MACROECONOMIC IMPLICATIONS OF COVID-19:
CAN NEGATIVE SUPPLY SHOCKS CAUSE DEMAND SHORTAGES?

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GOAL: STUDY MACRO EFFECTS OF COVID-19

- **Our approach:**

Covid-19 = asymmetric shock to **gains from trade**

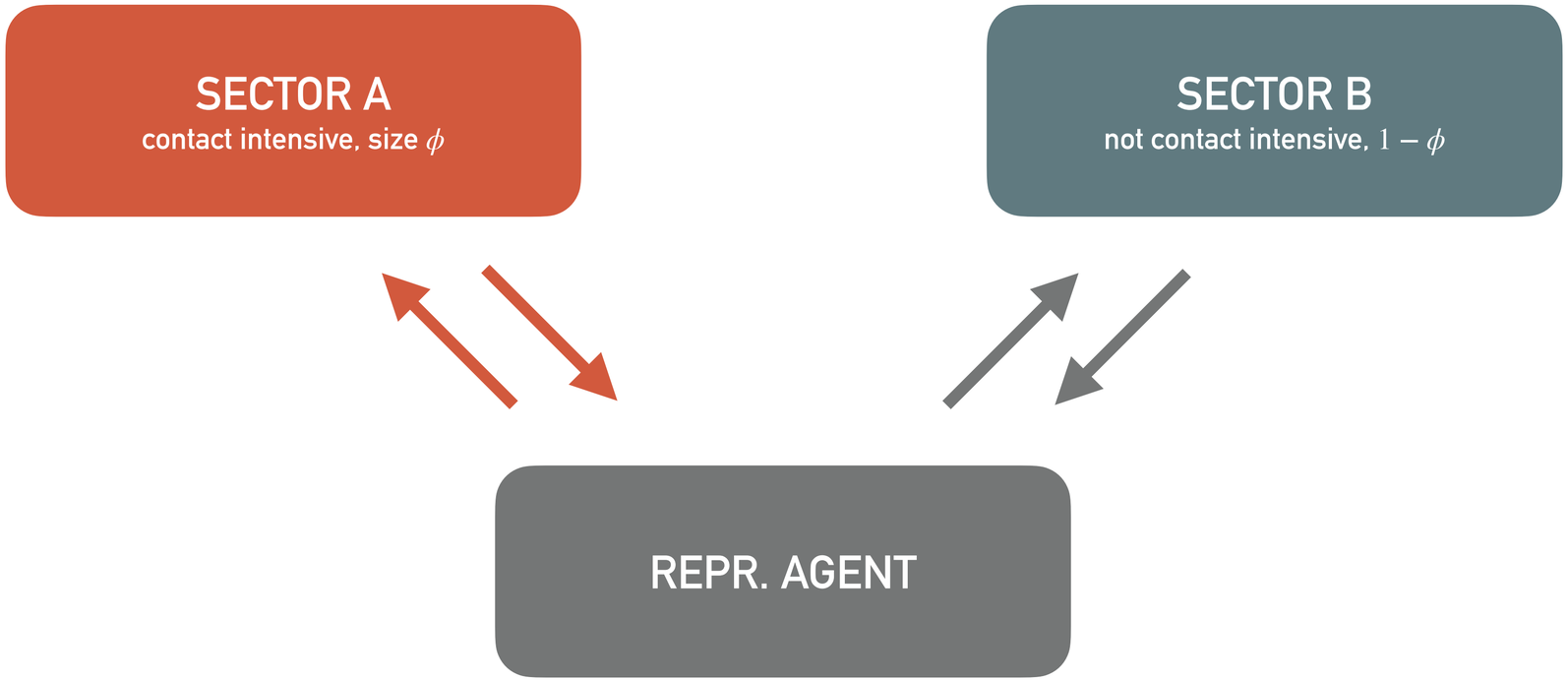
only contact-intensive sectors — *health risk inhibits trading among buyers & sellers*

- Shock reduces **efficient level of economic activity** in affected sectors
  - for most part, call it "**supply shock**" *(without loss for analyzing propagation)*

- **Today:**
  1. **Propagation?**
  2. **Policy implications?**
  3. **Role of business exits**
  4. **How to measure propagation?**

THE BASIC MODEL

- 2-sector economy, **intra**temporal substitution: ϵ, **inter**temporal substitution: σ
- Assume shock shuts down sector A for 1 period.
- **Key question:** how does shock propagate from A to B ? Demand? Supply?



