Debt crises, fast and slow

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Sovereign Debt in the European Union

D-DebtCon: Distributed Interdisciplinary Sovereign Debt Research and Management Conference

September 8, 2020

Motivation and Questions

High and rising GDP ratios with the Covid-19 pandemic create vulnerability to disruptive believe debt crises

- e.g., Euro area 2010-2012

...and raise a host of policy questions:

- DSA: How should multiple equilibria be integrated in sustainability assessment?
- Debt management: are long-term bonds—issues at higher costs—effective in reducing vulnerability?
- Fiscal space: is deleveraging to be preferred to consumption smoothing?
- Official Lending: which international institutions/policy arrangements could help reducing vulnerability?

Models of belief-driven crises

- Large literature after two seminal contributions
  1. Cole and Kehoe CK (2000):
     sudden loss of market access
     (Mexico 1994)
  2. Calvo (1988) Lorenzoni and Werning (2019) LW:
     Hikes in costs of borrowing, accelerating debt dynamics
     (Brazil 1980s, euro area 2010-12)

- Do we need two classes of models?

This paper

- We show that both **rollover (fast) and slow-moving crises are pervasive in (strategic default and debt limit) models** with standard features, without relying on the specific assumption by Cole and Kehoe (2000).
  - DSA
    - Debt default thresholds shift with lenders' belief
    - rollover crises at higher debt levels
    - slow-moving debt crises at intermediate debt levels
  - Debt management
    - Longer bonds help ruling out fast (rollover) crisis, not necessarily slow-moving ones.
  - Fiscal space
    - Threat of belief-driven crises not enough to motivate deleveraging as in CK and LW.
    - In a downturn welfare-maximazing governments optimally keep borrowing to smooth consumption (**"Gambling for redemption"**)
    - Deleveraging optimal only if debt is close enough to threshold at which country is shielded from self-fulfilling sovereign risk crises.

Literature

Very large—selected titles

- **Gambling for Redemption and Self-Fulfilling Debt Crises**, Conesa, J. C. and T. J. Kehoe (2017)
- **Self-Fullfilling Debt Crises**, Cole, H. L. and T. J. Kehoe (2000)
- **Servicing the Public Debt: The Role of Expectations** Calvo, G. A (1988)
- **The Mystery of the Printing Press: Monetary Policy and Self-Fulfilling Debt Crises**, Corsetti, G. and L. Dedola (2016)
- **Slow moving debt crises** Lorenzoni, G. and I.Werning (2019)
- **Sovereign Default: The Role of Expectations** Ayres, J., G. Navarro, J. P. Nicolini, and P. Teles (2018).

Framework

Basic Environment: agents

- Benevolent government—consumers are "passive"
- Risk neutral lenders, atomistic, risk neutral, discount at β and have deep pockets

Framework

Standard

- State of the economy s $= (B,\ a,\ z_{-1})$

  B : Government debt owed to international lenders

  a : The economy is in a recession a=0 or in normal times a=1

  z : If it chooses to default, $z = 0$, and it stays in default forever. It cannot borrow from the market anymore.

- GDP $= A^{1-a} Z^{1-z} \bar{y}$, $Z < 1$, $A < 1$

  Z : output in default ($1 - Z$ is default penalty)

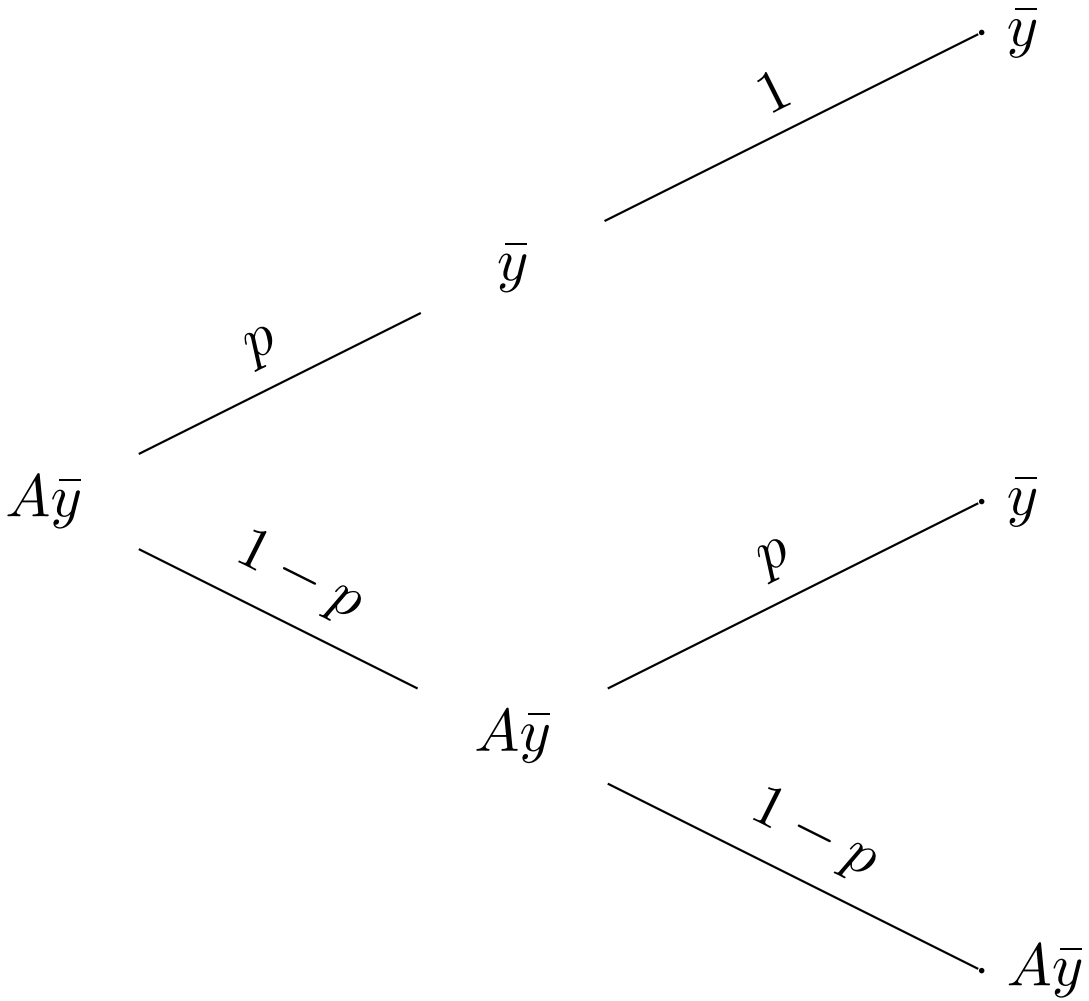
  A : output in recession ($1 - A$ is severity of recession).

  $p < 1$: probability of recovery when in a recession. Once recovered, economy never falls into recession again.

