Credit constraints and credit losses: an unsteady state approach

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Outline

1. Choice of model, choice of method
2. What does it mean to look for the global solution?
3. Modeling credit and defaults
4. Modeling catch-up
5. Results
6. Conclusion

1.1 Motivation

- **Questions to the model**
  - When are constraints on risky credit relevant?
  - Is creditless growth an anomaly or a norm?
  - How to model default as a macroeconomically significant phenomenon?
- **Concerns about the method**
  - The popular *linearization/perturbation exercises around a "non-stochastic steady state" (NSSS)* conducted on DSGE models are at odds with the environment of risky contracts
  - "*The idea that the economy will tend in the long run to a single steady state had likely outlived its usefulness,*" Federal Reserve Bank of St Louis president James Bullard told an audience at Washington University in St Louis on August 17, 2016 (about two decades too late, it seems)

1.2 Literature

Production models with credit

- Dynamic models with borrowing, investment, production and consumption with stochastic TFP: the whole "*BGG tradition*" (following Bernanake-Gertler-Gilchrist, 1999)
- Human capital and firm financing: Garcia-Macia (2015)
- Unsecured debt through balance sheet expansion: Benes, Kumhof, Laxton (2014) *i.a.*

Critique of the NSSS, linearization and perturbation analysis

- Mild reservations to the dogma: Coeurdacier et al. (2010), Gertler-Kiyotaki-Queralto (2012)
- Quantitative demonstration of inadequacy: Aldrich and Kung (2013), Pohl-Schmedders-Wilms (2016), *same authors elsewhere*

Proper DSGE solutions with limit ergodic distributions

- Continuous time: He and Krishnamurthy (2012), Brunnermeier and Sannikov (2014)
- Discrete time: Mendoza (2010), i.a.

1.3 Approach

- A dynamic model with defaulting loans in equilibrium
- **Two kinds of capital: physical that needs to be financed and human that is associated with a non-pecuniary disutility**
- Physical capital (largely debt-financed) and human capital (only requires effort) are imperfect substitutes in the production function

1.4 Solution: why not the usual linearization around a "steady state"?

- Everything important for "**early periods**" derives from the rules chosen for the "**late periods**" ("*infinity*")
- In linearized DSGE, even a minor change "at infinity" may cause substantial revisions of the adjustment dynamics (the ***Butterfly Wing Effect*** in reverse)
- Therefore, once one sets out to define **infinity**, this should be done properly
- For models with risky debt, this requires ditching the NSSS self-delusion

2.1 Trade-offs

- **Equilibrium has to be dynamic, no "steady states" – hence technically challenging**
- Neither purely exogenous nor purely endogenous defaults suffice
- Separation of consumers and producers undesirable: defaults would be artificial and hard to justify, investment catch-up strategies disconnected from credit risk

2.2 “Modeling the infinity“

- **In our understanding, infinity is a full-fledged dynamic equilibrium (call it LTE) with optimal feedback decision rules, although with decision sets somewhat simpler than in the intermediate periods**
- In the present setting, the **Euler equation** becomes a highly nonlinear integro-difference equation in infinite horizon
- **The “curse of dimensionality“ is present if generally available solution methods are tried**
- One uses a method highly specific to the model at hand

2.3 Agents and decision spaces

- A representative "backyard" investor-producer-consumer ("yeoman economy")
- **Can invest in cash and physical capital and take bank loans**
- Interest rates on cash (R^M) and loans (R^B) are fixed constants (for now), $R^M < R^B$
- **A standard CRS production with random TFP**
- Unit labor supply

3.1 Credit Regimes

- All loans are for one period
- **One standard ("free") regime when a loan of any size can be taken at the beginning of the current period to repay past debt and finance new investment and consumption; occurs with probability ξ**
- the other ("constrained") regime requires the principal of the new loan to be fully collateralized with physical capital and cash; occurs with probability 1-ξ

