

Retail Financial Innovation and Stock Market Dynamics: The Case of Target Date Funds

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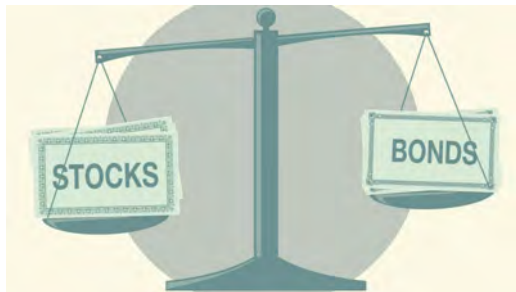
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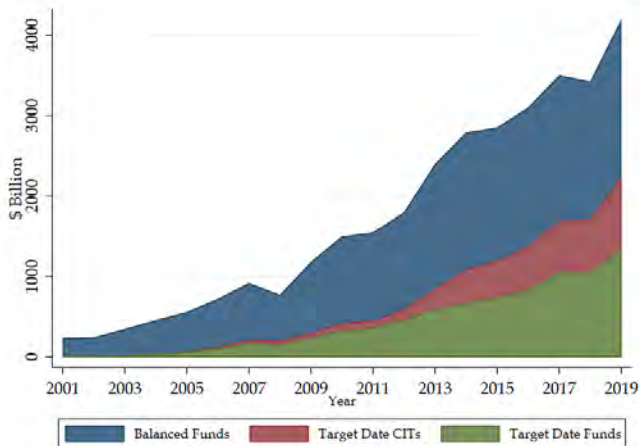
Q Group
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Fixed Share and Balanced Funds

- Invest in stocks and bonds with pre-determined asset allocations
- Large heterogeneity across providers
 - FoFs that invest in underlying mutual funds or “direct” (in securities)
 - Precise targets (e.g., 60/40) or ranges (e.g. 60% to 70% equity)
 - Target Date Funds (TDFs)

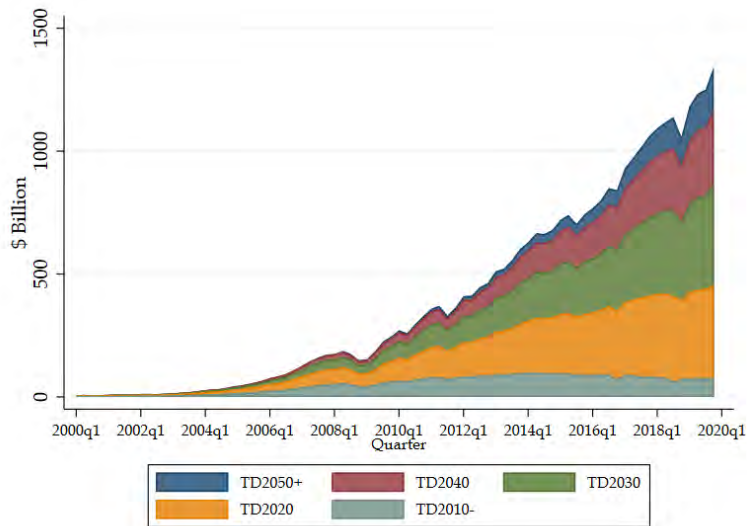


TDFs, Balanced Funds, and CITs



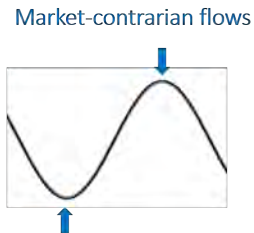
- We use “TDBFs” to refer to TDFs, balanced funds and CITs

Rise of Target Date Funds, Following PPA 2006



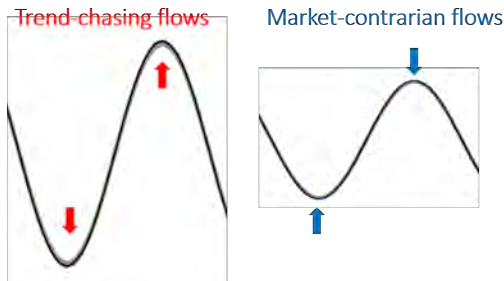
“Market Contrarian” Trading Strategies

- TDBFs sell equity after equity gains, buy after equity losses:



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- TDBFs sell equity after equity gains, buy after equity losses:



- Previously retirement investors were passive (Agnew, Balduzzi, Sunden 2003, Ameriks and Zeldes 2004, Brunnermeier and Nagel 2008, Sialm, Starks, and Zhang 2015)
- Or trend-chasing (Choi, Laibson, Madrian, Metrick 2009)
- Market contrarian trading should dampen asset-price fluctuations

What is the Impact of TDBFs on Stock Market Dynamics?

