Appendix to Effects of Unconventional Monetary Policy on Financial Institutions[1]

A. Pension fund data description

The Department of Labor collects the form 5500 series annual filings by private pension plans and provides them in machine readable format.[2] The main form reports the filing date and the plan filing id. The filing id allows within year linking of schedule H (financial information), schedule B (actuarial information, pre-2008) and schedule SB (actuarial information, single employer plans post-2008). Schedule SB is not provided for 2008.

The sample in the paper starts from the universe of all observations for defined benefit plans with a plan year between 2004 and 2012, and with a non-missing filing id. I drop observations where:

- the reported total asset value differs by more than 1% from the sum of individual asset categories,
- reported total income is not the sum of income categories,
- reported total assets at the end of the filling period differ by more than 1% from the sum of reported total assets at the beginning of the period plus total flows,
- the reporting period covers fewer than 300 days or more than 400 days and doesn't start January 1st,
- plan year expenses or income exceed one third of initial assets.

In general, the filing id also longitudinally matches plans across years. Plans that change filing id report their previous filing id. A complication emerges when multiple plans consolidate into one. In that event, I drop observations where total assets at the beginning of the year differ by more than 5% or $1000 from the sum of end of year assets across filings in the previous year.

Finally, before 2009 the raw data may contain multiple submissions (amended or restated filings) by the same plan. To remove duplicates, I sequentially

- drop duplicate filing id-year observations with a filing date before the most recent filing,
- drop duplicates with incorrect signature or filing status,
- drop duplicates reported as non amended filings,

[1] http://www.brookings.edu/~/media/projects/bpea/spring%202014/2014a_chodorowreich.pdf.
[2] http://www.dol.gov/ebsa/foia/foia-5500.html.

- keep the filing id-year with beginning of year assets closest to the end of year assets in the previous year,
- drop duplicates with missing funding measures,
- drop duplicates with missing signature or entity code.

If duplicate filing id-years remain I randomly select one for inclusion.

B. Derivations for the model in section 2.1

I make parametric assumptions that yield a closed-form solution to the consumer's problem. The return on a risky project with mean μ and variance σ^2, denoted $R(\mu, \sigma)$, is normally distributed and independent of the return on other projects. The space of possible projects has a maximum return μ_H. Utility takes the exponential (CARA) form, $u(C) = -\exp(-\gamma C)$, and I do not require $C > 0$. Finally, I assume initial real money balances Y_0 large enough that the household makes strictly positive riskless deposits, $A^f > 0$.

The portfolio of risky projects A^p satisfies

$$A^p = \int_{R^f}^{\mu_H} \int_0^{\infty} K(\mu, \sigma) A(\mu, \sigma) \, d\sigma d\mu. \tag{B.1}$$

With independent normally distributed returns, the risky portfolio return R^p has distribution $R^p \sim N(\mu^p, \sigma^p)$, where

$$\mu^p = \frac{1}{A^p} \int_{R^f}^{\mu_H} \int_0^{\infty} \mu K(\mu, \sigma) A(\mu, \sigma) \, d\sigma d\mu, \tag{B.2}$$

$$(\sigma^p)^2 = \frac{1}{(A^p)^2} \int_{R^f}^{\mu_H} \int_0^{\infty} \sigma^2 K(\mu, \sigma) A(\mu, \sigma) \, d\sigma d\mu. \tag{B.3}$$

The assumption $A^f > 0$ means that R^f prices the consumption Euler equation,

$$\gamma \exp(-\gamma C_0) = \beta R^f \gamma E_0 [\exp(-\gamma C_1)]. \tag{B.4}$$

Substituting into the Euler equation (B.4) using the budget constraints in equations (3) and (4), taking logs, and solving for A^f as a function of $A^p, \mu^p, (\sigma^p)^2$, and parameters, gives

$$A^f = \left[1 + R^f\right]^{-1} \left[\frac{1}{\gamma}\left(\ln \beta + \ln R^f\right) + Y_0 - A^p(1 + \mu^p) + \frac{\gamma}{2}(A^p \sigma^p)^2\right]. \tag{B.5}$$

Substituting equations (B.5), (3) and (4) into the maximization problem (2), making use of the parametric assumptions of exponential utility and normally-distributed returns, and ignoring constants, the problem becomes

$$\max\left\{\left(\mu^p - R^f\right)A^p - \frac{\gamma}{2}\left(A^p\sigma^p\right)^2\right\}. \tag{B.6}$$