3.2 Default

- **The agent may only default in the constrained regime**
- The defaulting firm gives the depreciated physical capital, cash and output over to the creditors
- **The working member of the agent household receives wage income from all the firms in the market, which he takes to be exogenous**
- Default occurs either when the agent faces negative after-interest income and cannot consume if the unsecured portion of the debt is not rolled over (which it is not, in the constrained regime; this feature is closest to the usual notion of exogenous default) or when the after-interest income, albeit positive, is less than the guaranteed labor income (endogenous default)

4.1 What is modeled prior to infinity?

- There are two capital categories: physical and human, that enter the production function through a CES term
- Human capital is 100% perishable (does not survive in periods after its use in production)
- Its supply is not fixed or ex ante constrained from above
- It has no pecuniary costs (or wage), just a disutility analogous to the usual disutility of labor
- It is neither transferrable between agents nor can be pledged as collateral
- Average TFP is lower prior to "infinity" (LTE); when the phase with HC-availability ends, average TFP jumps to a higher level

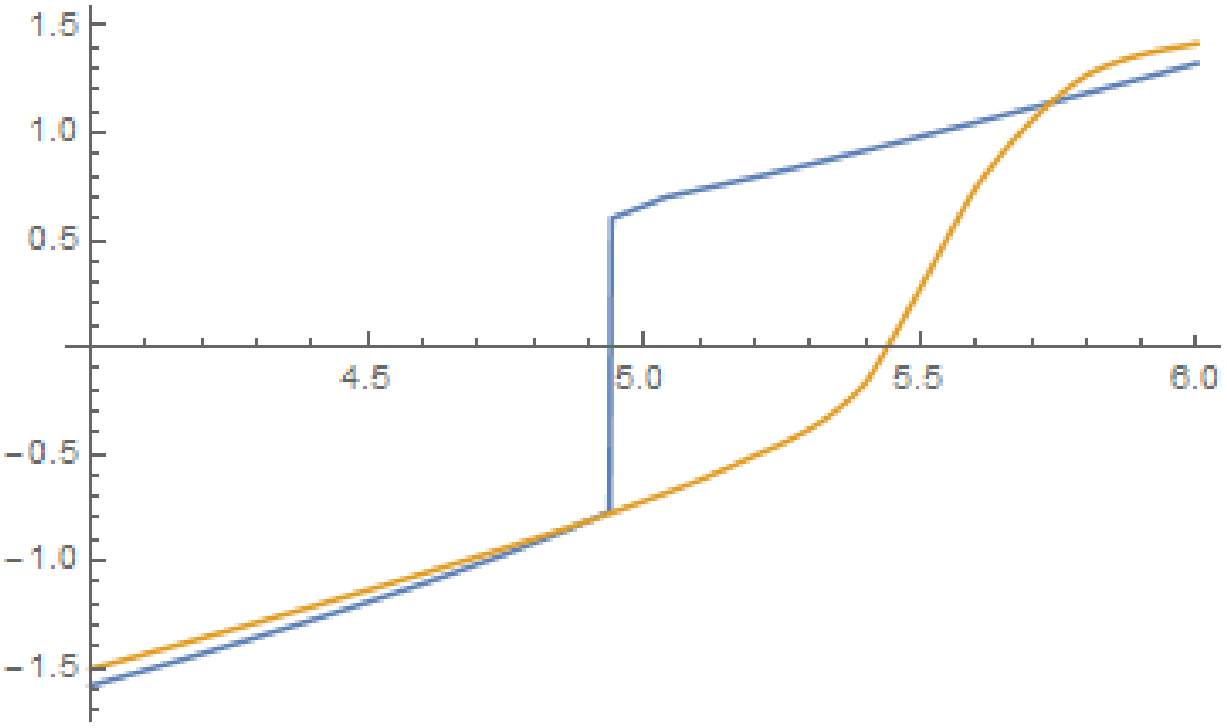
4.2 Interpretation

- An economy after an adverse supply shock, needs to work itself up to the output levels that had existed prior to it
- **There are two ways to proceed, either by borrowing a lot to purchase new PhC immediately or by putting in effort ("**knowledge-based economy**") and toil to accumulate PhC gradually until the old welfare levels are achieved**
- The first way is less painful, but generates more credit losses
- **Does one need a special policy (e.g. discouraging unsecured borrowing) to motivate people to use their brains more?**

