expenditures are solely defined by expenditures on excess consumption (c_t^i) in the standard and TS HANK models ($C^* = 0$). In the HB HANK model ($C^* > 0$), the subsistence level on essential-good consumption enters households' real expenditures. This is important as the relevant price index for household decisions is $P_{c,t}$. However, C^* is purchased at price $P_{1,t}$. Thus, the relative price of essential goods determines the allocation of real expenditures to excess consumption and the subsistence level (and thereby the share of C^* in the households' consumption basket).

The solution to the optimization problem of the household is given by

$$\chi(h_t^i)^{\varphi} = w_t \eta_t^i (c_t^i)^{-\sigma}, \tag{12}$$

$$1 = \beta \mathbb{E}_t \left[(1 + r_{t+1}) \left(\frac{c_{t+1}^i}{c_t^i} \right)^{-\sigma} \right], \tag{13}$$

Equation (12) describes the optimal labor supply of household i, Equation (13) is the Euler equation.

3.2 Firms

3.2.1 Intermediate Good Producers

A representative, competitive intermediate good firm produces goods that are sold to retail good producers. The only input is effective labor, defined as

$$N_t \equiv \int \eta_t^i h_t^i l(a_{t-1}^i, \eta_t^i) di. \tag{14}$$

The production function is given by

$$Y_{m,t} = N_t \ , \tag{15}$$

where $Y_{m,t}$ denotes output of intermediate good firm m. Perfect competition implies that the intermediate good firm sells output at real marginal costs $mc_{m,t}$. As the firm aims to maximize its real profit $\Gamma_{m,t}$, its the objective function becomes

$$\max_{Y_{m,t}} \Gamma_{m,t} = mc_{m,t} Y_{m,t} - w_t N_t, \tag{16}$$

where

$$mc_{m,t} = w_t \ . \tag{17}$$

3.2.2 Retail Firms

There are two types of retail firms $h = 1, 2$. Type-1 firms produce varieties of essential goods $b = k$, type-2 firms varieties of non-essentials $b = j$. Retail firms aggregate intermediate goods in a monopolistic-competitive environment. Each retail firm repackages one unit of intermediate goods into one unit of final output $Y_{h,t}$. Retail firm b faces the following real total costs:

$$tc_{b,t} = mc_{m,t}Y_{b,t} + \psi_{b,t} \tag{18}$$

i.e., the costs retail firms face are determined by the price they pay for the intermediate good and real price adjustment costs $\psi_{b,t}$. Following Rotemberg (1982), we assume quadratic adjustment costs given by

$$\psi_{b,t} = \epsilon \frac{1}{2\kappa_h} \pi_{h,t}^2 Y_{b,t}, \tag{19}$$

where the parameter κ_h determines price rigidity. Each retail firm maximizes real profits given by

$$\max_{P_{b,t}} d_{b,t} = \frac{P_{b,t}}{P_{c,t}} Y_{b,t} - mc_{m,t}Y_{b,t} - \psi_{b,t} \tag{20}$$

subject to the demand function

$$Y_{b,t} = \left(\frac{P_{b,t}}{P_{h,t}} \right)^{-\epsilon} Y_{h,t} \,. \tag{21}$$

The New Keynesian Philip Curve is then given by

$$\pi_{h,t} = \kappa_h \left(mc_{m,t} - \frac{\epsilon - 1}{\epsilon} \frac{P_{h,t}}{P_{c,t}} \right) + \frac{Y_{h,t+1}}{Y_{h,t}} \pi_{h,t+1} \,. \tag{22}$$

3.3 Monetary and Fiscal Policy

The monetary authority sets the nominal interest rate according to a Taylor rule given by

$$i_t = \phi_\pi \pi_{CPI,t} + \upsilon_t, \tag{23}$$

where i_t is the nominal interest rate and υ_t is a monetary policy shock and is assumed to follow an AR(1) process. The parameter $\phi_\pi > 0$ is the reaction coefficient of the central bank to CPI inflation which is given by

$$\pi_{CPI,t} = \int \pi^i_{CPI,t} l(a^i_{t-1}, \eta^i_t) di, \tag{24}$$

where

$$\pi^i_{CPI,t} = \frac{c^i_{SS}}{C^* + c^i_{SS}} \pi_{c,t} + \frac{C^*}{C^* + c^i_{SS}} \pi_{1,t} \tag{25}$$

with c^i_{SS} being the zero inflation steady state excess consumption. CPI inflation of household i is the weighted average of the inflation rate of excess consumption ($\pi_{c,t}$) and the inflation rate of type-1 goods consumption ($\pi_{1,t}$). Importantly, in the standard and the TS HANK models, CPI inflation coincides with the inflation rate of excess consumption. In the HB HANK model, essential-good inflation is assigned a larger weight, proportional to the share of subsistence consumption in a household's consumption basket.

The Fisher equation is given by

$$i_t = r_t + \mathbb{E}\left[\pi_{c,t+1}\right]. \tag{26}$$

The Fisher equation includes inflation of excess consumption rather than the CPI as households (marginal) consumption/savings decisions depend on excess consumption only.

