Why the durable spending recovers faster this time?

Yuanzhe Liu*

December 7, 2021

Abstract

Previous studies find that households spend about 25 percent of their 2001 and 2008 rebates on nondurable consumptions. The majority of the fiscal stimulus would be either saved or used to pay off debt. However, most empirical researches found that durable consumptions are not very responsive to fiscal stimulus, especially during recessions. This contradicts the observation of the 2020 stimulus payment. We see a decrease in durable spending at the beginning of the pandemic and a quick recovery to a much higher level than the pre-pandemic. We proposed a model incorporating household production and working from home to explain this unusual increase in durable spending and discuss the heterogeneous reaction among agents.

*Email: yliu793@ucsb.edu

1 Introduction

In the past two decades, the US experienced three recessions. The government made a direct cash payment to households to mitigate the effect of economic downturns. The 2001 rebate was a payment of the benefit of a new tax bracket; the previous 15 percent tax bracket was reduced to 10 percent. The 2008 rebate is a one-time stimulus payment, even though it was administered through the tax system, similar to the 2020 stimulus, it was not related to any change in tax policy. Many previous research has shown that direct cash transfers can stimulate non-durable consumption and do not have much of an effect on durables. The reason is that durable consumption is lumpy, and there is adjustment cost. This makes them can be easily postponed, especially during recessions.

(Johnson et al., 2006) utilized the random timing of the arrival of the 2001 rebate to estimate how people spent their 2001 rebate. The timing of the sending of each rebate was determined by the second-to-last digit of the SSN. They found that households spent 20-40 percent of their rebates on non-durable goods during the three months they received their rebate. They also found no significant evidence of response in durables such as automobiles or large household equipment, which again might reflect the relatively small size of the average refund per household and the greater volatility of expenditure on such durables. (Shapiro and Slemrod, 2003)report that only 21.8 percent of households increased their spending in response to the 2001 rebate. The amount spent on durable goods would be even smaller. (Agarwal et al., 2007) find that households first improved their balance sheet by saving more or paying off credit card debt, then increased spending in the following nine months. The increased amount is $200 or about 40 percent of the average household rebate.

(Shapiro and Slemrod, 2009) find that most survey respondents said they would either mainly save the 2008 rebate or mostly use it to pay off debt. The most common plan for the rebate was debt repayment. (Parker et al., 2013) find on average households spent about 12 to 30 percent of their 2008 stimulus payments on nondurable consumption goods and services during the three-month period in which the payments were received. This response is statistically and economically significant. They also find a significant effect on the purchase of durable goods and related services, primarily the purchase of vehicles, bringing the average response of total consumption expenditures to about 50 to 90 percent of the payments during the three-month period of receipt. The durable response is quite different from what we observed during the pandemic, the auto sales did increase, but the magnitude is small relative to the aggregate durable consumptions[1].

A traditional one asset model that is reasonably calibrated to align with the net worth data failed to predict the aggregate consumption response to a transitory income fluctuation. (Kaplan and Violante, 2014) proposed a two assets structural model to overcome the challenge. The wealthy hand-to-mouth households are the key feature to generate strong aggregate consumption responses to fiscal stimulus payment. Their baseline model predicts that households spend 15% of the unanticipated fiscal payment, which is about two-thirds of the empirical estimates. If the payment is anticipated, then about 40% will be spent on nondurable consumptions.

Most previous research shows that 2001 and 2008 stimuli are mostly saved, used to pay down debt, or on nondurable consumptions and services. There are either no effects on durable spending or the effect is relatively small. However, from the following Figure 1 we can see that the durable consumption first dropped sharply in early 2020 and then bounced back to a level that is even higher than the pre-pandemic level. Such a quick recovery is different from any recession we observed, even compare to 2001 and 2008 that the US government also made direct cash transfer. (Berger and Vavra, 2015) proposed a theoretical model that durable spending is less responsive to the economic stimulus by incorporating transaction cost. They point out that as household wealth and income fall during a recession, the microeconomic friction, transaction cost make them less likely to adjust their household capital stock. This is consistent with previous empirical researches.

[1]See Figure 20 in the appendix

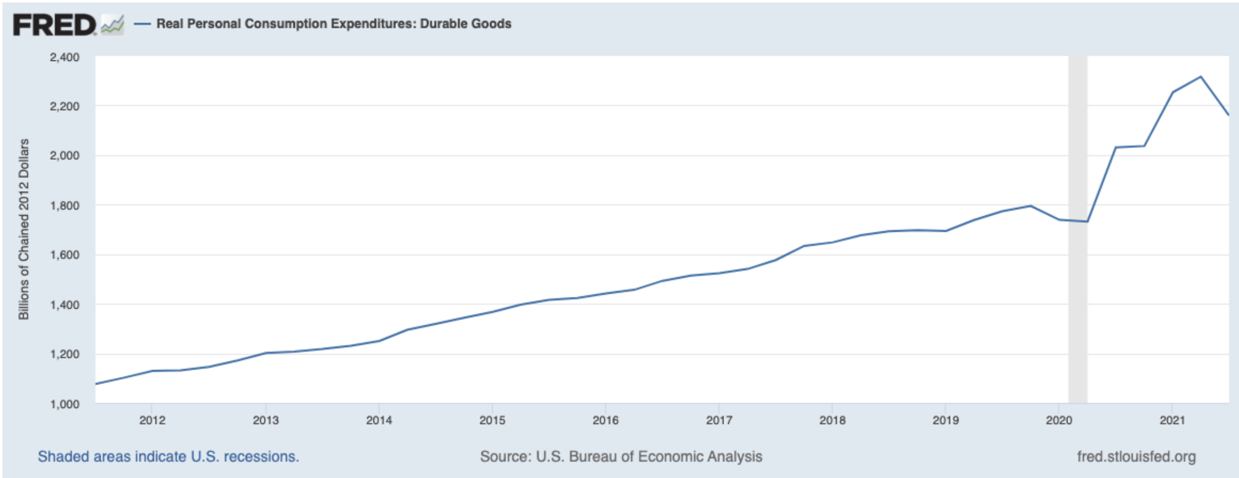


Figure 1: Quarterly Durable Goods Spending

Recent researches about the effect of the 2020 CARES act stimulus also find similar patterns that most of the stimulus payments are saved or used to pay off debt. (Coibion et al., 2020) document that only 15 percent of recipients say that they spent (or planned to spend) most of their payment, with the large majority of respondents saying instead that they either mostly saved it (33 percent) or used it to pay down debt (52 percent). When asked to provide a quantitative breakdown of how they used their checks, U.S. households report having spent approximately 40 percent of their checks on average, with about 60 percent of the average check being saved or used to pay down debt. Little of the spending went to large durable goods (Baker et al., 2020) used transaction-level data to analyze how recipients spend their 2020 stimulus payment. Relative to the effects of previous economic stimulus programs in 2001 and 2008, they find faster effects, smaller increases in durables spending, more significant increases in spending on food, and substantial increases in payments like rents, mortgages, and credit cards. They also find substantially smaller impacts on durables spending and confirm this in our survey of users.

Previous researches found mixed results on the response of durable spending of stimulus payments. Most papers report either negligible effect see (Shapiro and Slemrod, 2003), (Johnson et al., 2006), (Graziani et al., 2016), (Shapiro and Slemrod, 2009),or auto and related services contribute to most of the durable spending responses, see (Parker et al., 2013), (Kanishka Misra et al., 2014),(Kueng, 2018).