4.3 Some properties of credit in HC-economies

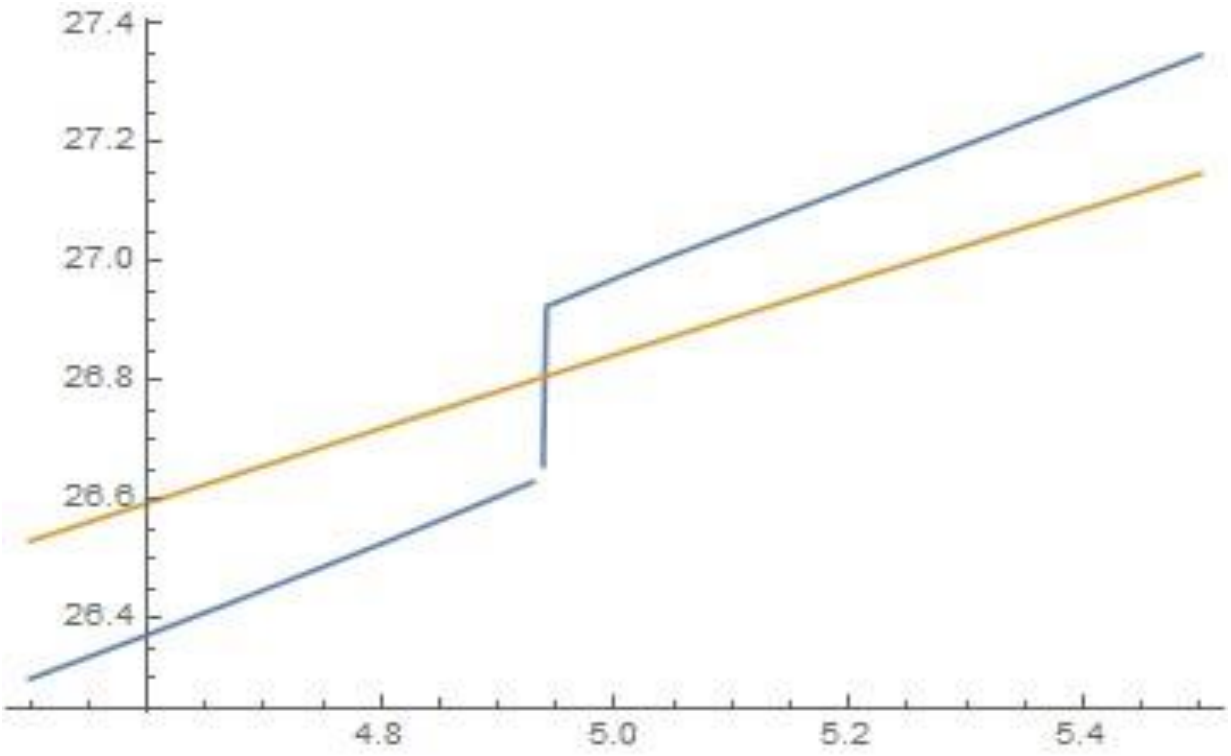
- They produce fewer defaults, and lower LGD, under comparable levels of unsecured debt than economies without human capital
- They are subject to sudden jumps in the unsecured debt levels, under initial conditions (i.e. TFP, PhC and HC) around certain – non-extreme – points
- The influence of legacy debt on decisions is weaker than in PhC-only economies

5.1 Unsecured debt as a function of current income with and without HC, no credit constraints



(*plus-sign means partially unused collateralized debt capacity*)