The government issues one-period nominal bonds B_t, which are bought by households to save, and adjusts the level of taxes T_t to balance its budget in each period according to

$$T_t = r_t B_t. \tag{27}$$

3.4 Equilibrium

The solution to the households optimization problem described by equations 7—9 is a set of policy rules which determine consumption $c^i_t(\eta^i_t, a^i_{t-1})$, labor supply $h^i_t(\eta^i_t, a^i_{t-1})$, and saving decisions $a^i_t(\eta^i_t, a^i_{t-1})$ as a function of households' idiosyncratic history with respect to labor productivity shocks and initial wealth.

The equilibrium condition on the capital market states that the sum of individual savings equals government bonds:

$$\int a_t^i l(a_{t-1}^i, \eta_t^i) di = B_t. \tag{28}$$

The goods market clearing conditions are given by

$$Y_{1,t} = C_{1,t} + \psi_{1,t} \quad ; \quad Y_{2,t} = C_{2,t} + \psi_{2,t}, \tag{29}$$

$$Y_t = Y_{1,t} + Y_{2,t}. \tag{30}$$

Labor market clearing implies

$$N_t \equiv \int \eta_t^i h_t^i l(a_{t-1}^i, \eta_t^i) di. \tag{31}$$

4 Implementation and Calibration Strategy

4.1 Implementing the HANK Model

This section describes the solution method. We first compute the steady state of the model. We discretize the level of individual asset holdings by constructing a grid for individual asset holdings. We set the size of the asset grid to $n_a = 100$, i.e., there are 100 points on the asset grid. We employ the Rouwenhorst (1995) method to discretize the households' productivity process into $n_\eta = 7$ productivity states, where 1 denotes the lowest and 7 the highest productivity state. Then, we solve the household optimization problem by backward iteration using the Endogenous Grid method proposed by Carroll (2006). Backward iteration on the marginal value of assets allows to compute the policy functions for consumption, labor supply and asset holdings. As in Auclert et al. (2021), we iterate over the discount factor and disutility of labor in order to match targeted values for the interest rate and effective labor in steady state. The steady state solution is presented in Section 5.1.

Following the computation of the steady state, we simulate the model's responses to a 25 basis point (BP) expansionary monetary policy shock. We apply the Sequence-Space Jacobian method from Auclert et al. (2021), which is an efficient algorithm to solve heterogeneous-agent models in general equilibrium with aggregate shocks. In this solution method the model is linearized with respect to aggregate shocks around its steady state, and then solved for the model responses to a finite sequence of shocks. We first compute the partial equilibrium Jacobians that describe how individual household consumption, savings and labor supply decisions respond to small deviations from the steady state over time. These are computed using the fake news algorithm introduced in Auclert et al. (2021). These individual responses are then aggregated across the steady-state distribution to construct the general equilibrium Jacobians. For this, we set the truncation horizon to T=300, i.e. we compute the Jacobians and impulse responses over 300 periods. Given the general equilibrium Jacobians, we then obtain the model's impulse responses to a monetary policy shock. The corresponding results are described in Section 5.2.

4.2 Calibration

The calibration of the model is summarized in Table 2. Our calibration is based on relevant literature and targeted moments. Following Kaplan et al. (2018), we set $\sigma = 1$ and $\varphi = 1$, implying log utility. The price elasticity of demand and is set to $\epsilon = 6$ and the Taylor rule coefficient to $\phi_\pi = 1.5$, as in Galí (2015).

The internally calibrated parameters are determined as follows. The discount factor and the disutility of labor supply implied by the iteration are $\beta = 0.95$ for an annual interest rate target of 2% and $\chi = 1.33$ for a target $N = 1$ in steady state (in the standard HANK model and the TS HANK model the iteration yields $\beta = 0.96$ $\chi = 0.85$). The elasticity of substitution parameter is set to $\upsilon_C = 0.75$ which implies a price elasticity of demand for essential goods ϵ_C^i (under consideration of the subsistence level) between 0.25 and 0.6 (depending on household income/wealth), which is consistent with estimates for food by United States Department of Agriculture (2012). Households with higher income/wealth can therefore substitute goods more effectively, which is in line with Gürer and Weichenrieder (2020), and Argente and Lee (2021).

Parameter	Description	Value	Target/Source
	Households		
σ	Inverse intertemporal elasticity of substitution	1	Kaplan et al. (2018)
φ	Inverse Frisch labor supply elasticity	1	Kaplan et al. (2018)
γ	Share of type-1 goods	0.2	internally calibrated
υ_C	Elasticity of substitution parameter	0.75	United States Department of Agriculture (2012)
C^*	Subsistence level on type-1 goods	0.35	internally calibrated
ϵ	Price elasticity of demand for varieties	6	Galí (2015)
β	Discount factor	0.95	internally calibrated, $r = 0.005$
ρ_η	Autocorrelation idiosyncratic shock	0.95	internally calibrated
σ_η	Standard deviation idiosyncratic shock	0.75	internally calibrated
χ	Disutility of labor supply	1.33	internally calibrated, $N = 1$
	Firms		
κ_1	Price adjustment cost 1	0.021	Gautier et al. (2024), Auclert et al. (2024)
κ_2	Price adjustment cost 2	0.007	Gautier et al. (2024), Auclert et al. (2024)
	Central Bank		
ϕ_π	Reaction coefficient	1.5	Galí (2015)
	Fiscal Authority		
B	Bond supply	2	$B = 2Y$