It is important to understand why the durable consumption recovered so quickly this time. Past researches show that durable spending is less responsive to economic stimulus and households tend to either save or spend the stimulus payment on nondurables. The increase in durable goods spending can be partially explained by shifting consumer demand. Precautions such as social distancing and lockdowns limited consumers choice of consumption and services. Therefore, they spend more time than usual in and around their home, to take care their children, work or study from home, engage in home production or enjoy leisure (Tauber and Van Zandweghe, 2021). There is a large and important literature focusing on household production started by (Becker, 1965). Most papers including household production to explain allocation of capital and labor between market and household activities and their business cycle implications (Heckman, 1974),(McGrattan et al., 1997),(Gomme et al., 2001),(Greenwood, 1991),(Benhabib and Rogerson, 1991),(Boerma and Karabarbounis, 2021),(Fang and Zhu, 2017),(Chang, 2000). The complementarity between household capital and business capital was first proposed by Fisher (2007), and followed by empirical evidence in (Díaz and Franjo, 2016).

We notice that the survey evidence presented by (Baker et al., 2020) and (Coibion et al., 2020) is inconsistent with the aggregate durable consumption. So far, the federal government has provided about \$867 billion of direct payments to qualified households. It is a relatively small amount compare to how much more households have spent on durables compare to the pre pandemic, that is approximately \$4612 billion. See appendix for details. During the pandemic, more workers either have the option of working from home or being forced to do so, and this is more common among high-income groups. These people will be more likely to invest in durable goods than people who have to work in person. In this paper, we propose a two agents model to explore the driving force behind the spike of durable spendings.

The remainder of this paper is organized as follows. Section 2 presents a model that incorporates household production and complementarity between household capital and market capital. Section 3 describes our calibration strategy and result and discusses its implication. Section 4 concludes.

2 Model

2.1 Model description

In this model, we have two types of agents. The first type of agent has the option of working from home, and they can substitute between working from home and working at the office. The second type of agent does not have the option of working from home. We can think of the first type of agent as a software engineer and the second type of agent as a truck driver.

There are also two types of capital in this economy, market capital, and household capital. Firms use market capital and effective labor to produce goods, both durable and nondurable, and services. Both type of households can use household capital to produce homemade goods and services. Homemade goods and services cannot be traded, invested, or stored. Household capital can be used by type 1 agent and type 1 agent only to boost their working from home productivity. This complementarity between market capital and household capital has been shown in (Fisher, 2007). Because during the pandemic there is a considerable proportion of works have been done remotely, the complementarity relation should be at least maintained if not strengthened.

We use the following notation for capital, labor, and consumption through this paper, $X_{\{1,2\},\{m,h\},\{t\}}$. The first index is agent type, the second index represents the sector, market, or household, and the third index is timing. Some variables may not need all three indexes; for example, for aggregate consumption, we only need the type and time index, and both agents face the same interest rate and wage, we do not need to distinguish them for different agents. Therefore, we only index interest rate and wage by time.

The type 1 agent faces the following problem.

$$Max\,\mathbb{E}\sum_{t=0}^{\infty}\beta^t U(C_{1,t}, H_{1,t}) \tag{1}$$

$$c_{1,m,t} + k_{1,m,t+1} + k_{1,h,t+1} = w_t * EL + (1 + r_t)k_{1,m,t} + (1 - \delta)k_{1,h,t} \tag{2}$$

$$c_{1,h,t} = k_{1,h,t}^{\alpha_h} h_{1,h,t}^{1-\alpha_h} \tag{3}$$

$$C_{1,t} = f(c_{1,m,t}, c_{1,h,t}) = (\omega c_{1,m,t}^{\epsilon_c} + (1 - \omega)c_{1,h,t}^{\epsilon_c})^{\frac{1}{\epsilon_c}} \tag{4}$$

$$H_{1,t} = h_{1,m_1,t} + h_{1,m_2,t} + h_{1,h,t} \tag{5}$$

$$EL = \left((k_{1,h,t}^{\alpha_l} h_{1,m_1,t}^{1-\alpha_l})^{\epsilon_l} + y_{1,t} h_{1,m_2,t}^{\epsilon_l}\right)^{\frac{1}{\epsilon_l}} \tag{6}$$

$$U(C_{1,t}, H_{1,t}) = \frac{C_{1,t}^{(1-\gamma)} - 1}{1 - \gamma} - \frac{H_{1,t}^{1+\phi}}{1 + \phi} \tag{7}$$

$$log(y_{1,t}) = \rho_1 log(y_{1,t-1}) + \epsilon_{2,t} \tag{8}$$

Equation 1 is the objective function in which $C_{1,t}$ represents the aggregate consumption of type 1 agent and $H_{1,t}$ represent the aggregate working hours of type1 agent.
Equation 7 shows that the utility is composed of two parts, the first part is the utility from aggregate consumption and the second part is the disutility from working. We use a CRRA utility function, and γ governs the risk aversion. ϕ is the Frisch elasticity of labor supply. Equation 2 is the budget constraints in which EL is the effective labor supply of type 1 agent. As shown in Equation 6, we aggregate hours working from home and hours of work at the office by a CES aggregator function. ϵ_l governs the elasticity of substitution between working from home and working at the office. The labor productivity y_t follows a log $AR(1)$ process, ρ_1 is the persistence parameter and $\epsilon_{1,t} \sim \mathcal{N}(0,\, \sigma_1^2)$ Equation 3 is the household production function, household capital and labor are used to produce homemade goods and services. Equation 4 is the consumption CES aggregator function, ϵ_c governs the elasticity of substitution between market goods consumption and homemade goods consumption. Finally, equation 5 shows that the agent is indifferent between labor allocations.

The type 2 agent faces the following problem. The notation is broadly consistent with the type 1 agent's problem. The difference is that type 2 agents could not benefit from working from home or do not have the option of working from home. In other words, if a type 2 agent suffers from a negative labor productivity shock, then they cannot substitute by working from home.

$$Max\,\mathbb{E}\sum_{t=0}^{\infty}\beta^t U(C_{2,t},H_{2,t}) \tag{9}$$

$$c_{2,m,t}+k_{2,m,t+1}+k_{2,h,t+1}=w_t*y_{2,t}*h_{2,m,t}+(1+r_t)k_{2,m,t}+(1-\delta)k_{2,h,t} \tag{10}$$

$$c_{2,h,t}=k_{2,h,t}^{\alpha_h}h_{2,h,t}^{1-\alpha_h} \tag{11}$$

$$C_{2,t}=f(c_{2,m,t},c_{2,h,t})=(\omega c_{2,m,t}^{\epsilon_c}+(1-\omega)c_{2,h,t}^{\epsilon_c})^{\frac{1}{\epsilon_c}} \tag{12}$$

$$H_{2,t}=h_{2,m_2,t}+h_{2,h,t} \tag{13}$$

$$U(C_{2,t},H_{2,t})=\frac{C_{2,t}^{(1-\gamma)}-1}{1-\gamma}-\frac{H_{2,t}^{1+\phi}}{1+\phi} \tag{14}$$

$$log(y_{2,t})=\rho log(y_{2,t-1})+\epsilon_{2,t} \tag{15}$$

We assume there is a continuum of agents in this economy, and θ is the ratio of type 1 agents. $K_{m,t}$ is the aggregate market capital supply and L_t is the aggregate labor supply, as shown in 16 and 17.

$$K_{m,t}=\theta k_{1,m,t}+(1-\theta)k_{2,m,t} \tag{16}$$

$$L_t=\theta EL+(1-\theta)yh_{2,m_2,t} \tag{17}$$

We assume the market is competitive and firms face the following problem.

$$MaxK_{m,t}^{\alpha}L_t^{1-\alpha}-(1-r_t)K_{m,t}-w_tL_t \tag{18}$$

Euler equations and law of motions are shown in appendix.