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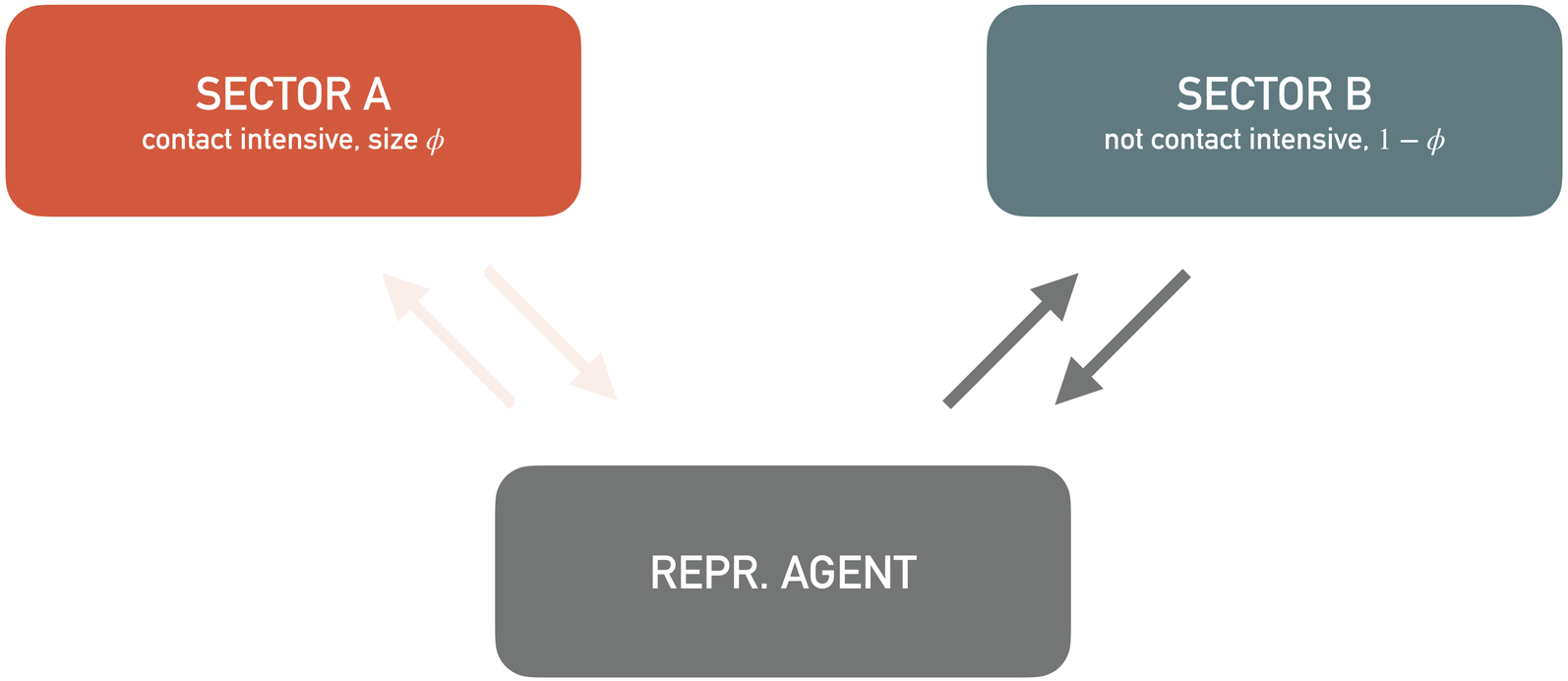


MECHANICS OF THE BASIC MODEL

- Representative worker maximizes utility $\sum_{t=0}^{\infty} \beta^t U(C_t)$

$$U(C) = \frac{1}{1 - 1/\sigma} C^{1-1/\sigma} \qquad C_t = \left(\phi^{1/\epsilon} c_{At}^{1-1/\epsilon} + (1-\phi)^{1/\epsilon} c_{Bt}^{1-1/\epsilon}\right)^{\frac{1}{1-1/\epsilon}}$$

- subject to budget constraint

$$P_{At} c_{At} + P_{Bt} c_{Bt} + a_{t+1} \leq W_t N_{At} + W_t N_{Bt} + (1 + i_t) a_t$$

- Linear production

$$Y_{At} = N_{At} \qquad Y_{Bt} = N_{Bt}$$

- Today: Focus on Keynesian economy…
  - rigid wages $W_t = 1$, fixed nominal rate i_t at steady state value $1/\beta - 1$
  - production entirely pinned down by demand

SHUTTING DOWN SECTOR A

- Sector A gains from trade evaporate. Spillovers to rest of economy? Inefficient?
- Euler equation (in terms of sector B goods)

$$\frac{\partial U}{\partial c_B}(0, Y_{B0}) = \frac{\partial U}{\partial c_B}(c_A, c_B)$$

How is sector B demand affected?

$$\frac{Y_B}{Y_B^*} = (1-\phi)^{\frac{\sigma-\epsilon}{\epsilon-1}}$$

What if $\epsilon \to \infty$?
[1-sector model or symmetric shock]

