The Media is the Message:

Documenting the relationship between technical change and employment, 1909-49

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May 2008

Overview

In the paper we:

- Use new measures of technical innovation to evaluate the impact of new technology on employment for the period
- Discuss the implications for the debate concerning the New deal policies

Motivation

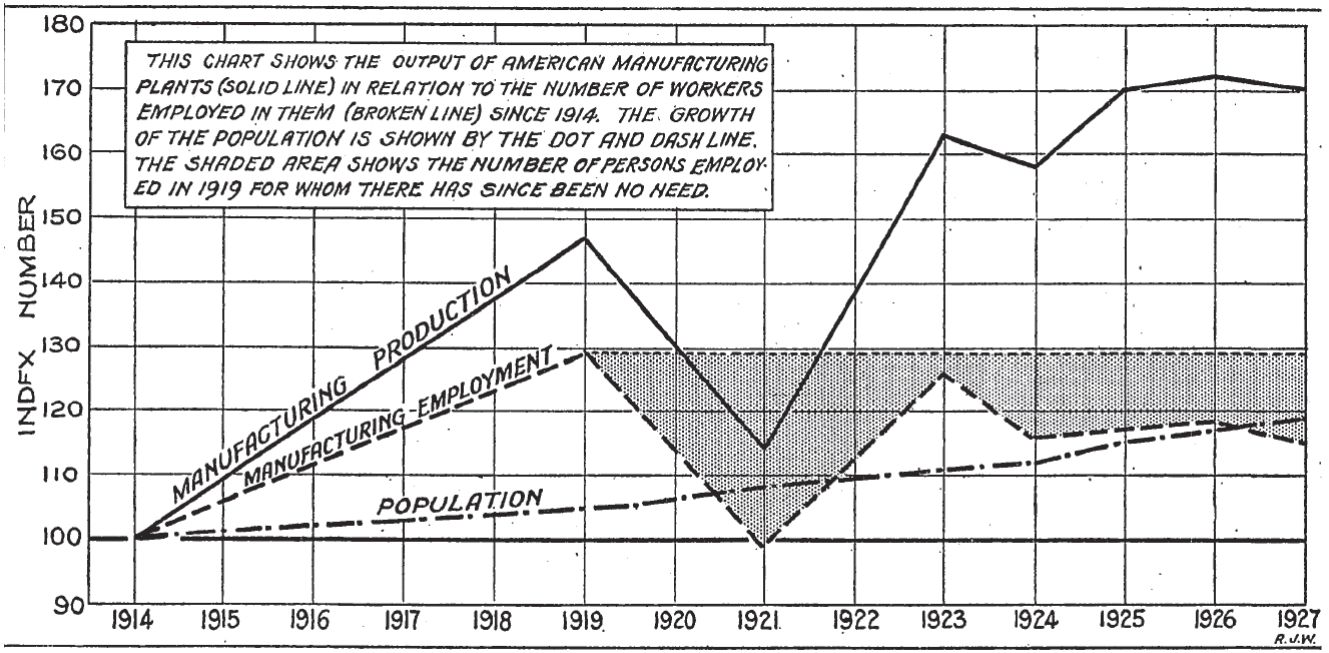
- There is a repeating concern that technical change displaces workers (especially in the short run)

Example: 1884

The first report of the Bureau of labor statistics stated that "…mechanization was the essential reason for the unemployment characteristic of depression."

Example: 1928

Graph from New York Times Article, "March of the Machine Makes Idle Hands" by E. Clark (Feb 26, 1928. p. 129)

