The Effects of Macroeconomic Shocks: Household Financial Distress Matters

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- We want to understand how the pass-through of macroeconomic shocks into consumption depends on the distribution of household-level balance sheet health, or *financial distress (FD)*.
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  - Prior FD is correlated with aggregate shock severity.
  - We’ll show today that models with FD have different implications for consumption pass-through compared to models without it.
Why FD: it is common and persistent

Note: Here FD is 120+ days delinquent on unsecured debt.
Why FD: higher FD in 2002 was associated with larger house-price declines during Great Recession

Sources: Zillow and Equifax/NY Fed CCP.
Why FD: higher FD in 2018 was associated with larger earnings losses early in the pandemic

In part, reflects positive relationship between FD and higher pre-pandemic employment shares in leisure & hospitality.
What we do

Build a life cycle model of consumption/savings with housing and FD.

• FD arises from ability to repudiate unsecured debt via delinquency (DQ).

Structurally estimate model to match incidence and persistence of FD.

• Parameter estimates imply a significant degree of ex-ante heterogeneity across individuals.

Hit model with aggregate shocks (house price or earnings) that are correlated with FD.

Quantitatively assess how (modeling, matching, or correlation) and by how much does FD shape the transmission of shocks into consumption.
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What we don’t do

• Allow for general equilibrium (GE) effects.
• Want to understand how unanticipated housing or earnings shocks transmit into consumption and how this transmission depends on debt market assumptions.
• Model disease transmission during CV-19 pandemic.
• Earnings shock experiments should be viewed more generically.
• Model fiscal or monetary policy.
• Not trying to account for observed change in consumption following these shocks. Rather, want to understand (via counterfactuals) how the response of consumption depends on FD.
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What we find

At the aggregate level, differences in FD across households amplify the response of consumption, regardless of the shock.

At the individual level, the importance of FD depends on the shock:

• When house prices fall, models with FD generate a decline in consumption inequality and poverty. Models without FD generate the opposite.

• When earnings fall, models with FD imply larger increases in consumption inequality and poverty compared to models with FD.

The correlation channel is unimportant for these results.
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Model description
The model: basic ingredients

- Life cycle model \((n = 1..., N)\) with idiosyncratic risk to income \(y\) and housing tenure choice.
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- Individuals can be of type \(j \in \{H, L\}\), which differ in their impatience \(\beta_j\) and taste for renting \(h^R_j\). Denote share of \(L\)-types as \(s_L\).
  - Differences in \(\beta_j\) help match persistence of FD and wealth distribution.
  - Differences in \(h^R_j\) help match homeownership by FD.
Owner-occupied houses come in discrete sizes $h \in \{h_1, h_2, \ldots, h_H\}$ and cost $p$ per unit of housing.
The model: homeownership

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- Allow for mortgage default:
  - Competitive risk-neutral lenders price mortgages as: $q_{j,n}^m(h', m', y, a')$. 
The model: asset markets and FD

- Asset markets are incomplete: individuals can save in financial assets \( a \) at risk-free rate \( r \) (partial equilibrium), or borrow.

Financial debt, \( a < 0 \), can be repudiated through delinquency (DQ) or bankruptcy (BK).

- DQ formalizes FD in the model. Today don’t pay \( a \), but tomorrow:
  - with prob. \( \eta \) debt gets fully discharged, so \( a' = 0 \),
  - with prob. \( 1 - \eta \) debt gets rolled over at a penalty rate \( \tilde{r} \), so \( a' = a(1 + \tilde{r}) \).

If agents choose BK, they pay a filing fee \( f \) and enter tomorrow with \( a' = 0 \).

