Market Turmoil and Destabilizing Speculation

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Supplementary Material

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1 Empirical Supplementary Appendix

This section investigates which types of funds are more likely to exploit increased uncertainty, with evidence in support of Hypotheses 2 and 3. The hypothesis suggested by the model is that the funds that are more prone to sell their holdings when uncertainty spikes are those most affected by short-term fluctuations. This suggests that the incentives to capture capital gains are greater if the fund’s portfolio has longer maturity, which will allow it to profit from price swings. The idea is: a fund that has 80% of its assets maturing within seven days has less incentive than one that has only 30% maturing. In fact, the latter is affected more severely by the negative shock and may opt to liquidate some of its holdings early in order to buy them back at a better price.

The foregoing suggests that the fraction of assets maturing within seven days might be a good proxy for the fund’s incentive to take advantage of market fluctuations. This is highlighted in Table 1, which shows the summary statistics for the main fund characteristics for short-maturity and longer-maturity funds. The latter are usually larger in terms of AUM and invest more in riskier asset classes, ABCP, bank obligations (both domestic and foreign banks) and significantly less in U.S. treasuries and repos. Moreover, funds with less liquid portfolios are more likely to be institutional than retail funds. This finding suggests that the funds with less liquid portfolios are more sophisticated than those with more liquid portfolios and so can play the role of speculators in this market.

Next, I divide MMFs into two groups according to portfolio liquidity. The primary measure of portfolio liquidity is the fraction of their portfolio maturing within seven days, which is the key measure adopted by the Dobb-Frank Act to regulate money market funds. High-liquidity funds are those above the median in this indicator, low-liquidity funds are those below the median. Figure 1 shows the kernel distribution of liquidity across funds as in August 2011. There is significant variation across funds, ranging from 10% to almost 90%. Figure 2 gives the time-series exposure of MMFs to the euro area, showing that after the October 2011 shock the less liquid funds do indeed liquidate more of their European assets and then reenter the market more aggressively after February 2012. This finding suggests that the liquidity of the funds’ portfolio does capture an important source of variation that might explain their trading behavior.

To exploit this cross-sectional variation across funds while controlling for other sources of unobserved heterogeneity, I estimate the following difference-in-difference regression model for differences between the post- and pre-period coefficients:

\[
\text{Euro Exposure}_{i,t} = \gamma_t + \eta_i + \beta_1 \text{Post}_{Oct 2011} \times \text{Liquidity}_{i,\text{Aug 2011}} + \delta \text{X}_{i,\text{Aug 2011}} + \varepsilon_{i,t}, \quad (1)
\]

where \( \text{Euro Exposure}_{i,t} \) is the main dependent variable and is defined as the fraction of assets invested in the euro area by fund \( i \) in month \( t \), \( \eta_i \) denotes fund-fixed effects, and \( \gamma_t \) denotes time-fixed effects. \( \text{Post}_{t} \) is an indicator variable equal to 1 after October 2011, which identifies the high-uncertainty period. \( \text{Liquidity}_{i,\text{Aug 2011}} \) is the fraction of assets maturing within seven days, as of August 2011. When I do not control for fund-fixed effects, I include \( \text{X}_{i,\text{Aug 2011}} \), a vector of
fund-specific controls that includes size, average annualized gross 7-day yield, and the fraction of assets invested in repos, U.S. Treasury securities and foreign bank securities. These variables control for the observed differences across funds, which might be correlated with their behavior in the post period. Both the liquidity variable and the other controls are measured as of August 2011, which mitigates any concern that investment choices are driven by changes in fund characteristics because of variations in uncertainty in the post-period. Since the exposure to the euro area is a fund-specific attribute, it is possible that it is serially correlated. To address this concern, I cluster standard errors at the fund level. The coefficient of interest is \( \beta_1 \), which measures the differential impact of uncertainty on the more liquid funds’ exposure to the euro area relative to that of the less liquid ones.

I begin with a nonparametric analysis of the observed effects. For each month between August 2011 and May 2012, I estimate the coefficient from the cross-sectional regression model (1) for Liquidity. Specifically, Figure 3 presents the coefficients \( \beta_\tau \) of the following regression model

\[
\text{Euro Exposure}_{i,t} = \sum_{\tau \neq t_0} \beta_\tau \text{Liquidity}_{i,\text{Aug 11}} 1_{(\tau = t)} + \gamma_t + \eta_i + \varepsilon_{i,t},
\]

where I have normalized the coefficient for October 2011 to zero. I find no visible differences in the impact of uncertainty prior to October 2011 on exposure to the euro area, but starting at that date there is a large positive effect of Liquidity. This finding validates my econometric approach by showing that the pre-trends between the treatment group (low-liquidity funds) and control group (high-liquidity funds) are indeed parallel. In other words, funds might have very different levels of exposure to the euro area, but their trends are not significantly different in the period preceding the spike in uncertainty. This parallels what happens in the model when \( \varepsilon = 0 \): the speculators behave exactly like the buy-and-hold investors.