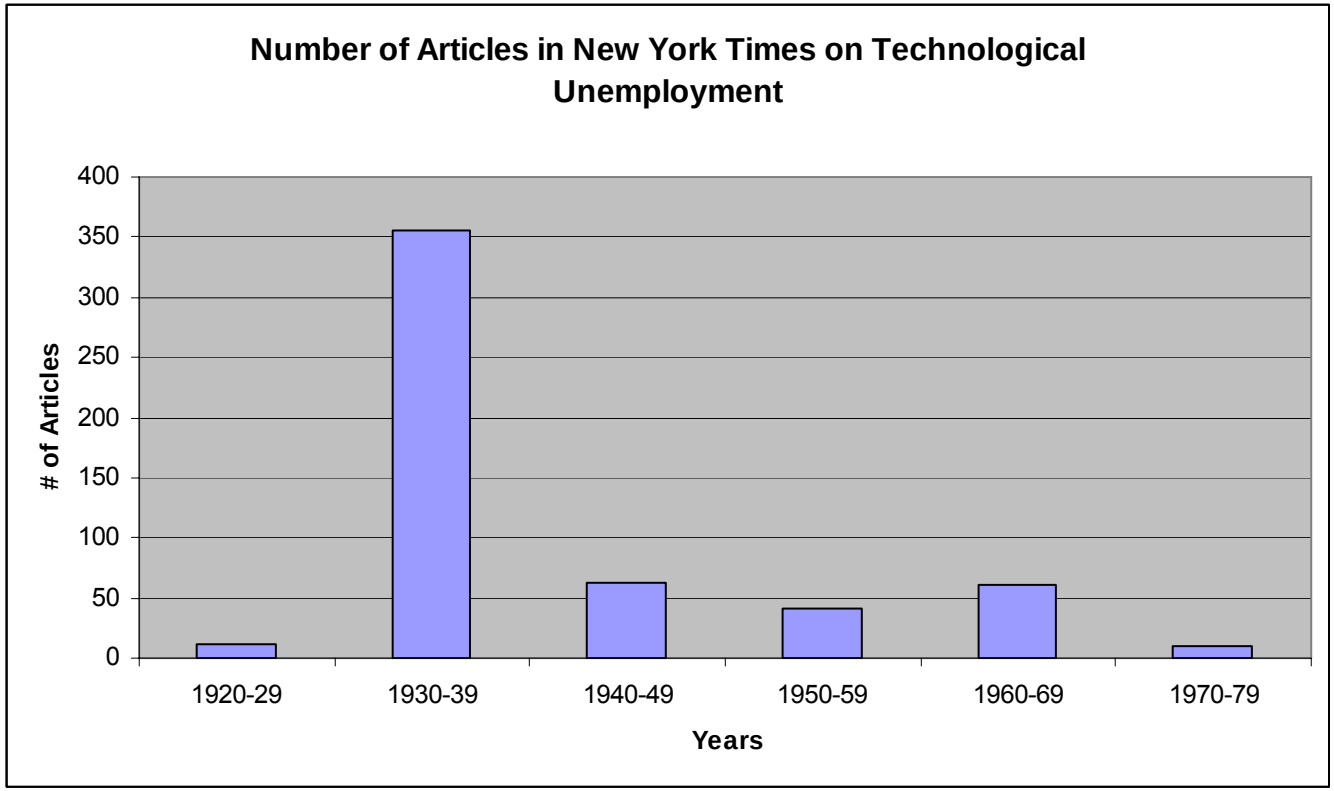


INDUSTRY CARRIES ON WITH FEWER HANDS

The Nation's Factories Have Been Turning Out More Goods Than Ever While More Men Look for Work.

Example: 1930s and 1940s

- Roosevelt's statements at a press conference in 1935 & 1940 State of the Union address
- Hundreds of Articles on Technological Unemployment



- Millions of dollars spend on Works Progress Administrations National Research Project

Examples: 1980s and 1990s

- Cyert and Mowery (1987) Report
- Articles on reasons for Jobless Recovery in early 1990s (e.g., are computers to blame?)

Motivation con't

- A good direct measure of technical change can be used to help determine if the response of employment to a positive technology shock is positive or negative

***Important for model selection and can help with policy debates

The New Deal Policies Debate

- Cole and Ohanian (2004)
  - Assume benchmark economy is a RBC model
  - Slow recovery in the face of large upswings in productivity from 1933 on ---> something changed
  - Conclusion: the New Deal policies (and the NIRA in particular) caused the slow recovery

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- Eggertson (2006)
  - Assumes benchmark economy in the 1930s is New Keynesian
  - the zero bound on nominal interest rates is reached and there are large deflationary shocks
  - Conclusion: the New Deal policies helped the economy recover

- Conclusions depend on whether the economy is best approximated by RBC model or New Keynesian model

- These models generally differ w.r.t. the response of employment to a technology shock

$\therefore$ Knowing what the estimated impulse responses look like for the period can help

How can we identify technology shocks and answer the question of interest?

For the post WWII period the following approaches have been use

Approach 1: Only Tech shocks affect long-run productivity-Gali (1999)

- Post war results are sensitive to assumptions about stationarity of hours
- Long run identifying assumption may be violated

Approach 2: Corrected Solow Residual- BFK(2005))

- Even after correction, residuals may still include non-technology factors

Approach 3: Patent and R&D measures of technology-Shea (1998)

- Patents and R&D expenditures are found to be poor predictors of TFP movements (perhaps because of long lags between Patents, R&D and the time the innovation affects TFP)

Approach 4: Book based measures of technology-Alexopoulos (2006, 2007)

- May not capture all forms of technical change

For the pre WWII period

- We don't have cleansed residuals
- We don't have R&D numbers
- Patents may be affected by changes in the patent protection (especially in the 1930s)
- The long run identifying assumptions proposed by Gali (1999) may be violated

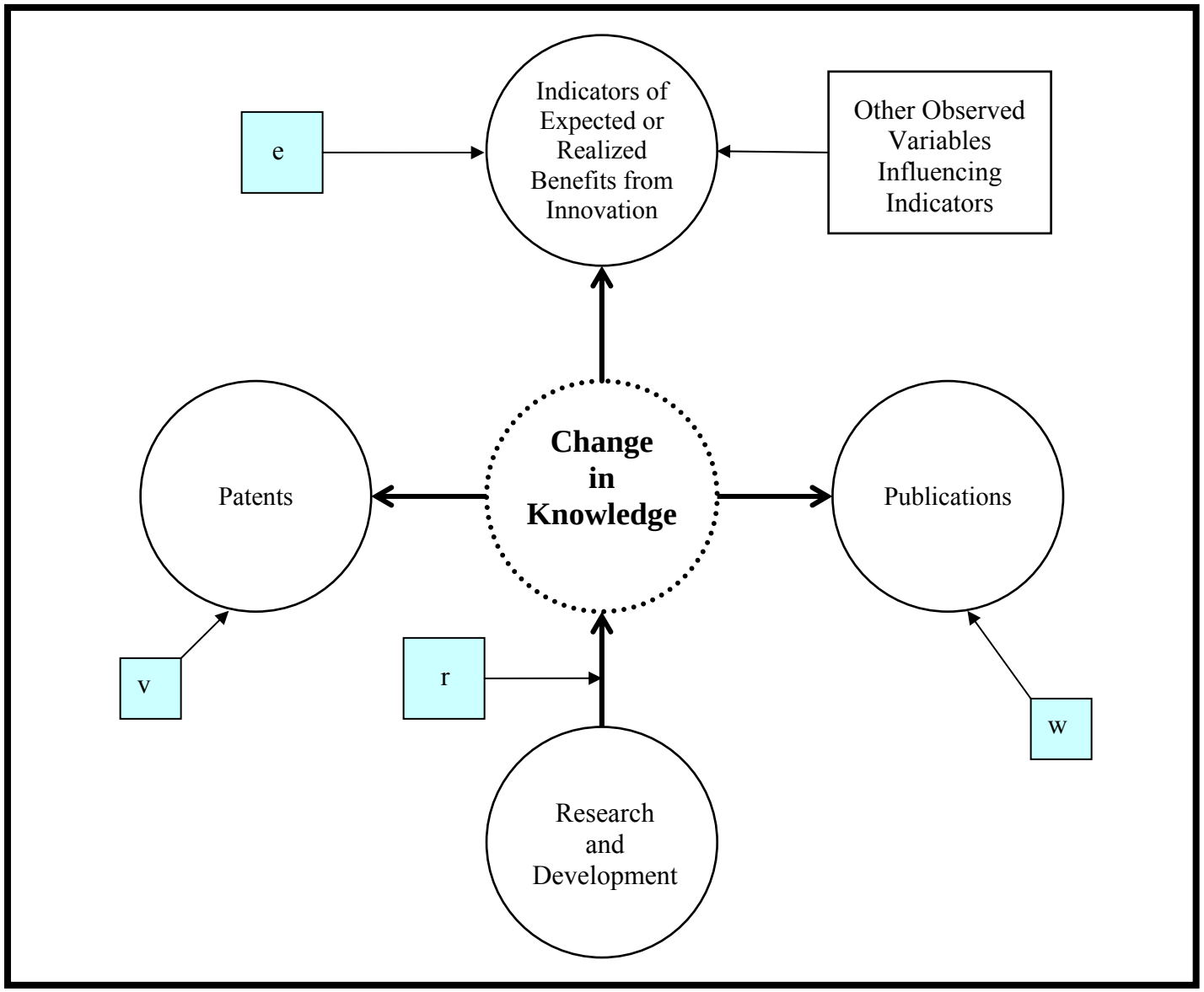
$\therefore$ we will use a publication based measure

