Effective Demand Failures and the Limits of Monetary Stabilization Policy in a Pandemic

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Is Interest-Rate Policy Enough?

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- The orthodoxy that had developed during the "Great Moderation": stabilization policy could be considered essentially a **one-dimensional** problem

Is Interest-Rate Policy Enough?

- The questions whether
  - aggregate real activity was in line with the economy's **productive potential**
  - aggregate nominal spending growth was consistent with **price stability**
  - real interest rates were in line with the Wicksellian **"natural rate"** (i.e., the intertemporal relative price associated with an efficient allocation of resources)

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  were considered essentially **equivalent**
- Hence using interest-rate policy to ensure the last condition should be enough to ensure the others as well

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  — notably, many central banks reached an **"effective lower bound"** for their policy rates by late 2008/early 2009, while economic activity remained far below potential (and typically, inflation targets were chronically undershot as well)

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  — notably, many central banks reached an **"effective lower bound"** for their policy rates by late 2008/early 2009, while economic activity remained far below potential (and typically, inflation targets were chronically undershot as well)

- Current reviews of monetary policy strategy have particularly focused on the issue: what **additional tools** can be deployed when conventional monetary policy is constrained by the effective lower bound?

Is Interest-Rate Policy Enough?

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  - experiments with **negative interest rates** [and perhaps institutional changes to make more sharply negative rates feasible]

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  - calls to **increase the inflation target**
  - market interventions by the central bank to **reduce spreads** between longer-term interest rates and the policy rate
- Another possible response: to move away from **sole reliance upon interest-rate cuts** to stabilize economy in response to recessionary shocks

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- Instead, I will argue that sometimes interest-rate policy is inadequate on its own, **not** because real interest rates **haven't been reduced enough,** but because interest-rate policy is the **wrong tool** to address the fundamental economic problem

Fiscal Transfers and Stabilization

- Another aspect of the pre-GFC orthodoxy regarding stabilization policy: no use of cyclical variation in the government's budget as a tool of stabilization policy

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- These views defensible, under a particular assumption about the **kind of shocks** to which the economy would typically be subject:

  — that disturbances to both supply and demand might well occur, but that they would have similar effects on **all parts of the economy** simultaneously

Fiscal Transfers and Stabilization

- Consequence of such **purely aggregate** disturbances: while level of economic activity can vary over time, there is at all times a **balanced "circular flow" of payments:**

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- As a result, **borrowing constraints** should not bind (even if many units operate with a **low level of liquid asset balances** and have difficulty **credibly promising** to repay debts)
  - spending by all units determined by Euler equation ⇒ **interest-rate policy** can simultaneously regulate spending of all
  - timing of lump-sum taxes/transfers shouldn't change intertemporal budget constraint ⇒ **transfers ineffective** as source of aggregate demand stimulus

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- For health reasons, **part** of the economy has had to be **shut down** (theaters, restaurants, etc.) — while many other goods and services can still be supplied (no material change in either **costs of supply** or **utility from consuming** them)
- In the case of such a shock, it is **efficient** for aggregate GDP to fall (abruptly, and perhaps dramatically, relative to a normal recession)

  — but the reduction in economic activity that actually occurs (in absence of a policy response) may be **much deeper** than would be efficient

How to Respond to a Pandemic?

- The inefficiency results from the **disruption of the circular flow of payments,** given severe **sectoral asymmetry** of the effects of the shock

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- Most obviously, there can be insufficient effective demand for the things that the **immediately impacted sectors** ought still to **purchase**

  — restaurant workers ought still to be able to consume food, shelter, medical services, etc.; but may not be able to when their incomes collapse

How to Respond to a Pandemic?

- But the effective demand shortfall can also **propagate**

  — if restaurant workers can't pay rent, their landlords may have to lay off maintenance workers, and fail to pay taxes; shortfall of property tax revenue may require city to lay off municipal employees; and so on

  — severity of the overall impact on economic activity depends on **network structure of payments**

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- Moreover, the insufficiency of effective demand isn't a problem to which **interest-rate cuts** provide an adequate answer

  — many units borrowing-constrained $\Rightarrow$ interest-rate cuts stimulate **some kinds** of spending, but don't result in **efficient composition** of spending

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- Even if **indiscriminately targeted,**
  - sufficiently large transfers can achieve the ex-ante **optimal allocation of resources** [effectively provide social insurance]
  - and [whether that large or not] bring about an ex-post **Pareto improvement**

