

Fiscal Federalism and Monetary Unions

Rafael Berriel¹ Eugenia Gonzalez-Aguado² Patrick Kehoe³ Elena Pastorino⁴

¹Stanford ²TSE ³Stanford ⁴Stanford and Hoover

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 - *“We should know over which matters several local tribunals are to have jurisdiction, and in which authority should be centralized.”*

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 - “*What tasks should the EU have and which ones should be left to the Member States*”

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Next: what are the answers?

Answer from *Small Macro Literature on Monetary Unions*

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- Centralized authority with fiscal decision making power is *always weakly better*
- Why? As in the work of Chari and Kehoe (2008) and Aguiar et al. (2017)
 - macro literature presumes that absent externalities, central and local authorities are equally good
 - so *even tiny* externalities make centralized authority better because it can internalize them
- Idea: if a country in a union increases its nominal debt, it induces the monetary authority to *inflate*
 - a decentralized fiscal authority does not take into account the costs of inflation on others
 - a centralized fiscal authority does so spends less and leads to less inflation
 - hence central authority always better because it internalizes these externalities
- Main takeaway from this literature: *no benefit to decentralized authority*

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- Local authority is better unless fiscal externalities are fairly high
- Why? As in the work of Oates (1972)
 - micro literature presumes that absent externalities, local authorities are much better
 - so need *substantial externalities* before centralized authority is better
- Idea: local authorities are better at tailoring policies to the tastes of local citizens
 - Oates (1972)'s approach: verbally presumes locals have better information
 - recent literature: micro-founded approach that similarly argues local authority is superior
 - so local authorities preferred unless there are large externalities
- Main takeaway from this literature: in general *large benefits to decentralized authority*

Our Approach to the Benefits of Centralization vs. Decentralization

- This paper: we isolate the circumstances under which centralization is preferable to decentralization
- We do so by contrasting two forces
 - *informational benefit* of decentralization in the spirit of fiscal federalism literature
 - *externality benefit* of centralization in the spirit of the macro literature

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 - * Waldfogel (1993) estimates that holiday gifts destroy 10% of their value when given from a partner
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- **Benefit of centralization:** a central fiscal authority internalizes the inflationary cost of debt

Overview

- Real model as in Oates (1972) [Berriel et al. (forthcoming)]
 - *Oates Decentralization Theorem*: absent externalities, local authorities are strictly better
 - *Cutoff Rule*: for a class of externalities, centralized authorities better iff union is sufficiently large
- This paper: monetary model with nominal debt as in macro literature
 - *Generalized Decentralization Theorem*: under commitment by MA, local authorities are strictly better
 - *Cutoff Rule*: without commitment, centralized authorities better if union is sufficiently large
- In sum: existing macro literature argues centralization is always better, we find *not* true
- Important implications for the debate on the EU enlargement
 - the degree of optimal delegation of fiscal authority should adjust as EU enlarges
 - future work: all else equal, adding *smaller* countries *less attractive* than adding larger ones

Two-Period Monetary Union: Overview

- Each region/country $i \in I$ has a representative consumer and a **local fiscal authority**
- There is a union-wide **central fiscal authority** (fiscal union)
- Fiscal authorities (local or central) choose level of nominal debt

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- Fiscal authorities (local or central) choose level of nominal debt
- Timing
 - in period 1, governments finance spending with nominal debt
 - in period 2, governments must pay real value of their nominal debt with distortionary labor taxes
- **Monetary authority** chooses inflation
 - costs of inflation: productivity is decreasing with inflation
 - benefits of inflation
 - * under commitment: *none*
 - * no commitment: ex-post inflation erodes real value of nominal debt and *lowers distortions from taxation*

Firm Problem: Inflation Cost

- Throughout the monetary policy instrument is inflation $\pi = p_2/p_1$ with $p_1 = 1$ ($\pi \geq 1$ is feasible)
- Firms in country i have a fixed amount of money M to buy inputs x that enhance productivity $A(x)$

- Firm problem

$$\max_{x_i, \ell_i} [A(x_i)\ell_i - w_i\ell_i] \quad \text{subject to} \quad x_i \leq M/\pi$$

