Loss Aversion and Monetary Policy Transmission Mechanism

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AEA meetings, Atlanta

January 2009

Motivation

- Substantial evidence of asymmetries in the macroeconomic data and of the impact of monetary policy shocks
  - e.g. varying slopes of expansion and contraction phases that induce time variations from the mean to the trough or peak of cycles is an old stylized fact (Mitchell (1927)).
- So far most of the literature has focused on asymmetric/regime switching Taylor rules (especially in the context of the Great Moderation).
- However the asymmetries can arise also due to other reasons: The literature has proposed a number of "regime-shift variables" acting both from the supply and the demand side of the economy.
  - Credit channel of the monetary transmission mechanism might be important, as commercial banks can act as to amplify or attenuate monetary shocks across different phases of the cycle (Galbraith (1996))
  - Also nominal rigidities in the labour and goods market and the credibility of the monetary authority

This Paper

- The focus of this project is on the demand side, and especially on how the dynamics of households' consumption profile can determine asymmetric effects of the monetary policy on economic activity.
- Built a DSGE model that will explain the asymmetries in the data.
- We construct a structural model that allows for endogenous switching across different regimes whenever consumption is (or is expected to be) below or above consumers' reference level (or stock of habits).
- We propose a novel approach, which consists of extending an otherwise standard DSGE framework by modeling households' preferences on consumption growth through a prospect utility function á la Kahneman and Tversky (1979).

Loss aversion

- This theory builds on the assumption that economic agents value their prospects relative to a reference point and that losses loom larger than gains.
- Experimental evidence on agents' aversion to loss is widespread (e.g. Thaler et. al, 1997).
- However, no attempt has been made to incorporate this feature into dynamic models used for policy analysis.
- We assume that consumers' current utility depends on current consumption relative to lagged average consumption, i.e. the habit reference level below which switching to a different consumption plan takes place.
- This framework should allow us to reproduce characteristic asymmetries both in the business cycle and the transmission of the monetary policy
- Optimal monetary policy?

Outline

1. Empirical evidence on the asymmetries
2. DSGE model with Utility function that exhibits Loss Aversion
3. Estimation of the reduced form model
4. Conclusion

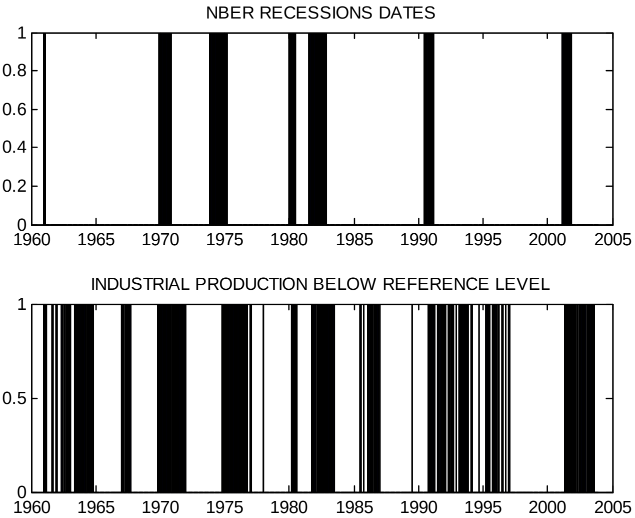
Empirical Evidence: multiple regime STAR models:

- money does affect output strongly when monetary policy is restrictive and raises inflation when it is expansive;
- the effects of money on output is greater during the contraction phases of business cycles and their impact on inflation are greater during expansion phases;
- if prices adjust slowly, then only negative shocks affect the output.
- Since such asymmetric effects in principle can have strong implications not only for the way we think about the macroeconomy, but also for the conduct of economic policy, it thus seems important to provide a framework capable to account for the rise of these asymmetries.
- A main argument advocated to motivate a non-linear structure is that output fluctuations are influenced by variables that distort the shape of the business cycle (see Dufrenot et al., 2003).

SVAR Evidence

- VAR with IPI, Commodity Inflation, CPI Inflation, Federal Funds rate
- Choleski decomposition, monthly data from 1960 onwards, 3 lags employed
- 2 regimes defined as: $y_t + 1 - \gamma \geq \gamma y_{t-1}$ with $\gamma = 0.7$.