An ideal indicator would:

1. Be available at least yearly
2. Not be subjective
3. Be related to the introduction of the new good or process to market
4. Weight various technologies according to their importance
5. Cover all new technologies across industries

The Knowledge Production Function (Griliches)

A Simplified Path Analysis Diagram



The New Book-Based Indicators

Annual Series on Technology and sub-groups (manufacturing/mechanical, electrical/electronics, automotive, railroads)

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- only contains books without History as a descriptor

Figure 5: Sample Marc Record

Actual Record: 00708nam 2200205u
5000010008000000050017000080080041000250350021000669060045000870100017001320400019001
4905000160016810000520018424500300023626000220026630000400028865000580032871000750038
6991004100461-9266583-00000000000000.0-810403s1939 paua 000 0 eng - 9(DLC)
43040050- a0bcbccpremunvduencipf19gy-gencatlg- a 43040050 - aDLCcCarPdDLC-00aTL260-
b.S77-1 aStrouse, Charles Ray,d1889- [from old catalog]-00aAutomatic transmissions, - a[Scranton,-
c1939]- acover-title, 106 p.billus.c19 cm.- 0aAutomobilesxTransmission devices. [from old catalog]-2 -
aInternational correspondence schools, Scranton, Pa. [from old catalog]- bc-GenCollhTL260i.S77tCopy
1wPREM-□

Online Display of Marc Record for Title: Automatic transmissions, by C. Strouse

LC Control No.: 43040050
LCCN Permalink: http://lccn.loc.gov/43040050
Type of Material: Book (Print, Microform, Electronic, etc.)
Personal Name: Strouse, Charles Ray, 1889- [from old catalog]
Main Title: Automatic transmissions,
Published/Created: [Scranton, 1939]
Related Names: International correspondence schools, Scranton, Pa. [from old catalog]
Description: cover-title, 106 p. illus. 19 cm.
Subjects: Automobiles--Transmission devices. [from old catalog]
LC Classification: TL260 .S77

LIBRARY OF CONGRESS CLASSIFICATION OUTLINE - TECHNOLOGY

T Technology (General)

TA Engineering (General). Civil engineering

TC Hydraulic engineering. Ocean engineering

TD Environmental technology. Sanitary engineering

TE Highway engineering. Roads and pavements

TF Railroad engineering and operation

TG Bridge engineering

TH Building construction

TJ Mechanical engineering and machinery

TK Electrical engineering. Electronics. Nuclear engineering

TL Motor vehicles. Aeronautics. Astronautics

TN Mining engineering. Metallurgy

TP Chemical technology

TR Photography

TS Manufactures

TT Handicrafts. Arts and crafts

TX Home economics

Intuition behind timing of book measure

New books are required with new technologies to teach people to use them, fix them etc.

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∴ Timing of first books related to commercialization date

Strengths of New Book Indicators

- Quantitative measure with fairly long time series
- Library of Congress is a Copyright depository
- Can link of book data to economic and financial data at the industry level
- Records contain detailed information on editions, country of publication, subject information, source of information, and year of copyright
- Since it is expensive to produce and market books, new titles are published when the publishers believe there is a market for it
- Average time to release new book on technology/Computers is 6 months
- Books should be related to technological advancement and knowledge

Strengths of New Book Indicators

- Gives more weight to major technological advances

- Although changes in the number of books published can be affected by changes in the book industry, pattern of new books published in other fields (e.g., literature, history, music, etc) can help identify what impact these changes have