Furthermore, Figure 3 also shows the dynamics of the effect: increasing right after the shock in October 2011 and then decreasing in the second quarter of 2012. Funds react to the new high-uncertainty environment for a fairly extended period of time, between three and four months. This could reflect the fact that while some assets can be readily liquidated, such as overnight repos, others such as commercial paper take longer.

Next, I present the results of the difference-in-difference regression corresponding to the non-parametric analysis. Column (1) of Table 1 confirms that in the post-period, funds decreased their exposure to the euro area significantly, by more than 4 percentage points, as is shown by the significance of the Post variable. Moreover, more liquid funds decrease their exposure less than the less liquid ones. The results might be driven by other shocks or news released after October 2011, and to address this question I include time-fixed effects in columns (2)-(6). The results might also be driven by unobserved time-invariant differences among funds that are correlated with liquidity. This issue is addressed by including fund-fixed effects in columns (3)-(6). In all of these specifications, no difference in the quality of the results emerges.

Column (3) of Table 1 shows the results for the baseline model. For the post-period, I find that
a one-standard-deviation increase in Liquidity increases Euro Exposure by 89 basis points. These results are statistically significant at the 1% level. They are also economically significant: a one-standard-deviation increase in Liquidity corresponds to a 10% increase in Euro Exposure relative to the cross-sectional standard deviation of fund’s Euro Exposure.

My effects might be driven not by differences in fund liquidity but by unobserved differences in investment styles, expertise or ability, which in turn might be correlated with liquidity. To the extent that the variation in style or risk aversion among funds is permanent, it would be accounted for by the difference-in-differences estimator. But the empirical approach taken here might fail if the variation affects risk-taking differentially in the pre and post periods. For example, funds may differ in their reactions to changes in uncertainty or in their propensity to take on risk when uncertainty arises.

My method of accounting for this possibility is twofold. First, I include a set of controls that might drive the results and capture (at least partially) heterogeneity across funds. These controls involve a set of fund and portfolio characteristics. The fund characteristics are yield, size, an indicator variable for institutional fund, weighted average portfolio maturity, pre-shock exposure to the euro area, and net asset flow. For instance, large funds are often thought to be more involved in active risk choices, while smaller funds are often considered simple, cash-parking vehicles with no active risk-management strategy. Or funds’ behavior might be driven, at least partially, by redemptions; to account for this possibility, I control for the fund’s net flow. Portfolio characteristics controlled for are the fractions of assets invested in foreign bank obligations, repos, ABCP and Treasuries. I include these time-varying characteristics, as measured in August 2011, in Column (2), and also in Columns (4)-(6). Second, in Column (6) I include fund-specific linear trends to check whether allowing for differential trends significantly changes the results in a meaningful way. It does not, further confirming the empirical strategy.

If uncertainty is the main driver of funds’ decisions to lend to financial institutions and corporations in the euro area over the short term, the opposite effect should be true when the uncertainty regarding the European debt crisis is attenuated and the funds regain confidence. Accordingly, I investigate whether money market funds resumed euro area asset purchases once uncertainty began to abate in February 2012 or whether they continued to invest exclusively in safe havens such as U.S. Treasury paper. Specifically, I estimate the following regression model, which is the counterpart to (1):

\[
\text{Euro Exposure}_{it} = \gamma_t + \eta_i + \beta_{PostFeb 2012} \times \text{Liquidity}_{i, Aug 2011} + \varepsilon_{i,t},
\]

where the dependent variable is also the fund’s exposure to the euro area and \(Post_{Low}^{feb} \) is a dummy variable equal to 1 after February 2012, when the VIX began to decline significantly, mainly because of the strong intervention by the European Central Bank. In fact, the ECB launched a new form of “emergency relief”, Longer Term Refinancing Operations (LTRO), which gave “breathing room” to banks struggling to find private sources of funding with a three-year lending facility, with a total of more than $1.3 trillion borrowed.
Table 2 shows that $\beta_1$ is indeed positive and significant, suggesting an increase of 1.4% in exposure to the euro area after February 2012, which confirms the perceived normalization of the European situation. Moreover, the coefficient of interest, $\beta_1$, is negative and significant. This finding suggests that low-liquidity funds increase their holdings in the euro area as uncertainty fades, corresponding to what happens after $T_p$ in the model.

