Footnote in script, VAR(2)

Form of the matrix $\mathsf{A}(\mathtt{L})$ (equation 1.8 Walsh) in case of a VAR(2); SVAR(2) has the following expression

$$\mathbf{A}_0\mathbf{y}_t^\star = \mathbf{A}_1\mathbf{y}_{t-1}^\star + \mathbf{A}_2\mathbf{y}_{t-2}^\star + \mathbf{e}_t$$

reduced form, pre-multiplying by $\mathbf{A}_0^{-1}$

$$\mathbf{y}_t^\star = \mathbf{A}_0^{-1}\mathbf{A}_1\mathbf{y}_{t-1}^\star + \mathbf{A}_0^{-1}\mathbf{A}_2\mathbf{y}_{t-2}^\star + \underbrace{\mathbf{A}_0^{-1}\mathbf{e}_t}_{\mathbf{u}_t}$$

rewrite using lag operator for lags older than $t-1$

$$\begin{aligned}\mathbf{y}_t^\star &= \mathbf{A}_0^{-1}\mathbf{A}_1\mathbf{y}_{t-1}^\star + \mathbf{A}_0^{-1}\mathbf{A}_2\left(\mathtt{L}\mathbf{y}_{t-1}^\star\right) + \mathbf{u}_t\\ \mathbf{y}_t^\star &= \mathbf{A}_0^{-1}\left(\mathbf{A}_1 + \mathbf{A}_2\mathtt{L}\right)\mathbf{y}_{t-1}^\star + \mathbf{u}_t\end{aligned}$$

which gives with $\mathsf{A}(\mathtt{L}) = \mathbf{A}_0^{-1}\left(\mathbf{A}_1 + \mathbf{A}_2\mathtt{L}\right)$

$$\mathbf{y}_t^\star = \mathsf{A}(\mathtt{L})\,\mathbf{y}_{t-1}^\star + \mathbf{u}_t \qquad (1.8\ \text{Walsh})$$

Cholesky decomposition

Elements

Decomposition $\mathbf{u}_t = \mathbf{B}\mathbf{e}_t$, after calculation of the variance-covariance matrix $\mathtt{Var}\mathbf{u}_t = \mathtt{Var}\left(\mathbf{B}\mathbf{e}_t\right)$

$$\begin{bmatrix} \otimes & \otimes & \otimes & \otimes & \dots & \otimes \\ \otimes & \otimes & \otimes & \otimes & & \vdots \\ \otimes & \otimes & \otimes & \otimes & & \\ \otimes & \otimes & \otimes & \otimes & & \\ \vdots & & & & \ddots & \vdots \\ \otimes & \dots & & & \dots & \otimes \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & \dots & 0 \\ \otimes & 1 & 0 & 0 & & \vdots \\ \otimes & \otimes & 1 & 0 & & \\ \otimes & \otimes & \otimes & 1 & & \vdots \\ \vdots & & & & \ddots & 0 \\ \otimes & \dots & & \dots & \otimes & 1 \end{bmatrix} \begin{bmatrix} \otimes & 0 & 0 & 0 & \dots & 0 \\ 0 & \otimes & 0 & 0 & & \vdots \\ 0 & 0 & \otimes & 0 & & \\ 0 & 0 & 0 & \otimes & & \vdots \\ \vdots & & & & \ddots & 0 \\ 0 & & & \dots & 0 & \otimes \end{bmatrix} \mathbf{B}'$$

Restrictions

Number of restrictions for a SVAR with p lags and n variables; the VAR estimation gives p matrices with n^2 elements and a variance-covariance matrix of the residuals with $\frac{n^2+n}{2}$ different elements (together $pn^2+\frac{n^2+n}{2}$); for the SVAR model, we need to estimate $(p+1)\,n^2+\frac{n^2+n}{2}$ elements; the number of restrictions is the difference $(p+1)\,n^2+\frac{n^2+n}{2}-pn^2-\frac{n^2+n}{2}=n^2$