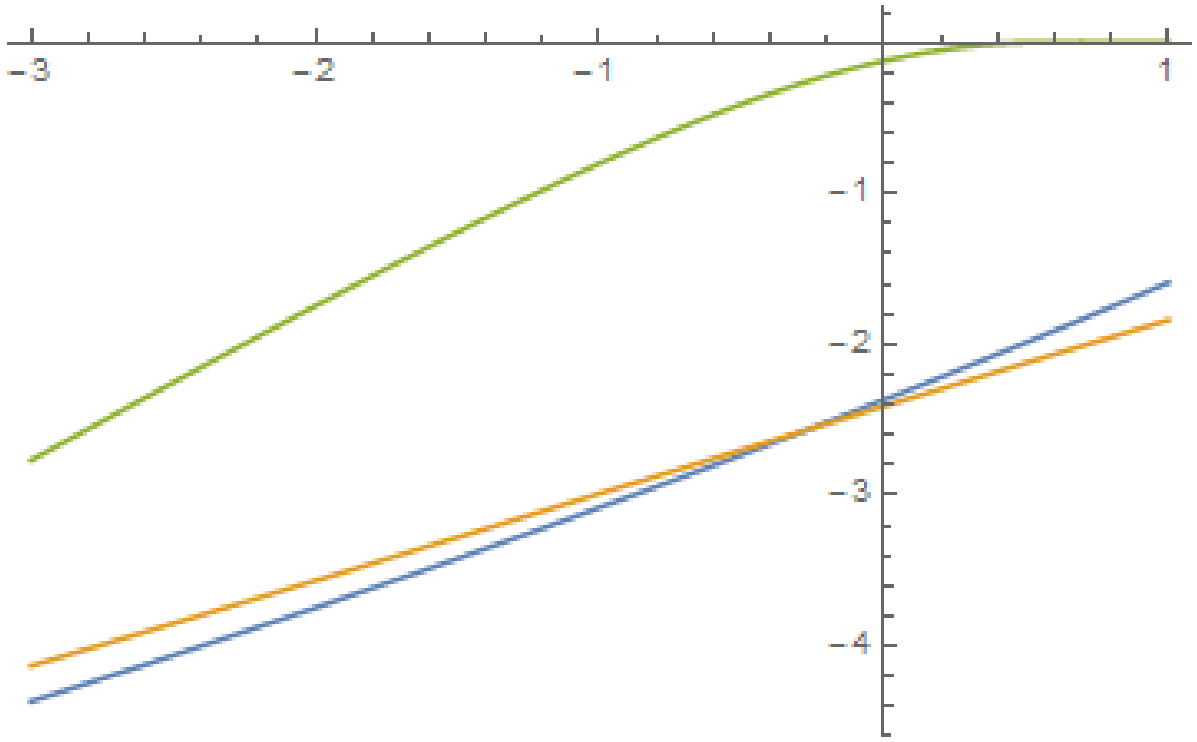
5.2 Welfare with and without restrictions on unsecured borrowing: depends on whether the economy starts as rich enough



5.2.1 "The rich are different"

- Relatively initially rich HC-economies would prefer gradualist recovery without any prudential policy pressure
- Relatively initially poor HC-economies generate more defaults under unsecured debt prohibition than comparable PhC-only economies
- **<u>Reason:</u> under non-zero unsecured debt, the default risk is too high in the local optimum**

5.3.1 Aggregate unsecured debt, future LGD (no policy), and current LGD (unsecured debt ban policy) as a function of unsecured legacy debt – **Positive HC-case**



6. Conclusions

- Creditless recovery is a generic feature of economies with a prominent role of human capital
- Well-off economies behave prudently on their own, troubled economies may use regulatory guidance to avoid a tempting lending spree
- The frontier between "well-off" and "troubled" is where credit can become unstable
- The bank balance sheet expansion needed to accommodate unsecured debt is comparable to the losses on the bad part of that debt; the current LGD from "regulatory overkill" is much smaller