Competitive risk-neutral lenders price unsecured debt as:

\[ q(a, \eta, \tilde{r}, h', m', y, a') \]
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The model: non-homeowner’s choices

\[ N, \text{non-homeowner} \quad \text{with} \quad (a, y) \]

\[ B, \text{buyer} \]

- \( R, \text{rent} \; h_R \)
  - \( R_P, \text{pay/save} \; a \)
  - \( R_{BK}, \text{default on} \; a \)
  - \( R_{DQ}, \text{become delinquent on} \; a \)

\[ \text{Choose} \; h' \; \text{and} \; m'; \; \text{pay/save} \; a \]
The model: homeowner’s choices

- **Homeowner (H)**
  - Pay/m
  - Sell/h
  - Rent/h

- **Non-homeowner (N)**
  - Buy
  - Rent

- **Buyer (B)**
  - Choose h0 and m0;
  - Pay/save a

- **Rent (R)**
  - Become delinquent on a

- **Default (D)**
  - Pay/save a
  - Pay/save a

- **Refinance (F)**
  - Pay/save a

- **Pay (P)**
  - Become delinquent on a
  - Default on a

- **Sell/h**
  - Pay/save a

- **Choose h' and m'; pay/save a**
Model estimation and aggregate shock calibration
Model parametrization/estimation

- Want to capture the wide dispersion of FD seen in the data.
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- Take zip codes in the U.S. and sort by FD to generate five groups/quintiles of equal population size:
  - Quintiles of zip codes are not geographically connected, but are similar in terms of FD.

- Estimate model for each quintile to replicate dispersion of FD across U.S.
- Estimate a few parameters ($s_L, h_R, \eta$) to match statistics on wealth, homeownership, and incidence and persistence of FD for each quintile.
- Set other parameters externally and equal across quintiles (e.g. $\beta_H = 1, \beta_L = 0.8$).

Key take-aways: model implies significant parameter differences across quintiles. Also generates reasonable MPCs out of earnings and house-price shocks.

Targets

Estimates

Model MPCs
Model parametrization/estimation

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Aggregate shock calibration

- For house prices, calculate average change between 2007-2008 by quintile using zip code level data from Zillow.
  - Feed into the model as an unanticipated permanent change in house prices.

- For earnings, calculate shares of individuals reporting 0, 25, 50+ percent loss in earnings relative to February 2020 by quintile using survey evidence from Bick and Blandin (2021).
  - Feed into the model as an unanticipated transitory change in earnings.

Key take-away: for both types of shocks we replicate that severity increases with FD.
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Main results
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With model and shocks in hand we ask two questions:

- Amplification role of FD: how much more/less does consumption change when allowing for FD versus not?
- Accounting for FD: what feature of the model with FD is crucial?

For all exercises we consider three measures of consumption responses:

- change in p90/p10 of consumption distribution
- change in consumption-based poverty (e.g. Cutler and Katz 1991, Meyer and Sullivan 2019)
- change in aggregate consumption
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Main results: amplification

- Compare responses of baseline model with a simplified heterogeneous agent life cycle model with housing, but no FD.
  - no borrowing \( (a' \geq 0) \), so no DQ or BK
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- Calibrate this model to match wealth and homeownership of Q3.
When house prices fall, poverty and inequality *fall* in the baseline model, but *not* in the simple model

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Notes: All values are percentage points of steady-state value. These are average changes over three periods following the housing shock.

- There is a tight relationship between FD and homeownership in the baseline model:
  - Low FD individuals own homes, lose home equity, so p90 falls.
  - High FD individuals don’t own homes, benefit from affordability, so p10 rises.
When house prices fall, aggregate consumption *contracts more* in the baseline model with FD

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- Conditional on owning a home, being in FD makes it harder to insulate consumption from house-price declines.
When earnings decline, poverty and inequality increase *more* in the baseline model with FD

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Notes: All values are percentage points of steady-state value. The change is measured only in the period of the earnings shock and is calculated over the working-age population.

- Again reflects reduced capacity to smooth consumption when in FD compared to model w/o FD.
When earnings decline, the drop in aggregate consumption is also larger in the baseline model with FD

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Main results: accounting

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- In the baseline model, FD enters in three ways (which don’t exist in simplified model):
  - direct: allowing for FD requires modeling debt repudiation (DQ and BK).
  - indirect: matching FD requires some ex-ante heterogeneity across individuals.
  - correlation: aggregate shocks are correlated with prior FD.
Main results: accounting

Now want to disentangle which feature of the baseline model with FD accounts for the amplification relative to the simplified model.