These results confirm Hypothesis 2: speculators, when faced with a future market shock, first trade in the direction of the shock and then, when the uncertainty dissipates, buy the asset back.

1.1 Timing the Market

For additional confirmation of a strategic motive, I analyze how the funds changed their portfolios after the shock in October 2011. Specifically, if the funds temporarily reduced their exposure to the euro area and in particular to issuers with fewer funding relationships only temporarily, and then bought back at better terms, I should find that they had prepared by determining precisely the right moment to repurchase. In other words, the funds that want to maximize capital gains should become more liquid to be able to buy back as soon as the uncertainty is dissipated. Formally, I estimate the following regression

$$Liquidity_{i,t} = \gamma_t + \eta_i + \beta \text{PostOct 2011} \times Liquidity_{i,\text{Aug 2011}} + \varepsilon_{i,t}$$

where the dependent variable $Liquidity_{i,t}$ is the fraction of fund $i$’s asset maturing within seven days. I control for fund- and time-fixed effects and cluster the standard errors at fund level. Table 3 shows that the funds that were less liquid in the pre-period acted like the speculators of my model did in fact begin to increase the liquidity of their portfolio after the October 2011 shock. This confirms Hypothesis 3.
Figure 1: Kernel Distribution of MMMFs' Portfolio Liquidity

Notes: The panel above plots the kernel density of the fraction of assets maturing in the next seven days for all taxable funds in the period August 2011-May 2012.
Figure 2: MMMFs Exposure to the Eurozone

Notes: The panel above plots the MMFs exposure to the euro area measured as the fraction of assets under management for the period August 2011-May 2012 for funds with above (the red dashed line) and below (the blue connected line) average share of assets maturing in the next seven days.
Figure 3: Event Study: Uncertainty Shock and Exposure to Eurozone

Notes: The panel above plots the interaction coefficients from the OLS regression below. The dependent variable is the fund exposure to the euro area. The main independent variable is the interaction of the fund liquidity and monthly indicator variables. The vertical line identifies the post period after October 2011. We include time-fixed effects and fund-fixed effects.

\[ \text{Euro Exposure}_{i,t} = \sum_{\tau \neq t_0} \beta_{\tau} \text{Liquidity}_{i,\text{Aug} \ 11} 1_{(\tau=t)} + \gamma_t + \eta_i + \varepsilon_{i,t} \]
Table 1: Impact of Uncertainty on MMFs Exposure to Euro Area

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<th>(1)</th>
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<th>(4)</th>
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<td></td>
<td>(0.879)</td>
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<td>Portfolio Liquidity</td>
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<td>-0.0432*</td>
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<td></td>
<td>(0.0255)</td>
<td>(0.0248)</td>
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<td>Portfolio Liquidity×Post Indicator</td>
<td>0.0346**</td>
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<td>0.0492**</td>
<td>0.0612***</td>
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<td>(0.0162)</td>
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Controls

- Time fixed effects ✔ ✔ ✔ ✔ ✔ ✔
- Fund fixed effects ✔ ✔ ✔ ✔ ✔
- Fund characteristics ✔ ✔
- Portfolio characteristics ✔
- Fund linear trends ✔

Observations 2,321 2,321 2,321 2,083 2,083 2,321
R-squared 0.043 0.071 0.072 0.054 0.072 0.393
Number of funds 331 331 331 331 331 331

Notes: This table reports the estimated effect of uncertainty on money market mutual fund (MMMF) holdings. The dependent variable is the exposure to the euro area for a given MMMF. The sample is a panel of monthly observations for taxable money market mutual funds from August, 2011 to February, 2012. Post Indicator is a dummy variable that equals 1 after October, 2011, when the VIX index spiked due to the European debt crisis. Liquidity is the fraction of assets maturing in the next 7 days computed as of August 2011. Portfolio Liquidity×Post Indicator is the interaction between the dummy variable and the fund portfolio liquidity. Fund characteristics include the fund yield, the size, and indicator variable if it is an institutional fund, the weighted average maturity, the pre-shock exposure to the euro area, and the net flow of assets. Portfolio characteristics include the fraction of assets invested in foreign bank obligations, repos, ABCP and Treasuries. Controls include the fund characteristics as measured in August 2011. Data on MMMF portfolios and yields are from iMoneyNet. Robust standard errors clustered by fund are reported in parentheses.

*** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.
Table 2: Impact of Uncertainty on MMFs Exposure to Euro Area

<table>
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<tr>
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<td></td>
<td>(0.450)</td>
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<tr>
<td>Portfolio Liquidity</td>
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<td>-0.0349*</td>
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<tr>
<td></td>
<td>(0.0189)</td>
<td>(0.0189)</td>
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<td>Portfolio Liquidity× Post indicator</td>
<td>-0.0182*</td>
<td>-0.0183*</td>
<td>-0.0190*</td>
<td>-0.0196**</td>
<td>-0.0214**</td>
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<tr>
<td>Fund characteristics</td>
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<td>Portfolio characteristics</td>
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<td>Fund linear trends</td>
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<tr>
<td>Observations</td>
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<td>2,084</td>
<td>2,084</td>
<td>2,082</td>
<td>2,082</td>
<td>2,084</td>
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<tr>
<td>R-squared</td>
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<td>0.034</td>
<td>0.035</td>
<td>0.038</td>
<td>0.054</td>
<td>0.310</td>
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<td>Number of funds</td>
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<td>331</td>
<td>331</td>
<td>331</td>
<td>331</td>
<td>331</td>
</tr>
</tbody>
</table>

Notes: This table reports the estimated effect of uncertainty on money market mutual fund (MMMF) holdings. The dependent variable is the exposure to the euro area for a given MMMF. The sample is a panel of monthly observations for taxable money market mutual funds from October, 2011 to May, 2012. Post Indicator is a dummy variable that equals 1 after October, 2011, when the VIX index spiked due to the European debt crisis. Liquidity is the fraction of assets maturing in the next 7 days computed as of August 2011. Portfolio Liquidity × Post Indicator is the interaction between the dummy variable and the fund portfolio liquidity. Fund characteristics include the fund yield, the size, and indicator variable if it is an institutional fund, the weighted average maturity, the pre-shock exposure to the euro area, and the net flow of assets. Portfolio characteristics include the fraction of assets invested in foreign bank obligations, repos, ABCP and Treasuries. Controls include the fund characteristics as measured in August 2011. Data on MMMF portfolios and yields are from iMoneyNet. Robust standard errors clustered by fund are reported in parentheses. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.
Table 3: Changes in MMFs Portfolio Liquidity

<table>
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<th>(1) Short-Term Liquidity</th>
<th>(2) Short-Term Liquidity</th>
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<td>(1.107)</td>
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<td>Portfolio Liquidity</td>
<td>0.991***</td>
<td>0.991***</td>
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<td></td>
<td>(0.00924)</td>
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<tr>
<td>Portfolio Liquidity × Post indicator</td>
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<td>-0.110***</td>
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<tr>
<td></td>
<td>(0.0208)</td>
<td>(0.0208)</td>
<td>(0.0215)</td>
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Time fixed effects ✔ ✔ ✔

Fund fixed effects ✔

Observations 2,321 2,321 2,321

R-squared 0.023 0.035 0.035

Notes: The dependent variable is the fraction of assets maturing in the next seven days for a given MMMF. The sample is a panel of monthly observations for taxable money market mutual funds from August, 2011 to February, 2012. Post Indicator is a dummy variable that equals 1 after October, 2011, when the VIX index spiked due to the European debt crisis. Liquidity is the fraction of assets maturing in the next 7 days computed as of August 2011. Portfolio Liquidity × Post Indicator is the interaction between the dummy variable and the fund portfolio liquidity. Robust standard errors clustered by fund are reported in parentheses.

*** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.
Theoretical Supplementary Appendix – Tobin tax

The recent economic crisis has rekindled interest in James Tobin’s proposal to “throw some sand in the wheels” of speculators. Specifically, on December 3, 2009, the “Let Wall Street Pay for the Restoration of Main Street Bill” to impose a tax on US financial market securities transactions was presented in the House of Representatives. Similarly, in September 2011 the European Commission proposed instituting a financial transaction tax within the 27 EU member states by 2014. Such taxes would be akin to Pigovian taxes, obliging speculators to internalize the costs of the systemic risk they generate. The advocates of the transaction tax believe that it would calm the self-fulfilling financial turmoil we have experienced in recent years; however, many market practitioners have opposed it, maintaining that it would affect market liquidity adversely or cause financial transactions to shift into other jurisdictions.