Table 2: Model Parameters

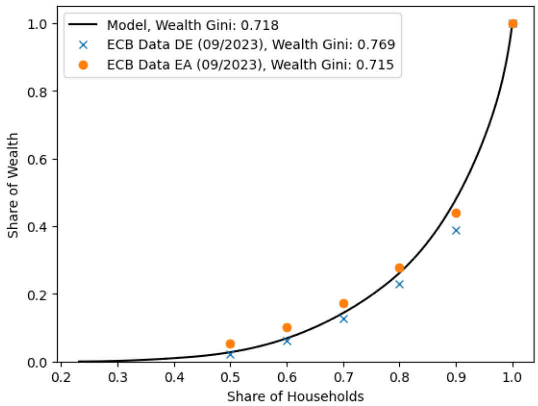
We set the Rotemberg (1982) price adjustment cost for essential goods to $\kappa_1 = 0.021$, and for non-essential goods to $\kappa_2 = 0.007$, implying larger volatility of essential good prices by a factor of three. This is in line with the fundamentals presented in Section 2 (see Footnote 4). This implies an average κ of 0.01, as in Auclert et al. (2024). This value is also chosen in the standard HANK model.

We set government bonds to $B = 2$. This implies that household wealth is twice as large as GDP, which is consistent with German data (household liquid wealth: 9.05 trillion € in 2024; GDP: 4.31 trillion € in 2024; data source: Deutsche Bundesbank 2025). The idiosyncratic risk is assumed to follow an AR(1) process with an autocorrelation $\rho_\eta = 0.95$ and standard deviation $\sigma_\eta = 0.75$. We employ the Rouwenhorst (1995) method to discretize the productivity process into seven productivity states- The corresponding productivity levels are $\eta_t \in (0.12, 0.22, 0.41, 0.76, 1.40, 2.58, 4.76)$. The values are calibrated to receive a realistic level of income and wealth inequality in steady state. The income and wealth distribution can be found in the next Section. Finally, we calibrate the subsistence level on essential goods as $C^* = 0.35$ (or 0, for comparison in the standard HANK and TS HANK models) and the preference for essentials as $\gamma = 0.2$. The implied consumption baskets are discussed in detail in the following Section.

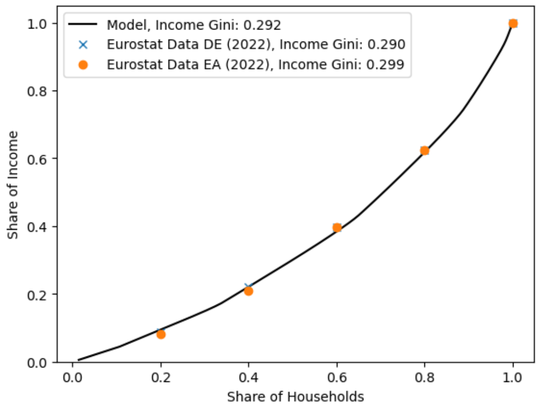
5 Results

5.1 Steady State

Figure 3a shows the wealth Lorenz curve resulting from our model in comparison to the data for Germany and the euro area reported by the ECB. The shape of the Lorenz curve suggests that a large proportion of total wealth is held by the richest (highly productive) households. The model produces a wealth Gini coefficient of 0.718, which is close to the ones reported for Germany and the euro area.



(a)



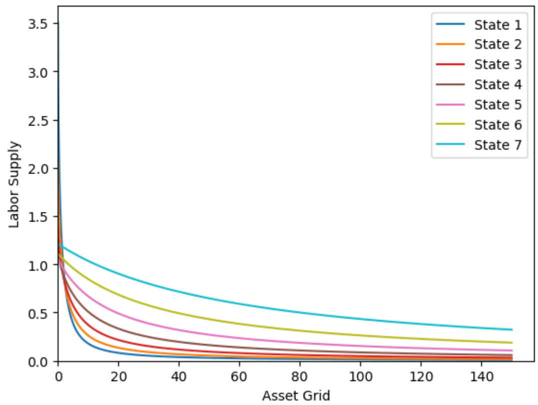
(b)

Figure 3: Wealth Lorenz and Income Lorenz Curves.

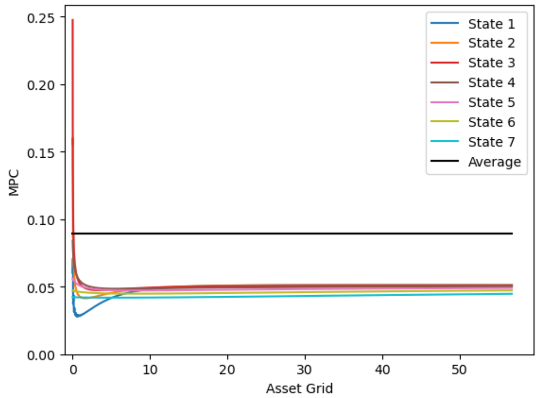
Figure 3b illustrates our income Lorenz curve in comparison to the data for Germany and the euro area reported by Eurostat. A more equal distribution of income than of wealth can be observed. The model produces a realistic income Gini coefficient of 0.292.