An N-Sector Model

- An N-sector "yeoman farmer" model: in each sector, a continuum of producer/consumers of equal (unit) size

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- Order the sectors on a circle, and use modulo-N arithmetic for addition or substraction of numbers from sectoral indices (sector $N + 1$ is same as sector 1, sector -1 same as sector $N - 1$)

An N-Sector Model

- Preferences of a sector j producer/consumer: max

  $$\sum_{t=0}^{\infty} \beta^t U^j(t)$$

  where $0 < \beta < 1$, and in each period

  $$U^j(t) \; = \; \sum_{k \in K} \alpha_k u(c^j_{j+k}(t)/\alpha_k) \; - \; v(y_j(t))$$

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  - Weights $\{\alpha_k\}$: same for all sectors (network structure has **rotational symmetry**)

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$$U^j(t) \;=\; \sum_{k \in K} \alpha_k u(c^j_{j+k}(t)/\alpha_k;\, \xi_t) \;-\; v(y_j(t);\, \xi_t)$$

- The coefficients $\{\alpha_k\}$ determine the **network structure** of the flow of payments in the economy:
  - we assume that $\sum_k \alpha_k = 1 \Rightarrow$ if all goods have the same price, optimal allocation of expenditure by any sector will be

$$c^j_{j+k}(t) \;=\; \alpha_k \cdot c^j(t)$$

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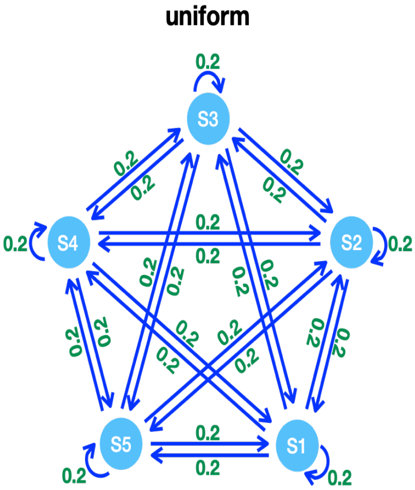
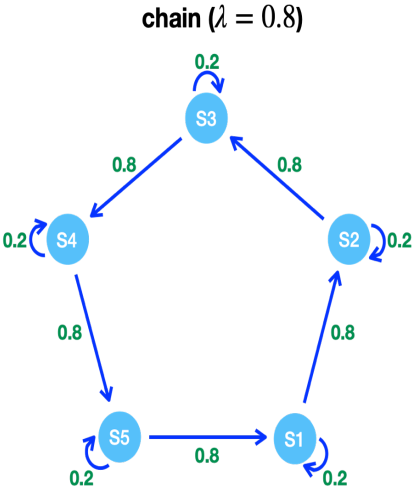
  - we also assume that $\alpha_0, \alpha_1 > 0$

Examples of Network Structure





An N-Sector Model

- We consider the effects of a **"pandemic shock":**
  - at $t = 0$, people learn that there can be **no production or consumption** of the good produced by some sector p in period zero
  - if occurs, lasts **only for one period,** and (for simplicity) not expected ever to recur
  - **equal ex ante probability** of each sector's being the affected one

An N-Sector Model

- Before the state at $t = 0$ is learned, model has complete **rotational symmetry**

- Hence **all sectors agree** on the ex ante ranking of possible policies to pursue from $t = 0$ onward:

  — want the highest possible value of

$$\sum_{j=1}^{N} \sum_{t=0}^{\infty} \beta^t U^j(t)$$

  given the state revealed at $t = 0$

First-Best Optimal Resource Allocation

- If no pandemic: optimal to have $y_k(t) = \bar{y}$ for all sectors, and $c_k^j(t) = \alpha_{k-j}\bar{y}$ each period, where $\bar{y}$ satisfies

$$u'(\bar{y}) \;=\; v'(\bar{y})$$

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- If instead **pandemic shock** requires sector p to shut down in period zero: optimal to have $y_p(0) = 0$, but still

$$y_k(0) \; = \; \bar{y}, \qquad c_k^j \; = \; \alpha_{k-j}\bar{y} \;\text{ for all } j$$

for all sectors $k \neq p$; and same allocation as before in all $t \geq 1$

— only production and consumption of sector p good in period 0 should change

The Decentralized Economy

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- We are interested in the equilibrium allocations that can be achieved in a **decentralized market economy,** using a particular (limited) set of possible stabilization policies
- We assume the existence of a **perfect foresight equilibrium** from $t = 0$ onward (given the shock and the policy response), as there is no further uncertainty to resolve
- Markets: we assume that each period, there are
  - spot markets for each of the goods [for which exchange has not been prohibited for public health reasons], with a money price $p_j(t)$ for good j
  - trading in a one-period nominal asset, earning nominal interest rate $i(t)$ between periods t and $t + 1$