- Think of last constraint as “cash-in-advance” constraint (with timing as in Nicolini (1998))

- So in equilibrium

$$w = A(x_i) \quad \text{and} \quad x_i = \frac{M}{\pi}$$

- **Cost of inflation:** *directly decreases* real input $x_i = M/\pi$ and hence decreases *productivity*

Government Budget Constraint

- Country i 's government budget
 - period 1: to finance g_i the government issues claim to B_i dollars in period 2 at price $1/(1 + R)$ so

$$g_i = \frac{B_i}{1 + R}$$

- period 2: collects tax revenues $\tau_i w \ell_i$ to repay real debt B_i/π so

$$\tau_i w \ell_i = \frac{B_i}{\pi}$$

- Under no commitment: this is the source of **benefits to inflation**
- Under commitment: *no* such benefit since monetary authority cannot affect ex-post real rate

Consumer Problem

- Two ways to save
 - buy *nominal* debt d_i or store *real* assets k_i with technology that has *fixed real return* r
- Period 1: endowment y_1 , consume and save, and get utility from public goods
- Period 2: supply labor, consume, and get returns on savings and labor
- Consumer problem

$$\max_{k_i, d_i, \ell_i} \{u(c_{1i}) + \theta_i h(g_i) + \beta u[c_{2i} - v(\ell_i)]\}$$

where

$$c_{1i} = y_1 - d_i - k_i \quad \text{and} \quad c_{2i} = (1 - \tau_i)w\ell_i + (1 + r)k_i + (1 + R)\frac{d_i}{\pi}$$

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- Taste θ for government spending is $\theta \in \{\theta_H, \theta_L\}$ with $q_H = \Pr(\theta_H)$, $q_L = \Pr(\theta_L)$ and mean μ_θ

Information Structure of Local and Central Fiscal Authority

- **Local authority:** perfectly observes $\theta_i \in \{\theta_H, \theta_L\}$
- **Central authority:** observes noisy symmetric signal $s_i \in \{s_H, s_L\}$ with *informativeness* $\phi \in [1/2, 1]$

$$\phi = \Pr(s_H|\theta_H) = \Pr(s_L|\theta_L)$$

- If $\phi = 1$: signal perfectly informative in that $E(\theta_i|s_i) = \theta_i$
- But if $\phi = 1/2$: signal informative in that $E(\theta_i|s_i) = \mu_\theta$

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- But if $\phi = 1/2$: signal informative in that $E(\theta_i|s_i) = \mu_\theta$
- For general ϕ use Bayes' rule so observing, say, s_H shifts posterior towards θ_H

$$E(\theta|s_H) = \frac{q_H\phi}{q_H\phi + q_L(1-\phi)}\theta_H + \frac{q_L(1-\phi)}{q_H\phi + q_L(1-\phi)}\theta_L$$

- Idea: local authority tries to communicate θ_i but this type of communication difficult
 - e.g. preferences over complex policies are nearly impossible to fully specify

Consumer Problem

- Consumer problem

$$\max_{k_i, d_i, \ell_i} \{u(c_{1i}) + \theta_i h(g_i) + \beta u[c_{2i} - v(\ell_i)]\}$$

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$$c_{1i} = y_1 - d_i - k_i \quad \text{and} \quad c_{2i} = (1 - \tau_i)w\ell_i + (1 + r)k_i + (1 + R)\frac{d_i}{\pi}$$

with FOC

$$v'(\ell_i) = A(1 - \tau_i)$$

- Convenient to change control of government from tax rates τ_i to tax revenues T_i
- We do so by multiplying the FOC for labor by ℓ_i and using that $T_i = A\tau_i\ell_i$

$$\ell_i : \quad \ell_i v'(\ell_i) = A(1 - \tau_i)\ell_i = A\ell_i - T_i$$

- To express the implied optimal ℓ_i as $\ell_i = \ell(T_i, A)$ rather than $\ell(\tau_i, A)$