Output risk

Initial state: recession

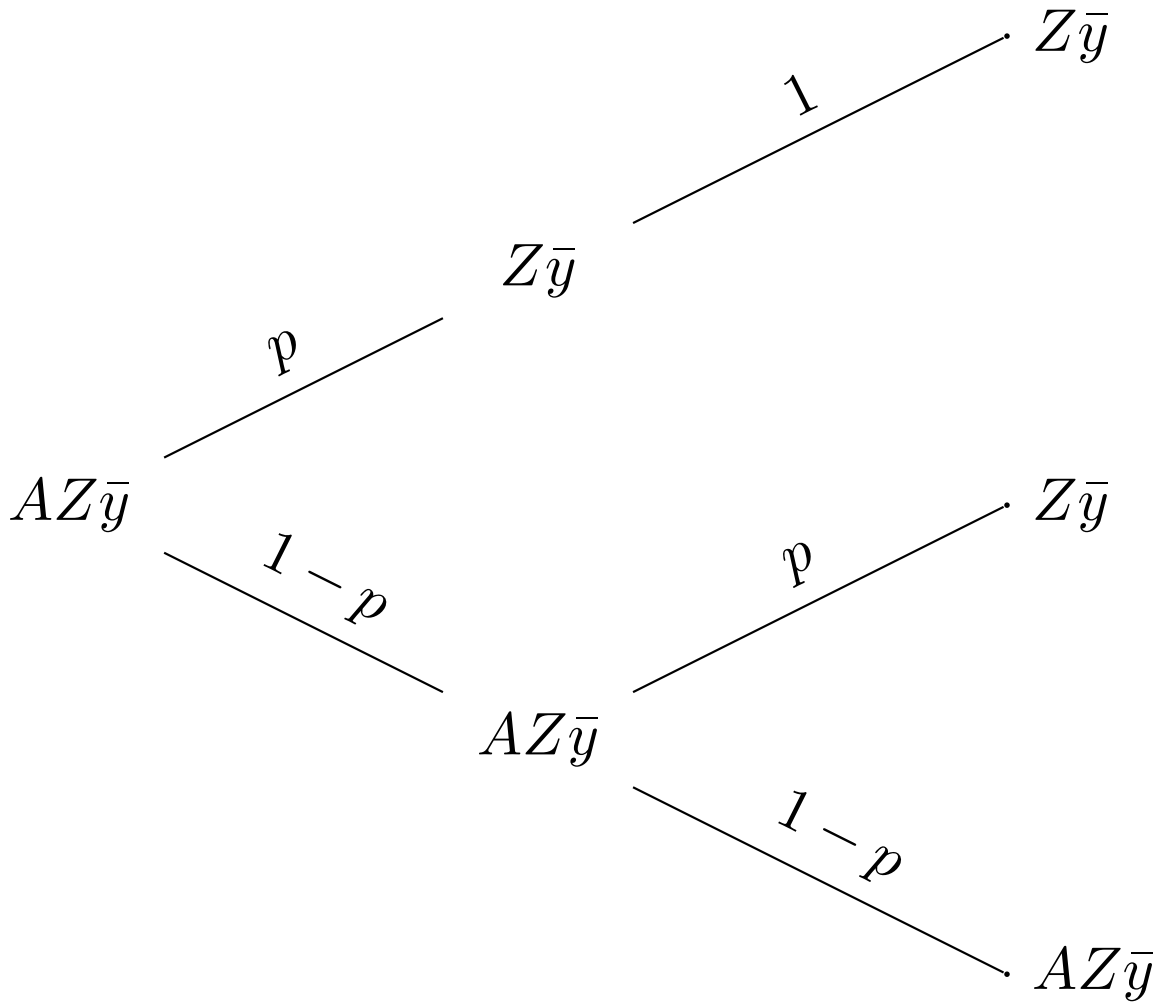
$A < 1,\ p < 1$



Output if the government defaults

If initial default

$Z < 1$: combination of permanent autarky and endowment loss



Framework

As in Cole and Kehoe (Conesa Kehoe)...

- Strategic default: gov't maximizes

$$V(s) = \max_{B',g,z} u(c,g) + \beta \mathbb{E}[V(s')]$$

issuing discount bonds.

Tax rate θ exogenous, agents consume $c = (1-\theta)y(s)$.

- The gov't chooses to repay if

$$V_{repay} > V_{default}$$

If repay, it chooses g, determining its gross financing need (GFN).

- (for "Debt limit" version: see paper).

Framework

...but Calvo "Timing"

- Lenders set bond prices q knowing the Gross Financing Need (GFN) the government would optimally choose in reaction
- The government decides its optimal GFN knowing the bond equilibrium price q

  $\Rightarrow$ bond issuance b' endogenous: $qb' = GFN$

Short-term debt example

Multiple equilibria

- If government has not defaulted in previous periods, the first order condition of lenders' problem is:

$$q(b', s) = \beta \mathbb{E}\left[z\Big(B'(q(b'(s'), s'), s'), s', q(b'(s'), s') \Big) \right] \quad (1)$$

$$\text{where } s' = s'\big(q(b'(s), s)\big)$$

$$\text{bond price} = \text{risk-free price} \times \text{probability of repayment}$$

- Multiple values of $q(b', s), b'$ solve (1) $\Rightarrow$ Multiple equilibria. In our framework:
  - safe price: $q = \beta$
    default risky: $q = \beta p$

Debt tolerance thresholds contingent on output/expectations

As in Cole and Kehoe, these define maximum level of debt at which gov't repays in normal times ($\bar{B}(1)$) or in a recession ($\bar{B}(0)_{opt}$,$\bar{B}(0)_{pes}$), depending on optimistic or pessimistic expectations (opt, pes).
They solves

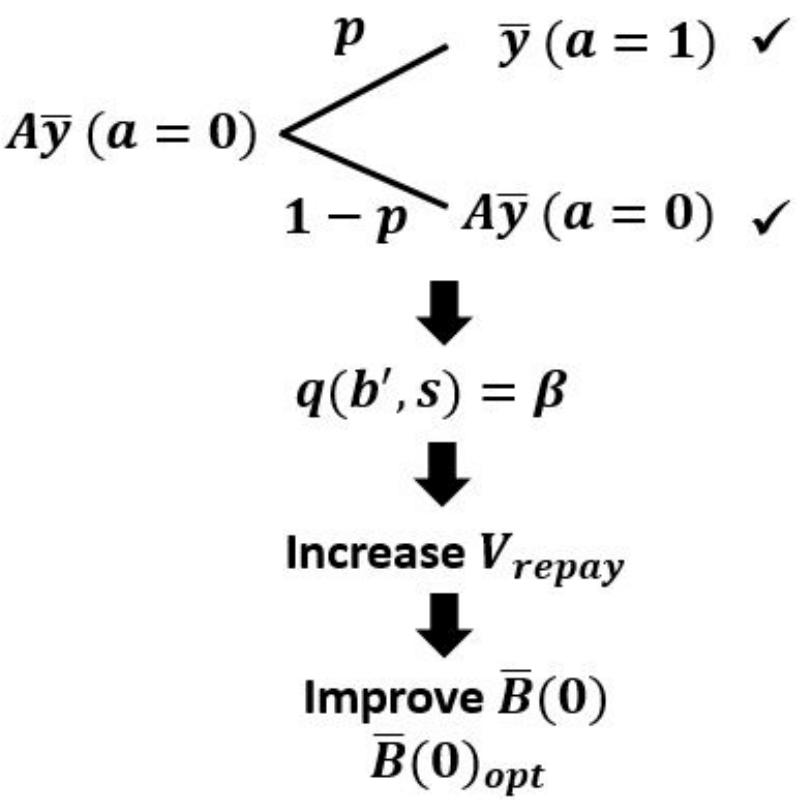
- $V_{repay}(\bar{B}(1), a = 1) = V_{default}(a = 1)$
- $V_{repay}(\bar{B}(0)_{opt}, a = 0, opt) = V_{default}(a = 0)$
- $V_{repay}(\bar{B}(0)_{pes}, a = 0, pes) = V_{default}(a = 0)$

where $\bar{B}(1)$ is unique by (simplifying) assumption (once the economy recovers, no more output risk, no multiplicity.)

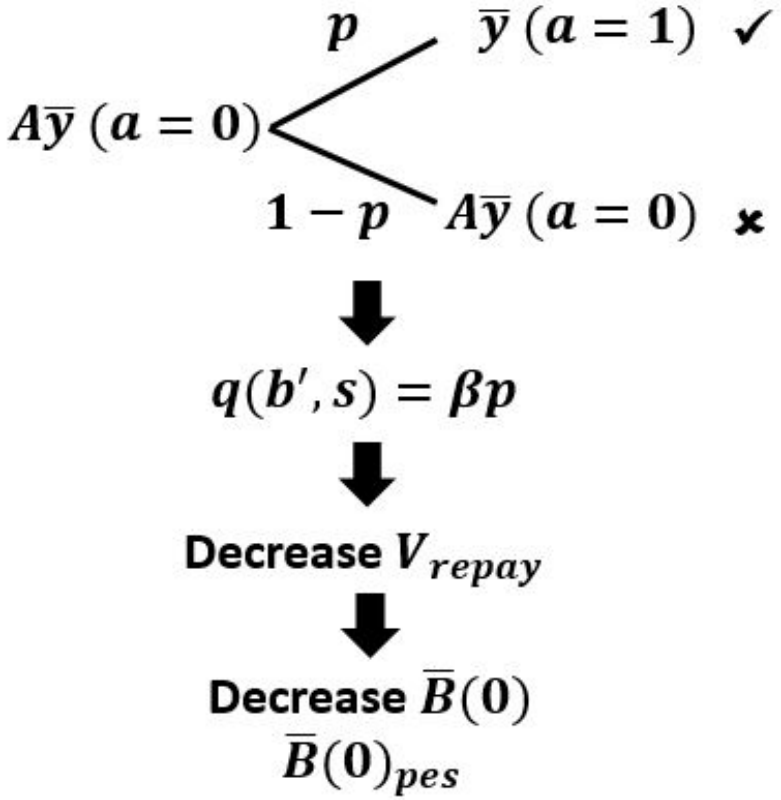
Debt tolerance threshold contingent on output/expectations