Prisoner's dilemma, game theory, chapter 8

Setup		Zentralbank	
		Preisstabilität	Andere Ziele
Wirtschaftssubjekte	tiefe π^e	$10, 10$	$4, 11$
	hohe π^e	$9, 4$	$5, 5$

Nash-GG		Zentralbank	
		Preisstabilität	Andere Ziele
Wirtschaftssubjekte	tiefe π^e	$\underline{10}, 10$	$4, \underline{11}$
	hohe π^e	$9, 4$	$\underline{5}, \underline{5}$

Overview, complements, chapter 8

- Starting point: (actually end point, because the time inconsistency literature has contributed a lot to the following facts)
  - Microfunded models: New Keynesian model assumes a feedback rule à la Taylor with inflation and output gaps (stabilization of variables)
  - Reality: central banks have multiple objectives, with/without hierarchy; central banks behave with more or less discretion/commitment
- Problem: central banks may face incentives which lead to a suboptimal outcome (e.g. inflation and a certain GDP level, which could be achieved without inflation)
- Basic framework: game theory, static, simultaneous games
- Timing:
  - Timing of the game: $\left\{ \begin{array}{ccccccccc} \text{i)} & & \text{ii)} & & \text{iii)} & & \text{iv)} & & \text{v)} \\ \hline \pi^e & \rightarrow & e & \rightarrow & \Delta m & \rightarrow & v & \rightarrow & \underset{\text{simul.}}{y, \pi} \end{array} \right.$

    - central bank observes π^e

    - central bank observes e
  - Timing (discretion):
    - 1. Central bank finds Δm_t as function of π^e and e
    - 2. Agents form π^e knowing how the central bank behaves, without seeing e
    - 3. Central banks set Δm_t
    - 4. Outcome y, π
  - Timing (commitment):
    - 1. Form of the rule is known, some parameters unknown

  - 2. Agents form π^e knowing the form of the rule
  - 3. Central bank optimally sets the parameters of the rule (minimizes its loss function over the rule parameters) and so Δm_t
  - 4. Outcome y, π

- Utility function:
  - $U_t = \underbrace{\lambda\left(y_t - y_n\right)}_{\text{output expansion}} - \underbrace{\frac{1}{2}\pi_t^2}_{\text{inflation stabilization}}$
  - Form of the preference (U_t) influences the behavior of the bank, i.e. its discretionary policy or its optimal commitment
  - Discretion:
    - MB>MC, in equilibrium $\pi_t = a\lambda$
  - Commitment: $\Delta m_t = 0$ (optimal parameters already given)
  - $\mathbb{E}U_t^c > \mathbb{E}U_t^d$

- Loss function:
  - $V_t = \underbrace{\frac{1}{2}\lambda\left(y_t - y_n - k\right)^2}_{\text{output stabilization}} + \underbrace{\frac{1}{2}\pi_t^2}_{\text{inflation stabilization}}$
  - Form of the preference (U_t) influences the behavior of the bank, i.e. its discretionary policy or its optimal commitment
  - Discretion:
    - Relation between inflation and expected inflation: $\pi_t = \underbrace{\frac{a^2\lambda}{1+a^2\lambda}}_{\text{slope <1}}\pi_t^e + \underbrace{\frac{a\lambda k}{1+a^2\lambda}}_{\text{intercept >0}}$, in equilibrium $\pi_t = a\lambda k$

- <u>Commitment</u>: $\Delta m_t^c = 0 - \frac{a\lambda}{1+a^2\lambda} e_t$ (optimal commitment determined by the central bank)
- $\mathbb{E}V_t^c < \mathbb{E}V_t^d$ [not always true e.g. if forced commitment; volatility of output may play a role]

□ <u>Solution against bias</u>

- Repeated game (reputation of the central bank)
  - Trigger strategy
  - Gain of 'cheating' vs. cost of 'cheating'
- Conservative banker (reputation of the central banker)
  - More weight on inflation punishment in the loss function $(1 + \delta)$
  - Same framework as weight on inflation 1 (loss function V_t)
  - Optimal δ
- Contract with compensation
  - Wage structure of the central banker, so he/she avoids the inflation bias, but keeps the optimal reaction to output volatility
- Flexible targeting rules -> relation to conservative banker and contract
- Strict targeting rules (monetary targeting, income targeting)

