# More on the Basics of the Demand for Money

$$r_N = r_R + \eta + r_R\eta$$

$$r_N \cong r_R + \eta$$



## The Nominal Rate

- Interest stated in money.
- I lend you 100 pictures of George; you promise to give me 106 back.

$$r_N = 6\%$$



## The Real Rate

- Interest stated in purchasing power.
- I lend you enough to purchase 100 slices of pizza; you promise to repay me enough to purchase 103.

$$r_R = 3\%$$



## The Relation

- I have promised you a real return of $r_R$
- The inflation rate is $\eta$
- What kind of nominal return $(r_N)$ have I promised?



## The Relation

$$[\$100(1+r_R)]$$

Amount due with no inflation



## The Relation

$$[\$100(1+r_R)](1+\eta)$$

Inflation adjustment

## The Relation

$$[\$100(1+r_R)](1+\eta) =$$

$$\$100(1+r_N)$$

Amount due in nominal terms



## The Relation

$$[\not{\$100}(1+r_R)](1+\eta) =$$

$$\not{\$100}(1+r_N)$$



## The Relation

$$(1+r_R)(1+\eta) = (1+r_N)$$



## The Fisher Equation

$$(1+r_N) = (1+r_R)(1+\eta)$$

$$r_N = r_R + \eta + r_R\eta$$

$$r_N \cong r_R + \eta$$



## An Aside

$$r_N = r_R + \eta + r_R\eta$$

$$r_N \cong r_R + \eta$$



## How good is the approximation

$r_R = 3\%$

$\eta = 2\%$

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$r_R = 3\%$
$\eta = 2\%$
$r_N = r_R + \eta + r_R\eta$



## How good is the approximation

$r_R = 3\%$
$\eta = 2\%$
$r_N = r_R + \eta + r_R\eta$
$= 0.03 + 0.02 + (0.03)(0.02)$
$= 0.0506$



## How good is the approximation

$r_R = 3\%$
$\eta = 2\%$
$r_N = r_R + \eta + r_R\eta$
$= 0.0506$
$r_N \cong r_R + \eta = 0.05$



## How good is the approximation

$r_R = 3\%$ | $r_R = 50\%$
$\eta = 2\%$ | $\eta = 50\%$
$r_N = r_R + \eta + r_R\eta$
$= 0.0506$
$r_N \cong r_R + \eta = 0.05$



## How good is the approximation

$r_R = 3\%$ | $r_R = 50\%$
$\eta = 2\%$ | $\eta = 50\%$
$r_N = r_R + \eta + r_R\eta$ | $r_N = r_R + \eta + r_R\eta$
$= 0.0506$
$r_N \cong r_R + \eta = 0.05$



## How good is the approximation

$r_R = 3\%$ | $r_R = 50\%$
$\eta = 2\%$ | $\eta = 50\%$
$r_N = r_R + \eta + r_R\eta$ | $r_N = r_R + \eta + r_R\eta$
$= 0.0506$ | $= 0.50 + 0.50 + (0.50)(0.50)$
$r_N \cong r_R + \eta = 0.05$ | $= 1.25$