Monetary Authority with Commitment

- Timing
 - monetary authority moves first, before any information or signal is realized and chooses π
 - all other agents then move, taking π as given
- Lack of arbitrage between nominal and real assets by consumers implies Fisher equation

$$1 + r = \frac{1 + R}{\pi}$$

- *no effect from π on real return on nominal bonds*
 - as π changes, nominal rate adjusts so real return on bonds constant
- What are the costs and benefits of inflation?
 - costs: inflation decreases productivity $A(M/\pi)$
 - benefits: *none* since inflation cannot affect the ex-post real rate on nominal debt

Results With Commitment

- Optimal inflation rate is zero ($\pi^* = 1$)
- Monetary economy is then equivalent to a real economy *without* externalities
- Generalized Decentralization Theorem immediately applies
- *Result*
 - If signals not perfectly informative ($\phi < 1$), a decentralized regime yields higher ex-ante welfare than fiscal union
 - The difference in welfare between regimes increases as the informativeness of signal decreases
- Contrast with results by Chari and Kehoe (2008) and Aguiar et al. (2017)
 - under commitment a centralized regime ties a decentralized regime

Monetary Authority without Commitment

- Timing: monetary authority moves *after* nominal debt decisions, so time-inconsistency problem
- Period 1
 - preferences and signals about them are realized
 - consumers and government choose spending, nominal debt and savings
- Period 2
 - monetary authority chooses π facing states $\bar{B} = (B_1, \dots, B_I)$ and $\bar{k} = (k_1, \dots, k_I)$
 - government chooses taxes on labor to pay for its real debt
 - consumers choose labor according to $\ell(T_i, A)$ with $T_i = B_i/\pi$
- What are the costs and benefits to inflation?
 - costs: inflation decrease productivity $A(M/\pi)$
 - benefits: *real value of nominal debt* \downarrow and hence distortions on labor from $T_i = B_i/\pi$ to pay for it

Indirect Fiscal Externality: Lack of Commitment by Monetary Authority

- Given utility is additively separable, the optimal choice for inflation by the monetary authority
 - does not depend on countries' preference types or information
 - but rather only on states (\bar{B}, \bar{k}) and value of period-2 utility
- Monetary authority problem with $c_{2i} = A\ell_i + (1+r)k_i$, $\ell_i = \ell(T_i, A)$, $A = A(M/\pi)$ and $T_i = B_i/\pi$

$$W_{MA}(\bar{B}, \bar{k}) = \max_{\pi \geq 1} \frac{1}{I} \sum_{i=1}^I u[c_{2i} - v(\ell_i)]$$

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- Why does this generate an *indirect* fiscal externality in a decentralized regime? Idea
 - it is indirect because government i 's actions do not *directly* enter country j 's utility or productivity
 - it arises because government of i understands its actions affect monetary policy in that

$$\frac{\partial \hat{\pi}(\bar{B}, \bar{k})}{\partial B_i} \quad \text{and} \quad \frac{\partial \hat{\pi}(\bar{B}, \bar{k})}{\partial k_i}$$

- but country i does not care about the inflation it induces in other countries

Perfectly Correlated Case: Details on Fiscal Externality

- Key to externality: what fiscal authority anticipates the monetary authority will do in two regimes
- For simplicity, let $u(c) = c$, then problem of monetary authority is

$$W_{MA}(\bar{B}, \bar{k}) = \max_{\pi \geq 1} \frac{1}{I} \sum_{i=1}^I [A\ell(B_i/\pi, A) - v(\ell(B_i/\pi, A)) + (1+r)k_i], \quad A = A(M/\pi)$$

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- Notation: the part of the objective function that encodes benefits and costs of inflation for any level of B is

$$F(B, \pi) = A(M/\pi)\ell(B/\pi, A(M/\pi)) - v(\ell(B/\pi, A(M/\pi)))$$

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- Assume taste θ_i is perfectly correlated across countries, so preferences are identical
- In **centralized regime**: fiscal authority chooses same B for all i so MA faces a symmetric history
- Hence fiscal authority anticipates that MA will choose optimal inflation $\hat{\pi}^C(B)$ to solve

$$F_{\pi}(B, \pi) = 0$$

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- Assume taste θ_i is perfectly correlated across countries, so preferences are identical
- In **decentralized regime**: taking as given symmetric choices by others B_{-i} , MA faces *almost symmetric* history
- Hence fiscal authority anticipates that MA will choose optimal inflation $\hat{\pi}^D(B_i, B_{-i})$ to solve