The Decentralized Economy

- **Budget constraints** in period t of a unit in sector j:

$$\sum_{k=1}^{N} p_k(t)c_k^j(t) + b^j(t) = p_j(t)y_j(t) + a^j(t), \qquad b^j(t) \geq 0$$

where $a^j(t)$ is beginning asset balances (after any taxes or transfers) and $b^j(t)$ are ending asset balances (required to be non-negative: a **borrowing constraint)**

- **Asset balances** evolve according to

$$a^j(t+1) = b^j(t)(1+i(t)) - \tau(t+1)$$

where $\tau(t+1)$ is a lump-sum tax collection (assumed the same for all sectors, in all periods from 1 onwards)

The Decentralized Economy

- We allow monetary policy to affect the real allocation of resources by supposing that all goods prices are **fixed one period in advance,** in a way that is expected to clear markets
  - since no uncertainty to resolve at dates $t \geq 1$, this means that prices will clear all goods markets in those periods
  - because we assume a symmetric situation prior to possible realization of an asymmetric shock at $t = 0$, the prices fixed for period zero will satisfy $p_j(0) = \bar{p}$ for all j

    — the exact value of $\bar{p}$ does not matter for results below

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Policy tools to consider:

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- lump-sum **fiscal transfers** and taxes:

  - in this lecture, consider only **uniform** transfers [same to all sectors] in period zero, and uniform lump-sum taxes in subsequent periods

  - thus can specify fiscal policy by a path $\{a(t)\}$ of the public debt [satisfying transversality condition]

  - implied lump-sum tax obligation each period the one required to achieve this path for debt

The Case of Only Aggregate Shocks

- If only aggregate shocks, and sectors start out with equal asset balances: then the optimal resource allocation is obtained as equilibrium under a policy with
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  - real public debt kept constant forever
  - interest rate given by a Taylor rule, the intercept of which tracks the variation in the "natural rate of interest"
- Notably, an appropriately state-contingent **monetary policy suffices** to deal with all such shocks
- And uniform fiscal transfers to all sectors will have **no effect,** even if ZLB binds

Effects of a Pandemic Shock

- Can the **first-best optimal allocation** be supported as an equilibrium?

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- Can the **first-best optimal allocation** be supported as an equilibrium?

- If there exists an efficient ex ante market for **pandemic insurance,** the answer is YES

  — doesn't even require any different monetary or fiscal policy than the ones prescribed above in the case of only aggregate shocks

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- Result can be an equilibrium with **much greater reduction of economic activity** than in the efficient allocation, owing to a **collapse of effective demand:**

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- Consider first the **limiting case** in which $a(0) \to 0$
  - note that in the event of only aggregate shocks, this creates no inefficiency

Effects of a Pandemic Shock

- Each sector's spending, given pandemic shock: can no longer purchase good 1, but [given equal prices for all goods $k \neq 1$] must equate marginal utility of consumption of all other goods
  - hence $c_k^j(0) \sim \alpha_{k-j}$ for all $k \neq 1$
  - it follows that

$$c_k^j(0) \;=\; A_{kj} c^j(0),$$

where

$$A_{kj} \;\equiv\; \frac{\alpha_{k-j}}{1-\alpha_{1-j}} \quad \text{for all } k \neq 1$$

$$\equiv\; 0 \quad \text{for } k = 1$$

Effects of a Pandemic Shock

- When $a(0) \to 0$, eq'm allocation with the pandemic shock approaches one in which $b^j(0) = 0$ for all sectors [only way to satisfy both $b^j(0) \geq 0$ for all j and $\sum_j b_j(0) = a(0) = 0$]

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- Hence we must have $c^k(0) = y_k(0) = \sum_j A_{kj} c^j(0)$ for all k $\Rightarrow$ vector of spending levels $\boldsymbol{c}(0)$ must be a **right eigenvector** of $\boldsymbol{A}$, with **eigenvalue 1**

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- We can show that $\boldsymbol{A}$ has a **unique** right eigenvector $\boldsymbol{\pi}$ [which we normalize so that $\sum_j \pi_j = 1$] with eigenvalue 1; moreover,
  - all elements $\pi_j \geq 0$ [note: $\pi_1 = 0$]
  - all other eigenvalues of $\boldsymbol{A}$ have modulus less than 1, so that $\lim_{k \to \infty} \boldsymbol{A}^k = \boldsymbol{\pi e'}$

