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Learning By Necessity: Government demand, capacity constraints, and productivity growth

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A long tradition in economics posits that producers' productivity increases with scale and experience, whether due to fixed costs to production or "learning by doing". Much of this evidence comes from the US war production drive during the Second World War, during which US industry produced more munitions than was thought possible at the beginning of the war. The evidence is mostly non-causal, showing that plants' productivity is correlated with the (cumulative) volume of sales. I revisit this canonical setting and investigate productivity growth in the US aircraft industry during the war. I propose an instrument to address the problem of causal inference based on changes in demand for broad aircraft types due to shifting military needs and strategy. I show that traditional "learning by doing" regressions show substantial pre-trends, suggesting a reverse direction of causation whereby the US military directed procurement to plant that were already more productive. However, using the instrumental variables approach I find a causal relationship whereby plants' productivity did indeed increase when receiving more demand. I find important heterogeneity in the effects of demand on productivity. It is primarily plants operating at high rates of capital utilization that increased productivity when demand surged. Further, I show that plants took active measures to increase productivity when facing higher demand and tight capacity constraints. These include modernizing their production methods, combatting absenteeism and turnover, and outsourcing production to feeder plants. Combined, the evidence suggests that "learning" doesn't occur passively through "doing". Instead, plants take active measures to increase productivity when demand increases, particularly so when facing tight constraints on their production capacity. I refer to this phenomenon as "learning by necessity". The evidence is based on newly collected and digitized archival data on the US airframe industry during World War II.