Overview Models

- ☐ At the SNB's (p. 23/37)
  - Non-structural
    - i) Monetary indicators, financial market information, etc.
    - ii) VAR and VEC, vector autoregressive model, vector error correction model
  - Semi-structural
    - i) SVAR
    - ii) SVEC
  - Structural
    - i) SEM, simultaneous equation models, poorly microfunded
    - ii) DSGE, dynamic stochastic general equilibrium model, New Keynesian, microfunded
- ☐ Structural
  - SEM, big models, Cowles Commission, 1930s (poor microfundation, poor shock behavior, essentially backward looking)
  - [RBC, real business cycles model, no money, all flexible, no rigidities, technical (productivity) shock, forward looking
  - [Sidrauski (MIU, $\neq$ CIA), money, no rigidities, LR properties]
  - New Keynesian, DSGE models, a lot of rigidities, a lot of shocks, SR effects of monetary policy, no LR effect

Steps

- ☐ Script part 8.4.2.2: three-equation NK model
  - i) AD (IS)
  - ii) AS (PC)
  - iii) central bank behavior

TABLE 23 NK MODEL OVERVIEW

Model equations		
$x_t = \mathbb{E}_t x_{t+1} - \frac{1}{\sigma}\left(\hat{\imath}_t - \mathbb{E}_t \pi_{t+1}\right) + u_t$	$\longrightarrow$	$-\frac{1}{\sigma}\hat{\imath}_t + \mathbb{E}_t x_{t+1} + \frac{1}{\sigma}\mathbb{E}_t \pi_{t+1} = x_t - u_t$
$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \kappa x_t$	$\longrightarrow$	$\beta \mathbb{E}_t \pi_{t+1} = -\kappa x_t + \pi_t$
$\hat{\imath}_t = \delta \pi_t + \mathrm{v}_t$	$\longrightarrow$	$\hat{\imath}_t = \delta \pi_t + \mathrm{v}_t$

- ☐ Microfunded models
  - Variables (states vs. controls), parameters
  - Rational, optimal behavior of agents (max/min under constraint); timing t, $t-1$, $t+1$
  - Set of equations (definition and behavioral equations)
  - Linearization of equations

  - (Recursive) solution of the model (t as a function of $t-1$)
  - Calibration vs. estimation of the parameters (script p. 273)

Solution Example Question 8

Equilibrium inflation rate

Utility of conservative central banker, with supply curve y

$$\begin{aligned} U &= -(y-k)^2 - (1+\delta)\pi^2 \\ U &= -(\pi - \pi^e + \varepsilon - k)^2 - (1+\delta)\pi^2 \end{aligned}$$

group elements in the first parenthesis

$$U = -((\pi - \pi^e) + (\varepsilon - k))^2 - (1+\delta)\pi^2$$

use formula $(a+b)^2 = a^2 + b^2 + 2ab$

$$U = -\left((\pi - \pi^e)^2 + (\varepsilon - k)^2 + 2(\varepsilon - k)(\pi - \pi^e)\right) - (1+\delta)\pi^2$$

use formula again for the other square elements

$$\begin{gathered} U = -\pi^2 - (\pi^e)^2 + 2\pi\pi^e - \varepsilon^2 - k^2 + 2k\varepsilon \\ -2\varepsilon\pi + 2\varepsilon\pi^e + 2k\pi - 2k\pi^e - (1+\delta)\pi^2 \end{gathered}$$

take expectation, knowing that the central banker observes ε; $\mathbb{E}\varepsilon^2$ is the variance of the output shock

$$\begin{gathered} \mathbb{E}U = -\pi^2 - (\pi^e)^2 + 2\pi\pi^e - \sigma_\varepsilon^2 - k^2 + 2k\varepsilon \\ -2\varepsilon\pi + 2\varepsilon\pi^e + 2k\pi - 2k\pi^e - (1+\delta)\pi^2 \end{gathered}$$

