Theory of Income II
Winter 2018

Summaries of required readings

Takuma Habu

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1 Home production

1.1 * Greenwood and Hercowitz (JPE, 1991): The Allocation of Time over the Business Cycle

1.1.1 Summary

Question/Motivation Standard models assume HH and B capitals are perfect substitutes. However, HH capital income is not taxed—i.e. creates distortion favouring investment in HH capital over B capital.

Can we create model that explains the allocation of capital between the business (B) and household (HH) sectors over the business cycle observed in the data?

"Facts"

(i) Stock of household capital (durables + residential) is greater than the stock of business capital (non-residential) (x1.1)

(ii) Investment in household capital is highly procyclical, leading business investment

Model Same set up as Greenwood, Rogerson and Wright (1993), except for the fact that (i) consumers do not value leisure directly; (ii) labour augmenting shocks are common.

- ▷ Beckerian HH: Consumers value market goods and home goods, not directly leisure (so time is split between market and home good)
- ▷ Market goods produced by combining B capital and time; home goods produced by combining HH capital and time.
- ▷ Capital goods (HH and/or B) can be produced by the B sector (using market goods) only. ((HH and B capital can be freely transformed).
  - ▷ Implication: Positive technology shock increases optimal levels of B and HH capital. Capital goods can only be produced in the B sector means that consumption of market good must be sacrificed—home goods become relatively cheaper, and market goods become more scarce. So benefit of B investment is greater (to relieve the excess demand) than HH investment—leads to negative comovement in B and HH investment.
- ▷ Common labour augmenting shocks to HH and B production.

Conclusion

- ▷ Model can explain Fact 1—as suspected, taxes on B capital income can explain the shift towards HH capital vs B capital.
- ▷ Increase complementarity between time and capital in HH production to generate the procyclical behaviour of investment
  - ▷ Two opposing forces when positive technology shocks hits. (+) Higher shock today implies higher shock tomorrow (persistency in shocks) ⇒ marginal product from HH investment is higher (–) Higher shock implies scarcity in market goods (see argument above), so relative price of HH goods decrease ⇒ less incentive to invest.

- ▷ With Cobb-Douglas production function, two effects cancel out.
- ▷ When complementarity is greater, positive impact of the shock on marginal product is greater, allowing the model to produce procyclical HH investment.

▷ Cannot explain why HH investment leads B investment (increasing complementarity or adding capital adjustment costs does not help)

1.2 ** Greenwood, Rogerson and Wright (1993): Putting Home Economics into Macroeconomics

1.2.1 Summary

Question/Motivation

▷ (Builds on the previous paper and incorporates home production to RBC model)

▷ Home production is empirically sizeable. So, how does an RBC model with home production perform?

▷ Idea: Investment in the standard RBC model is too volatile while consumption too smooth. Introducing home production allows more substitution into and out of market activity in response to shocks so might help.

"Facts"

(i) Married couples spend 25% of discretionary time on unpaid work in the home vs 33% on work for pay.

(ii) Stock of household capital (durables + residential) is greater than the stock of business capital (non-residential) (c. +15%)

(iii) HH output accounts for 20-50% of GNP.

Model

▷ Households (HH) value consumption (home and market good) and leisure. Time can be split between home production, market production and leisure.

▷ Market goods produced by combining B capital and time; home goods produced by combining HH capital and time.

▷ Capital goods (HH and/or B) can be produced by the B sector (using market goods) only; i.e. home output can only be consumed (HH and B capital can be freely transformed).

▷ Correlated labour augmenting shocks to HH and B production

Conclusion

▷ Adding home production improves ability of RBC model to fit data

- ▷ investment becomes less volatile and consumption more volatile

- ▹ but correlation between HH and B investment in the model is negative while data suggest positive

▷ Trade off between ability to explain (i) positive correlation between HH and B investment in data; vs (ii) smoother investment and less smooth consumption relative to standard RBC models.