Exploring the Relationship between the Indicators, Output and TFP

We run the following VAR:

$$Y_t = \alpha + \gamma_0 t + \gamma_1 t^2 + \rho Y_{t-1} + \varepsilon_t$$

where $Y_t = [\ln(\text{Productivity}_t), \ln(X_t)]'$

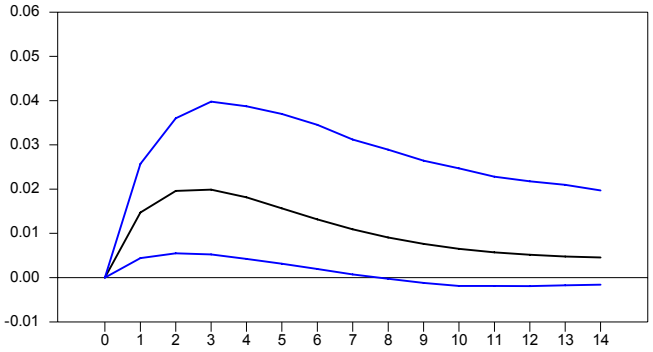
or $Y_t = [\ln(\text{Employment}_t), \ln(X_t)]'$

Identifying assumption: A technology shock doesn't have a contemporaneous impact on output or TFP
(used in Shea (1998) and Alexopoulos (2006))

Impulse Responses of Labor Productivity in the Aggregate Economy

Total Technology Shock

GNP per worker ($1929)



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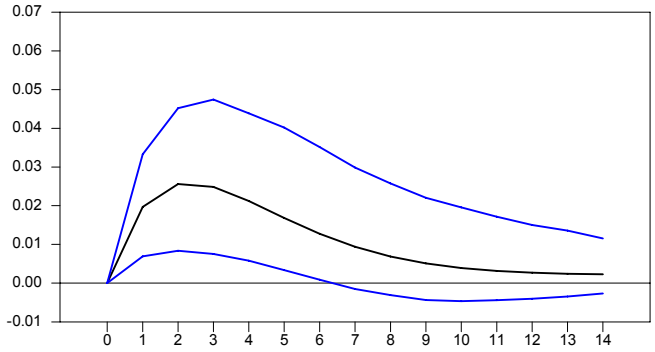
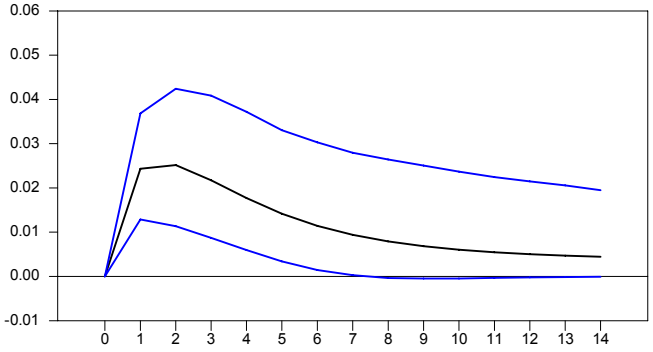


Electrical/Electronics Technology Shock

GNP per worker ($1929)



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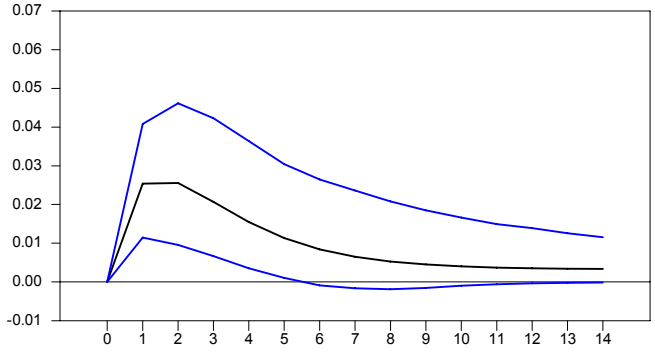
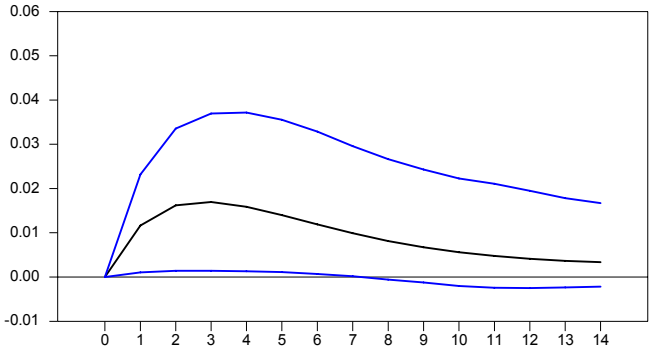


Mechanical/Manufacturing Technology Shock

GNP per worker ($1929)



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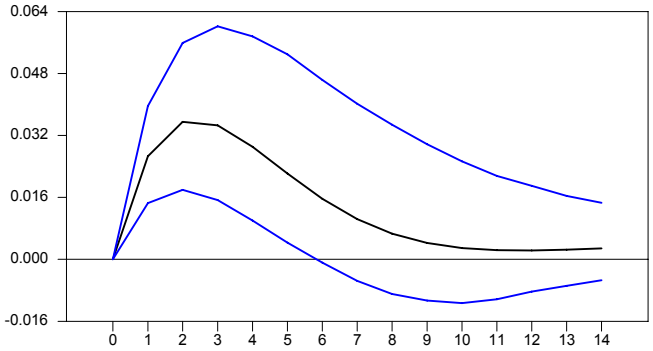

Automotive Technology Shock

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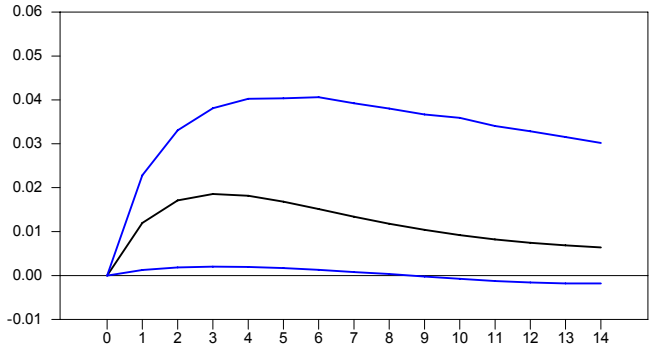