Main findings (currently focused on TDFs):

- ① TDFs actively rebalance out of asset classes after good returns, consistent with their mandate

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- ① TDFs actively rebalance out of asset classes after good returns, consistent with their mandate
- ② Typically, following good stock market returns, money flows into equity mutual funds. TDF rebalancing significantly reduces flows to equity funds following good stock market returns
- ③ Individual stocks held *more* by TDFs have *lower* returns after *high* stock market returns
 - The price effects are large. Why? 1) TDFs (indirectly) buy lots of similar/large stocks 2) TDFs trade in the same direction as arbitrageurs 3) Estimated elasticity is higher when BFs are included, but still missing other fixed-share strategies

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Implications:

- ④ We predict that continued rise of fixed-share strategies will help stabilize the stock market and increase correlation between stocks and bonds

Outline

- 1 Introduction
- 2 TDFs Rebalance out of Asset Classes with High Returns**
- 3 TDF Trading Causes Market-Contrarian Equity Fund Flows
- 4 Impact on Stock Return Dynamics
- 5 Conclusion

TDF Rebalancing Example

Initial TDF portfolio value = \$100

| | | Init. value | R | Value bef. trades | Desired value | Re-balancing trades |
|-------|--------|----------------|-----|----------------------|------------------|------------------------|
| TDF 1 | Equity | 80 | 20% | 96 | 92.8 | - 3.2 |
| | Bond | 20 | 0% | 20 | 23.2 | +3.2 |
| | Total | 100 | | 116 | 116.0 | 0 |
| TDF 2 | Equity | 50 | 20% | 60 | 55 | - 5 |
| | Bond | 50 | 0% | 50 | 55 | +5 |
| | Total | 100 | | 110 | 110 | 0 |

- Applies to balanced funds as well
- Rebalancing trades *quadratic* in desired equity share
- TDFd with equity share of 50%, most sensitive to asset class returns
- Can predict magnitudes of rebalancing trades based on formula

TDF Rebalancing with Investor Flows

Initial TDF portfolio value = \$100

| | Init. value | R | Value bef. trades | Flow | Desired value | Total trades | Flow trades | Rebal. trades |
|--------|-------------|-----|-------------------|------|---------------|--------------|-------------|---------------|
| TDF 1 | | | | | | | | |
| Equity | 80 | 20% | 96 | | 100.8 | 4.8 | 8 | -3.2 |
| Bond | 20 | 0% | 20 | | 25.2 | 5.2 | 2 | 3.2 |
| Total | 100 | | 116 | 10 | 126.0 | 10.0 | 10 | 0 |
| TDF 2 | | | | | | | | |
| Equity | 50 | 20% | 60 | | 60 | 0 | 5 | -5 |
| Bond | 50 | 0% | 50 | | 60 | 10 | 5 | 5 |
| Total | 100 | | 110 | 10 | 120 | 10 | 10 | 0 |

- Rebalancing trades are *the same* as previous slide
- Rebalancing trades still quadratic in desired equity share
- TDFs can rebalance through allocating investor flows
 - Reduced transaction costs and taxes, or faster rebalancing

Result 1: TDFs Rebalance Out of Equity If $R^E - R^B > 0$

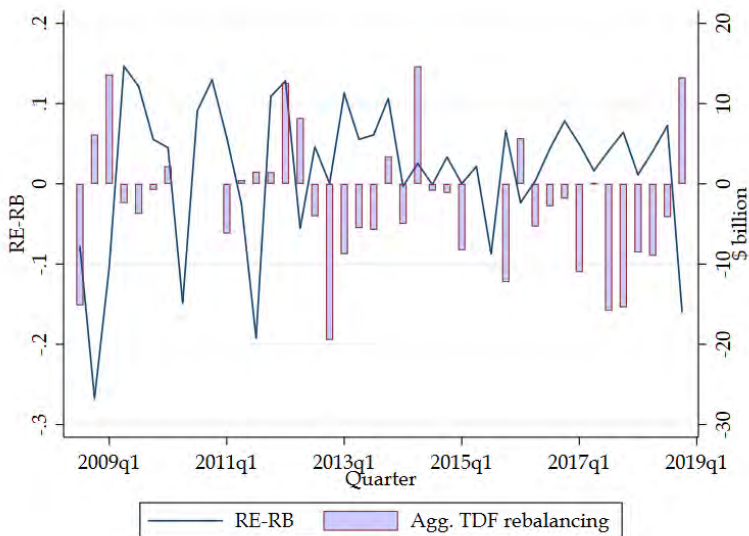
$$\text{Rebal.}_{kt}^E = \eta^E S_{kt-1} (1 - S_{kt-1}) (R^E - R^B)_t + \pi^E S_{kt-1} (1 - S_{kt-1}) (R^E - R^B)_{t-1} + \theta_k + X_{kt} + \epsilon_{kt}^E$$