Figure 4a illustrates that the model produces rich labor supply heterogeneity. Labor supply decreases in wealth for all productivity levels. Specifically, the wealthier households are, the lower is their incentive to work. Larger asset holdings imply that labor income becomes less relevant, as capital income is high. In general, labor supply increases in productivity, as higher productivity implies larger labor income. However, this relation does not hold for the very lower end of the wealth distribution (where a large share of households are located). At this point of the wealth distribution, the relation between labor supply and productivity reverses, and less productive households supply more labor. This is due to the subsistence level on essential good consumption and the borrowing constraint:

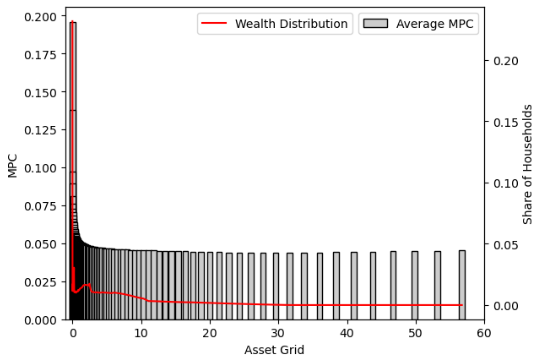
When asset holdings (and, thereby, capital income) are low, the most important source of income to cover expenditures is labor income. In order to meet the subsistence level and to afford some utility-relevant consumption without generating negative savings, households with low wealth and low productivity levels need to increase their labor supply.



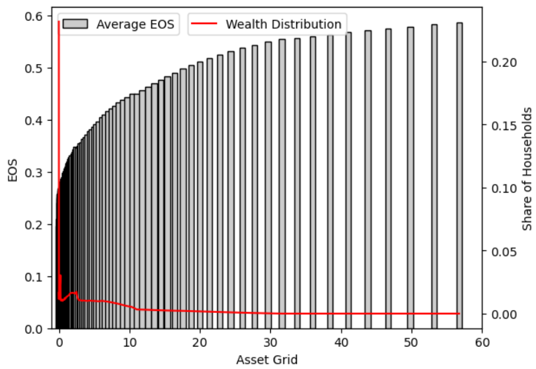
(a)



(b)



(c)



(d)

Figure 4: Labor Supply (by Productivity State), Marginal Propensity to Consume (Average and by Productivity State), and Elasticity of Substitution.

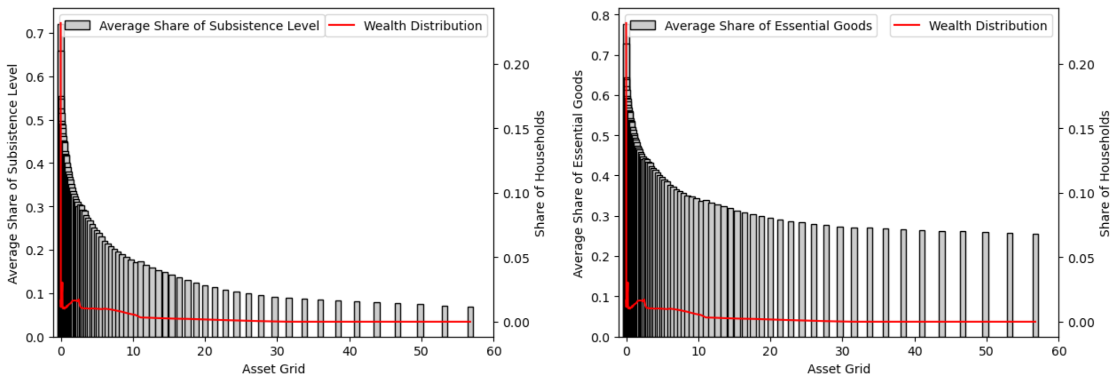
Figure 4b shows relevant properties of the MPC produced by the model. In the existing literature, estimates of the MPC vary substantially ranging between 0 and 0.9 (Carroll et al., 2017). We refer to Carroll et al. (2014), who estimate an average MPC 0.12 across 15 European countries.[6] Furthermore, they find that MPCs differ between households along the wealth distribution. On average, the bottom 50% of the wealth distribution exhibit a MPC of 0.17, the top 50% of 0.06.[7] Our model produces an average MPC of 0.089 and captures the described heterogeneity quite well, as shown in Figure 4c. The model

[6]They estimate MPCs for different model specifications. We refer to the specification closest to our model, i.e., the model in which assets are fully liquid.