maximize the utility, take first derivative wrt π, and set it equal to zero

$$0 = -2\pi + 2\pi^e - 2\varepsilon + 2k - 2(1+\delta)\pi$$

solve for the inflation rate as a function of the expected inflation rate by the economic agents

$$\pi = \frac{\pi^e - \varepsilon + k}{2+\delta}$$

inflation expectations of agents, which do not observe ε

$$\mathbb{E}\pi = \frac{\pi^e - \mathbb{E}\varepsilon + k}{2+\delta} = \pi^e$$

solve for π^e

$$\pi^e = \frac{k}{1+\delta}$$

plug in $\pi = \frac{\pi^e - \varepsilon + k}{2+\delta}$

$$\pi = \frac{\frac{k}{1+\delta} - \varepsilon + k}{2+\delta}$$

to get the equilibrium inflation rate

$$\pi = \frac{k}{1+\delta} - \frac{\varepsilon}{2+\delta}$$

Optimal degree of conservatism

Plug π^e and π in the utility function of the society $U = -(\pi - \pi^e + \varepsilon - k)^2 - \pi^2$ (after having used the definition of the supply curve)

$$U = -\left(\frac{k}{1+\delta} - \frac{\varepsilon}{2+\delta} - \frac{k}{1+\delta} + \varepsilon - k\right)^2 - \left(\frac{k}{1+\delta} - \frac{\varepsilon}{2+\delta}\right)^2$$

rewrite

$$U = -\left(\frac{1+\delta}{2+\delta}\varepsilon - k\right)^2 - \left(\frac{k}{1+\delta} - \frac{\varepsilon}{2+\delta}\right)^2$$

take expectation, knowing that the element with ε are zero and the elements with ε^2 become σ_ε^2

$$\mathbb{E}U = -\left(\left(\frac{1+\delta}{2+\delta}\right)^2 \sigma_\varepsilon^2 + k^2\right) - \left(\left(\frac{k}{1+\delta}\right)^2 + \frac{\sigma_\varepsilon^2}{(2+\delta)^2}\right)$$

group similar elements (i.e. σ_ε^2 and k^2)

$$\mathbb{E}U = -\left[\left[(1+\delta)^2 + 1\right]\left(\frac{\sigma_\varepsilon^2}{(2+\delta)^2} + \frac{k^2}{(1+\delta)^2}\right)\right]$$

maximize the utility, take first derivative wrt δ, and set it equal to zero

$$-\left[\begin{array}{c} 2(1+\delta)\left(\frac{\sigma_\varepsilon^2}{(2+\delta)^2} + \frac{k^2}{(1+\delta)^2}\right) \\ +\left[(1+\delta)^2+1\right]\left(-\frac{2\sigma_\varepsilon^2}{(2+\delta)^3} - \frac{2k^2}{(1+\delta)^3}\right) \end{array}\right] = 0$$

rewrite

$$-(1+\delta)\left(\frac{\sigma_\varepsilon^2}{(2+\delta)^2} + \frac{k^2}{(1+\delta)^2}\right) + \left[(1+\delta)^2+1\right]\left(\frac{\sigma_\varepsilon^2}{(2+\delta)^3} + \frac{k^2}{(1+\delta)^3}\right) = 0$$

rewrite

$$\frac{\left[(1+\delta)^2+1\right]\sigma_\varepsilon^2}{(2+\delta)^3} - \frac{(1+\delta)\sigma_\varepsilon^2}{(2+\delta)^2} + \frac{\left[(1+\delta)^2+1\right]k^2}{(1+\delta)^3} - \frac{(1+\delta)k^2}{(1+\delta)^2} = 0$$

which gives

$$\delta\frac{\sigma_\varepsilon^2}{(2+\delta)^3} = \frac{k^2}{(1+\delta)^3}$$

or simplified

$$\delta = \frac{k^2}{\sigma_\varepsilon^2}\frac{(2+\delta)^3}{(1+\delta)^3}$$

Road map (Sidrauski $\rightarrow$ NK)