| | (1) | (2) | (3) | (4) |
|-------------------------------------|-----------------------------------|----------------------|---------------------|----------------------|
| <i>A. Rebalancing out of equity</i> | | | | |
| | Rebal (E), t / Total holding, t-1 | | | |
| | All | Passive | Active | Aggregate |
| $S(1 - S)(R^E - R^B)_t$ | -0.485*** (0.134) | -0.616*** (0.139) | -0.394** (0.168) | -0.415*** (0.149) |
| $S(1 - S)(R^E - R^B)_{t-1}$ | 0.131 (0.149) | -0.035 (0.189) | 0.217 (0.164) | -0.065 (0.130) |
| TDF FE | yes | yes | yes | n.a. |
| Observations | 4,720 | 1,684 | 3,036 | 37 |
| R-squared | 0.171 | 0.175 | 0.180 | 0.260 |

TDFs Rebalance Into Bonds When $R^E - R^B > 0$

| | (1) | (2) | (3) | (4) |
|----------------------------------|------------------------------------|---------------------|--------------------|---------------------|
| <i>B. Rebalancing into bonds</i> | Rebal (FI), t / Total holding, t-1 | | | |
| | All | Passive | Active | Aggregate |
| $S(1 - S)(R^E - R^B)_t$ | 0.416*** (0.105) | 0.578*** (0.107) | 0.307** (0.135) | 0.408*** (0.127) |
| $S(1 - S)(R^E - R^B)_{t-1}$ | -0.001 (0.083) | 0.038 (0.177) | -0.010 (0.087) | 0.057 (0.156) |
| TDF FE | yes | yes | yes | n.a. |
| Observations | 4,720 | 1,684 | 3,036 | 37 |
| R-squared | 0.244 | 0.361 | 0.227 | 0.290 |

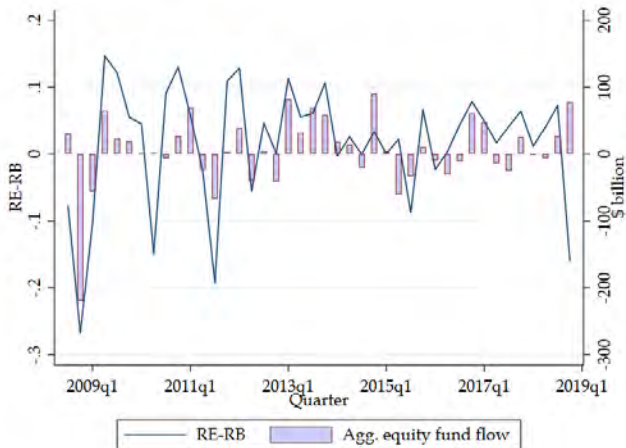
Aggregate TDF Rebalancing Trades of U.S. Equity Funds



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Aggregate Flows to U.S. Equity Funds Are Typically Trend-Chasing



- Includes retail and institutional share classes

TDF Investment Reduces Trend-Chasing Tendency in Equity Mutual Fund Flows

- Monthly data at the fund level for retail domestic equity funds from 2008 to 2018
- *FundFlow* = Net inflow as percent of lagged assets

$$FundFlow_{jt} = \beta_1(R^E - R^B)_t + \beta_2(R^E - R^B)_t \times Frac.TDF_{jt-1} + \beta_3(R^E - R^B)_{t-1} + \beta_4(R^E - R^B)_{t-1} \times Frac.TDF_{jt} + X_{jt} + \epsilon_{jt}$$

And

$$FundFlow_{jt} = \gamma_1(R^E - R^B)_t + \gamma_2|Rebal|_{j,t} + \gamma_3(R^E - R^B)_{t-1} + \gamma_4|Rebal|_{j,t-1} + X_{jt} + \epsilon_{jt}$$

