HAFiscal project paper outline

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1 Introduction

2 Model

3 Estimation and calibration

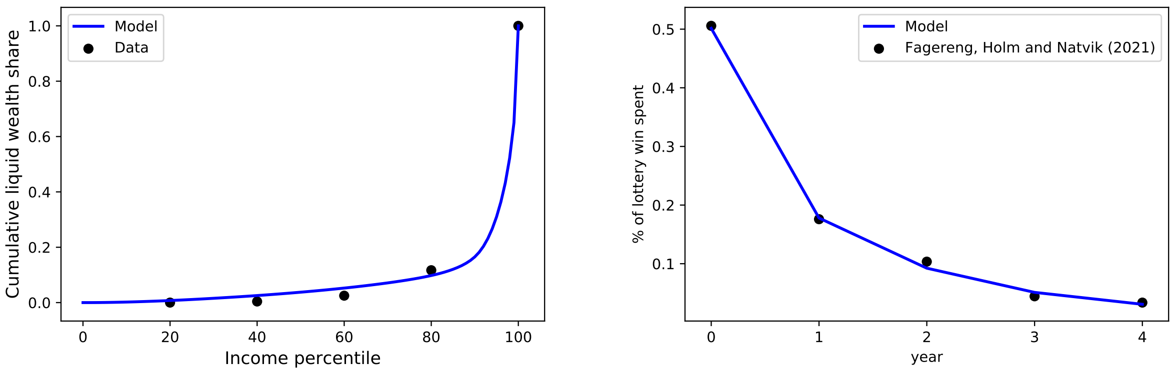
3.1 Estimation of the "splurge" factor

We define splurging as the free spending of available income without concern for intertemporal maximization of utility. As we will show in this section, a model allowing for splurging performs well at capturing the shorter and longer term response of consumption to income shocks. Specifically, we show that our model can account well for the results of Fagereng, Holm, and Natvik (2021), who study the impact of lottery winnings in Norway on consumption using millions of datapoints from the Norwegian population registry. To do so we calibrate our model to reflect the Norwegian economy and estimate the splurge factor, as well as the distribution of discount factors in the population to match two empirical moments. First, we match the steady-state distribution of liquid wealth in the model to its empirical counterpart. Due to the lack of data on the liquid wealth distribution in Norway, we resort to the corresponding data from the US - assuming that liquid wealth inequality is comparable across these countries. Specifically, we impose as targets the cummulative liquid wealth share at the 20th, 40th, 60th and 80th income percentile, which equal 0%, 0.4%, 2.5% and 11.7%.[1] Hence, 87.3% of the total liquid wealth is held by the top income quintile. The data is plotted in figure 1a. Second, we take from Fagereng, Holm, and Natvik (2021) the marginal propensity to consume out of a one-period income shock. We not only target the contemporaneous respone of consumption to the income shock, but also the subsequent impact on consumption in years one to four after the income shock. The share of lottery winnings expended at different time horizions, as found in Fagereng, Holm, and Natvik (2021), are plotted in figure 1b.

The remaining model parameters are calibrated to reflect the Norwegian economy. Specifically, we set the real interest rate to 2% annually and the unemployment rate to 4.4%, in line with Aursland, Frankovic, Kanik, and Saxegaard (2020). The quartarly probability to survive is calibrated to $1 - 1/160$, reflecting an expected working life of 40 years. Aggregate productivity growth is set to 1% annually following Kravik and Mimir (2019). The unemployment net replacement rate is calibrated to 60% following OECD (2020). Finally, we set the real interest rate on liquid debt to 13.6% and the borrowing constraint on 80% of permanent income following data from the Norwegian debt registry Gjeldsregistret (2022).[2] The standard deviation of the permanent and transitory shock are

[1] @Edmund, where is this data from?

[2] Specifically, we determine the average volume-weighted interest rate on liquid debt, which consists of consumer loans, credit and payment card debt and all other unsecured debt. To determine the borrowing limit on liquid debt



(a) Distribution of liquid wealth

(b) Share of lottery win spent

Figure 1: Targets and model moments from the estimation

0.07 and 0.346, respectively. [@Hakon, could you add a few sentences on the data on which the std was estimated?]

Using the calibrated model, unexpected lottery winnings are simulated and the share of the lottery spent in each year is calculated. Specifically, each simulated agent receives a lottery win in a random quarter of the first year of the simulation. The size of the lottery win is itself random and spans the range of lottery sizes found in Fagereng, Holm, and Natvik (2021). The estimation procedure minimizes the distance between the targets and model moments by selecting the splurge factor and the distribution of discount factors in the population, where the latter are assumed to be uniformly distributed in the range $[\beta - \nabla, \beta + \nabla]$. We approximate the uniform distribution of discount factors with a discrete approximation and let the population consist of 7 different discount types.

