

Gene Ambrocio\*  
Bank of Finland

## Abstract

I document a positive link between old-age dependency ratios and average markups. I propose a mechanism whereby households develop deep habits in consumption as they age to explain this feature in the data. When this mechanism is embedded in an overlapping generations New Keynesian model, the slope of the New Keynesian Phillips Curve flattens as the population ages. Consequently, the contractionary effects of monetary policy surprises are amplified. These results suggest that the challenges faced by monetary policy may become more pronounced as populations age.

## 1. Introduction

Society is aging in many countries around the world. The literature has shown that this demographic shift matters for other observed trends such as in rates of return on assets, labor markets, economic structure and growth, and inflation.<sup>1</sup>

This paper explores a new dimension to the economic implications of aging – how it affects the market power of firms as reflected in the markups they charge over their marginal cost.

I document a new stylized fact – that the age dependency ratio correlates well with average markups – and propose an extension of the New Keynesian Deep Habits framework with overlapping generations and age-dependent deep habits to match this stylized fact.

## 3. Age-dependent deep habits

I develop an extension of the New Keynesian Deep Habits model with (i) Blanchard-Yaari overlapping generations, and (ii) age-dependent deep habits. The former parsimoniously generates an age distribution over the working age population. The latter is the key assumption of the model whereby households are assumed to gradually develop stronger deep habits over time. This assumption captures the notion that households develop a taste or preference for a specific product as they repeatedly consume it, becoming more price inelastic in their consumption over time.

In the model, the demand curve faced by firm  $i$  is given by equation (1) where  $\tilde{\theta}$  is average deep habits which depends on the age distribution of households. An economy with a larger share of older households have stronger average deep habits.

$$c_{i,t} = x_t \left[ \frac{P_{i,t}}{P_t} \right]^{-\eta} + \tilde{\theta} c_{i,t-1} \quad (1)$$

Consequently, firms charge higher markups as populations age. Equation (2) expresses steady state markups ( $\mu$ ) which depends on average deep habits. In the model, economies with aging households exhibit higher markups.

$$\mu = \frac{\eta}{\eta - 1} \left[ \frac{1 - \tilde{\theta}}{1 - \tilde{\theta} \left( \frac{\eta - \beta}{\eta - 1} \right)} \right] \quad (2)$$

Table 1. Markups and age dependency

Dep. var.: Markups	(1)	(2)	(3)	(4)	(5)	(6)
Sample	FULL	FULL	FULL	FULL	OECD	non-OECD
Age dependency ratio (total)	0.009**	0.009**	0.004*			
Share young to total pop.				0.008*	0.002	0.003
Share old to total pop.				0.015*	0.011*	-0.008
L.Markups			0.489***	0.492***	0.814***	0.397***
Additional controls	NO	YES	YES	YES	YES	YES
Model	PFE	PFE	DP	DP	DP	DP
Observations	1356	628	628	628	591	393

Panel Fixed Effects and Dynamic Panel methods: Country and Year fixed effects included. Additional control variables are Real GDP, current account and total trade to GDP, government spending to GDP, savings to GDP, share of Services to GDP, unemployment and labor force participation rates, population density, life expectancy, population growth, share female, stock market capitalization and credit to GDP, and a linear time trend. Country-year panel of 40 countries over 1980-2016. Data from World Bank and De Loecker and Eeckhout (2020)

## 2. Age dependency and markups

Using data on the age distribution of the population of 40 countries for the period 1980-2016 as well as markup estimates from De Loecker and Eeckhout (2021), I show that there is a significant positive correlation between markups and the age dependency ratio. Further, as shown in the last two columns of Table 1, the result is primarily driven by the old-age dependency ratio in OECD countries.

The estimates indicate that about 10% of the increase in markups over the period 1980-2016 in OECD countries can be accounted for by the increase in the old-age dependency ratio.

One (non-exclusive) explanation is declining price sensitivities over households' lifetimes, possibly because households develop a preference or taste for specific products or brands as they age. This is consistent with evidence in the literature where older households are less likely to try out new brands (Bornstein, 2021) and exhibit more niche consumption (Neiman and Vavra, 2023). I also find evidence that older European households care less about prices when making food purchases.<sup>2</sup>