SVAR Evidence



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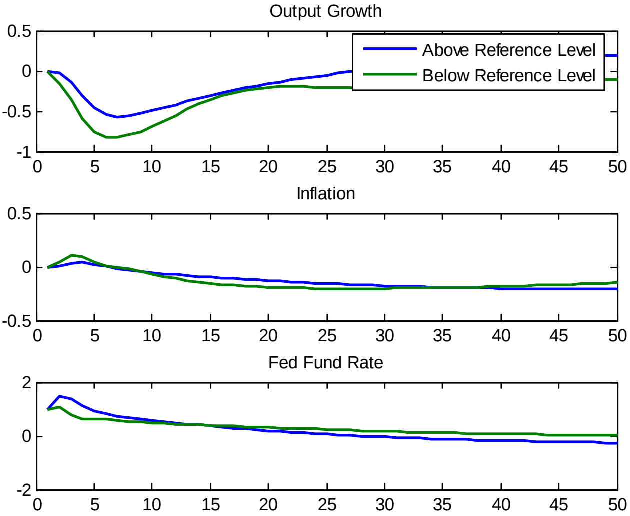

Demand side

- There is a continuum of consumers in the economy, indexed by $i \in [0, 1]$. The representative consumer has preferences defined over leisure, $1 - N_{it}$, and the deviation of her consumption level (C_{it}) from the stock of habits (H_{it}):

$$X_{it} = C_{it} - H_{it}.$$

  Specifically, consumers evaluate the distance between individual consumption and a fraction of the average consumption in the previous period, thus $H_{it} = \gamma \overline{C}_{t-1}$, where γ indexes the importance of external habit formation.

- Two main features characterize households' utility from consumption: (i) reference dependent choices with respect to the stock of consumption habits and (ii) in every period t, households have imperfect observability of their consumption at relative to the reference level in the current and the next period.

Utility function

- As to (i), the utility function $U(\cdot)$ satisfies the properties specified in Kahneman and Tversky (1979), Bowman, Minehart, and Rabin (1999) and Kosgezi and Rabin (2006).
- We adopt the following formulation for $U(X_{it})$:

$$U(X_{it}) = \begin{cases} 1 - \exp(-\rho X_{it}) & \text{iff } X_{it} \geq 0 \\ -\lambda \left[1 - \exp\left(\frac{\rho}{\lambda} X_{it}\right)\right] & \text{otherwise} \end{cases} \quad (1)$$

where $\lambda (> 1)$ indexes the degree of loss aversion, ρ denotes the inverse of the intertemporal elasticity of substitution.

Utility function

- Households do not observe the state of the economy when maximizing their utility $\rightarrow$ their utility depends upon their beliefs on the distance between their consumption and the reference level at time t and $t+1$.
- Households' beliefs about their relative consumption evolve according to a MC process with a 4×4 transition matrix, Ξ:

$$\xi_{it+1} = \Xi \xi_{it}$$

- The associated transition matrix can be written as:

$\Xi =$

$t \backslash t+1$	$\{E_t X_{t+1} \geq 0\} \cap \{E_t X_{t+2} \geq 0\}$	$\{E_t X_{t+1} < 0\} \cap \{E_t X_{t+2} < 0\}$	$\{E_t X_{t+1} \geq 0\} \cap \{E_t X_{t+2} < 0\}$	$\{E_t X_{t+1} < 0\} \cap \{E_t X_{t+2} \geq 0\}$
$\{E_t X_t \geq 0\} \cap \{E_t X_{it+1} \geq 0\}$	p_{11}	p_{12}	p_{13}	p_{14}
$\{E_t X_t < 0\} \cap \{E_t X_{it+1} < 0\}$	p_{21}	p_{22}	p_{23}	p_{24}
$\{E_t X_t \geq 0\} \cap \{E_t X_{it+1} < 0\}$	p_{31}	p_{32}	p_{33}	p_{34}
$\{E_t X_t < 0\} \cap \{E_t X_{it+1} \geq 0\}$	p_{41}	p_{42}	p_{43}	p_{44}

- Where p_{ij} is the probability that in period $t+1$ the economy is in state j given that it is currently in state i. Therefore, $\sum_j p_{ij} = 1, \forall i$.