$\frac{Y_B}{Y_B^*} = (1-\phi)^{-1} > 1$ *standard supply shock*

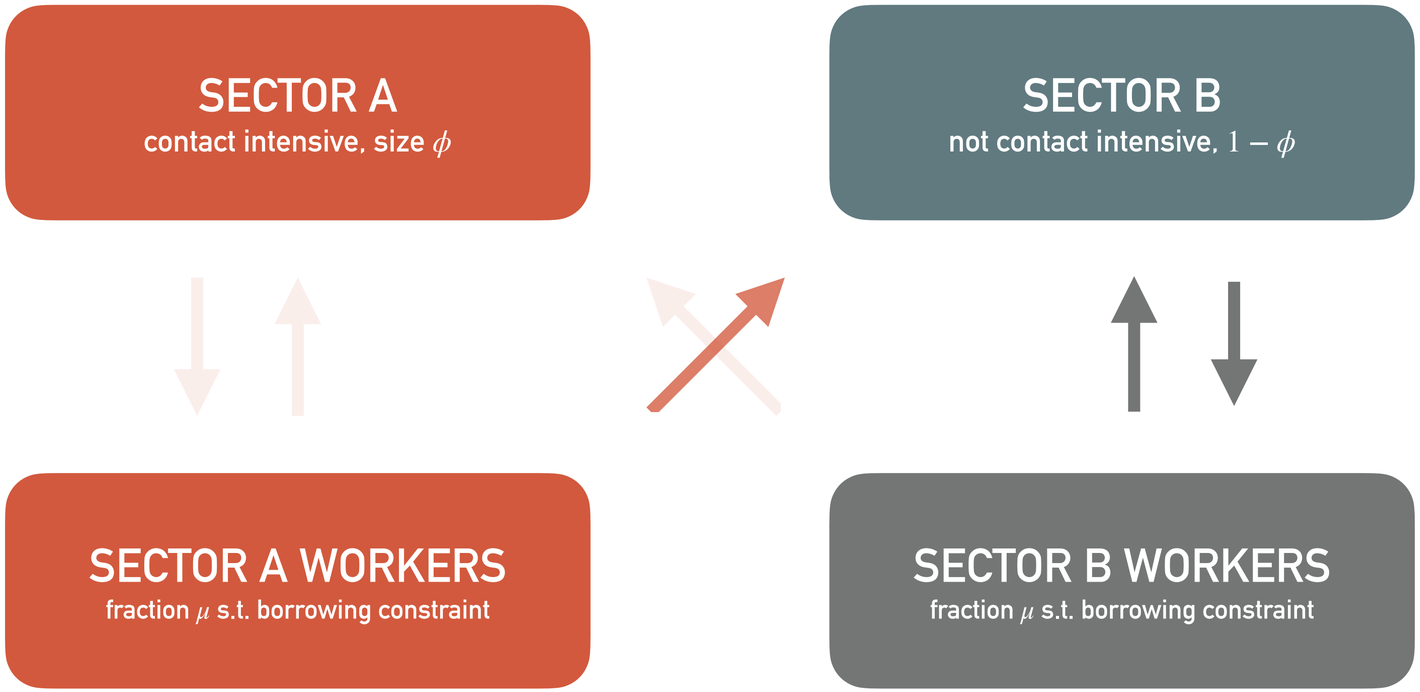
What if $\sigma > \epsilon$?

$\frac{Y_B}{Y_B^*} = (1-\phi)^{\frac{\sigma-\epsilon}{\epsilon-1}} < 1$ ***"Keynesian** supply shock"*

***Cross-sectoral substitution channel:** Negative spillovers if $\sigma > \epsilon$*

PROPAGATION CHANNEL 2: ADDING INCOMPLETE MARKETS

- So far representative agent, implicitly assuming **complete markets**
- Next: sector A workers & sector B workers, with fraction μ facing borrowing constraint
- Shock: Sector A workers lose all income, hence fraction $\mu\phi$ has zero consumption!



How is sector B demand affected?

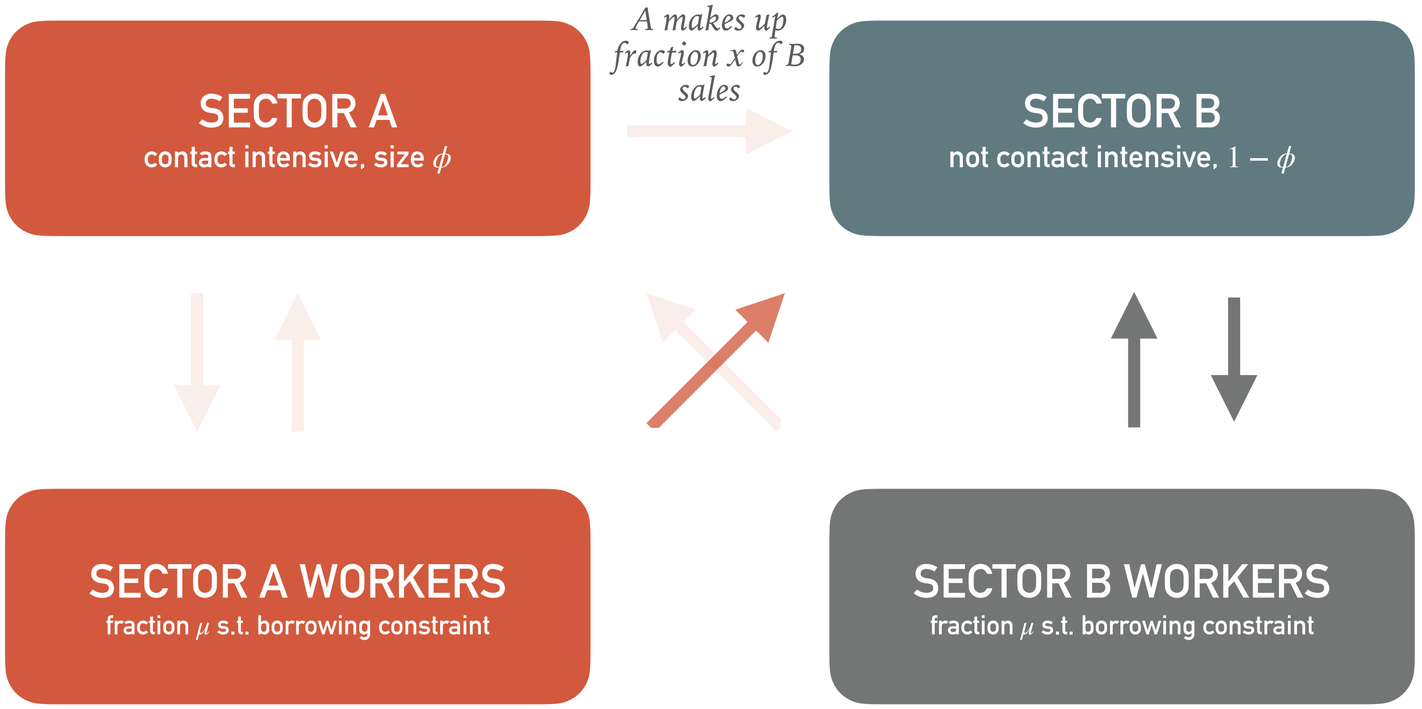
$$\frac{Y_B}{Y_B^*} = (1-\phi)^{\frac{\sigma-\epsilon}{\epsilon-1}}(1-\mu\phi)$$