2 Labour supply elasticities

2.1 * Keane and Rogerson (JEL, 2012): Micro and Macro Labor Supply Elasticities: A Reassessment of Conventional Wisdom

2.1.1 Summary

Question/Motivation

- ▷ Labour supply elasticity is important in understanding impact of labour tax on labour supply
- ▷ Micro data suggests labour supply elasticities are small. Marco models use relatively large aggregate labour supply elasticities in model.
- ▷ How can we reconcile these micro vs macro views on labour supply elasticities?

Conclusion Small labour supply elasticities based on micro data are consistent with large aggregate labour supply elasticities

Explanation 1: Human capital

- ▷ Return from working = (post-tax) wages + expected PV of higher earnings from greater human capital ("HC").
- ▷ Micro elasticities consider how labour supply (hours) vary with wages. But the *true* elasticities should capture how labour supply varies with wages + HC.
- ▷ Since HC is decreasing with age, labour supply elasticities can differ across ages.
  - ▷ *Effect of temporary tax change.* Temporary tax change does not affect HC. When young, HC component is large, so change in wage component (e.g. tax) has relatively small effect on hours. When old, HC component is small so hours are more responsive; i.e. elasticities are increasing with wage.
  - ▷ *Effect of permanent tax change.* Permanent tax increase reduces both wages and HC component.

Explanation 2: Extensive vs intensive margin

- ▷ See next paper.

2.2 * Rogerson and Wallenius (JET, 2009): Micro and macro elasticities in a life cycle model with taxes

2.2.1 Summary

"Facts" (US)

- ▷ fraction of people working (+800 hours/year) declines significantly with age
- ▷ hours worked for those individuals who work (+800 hours/year) declines little with age
- ▷ Main margin of cyclical adjustment is the fraction of working age population employed, not hours worked per worker.

2.2.2 Model answer 1

In their paper "Micro and macro elasticities in a life cycle model with taxes" (JET 2009), Rogerson and Wallenius develop a model in which different elasticities are virtually unrelated. Briefly describe why they want to construct such a model, and the key model feature that accomplished the task.

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Prescott (AER, 2002) and others have argued that labour taxes explain a large share of the differences between time devoted to work in continental Europe versus the US (Europeans work about 70% of the US counterparts). A key driver of this result is that labour supply is elastic with respect to wages since labour taxes introduce a "wedge" in the wages. However, elasticities of labour supply based on micro data tends to be low (ranging from 0.05-1.25) while the macro elasticities assumed in the models tend to be around 2.25-3.0.

Rogerson and Wallenius (JET 2009) create a model in which labour supply adjusts both on the intensive and extensive margin, motivated by the fact that, whereas aggregate employment is correlated with output, total hours worked by those who work do not vary much with output. They do so by introducing a convex labour services schedule in which labour service is a function of productivity that depend upon age, $e(a)$, and labour-time supply of the form $\max\{h-f,0\}$. The total labour services provided is given by

$$e(a)\max\{h-f,0\}.$$

The idea is that there is some fixed cost to begin working and that until such costs can be covered by wages, workers will choose not to work. This feature of the model means that labour-time supply h has a reservation property in which $h=0$ if $e<e^*$ where as $h>f$ is $e\geq e^*$. By assuming a profile how e changes with age, the model can "create" individuals who begins work at a particular age, and work continuously until retirement. Thus, the individuals in the model has a choice as to when to begin/end working (the extensive margin), as well as how much to work conditional on them working (intensive margin). Micro elasticities estimates only capture the intensive margin, and this is why in which they are able to develop a model in which different elasticities are virtually unrelated.

2.2.3 Model answer 2

Briefly describe Rogerson and Wallenius' (JET 2009) conclusion about the relationship between micro and macro elasticities of labour supply. What important model feature do they introduce to reconcile the differences in estimates from the two types of data?

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Rogerson and Wallenius (2009) conclude that there is little relationship between micro and macro elasticities of labour supply. This is because micro elasticities estimates only capture the intensive margin (i.e. conditional on working, how hours change in respose to wage changes), whereas macro elasticities must also capture the extensive margin (i.e. the decision to work or not).