Result 2: TDF Investment Reduces Trend-Chasing Tendency in Equity Mutual Fund Flows

| | (1) | (2) | (3) |
|---|----------------------|-----------------------|---------------------|
| | All | Fund flow, t Index | Active |
| $(R^E - R^B)_t \times \text{Frac. by TDFs, } q-1$ | -0.145*** (0.050) | -0.228*** (0.080) | -0.132** (0.052) |
| $(R^E - R^B)_{t-1} \times \text{Frac. by TDFs, } q-1$ | -0.088* (0.048) | -0.139 (0.095) | -0.081* (0.049) |
| $(R^E - R^B)_t$ | 0.067* (0.038) | 0.112*** (0.036) | 0.065* (0.038) |
| $(R^E - R^B)_{t-1}$ | 0.026 (0.023) | 0.071* (0.038) | 0.025 (0.023) |
| Fund FE | Y | Y | Y |
| Time FE | N | N | N |
| Observations | 22,822 | 4,443 | 18,379 |
| R-squared | 0.153 | 0.124 | 0.158 |

- 10% TDF ownership in mutual fund flattens trend-chasing relationship by 20%

TDF Rebalancing Shown in Mutual Fund Flows

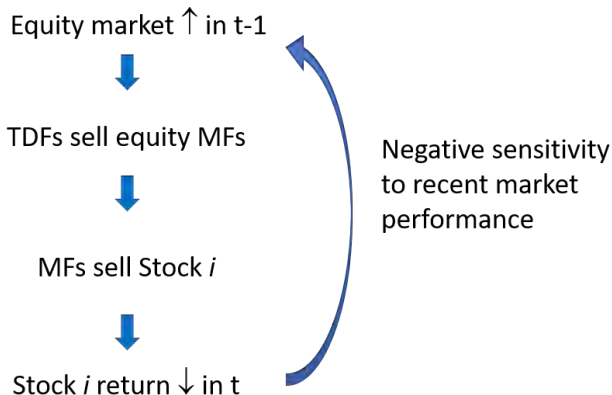
| | (1) | (2) | (3) |
|------------------------|----------------------|-----------------------|----------------------|
| | All | Fund flow, t Index | Active |
| Pred. rebalancing, t | -0.636*** (0.194) | -0.977*** (0.277) | -0.560*** (0.210) |
| Pred. rebalancing, t-1 | -0.416** (0.171) | -0.482 (0.312) | -0.401** (0.177) |
| $(R^E - R^B)_t$ | 0.070* (0.037) | 0.116*** (0.035) | 0.066* (0.038) |
| $(R^E - R^B)_{t-1}$ | 0.028 (0.022) | 0.068* (0.036) | 0.028 (0.022) |
| Fund FE | Y | Y | Y |
| Time FE | N | N | N |
| Observations | 22,822 | 4,443 | 18,379 |
| R-squared | 0.153 | 0.125 | 0.158 |

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Hypothesis on Stock Returns

If Stock i has high indirect TDF investment (through mutual funds)



Result 3: TDBF-Invested Stocks Have Lower Sensitivity to Lagged Market Performance

| | (1) | (2) | (3) | (4) |
|---------------------------------------|---------------------|----------------------------|---------------------|----------------------------|
| | | Raw return, t 2010-2018 | | Falsification 1986-2005 |
| Mkt, t-1 \times TDF (%), q-1 | -0.024** (0.010) | -0.020* (0.011) | | |
| Mkt, t-1 \times BFoF (%), q-1 | | -0.019 (0.022) | | |
| Mkt, t-1 \times BF direct (%), q-1 | | -0.002 (0.005) | | |
| Mkt, t-1 \times Total TDBF (%), q-1 | | | -0.009** (0.004) | -0.004 (0.010) |
| Time FE | Y | Y | Y | Y |
| Mkt, t-1 \times Size decile dummies | Y | Y | Y | Y |
| Controls | Y | Y | Y | Y |
| Observations | 400,805 | 400,805 | 400,805 | 448,026 |
| R-squared | 0.199 | 0.199 | 0.199 | 0.118 |

