Discussion:
Government Purchases and Plant Level Productivity
By: Ethan Ilzetzki

Gabriel Chodorow-Reich
Harvard University and NBER

AEA
January 3, 2021

Overview

- RBC theory: TFP $\Rightarrow$ booms.
- Learning-by-doing: growth $\Rightarrow$ TFP.
- Learning-by-necessity: booms $\Rightarrow$ TFP.
- Difficult to disentangle empirically:
  - Very tight labor markets are rare.
  - Hard to measure physical TFP and prices, utilization vary cyclically.
  - Causality in all directions.
- This paper: learning-by-necessity in WWII aircraft production.

Arrow (1962)

I would like to suggest here an endogenous theory of the changes in knowledge which underlie intertemporal and international shifts in production functions... Learning is the product of experience... The role of experience in increasing productivity has not gone unobserved, though the relation has yet to be absorbed into the main corpus of economic theory. It was early observed by aeronautical engineers, particularly T. P. Wright, that the number of labor-hours expended in the production of an airframe (airplane body without engines) is a decreasing function of the total number of airframes of the same type previously produced. Indeed, the relation is remarkably precise; to produce the N th airframe of a given type, counting from the inception of production, the amount of labor required is proportional to $N^{-1/3}$. This relation has become basic in the production and cost planning of the United States Air Force.

— Kenneth Arrow, "The Economic Implications of Learning by Doing," *Review of Economic Studies*, 1962 (16,000+ Google Scholar citations).

Bernstein and Bentele (2019)

Since at least the advent of "Verdoorn's Law," it has been argued that high-pressure labor markets can boost productivity growth. Here too, evidence is not robust and deeply tangled endogeneities abound.
— Jared Bernstein and Keith Bentele, "The Increasing Benefits and Diminished Costs of Running a High-Pressure Labor Market," 2019.

Empirical design

- War Planning Board kept detailed records of physical output and inputs $\Rightarrow$ mitigates measurement problem.
- But allocation of orders not random: war planners invested a lot of effort into maximizing production.
- Bartik instrument: interaction of pre-existing plant specialization with changes in war needs.

Comment I: distinction or difference?

- Often distinguish between capital utilization and "purified" TFP.
- Utilization difficult to measure. Main measure is shift utilization.
- Maybe plants with high *ex ante* shift utilization expanded utilization on other dimensions.
- How should we draw line between utilization and purified TFP?
  - 1 labor shift $\rightarrow$ 2 shifts: clearly higher utilization of floor space.
  - Assembly line rearranged to take up less floor space allowing for additional simultaneous shift: TFP or higher utilization?
  - Wage bonuses if workers hammer doors on faster: TFP or utilization?
- In some models distinction is whether costly to firm or manna from heaven, e.g.: $Y_t = A_t F(U_t K_t, L_t),\ K_{t+1} = (1-\delta(U_t))K_t + I_t$.
- Endogenous growth models blur this distinction.

Comment II: econometric suggestions

1. Incorporate recent applied econometrics Bartik literature:
   - Goldsmith-Pinkham, Sorkin, and Swift (AER 2020).
   - Borusyak, Jaravel, and Hull (RESTUD forthcoming).
   - Or my Ph.D lecture notes: https://dl.dropboxusercontent.com/s/5mwor4r8hmds9nq/All_lecture_slides.zip?dl=0.
2. Prove identification with other types of treatment effect heterogeneity.
3. Outcome (productivity), endogenous variable (current output), excluded instrument (Bartik) all highly serially correlated and interaction (initial capacity constraint) time invariant.
   - Specification controls for lags of output. Are these exogenous and sufficient for lead-lag exogeneity (Stock and Watson, EJ 2018)?
   - Maybe difficult but unnecessary to identify full IRF.
   - Or isolate turning points in war that changed aircraft demand.
4. Control for cumulative production to fully differentiate from learning-by-doing.

Appendix slides