## How good is the approximation

$r_R = 3\%$

$\eta = 2\%$

$r_N = r_R + \eta + r_R \eta$

$= 0.0506$

$r_N \cong r_R + \eta = 0.05$

$r_R = 50\%$

$\eta = 50\%$

$r_N = r_R + \eta + r_R \eta$

$= 1.25$

$r_N \cong r_R + \eta = 1.00$



## How good is the approximation

$r_R = 3\%$

$\eta = 2\%$

$r_N = r_R + \eta + r_R \eta$

$= 0.0506$

$r_N \cong r_R + \eta = 0.05$

$r_R = 50\%$

5% versus 5.06%. Not bad

$= 1.25$

$r_N \cong r_R + \eta = 1.00$



## How good is the approximation

$r_R = 3\%$

100% versus 125%. Pretty bad

$r_N \cong r_R + \eta = 0.05$

$r_R = 50\%$

$\eta = 50\%$

$r_N = r_R + \eta + r_R \eta$

$= 1.25$

$r_N \cong r_R + \eta = 1.00$



## End of Aside



## Prices Double Every Year

| Bank Balance | 0 Trips | One Trip | Two Trips | Five Trips |
|---|---|---|---|---|
| Monday | $ 80 | $ 140 | $ 160 | $ 180 |
| Tuesday | $ 80 | $ 140 | $ 160 | $ 160 |
| Wednesd | $ 80 | $ 140 | $ 120 | $ 140 |
| Thursday | $ 80 | $ 80 | $ 120 | $ 120 |
| Friday | $ 80 | $ 80 | $ 80 | $100 |
| Saturday | $ 80 | $ 80 | $ 80 | $ 80 |
| Daily Bala | 480 | $ 660 | $ 720 | $ 780 |
| **Interest (** | **20** | **$ 0.990** | **$ 1.080** | **$ 1.170** |
| **Trip Cost** | | **$ 0.120** | **$ 0.240** | **$ 0.600** |
| **Net Earnings** | **$ 0.720** | **$ 0.870** | **$ 0.840** | **$ 0.570** |

Which rate should we use here? The real or the nominal?



## Prices Double Every Year

| Bank Balance | 0 Trips | One Trip | Two Trips | Five Trips |
|---|---|---|---|---|
| Monday | | 40 | $ 160 | $ 180 |
| Tuesday | | 40 | $ 160 | $ 160 |
| Wednesd | | 40 | $ 120 | $ 140 |
| Thursday | | 80 | $ 120 | $ 120 |
| Friday | | 80 | $ 80 | $100 |
| Saturday | | 80 | $ 80 | $ 80 |
| Daily Bala | | 60 | $ 720 | $ 780 |
| **Interest (** | | | **$ 1.080** | **$ 1.170** |
| **Trip Cost** | | | **$ 0.240** | **$ 0.600** |
| **Net Earni** | | | **$ 0.840** | **$ 0.570** |

$r_N$, the nominal rate, for money is a nominal asset. The interest we lose by being in money is a nominal rate.

## Pr r

Wealth calculations and the like can be done either in real rates if we discount real (inflation adjusted) cash flows or in nominal rates if we discount nominal cash flows.

| | ps | Five Trips |
|---|---|---|
| Monday | 160 | $ 180 |
| Tuesday | 160 | $ 160 |
| Wednesday | 120 | $ 140 |
| Thursday | 120 | $ 120 |
| Friday | $ 80 | $100 |
| Saturday | $ 80 | $ 80 |
| Daily Balance | *720* | *$ 780* |
| **Interest (0.00** | **30** | **$ 1.170** |
| **Trip Cost** | **40** | **$ 0.600** |
| **Net Cost** | **40** | **$ 0.570** |



## Prices Double Every Year

| *Bank Balance* | *0 Trips* | *One Trip* | *Two Trips* | *Five Trips* |
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| Wednesd | | | $ 120 | $ 140 |
| Thursday | | | $ 120 | $ 120 |
| Friday | | | $ 80 | $100 |
| Saturday | | | $ 80 | $ 80 |
| Daily Bala | | | *$ 720* | *$ 780* |
| **Interest (** | | | **1.080** | **$ 1.170** |
| **Trip Cost** | | | **0.240** | **$ 0.600** |
| **Net Earni** | | | **0.840** | **$ 0.570** |

Intuitively, money is subject to "depreciation", that is the loss of value as a function of inflation, and including a term for inflation captures this effect.



## Properties of Money Demand Function

- Demand for ***nominal*** money balances rises in proportion to prices.
- Demand for ***real*** money balances rises with income.
- Demand for money balances is a function of the ***nominal*** interest rate.



## End