Thank you for your attention

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Backups

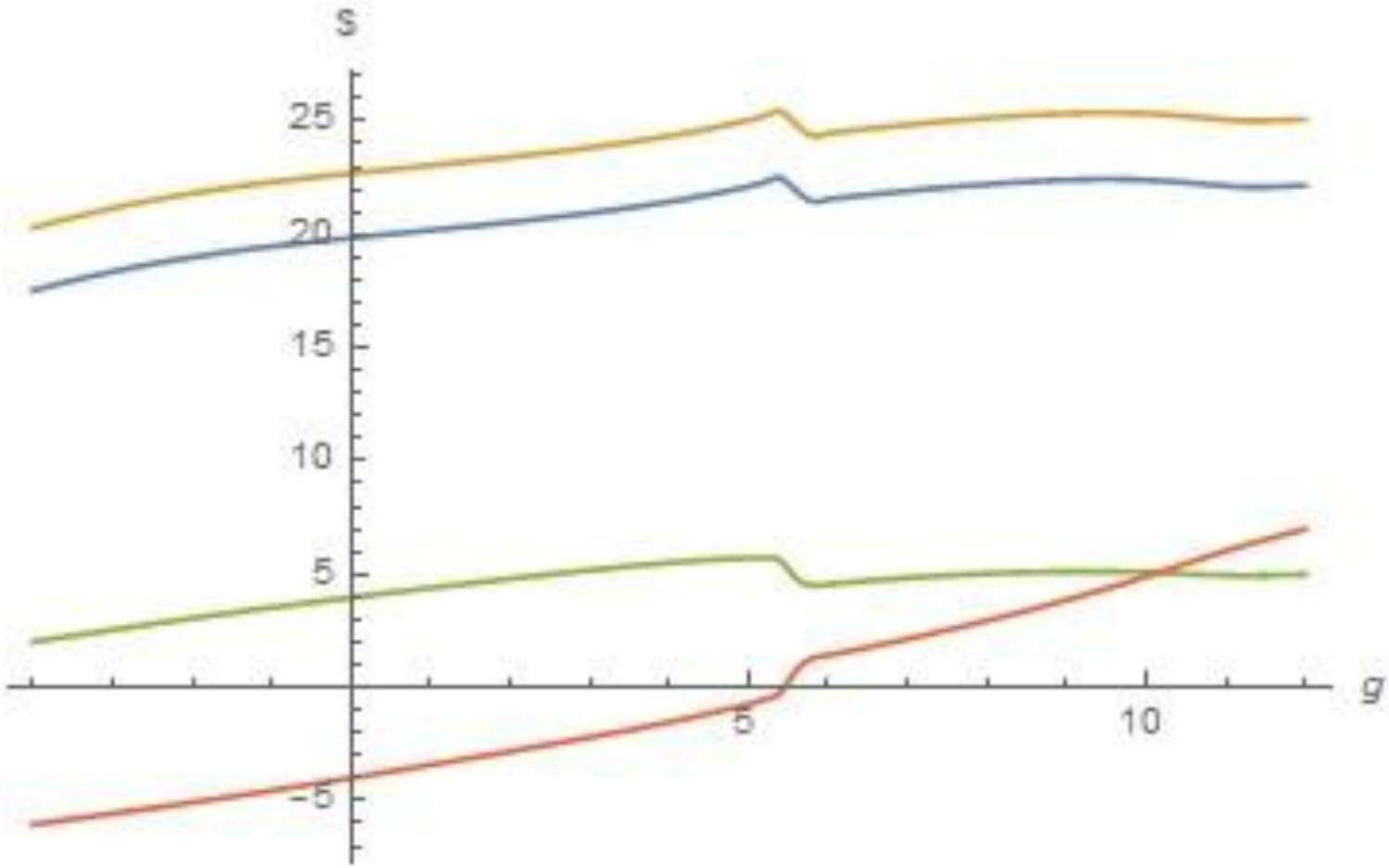
3.3 Timeline within the period

- All agents are ex ante identical with respect to future TFP
- At the start of the period, they inherit some cash, physical capital and the debt to repay
- The agent learns whether there will be the credit constraint or not, the current TFP level, and then produces
- The agent decides whether to default or repay the loan; *under default, his disposable income is set equal to the labor share, assets are lost to the creditors*
- The agent chooses the new loan size (*up to the available collateral if the credit-constrained regime is in force*), invests in new physical capital to add to the old one that underwent depreciation, and consumes