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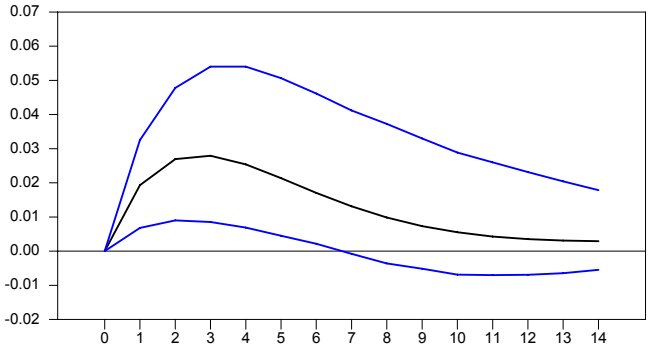
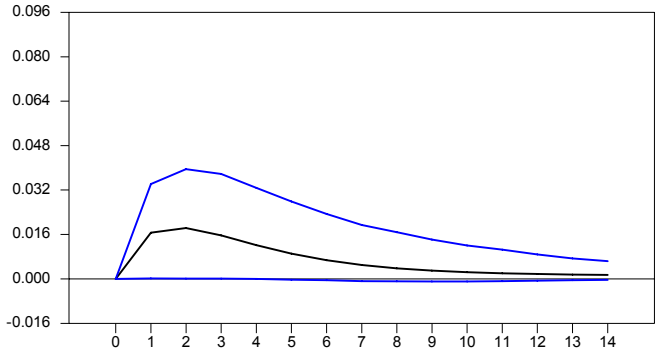


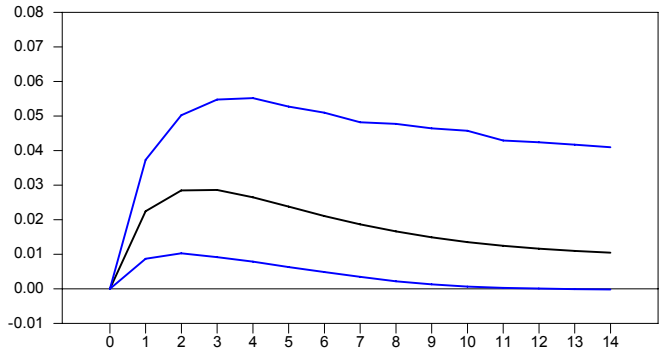
Impulse Responses of Labor Productivity in Manufacturing and Transportation

Total Technology Shock

Manufacturing Sector



Transportation Sector



Electrical/Electronics Technology Shock

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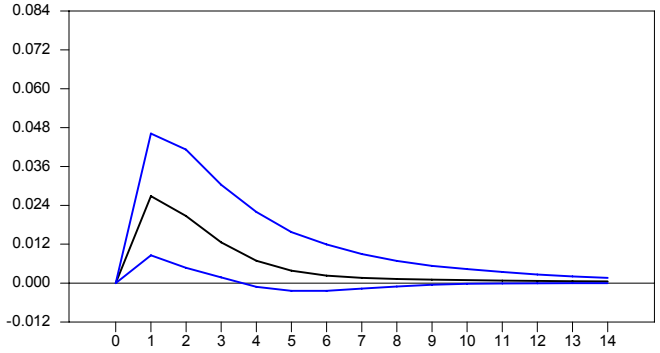

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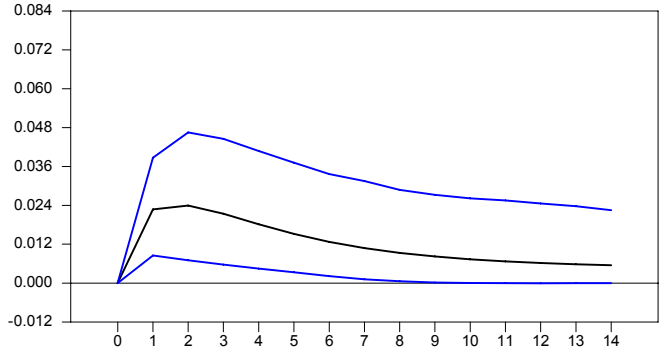

Mechanical/Manufacturing Technology Shock

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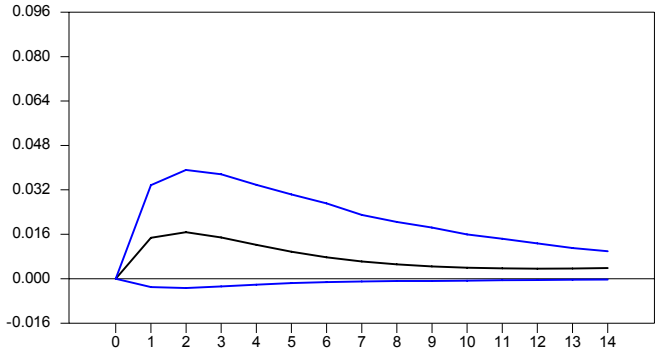

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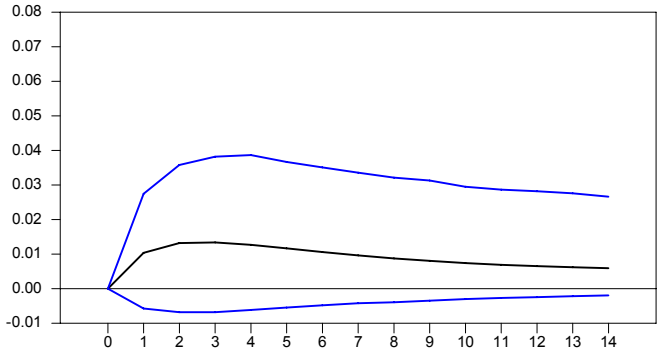