3 Calibration and Results

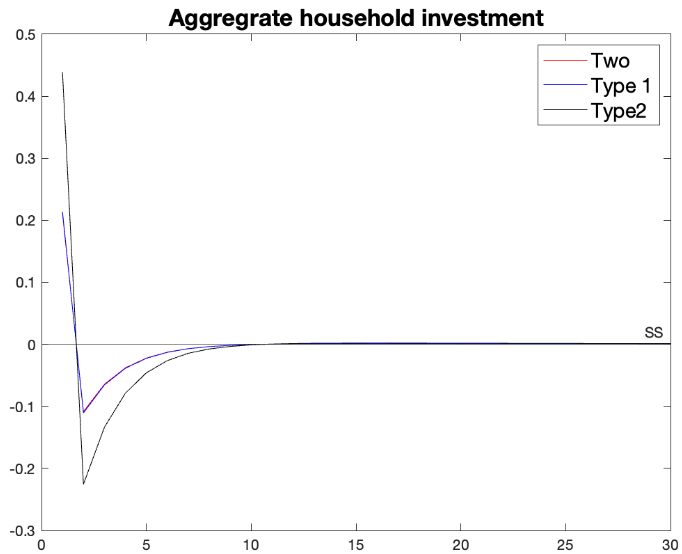
We choose most of the parameters quarterly. We set β, the discount rate of the flow of utility, to 0.98 and set γ_i the risk aversion to 2 as it is common in the literature. We set α_m the share of market capital in production to 0.3, α_h, the share of household capital in home production to 0.15, and α_l, the household capital share in the 'production function' of effective labor when working from home to 0.15. The elasticity of substitution between homemade goods and market goods ϵ_c is set to 0.6, which is the upper bound of empirically estimated value in the literature, $0.3 - 0.6$. ϵ_l, the elasticity of substitution between working at home and working at the office, is set to be 0.7; we do not find any empirical estimation of this parameter; this value gives us reasonable results. According to the new release of the America Time USE Survey (ATUS), about 40% of workers work from home from May 2020 to December 2020. Therefore, we set θ, the ratio of type 1 agent in our economy to 0.4

Table 1: Parameters

Parameters	Value	Descriptions
β	0.98	Discount rate
γ_1	2	Risk aversion
γ_2	2	Risk aversion
α_h	0.15	Capital share in household production
α_m	0.3	Capital share in market production
ϵ_c	0.6	EIS between consumptions
ϵ_l	0.7	EIS between labors
ϕ_1	2.5	Frisch elasticity of labor supply
ϕ_2	2.5	Frisch elasticity of labor supply
σ_1	0.01	SD of labor productivity shock
σ_2	0.01	SD of labor productivity shock
ρ_1	0.6	Persistence of labor productivity shock
ρ_2	0.6	Persistence of labor productivity shock
δ_m	0.025	Depreciation rate of market capital
δ_h	0.018	Depreciation rate of household capital
θ	0.4	Ratio of type 1 agent

3.1 Labor productivity shock

We first explore the implication of labor productivity shock. As described in the model, we assume that when working at office the log labor productivity follows an $AR(1)$ procecess, $log(y_{i,t}) = \rho_i log(y_{i,t-1}) + \epsilon_{i,t}$, where i is the agent type index, $i \in \{1, 2\}$. Given this productivity process, we can then compute the response of durable spending to a one standard deviation impulse.

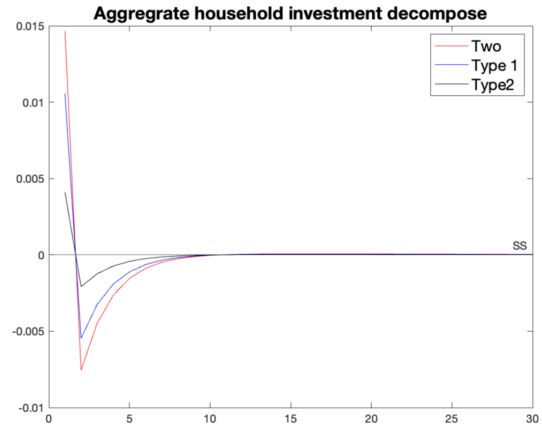


This graphs shows the decomposition of the aggregate household investment response of a one standard deviation shock on labor productivity .

Figure 2: Aggregate household capital investment decomposition in terms of actual value

From Figure 2 we can see that the aggregate household investment increased by 20% in response to a negative labor productivity shock. Type 2 agents are more responsive than type 1 agents; type 2 agents' household investment increased by roughly 42%, but type 1 agents only increased by 20%. The reason is, unlike type 1 agents, the type 2 agent could not utilize their household capital to buffer the labor productivity shock. Therefore, they need to invest more in household capital to insure their aggregate consumption.

We can see the aggregate household capital response is almost overlapped with type 1 agent's response which makes Figure 2 potentially misleading for two reasons. First, as shown in Table 2, the type 2 agent hold less household capital at a steady state; therefore, even though they are more responsive in percentage terms, they contribute less to the aggregate household capital investment. Second, there are 40% of agents in our economy are type 1. The type 2 agent's contribution to the aggregate household capital investment is, therefore, weighed down by two factors, agent type ratio and their steady state household capital stocks. Figure 3 shows IRF in level instead of percentage, and they are weighted by agent type ratio, from which we can see that type 2 agents only contribute to a small part of the aggregate household capital investment.



This graphs shows the decomposition of the aggregate household investment response of a one standard deviation shock on labor productivity .

Figure 3: Aggregate household capital investment decomposition in terms of actual value

3.2 Wealth shock and stimulus payment

At the early stage of the pandemic, many households experienced a sharp decline in wealth level and income due to the crash of the stock market and unemployment (or partial unemployment)[2]. However, this trend was quickly reversed as the US government and the Federal Reserve bank stepped in.

$$log(y_{k,t}) = \rho_{y_k} log(y_{k,t-1}) + \epsilon_{y_k,t} \tag{19}$$

$$\epsilon_{y_k,t} \sim \mathcal{N}(0,\, \sigma^2_{y_k}) \tag{20}$$

$$k^{actual}_{i,m,t} = y_k k^{choice}_{i,m,t}, i \in \{1, 2\} \tag{21}$$

We consider that negative wealth shocks as a proxy for declines in liquid asset holdings at the early stage of the pandemic. We assume that instead of the labor productivity shocks we described in Section 2, agents are also subject to an aggregate shock that follows the log $AR(1)$ process, (Berger and Vavra, 2015). $k^{choice}_{i,m,t}$ is agents' choice of saving and $k^{actual}_{i,m,t}$ is their actual saving. This process reflects the exogenous fluctuation of households' asset

[2]Most people either went back to their original work or found a new job, (Batty et al., 2021) and the wealth distribution do not change much compare to pre-pandemic.

holding. The actual saving determines the aggregate market capital and the household's return on capital. We show the IRF when $\rho_{y_k} = 0.6$ and $\sigma^2_{y_k} = 0.004$. We choose a small persistence parameter because the negative effect on wealth is transitory.