The key model feature is a convex labour services schedule in which labour service is a function of productivity that depend upon age, $e(a)$, and labour-time supply of the form $\max\{h-f,0\}$.

The total labour services provided is given by

$$e(a)\max\{h-f,0\}.$$

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3 RBC models

3.1 ** Long and Plosser (JPE, 1983): Real Business Cycles

3.1.1 Summary

Question/Motivation/Conclusion

- ▷ Wide range of economic variables move together (e.g. output in different sectors)
- ▷ Significant persistency in deviations from trend
- ▷ Can we explain these observations with a "basic" RBC model? (i.e. rational expectations, complete information, stable preferences, no technological change, no longed-lived commodities, no frictions, no government, no money and no serial depend in shocks)
    - ▷ Yes.

Model

(i) Multiple inputs used to produce each single output (Outputs from previous periods are used as inputs to produce outputs next period.

(ii) Next-period production depends on amount produced today + the shock next period (which is unobserved before making production decisions).

This creates mechanism for exogenous shocks to propagate through time via (ii) and across commodities via (i), even with iid shocks.

3.2 ** Greenwood, Hercowitz and Krussell (AER, 1997): Long-Run Implications of Investment-Specific Technological Change

3.2.1 Summary

Motivation/Question

- ▷ There has been a significant technology change in production of new equipment.
    - ▷ Long-run relative price of equipment has declined significantly, while equipment-to-GDP ratio increased. (Latter implies greater demand for equipment, which, holding technology constant, implies higher relative price of equipment)
    - ▷ Short-run data display a negative correlation between price for new equipment vs equipment investment. (higher price implies lower investment)
- ▷ What is the role of investment-specific technological change as engine of growth? (i.e. production of capital becomes increasingly efficient over time)

Model

- ▷ Introduce "vintage capital model" to otherwise standard neoclassical growth model.

▷ Two types of capital—"equipment" and "structure"—used to produce output. The law of motion for equipment has q:

$$k'_e = (1 - \delta_\epsilon)\, k_e + i_e q.$$

q is the amount of equipment that can be purchased for one unit of output—it represents the current state of technology for producing equipment.

▷ The model assumes q grows according to a Markov process. Two interpretations:

  ▷ the cost of producing a unit of new equipment in terms of final good, $1/q$, is falling over time.

  ▷ the productivity of each unit of vintage of equipment is increasing over time (cost of producing equipment is the same in every period).

▷ Key: To benefit from investment-specific technological change, you have to invest in equipment. This is contrast to the neutral technological change.

Conclusion

▷ Investment-specific technological growth explains ~60% of growth in output per hours worked.

▷ Neutral technological change explains the residual. They find that productivity growth in this residual has regressed "sharply and continuously since the early 1970's".

4 Asset pricing

4.1 * Kocherlakota (JEL, 1996): The Equity Premium: It's Still a Puzzle

4.1.1 Summary

Equity premium puzzle Why average stock returns are so much higher than bond returns? (7% vs 1%)
Risk-free rate puzzle: Why has per-capital consumption grown so quickly given that bond returns are so low? (2% vs 1%).

The puzzles are driven by three assumptions: (i) *individual preferences* (expected utility, CRRA); (ii) *complete asset markets*; (iii) *costless asset trading*.

Individual preferences

- ▷ Idea 1: CRRA/Expected utility implies that individual's preferences towards risk and growth are inversely related. More risk-averse agents like smooth consumption—i.e. they do not like growth in consumption. The idea is to split this relation.
  - ▷ Assuming a more general utility function, risk-free rate puzzle can be resolved; i.e. we can have high risk aversion and low intertemporal substitution at the same time.
  - ▷ Problem: But equity premium puzzle cannot be resolved because this puzzle arises only because of prior belief about risk aversion of individuals being relatively low.
- ▷ Idea 2: Habit formation. Standard model assumes additively separable utility—consumption in the past does not affect consumption today. We can instead assume that utilities depends on the past (to help explain risk-free rate puzzle) and contemporaneous aggregate consumption (to help explain the equity premium puzzle).
  - ▷ Problem: Since consumption is smooth (at individual or aggregate level), we would need individuals that are highly averse to consumption risk.