$\bar{B}(0)$ (in a recession) not unique

Panel 1: Optimistic



Panel 2: Pessimistic



$$\bar{B}(0)_{opt} > \bar{B}(0)_{pes}$$

We introduce a new, useful debt threshold

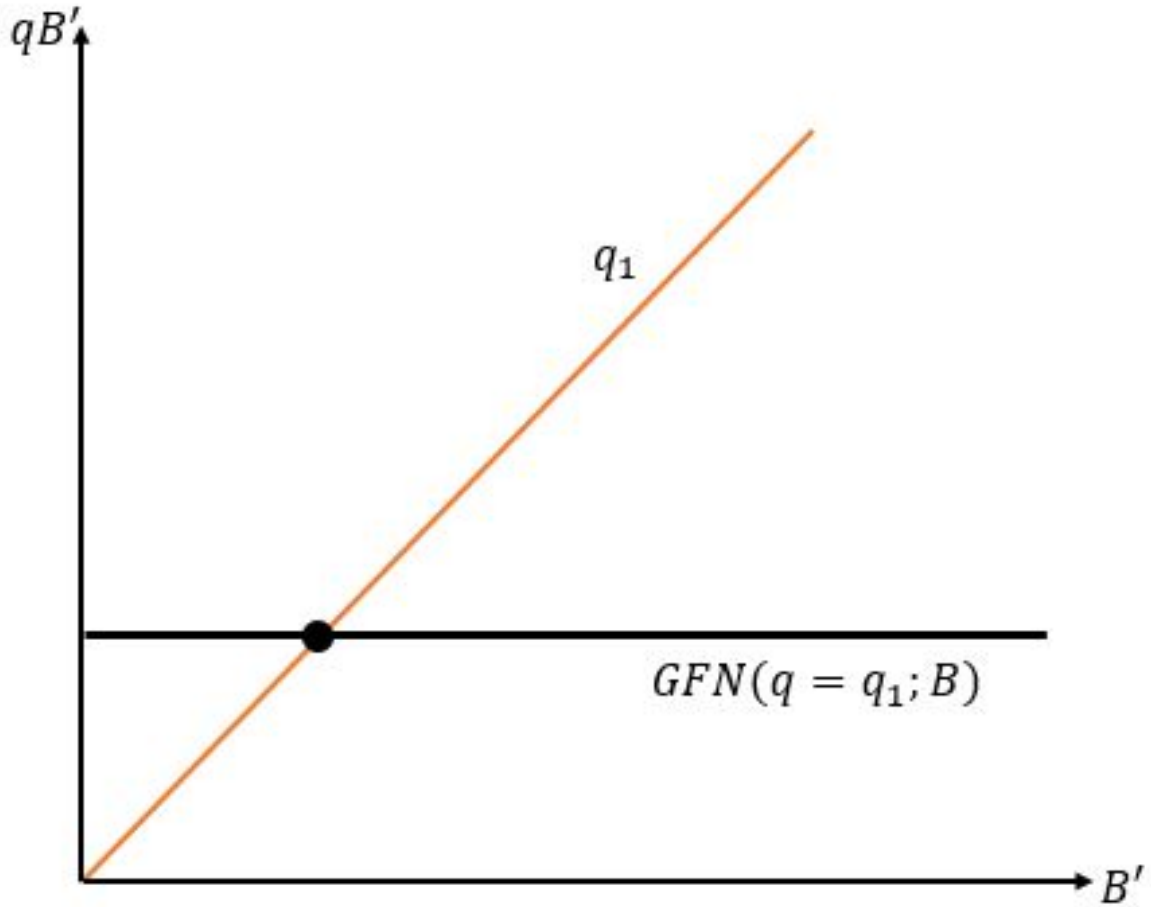
B_N: maximum amount of the initial debt level in a recession below which the country is immune to pessimism.

- At B_N, the default-risky bond price ($q = \beta p$) cannot solve the lenders' FoC.

$$B_N = \sup_{b'} \left\{ \underbrace{q(b', s)}_{=\beta p} \neq \beta \mathbb{E}\left[\overbrace{z\left(\underbrace{B'(q(b'(s'), s'), s')}_{<\bar{B}(0)}, s', \underbrace{q(b'(s'), s')}_{\bar{B}(0)=\bar{B}(0)_{pes}} \right)}^{=1} \right] \right\}$$

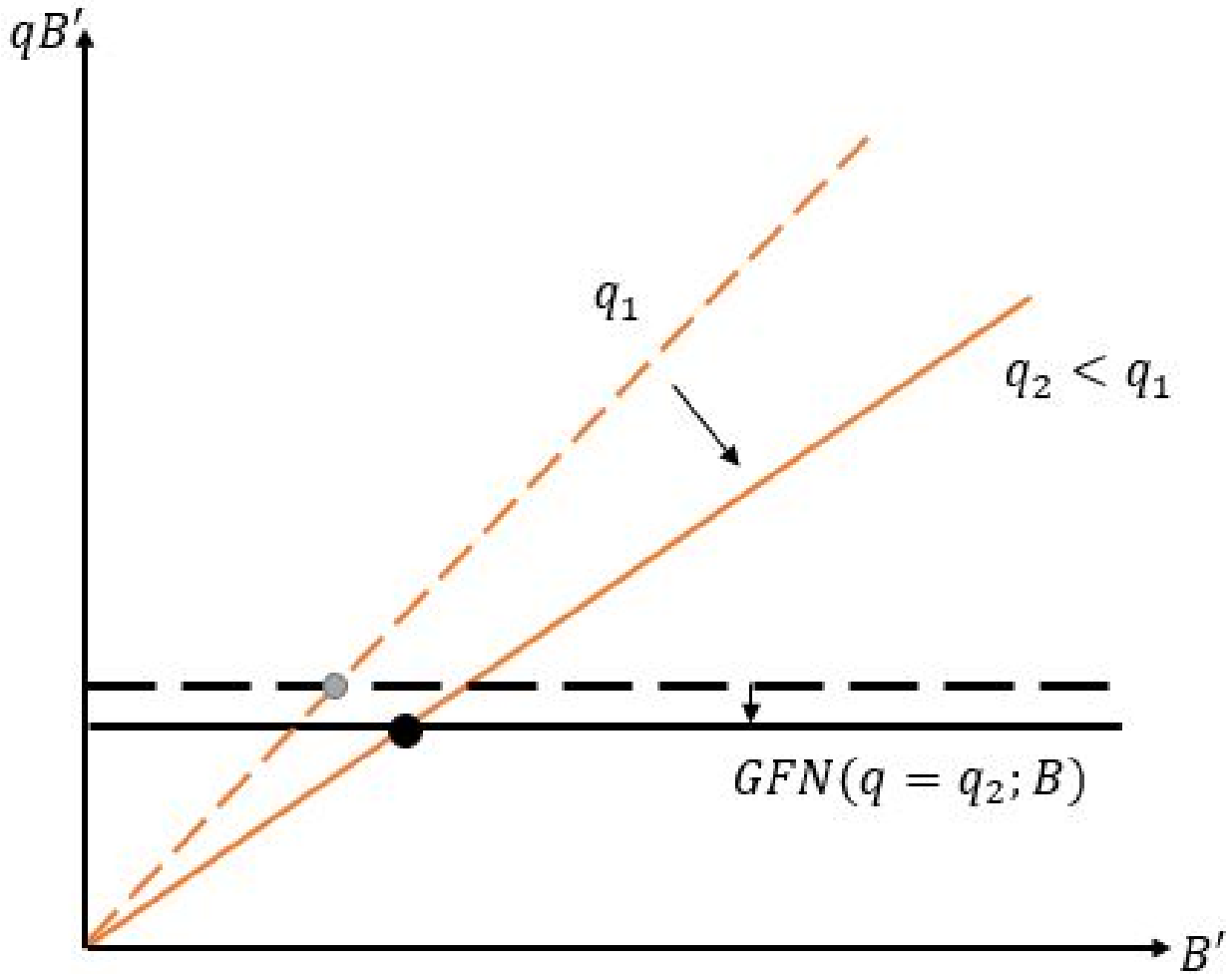
Graph: in equilibrium, GFN must be financed