☐ Chapter 2

I) intertemporal utility maximization s.t. budget constraint

$\downarrow$

first order conditions (FOC)

$\downarrow$

main features (essentially at the steady state):
Neutrality, Superneutrality, Money demand, Cost of inflation, Interest on money

☐ Chapter 2

II) intertemporal utility maximization s.t. budget constraint (Sidrauski, 7.2 script)

$\downarrow$

first order conditions (FOC)

$\downarrow$

representation of the model w/o functional forms (TABLE 13)

$\downarrow$

representation of the model with functional forms (TABLES 14/15)

$\downarrow$

linearization (TABLE 16/17)

☐ Chapter 5

III) simplificaton of the model (Tables 18/19/20)

↓

monopolistic competition and price rigidity (Calvo)

☐ Chapter 5

IV) intertemporal utility maximization s.t. budget constraint (NK, 8.4 script)

↓

first order conditions (FOC)

↓

NK (Tables 22/23)

Nationale Buchhaltung

- ☐ Produktionsansatz Y, Summe der Wertschöpfung
- ☐ Verwendungsansatz, $C + I + G + NX$
- ☐ Einkommenansatz, Summe der Einkommenströme

Cobb-Douglas

- ☐ Production function of the single good y:

$$y_t = k_{t-1}^{\alpha}\left(e^{z_t} l_t\right)^{1-\alpha} \quad \text{with} \quad z_t = \rho z_{t-1} + \varepsilon_t \tag{1}$$

at the steady state $y = k^{\alpha} l^{1-\alpha}$

- i) Substitution: both factors needed for production ($\rightarrow$ non separable)
- ii) Economies of scale: $\alpha + 1 - \alpha = 1$ (constant returns to scale)

$$\begin{aligned} &\left(x k_{t-1}\right)^{\alpha}\left(e^{z_t} x l_t\right)^{1-\alpha} \\ &x^{\alpha} k_{t-1}^{\alpha} x^{1-\alpha}\left(e^{z_t} l_t\right)^{1-\alpha} \\ &x k_{t-1}^{\alpha}\left(e^{z_t} l_t\right)^{1-\alpha} \\ &x y \end{aligned}$$

- iii) Labor share: perfect competition implying that factor price = marginal product of factor, e.g. $w_t = MPL_t$

$$\frac{w_t l_t}{y_t} = \frac{MPL_t l_t}{y_t} = \frac{\left((1-\alpha) k_{t-1}^{\alpha}\left(e^{z_t}\right)^{1-\alpha} l_t^{-\alpha}\right) l_t}{k_{t-1}^{\alpha}\left(e^{z_t} l_t\right)^{1-\alpha}} = 1 - \alpha$$

– iv) Technical rate of substitution: assuming $dz_t = 0$ and the total differential $dy_t = 0$

$$dy_t = \alpha k_{t-1}^{\alpha-1} \left(e^{z_t} l_t\right)^{1-\alpha} dk_{t-1} + (1-\alpha) k_{t-1}^{\alpha} \left(e^{z_t}\right)^{1-\alpha} l_t^{-\alpha} dl_t = 0$$

TRS_t

$$\frac{dk_{t-1}}{dl_t} = -\frac{1-\alpha}{\alpha} \frac{k_{t-1}}{l_t}$$

– v) Elasticity of substitution: using $|TRS_t| = \frac{1-\alpha}{\alpha} \frac{k_{t-1}}{l_t}$; rewrite TRS_t-equation using the logarithm: $\ln \frac{k_{t-1}}{l_t} = \ln |TRS_t| - \ln \frac{1-\alpha}{\alpha}$; use the formula for the elasticity of substitution

$$\frac{d \ln \frac{k_{t-1}}{l_t}}{d \ln |TRS_t|} = 1$$

Interest rate structure: example

3 markets
Y1: 4%
Y2: 8%
2Y: ?