Complete asset markets

- ▷ Idea: individuals cannot insure fully so that individual consumption growth will be more variable than per-capital consumption growth. So if individual consumption growth path covary enough with stock return, we can explain the equity premium.
  - ▷ Problem: *Dynamic self-insurance*—long lived agents need not absorb income risk fully into current consumption and instead offset it by reducing (increasing) savings when income is high (low)—means that complete markets in fact approximate incomplete markets well. To solve the puzzle, one would require unrealistically incomplete markets.

Costless trading

- ▷ Idea 1: Cost associated with trading create a "wedge" which prevents individuals from investing more in equity even if it is profitable to do so if there were no costs.
  - ▷ Problem: In order for this to work, need to assume significant trading cost difference between buying bonds and equity. Not observed.

- ▷ Idea 2: Borrowing constraints. Reduces demand for borrowing which reduces equilibrium interest rate.
  - ▷ Problem: Someone facing borrowing constraint for bonds is likely to face borrowing constraint in buying stocks—this implies that both equity and bond returns fall.
- ▷ Idea 3: Market segmentation—not everyone in the economy trade stocks (only 30%). Maybe only the per-capita consumption growth path of active traders should be looked at.
  - ▷ Problem: Trader's consumption growth path covaries with considerably more with stock returns but still not large enough. Still requires implausibly risk averse individuals.

Conclusion Ad hoc patching of standard model does not get at the fundamental that must be driving the puzzles. We must seek to identify the fundamentals. But he has no idea what they might be.

4.1.2 Model answer

What does Kocherlakota (JEL, 1996) describe as the two most fundamental puzzles in asset pricing theory? What is his view about usefulness of various (more elaborate) model features in explaining these puzzles?

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One of the puzzle was first exposed by Mehra and Prescott (JME, 1985) in which they observed that, whereas return on (virtually) riskless bond has been around 1%, the return on equity has been around 7%. They use a simplified model of Lucas (Econometrica, 1978) assuming CARA utility function and find that, in order to justify a equity premium of 6%, the consumers would have to have implausibly large coefficient of risk aversion. This is the equity premium puzzle—i.e. why is the equity premium so high?—one of the two fundamental puzzles in asset pricing theory according to Kocherlakota. The other fundamental puzzle is the "flip-side" of the equity premium puzzle—the risk-free rate puzzle; i.e. why has per-capita consumption grown so quickly given that bond returns are so low? That is, if we assume high risk aversion to explain the the equity premium puzzle, the model predicts consumption to be smooth, yet we see that consumption has been growing over time.

Kocherlakota observes that, in order to explain these puzzles, one must relax at least one of the three key assumptions in Mehra and Prescott: (i) expected utility preferences; (ii) nature of market (complete vs incomplete); and (iii) transaction costs. He concludes that although modifying preferences (separating the coefficient of risk aversion from elasticities of intertemporal substitution so that individuals being risk averse does not imply that they do not like growth in consumption) can help explain the risk-free rate puzzle; none of them are able to fully resolve the equity premium puzzle. The author concludes that the universality of the equity premium puzzle implies that a resolution of the puzzle will come in the form of capturing some fundamental features of asset exchange that drive the puzzle, rather than a somewhat "ad hoc" patching of the standard model as has been attempted thus far.