$$qB' = \underbrace{B + g - \theta A\bar{y}}_{GFN(q;B)}$$



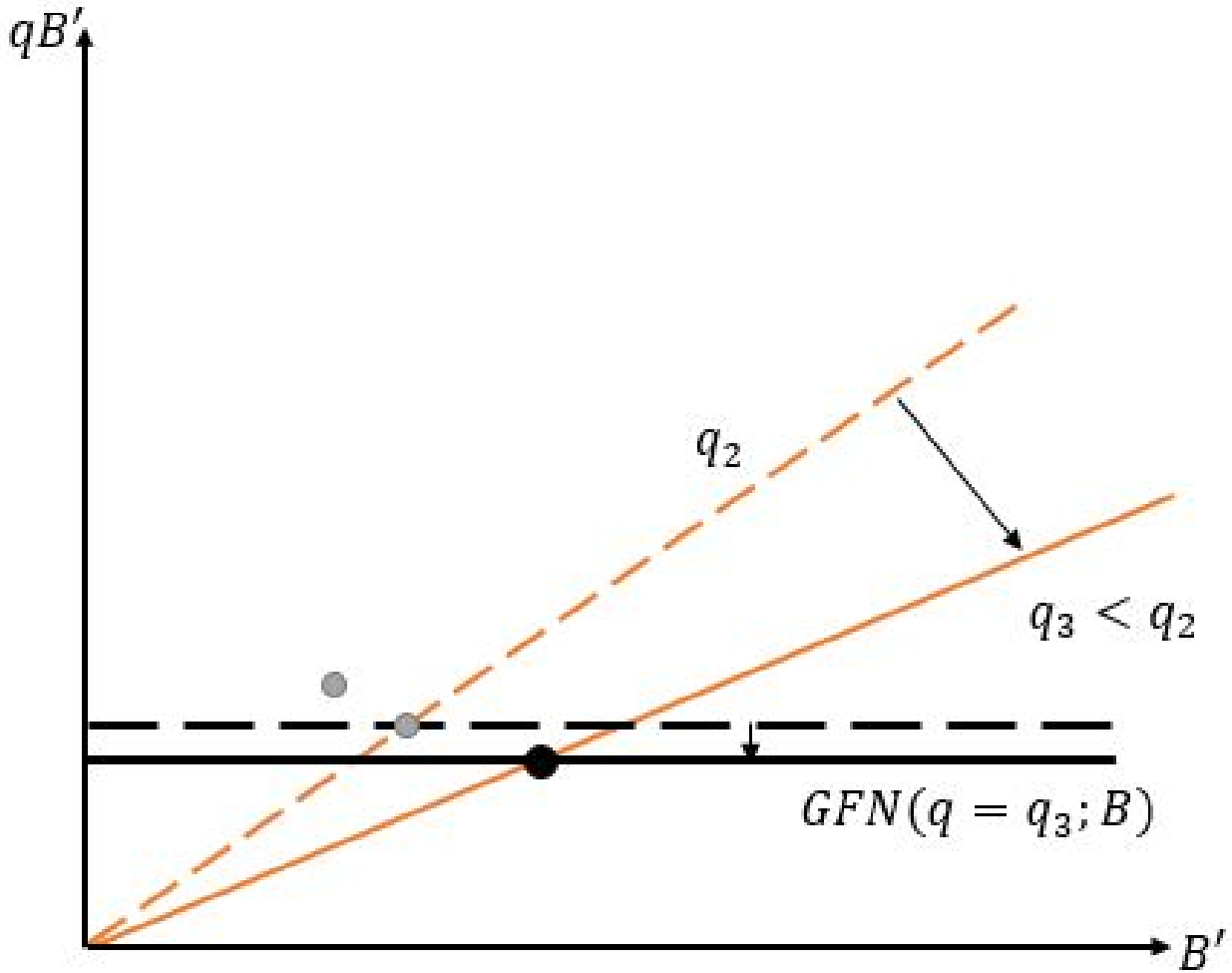
If market conditions deteriorate, q lower $\Rightarrow$ GFN lower, B' higher

$q_1 > q_2$: the government optimally 'trims' spending, yet needs to issues more B'



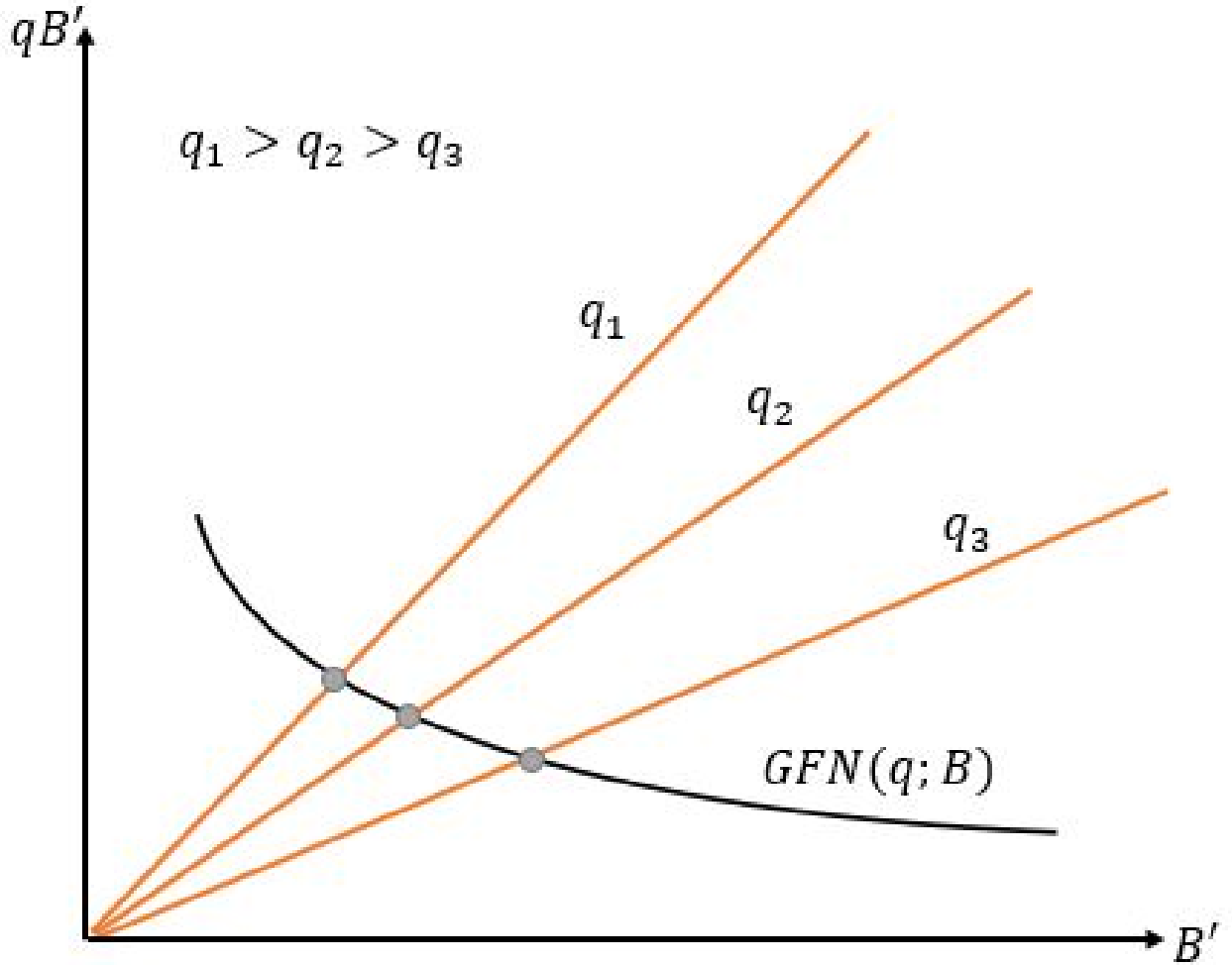
Further deterioration of market conditions

