ICT-Specific Investment Shocks and Economic Fluctuations

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Motivation

Empirical Fact. U.S. output has expanded only slowly in the aftermath of the financial crisis

Fernald, Hall, Stock and Watson (2017) empirically show that two components explain nearly all this growth gap

1. Slow growth in total factor productivity (TFP)
2. Falling labor force participation

In this paper we focus on the **slowdown in TFP**,

⇒ Which variable actually boost productivity? Why?

⇒ Can this variable explain the recent slowdown in TFP?

An alternative to R&D Investment

Several papers endogenize TFP through **R&D investment**

- Financial crisis $\Rightarrow \downarrow Y \Rightarrow \downarrow$ R&D $\Rightarrow \downarrow$ TFP

However, as showed by Oliner et al. (2007) and Jorgerson et al. (2008), TFP have started slowing down **before** the crisis.

$\Rightarrow$ R&D cannot be the full story

We follow an alternative avenue and focus on the relation between **Information and Communication Technology Investment** (ICTI) and total factor productivity

- *Expenditure in equipment and computer software meant to be used in production (as an input) for more than a year.*

Our Contribution

1. **Empirical evidence** that contemporaneous jumps in ICTI explain significant and persistent increases in future TFP
   - SVAR techniques on U.S. aggregates to identify supply shocks specific to the ICT sector

2. We analyze a **theoretical model** to rationalize our empirical findings and draw conclusions concerning the nature of ICT
   - We extend the 2-sector GE model of Greenwood et al. (1997) to accommodate for the role of ICT capital in production

Empirical Analysis

We estimate a structural VAR using aggregate, quarterly US data from 1989Q1 to 2017Q2.

$$X_t = B(L)X_{t-1} + \underbrace{A\varepsilon_t}_{u_t} \qquad (1)$$

- $X_t = [TFP_t \;\; ICTI_t \;\; RP_t \;\; Y_t]$ where $RP_t = \pi_t^{IT}/\pi_t^{CPI}$
- Y_t represents the log transformations of endogenous variables
- A is Cholesky decomposition of $\Sigma_u = u_t' u_t$

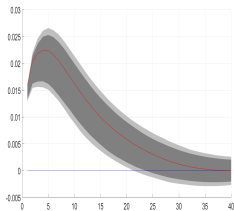Focus is on the second structural shock $\varepsilon_{2,t}$

$\Rightarrow$ $\varepsilon_{2,t}$ maximizes the impact effect on $ICTI_t$ and is orthogonal to contemporaneous innovations in TFP
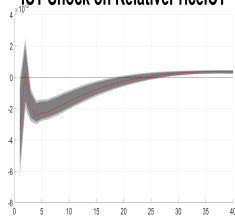
ICT Shock on TFPUtil
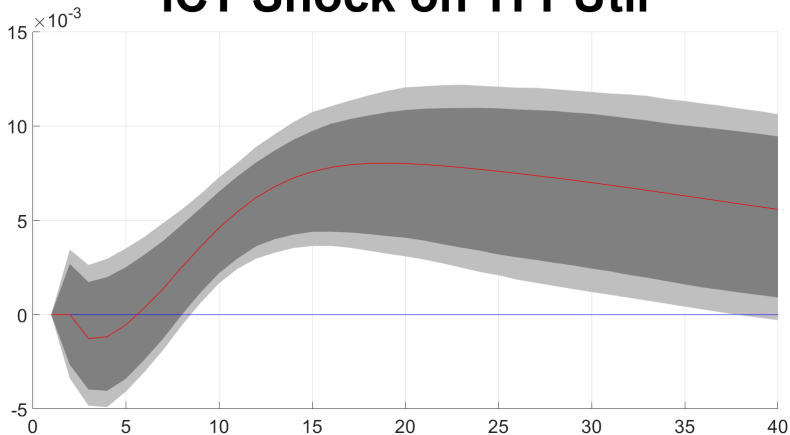
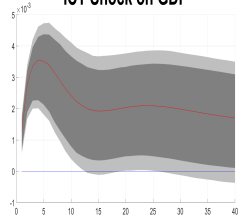# Impulse Responses of X_t to $\varepsilon_{2,t}$
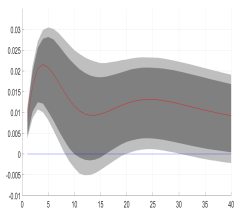

ICT Shock on ICTInvestment
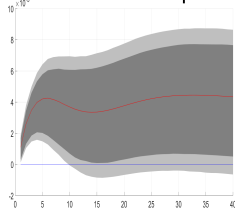
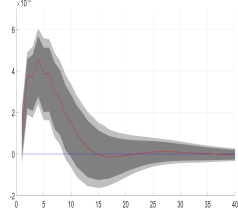ICT Shock on RelativePriceICT

ICT Shock on GDP

ICT Shock on Investment

ICT Shock on Consumption

ICT Shock on Hours

Robustness Checks and Related Exercises

- ICT shocks are **important driver** of business cycle fluctuations
    - Almost 100% of ICT investment on impact
    - Around 30% of TFP fluctuations over 10-year horizon
    - Almost 40% of GDP fluctuations over BC frequencies

- **Results are robust** to
    - Changing the available information in the system
        - $\rightarrow$ Estimated ICT shocks pass Forni-Gambetti test
    - Not controlling for contemporaneous TFP
    - Controlling for news shocks à la Barsky and Sims
    - Controlling for other shocks
        - $\rightarrow$ Ramey Military News
        - $\rightarrow$ Romer-Romer Monetary Policy
        - $\rightarrow$ . . .

Takeaway

We identify a shock specific to the ICT sector where prices and quantities move in different directions

Although TFP does not move on impact, it start rising significantly after a couple of years

- this effect is significant and economically meaningful

- Supply shocks specific to the ICT sector explain a large part of medium-run TFP fluctuations
    - ICT prices fall relatively to CPI
- Shocks which explains large part of TFP fluctuations