[7]The same value applies to the top 1%, 10%, 20%, and 40%.

produces an additional interesting property. Generally, low-productivity households with zero wealth have a very high MPC. However, there are a few households, namely the ones with the lowest productivity level, whose MPC decreases as their income increases and they accumulate wealth. This is due to the labor supply of these households. As they have to supply an enormous amount of labor to meet the subsistence level and the borrowing constraint, they choose to forego parts of their additional consumption opportunities to decrease their work hours when their income/wealth increases.

Figure 4d displays the average elasticity of substitution, as defined by Equation 3, along the wealth distribution. The lower the wealth/income of households, the lower their consumption. Thus, the share of the subsistence level in their consumption basket increases and their substitution capabilities decrease.



(a) (b)

Figure 5: Subsistence Level and Essential Good Share in Overall Consumption.

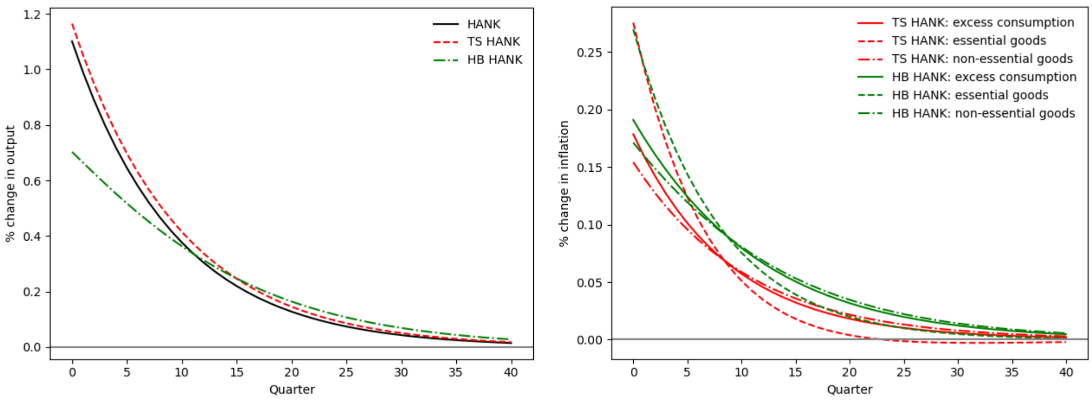
Complementary to these differences in the elasticity of substitution between households, Figure 5a reveals that the share of subsistence level consumption is around 70% for the lowest income quintile, around 30% for the highest income quintile, and at 45% on average. These values are very close to the ones reported in Section 2.

In addition to the necessary level of consumption of essential goods, households consume essential goods according to their preference. The share of essential-good consumption is, therefore, larger than the share of subsistence consumption (see Figure 5b). Importantly, the share of essential good consumption decreases in wealth/income as households have a preference for non-essential good consumption. The average share of essential good consumption is 56%, households with the highest wealth/income spend about 35% of their consumption expenditures on essential goods. These numbers are consistent with the expenditure shares of the core essential goods (food and housing) in the consumption baskets of households with average and high income, as presented in Section 2.

5.2 Transmission of Monetary Policy

Figure 6a displays the output responses of the three model specifications (standard HANK, TS HANK, and HB HANK) to an expansionary monetary policy shock. The transmission of monetary policy on output is strongest in the TS HANK model: due to differing price rigidities, inflation rates differ across good types. In particular, essential-good prices adjust faster to shocks (Figure 6b), increasing the relative price of essential goods after an expansionary monetary policy shock. The relative price of non-essential goods, conversely, decreases which incentivizes consumption of non-essential goods. As these types of goods predominantly determine the consumption index in the TS HANK model, overall consumption increases more. Thus, the two-sector structure implies a stronger transmission of monetary policy in our context. The additional introduction of a subsistence level, i.e., of heterogeneous consumption baskets, weakens the transmission of monetary policy on output. There is a multitude of reasons for this outcome.

In the HB HANK model, households choose to forego parts of their shock-induced additional consumption opportunities to decrease their working hours, i.e., the MPC at the lower end of the wealth distribution is lower than in the other model specifications. Furthermore, an important transmission channel of monetary policy emerges that primarily affects real expenditures of low-income households. This transmission channel is absent in the standard HANK and the TS HANK models. Figure 7a illustrates the effect. In the standard HANK and the TS HANK model, the increase in expenditures mirrors the increase in consumption. In the HB HANK model, a novel indirect transmission channel of monetary policy operating through the relative price of essential goods emerges. Following an expansionary monetary impulse, the real value of the subsistence level of consumption on essential goods, $\frac{P_{1,t}}{P_{c,t}}C^*$, increases as the price of essential goods increases more strongly than the average price level. Thus, the increase in household expenditures does not fully translate into an increase in (excess) consumption, which determines the increase in output, but is partly absorbed by the increase in the relative price of subsistence consumption. Therefore, expenditure reevaluation decreases the effectiveness of monetary policy.