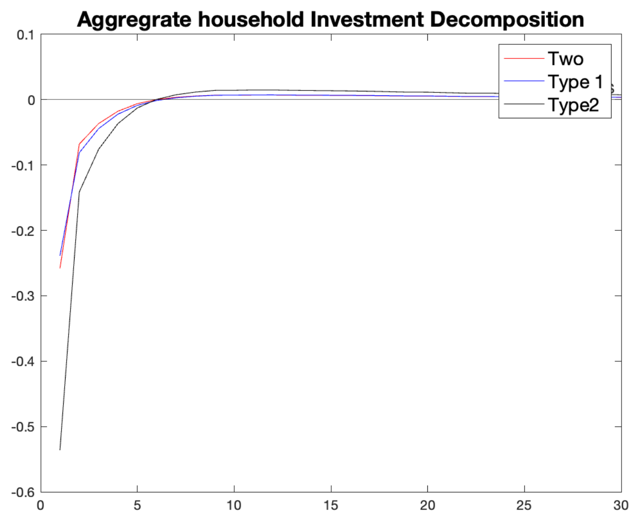


Figure 4: Aggregate household capital investment decomposition

Figure 4 shows that the aggregate household investment drops about 24% then gradually comes back to its steady state. Type 2 agents respond more aggressively than type 1 agents. Their household capital investment dropped more than 50%, compared to type 1 agent's 23%. However, the aggregate household investment fluctuation is mainly driven by type 1 agent because type 2 agent holds less household capital at the steady state. See Figure 5 for the decomposition of each type of agent's share in terms of level.

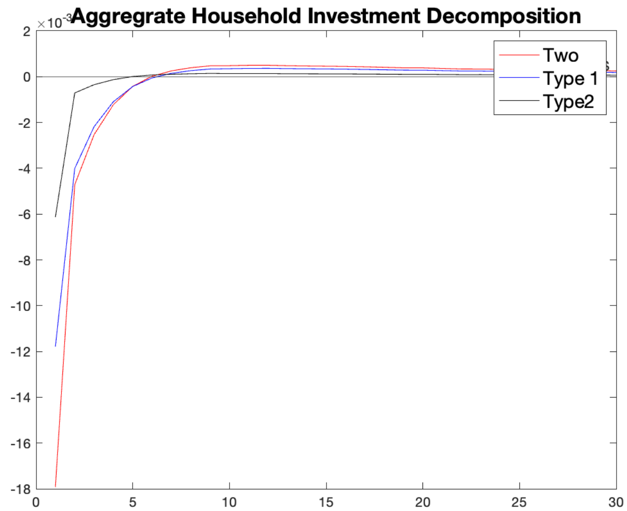


Figure 5: Household capital investment decomposition in response to stimulus payment

The US government has provided about $867 billion of direct payments to qualified households. As a natural next step, we would like to see the household's reaction to the stimulus, equivalently, a positive wealth shock. Here we consider a positive wealth as a proxy to the overall stimulus the US government has provided to the economy, including direct stimulus payment, Paycheck Protection Program, extended unemployment benefits, etc. Empirical researches, (Coibion et al., 2020) and (Baker et al., 2020), have shown that most households do not plan to spend their stimulus payments on durables; they would rather spend it on nondurables, pay off debt or save it. However, most of these results are from early survey data; households may end up spending more money than they expected on durables because of improved balance sheets. A similar result is shown in (Agarwal et al., 2007), they find that after receiving the 2001 rebate, spending on the most intensively used credit card account rose by over $200 cumulatively over the nine months after rebate receipt, which represents over 40 percent of the average household rebate. (Erceg and Levin, 2006) document that durable spending is more interest sensitive than nondurable. The interest rate is at its historical low, and it will for sure increase household capital investment such as automobiles, furniture, appliance, etc. In order to keep our model tractable, we do not explicitly include the monetary policy in this project, and we focus on the implication of having the option of working from home.

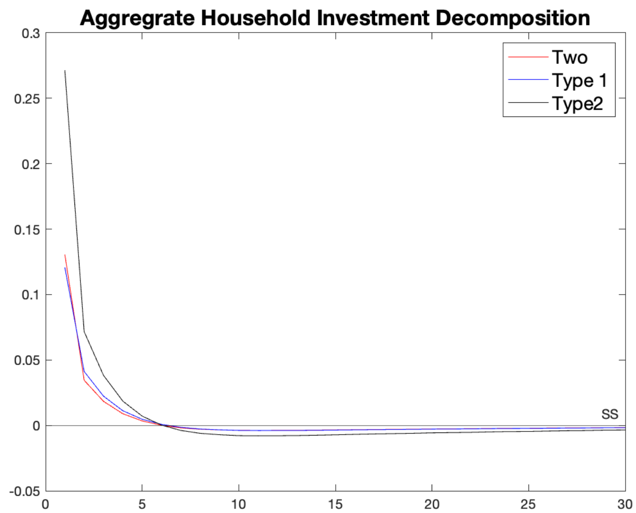


Figure 6: Aggregate household capital investment decomposition in terms of level

Figure 6 shows the IRF of the aggregate household investment and the response of each type of agent, the red line in the figure represents the aggregate response; it raises about 14% and gradually falls back to the steady state. The type 2 agent increased their household investment by 27%, and type 1 agent's response is very close to the aggregate variable. Figure 7 shows the IRF in level. We can see that two-third of the aggregate household investment is from type 1 agents.

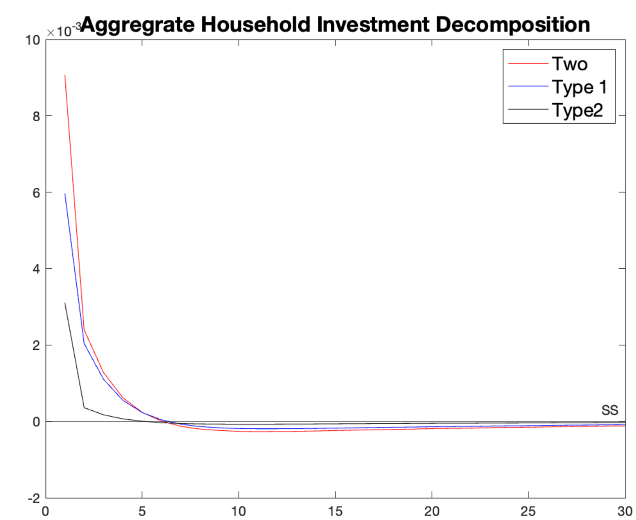
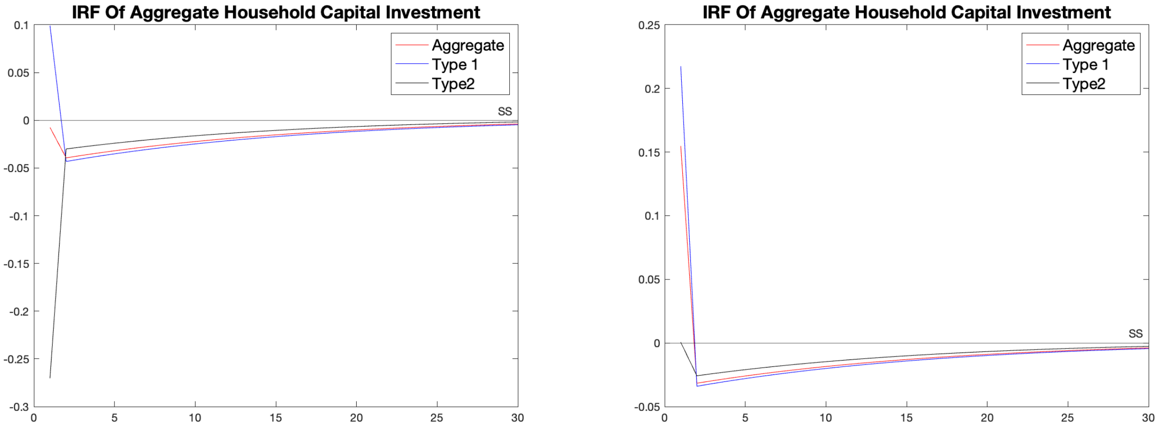