$$\begin{aligned}\left(1+\frac{4}{100}\right)\left(1+\frac{8}{100}\right) &= \left(1+\frac{12.32}{100}\right)\\ \left(1+\frac{?}{100}\right)^2 &= \left(1+\frac{12.32}{100}\right)\\ ? &= \left(\sqrt{1+\frac{12.32}{100}}-1\right)100 = 5.9811\end{aligned}$$

Strategy if ?<6% (no arbitrage condition): 2Y-loan (demand $\nearrow$, interest $\nearrow$), Investition Y1 und Y2 (Angebot$\nearrow$, interest $\searrow$)

Solution Example Question 9

☐ Price-elasticity of demand $Y_t(i)$

$$Y_t(i) = \left(\frac{P_t}{P_t(i)}\right)^{\frac{1}{1-q}} Y_t$$

– solution, quick way

$$\begin{aligned}
\ln Y_t(i) &= \frac{1}{1-q}\ln P_t - \frac{1}{1-q}\ln P_t(i) + \ln Y_t \\
\frac{\partial \ln Y_t(i)}{\partial \ln P_t(i)} &= -\frac{1}{1-q}
\end{aligned}$$

– solution, long way

$$\begin{aligned}
\frac{\partial Y_t(i)}{\partial P_t(i)}\frac{P_t(i)}{Y_t(i)} &= \overbrace{\left[\frac{1}{1-q}\left(\frac{P_t}{P_t(i)}\right)^{\frac{1}{1-q}-1} Y_t \frac{-P_t}{P_t(i)\,P_t(i)}\right]}^{-\frac{1}{1-q}\frac{Y_t(i)}{P_t(i)}}\frac{P_t(i)}{Y_t(i)} \\
&= \left[\frac{1}{1-q}\left(\frac{P_t}{P_t(i)}\right)^{\frac{1}{1-q}-1} Y_t \frac{-P_t}{P_t(i)\,P_t(i)}\right]\frac{P_t(i)}{\left(\frac{P_t}{P_t(i)}\right)^{\frac{1}{1-q}} Y_t} \\
&= -\frac{1}{1-q}\left(\frac{P_t}{P_t(i)}\right)^{\frac{1}{1-q}-1}\left(\frac{P_t}{P_t(i)}\right)^{-\frac{1}{1-q}}\frac{Y_t P_t(i)}{Y_t P_t(i)}\frac{P_t}{P_t(i)} \\
&= -\frac{1}{1-q}
\end{aligned}$$

☐ Elasticity of substitution of production function Y_t

$$Y_t = \left[\int Y_t(i)^q \,\mathrm{d}i\right]^{\frac{1}{q}}, 0 < q \leqslant 1$$

– rewrite

$$Y_t = \left[\ldots + Y_t(i_1)^q + Y_t(i_2)^q + \ldots\right]^{\frac{1}{q}}$$

– total differential

$$\begin{aligned} \mathtt{d}Y_t &= \left[\ldots + Y_t(i_1)^q + Y_t(i_2)^q + \ldots\right]^{\frac{1}{q}-1} \\ &\quad \times \left[\ldots + Y_t(i_1)^{q-1}\,\mathtt{d}Y_t(i_1) + Y_t(i_2)^{q-1}\,\mathtt{d}Y_t(i_2) + \ldots\right] \end{aligned}$$

– restrictions

$$\mathtt{d}Y_t = \mathtt{d}Y_t(i_3) = \mathtt{d}Y_t(i_4) = \ldots = 0$$

– apply to $\mathtt{d}Y_t$ to get the TRS

$$0 = Y_t(i_1)^{q-1}\,\mathtt{d}Y_t(i_1) + Y_t(i_2)^{q-1}\,\mathtt{d}Y_t(i_2)$$

$$\frac{\mathtt{d}Y_t(i_1)}{\mathtt{d}Y_t(i_2)} = -\left(\frac{Y_t(i_2)}{Y_t(i_1)}\right)^{q-1}$$