$$F_{\pi}(B_i, \pi) + (I-1)F_{\pi}(B_{-i}, \pi) = 0$$

Elasticity of Inflation to Change in Debt in the Two Regimes

- Centralized regime: optimal inflation policy $\pi^C(B)$ is defined by the FOC

$$F_{\pi}(B, \pi) = 0$$

- differentiate it to get so

$$\frac{\partial \pi^C(B)}{\partial B} = - \frac{F_{\pi B}}{F_{\pi \pi}}$$

- MA takes into account that if it changes π because of one country changing B_i , it hurts all others

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- Decentralized regime: optimal inflation policy $\pi^D(B_i; B_{-i}, I)$ is defined by the FOC

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- differentiate it to get

$$\frac{\partial \pi^D(B_i; B_{-i}, I)}{\partial B_i} \Big|_{B_i=B_{-i}=B} = - \frac{1}{I} \frac{F_{\pi B}}{F_{\pi \pi}}$$

- local authority anticipates smaller change in π if *it alone increases debt than when central authority increases all debt*

Debt Elasticity of Inflation in the Two Regimes and Fiscal Externalities

- The elasticities under the centralized and decentralized regimes are

$$\eta^C = \frac{B}{\pi} \frac{\partial \pi^C(B)}{\partial B} \quad \text{and} \quad \eta^D(I) = \frac{B}{\pi} \frac{\partial \pi^D(B_i; B_{-i}, I)}{\partial B_i} \Big|_{B_i=B_{-i}=B}$$

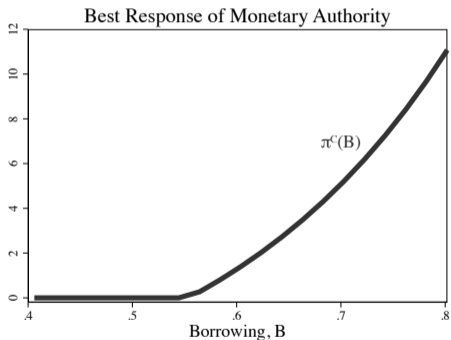
- Key to fiscal externality is

$$\eta^D(I) = \frac{1}{I} \eta^C$$

- Given anticipation of what MA will do, consider fiscal authority's decentralized choice of B_i
- Because each decentralized authority only cares about itself
 - it *internalizes only fraction* $1/I$ of total costs it imposes on union as a whole
 - so, it issues too much debt and causes too much inflation: $\eta^D(I) = \eta^C/I$

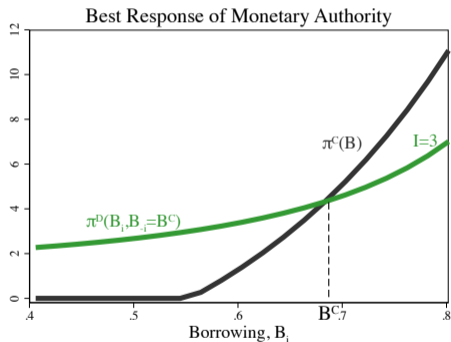
Response of Monetary Authority to Different Patterns of Incoming Debt

- Central: will pick $B_i = B$ for all i so incoming debt is (B, \dots, B) and MA policy is $\pi^C(B)$



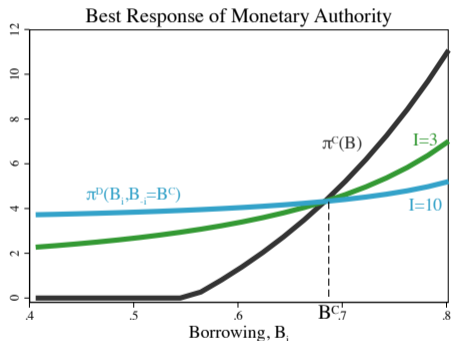
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- **Local:** given others pick $B_j = B$, incoming debt is $(B_i; B, \dots, B)$ and MA policy is $\pi^D(B_i, B_{-i})$