Figure 7: Aggregate household capital investment decomposition

3.3 Discussion

We have shown how aggregate household capital investment responds to negative labor productivity shock, wealth shock, and stimulus. From the decomposition, we find that even though type 2 agent responds more aggressively than type 1, their contribution to aggregate fluctuation is relatively small. Figure 1 shows the durable spending starts to increase from 2020 Q2. However, we do not know how different agent types behave since more than one shock hit the economy simultaneously. A negative labor productivity shock would lead to a higher household capital investment, but a negative wealth shock will lead to a lower household capital investment. When agents face more than one shock, the magnitude matters, and we could see completely different responses across different types of agents. To better understand the potential behavior of each type of agent and the aggregate variable movements, we feed the economy three shocks at the same time to see the response of the aggregate variable and each type of agent. We feed the economy a negative labor productivity shock and a negative wealth shock at period 1, and a stimulus shock at period 2. We also assume that at period 1 agent knows there will be a stimulus at period 2. Since the first stimulus plan, the American Rescue Plan Act of 2021, was proposed in January and signed into law in March. The stimulus was widely covered and discussed in the media. Therefore, it is safe to assume that agents have learned about the stimulus before it takes effect.



(a)

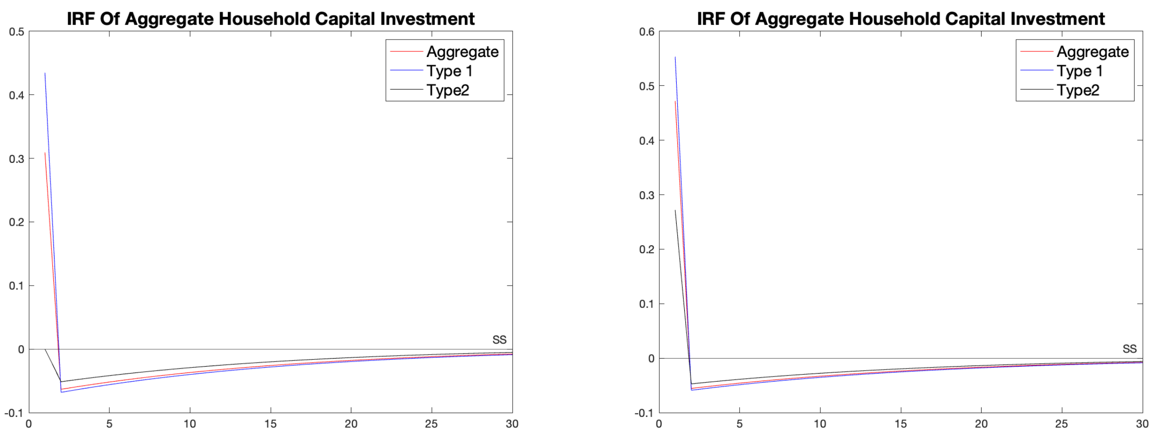
(b)

This graphs shows the IRF of household capital investment to a negative one standard deviation shock on wealth at period 1, a negative one standard deviation wealth shock at period 1 and a positive stimulus at periods 2 . Panel (a) shows when $\sigma_i^2 = 0.005$, $\sigma_{yk} = 0.004$, and $\sigma_{sk} = 0.002$. Panel (b) shows when $\sigma_i^2 = 0.005$, $\sigma_{yk} = 0.004$, and $\sigma_{sk} = 0.003$. The red line is the aggregate response, the blue line is the response of type 1 agent. The black line is the response of type 2 agent.

Figure 8: Aggregate household capital investment

Figure 8 and 9 show that when experiencing multiple shocks, the aggregate household investment could be mainly driven by the type 1 agent and mask the heterogeneity among households. We see that panel (b) of both Figure 8 and 9 shows a significant increase of the aggregate variable but the household capital investment of type 2 agent drops slightly and then goes back to its steady state. Type 2 agent's behavior is consistent with (Coibion et al., 2020) and (Baker et al., 2020) that the stimulus payments are mostly saved or used to pay off debt, even though stimulus in our model is different from the direct stimulus payment they discussed but this could be a sign that looks at the survey data only is misleading. Type 1 agent, however, is the main driving force of the aggregate household investment as we discussed before, even though type 1 agent is only 40% of the population but they own most of the household capital stock. Most of them might not be qualified for a direct stimulus payment in the real world, but they can still benefit from the lower interest rate, market capital appreciation, etc.

The heterogeneous reaction among agents is worth future research. We can identify agent type using the American Time Use Survey (ATUS). The survey shows the percent of employed persons working from home raised to 42%, and the working hours at home on average increased from 3.6 hours in 2019 to 5.8 hours in 2020. There are more workers now working from home and the average working from home hours are also longer. Meanwhile, the average commuting time declined from 72 minutes in 2019 to 47 minutes in 2020. These observations are in line with our model. Please see the appendix for more IRFs. The Consumer Expenditure Survey (CE) provides details on household expenditure from which we can identify the change of durable and non-durable spendings and further explore the heterogeneous reactions across different types of agents.



(a) (b)

This graphs shows the IRF of household capital investment to a negative one standard deviation shock on wealth at period 1, a negative one standard deviation wealth shock at period 1 and a positive stimulus at periods 2 . Panel (a) shows when $\sigma_i^2 = 0.01$, $\sigma_{yk} = 0.004$, and $\sigma_{sk} = 0.002$. Panel (b) shows when $\sigma_i^2 = 0.01$, $\sigma_{yk} = 0.004$, and $\sigma_{sk} = 0.003$ The red line is the aggregate response, the blue line is the response of type 1 agent. The black line is the response of type 2 agent

Figure 9: Aggregate household capital investment

There are some caveats to keep in mind when interpreting our results. First, even though empirical researches haven shown that most households do not spend or do not plan to spend their stimulus payments on durables, we still see some moderate reaction to the payment from our model. One reason is that in real life, households might face some liquidity constraints and transaction costs, as shown in (Kaplan and Violante, 2014). Therefore, it may not be worth it to liquidize their household capital when the liquidity constraints are binding, and when they receive a stimulus payment, they are more likely to spend them on nondurables or precautionary savings. However, our model does not have transaction costs because it will introduce a kink on the budget constraints and make the problem harder to solve. Second, we assume that type 1 agents could continuously substitute between working from home and working at the office, which corresponds to a hybrid working schedule. However, it would be more realistic to make this a discrete choice problem, that is, type 1 agent either work from home or work at the office.

4 Conclusion

In this paper, we proposed a model that incorporates household production and working from home. We show that agents with the option of working from home will accumulate more household capital and is the main driving force of the increase of aggregate durable spending. We also document that when hit by several shocks simultaneously, the aggregate durable spending could mask the heterogeneity among agents, as shown in Section 3.3. This could be a potential explanation to why empirical researches such as (Coibion et al., 2020) and (Baker et al., 2020) find either minimal or no effect of direct stimulus payment on durable spending. Workers with higher levels of education are much more likely to work from home in 2020; this group of workers is also more likely to overlap with the high-income group. Even though they might not be qualified for the direct stimulus payment, they can still benefit from the overall economic stimulus. They are the main driving force of aggregate durable spending. Households qualified for the direct stimulus payment are more likely to be type 2 agents in our model. Therefore, they may spend less on durables than before the pandemic, as shown in 3.3.

