Glossary of Mathematical Symbols in Order of Appearance

Chapter 1
\( y \) exponential average
\( x \) rate of change (in nominal spending) or rate of inflation
or rate of return
\( k \) parameter setting the elasticity of an exponential average

Chapter 2
\( m_n \) money supply
\( p_n \) price level
\( p^e_n \) expected value of \( p_n \)
\( y_n \) volume of output
\( d_n \) excess demand/liquidity measured in terms of real
money balances
\( \mu \) demand for real money balances
\( \bar{y} \) volume of output when \( d_n = 0 \)

Chapter 3
\( \text{PUR}^j \) intermediate consumption of goods and services of busi-
ness \( j \)
\( I^j \) investment of business \( j \) (or of commercial bank \( k \))
\( W^j \) wages paid out by business \( j \) (or by commercial bank \( k \))
\( \text{DIV}_o^j \) dividends paid out by business \( j \) (or by commercial
bank \( k \))
\( \text{INT}_o^j \) interests paid out by business \( j \) (or by commercial bank \( k \))
\( A_o^j \) securities amortized (or redeemed) by business \( j \) (or by
commercial bank \( k \))
$SEC_j$  securities bought by business $j$ (or by commercial bank $k$)

$dM^j$  change in the money balance held by business $j$

$D^j$  total applications of funds of business $j$ (excluding $dM^j$)

$REV^j$  sales of goods and services of business $j$ (or of commercial bank $k$)

$DIV^j_i$  dividends received by business $j$ (or by commercial bank $k$)

$INT^j_i$  interests received by business $j$ (or by commercial bank $k$)

$A^j_i$  securities amortized (or redeemed) to business $j$ (or to commercial bank $k$)

$SEC_i^j$  securities sold or issued by business $j$ (or by commercial bank $k$)

$dL^j$  new bank loans raised by business $j$ from commercial banks

$dL^j$  new loans raised by business $j$ from the central banks

$R^j$  total sources of funds of business $j$ (excluding $dL^j$ and $dL^j$)

$M$  broad money supply

$M_M$  currency

$M_S$  deposits with commercial banks

$M_{bh}$  money balances held by households

$M_b$  money balances held by the business sector (including commercial banks)

$INC_{bh}$  aggregate income of households

$C_{bh}$  aggregate consumption of households

$SAV_{bh}$  aggregate savings of households

$CF_b$  retained operating earnings of the business sector

$D$  aggregate nominal spending (cash outlays) of all sectors

$RT$  aggregate cash receipts of all sectors

$M_T$  transaction balances

$M_p$  precautionary balances

$V$  transactions velocity of $M$

$t$  point on the physical (or calendar) time scale

$V_P$  transactions velocity of precautionary balances

$V_T$  transactions velocity of transaction balances

$f(x)$  demand for money function in Allais’s 1953 formulation
$g(x)$ supply of money function in Allais’s 1953 formulation
$M_D$ desired money balances
$T$ response period (elementary average planning period for all agents)
$f_m$ lower limit of the demand for money function
$f_M$ upper limit of the demand for money function
$g_m$ lower limit of the supply of money function
$g_M$ upper limit of the supply of money function
$D_e$ aggregate nominal spending in a stationary equilibrium

Chapter 4

$r$ continuous constant periodic rate of decay in an exponential average
$V_0$ transaction velocity of money in a stationary state
$\phi_t$ notional function used to introduce the relationship between the physical and the psychological time scale as well as the variability of the velocity of money and that of the rate of memory decay
$T_0$ response period in a stationary state
$t'$ a point on the psychological time scale
$\chi$ continuous rate of memory decay along the physical time scale
$\chi_0$ continuous rate of memory decay along the psychological time scale (or in a stationary state)
$Z$ coefficient of psychological expansion
$\phi_0$ scaling parameter (ratio of desired balances to nominal spending when $Z = 0$)
$\Psi(Z)$ relative desired balances, a logistic function of $Z$
$b$ parameter in the function $\Psi$, setting its maximum value $\phi_0(Z)$
$\alpha$ parameter in the function $\Psi$, setting the slope of $\phi_0(Z)$ the asymptotic limit of its elasticity with respect to $Z$
$z$ dynamic equilibrium rate (“perceived” rate of change)
$\bar{x}$ average rate of growth during a period $p$
$p$ time-scaling factor used to compute $Z$ in discrete time
$\Psi^*$ estimated value of $\Psi$
$\beta$ elasticity of expected inflation with respect to actual price changes in Cagan’s 1954 formulation
\[ E \] expected inflation in Cagan’s 1954 formulation
\[ C \] actual change in prices in Cagan’s 1954 formulation
\[ \alpha \] elasticity of the demand for real balances with respect to expected inflation in Cagan’s 1954 formulation
\[ \chi \] elasticity of memorized nominal growth with respect to actual changes in Allais’s 1954 formulation
\[ u \] memorized nominal growth in Allais’s 1954 formulation
\[ K \] elasticity of the demand for desired balances with respect to memorized nominal growth in Allais’s 1954 formulation
\[ Z_0 \] initialization parameter, value of \( Z \) for \( t = 0 \)
\[ P \] a price or a price index
\[ \xi_1 \] expectations of momentum traders in Smith’s formulation
\[ \dot{c}_1 \] elasticity of the expectations of momentum traders with respect to price changes in Smith’s formulation
\[ q_1 \] weight given to momentum traders in Smith’s formulation
\[ \xi_2 \] price deviation from fundamental value in Smith’s formulation
\[ q_2 \] weight given to fundamental investors in Smith’s formulation
\[ k(\xi) \] total investor sentiment function in Smith’s formulation
\[ \rho \] rate of growth in base money
\[ \gamma(Z) \] base-money multiplier, a logistic function of \( Z \)
\[ a' \] parameter in the function \( \gamma \), setting its minimum value \((1-a')\)
\[ b' \] parameter in the function \( \gamma \), setting its maximum value \((1+a'b')\)
\[ \alpha' \] parameter in the function \( \gamma \), setting the slope of the asymptotic limit of its elasticity with respect to \( Z \)
\[ B_0 \] value of base money for \( t = 0 \)
\[ q \] scaling parameter in the money supply function