*With **incomplete markets:** Negative spillovers if* $\sigma > (1-\mu)\epsilon + \mu$

(small ϕ limit, $\epsilon > 1$)

PROPAGATION CHANNEL 3: SUPPLY CHAINS

- Add supply chains: Sector A produces using $Y_A = F(X, N_A)$, X from sector B
- Let X account for fraction x of B's sales. Gets lost when A is shocked!



How is sector B demand affected?

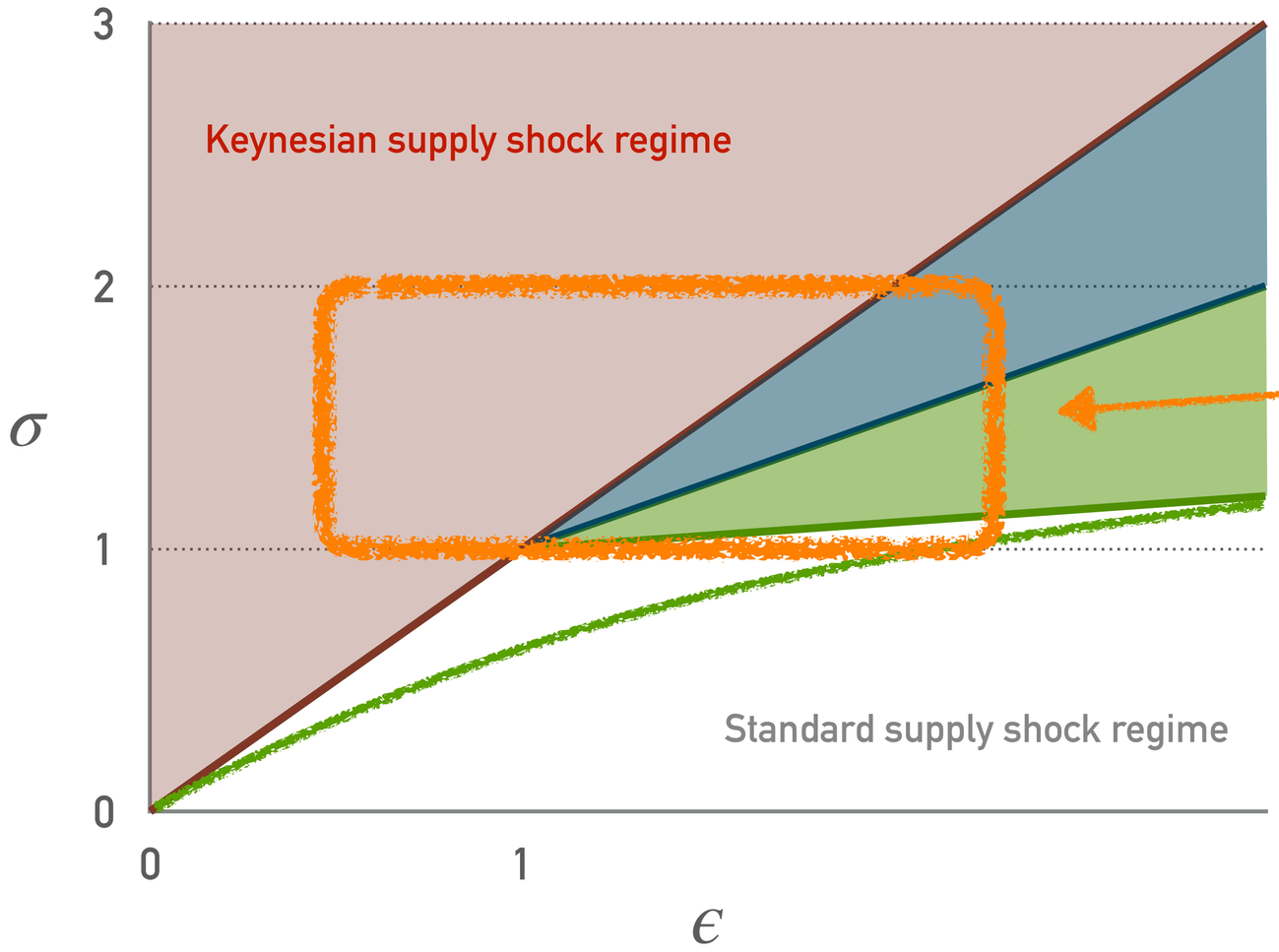
$$\frac{Y_B}{Y_B^*} = (1-\phi)^{\frac{\sigma-\epsilon}{\epsilon-1}}(1-\mu\phi-(1-\mu)x)$$