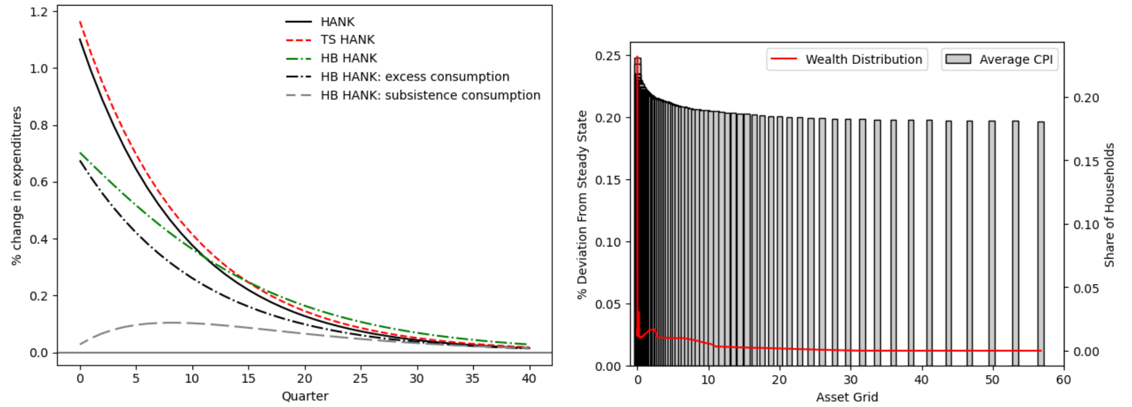


(a) Output Responses. (b) Inflation Responses.

Figure 6: Impulse Responses to a 25BP Expansionary Monetary Policy Shock.

This effect is underscored by the fact that households in the HB HANK model are affected differently by inflation. Figure 7b shows the average, initial CPI inflation rate response along the wealth distribution. As households at the lower end of the wealth distribution, on average, consume dis-proportionally more essential goods than wealthier households, the stronger increase in essential-good prices affects less-wealthy households more, decreasing their purchasing power.

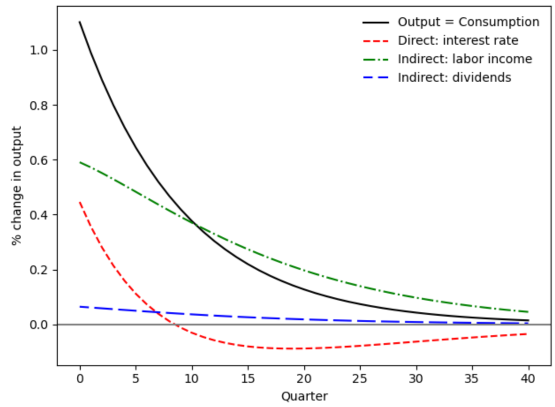
Finally, we decompose the consumption/output impulse response to a monetary policy shock into direct and indirect effects. Figure 8a illustrates the decomposition of the consumption responses for the standard HANK model. As established in the HANK literature, direct effects arising from intertemporal substitution in response to interest rate changes are smaller than indirect effects arising from the increase in labor demand and thus labor income. The remaining part of the response is explained by an increase in demand for goods, which implies an increase in profits and, therefore, dividend income of households.



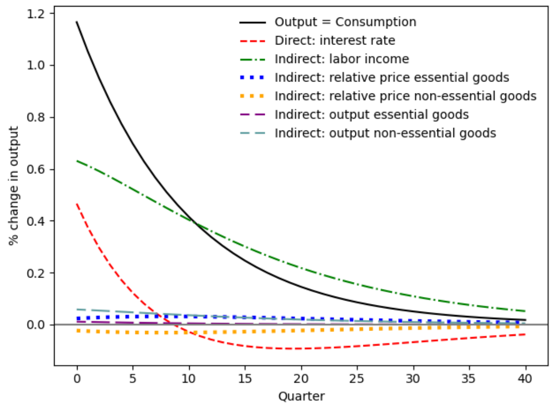
(a) Expenditure Response in the Three Model Specifications.

(b) Initial CPI Inflation Response Along the Wealth Distribution in the HB HANK Model.

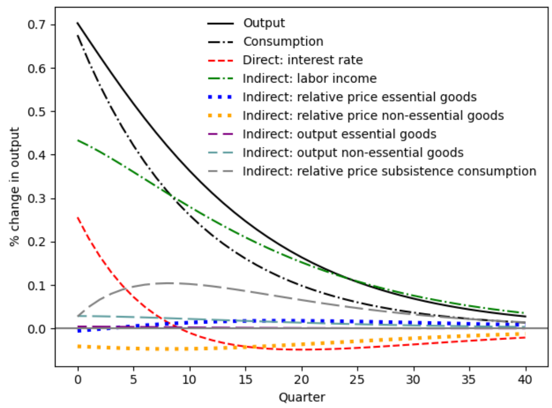
Figure 7: Impulse Responses to a 25BP Expansionary Monetary Policy Shock.



(a) Output, Standard HANK Model.