- We calculate a demand elasticity of -0.5, or a price multiplier of 2

Discussion on Magnitude of Price Impact

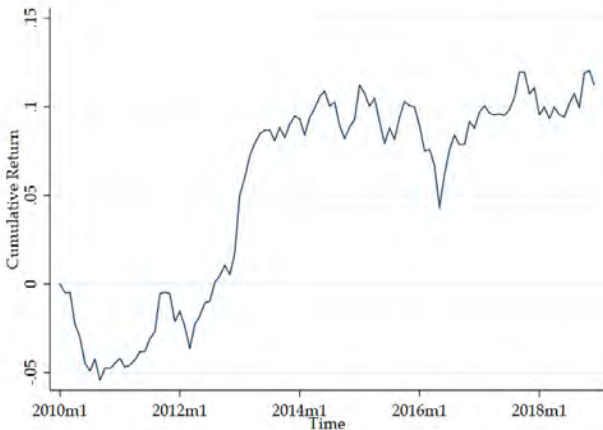
- Estimated elasticity lower (price impact higher) than previous literature
 - e.g., Index inclusion literature: Shleifer (1986) and Chang, Hong, and Liskovich (2015) report around -1 , see also Wurgler and Zhuravskaya (2002)
- Closer to asset-class level elasticity, but still big price movement
 - e.g., -0.45 in Da, Larrain, Sialm, and Tessada (2018), -0.2 in Gabaix and Koijen (2020)
- Possible interpretations
 - Systematic changes in demand for a similar set of stocks
 - Difficult for hedge funds to trade against contrarian strategies
 - Impact of other “rebalancing” strategies, e.g. pension funds, robo advisors
 - Other factors also correlate with TDBF ownership so that the price impact of TDBF trades is smaller than our estimate

Long-Short Strategy Based on “TDF Effect”

- In cross sections, sort stocks into quintiles according to (indirect) TDF ownership (Quintile 5 = Highest TDF; Quintile 1 = Lowest TDF)
- If $(R^E - R^B)_{t-1} > 0 \rightarrow$, long Quintile 1, short Quintile 5;
- If $(R^E - R^B)_{t-1} < 0 \rightarrow$, long Quintile 5, short Quintile 1

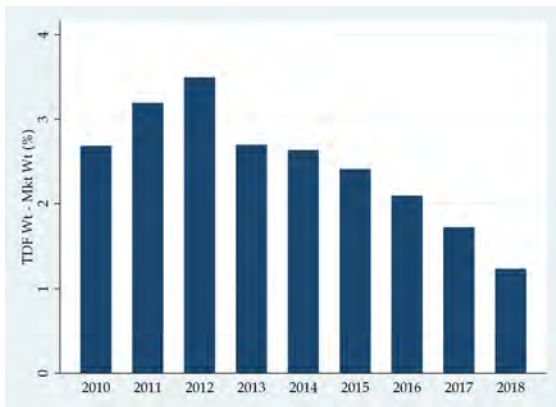
Cumulative Return of Long-Short Strategy

- Sorting based on overall TDF ownership at stock level
- Returns adjusted for market, SMB, HML, and momentum factor exposure



Motivation for Index Inclusion Study

- Relative overweighting of S&P 500 stocks in aggregate TDF portfolio vs. market portfolio



- Overweighting reduced from 3.5% in 2012 to 1.2% in 2018

Price Effect Driven by Passive TDBFs

| | (1) Raw return, t | (2) 3-Factor alpha, t | (3) 4-Factor alpha, t |
|------------------------------|----------------------|--------------------------|--------------------------|
| Mkt, t-1 × TDBF passive, q-1 | -0.200*** (0.046) | -0.099*** (0.028) | -0.098*** (0.029) |
| Mkt, t-1 × TDBF active, q-1 | 0.000 (0.006) | 0.002 (0.005) | 0.001 (0.005) |
| TDBF passive, q-1 | 0.005* (0.003) | 0.003 (0.002) | 0.002 (0.002) |
| TDBF active, q-1 | 0.000 (0.000) | -0.000 (0.000) | 0.000 (0.000) |
| ln (Market cap), t-1 | -0.003*** (0.000) | -0.002*** (0.000) | -0.003*** (0.000) |
| ln (Volume), t-1 | -0.001 (0.001) | -0.003*** (0.001) | -0.002** (0.001) |
| Raw return t-1 | -0.013 (0.008) | -0.009 (0.007) | -0.005 (0.007) |
| Size quintile FE × Mkt, t-1 | Y | Y | Y |
| Time FE | Y | Y | Y |
| Observations | 260,902 | 210,720 | 210,720 |
| R-squared | 0.187 | 0.004 | 0.004 |

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Conclusion and discussion

- TDBFs move passive or trend-chasing retail investor money into market contrarian strategies that affects fund flows (results 1 and 2)
- TDBF trading may be having some price impact, reducing returns of over-weighted stocks following good stock market returns and possibly contributing to increased reversal (result 3)
- TDBFs may eliminate some anomalies or reduce market volatility (d/P movements), but may create other anomalies (to keep d/P stable), since innovations to dividends increase the share of stocks in the market portfolio
- TDBFs propagate changes in interest rates (e.g. QE-type policies) into the stock market, and stock returns into bond markets