*With **supply chains:** Negative spillovers if* $\sigma > (1-\tilde{\mu})\epsilon + \tilde{\mu}$

$\tilde{\mu} > \mu$ *and rising in* x

$(\epsilon > 1)$

KEYNESIAN SUPPLY SHOCKS IN ϵ, σ SPACE



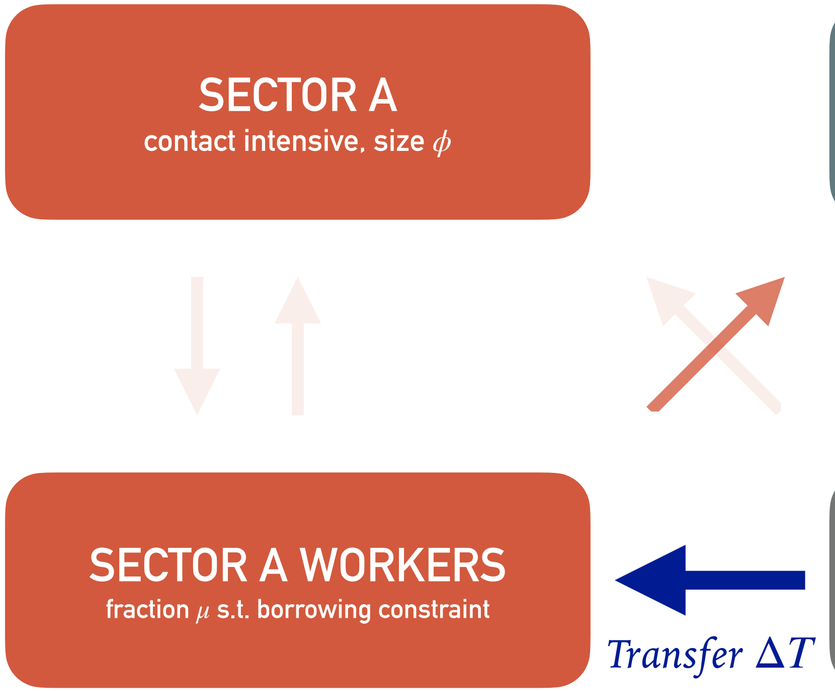
Cross-sectoral substitution
with incomplete markets
with incomplete markets & supply chains

Which area is plausible?

- $\sigma > 1$ … ?
- ϵ *around 1* … ?

FISCAL STIMULUS

- Focus on situation with negative spillovers (Keynesian supply shock)
- Introduce government which transfers ΔT to sector A workers



How is sector B output affected?

$$\Delta Y_B = \mu \Delta T$$

Multiplier only μ ...

$$\ldots \neq \frac{mpc}{1-mpc}$$

Keynesian cross is "broken"

But: **Insurance** value of transfer is **enormous** due to **asymmetry** of the shock!

BUSINESS EXITS

- Zoom into each sector: Continuum of monopolistically competitive firms in each…

$$Y_{At} = \left(\int_0^{\phi} y_{it}^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}} \qquad Y_{Bt} = \left(\int_{\phi}^{1} y_{it}^{\frac{\epsilon-1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}}$$