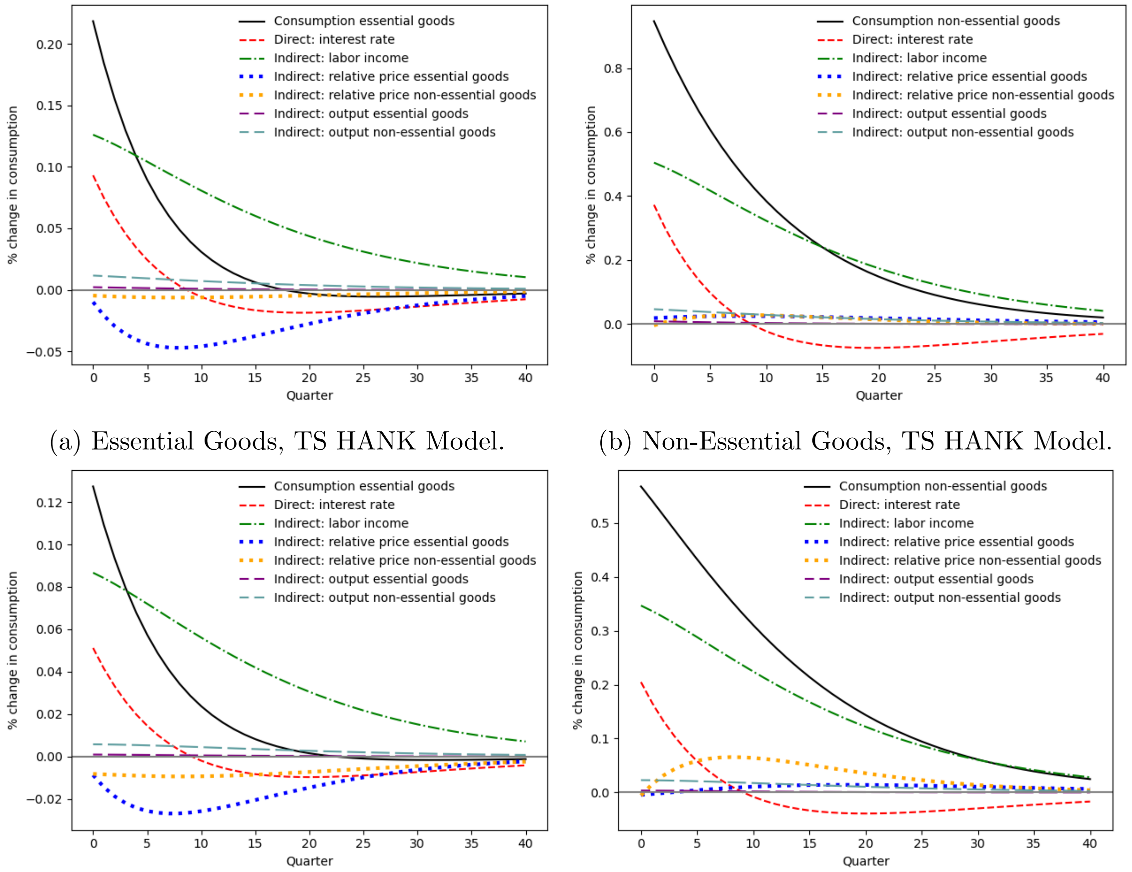
(b) Output, TS HANK Model.



(c) Output, HB HANK Model.

Figure 8: Decomposition of Impulse Responses to a 25BP Expansionary Monetary Policy Shock.

Figure 8b shows the decomposition in the TS HANK model. Quantitatively, both direct effects via the interest rate and indirect effects via labor income are larger than in the standard HANK model. However, the introduction of two-sectors changes the indirect effect generated via dividends: An increase in demand and thus output, generally, still implies an increase in dividend income. However, relative prices play an ambiguous role: an increase in the relative price of a good increases real profits but decreases the demand for the good, and vice versa. The relevance of the direct and indirect channels for monetary policy transmission, however, is very similar to the standard HANK model.



(a) Essential Goods, TS HANK Model.

(b) Non-Essential Goods, TS HANK Model.

(c) Essential Goods, HB HANK Model.

(d) Non-Essential Goods, HB HANK Model.

Figure 9: Decomposition of Impulse Responses to a 25BP Expansionary Monetary Policy Shock.

Figure 8c illustrates the decomposition of the consumption/output responses for the HB HANK model. Due to the reasons discussed before, the overall direct and indirect effects are quantitatively smaller than in the other two model specifications. In order to gain a better understanding of the transmission mechanisms, we depict the decomposition of essential and non-essential good consumption/output responses in the TS and the HB HANK models in Figure 9. Unsurprisingly, non-essential goods are the main driver of the overall consumption response as households have a greater preference for consuming them. The decomposition follows a similar pattern as overall consumption/output in both model specifications.

The decomposition of the essential good consumption/output response shows the main difference between the models. Figure 9a indicates that the development of the relative price of essential goods decreases the consumption/output response substantially over time as the relative price of essential goods increases after an expansionary monetary policy impulse. While this effect is still relevant in the HB HANK model (Figure 9c), it is muted: the subsistence level on essential good consumption limits the extent to which households can decrease their essential good consumption. Especially low-wealth/income households drive this result as they have a particularly low elasticity of substitution.