Utility function

- Households maximize the expected present discounted value of their utility:

$$\mathcal{W}_{t-j} = \sum_{s=0}^{\infty} E_{t+s-j}\beta^s \left[U\left(X_{it+s} \middle| \xi_{it+s-j} \right) - \frac{\chi N_{it+s}^{1+\eta}}{1+\eta} \right], \quad j = 0, 1, 2, 3, \ldots$$

  where β is the intertemporal discount factor and η is the inverse of the elasticity of substitution between work and leisure. At each point t households have a belief ξ_{it} about the sign of X_{it} and X_{it+1}.
- Moreover, notice that the timing of the belief upon which the (dis)utility deriving from X_{it+s} is conditioned agrees with the conditional expectation operator E_{t+s-j}.
- The intertemporal budget constraint can be specified as:

$$P_t C_{it} + B_{it} + M_{it+1} \leq M_{it} + R_{t-1} B_{it-1} + P_t W_t N_{it} + \int_0^1 \Pi_{ijt} d_j + T_{it}. \quad (2)$$

Utility function

- The usual optimization conditions deliver the following Euler equation:

$$E_{t+s-j}\left[\frac{U'\left(X_{it+s}\middle|\,\xi_{it+s-j}\right)}{U'\left(X_{it+s+1}\middle|\,\xi_{it+s-j}\right)}\right]=\beta E_{t+s-j}\left[\frac{R_{t+s}}{1+\pi_{t+s+1}}\right].$$

- Moreover, the marginal rate of substitution between X_{it} and N_{it} reads as:

$$E_{t+s-j}\left[\frac{\chi N_{it+s}^{\eta}}{W_{t+s}U'\left(X_{it+s}\middle|\,\xi_{it+s-j}\right)}\right]=1. \tag{3}$$

Supply side: Final good producers

- The aggregate non-durable good is produced by perfectly competitive firms and requires the assembly of a continuum of intermediate goods, indexed by $j \in [0,1]$, via the following technology: $Y_t = \left(\int_0^1 (Y_{jt})^{1-\frac{1}{\theta}} dj\right)^{\frac{\theta}{\theta-1}}$. Profit maximization leads to the typical demand function:

$$Y_{jt} = \left(\frac{P_{jt}}{P_t}\right)^{-\theta} Y_t \quad \forall j, \tag{4}$$

where $P_t = \left(\int_0^1 (P_{jt})^{1-\theta} dj\right)^{\frac{1}{1-\theta}}$ is the price index consistent with the final good producer earning null profits. Total production equals aggregate consumption.

Supply side: Intermediate producers

- constant-return-to scale production function:

$$Y_{jt} = Z_t N_{jt}, \tag{5}$$

  where Z_t is a TFP shifter, N_{jt} is the firm-specific demand for labor.
- Pricing: We adopt the Calvo (1983) specification for the price setting mechanism. Therefore, the average price index is:

$$P_t = \omega P_{t-1} + (1-\omega) P_t^*$$

  where P_t^* is an index of prices set in period t, based on the forward- and backward-looking price setters' behavior, such that:

$$P_t^* = \phi P_{t-1}^b + (1-\phi) P_t^f$$

  where P_{t-1}^b is the price set following a backward-looking rule of thumb, P_t^f is the price set by forward-looking firms, and ϕ is the degree of "backward-lookingness."

Supply side: Intermediate producers

- For the purpose of the hybrid Phillips curve specification, forward-looking firms behave exactly as in the basic Calvo framework described earlier. Consequently, their behavior can be expressed by:

$$P_t^f = (1 - \beta\omega) \sum_{i=0}^{\infty} (\beta\omega)^i E_t \Phi_{t+i}$$

where Φ_{t+i} is the real marginal cost at time t+i. For backward-looking firms, we adopt Galí and Gertler's assumptions and posit that these firms follow a rule of thumb based on recent aggregate pricing behavior, which can be stated as:

$$P_t^b = P_{t-1}^* + \pi_{t-1}$$

Monetary policy

- The nominal interbank interest rate is set according to a standard Taylor rule:

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{r_R} \left[\left(\frac{\Pi_t}{\Pi}\right)^{r_\Pi} \left(\frac{Y_t}{Y}\right)^{r_Y}\right]^{1-r_R} \varepsilon_t^R \tag{6}$$

where Π_t denotes the gross rate of inflation and ε_t^R is an $iid(0,1)$ innovation.