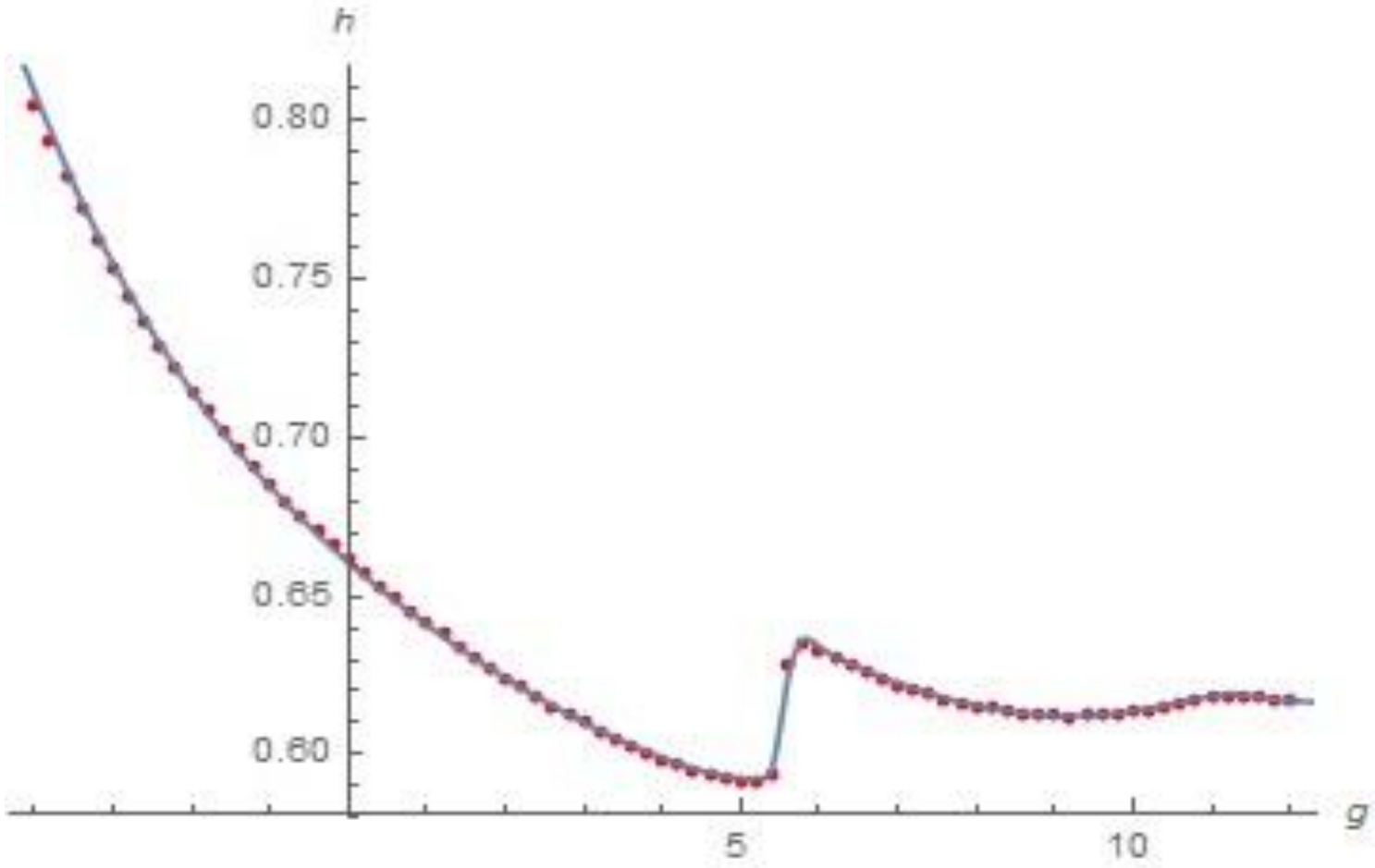
3.4 Consequences of default in equilibrium