To study how a transaction cost would affect speculators’ trading strategies and the asset price, I introduce a transaction cost $c > 0$ paid by speculators whenever they modify their portfolio holdings. That is, a speculator who buys the asset pays $p(t) + c$, one who sells receives only $p(t) - c$.

I can extend the analysis proposed in the previous section to analyze the conditions under which speculators decide to liquidate their positions when they are subject to a transaction tax. In the next proposition, I show that the introduction of a tax on financial transactions might reduce the fragility of the market: speculators need to expect a more severe negative shock (higher $\theta$) to induce a cashing-in equilibrium. However, according to Proposition 1 speculators might be induced to refrain from buying if the tax is sufficiently high.

**Proposition 1 (Tobin tax)** Suppose a speculator who has the opportunity to trade at time $t$ expects other speculators to sell the asset in the future. A more severe shock $\theta$ is needed to induce him to sell as well when $c > 0$. Moreover, there exists a threshold $c^*$ such that if $c > c^*$ the speculators refrain from trading at all.

**Proof.** Since the cost lowers the capital gain, it decreases the speculators’ incentive to profit from price swings. In other words, the threshold for the shock $\theta$ that makes the traders indifferent between holding the asset and profit from price swings need to increase. In fact, suppose a speculator meeting coming into contact with the market at time $t < T$, sells the asset if and only if the following condition holds

$$\frac{\delta}{r + \alpha + \rho} > \left( p(t) - c \right) - \bar{p}(\tau)$$

which is the same as in Lemma 2, except for the introduction of the transaction cost, which lowers the price gained by the speculator in the case in which he sells the asset. This means that a transaction cost reduces the speculators’ incentives to cash in on the crash.

To show that the introduction of a transaction cost reduces speculators’ incentive to profit from fluctuations, we can follow the same procedure as in Proposition 2, but including the tax $c$ in the capital gain $q(t)$. We can rewrite the problem of an investor who gains access to the market at time $t$ which has to pay a transaction cost $c$ as

$$\max_{a' \geq 0} \int_t^{T_\rho} e^{-r(s-t)} \delta a' ds - \left( p(t) + c \right) - \mathbb{E} \left[ e^{-r(T_\alpha-t)} \left\{ (\mathbb{I}_{(T_\alpha,T_\rho]} T_\alpha) p'(T_\alpha) + (\mathbb{I}_{(T_\alpha,T_\rho]} T_\rho) p'(T_\alpha|T_\rho) - c \right\} \right] a'$$

The only difference with Lemma 2 is that the investor who buys (sells) the asset will pay (receive) the price $p(t) + c$ ($p(t) - c$). As in Lemma 2 we can compute the expected utility flows that the
speculator obtains by holding portfolio $a$.

$$u^U(a) = \mathbb{E}\left[ \int_0^{T_{\alpha} - t} e^{-r_s \delta} d\alpha \right] = \mathbb{E}\left[ \int_0^{T_{\alpha} - t} e^{-r_s \delta} d\alpha \right] (\alpha + \rho) e^{-(\alpha + \rho)T_{\alpha}} d\tau_{\alpha}$$

$$= a^U\left( \frac{\delta}{r + \alpha + \rho} \right)$$

To derive the expected value of the price, we use the fact that $T_{\alpha} - t$ and $T_{\rho} - t$ are two independent exponentially distributed random variables:

$$\mathbb{E}\left[ e^{-r(T_{\alpha} - t)} \left\{ \mathbb{I}_{\{T_{\alpha} < T_{\rho}\}} \left( p^U(T_{\alpha}) - c \right) + \mathbb{I}_{\{T_{\alpha} > T_{\rho}\}} \left( p^U(T_{\alpha} | T_{\rho}) - c \right) \right\} \right]$$

$$= \int_t^{\infty} e^{-r(\tau_{\alpha} - t)} \left[ e^{-\rho(\tau_{\alpha} - t)} (p^U(\tau_{\alpha}) - c) + \int_{\tau_{\alpha}}^{r_{\alpha}} \rho e^{-\rho(\tau_{\rho} - t)} (p^U(\tau_{\alpha} | \tau_{\rho}) - c) \right] \alpha e^{-(\alpha + t)} d\tau_{\rho} d\tau_{\alpha}$$

$$= \int_t^{\infty} e^{-r(\tau_{\alpha} - t)} \left[ e^{-\rho(\tau_{\alpha} - t)} p^U(\tau_{\alpha}) + \int_{\tau_{\alpha}}^{r_{\alpha}} \rho e^{-\rho(\tau_{\rho} - t)} p^U(\tau_{\alpha} | \tau_{\rho}) \right] \alpha e^{-(\alpha + t)} d\tau_{\rho} d\tau_{\alpha} - \frac{\alpha c}{r + \alpha}$$

where the second equality follows from Lemma 2.