$q_1 > q_2 > q_3$



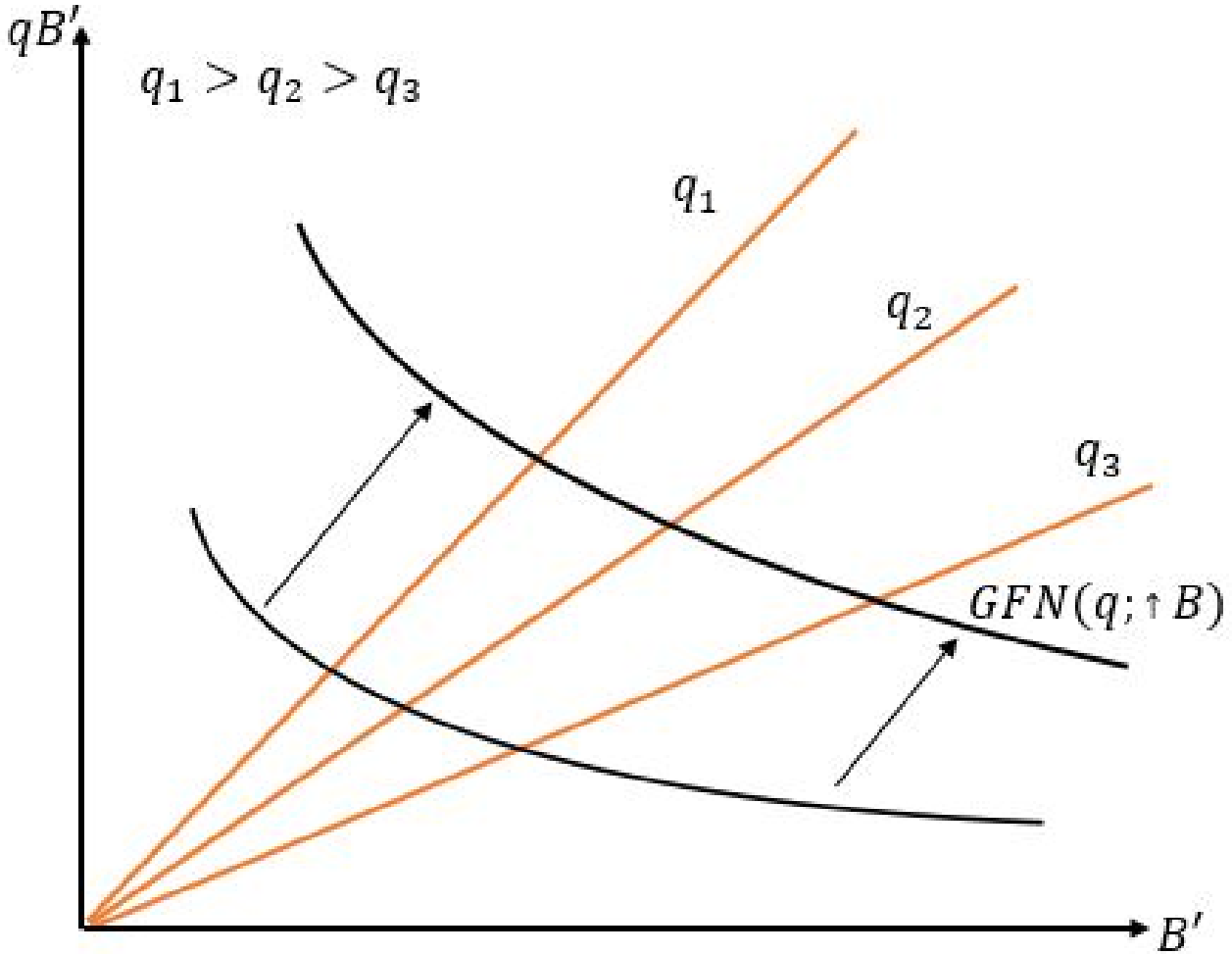
Drawing the GFN schedule

as a function of $q_1 > q_2 > q_3$



Higher debt shifts up the GFN schedule

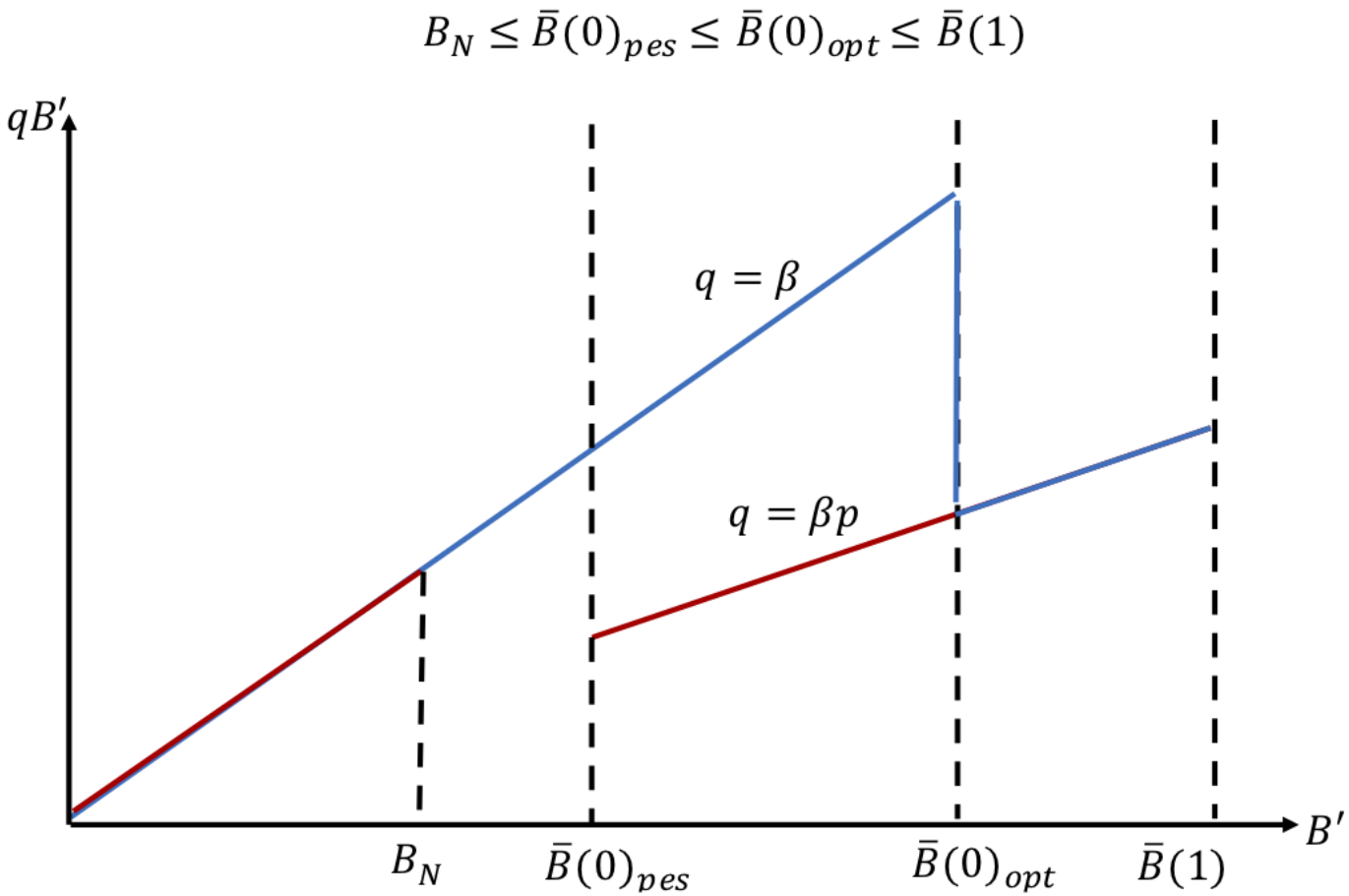
$q_1 > q_2 > q_3$



Enter debt tolerance thresholds and Laffer Curve

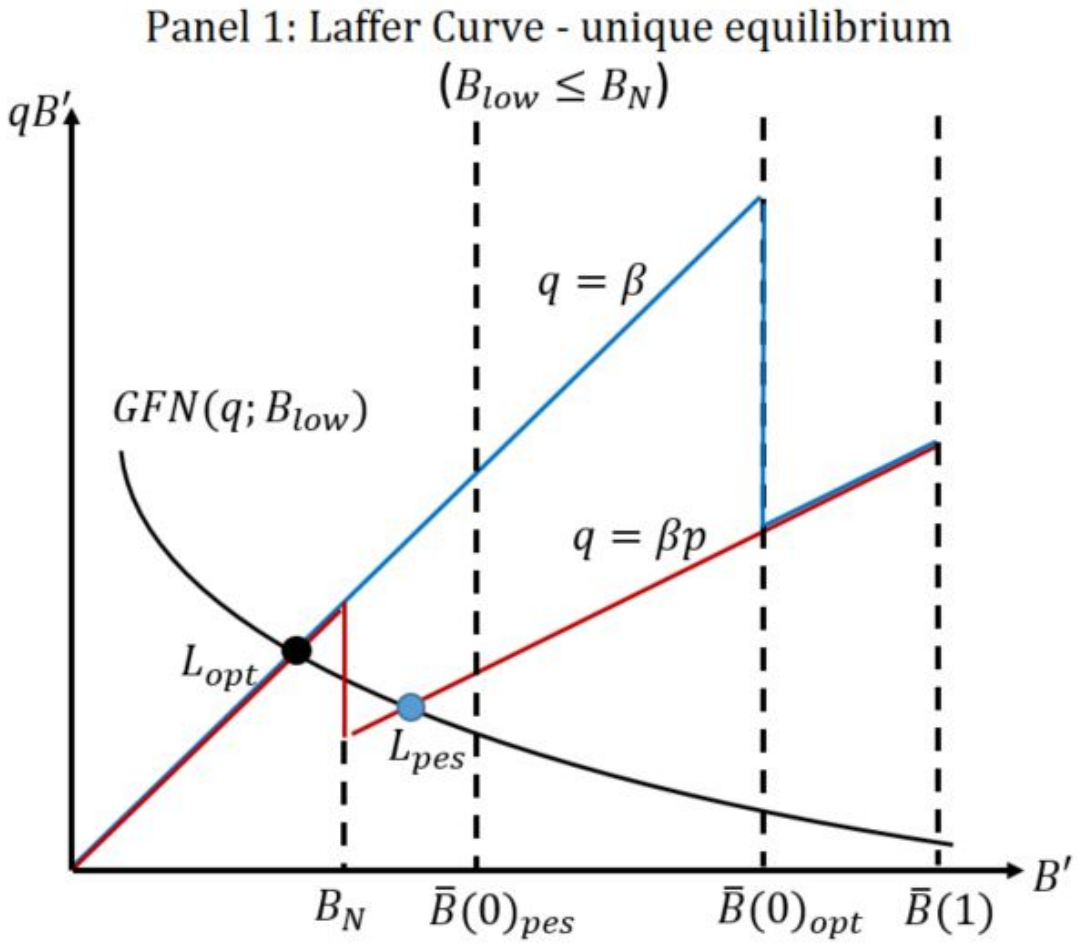
Thresholds B_N, $\bar{B}(0)_{pes}$, $\bar{B}(0)_{opt}$, $\bar{B}(1)$