The COVID-19 pandemic could have forever changed our way of life and work. For example, many workers now have the option of working from home. Many companies have decided that their employees will continue to work from home until 2022. Snapchat announced that it would keep work from home forever. Some companies proposed a hybrid working schedule that employees can work from home for three or four days a week, and they only need to come to their office once or twice a week. Those changes are unlikely to be reversed soon. Hence, household capital will be more critical than ever before, the complementarity between household capital and market capital will become stronger.

References

Agarwal, S., Liu, C., and Souleles, N. S. (2007). The reaction of consumer spending and debt to tax rebates - evidence from consumer credit data. *Journal of Political Economy*, 115(6):986–1019.

Baker, S. R., Farrokhnia, R., Meyer, S., Pagel, M., and Yannelis, C. (2020). Income, Liquidity, and the Consumption Response to the 2020 Economic Stimulus Payments. *SSRN Electronic Journal*.

Batty, M. M., Deeken, E., Volz, A. H., et al. (2021). Wealth inequality and covid-19: Evidence from the distributional financial accounts. Technical report, Board of Governors of the Federal Reserve System (US).

Becker, G. S. (1965). A theory of the allocation of time. *The economic journal*, 75(299):493–517.

Benhabib, J. and Rogerson, R. (1991). Homework in Macroeconomics : Household Production and Aggregate Fluctuations Author (s): Jess Benhabib , Richard Rogerson and Randall Wright Source : Journal of Political Economy , Dec ., 1991 , Vol . 99 , No . 6 (Dec ., 1991), pp . 1166- Published by. 99(6):1166–1187.

Berger, D. and Vavra, J. (2015). Consumption Dynamics During Recessions. *Econometrica*, 83(1):101–154.

Boerma, J. and Karabarbounis, L. (2021). Inferring Inequality With Home Production. *National Bureau of Economic Research*.

Chang, Y. (2000). Comovement, excess volatility, and home production. *Journal of Monetary Economics*, 46(2):385–396.

Coibion, O., Gorodnichenko, Y., and Weber, M. (2020). How Did U.S. Consumers Use Their Stimulus Payments? *Ssrn*.

Díaz, A. and Franjo, L. (2016). Capital goods, measured tfp and growth: The case of spain. *European Economic Review*, 83:19–39.

Erceg, C. and Levin, A. (2006). Optimal monetary policy with durable consumption goods. *Journal of Monetary Economics*, 53(7):1341–1359.

Fang, L. and Zhu, G. (2017). Time allocation and home production technology. *Journal of Economic Dynamics and Control*, 78:88–101.

Fisher, J. D. (2007). Why does household investment lead business investment over the business cycle? *Journal of political Economy*, 115(1):141–168.

Gomme, P., Kydland, F. E., and Rupert, P. (2001). Home production meets time to build. *Journal of Political Economy*, 109(5):1115–1131.

Graziani, G., van der Klaauw, W., and Zafar, B. (2016). Workers Spending Response to the 2011 Payroll Tax Cuts. *American Economic Journal: Economic Policy*, 8(4):124–59.

Greenwood, J. (1991). The Allocation of Capital and Time over the Business Cycle Author (s): Jeremy Greenwood and Zvi Hercowitz Source : Journal of Political Economy , Dec ., 1991 , Vol . 99 , No . 6 (Dec ., 1991), pp . 1188- Published by : The University of Chicago Press . 99(6):1188–1214.

Heckman, J. (1974). Shadow prices, market wages, and labor supply. *Econometrica: journal of the econometric society*, pages 679–694.

Johnson, D. S., Parker, J. A., and Souleles, N. S. (2006). Household Expenditure and the Income Tax Rebates of 2001. *American Economic Review*, 96(5):1589–1610.

Kanishka Misra, B., Surico, P., Anderson, E., Besley, T., Fernández-Villaverde, J., Kaplan, G., Koenker, R., Krueger, D., Parker, J., Rey, H., and Sargent, T. (2014). Consumption, Income Changes, and Heterogeneity: Evidence from Two Fiscal Stimulus Programs. *American Economic Journal: Macroeconomics*, 6(4):84–106.

Kaplan, G. and Violante, G. L. (2014). A Model of the Consumption Response to Fiscal Stimulus Payments. *Econometrica*, 82(4):1199–1239.

Kueng, L. (2018). Excess Sensitivity of High-Income Consumers. *The Quarterly Journal of Economics*, 133(4):1693–1751.

McGrattan, E. R., Rogerson, R., and Wright, R. (1997). An equilibrium model of the business cycle with household production and fiscal policy. *International Economic Review*, pages 267–290.

Parker, J. A., Souleles, N. S., Johnson, D. S., and McClelland, R. (2013). Consumer Spending and the Economic Stimulus Payments of 2008. *American Economic Review*, 103(6):2530–53.

Shapiro, M. D. and Slemrod, J. (2003). Consumer response to tax rebates. *American Economic Review*, 93(1):381–396.

Shapiro, M. D. and Slemrod, J. (2009). Did the 2008 tax rebates stimulate spending? *American Economic Review*, 99(2):374–79.

Tauber, K. N. and Van Zandweghe, W. (2021). Why Has Durable Goods Spending Been So Strong during the COVID-19 Pandemic? *Economic Commentary (Federal Reserve Bank of Cleveland)*, pages 1–6.

Appendix A. Optimal Conditions

$$
\begin{aligned}
&\mathbb{E}_t(C_t^{\frac{1-\gamma}{\epsilon_c}-1}\omega c_{m,t}^{\epsilon_c-1} - \lambda_t) = 0 \\
&\mathbb{E}_t(\lambda_t \left((k_{h,t}^{\alpha_l} h_{m_1,t}^{1-\alpha_l})^{\epsilon_l} + y h_{m_2,t}^{\epsilon_l}\right)^{\frac{1}{\epsilon_l}-1} (1-\alpha_l) k_{h,t}^{\alpha_l \epsilon_l} h_{m_1,t}^{(1-\alpha_l)\epsilon_l - 1} - H^\phi) = 0 \\
&\mathbb{E}_t(\lambda_t \left((k_{h,t}^{\alpha_l} h_{m_1,t}^{1-\alpha_l})^{\epsilon_l} + y h_{m_2,t}^{\epsilon_l}\right)^{\frac{1}{\epsilon_l}-1} y_{1,t} h_{m_2,t}^{\epsilon_l - 1} - H^\phi) = 0 \\
&\mathbb{E}_t(C_t^{\frac{1-\gamma}{\epsilon_c}-1}(1-\omega) c_{h,t}^{\epsilon_c-1} k_{h,t}^{\alpha_h} h_{h,t}^{-\alpha_h}(1-\alpha_h) - H^\phi) = 0 \\
&\mathbb{E}_t(\beta(1+r_{t+1})\lambda_{t+1} - \lambda_t) = 0 \\
&\mathbb{E}_t(-\lambda_t + \beta(1-\delta_h)\lambda_{t+1} = 0 \\
&+ \beta\lambda_{t+1} \left((k_{h,t+1}^{\alpha_l} h_{m_1,t+1}^{1-\alpha_l})^{\epsilon_l} + y h_{m_2,t+1}^{\epsilon_l}\right)^{\frac{1}{\epsilon_l}-1} \alpha_l k_{h,t+1}^{\alpha_l \epsilon_l - 1} h_{m1,t+1}^{(1-\alpha_l)\epsilon_l} \\
&+ \beta C_{t+1}^{\frac{1-\gamma}{\epsilon_c}-1}(1-\omega) c_{h,t+1}^{\epsilon_c-1} \alpha_h k_{h,t+1}^{\alpha_h-1} h_{h,t+1}^{1-\alpha_h}) \\
r_t &= \alpha_m k_{m,t}^{\alpha_m-1} EL_t^{1-\alpha_m} - \delta_m \\
w_t &= (1-\alpha_m) k_{m,t}^{\alpha_m} EL_t^{-\alpha_m}
\end{aligned}
$$