- Solve profit maximization

$$V_{i0} = y_0 - wn - \zeta_i + \frac{1}{1+r} V^*$$

Idiosyncratic liability. cdf F

- Firms exit if $V_{i0} < 0$

Average demand for each active firm $y_0 = \frac{Y_{B0}}{1 - \Phi}$

- Now: fraction of inactive firms can exceed ϕ. Call it Φ

THE BUSINESS EXIT MULTIPLIER

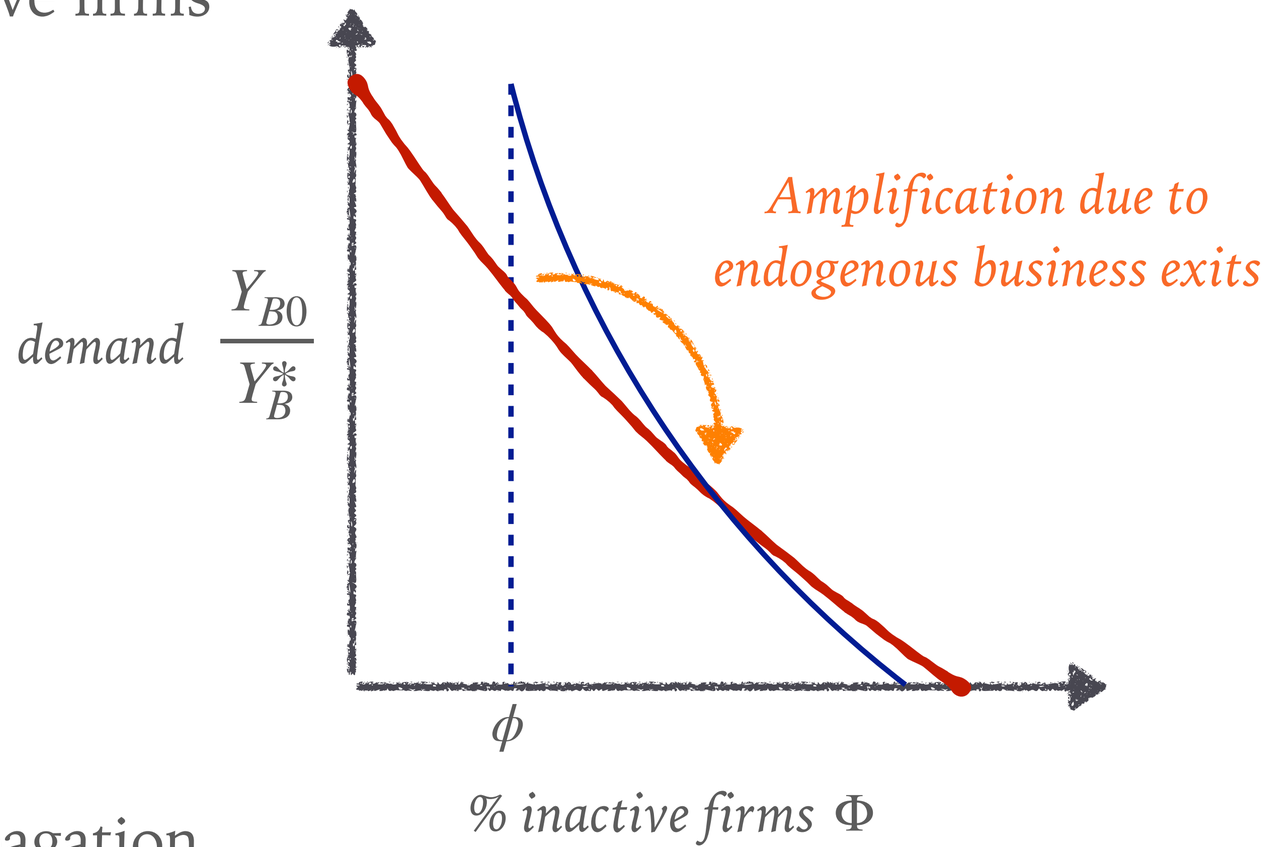
- Two relationships:
- Demand as a function of the % of active firms

$$\frac{Y_{B0}}{Y_B^*} = (1-\Phi)^{\frac{\sigma-\epsilon}{\epsilon-1}}$$

- Active firms as function of demand

$$1-\Phi = (1-\phi)F\left(\frac{Y_{B0}}{Y_{B0}^*}\right)$$

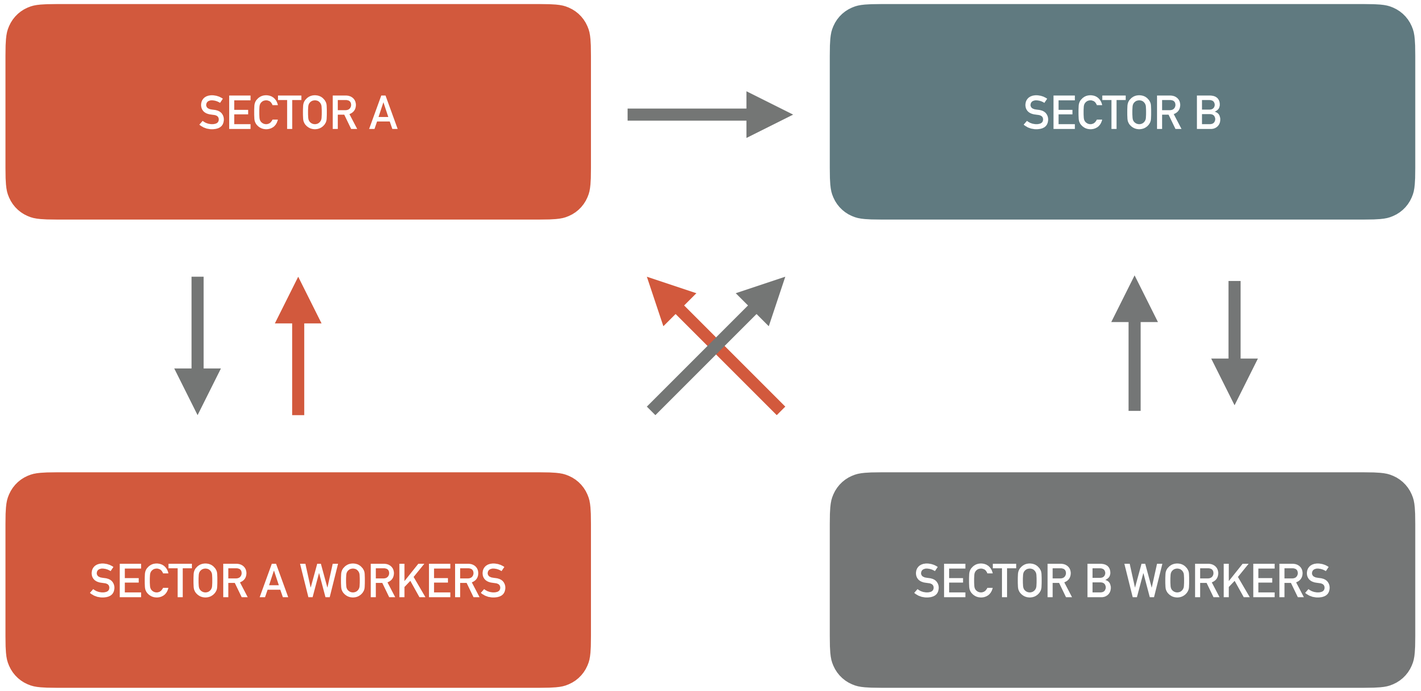
- Similar logic applies to the other propagation channels