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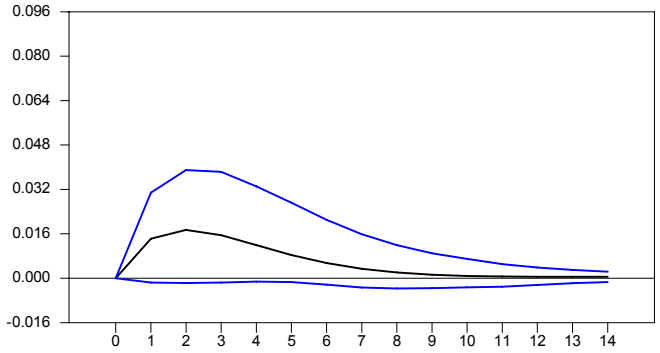
Manufacturing Sector



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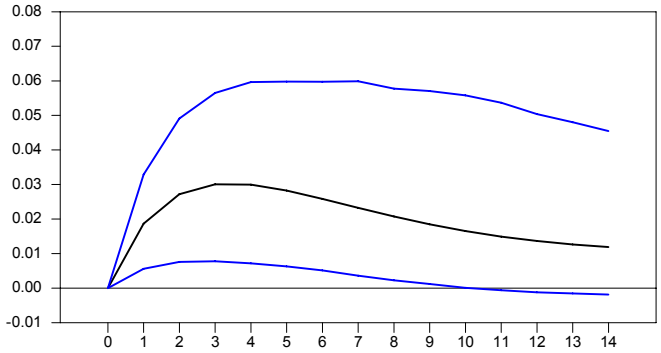
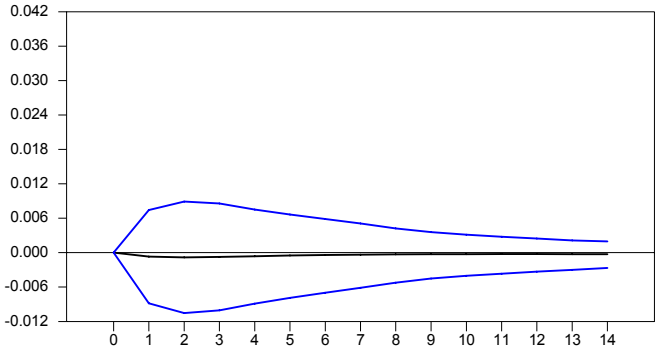


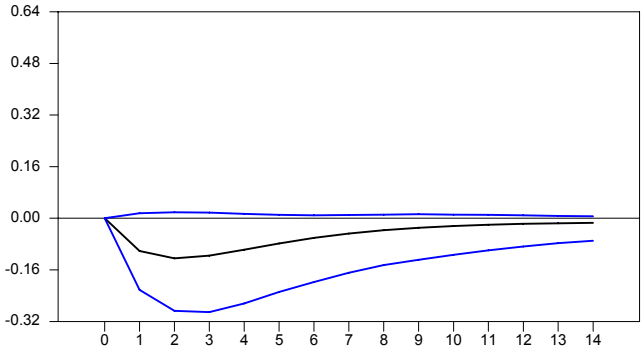
Responses of Aggregate employment per capita and the unemployment rate

Total Technology Shock

Employment

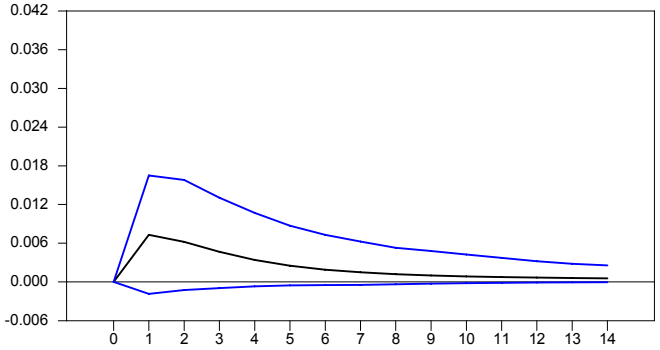


Unemployment Rate



Electrical/Electronics Technology Shock

Employment



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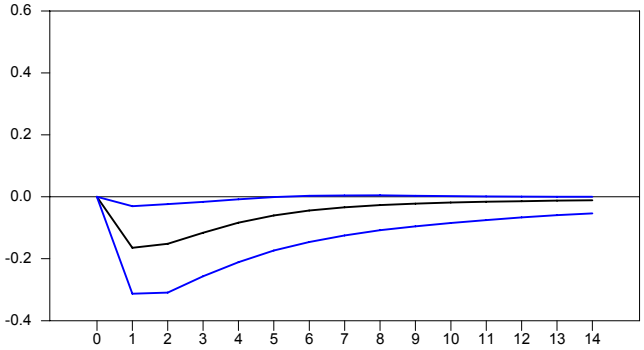
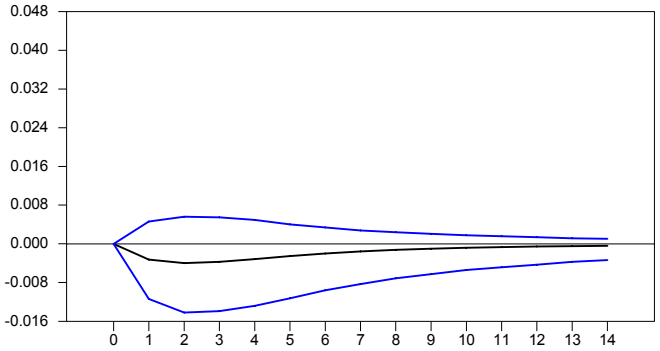
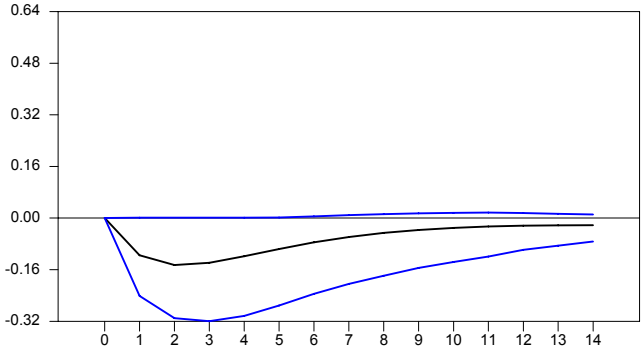