5 Consumption and saving

5.1 ** Aiyagari (QJE, 1994): Uninsured idiosyncratic risk and aggregate saving

- ▷ RBC models incorporate aggregate shocks with representative agents—no idiosyncratic shock. It also assumes complete markets.
- ▷ Aiyagari removes aggregate shocks and introduce uninsured idiosyncratic risk (in the form of individual shocks to labour endowment)—uninsured means incomplete market. (No aggregate uncertainty)
- ▷ Agents then has the incentive to accumulate asset—precautionary savings—as a buffer for when times are hard (i.e. bad labour shocks). The additional desire to save means equilibrium interest rates are lower than in the neoclassical growth models (i.e. time preference). It also implies aggregate capital stock is greater.
- ▷ Optimal individual saving behaviour leads to a distribution of agents with different levels of assets depending on individual histories of labour endowment shocks.
- ▷ The model is able to qualitatively match data: (i) positively skewed income/wealth distributions; (ii) wider distribution for wealth than income; (iii) Gini coefficient is significantly higher for wealth than income.

5.2 * Guvenen, Karaha, Ozkan, Song (NBER WP, 2015): What do data on millions of U.S. workers reveal about life-cycle earnings risk?

- ▷ Earnings shocks display substantial deviations from lognormality—a standard assumption in the incomplete markets literature
- ▷ Average earnings growth over the life cycle varies strongly with the level of lifetime earnings. 25–55 years old's earnings growth: 50th percentile, 38%; 95th pecentile, 230%; 99th percentile: 1500%.
- ▷ Earnings schocks are negatively skewed; more severe as individuals gets older and/or earnings increase. Skewness due entirely to upside earnings moves becoming smaller from ages 25 to 45, and to increasing risk of a sharp fall in earnings after age 45.
- ▷ Earnings changes display very high kurtosis (thin wide tails)—far more people with very small earnings changes in the data compared to normal density
- ▷ Risk premium demanded to bear the measured earnings fluctuations using the empirical distribution can be anywhere from x4 to x40 that from using normal distribution.
- ▷ Impulse response
  - ▷ Positive shocks to high-earnings individuals are quite transitory; negative shocks are very persistent
  - ▷ Positive shocks to low-earnings individuals are very persistent; positive shocks are quite transitory

5.3 * Deaton (Econometrica, 1991): Saving and liquidity constraints

- ▷ Agents who face borrowing constraints—leads to greater precautionary saving (inability to borrow when times are bad)
- ▷ In the face of labour income shocks; assets act as a buffer allowing agents to smooth consumption by dissaving/saving
- ▷ Positive serial correlation in the shock reduces effectiveness of assets as buffer
- ▷ If labour income is random walk, those who wish to borrow but cannot can do no better than to consumer their income
- ▷ Calibrated model (positive serial correlation) implies *contra-cyclical* savings; i.e. savings rise at the onset of the slump (when income is falling), and savings is falling at the onset of the boom (when income is rising).
    - ▷ During the boom, when income is expected to rise faster than the unconditional average growth rate, consumers have no incentive to save—they would prefer consumption to grow less rapidly than income, so they would like to dissave (and only prevented from doing so by the borrowing constraints)
    - ▷ In slumps, because growth rates exhibit persistence, income is expected to fall over the immediate future, so there is incentive to accumulate assets when income is still high, to mitigate the impact of the (oncoming) slump.
    - ▷ "The fact that actual data do not look like this tells us that the aggregate data cannot be modelled as the behaviour of a liquidity constrained representative consumer."

6 Fiscal policy: Capital taxation

6.1 ** Diamond (AER, 1965): National debt in a neoclassical growth model

6.2 * Lucas (OEP, 1990): Supply-side economics: an analytical review

6.3 * Golosov, Tsyvinski (JPE, 2006): Designing optimal disability insurance: a case for asset testing

7 Price setting: Menu cost models

7.1 * Caplin and Spulber (QJE, 1987): Menu costs and the neutrality of money

- ▷ Assumes prices are always increasing (inflation is always positive)
- ▷ Firms follow (s, S) pricing policies (if prices fall below s, adjusts prices to S) individually.
- ▷ Money is neutral in aggregate (no price stickiness)
- ▷ Contrasts with Calvo-style model in which firm's timing of price adjustment is preset.