In the baseline model, FD enters in three ways (which don’t exist in simplified model):

- **direct**: allowing for FD requires modeling debt repudiation (DQ and BK).

- **indirect**: matching FD requires some ex-ante heterogeneity across individuals.

- **correlation**: aggregate shocks are correlated with prior FD.

To account for these three channels, we consider three alternative models:

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The *direct channel* of FD accounts for most of the amplification of house-price shocks...

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in consumption p90/p10 ratio</td>
<td>108.83</td>
<td>-7.55</td>
<td>-1.28</td>
</tr>
<tr>
<td>Change in consumption-based poverty</td>
<td>83.21</td>
<td>18.33</td>
<td>-1.54</td>
</tr>
<tr>
<td>Change in aggregate consumption</td>
<td>88.91</td>
<td>19.57</td>
<td>-8.47</td>
</tr>
</tbody>
</table>

Notes: Each number is a ratio relative to the total amplification of the full model.
...this can be seen by comparing the responses of the baseline and no-borrow models to house price declines.
The indirect channel of FD accounts for most of the amplification of earnings shocks...

<table>
<thead>
<tr>
<th>Change in metric</th>
<th>Direct</th>
<th>Indirect</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in consumption p90/p10 ratio</td>
<td>-24.55</td>
<td>112.05</td>
<td>12.50</td>
</tr>
<tr>
<td>Change in consumption-based poverty</td>
<td>0.01</td>
<td>91.96</td>
<td>8.04</td>
</tr>
<tr>
<td>Change in aggregate consumption</td>
<td>14.17</td>
<td>81.13</td>
<td>4.70</td>
</tr>
</tbody>
</table>

Notes: Each number is a ratio relative to the total amplification of the full model.
...this can be seen by comparing the responses of the no-borrow and simple models to earnings declines.
Conclusions

We want to understand how the transmission of aggregate shocks into consumption depends on the distribution of FD.
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- With FD consumption inequality and poverty *fall* when house prices decline. Without FD they *rise*.

- With FD consumption responds *more* when earnings decline compared to model w/o FD.

- *Modeling and matching* FD drives these results. The *correlation* of FD with aggregate shocks matters less.
Thanks!
Why FD: higher FD is associated with larger MPCs out of house price shocks

Note: The horizontal line is the estimate at the zip code level by Mian, Rao, and Sufi (2013).
...this was likely related to higher employment shares in Leisure & hospitality.

Sources: Census LODES and Equifax/NY Fed CCP.
## Model fit by FD quintile

<table>
<thead>
<tr>
<th></th>
<th>Q1 (lowest FD)</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5 (highest FD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data</td>
<td>Model</td>
<td>Data</td>
<td>Model</td>
<td>Data</td>
</tr>
<tr>
<td>Savings/Inc</td>
<td>2.44</td>
<td>1.71</td>
<td>1.96</td>
<td>1.50</td>
<td>1.78</td>
</tr>
<tr>
<td>Homeownership*</td>
<td>76.3</td>
<td>76.1</td>
<td>71.9</td>
<td>67.8</td>
<td>68.8</td>
</tr>
<tr>
<td>Housing debt&gt; 0*</td>
<td>FD</td>
<td>33.3</td>
<td>35.1</td>
<td>30.7</td>
<td>22.8</td>
</tr>
<tr>
<td>Mortg def rate*</td>
<td>1.52</td>
<td>1.41</td>
<td>1.81</td>
<td>1.63</td>
<td>2.24</td>
</tr>
<tr>
<td>DQ rate*</td>
<td>8.98</td>
<td>9.64</td>
<td>12.6</td>
<td>13.2</td>
<td>15.4</td>
</tr>
<tr>
<td>BK rate*</td>
<td>0.39</td>
<td>0.43</td>
<td>0.55</td>
<td>0.58</td>
<td>0.63</td>
</tr>
<tr>
<td>Persistence of FD:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 2 yrs</td>
<td>9.2</td>
<td>5.15</td>
<td>8.05</td>
<td>5.38</td>
<td>6.82</td>
</tr>
<tr>
<td>Over 4 yrs</td>
<td>6.15</td>
<td>4.34</td>
<td>5.36</td>
<td>4.16</td>
<td>4.57</td>
</tr>
<tr>
<td>Over 8 yrs</td>
<td>3.89</td>
<td>4.43</td>
<td>3.56</td>
<td>3.95</td>
<td>2.95</td>
</tr>
<tr>
<td>Over 10 yrs</td>
<td>3.4</td>
<td>3.83</td>
<td>3.00</td>
<td>3.69</td>
<td>2.66</td>
</tr>
<tr>
<td>SSE</td>
<td>0.90</td>
<td>0.71</td>
<td>0.57</td>
<td>0.38</td>
<td>0.35</td>
</tr>
</tbody>
</table>