Appendix B. Steady state

Here we show the table of steady state. All parameters are set as shown in Table1

Table 2: Steady state

Variables	Two type	Type 1 only	type 2 only
r	0.0204082	0.0204082	0.0204082
w	1.57225	1.57225	1.57225
k_h	7.48254	6.73176	3.16084
$k_{1,h}$	8.10128	6.73176	-
$k_{2,h}$	6.0388	-	5.23096
k_m	15.7332	17.5211	9.72745
$k_{1,m}$	13.1272	17.5211	-
$k_{2,m}$	21.8139	-	9.72745
EL	1.06025	1.18074	0.614391
EL_1	1.28171	-	-
EL_2	0.543498	-	-
h_{1,m_1}	0.451942	0.415266	-
h_{1,m_2}	0.282904	0.269256	-
$h_{1,h}$	0.260809	0.182819	-
$h_{2,m}$	0.543498	-	0.655529
$h_{2,h}$	0.344215	-	0.298168
$c_{1,h}$	0.436674	0.314006	-
$c_{2,h}$	0.812955	-	0.704202
$c_{1,m}$	2.13725	2.09281	-
$c_{2,m}$	1.191	-	1.13501
$i_{1,h}$	0.145823	0.121172	-
$i_{2,h}$	0.108698	-	0.0941573
i_h	0.134686	-	0.158042
$Output$	2.38139	2.65201	1.47236