7.2 ** Golosov and Lucas (JPE, 2007): Menu costs and Phillips curves

7.2.1 Motivation

- ▷ Menu cost => sticky prices => monetary shocks can have real shocks (in NK models).
- ▷ Oft used time-dependent models (Calvo (1983)) assumes that firms do not choose *when* to change price, only the size (when is determined according to exponential distribution). BUT
  - ▷ repricing is more frequency in high-inflation environments
  - ▷ Caplin and Spulber showed that only a small fraction of firms reprice yet changes in money growth are neutral
- ▷ Idea: let firms choose when, as well as how much, to change prices.

7.2.2 Model

- ▷ Repricing of good is subject to a menu cost (variable and depends on the hours needed to change prices/wages)
- ▷ Monopolistically competitive firms.
- ▷ Firms face idiosyncratic shocks (productivity) and general/aggregate shocks (inflation)—introduction of idiosyncratic shock is a new feature of this model

7.2.3 Finding

- ▷ Monetary shocks have almost no impact on the frequency with which firms change prices
- ▷ Shocks' real effects are dramatically less persistent than with Calvo setting; i.e. responses to an unanticipated increase in money on output/employment/prices are small and transient (unlike in Calvo/NK settings)
  - ▷ In a menu cost model, a positive aggregate shock induces the lowest-priced firms to increase prices. It also offsets negative idiosyncratic shocks, causing some firms which would have otherwise decreases prices to wait. Thus, the lowest-priced firms do most of the adjusting.
  - ▷ In a Calvo setting, firms get the opportunity to reprice randomly, even firms who were already close to the desired price, so the average response of prices to the shock is much smaller.

- ▷ Fraction of firms that reprice (in a given time interval) increases with higher inflation.
- ▷ "What matters is not so much how many prices are changed but which prices are changed."

7.3 * Bils and Klenow (JPE, 2004): Some Evidence on the Importance of Sticky Prices

- ▷ Previous evidence: prices change once a year.
- ▷ Median frequency of price changes 20%/month = 4.3 months. Excluding sales,5.5 months
- ▷ Frequency of price changes differs dramatically across goods.
- ▷ For nearly all consumer goods, time-dependent sticky price models (e.g. Calvo) predict inflation rates that are much more persistent and much less volatile than data. Particularly, over-predict persistency and under-predict volitionality for goods with less frequent price changes.
- ▷ Model with synchronised price changes (or large sector-specific shocks under state-dependent pricing) within sectors might explain volatility and persistency observed in actual inflation rates.

7.4 * Nakamura and Steinsson (QJE, 2008): Five Facts about Prices: A Re-evaluation of Menu Cost Models

(i) Frequency of price changes:

- ▷ Consumer prices: (median) frequency of non-sale price change (~10%/month=9.5 months) is half of that including sales (~20%/month=4.5 months)
- ▷ Finished goods: (median) frequency of price change is comparable to that of consumer prices excluding sales (~10%).
- ▷ Frequency of regular price change across sectors differ considerably (vehicle fuel vs others)

(ii) Size of price changes

- ▷ Median change is 8.5%
- ▷ Price decrease is larger than increases. For consumers, difference is 3.2pp and for finished goods, 1pp.

(iii) Direction of price changes: 1/3 of non-sale price changes are price decreases

(iv) Price change vs inflation:

- ▷ Frequency of price increases covaries strongly with inflation.
- ▷ Frequency of prices decreases / Size of price changes (either way) does not covary with inflation.

(v) Seasonality:

- ▷ Frequency of price change is highly seasonal.

- ▷ Frequency of regular price change declines over quarters
- ▷ In each quarter, frequency is largest in the first month and declines monotonically within the quarter

(vi) Hazard function:

- ▷ No evidence that price changes are more likely for goods whose prices have not changed for longer.
- ▷ Generally, probability of price change falls longer they remain unchanged
- ▷ With the exception of services—flat
- ▷ Calibrated model: harazard rate increasing sharply in the first few months; data: hazard rate is decreasing in the first few months.