## Notes

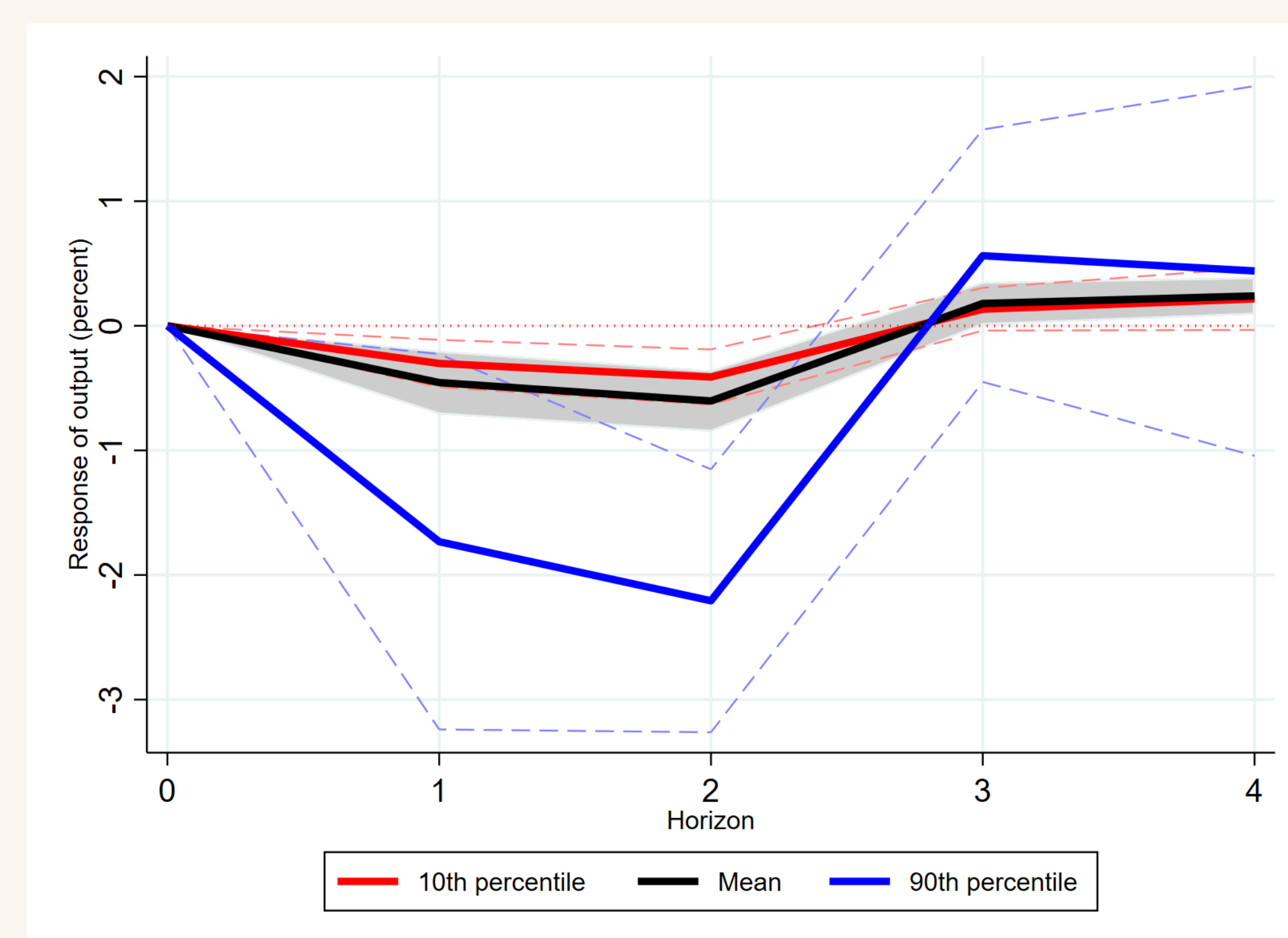
- \* The views and opinions expressed in this paper are the author's and does not necessarily represent the views of the Bank of Finland
- See e.g., Acemoglu and Restrepo (2022), Aksoy et al. (2019), Auclert et al. (2021), Cravino et al. (2022), Gagnon et al. (2021), Jones (2023), Juselius and Takats (2021), Katagiri et al. (2020), Leahy and Thapar (2022), Maestas et al. (2023), Mangiante (2023), and Rachel and Summers (2019) for a non-exhaustive list of such contributions to the literature.
  - See Parks and Barten (1973) and Pollack and Wales (1981) for an early analysis on the relationship between the age structure and aggregate consumption patterns. See also Atalay et al. (2023), Brand (2021), and Doepfer et al. (2022) for more recent analysis on the role of price sensitivities on markups.

## Contact

Gene Ambrocio  
Bank of Finland  
P.O. Box 160, 00101 Helsinki, Finland  
Email: gene.ambrocio@bof.fi  
Website: <https://sites.google.com/site/ambrociogpp/>



Figure 1. Output cost of monetary tightening



The figure plots state-dependent local projections of the response of output to a monetary surprise that reduces inflation by a cumulative 1% over four years using the Trilemma instrument of Jorda et al. (2020). Responses are plotted when the state is equivalent to the 10<sup>th</sup> percentile (red), average (black), and 90<sup>th</sup> percentile of the old-age dependency ratio. The gray shaded area and dotted lines represent 90% confidence intervals.

## 4. Implications on the slope of the NKPC

The model predicts that population aging flattens the slope of the New Keynesian Phillips Curve (NKPC). Consequently, it raises the output cost of monetary tightening.

This prediction of the model is confirmed in the data. When I estimate state-dependent local projections using the trilemma instrument of Jorda et al. (2020) for 16 countries over the period 1950-2020. I find that the output cost of monetary tightening is much higher when populations age.

Figure 1 plots the response of output to a monetary tightening that reduces inflation by a cumulative 1% over four years when the old-age dependency ratio is at the 10<sup>th</sup> percentile (red), average (black), and 90<sup>th</sup> percentile (blue) of the sample. The cumulated output loss at the 90<sup>th</sup> percentile is about 8 times larger than the output loss at the 10<sup>th</sup> percentile.

These results imply that the challenges faced by monetary policy may become more pronounced as populations age.