– compute $\ln|TRS|$

$$(q-1)\ln\frac{Y_t(i_2)}{Y_t(i_1)}$$

$$(1-q)\ln\frac{Y_t(i_1)}{Y_t(i_2)}$$

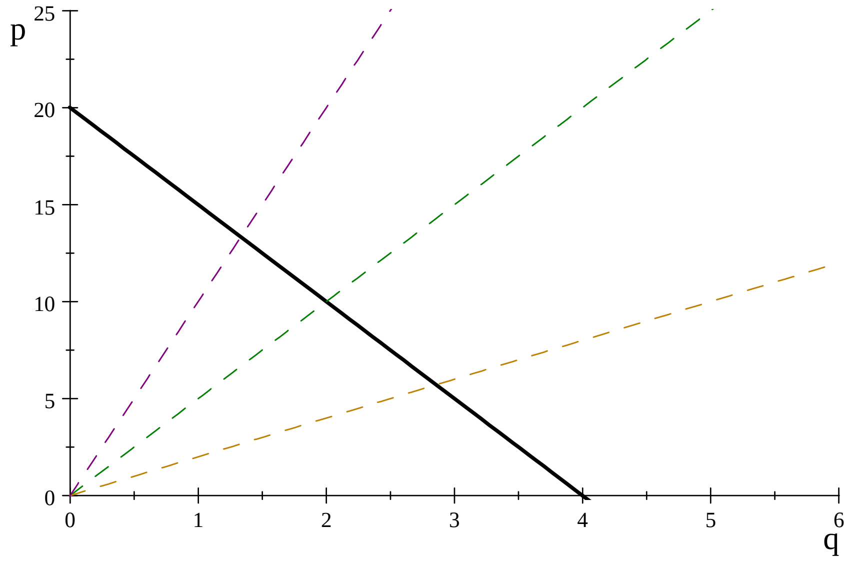
– compute $\frac{\mathtt{d}\ln|TRS_t|}{\mathtt{d}\ln\frac{Y_t(i_1)}{Y_t(i_2)}}$

$$1-q$$

– elasticity of substitution

$$\frac{\mathtt{d}\ln\frac{Y_t(i_1)}{Y_t(i_2)}}{\mathtt{d}\ln|TRS_t|} = \frac{1}{1-q}$$

☐ Elasticity, graphical representation, $\frac{\partial q}{\partial p}\frac{p}{q} = \frac{\frac{p}{q}}{\frac{\partial p}{\partial q}}$



Solution Example Question 11

- Random walk, AR(1), $x_t = \alpha + \beta x_{t-1} + \varepsilon_t$, with unit root, $\beta = 1$

$$\begin{aligned} x_t &= \alpha + x_{t-1} + \varepsilon_t \\ \mathbb{E}x_{t+1} &= \alpha + x_t + \mathbb{E}\varepsilon_{t+1} = \alpha + x_t \end{aligned}$$

- Growth rates

		qoq ann	yoy
Feb-05	47.73		
May-05	51.65	32.85	
Aug-05	61.62	77.21	
Nov-05	56.87	-30.83	
Feb-06	61.82	34.82	29.52
May-06	69.60	50.34	34.75
Aug-06	69.67	0.40	13.06
Nov-06	59.65	-57.53	4.89
Feb-07	57.79	-12.47	-6.52
May-07	68.69	75.45	-1.31
Aug-07	74.74	35.23	7.28
Nov-07	88.63	74.34	48.58
Feb-08	96.67	36.29	67.28
May-08	116.00	79.98	68.87
Aug-08	116.00	0.00	55.20
Nov-08	116.00	0.00	30.88
Feb-09	116.00	0.00	20.00
May-09	116.00	0.00	0.00
Aug-09	116.00	0.00	0.00
Nov-09	116.00	0.00	0.00
Feb-10	116.00	0.00	0.00
May-10	116.00	0.00	0.00
Aug-10	116.00	0.00	0.00
Nov-10	116.00	0.00	0.00
Feb-11	116.00	0.00	0.00
May-11	116.00	0.00	0.00
Aug-11	116.00	0.00	0.00
Nov-11	116.00	0.00	0.00