(i)–(iv) consistent with menu-cost models. (v)–(vi) are not (seasonality is not featured in the model; hazard function can in theory be anything but data doesn't match calibrated models)

8 Monetary theory: models of payments

8.1 ** Freeman and Kydland (AER, 2000): Monetary aggregates and output

[This paper is more about an exposition of how to model homogeneity of money supply than anything else]

8.1.1 Stylised facts

$M1$ is a measure of money supply consists of cash and demand deposits (i.e. money held in current/checking accounts). Money multiplier is the ratio of $M1$ to the money base (central bank's money, also called high-powered money, which is the sum of cash and reserves (reserves includes demand deposits)), MB. The stylised facts are from Freeman and Kydland (2000).

(i) $M1$ is positively correlated with output.

(ii) Money multiplier and deposit-to-cash ratio are positively correlated with real output.

(iii) Price level is negatively correlated with real output

(iv) Correlation of $M1$ contemporaneous prices is substantially weaker than the correlation of $M1$ with real output;

(v) Correlations among real variables are essentially unchanged under different monetary-policy regimes;

(vi) Real money balances are smooth than money-demand equations would predict

QUESTION: Does the endogenous nature of monetary aggregate account for the procyclical movement of nominal money stock?

8.1.2 Model

- ▷ Standard business cycle model with "endogenous money-multiplier model"
- ▷ No rigidities in the model (price or quantities)
- ▷ Consumption goods can be purchased with either current or bank deposits
- ▷ 2 transaction costs: check
  - ▷ Baumol-Tobin cost of acquiring money balances (to determine demand for money and to make velocity of money endogenous). In each people, a member of household makes a trip to withdraw money (cost of withdrawals plus foregone interest)
  - ▷ fixed cost of using deposits (to determine division of money balances into current and deposits) ⇒ use deposits for large transactions
- ▷ Cash-in-advance constraint: consumption must be purchased with money balances chosen at the beginning of the period

8.2 * Lucas and Nicolini (JME, 2015): On the stability of money demand

8.2.1 Goal

- ▷ Explain the empirical breakdown between money and interest rates
- ▷ Construct a new monetary aggregate that offers unified treatment of monetary facts

8.2.2 Facts

- ▷ Empirical relations connecting monetary aggregates to movements in prices and interest rates began to deteriorate in the 1980s and has not been restored
- ▷ Negative relations between money aggregate (e.g. M1)/GDP vs vs interest—caused by breakdown of the relationship of deposits (M1 = deposits + cash).

8.2.3 Messages

- ▷ Explanation for empirical breakdown
  - ▷ Regulatory changes in the 1980 increases availability of substitutes for deposits (but not for cash), including introduction of money market deposit accounts (MMDA)
  - ▷ Sweep technology that reduced cost of moving funds between accounts
- ▷ Introducing money market deposit accounts (MMDA) restores the empirical relationships

8.3 * Krishnamurthy and Vissing-Jorgensen (JPE, 2012): The aggregate demand for treasury debt

- ▷ Money offers low rate of return relative to other assets because it is a medium of exchange, has high liquidity and high safety (in offering absolute security of nominal repayment).
- ▷ Investors value these attributes of money driving the relative yield on money down.

- ▷ Same story for Treasury bonds, which are highly liquid and safe.
  - ▷ Changes in treasury supply have large effects on yield spreads (e.g. corporate Aaa/AAA vs treasury yield)
- ▷ Liquidity and safety attributes of Treasuries that drives investor's high valuation of treasuries (based on like-for-like comparison with other assets)
  - ▷ Liquidity (46bp) + Safety (27bp) = 73bp
- ▷ Government collects seigniorage from this (saving from lower cost of borrowing): 0.23% of GDP.
- ▷ Treasury interest rates are not good benchmark for riskless rates (beta 0 corporates would not be able to raise funds at treasury rates)

8.3.1 Model answer

Briefly describe Krishnamurthy and Vissing-Jorgensen's (JPE 2012) conclusion about why investors hold US Treasuries. What evidence do they offer to support their conclusions.

.....

