

# Title

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Broad consensus on secular stagnation.

The literature has agreed that there are two main factors driving this:

- decreasing labor force participation
- decreasing TFP growth

# A smaller, but still big question

Why has TFP slowed down?

# Two possible mechanisms

- a permanent, or very persistent exogenous shock to TFP
- an endogenous mechanism

→ What we do in a nutshell: test for the endogenous mechanism  
(main analysis will be a SVAR)

- One strand of literature: Exogenous TFP and news shocks
  - Beaudry & Portier (2006)
  - Barsky & Sims (2011)

**Our contribution: allow in this setting the existence of an endogenous mechanism that affects future TFP**

► Barsky & Sims quote

- Another strand of literature: Endogenous TFP with R&D investment as the key variable
  - Comin & Gertler (2006)
  - Moran & Queralto (2017)

**Our contribution: provide what we think is a more convincing test for the endogenous mechanism**

# Why more convincing?

Because the endogenous TFP literature faces a big problem: The endogenous mechanism is rationalized entirely using R&D investment.

- 1 But R&D in the data is almost acyclical.... → hard to rationalize as a driver of business cycle fluctuations

▶ Graph of acyclical R&D

- 2 Timing issue: the TFP slowdown begins around 2006, i.e. *before* the Great Recession and thus *before* the marked drop in R&D

▶ Graph of timing

⇒ Following the suggestion of Fernald, Hall, Stock & Watson (2009), we propose to use investment in information technology (IT)

▶ Graph of IT investment

We run a SVAR using aggregate, quarterly US data. The data vector is:

$$\mathbf{X}_t = \begin{bmatrix} TFP_t \\ SP_t \\ IT_t \\ GDP_t \\ C_t \\ RP_t \end{bmatrix} \quad (1)$$

- $RP = \pi^{IT} / \pi^{CPI}$ .
- All variables are in log levels except for RP, which is in growth rates.
- The dataset ranges from 1989:q1 - 2017:q1.

# From reduced form to structural form

## Structural Form

$$(\mathbf{AD})^{-1}\mathbf{X}_t = \mathbf{C}(\mathbf{L})\mathbf{X}_{t-1} + \mathbf{s}_t \quad (2)$$

## Reduced Form

$$\mathbf{X}_t = \underbrace{\mathbf{ADC}(\mathbf{L})}_{\mathbf{B}(\mathbf{L})}\mathbf{X}_{t-1} + \underbrace{\mathbf{AD}_t}_{\mathbf{i}_t} \quad (3)$$

- $\mathbf{AD}$  is the impact matrix
- $\mathbf{A}$  is s.t.  $\mathbf{As}_t\mathbf{s}_t'\mathbf{A}' = \mathbf{i}_t\mathbf{i}_t' = \Sigma$  and  $\mathbf{s}_t\mathbf{s}_t' = \mathbf{I}$
- $\mathbf{D}$  is a rotation matrix s.t.  $\mathbf{DD}' = \mathbf{I} \Rightarrow \mathbf{AD}(\mathbf{AD})' = \Sigma$

$\mathbf{D}$  will be a tool to impose our identification assumptions



# Identified Shocks

- We impose restrictions on  $D$  in order to identify two shocks:
  - 1 News Shock
  - 2 IT Productivity Shock
- Econometric challenge is to disentangle two shocks with very similar features
  - 1 No impact effect on TFP
  - 2 Persistent positive effect over time on TFP
  - 3 Most likely both shocks have positive impact effects on forward-looking variables
- Barsky & Sims' identification strategy is not sufficient to disentangle the two
  - We need a further assumption (restriction) to find a dimension of difference between the shocks

# Additional Restriction

- We rely in simple demand and supply theory

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$$TFP_t = \underbrace{\varepsilon_t}_{\text{surprise tech shock}} + \underbrace{V_{t-k}}_{\text{news shock}} + \underbrace{IT_{t-k}}_{\text{IT shock}} \quad (4)$$

- 1 The news shock  $V_{t-k}$  maximizes the FEV of future TFP subject to the restriction that it has no effect on the relative price  $RP$  in the long run;
- 2 The IT shock maximizes the remaining FEV of future TFP;
- 3 The tech shock  $\varepsilon_t$  is considered as a residual shock and is left unrestricted.

*A more general objection to our empirical approach would be that a number of structural shocks, which are not really “news” in the sense defined by the literature, might affect a measure of TFP in the future without impacting it immediately. Among these shocks might be research and development shocks, investment specific shocks, and reallocative shocks. Our identification (and any other existing VAR identifications) would obviously confound any true news shock with these shocks.*

Barsky & Sims (2011), p. 278.

# Growth rate of RD vs growth rate of TFP

◀ Return

# Timing: RD drop vs TFP drop

◀ Return

# IT investment: a break at the right time

◀ Return

$$D = \begin{bmatrix} d_{11} & \gamma_{12} & \gamma_{13} & d_{14} & \cdots \\ d_{21} & \gamma_{22} & \gamma_{23} & d_{24} & \cdots \\ \vdots & \vdots & \vdots & \ddots & \vdots \end{bmatrix} \quad (5)$$

- Indifferent over  $d_{ij}$  as long as  $D$  is orthogonal
- $A\gamma_2$  is the impact response to a news shock
- $A\gamma_3$  is the impact response to a IT productivity shock
- First element of both  $A\gamma_2$  and  $A\gamma_3$  is zero due to the no-contemporaneous effect of both shocks on TFP
- $A\gamma_2$  is such that the FEV of TFP is maximized subject to zero long-run effect on  $RP$
- $A\gamma_3$  is maximizing the remaining FEV of TFP