Chapter 5
\[ Q \] volume of transactions
\[ E \] nonbank credit in Allais’s fundamental equation of monetary dynamics
\[ M_{De} \] demand for money in dynamic equilibrium
\[ M_c \] supply of money in dynamic equilibrium
\[ x_c \] rate of growth in nominal spending in dynamic equilibrium
\( z_e \) dynamic equilibrium rate
\( Z_e \) coefficient of psychological expansion in dynamic equilibrium
\( V_e \) transaction velocity of money in dynamic equilibrium
\( \chi_e \) rate of memory decay in dynamic equilibrium
\( V_0^* \) transaction velocity of money in a stationary state
\( \Theta \) period of endogenous fluctuations in nominal spending

Chapter 6
\( x^* \) estimated rate of growth in nominal spending
\( Z^* \) estimated coefficient of psychological expansion
\( K \) ratio of aggregate nominal spending to national income,
  ratio of the transaction velocity of money to its income velocity
\( v \) income velocity of money

Chapter 7
\( \theta \) time elapsing between the assessment and the collection of taxes

Chapter 8
\( i \) psychological rate of interest
\( j \) yield on long-term bonds
\( i_l \) pure long-term interest rate
\( l_j \) liquidity premium on long-term bonds
\( \lambda \) parameter equal to the ratio of the liquidity premium \( l_j \)
  to the nominal interest \( j \)
\( W \) an approximation of aggregate nominal spending
\( j^* \) estimated yield on long-term bonds with respect to \( \chi \)
\( \mu \) ratio of the estimated nominal interest rate \( j^{**} \) to \( z \)
\( j^{**} \) estimated yield on long-term bonds with respect to \( z \)
\( P \) price of a share
\( d_0 \) current dividend
\( r \) discount rate of dividends
\( g^* \) expected long-term growth rate of dividend
\( \pi \) ex-ante equity risk premium

Chapter 9
\( O_{MD} \) outstanding margin debt
\( M_3 \) broad money supply
\( ff \) federal funds rate
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<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>$x_{SP}$</td>
<td>return of the S&amp;P 500 index</td>
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<tr>
<td>$x_N$</td>
<td>return of the NASDAQ index</td>
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<tr>
<td>$P$</td>
<td>rescaled ratio of margin debt to broad money supply $O_{MD}/M_3$</td>
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Chapter 10

- $x_i$: an outcome in a risky prospect
- $p_i$: the probability of outcome $x_i$
- $P$: a risky prospect consisting of one or several outcomes
- $V$: the psychological value of a risky prospect
- $E$: the mathematical expectation of a risky prospect
- $B$: a neo-Bernoullian index of the psychological value of a risky prospect (ignoring its distribution)
- $C$: an individual’s capital
- $u$: cardinal utility
- $w$: decision weights in prospect theory
- $v$: the psychological value of an outcome in prospect theory
- $\pi$: the function transforming probabilities into decision weights in prospect theory
- $\mu_l$: the $l$th-order moment of a risky prospect
- $\tau$: Allais’s cardinal utility (or absolute satisfaction) function
- $U_0$: an individual’s psychological capital
- $X$: the absolute change (gain or loss) in an individual’s psychological capital
- $U_0^*$: the statistical estimate of an individual’s psychological capital
- $B_{1/2}$: Bernoulli’s index for a constant-probability (1/2), variable-gain prospect
- $B_{200}$: Bernoulli’s index for a variable-probability, constant-gain (200) prospect
- $R$: the psychological value of a risky prospect according to Allais, a function of its moments

Chapter 11

- $\chi_0^i$: rate of memory decay of age group $i$ in a stationary state
Uncertainty, Expectations, and Financial Instability