- There is a cut-off value, A^D, of TFP below which agents default and above which they repay the debt
- There is another cut-off value, A^T , below which agents would prefer to take unsecured loans if unconstrained, and above which they borrow below the available collateral levels
- A^D and A^T depend on the current level of physical capital and legacy debt
- The mutual position of A^D and A^T is ambiguous; typically, agents with low prior debt and average TFP-realizations feel the credit constraint when it comes, but do not default ($A^D < A^T$), whereas highly indebted agents always default when the constraint comes ($A^D > A^T$), unless they get a very high TFP-realization
- However, very rich agents (low or negative unsecured debt, very high TFP-realizations) typically feel no constraint at all ($A^T \leq 0$)

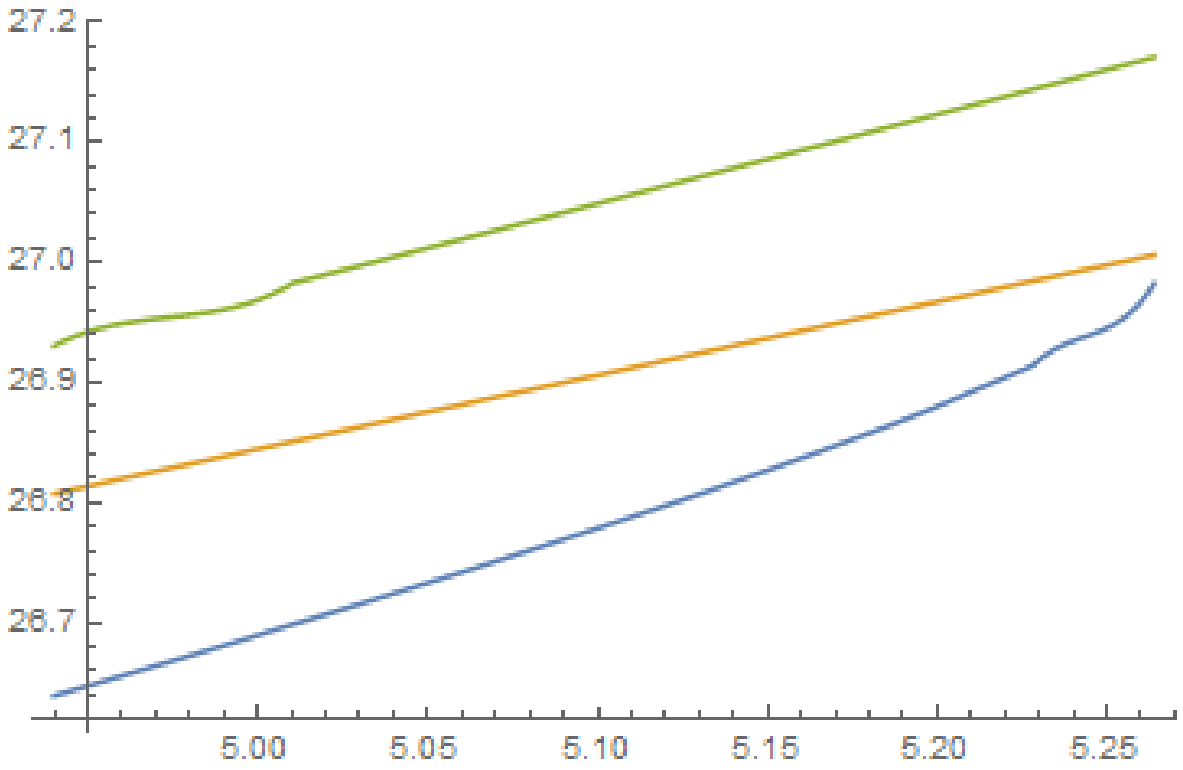
3.5 Physical capital, gross output, consumption and unsecured debt as a function of current income (in LTE, free credit regime)



3.6 Marginal utility of consumption as a function of current income (LTE)



5.1.1 Welfare gains from HC-intensive production choices (initially rich economies)



5.3.2 Aggregate unsecured debt, future LGD (no policy), and current LGD (unsecured debt ban policy) as a function of unsecured legacy debt

Zero HC (LTE) -case