6 Conclusion

Households differ in their consumption baskets and, therefore, their inflation rates along the wealth and income distribution. In particular, we use German data to provide some stylized facts on the relevance of subsistence consumption for households' consumption baskets and inflation rates. We show that households with low income use the vast majority of their expenditures for subsistence consumption (up to 87%). This share drops to close to 21% for the richest households. Furthermore, we show that prices of subsistence consumption exhibit the highest volatility over time.

We then set up a HANK model that incorporates these facts. In particular, we derive different household consumption baskets and thus inflation heterogeneity by introducing a subsistence level on essential good consumption to analyze the consequences of this heterogeneity for monetary policy transmission. Our model replicates key features of the income and wealth distribution, of marginal propensities to consume, of elasticities of substitution, of heterogeneous consumption baskets along these distributions, and generates rich labor supply heterogeneity. We show that these properties are empirically plausible.

We compare the transmission of a monetary policy in a standard HANK model, a two-sector HANK model with homogeneous consumption baskets, and a two-sector HANK model with heterogeneous consumption baskets. We find that considering multiple sectors increases the strength of monetary policy transmission to output due to the adjustment of relative prices in our context. Heterogeneous consumption baskets across households, however, imply a weaker monetary policy transmission. This is due to the heterogeneous responses of inflation rates to monetary policy shocks across households and the labor supply heterogeneity resulting from the subsistence level. We further provide evidence for a novel indirect transmission channel of monetary policy operating through the relative price of essential goods, which determines the real value of the subsistence level of consumption.

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Appendix

A Data

For 2018, the German Parliament reports the calculated annual subsistence level of consumption to be 9000€. The general breakdown assigns 4968€ to baseline expenditures, 3396€ to costs for housing, and 636€ to costs of heating. The FMLSA publishes the breakdown of baseline expenditures as shown in column 2 of Table A.1.

Category	FMLSA Breakdown	Final Subsistence Basket
Food and non-alcoholic beverages	34.74%	19.18%
Alcoholic beverages and tobacco	0.00%	0.00%
Clothing and footwear	8.31%	4.59%
Housing, water, electricity, gas and other fuels	8.49%	49.48%
Furniture, lighting equipment, appliances etc.	6.10%	3.37%
Health	3.82%	2.11%
Transport	8.98%	4.96%
Communication	8.84%	4.88%
Recreation, entertainment and culture	9.77%	5.39%
Education	0.36%	0.20%
Restaurant and accommodation services	2.61%	1.44%
Miscellaneous goods and services	7.99%	4.41%

Table A.1: Breakdown of Baseline Expenditures and Subsistence Consumption Basket of German One-Person Households.

Notes. Data source: German Parliament; FMLSA; SIE.

In order to arrive at the subsistence consumption basket (shown in column 3 for reference), the share provided by the FMLSA breakdown is multiplied by the value of baseline expenditures (4968€) and divided by the overall level of subsistence consumption (9000€). This applies to all categories except from housing, water, electricity, gas and other fuels. Here, the share of this category in baseline expenditures is multiplied by the value of baseline expenditures. The resulting value is added to the amount allocated to housing (3396€) and heating (636€), before being divided by the overall level of subsistence consumption.

The share of subsistence consumption in overall consumption at different net-income levels in calculated based on SIE data on consumption expenditures by net-income levels in 2018 reported in Table A.2. Column 3 also reports the share of households at each net-income level based on the 2018 micro census. Where possible, the share of households is aggregated to match the net-income levels reported by the SIE.

Net Income in €	Monthly Consumption Expenditures in €	Share Subsistence Level	Share of Households
< 500			2.40%
500 − 900			15.80%
< 900	865	86.71%	18.20%
900 − 1300	1117	67.14%	21.50%
1300 − 1500	1325	56.50%	10.60%
1500 − 1700			9.80%
1700 − 2000			11.60%
1500 − 2000	1563	47.98%	21.40%
2000 − 2600	1881	39.87%	14.20%
2600 − 3200			6.00%
2600 − 3600	2315	32.40%	
3200 − 4500			4.30%
3600 − 5000	2822	26.58%	
> 4500			2.20%
> 5000	3565	21.04%	

Table A.2: Consumption Expenditures, Share of Subsistence Level, and Share of Households at Different Net-Income Levels .

Notes. Data source: German Parliament; FMLSA; SIE; Micro Census.

Finally, we construct price indices for the three consumption baskets outlined in the main text using CPI data from the Federal Statistical Office. We hold consumption baskets constant and calculate the inflation rate π of basket i in month t as

$$\pi_{i,t} = \sum_{j=1}^{J} \frac{p_{j,t} - p_{j,t-1}}{p_{j,t-1}} c_{i,j},$$

where j denotes the expenditure category, $\frac{p_{j,t} - p_{j,t-1}}{p_{j,t-1}}$ the inflation rate of j, and $c_{i,j}$ the expenditure share of j in i.

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Heinrich-Heine-Universität Düsseldorf

Düsseldorfer Institut für Wettbewerbsökonomie (DICE)

Universitätsstraße 1, 40225 Düsseldorf

ISSN 2190-992X (online)
ISBN 978-3-86304-426-8