- We assume that the government adheres to this rule via open market operations, which are financed by means of money transfers to the households, such that any deficits are equal to zero, i.e. $T_t = B_t - R_{t-1}B_{t-1}$.

Piecewise linearized model

$$
y_t = \begin{cases}
\frac{1}{1+\gamma} E_t y_{t+1} + \frac{\gamma}{1+\gamma} y_{t-1} - \frac{1-\gamma}{\sigma(1+\gamma)} \left(i_t - E_t \pi_{t+1}\right) & \textbf{iff} \quad \left\{E_t y_t + 1 - \gamma \geq \gamma y_{t-1}\right\} \cap \left\{E_t y_{t+1} + 1 - \gamma \geq \gamma E_t y_t\right\} \\
\frac{1}{1+\gamma} E_t y_{t+1} + \frac{\gamma}{1+\gamma} y_{t-1} - \frac{\lambda(1-\gamma)}{\sigma(1+\gamma)} \left(i_t - E_t \pi_{t+1}\right) & \textbf{iff} \quad \left\{E_t y_t + 1 - \gamma < \gamma y_{t-1}\right\} \cap \left\{E_t y_{t+1} + 1 - \gamma < \gamma E_t y_t\right\} \\
-\frac{1}{\lambda+\gamma} E_t y_{t+1} + \frac{\lambda\gamma}{\lambda+\gamma} y_{t-1} - \frac{\lambda(1-\gamma)}{\sigma(\lambda+\gamma)} \left(i_t - E_t \pi_{t+1}\right) & \textbf{iff} \quad \left\{E_t y_t + 1 - \gamma \geq \gamma y_{t-1}\right\} \cap \left\{E_t y_{t+1} + 1 - \gamma < \gamma E_t y_t\right\} \\
-\frac{1}{1+\lambda\gamma} E_t y_{t+1} + \frac{\gamma}{1+\lambda\gamma} y_{t-1} - \frac{\lambda(1-\gamma)}{\sigma(1+\lambda\gamma)} \left(i_t - E_t \pi_{t+1}\right) & \textbf{iff} \quad \left\{E_t y_t + 1 - \gamma < \gamma y_{t-1}\right\} \cap \left\{E_t y_{t+1} + 1 - \gamma \geq \gamma E_t y_t\right\}
\end{cases}
$$

Piecewise linearized model

$$\pi_t = \varphi^f E_t \pi_{t+1} + \varphi^b \pi_{t-1} +$$

$$\kappa \begin{cases} \left(\eta + \frac{\sigma}{1-\gamma}\right) y_t - \frac{\sigma\gamma}{1-\gamma} y_{t-1} - (1+\eta) z_t & \textbf{iff} \quad E_t y_t + 1 - \gamma < \gamma y_{t-1} \\ \left(\eta - \frac{\sigma}{(1-\gamma)\lambda}\right) y_t + \frac{\sigma\gamma}{(1-\gamma)\lambda} y_{t-1} - (1+\eta) z_t & \textbf{otherwise} \end{cases}$$

- Taylor rule:

$$i_t = r_R i_{t-1} + r_\pi \pi_t + r_y y_t$$

GMM Estimation

We estimate the above system á la Clarida and Gali (1999) with GMM.

parameter	Coeff.	Std. Err	t-stat	p-val
p_1	0.42794	0.01337	32.01	0.0000
p_2	0.58186	0.00949	61.31	0.0000
p_3	0.03398	0.00686	4.96	0.0000
p_4	-0.1714	0.01869	-9.17	0.0000
p_5	0.50139	0.0189	26.52	0.0000
p_6	0.50049	0.01767	28.33	0.0000
p_7	0.01665	0.02469	0.67	0.5002
p_8	-0.0237	0.01718	-1.38	0.168
p_9	-0.0269	0.03308	-0.81	0.4162
p_{10}	0.10846	0.02326	4.66	0.0000
p_{11}	0.91352	0.00976	93.64	0.0000
p_{12}	0.09627	0.01255	7.67	0.0000
p_{13}	0.19546	0.00775	25.21	0.0000

Main Results and Conclusions

- We provide a model that could potentially explain some of the asymmetries found in the macroeconomic data
- We indeed found some preliminary support for our idea
- Optimal monetary policy in this framework?
- Simulating the model to see if it can match distributional asymmetries in the data.