Substituting equations (B.2) and (B.3) into the maximization (B.6) then gives

$$\max_{\{A(\mu,\sigma)\}}\left\{\int_{R^f}^{\mu_H}\int_0^{\infty}\left[\left(\mu - R^f - \frac{\gamma}{2}\sigma^2\right)K\left(\mu,\sigma\right)A\left(\mu,\sigma\right)\right]d\sigma d\mu\right\}. \tag{B.7}$$

Projects receive funding if their expected excess return $\mu - R^f$ exceeds a multiple $\gamma/2$ of their variance.

C. Appendix figures

Figure C.1: Five year note yield to maturity, percent

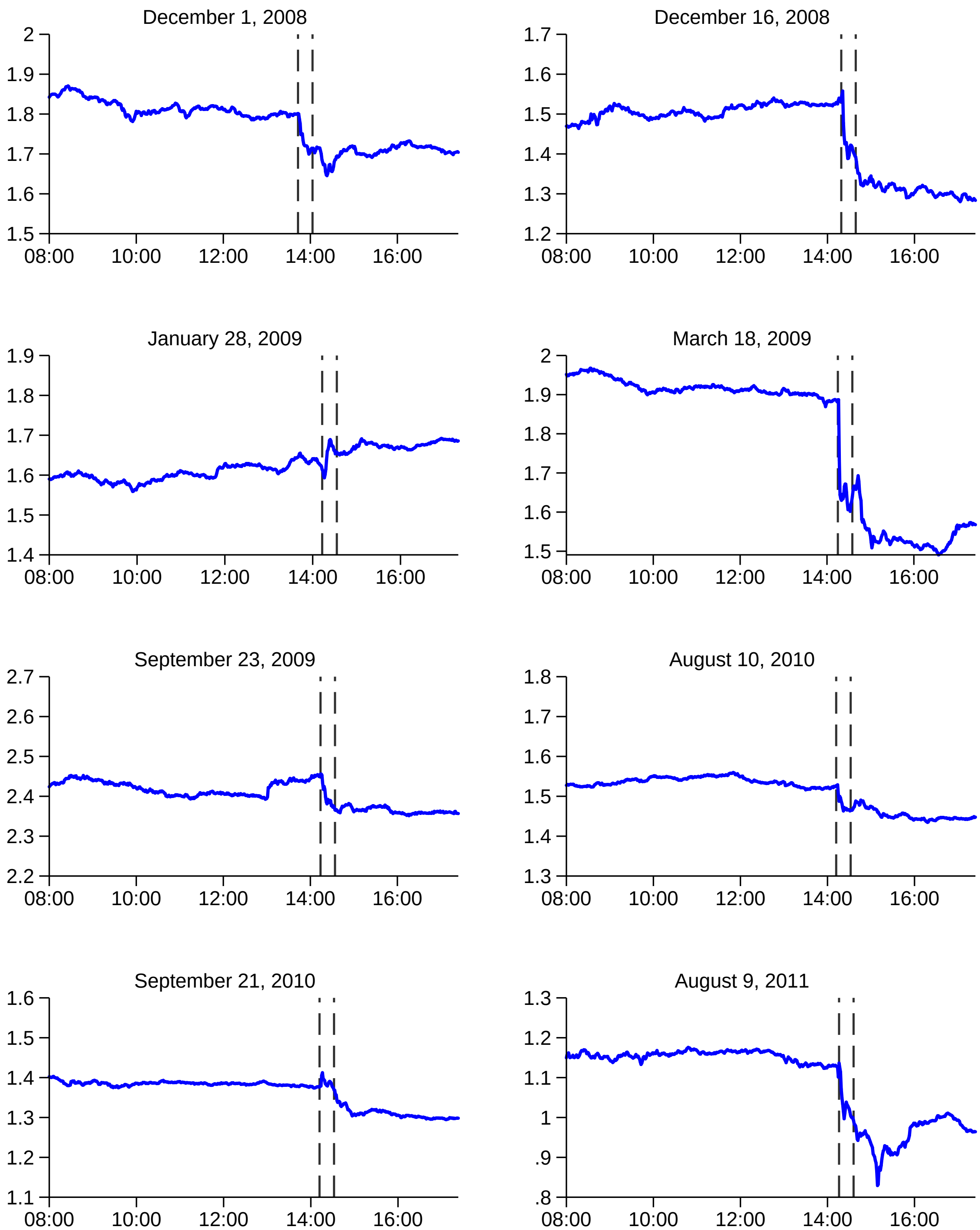

Figure C.1: Five year note yield to maturity, percent (continued)