Manufacturing/Mechanical Technology Shock

Employment

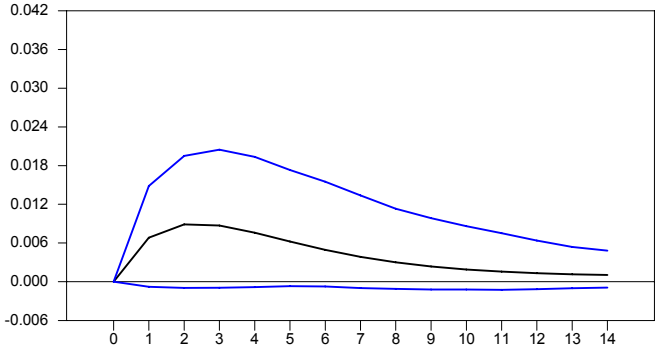


Unemployment Rate

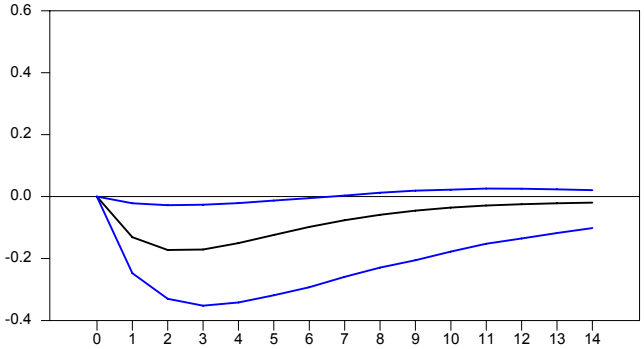


Automotive Technology Shock

Employment



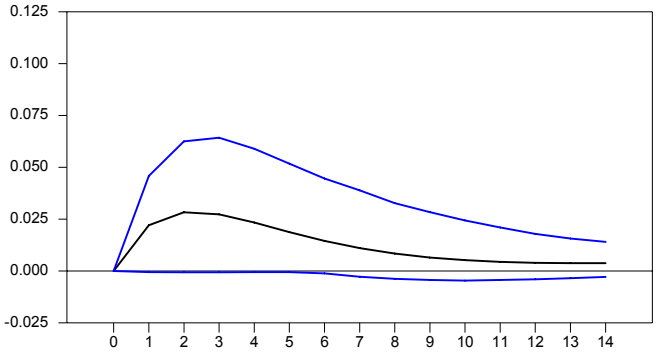
Unemployment Rate



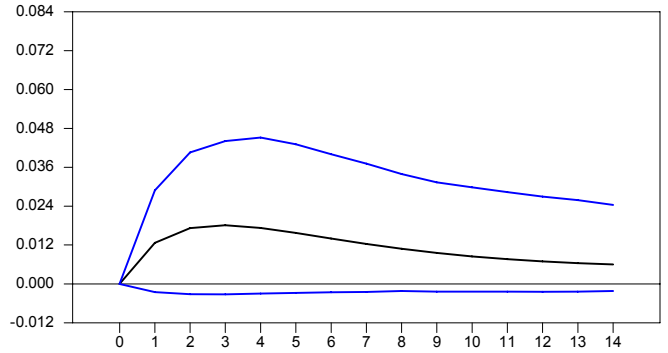
Responses of employment per capita in the manufacturing and transportation industries