The speculators who now need to pay the Tobin tax $c$ and do not own the asset will buy it if and only if:

$$\frac{\delta}{r + \alpha + \rho} - \frac{rc}{\alpha + \rho} > p(t) - \tilde{p}(\tau_{\alpha}).$$

Hence, the speculators have less incentives to buy the asset. This shows that there exists a high enough transaction cost $\bar{c}$, above which the speculators finds it optimal to abstain from trading outright. ■

Proposition 1 shows that the effect of the tax on financial transactions on speculators’ trading strategies is twofold. On the one hand, it can reduce the gain from selling in response to an increase in uncertainty. In fact, by reducing the capital gains speculators expect to realize from selling and then buying back after the shock, it reduces price volatility. On the other hand, a transaction cost above the threshold $c^*$ induces speculators to refrain from trading until uncertainty is realized, hoping to buy the asset at a lower price in the event of a shock.

A different argument, based on the trade-off between congestion and liquidity, which sets out the rationale for policies to avoid extreme price movements, has been proposed by Afonso (2011). Specifically, she argues in favor of trading halts and circuit breakers that interrupt trading when there is a significant imbalance between buy and sell orders or when asset prices decline beyond trigger levels. These instruments, by increasing search frictions during downswings, reduce the effect of congestion, resulting in a lower price discount and in a more liquid market. My result does not depend on negative externalities between speculators – the congestion effect –but follows from the impact of the transaction cost on capital gains: it is more costly for the speculators to exploit temporary price fluctuations. Moreover, Proposition 1 shows that the reduction in fragility might be achieved at the cost of diminishing participation of speculators. This means that even if in equilibrium speculators would have purchased the asset from $t = 0$ onwards, if the tax is excessive they might not.

 propositions: $1$

Up to now I have assumed that only the speculators are affected by the introduction of the Tobin tax. Actually, though, it would affect all market participants and might discourage potential liquidity providers. The model can be extended to accommodate this possibility by assuming that long-term

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1For instance, circuit breakers were adopted by the New York Stock Exchange following the 1987 stock market crash to reduce volatility and promote investor confidence.
investors’ demand function becomes steeper as the transaction cost increases, that is, $\lambda'(c) > 0$. In other words, the transaction cost leads some fraction of long-term investors to leave the market. The next proposition shows that, in this case, the Tobin tax might have a destabilizing effect on financial markets.

**Proposition 2 (Tobin tax and liquidity)** There exists a $\lambda$ such that if the introduction of a transaction cost $c$ increases $\lambda$ above $\bar{\lambda}$, then a Tobin tax increases the speculators’ incentive to sell at $t < T_p$.

**Proof.** The result that the introduction of a Tobin tax might actually increase speculators’ incentives to sell the asset at time $t < T_p$, follows from Proposition 5 and the assumption that the liquidity provided by long-term investors, $\lambda(c)$, is an increasing function of the transaction cost. In fact, Proposition 5 shows that speculators have higher incentives to sell their holdings in less-liquid markets, namely when $\lambda$ is high. Suppose now that for a given $\lambda$, the condition identified in Lemma 2 would predict them to purchase the asset. Consider now the introduction of the tax, which increases $\lambda$ to $\lambda' > \lambda$; if the market depth function $\lambda(\cdot)$ is sufficiently sensitive to $c$, such increase might increase the potential capital gains so much that now it is optimal for the speculators to actually sell the asset. Hence, it follows the statement of the proposition that when the introduction of transaction costs reduce the liquidity of the market, this might have destabilizing effects. ■

Proposition 2 follows from the comparative statics results in Proposition 5: since speculators have a greater incentive to amplify market shocks in less liquid markets, if the tax on financial transactions reduces participation by long-term investors, speculators expect to make more capital gains by selling in response to the uncertainty shock. Hence, the previous proposition highlights an important factor to weigh in seeking to understand the effectiveness of a Tobin tax: how to target such a measure to speculators and not to potential liquidity providers.

**References**