Equilibrium prices β, βp



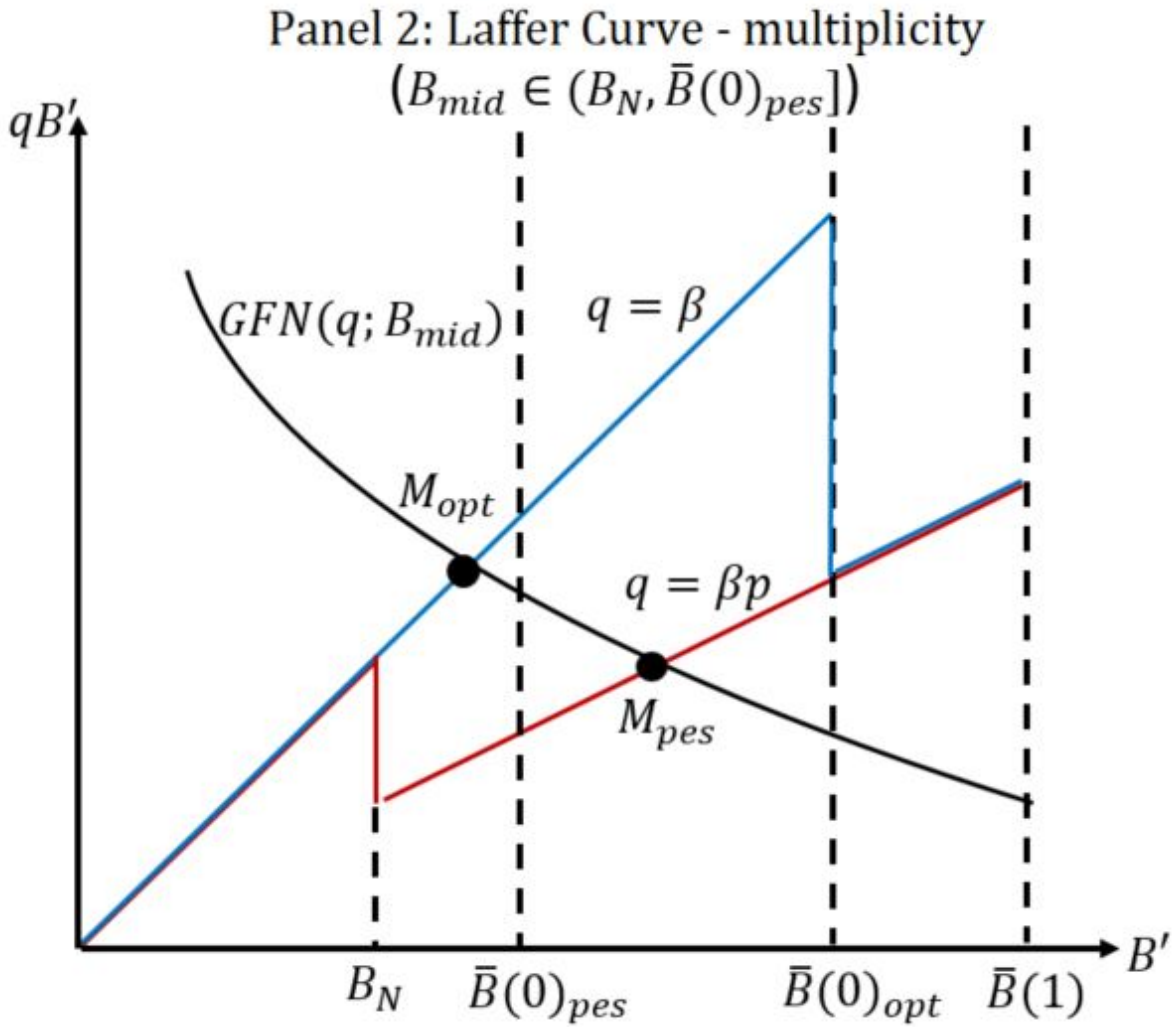
Crises: none, slow and fast

Debt sufficiently low



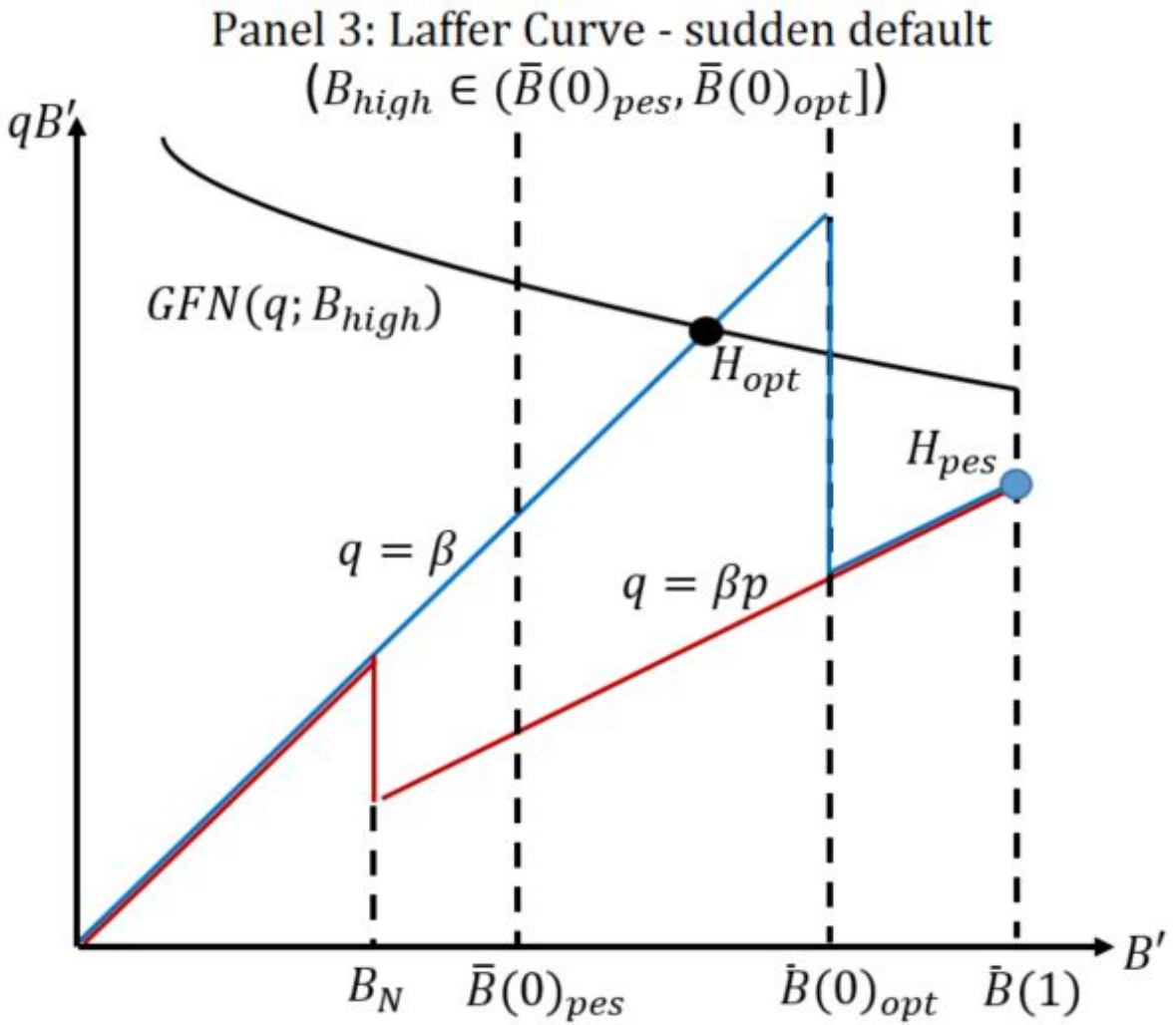
Crises: none, slow and fast

Intermediate debt



Crises: none, slow and fast

High enough debt

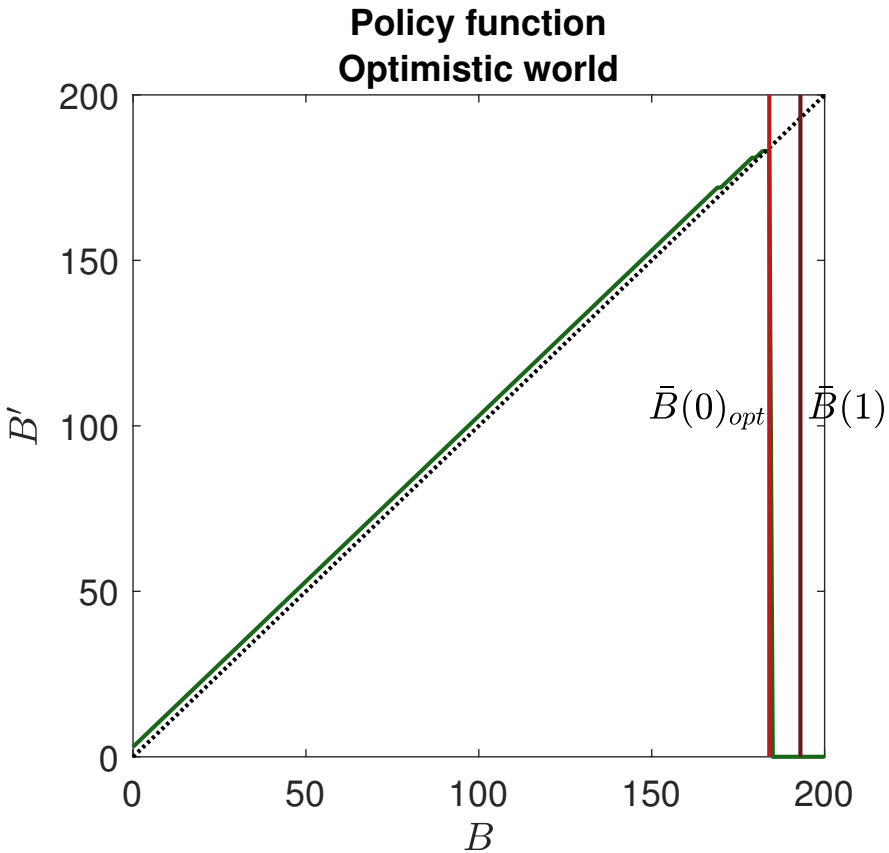


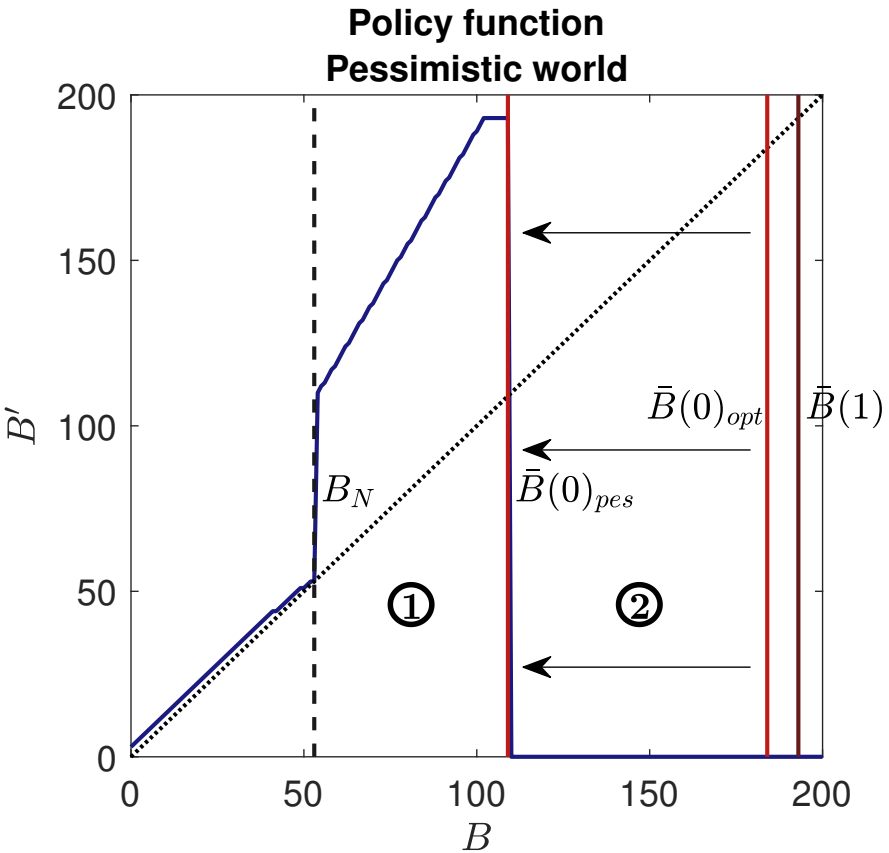
Crises: none, slow and fast
Why isn't borrowing at H_{pes} an equilibrium?

- Lenders only buy bonds at risky (low price) if B' is within $\bar{B}(1)$
- At $q = \beta p$ the government is unable to contain financing needs below $q\bar{B}(1)$
- Under rational expectations, lenders anticipate default, and refuse to buy bonds: sudden stop occurs .

Policy function with long-term debt (5-year)