Appendix C. Durable spendings

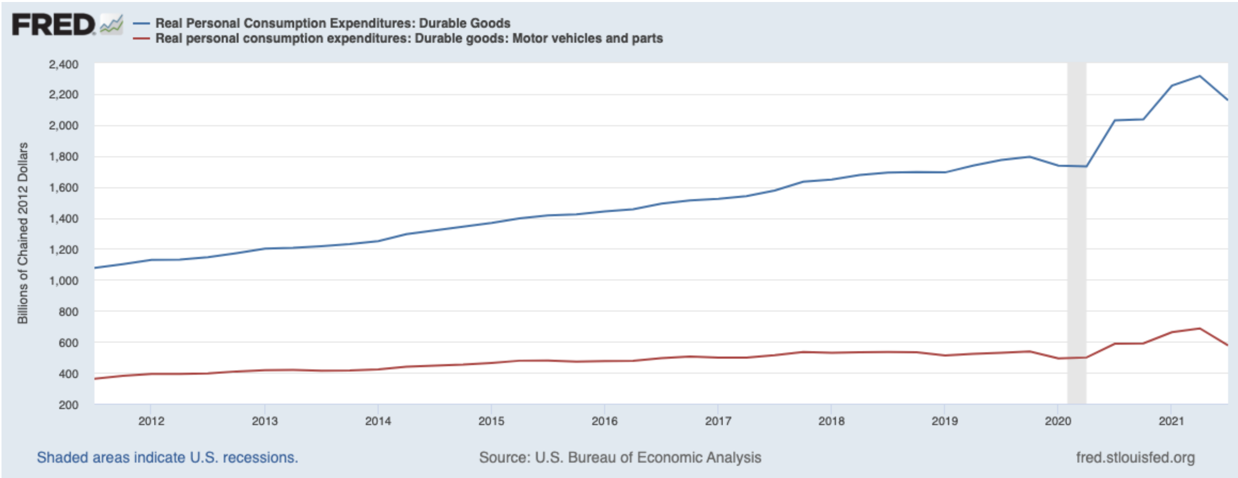


Figure 10: Quarterly Durable Goods Spending

Appendix D. IRFs

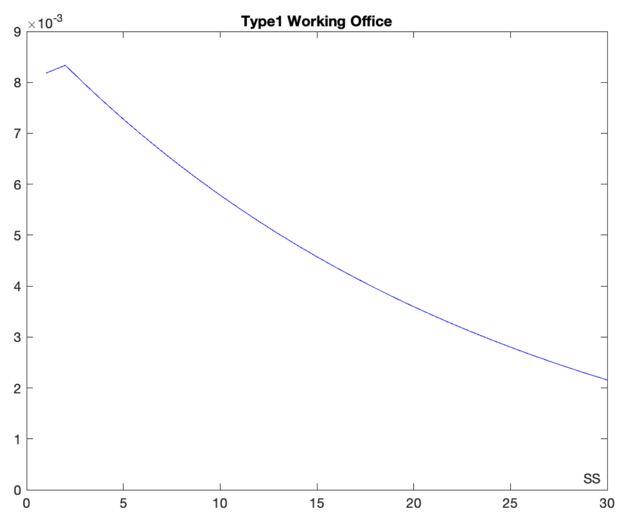


Figure 11

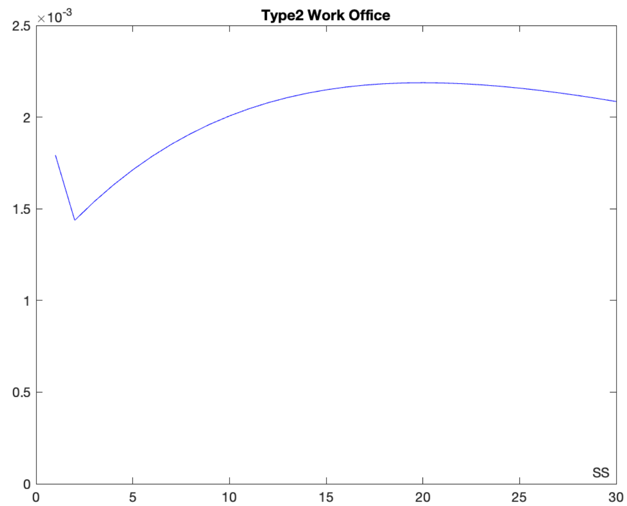


Figure 12

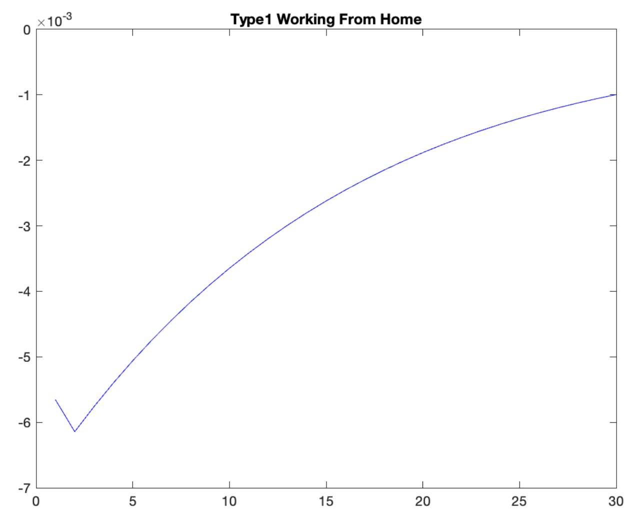


Figure 13

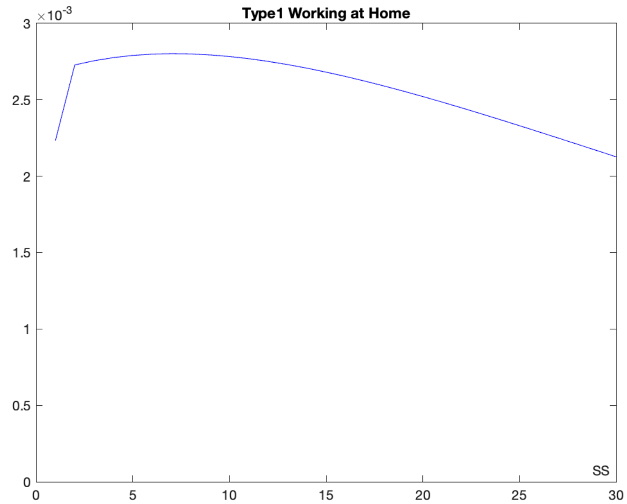


Figure 14

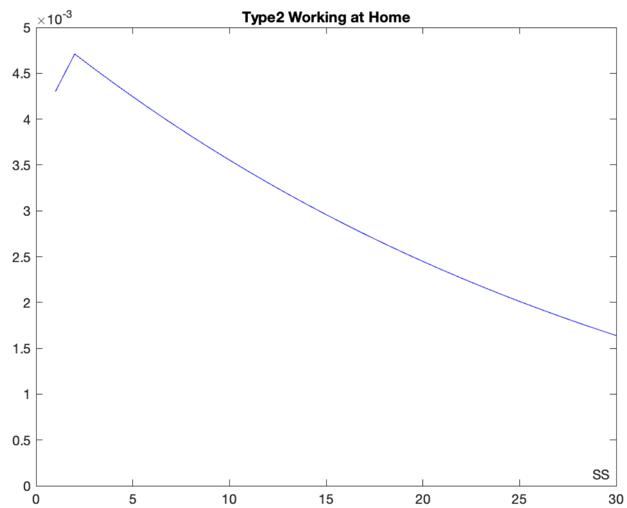


Figure 15

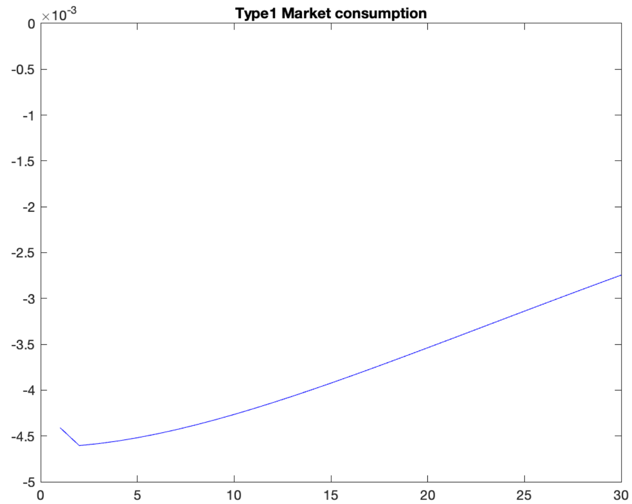


Figure 16

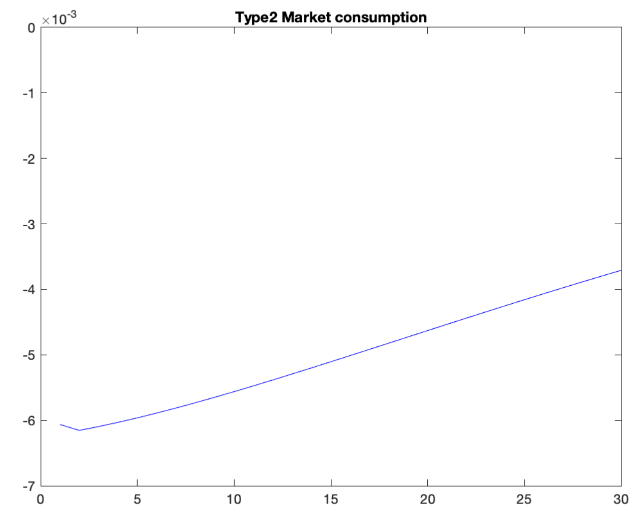


Figure 17

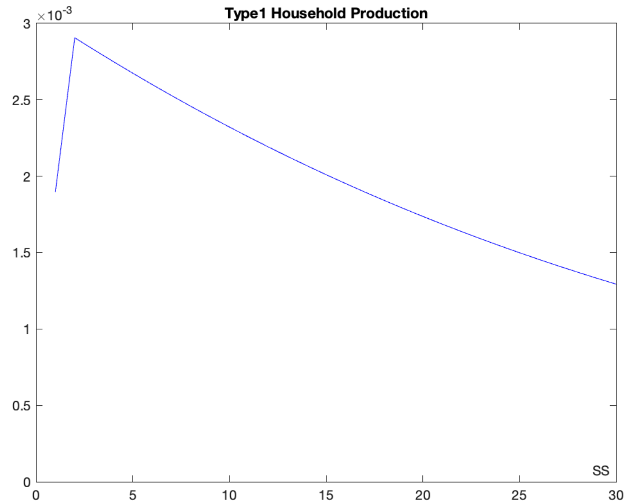


Figure 18

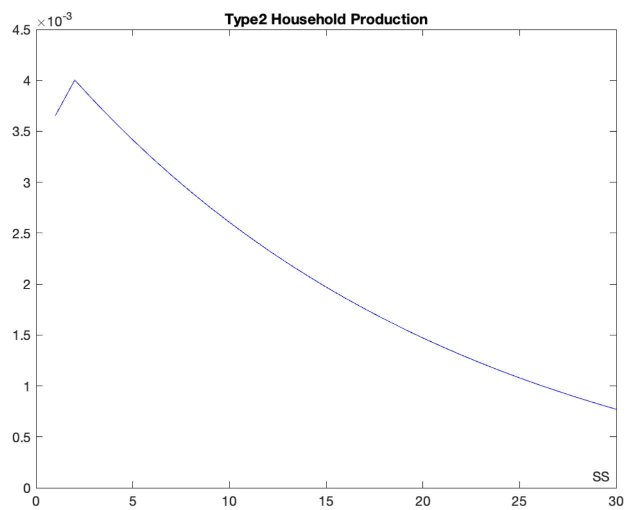


Figure 19

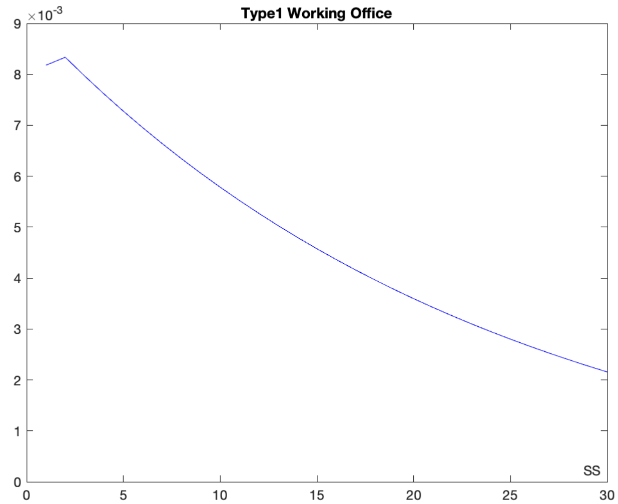


Figure 20