Total Technology Shock

Manufacturing Sector

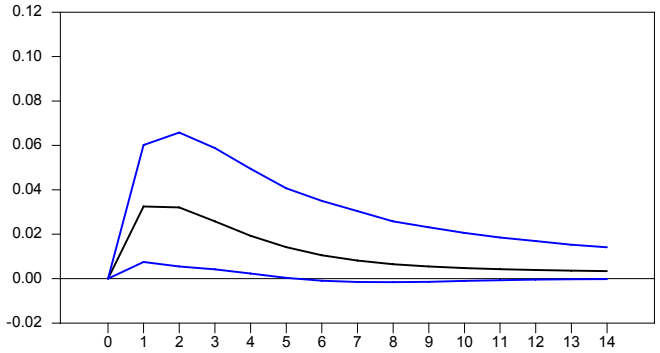


Transportation Sector



Electrical/Electronics Technology Shock

Manufacturing Sector



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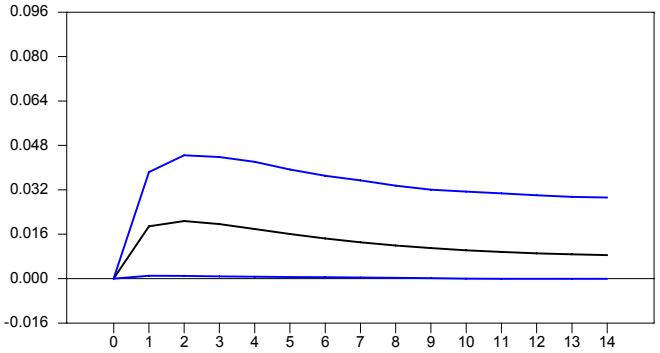
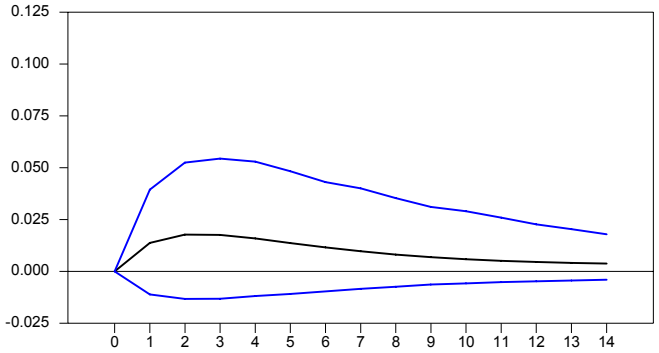


Manufacturing/Mechanical Technology Shock

Manufacturing Sector



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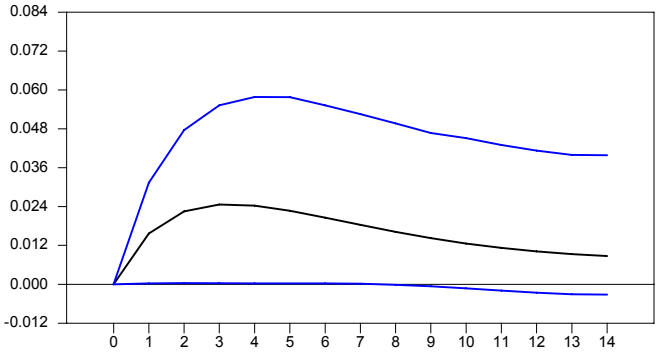
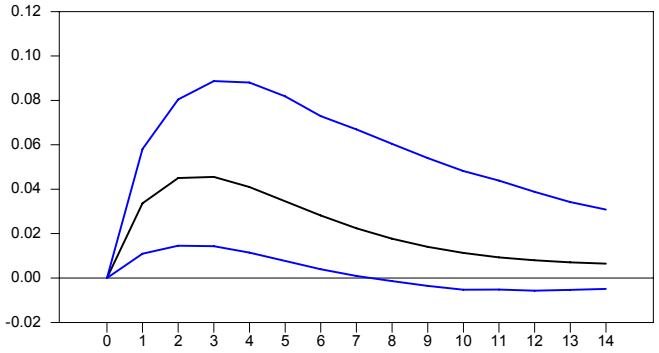


Automotive Technology Shock

Manufacturing Sector



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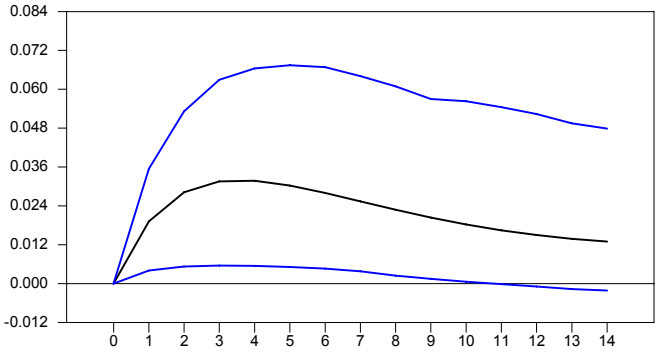

Summary of Variance Decompositions

Productivity

Indicator	Horizon	GNP per employee ($1929)	GNP per employee ($1947)	Private Non-Farm Y/E	Private Non-Farm TFP (1929)	Private Non-Farm TFP (1947)	Manuf. Y/E ($1929)	Transp. Y/E ($1929)
All Technology	3 years	11.19	14.31	2.43	0.22	10.24	7.41	12.40
	6 years	19.08	23.50	3.79	0.38	17.75	11.17	19.01
Manufacturing & Mechanical	3 years	7.03	26.95	11.08	4.16	18.70	6.03	2.75
	6 years	13.12	41.08	16.78	7.42	31.12	9.66	4.64
Electrical & Electronics	3 years	21.59	15.74	4.51	0.89	13.06	12.91	9.32
	6 years	26.25	19.10	5.39	1.11	16.20	14.18	11.61
Automotive	3 years	8.58	15.29	8.54	11.31	9.27	5.91	10.93
	6 years	17.80	28.27	13.76	19.52	18.49	9.87	21.84

Summary of Variance Decompositions

Employment

Indicator	Horizon	Agg. Emp.	Agg. Unemployment Rate	P. N.F. Emp.	P.N.E. Hours	Manuf. Emp.	Transp. Emp.
All Technology	3 years	0.06	5.49	0.16	1.63	6.02	3.63
	6 years	0.10	9.35	0.30	3.06	10.47	6.51
Manufacturing & Mechanical	3 years	1.30	7.30	0.21	0.58	2.37	5.83
	6 years	2.32	12.82	0.43	1.16	4.42	11.33
Electrical & Electronics	3 years	4.32	10.26	6.22	8.71	8.96	6.23
	6 years	5.17	12.54	7.78	10.84	11.10	8.46
Automotive	3 years	6.22	10.50	6.65	10.43	16.46	9.95
	6 years	11.87	19.82	13.35	20.30	29.56	20.59

Main Findings

**Majority of evidence suggests that positive technology shocks increase employment (decrease unemployment)

-Results do not depend on whether the late 1930s are included or not

**Findings more supportive of an RBC benchmark model than New Keynesian (finding similar to Francis and Ramey (2004))

-> Cole and Ohanian (2004) observations more likely correct

**On average only about 10% of variance in employment (or unemployment) are explained by our indicators at a short run horizon

-number between 10-30% for automotive technologies