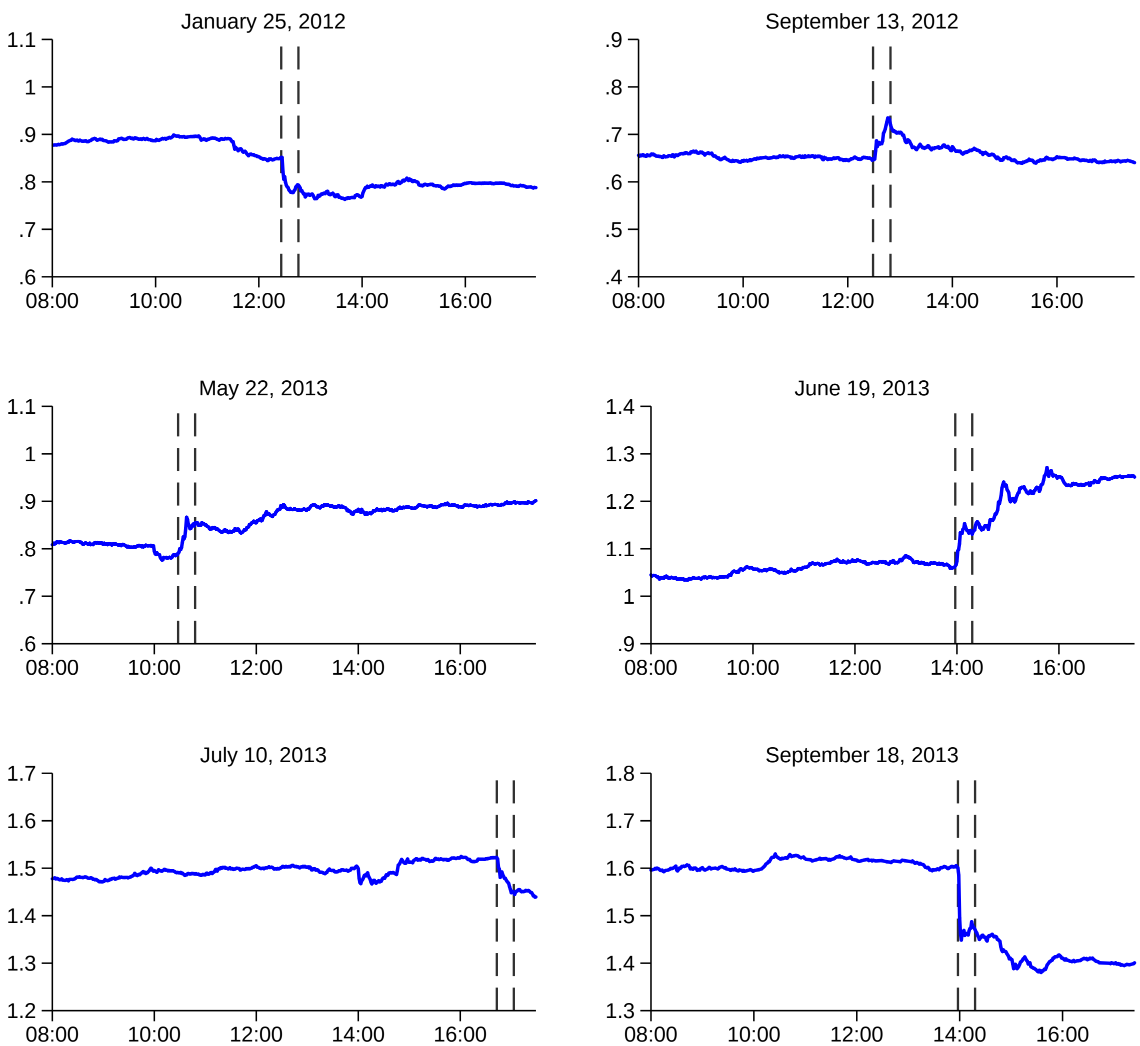

Figure C.2: Money market fund total financial assets