The estimation yields a splurge factor of 0.32 and a distribution of discount factors described by $\beta = 0.986$ and a $\nabla = 0.0174$. Given these estimated parameters and the remaining calibrated ones, the model is able to replicate the time path of consumption in response to a lottery win from Fagereng, Holm, and Natvik (2021) and the targeted distribution of liquid wealth very well, see figure 1.

4 Fiscal policy simulations

We consider the following fiscal policy experiments

- Payroll tax cut: Employed individuals benefit from a 2 percentage points lower payroll tax cut. The tax cut is unanticipated and usually lasts for 8 quarters. However, there is a 50% chance, that the policy is extended by another 8 quarters if the recession is still ongoing in the 8th quarter of the payroll tax cut.

- Unemployment insurance extension: The duration of the unemployment insurance is doubled from 2 to 4 quarters. Agents, that are unemployed when the policy is implemented thus receive up to 4 quarters of unemployment insurance. The policy is unanticipated and active only for one quarter.

we determine the ratio between total credit card limit divided by total wage income in Norway. We use data from December 2019.

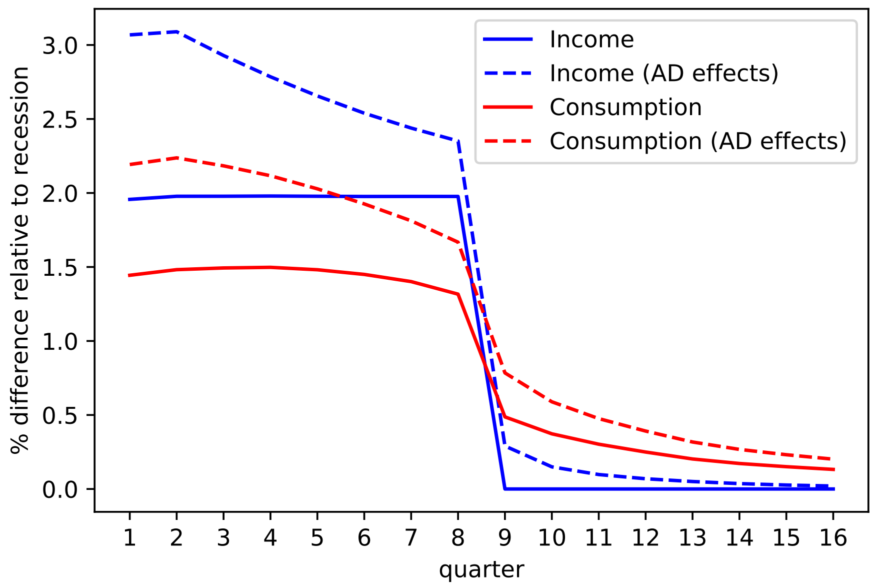


Figure 2: Impulse responses of aggregate income and consumption to a pay roll tax cut during a recesssion lasting eight quarters with and without aggregate demand effects

- Stimulus check: Each individual, independent of employment status, receives an unanticipated payment of \$1200 in one quarter. However, the check is only paid out fully to individuals with a permanent yearly income smaller than 100,000 and not at all to those with a income greater than 150,000. Those within the two thressholds receive a share of the full stimulus check amount proportionate to their position within threshholds.[3]

4.1 Impulse responses

[3] For this income group, the check amount is given by $\$1200(1 - \frac{Income - 100{,}000}{50{,}000})$. For example, an individual with a permanent yearly income of 110,000 receives 80% of the stimulus, i.e. \$960.