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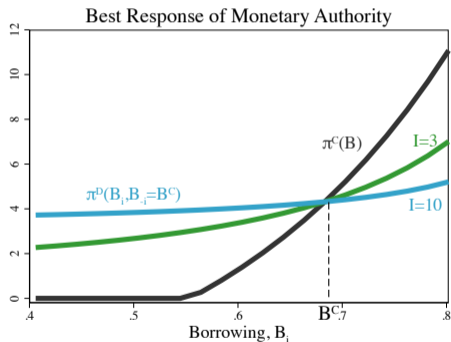
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- This implies that when a decentralized fiscal authority increases its own debt
 - it receives all of the benefits from the increase in spending but it only induces a small increase in inflation
 - much different trade-off than the centralized fiscal authority faces when deciding on all debt

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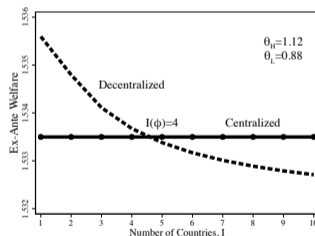
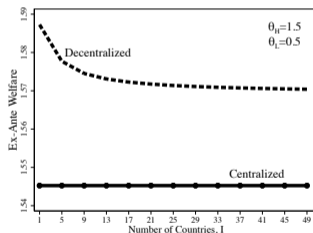
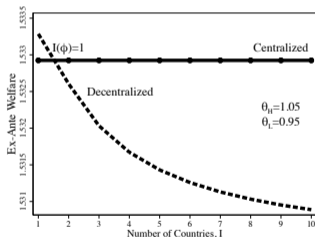
Next: this different trade-off is at the *heart of the free-rider problem*

Response of Monetary Authority to Different Patterns of Incoming Debt

- For a class of distortions from inflation embedded in $A(M/\pi)$: obtain following result
- *Result: A Cutoff Rule for Optimal Delegation.* For any given degree of informativeness ϕ
 - either there exists a finite cutoff $I(\phi)$, such that a fiscal union is preferred if $I > I(\phi)$
 - or a decentralized regime is preferred for all I

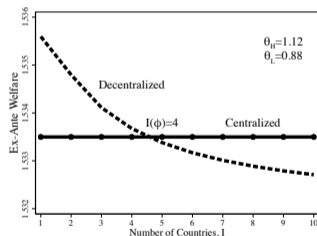
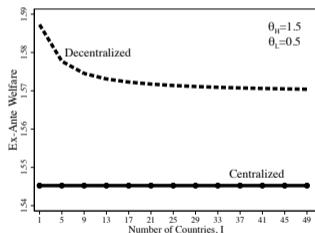
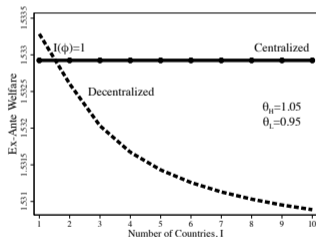
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- *Result: A Cutoff Rule for Optimal Delegation.* For any given degree of informativeness ϕ
 - either there exists a finite cutoff $I(\phi)$, such that a fiscal union is preferred if $I > I(\phi)$
 - or a decentralized regime is preferred for all I



- Moreover, the cutoff $I(\phi)$ decreases with the informativeness of the signal, ϕ

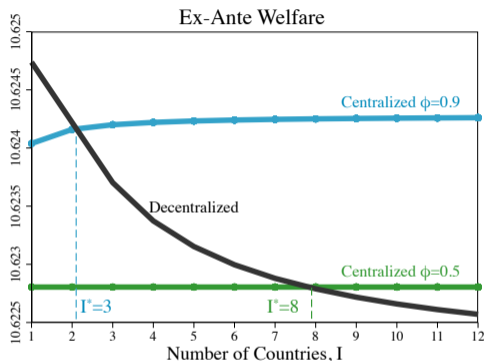
Case of Independent Preferences Across Countries: No Commitment