$\bar{y} = 100$, $A\bar{y} = 90$, $p = 0.2$, $1 - Z = 5\%$



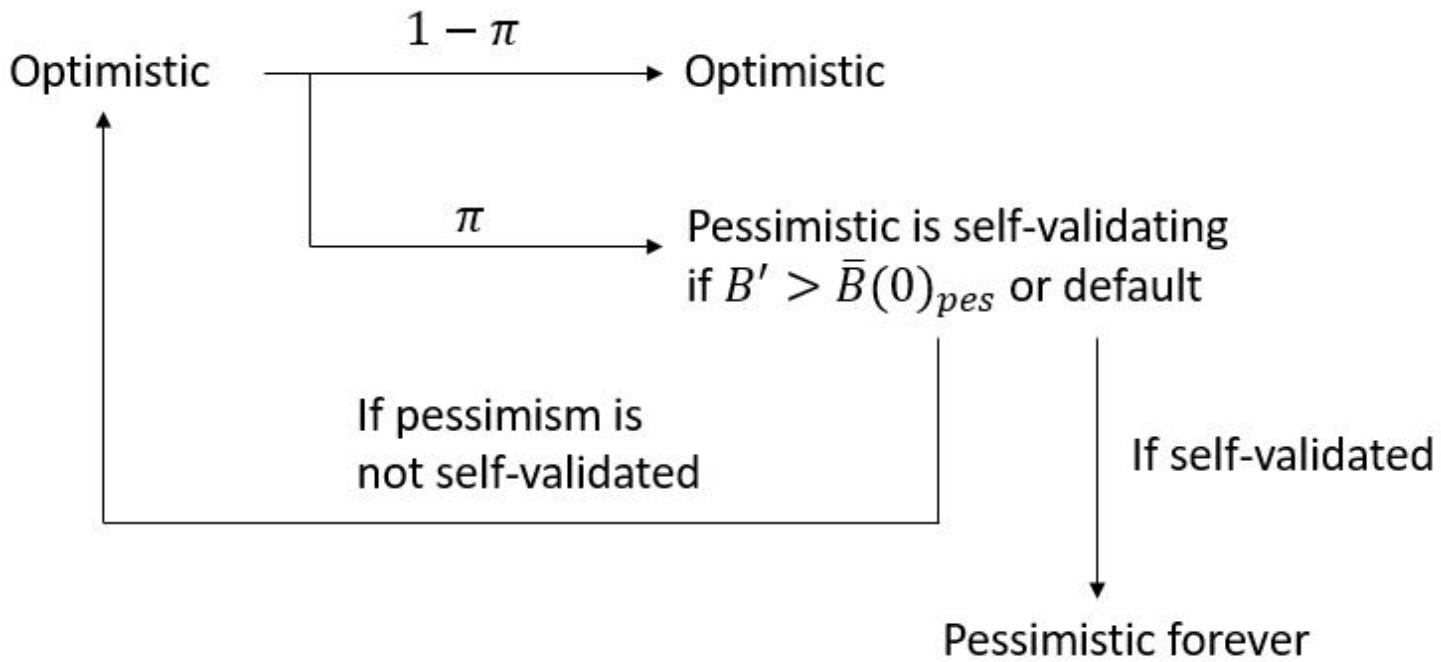


- No crisis $[0, B_N]$, slow-moving $(B_N, \bar{B}(0)_{pes}]$, fast $(\bar{B}(0)_{pes}, \bar{B}(0)_{opt}]$

Parameters

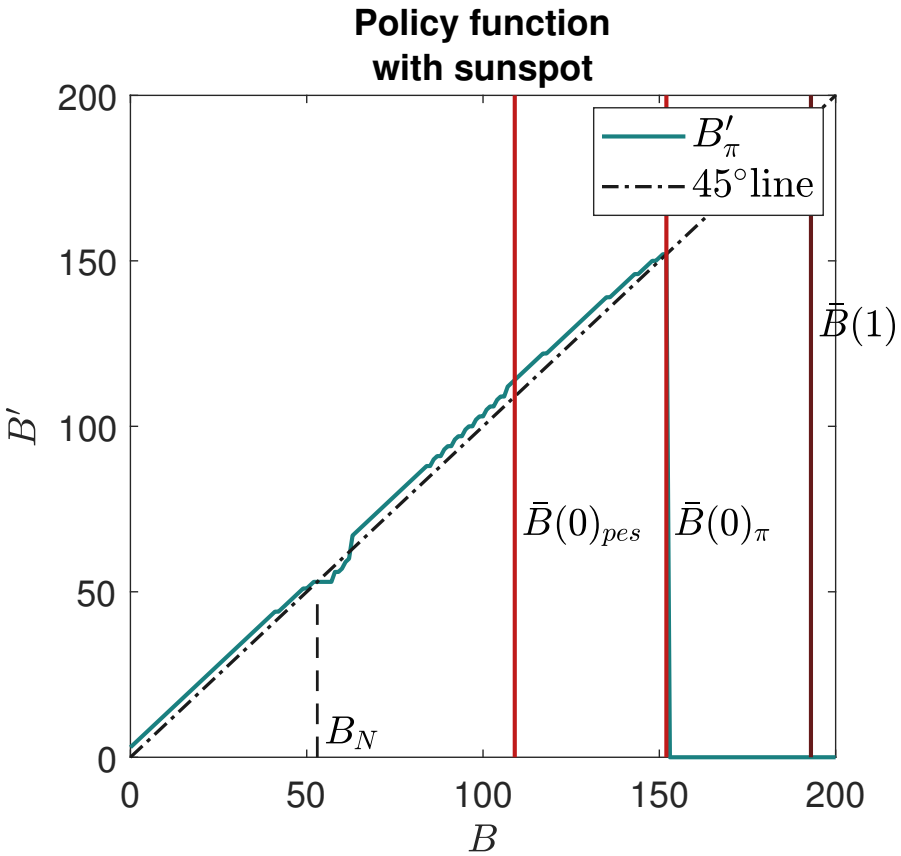
Sunspot

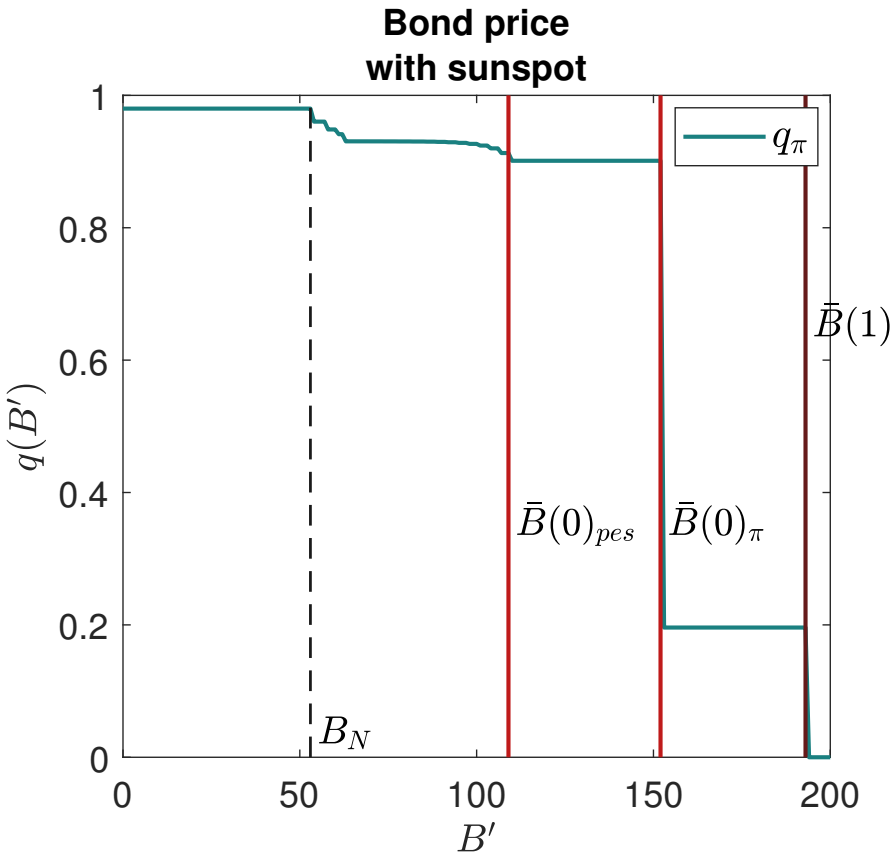
- Lenders are optimistic at $t = 0$, and may turn pessimistic with probability π.
  If crisis, they remain pessimistic forever afterwards



Sunspot: no deleveraging away from $\bar{B}_N$

Long-term debt (5-year) $\pi = 4\%$, $\bar{y} = 100$, $A\bar{y} = 90$, $p = 0.2$, $1 - Z = 5\%$





- Deleveraging optimal only around B_N—even if by reducing B below $\bar{B}(0)_{pes}$ or $\bar{B}(0)_\pi$ gov't would ultimately benefit from higher bond prices (lower borrowing costs).

Conclusion

- Multiplicity of equilibria is pervasive in debt default model featuring discretionary policymakers.
  - Debt thresholds shift with lenders' belief
  - None, slow, and fast (rollover) crises are possible depending on the initial debt level
- In sunspot equilibria, forward-looking benevolent governments generally prefer to run deficits in a recession.
  - The threat of belief-driven crisis is not enough to motivate risk reduction policies, opposed to Lorenzoni and Werning (2019) and Cole and Kehoe (2000)

Calibration

$$u(c, g) = log(c) + \gamma log(g - \bar{g})$$

$\bar{y}$	Output	100
β	Discount factor	0.98
Z	Cost of defaulting	0.95
γ	Relative weight of c and g in the utility function	0.20
θ	Government revenue as a share of output	0.36
$\bar{g}$	The critical level of expenditure	25
δ	Amortization rate of government debt	0.2
A	Fraction of output during recession	0.9
p	Probability of leaving the recession	0.2

Source: Conesa and Kehoe (2017)

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