— $\boldsymbol{\pi}$ is just the vector of **stationary probabilities**, if $\boldsymbol{A}$ is the transition probability matrix for a Markov chain

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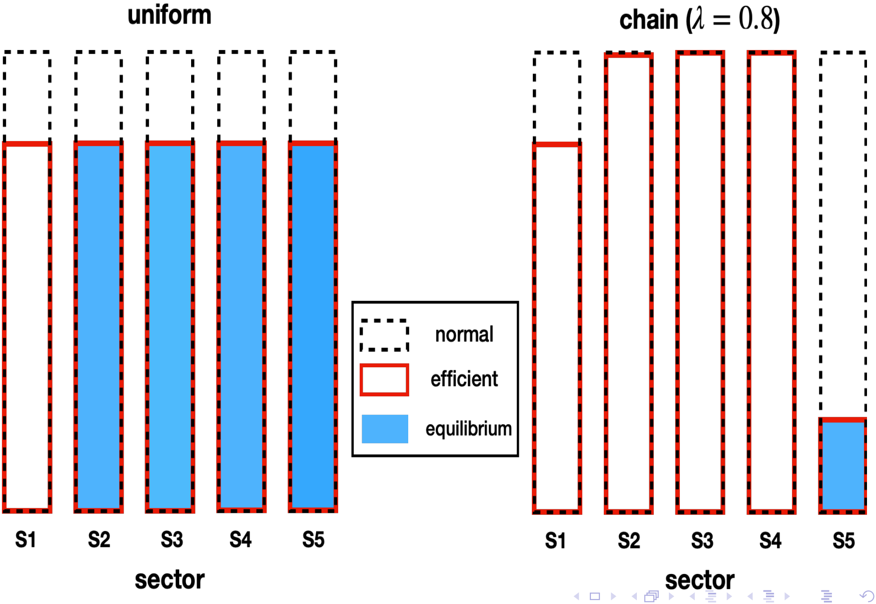
- Severity of the effective demand shortfall depends critically on the **network structure of payments** [vector $\boldsymbol{\pi}$ depends on the matrix $\boldsymbol{A}$]

Examples: Alternative Network Structures ($N = 5$)



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- Thus we still must have $\boldsymbol{c}(0) = \theta\boldsymbol{\pi}$, but now

$$\theta = \min_j \frac{(1-\alpha_{1-j})}{\pi_j} \hat{y}(i(0)) > 0$$

Effects of Monetary Policy

- Thus all c_k^j get scaled up by a common multiplicative factor [the increase in $\hat{y}$: depends on the IES, as usual]

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  — then consumption and output increase **only** in sector N, and that increased activity **lowers** welfare
- More generally: some reduction of real interest can raise ex ante welfare; but **not** optimal to cut interest rates as far as needed to get **aggregate** output to its optimal level [even if this is feasible, despite ZLB]

Effects of Monetary Policy

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  — in extreme example, output is far below efficient level [zero output in all sectors but N], yet an interest-rate cut reduces welfare

- Moreover, contrary to what can be shown in the case of aggregate shocks, here there is **no** monetary policy response that can achieve the efficient allocation of resources

  — perhaps not even any that can improve upon the no-response outcome

Effects of Fiscal Transfers

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- If we restrict attention to policies such that (a) path of public debt satisfies the TVC, and (b) taxes levied in periods $t \geq 1$ are never large enough to cause borrowing constraints to bind on any sector for $t \geq 1$ [note: this is possible, regardless of period zero transfers], then equilibrium outcomes depend only on **lump-sum transfers in period zero**

  — thus we can consider the effects of such policies by considering equilibrium for an arbitrary vector of **initial asset positions** $\{a^j(0)\}$ [post-transfer]

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- In this case we again have the **Euler condition**

$$u'\left(\frac{c^j(0)}{1-\alpha_{1-j}};\, \bar{\xi}\right) \;\geq\; u'(\bar{y};\, \bar{\xi}) \quad \Leftrightarrow \quad c^j(0) \;\leq\; (1-\alpha_{1-j})\bar{y}$$

A Multidimensional "Keynesian Cross"

- Expenditure by each sector k will then equal

$$c^k(0) \;=\; \min\left\{ \frac{a^k(0)}{\bar{p}} + \sum_j A_{kj} c^j(0), \;\; c^{*k} \right\}$$

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- For any vector $\boldsymbol{a}(0) >> 0$, RHS defines a positive concave operator that necessarily has a **unique fixed point** $\boldsymbol{c}(\boldsymbol{a}(0)) >> 0$

Effects of Fiscal Transfers

- The "multiplier" effect of a given transfer depends on
  - the fraction of it that goes to sectors that are **borrowing-constrained**
  - the fraction of the increased spending by those constrained sectors that is on products of sectors that are **also borrowing-constrained**
  - the fraction of that second-round increased spending that is on products of sectors that are also borrowing-constrained, etc.