- Illustrate results with an example
- Let $u(c) = c$, $h(g) = \log g$, $v(\ell) = \ell^{1+1/\eta}/(1 + 1/\eta)$ and

$$A(M/\pi) = a + d \left(\frac{M}{\pi} - 1 \right) - \frac{e}{2} \left(\frac{M}{\pi} - 1 \right)^2$$

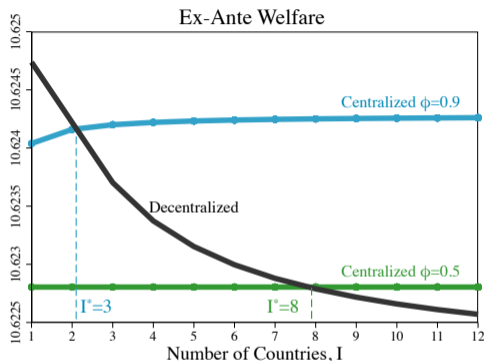
- Similar intuition as in the perfectly correlated case
 - but borrowing differs across countries depending on their realized preferences or signals

Case of Independent Preferences Across Countries: No Commitment



- Under better information ($\phi = 0.9$), centralized authority preferred if $I \geq 3$ preferred if $I \geq 8$

Case of Independent Preferences Across Countries: No Commitment



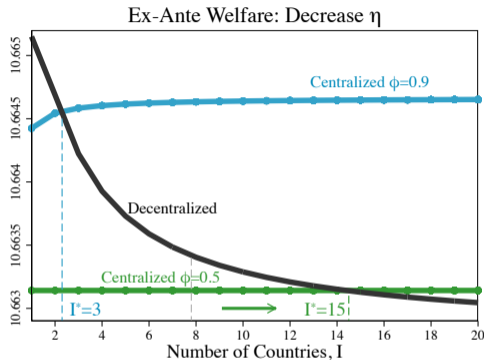
- Under better information ($\phi = 0.9$), centralized authority preferred if $I \geq 3$
- Under worse information ($\phi = 0.5$), centralized authority preferred if $I \geq 8$

[comparative statics]

Conclusion

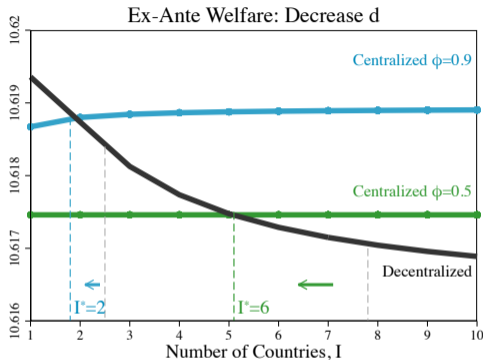
- Show how insights from fiscal federalism change principles of delegation from existing macro lit.
 - optimal delegation does not just depend on whether externalities exist or not
 - instead it depends on the trade-off between externalities and natural advantage of local authorities
 - so no “one size fits all” rule applies to delegation
- Implications for design of monetary union
 - more sophisticated trade-offs than in current macro literature
 - key new idea: *centralization optimal only if monetary union sufficiently large*
- Analysis has implications for enlargement policies: all else equal, countries are *less attractive* when
 - they are *smaller* because they internalize a smaller percentage of costs they impose (assuming utilitarian MA)
 - they are *prone to issuing more debt* (fast growing or less patient countries)

As Labor Elasticity Falls So Does Fiscal Externality



- Utility from working is given by $v(\ell) = \ell^{1+\frac{1}{\eta}} / (1 + \frac{1}{\eta})$
- Elasticity η decreases from 1 to 0.9: as taxes are less distortionary, incentives to increase π decrease
- Fiscal externality becomes less important, which gives an *advantage to decentralization*
- Hence the *cutoff for when centralization is better is larger*, $I^* = 15$

As Productivity Distortions Fall Fiscal Externality Worsens



- Productivity is given by $A(M/\pi) = a + d(M/\pi - 1) - \frac{\epsilon}{2}(M/\pi - 1)^2$
- Here d decreases from 0.15 to 0.05: borrowing increases as FA's anticipate lower distortions from π
- Fiscal externality becomes worse due to increase in borrowing: gives an *advantage to centralization*
- Hence the *cutoff for when centralization is better is smaller*, $I^* = 6$