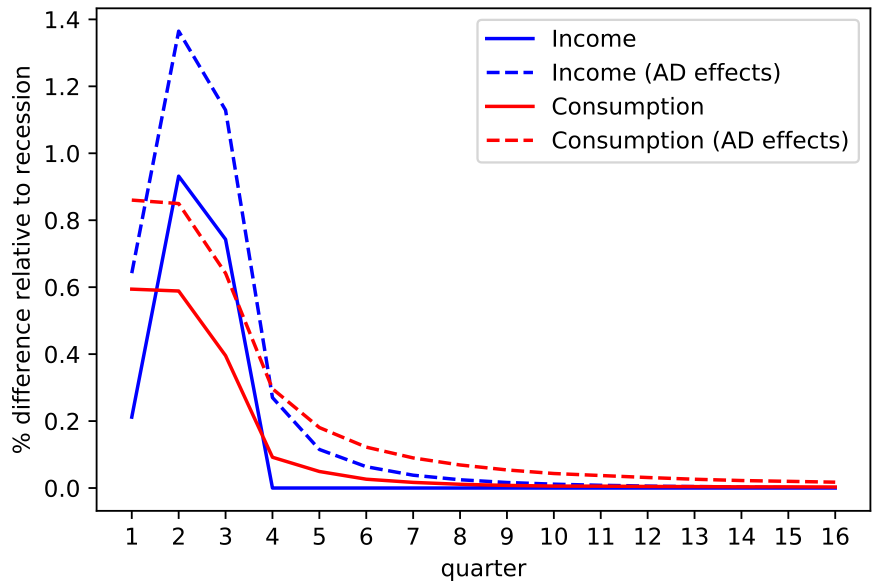


Figure 3: Impulse responses of aggregate income and consumption to a UI extension during a recesssion with and without aggregate demand effects

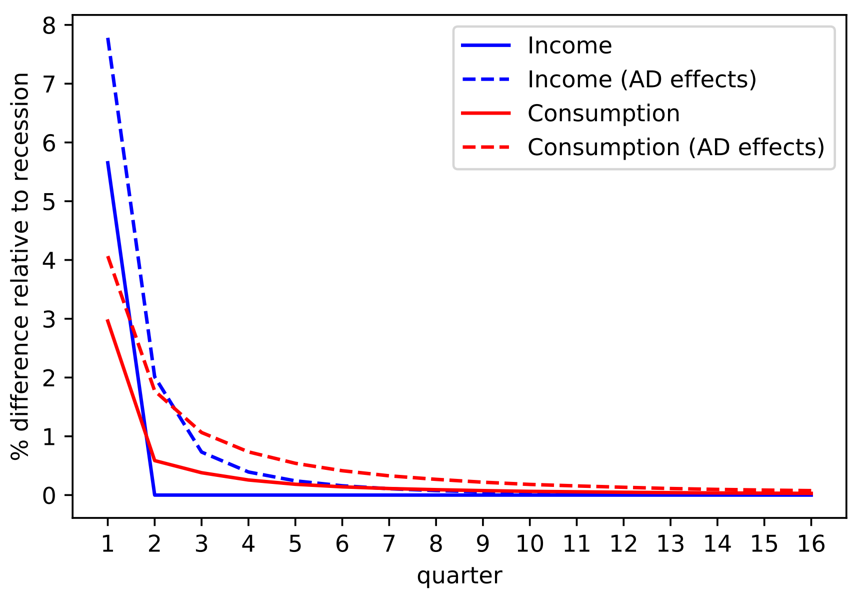


Figure 4: Impulse responses of aggregate income and consumption to a stimulus check during a recesssion with and without aggregate demand effects

4.2 Multipliers

Definitions:

- The *net present value (NPV)* of a variable X at horizon t is given by

$$NPV(t,X) = \sum_{s=0}^{t}\left(\prod_{i=1}^{s}\frac{1}{R_i}\right)X_s \tag{1}$$

- The *cummulative multiplier (CM)* of a policy is given by

$$CM(t) = \frac{NPV(t,\Delta C)}{NPV(T_{max},\Delta G)} \tag{2}$$

  where ΔC is the additional aggregate consumption spending in the policy scenario relative to the baseline and ΔG is the government expenditures caused by the policy.

	Tax Cut	UI extension	Stimulus check
Multiplier (with AD effects)	1.285	1.795	1.850
Multiplier (with only 1st round AD effects)	1.146	1.480	1.481
Share of policy expenditure during recession	46.4%	71.4%	66.0 %

Table 1: Multipliers as well as the share of the policy ocurring during the recession for the three policies considered

	Tax Cut	UI extension	Stimulus check
Recession lasts 2q	1.096	1.648	1.689
Recession lasts 4q	1.224	1.718	1.842
Recession lasts 8q	1.471	1.864	1.999

Table 2: Multipliers (with AD effects) for different recesssion lengths for the three policies considered