Krishnamurthy and Vissing-Jorgensen's (2012) finds that investors hold US Treasuries for two reasons: for its high liquidity and high safety. They postulate that investors value these attributes of money driving the relative yield on money down. The evidence they present is based on the comparison of yields on like-for-like non-Treasury assets with yields on US Treasuries. They find that changes in treasury supply have large effects on yield spreads.

8.4 * Lucas (2014): Liquidity: meaning, measurement, management

8.4.1 Model answer

Briefly describe McCandless and Weber's (1995) findings, as reported in Lucas (2014), about the long-run relationship between money growth, inflation, and real output growth. Do these relationships hold in the short run?

.....

McCandless and Weber's (1995) presented cross-country evidence on the one-for-one effects of money growth on inflation. They find that there is a high positive correlation, consistent with the quantity theory of money, between money growth and inflation. However, they find that there is little correlation between money and real output in the "full sample", although they find some positive correlation in the OECD subsample.

The relationship between money growth and inflation does not hold in the short run.

8.5 * Atkeson, Ohanian (2001): Are Phillips curve useful for forecasting inflation?

- ▷ Phillips curve relates unemployment rate (or some other measure of economic activity) to inflation rate

- ▷ Idea is that there is a baseline rate of unemployment rate at which inflation is constant: NAIRU (non-accelerating inflation rate of unemployment)
- ▷ NAIRU Phillips curve are used to produce inflation forecasts
- ▷ Message:
  - ▷ NAIRU Phillips curve based forecast are no more accurate than a naiive forecast (take previous value)
  - ▷ policy makers should be sceptical of relying on particular inflation indicators

8.6 * Lucas (Econometrica, 2000): Inflation and welfare

- ▷ It is in everyone's private interest to try to get someone else to hold non-interest-bearing cash and reserves—but someone has to hold it all, so all of these effort must cancel out. As long as interest rates are positive, people could be made better off if inflation were reduced.
- ▷ Reducing inflation rate from 10% to 0% = real income increases of 1%.
- ▷ Money holding behaviour at very low interest rates is central for estimating welfare costs
- ▷ Welfare measures: (i)Bailey (1956): consumer surplus that can be gained by reducing interest rate from r to zero; (ii) [...]

8.7 * McCallum and Goodfriend (1987): Demand for money: theoretical studies

- ▷ Model: Carrying out purchases require *shopping time* which is decreasing in the quantity of real money held by the household (up to some point)
- ▷ Cash-in-advance model, which places a strict upper limit on the purchases during the period, is a special case of shopping time model, in which purchases become increasingly expensive (in terms of time). Demand for money tends to be less sensitive to changes in interest under CIA.

8.8 * Kiyotaki and Wright (JPE, 1989): On money as a medium of exchange

- ▷ Defining characteristics of fiat money is that it is intrinsically useless
- ▷ Models the selection of certain goods as a medium of exchange, including equilibria in which fiat currency arise.
- ▷ Implications
  - ▷ Medium of exchange can change over time in the model
  - ▷ Velocity is not a very good indicator of moneyness; acceptability is a much better measure of moneyness

- ▷ Speculative commodity money equilibria = dominated assets can become medium of exchange. Sometimes goods become medium of exchange "not because they wish to consume it, but because they rationally expect that this is the best way to ultimately trade for another good that they do want to consume, that is, because it is more marketable'.

- ▷ CIA models assume existence of money; doesn't say much about how money came to be medium of exchanges

- ▷ Equilibria are not generally Pareto optimal and introducing fiat money into a commodity "may unambiguously" improve welfare.

9 Bank runs and depression

9.1 ** Diamong and Dyvbig (JPE, 1983): Bank runs, deposit insurance, and liquidity

9.1.1 Model answer

Briefly describe the economic function of the banking sector in Diamond and Dybvig's (JPE 1983) model of bank runs?

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Banks transform illiquid assets by offering liabilities with a smoother pattern of returns over time. D&D showed that Bank deposits can improve on a competitive market by pooling liquidity risk.

9.2 * Friedmand and Schwartz (1971): A monetary history of the United States, 1867–1960