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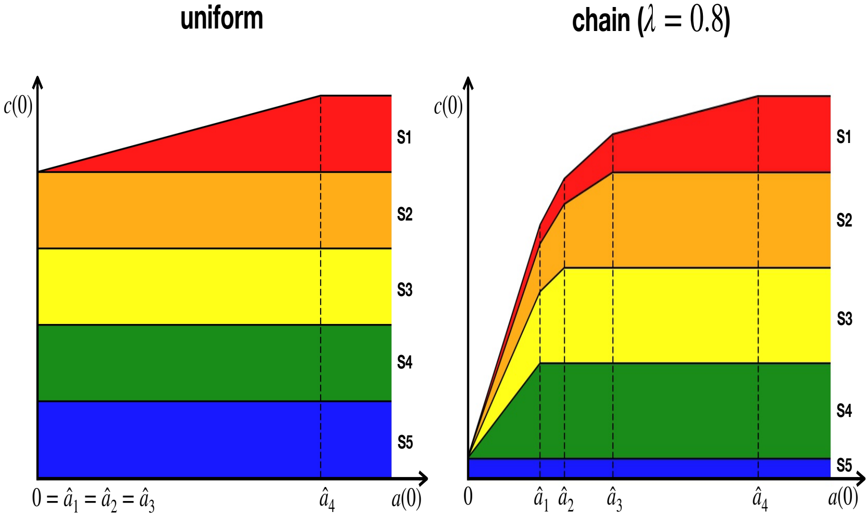
- As transfers are increased [or pre-transfer asset balances are simply larger], progressively fewer sectors continue to be borrowing-constrained $\Rightarrow$ **multipliers decrease**

  — eventually fall to **zero** once initial assets are large enough

Example: $N = 5$, Two Network Structures



Fiscal Transfers and Welfare

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- In fact, not only can one show that ex ante welfare is (at least weakly) increased, but **ex post welfare** is (at least weakly) increased **for each sector:** an ex post Pareto improvement!
- Ex post welfare of sector j [in $\beta \to 1$ limit]:

$$
\begin{aligned}
W^j &= U^j(0) + u'(\bar{y}) \cdot [b^j(0) - (a(0)/N)] \\
&= \sum_k \left[\alpha_k u\left(\frac{c^j_{j+k}}{\alpha_k}\right) - u'(\bar{y}) c^j_{j+k} \right] + [v'(\bar{y}) y_j - v(y_j(0))]
\end{aligned}
$$

note that every term must be at least weakly increasing

Fiscal Transfers and Welfare

- Moreover, large enough transfers support the **first-best allocation of resources** as an equilibrium [in the $\beta \to 1$ limiting case]
  - simply requires that $a(0) \geq N \cdot (1 - \alpha_0)\bar{p}\bar{y}$, at which point borrowing constraints no longer bind for any sector

Fiscal Transfers and Welfare

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    - simply requires that $a(0) \geq N \cdot (1 - \alpha_0)\bar{p}\bar{y}$, at which point borrowing constraints no longer bind for any sector
- Advantage of fiscal transfers over interest-rate policy:
    - in this example, pandemic shock does not reduce the **Wicksellian natural rate of interest** $\Rightarrow$ real interest-rate reduction necessarily creates **distortions,** even if average welfare increased
    - instead, fiscal transfers don't stimulate **inefficient expenditure** of any kind, because units receiving unnecessary transfers are able to **save** them

Conclusions

- The fact that a pandemic shock reduces economic activity — and even the fact that it reduces activity **relative to the efficient level of activity** — does not imply that **interest-rate cuts** are called for
  - in the model, fiscal transfers can achieve the first-best allocation of resources, **without** any reduction in interest rates
  - moreover, one can show that it is **only** in the case of no reduction in interest rates that the first-best outcome is achievable

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- To the extent that it is not, there may be **less to be gained** from innovations such as **raising the inflation target,** or **abolishing currency** than is often argued