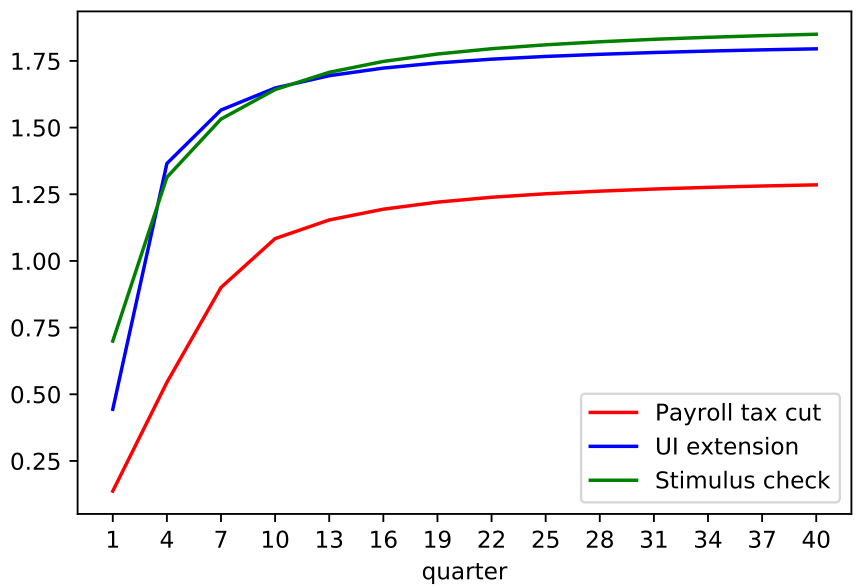


Figure 5: Cummulative Multiplier as a function of the horizon in quarters for the three policies considered. Policies are implemented during a recession with AD effects active

5 Welfare analysis

We want to convert welfare units to consumption units. A proportional increase in every agents' consumption in the baseline by fraction x, in welfare, is equal to:

$$x\frac{1}{N}\sum_{i=1}^{N}\sum_{t=0}^{\infty}D^t c_{it,\text{base}}u'(c_{it,\text{base}}) \tag{3}$$

where c_{it} is consumption (including the splurge) of agent i at time t and D is the social planner's discount rate. N is the number of agents.

The cost of such an increase is

$$x\frac{1}{N}\sum_{i=1}^{N}\sum_{t=0}^{\infty}R^{-t}c_{it,\text{base}} \tag{4}$$

Define

$$\mathcal{W}^c = \frac{1}{N}\sum_{i=1}^{N}\sum_{t=0}^{\infty}D^t c_{it,\text{base}}u'(c_{it,\text{base}}) \tag{5}$$

$$\mathcal{P}^c = \frac{1}{N}\sum_{i=1}^{N}\sum_{t=0}^{\infty}R^{-t}c_{it,\text{base}} \tag{6}$$

Aside - with log utility, $\mathcal{W}^c = \frac{1}{N}\sum_{i=1}^{N}\sum_{t=0}^{\infty}D^t = \frac{1}{1-D}$

We will assume that a government expenditure of size F with welfare benefit $\mathcal{W}$ will be funded by a proportional consumption tax of size $\frac{F}{\mathcal{P}^c}$ resulting in a welfare loss of $\frac{F}{\mathcal{P}^c}\mathcal{W}^c$. The overall welfare benefit will be equivalent to consumption units:

$$\mathcal{C} = \frac{\mathcal{W}}{\mathcal{W}^c} - \frac{F}{\mathcal{P}^c} \tag{7}$$

There is also an 'unseen' cost to the government policy exactly equal to implementing the policy in normal times.

Define welfare of a policy as:

$$\mathcal{W}(\text{policy}, AD, Rec) = \frac{1}{N}\sum_{i=1}^{N}\sum_{t=0}^{\infty}D^t u(c_{it,\text{policy},AD,Rec}) \tag{8}$$

So the consumption equivalent of a policy implemented in recession is:

$$\begin{aligned}\mathcal{C}(\text{policy}, AD, Rec) = &\left(\frac{\mathcal{W}(\text{policy}, AD, Rec) - \mathcal{W}(AD, Rec)}{\mathcal{W}^c} - \frac{PV(\text{policy}, Rec)}{\mathcal{P}^c}\right) \\ &- \left(\frac{\mathcal{W}(\text{policy}) - \mathcal{W}(\text{base})}{\mathcal{W}^c} - \frac{PV(\text{policy})}{\mathcal{P}^c}\right)\end{aligned} \tag{9}$$

Table 3 shows results for this method. Note that the policy expenditures of each policy have been equalized.

	Check	UI	Tax Cut
$\mathcal{C}(Rec, \text{policy})$	0.090	3.395	0.004
$\mathcal{C}(Rec, AD, \text{policy})$	0.426	5.005	0.133

Table 3: Consumption Equivalent Welfare Gains in Basis Points

6 Conclusion

References

Aursland, T. A., I. Frankovic, B. Kanik, and M. Saxegaard (2020): "State-dependent fiscal multipliers in NORA - A DSGE model for fiscal policy analysis in Norway," *Economic Modelling*, 93, 321–353.

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A Appendix section example