MEASURING DEMAND SPILLOVERS ...

- Three channels of transmission: **substitution**, **incomplete markets**, **supply chains**
- When do these channels produce Keynesian supply shocks, absent policy ?
  - ... what should we measure in the data?
- Our strategy: Follow the money!

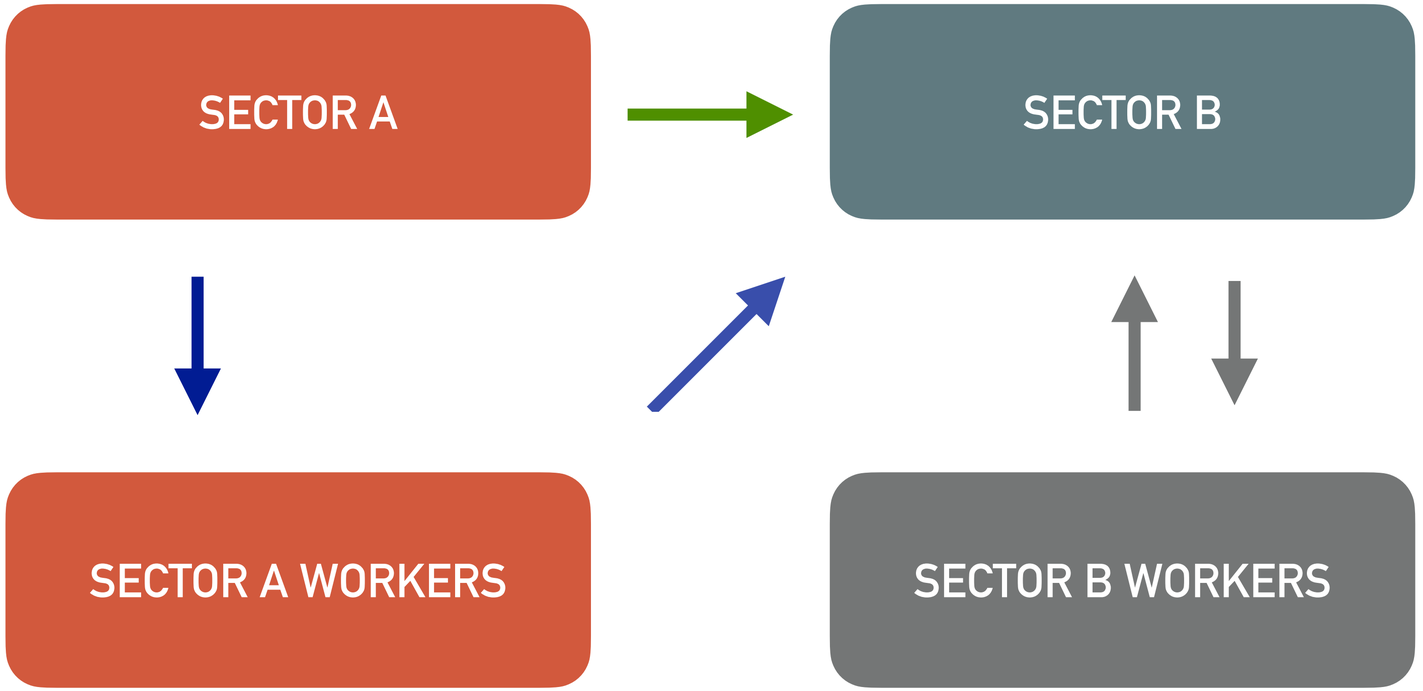
- Step 1: Where does each $ go that used to be **spent on A**?
- Some fraction $\Delta C_B / \Delta C_A$ is spent on sector B



MEASURING DEMAND SPILLOVERS ...

- Three channels of transmission: **substitution**, **incomplete markets**, **supply chains**
- When do these channels produce Keynesian supply shocks, absent policy ?
  - ... what should we measure in the data?
- Our strategy: Follow the money!

