Demographic Aging and the New Keynesian Phillips Curve
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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.1 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.

Table 1. Markups and age dependency

<table>
<thead>
<tr>
<th>Dep. var.</th>
<th>Markups</th>
<th>Sample</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age dependency ratio (total)</td>
<td>0.008**</td>
<td>0.006*</td>
<td>0.004*</td>
<td>0.008*</td>
<td>0.002</td>
<td>0.003</td>
<td>0.002</td>
<td>0.003</td>
</tr>
<tr>
<td>Share old to young pop.</td>
<td>0.015</td>
<td>0.011*</td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share old to total pop.</td>
<td>0.498***</td>
<td>0.462***</td>
<td>0.814***</td>
<td>0.397***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td></td>
<td></td>
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<tr>
<td>Model</td>
<td>PFE</td>
<td>PPE</td>
<td>DP</td>
<td>DP</td>
<td>DP</td>
<td>DP</td>
<td>DP</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>1356</td>
<td>628</td>
<td>628</td>
<td>628</td>
<td>591</td>
<td>362</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Data from Euro area countries, 2016-2020.

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 Eckehkt (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 Yoto, 2023). I also find evidence that older European households care less about prices when making food purchases.2

Notes

1. The views and opinions expressed in this paper are the authors’ and do not necessarily represent the views of the Bank of Finland.
2. See also Akita et al. (2017), Brand (2017), and Deeg and Gauthier (2017) for more recent analysis on the role of price sensitivities in markups.

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 $\bar{\theta}$ 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.

$$c_{it} = \frac{P_i/\bar{P}}{1 + \bar{c}_{i,t-1}}$$ (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.

$$\frac{\theta}{\bar{\theta}} \left( 1 - \frac{\theta}{\bar{\theta}} \right)$$ (2)

Figure 1. Output cost of monetary tightening

The figure plots state-dependent local projections of the response of output to a monetary shock 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 10th percentile (red), average (black), and 90th percentile of the old-age dependency ratio. The grey shaded areas and dotted lines represent 90% confidence intervals.

4. Implications of 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 10th percentile (red), average (black), and 90th percentile (blue) of the sample. The cumulated output loss at the 90th percentile is about 8 times larger than the output loss at the 10th percentile.

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

Notes

1. For an exhaustive list of papers on this topic, see e.g. Acemoglu and Autor (2012), Deaton (2014), and Deaton and others (2015).
2. See also Bovenberg et al. (1989), Deaton (2000), and Deaton and Lee (2000) for a more recent analysis on the role of price sensitivities in markups.

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