Algebra Scratch Work for Assignment 6

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1

$p_t = E_t m_{t+1} E_t(c_{t+1} + p_{t+1}) + cov_t(m_{t+1}, c_{t+1} + p_{t+1})$

Recall $c_{t+1} = \lambda_{t+1} c_t$ and $p_t = v_t c_t$

$v_t c_t = E_t[m_{t+1}]E_t[c_{t+1} + p_{t+1}] + E_t[m_{t+1} \times (c_{t+1} + p_{t+1})] - E_t[m_{t+1}]E_t[c_{t+1} + p_{t+1}]$

$v_t c_t = E_t[m_{t+1}]E_t[\lambda_{t+1} c_t + v_{t+1}\lambda_{t+1} c_t] + E_t[m_{t+1} \times (\lambda_{t+1} c_t + v_{t+1}\lambda_{t+1} c_t)] - E_t[m_{t+1}]E_t[\lambda_{t+1} c_t + v_{t+1}\lambda_{t+1} c_t]$

Cancelling out all of the c_t terms we get:

$v_t = E_t[m_{t+1}]E_t[\lambda_{t+1} + v_{t+1}\lambda_{t+1}] + E_t[m_{t+1} \times (\lambda_{t+1} + v_{t+1}\lambda_{t+1})] - E_t[m_{t+1}]E_t[\lambda_{t+1} + v_{t+1}\lambda_{t+1}]$

Simplifying a bit further we get:

$v_t = E_t[m_{t+1} \times (\lambda_{t+1} + v_{t+1}\lambda_{t+1})]$

Now to put this in a form where we can verify the given data in Python:

$v_i = \Sigma_{j=1}^{n} P_{ij} m_j (s_j + s_j v_j)$

Let $\hat{P}_{ij} = P_{ij} m_j$

Then: $v = \hat{P}s + \hat{P}sv$

2

$1 = E_t m_{t+1} E_t R_{t+1} + cov_t(m_{t+1} R_{t+1})$ $1 = E_t m_{t+1} E_t R_{t+1} + E_t(m_{t+1} R_{t+1}) - E_t m_{t+1} E_t R_{t+1}$
$1 = E_t(m_{t+1} R_{t+1})$

3

$v_i = \Sigma_{j=1}^{n} P_{ij} m_j (s_j + s_j v_j)$

$v = Pms + Pmsv$

$v - Pmsv = Pms$

$v(I - Pms) = Pms$