- Step 2: Where does each \$ **no longer go** that used to be **spent by A**?
- Fraction z used to go straight to B via supply chains
- Fraction $(1-z)\overline{MPC}^{A}$ used to be spent on B by sector A workers



MEASURING DEMAND SPILLOVERS …

- Putting all three channels together …

Keynesian supply shock if and only if

$$(1 - z) \cdot \overline{MPC}^{A} < z \cdot \frac{\Delta C_B}{\Delta C_A}$$

intermediate input share in sector A

MPC of sector A workers during shock period

% of previous sector A spending that ends up in sector B

INFLATION

- What happens to prices with Keynesian supply shock:

SECTOR A
contact intensive

Nature of gains from trade shock matters:

- *prices ↑ if shock hits supply more*
- *prices ↓ if shock hits demand more*

SECTOR B
not contact intensive

Keynesian supply shock: prices ↓

only this is measured if sector A shut down!

Overall: **measured** price inflation falls, **ideal** price inflation can go either way

WHY DO WE CARE ABOUT SUPPLY VS DEMAND ?

SECTOR A

- crucial for cost-benefit analysis of NPIs
  - lockdowns not as costly if gains from trade shock driven by demand
- shapes nature of recovery
  - if demand, recovery hinges on fading subjective health concerns
  - might not occur even in regions with low Covid incidence

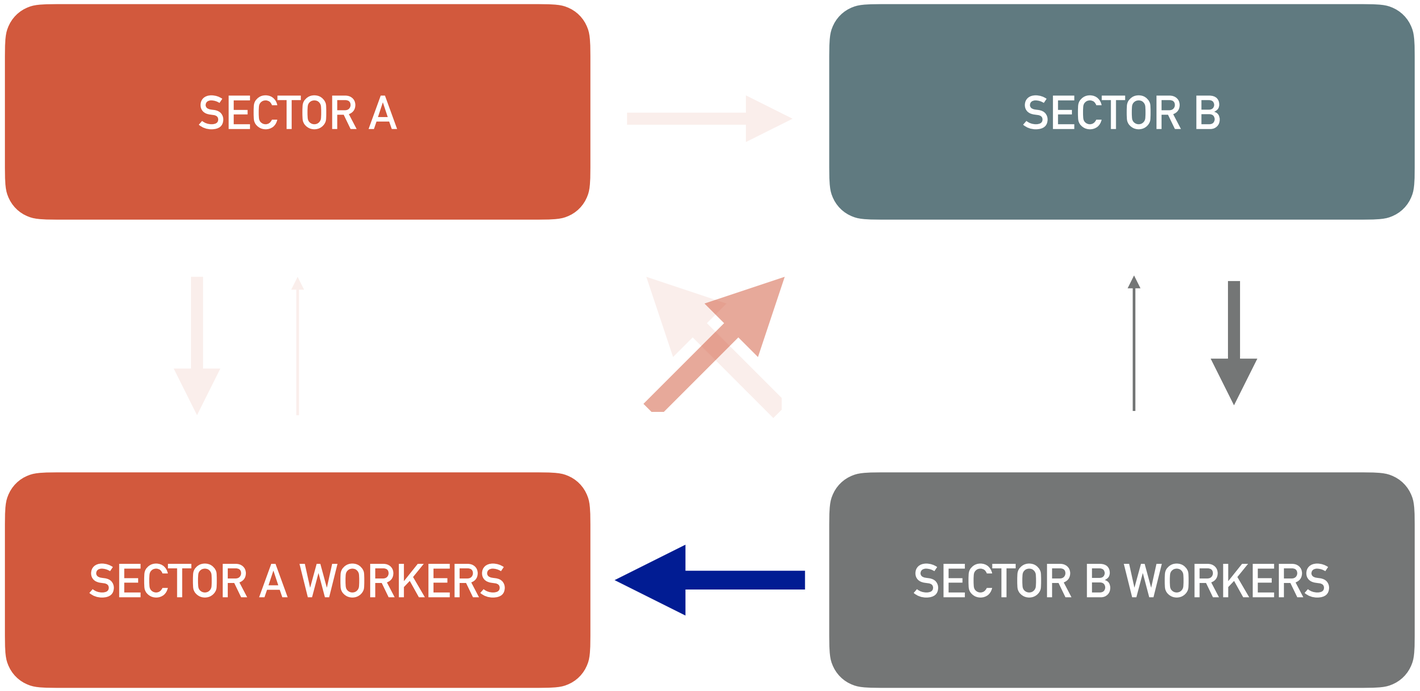
SECTOR B

- demand deficiency implies sector B suffers inefficient unemployment
- role for demand stimulus
- active transmission channels provide policy guidance & info about future
- e.g. if IM important, social insurance in sector A has positive spillovers on sector B
- & IM possibly has more persistent effects than cross-sectoral substitution

LARGER INCOME DROP FOR THE RICH?

- Assume sector B workers have larger pre-shock spending on Sector A, and vice versa

- Likely …
  - dampens cross-sectoral substitution channel
  - amplifies incomplete markets channel
- Sufficient statistic formula unchanged



SUMMARY: ASYMMETRIC SHOCK TO GAINS FROM TRADE