Notes: * in percent. SSE is the sum of squared errors for each quintile. "Savings/Income" represents mean net financial wealth divided by mean income, and "With housing debt / In FD" is the percent of the population with housing debt, conditional on being in FD.
## Parameter estimates by quintile of FD

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Q1 (lowest FD)</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5 (highest FD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of $L$-types</td>
<td>0.297</td>
<td>0.385</td>
<td>0.442</td>
<td>0.497</td>
<td>0.575</td>
</tr>
<tr>
<td>$s_L$</td>
<td>(0.081)</td>
<td>(0.057)</td>
<td>(0.054)</td>
<td>(0.046)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Size of rental for $L$-types</td>
<td>4.500</td>
<td>4.362</td>
<td>3.943</td>
<td>2.988</td>
<td>2.985</td>
</tr>
<tr>
<td>$h^R_L$</td>
<td>(0.016)</td>
<td>(0.036)</td>
<td>(0.028)</td>
<td>(0.035)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Discharge rate of DQ debt</td>
<td>0.449</td>
<td>0.294</td>
<td>0.277</td>
<td>0.244</td>
<td>0.244</td>
</tr>
<tr>
<td>$\eta$</td>
<td>(0.009)</td>
<td>(0.004)</td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
</tbody>
</table>

Notes: Asymptotic standard errors appear in parentheses.
Model generates reasonable MPCs out of housing and income shocks

<table>
<thead>
<tr>
<th></th>
<th>Aggregate</th>
<th>Q1</th>
<th>Q5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of house-price shocks (homeowners only)</td>
<td>0.087</td>
<td>0.081</td>
<td>0.095</td>
</tr>
<tr>
<td>Out of income shocks</td>
<td>0.308</td>
<td>0.239</td>
<td>0.385</td>
</tr>
</tbody>
</table>

- Model-implied MPC out of house-price shocks is in range of Mian, Rao, and Sufi (2013) and Aladangady (2017).

- Model-implied MPC out of transitory earnings shocks is similar to Sahm, Shapiro, and Slemrod (2010), Coronado, Lupton, and Sheiner (2005) and Jappelli and Pistaferri (2006).

- MPCs out of earnings shocks rising with FD is related to Parker (2017): “the majority of lack of consumption smoothing is predicted by a simple measure that can be interpreted as impatience.”
Calibration of house-price and earnings shocks

<table>
<thead>
<tr>
<th>FD Quintile</th>
<th>Average decline in house prices</th>
<th>Percent of population with earnings loss of:</th>
<th>Average earnings loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.0</td>
<td>80.3 5.3 14.4</td>
<td>8.5</td>
</tr>
<tr>
<td>2</td>
<td>8.6</td>
<td>79.3 5.6 15.1</td>
<td>9.0</td>
</tr>
<tr>
<td>3</td>
<td>10.0</td>
<td>78.2 5.1 16.7</td>
<td>9.6</td>
</tr>
<tr>
<td>4</td>
<td>10.9</td>
<td>76.5 5.9 17.6</td>
<td>10.3</td>
</tr>
<tr>
<td>5</td>
<td>11.5</td>
<td>72.4 5.9 21.7</td>
<td>12.3</td>
</tr>
</tbody>
</table>

Sources: Zillow, Bick and Blandin (2021), and authors’ calculations.