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Whither Technological Innovation, Business Dynamism, and Productivity Growth?

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Workforce Disrupted

Seeking the Labor Market's Next Equilibrium

This paper explores the ups and downs of innovation and productivity growth in the US economy and potential connections to the ups and downs of business dynamism and entrepreneurship over the last few decades. The 1990s and early 2000s exhibited rapid innovation and productivity growth. Productivity growth has slowed since the mid-2000s in a somewhat surprising manner – especially to those who monitor advances in innovation with apparent ongoing advances in cloud computing, robotics and automation. In the high productivity growth period of the 1990s, the US exhibited a highly entrepreneurial and dynamic economy. Indeed, policymakers in the late 1990s and early 2000s highlighted these factors as being critical for the surge in productivity during this period.[1] In the productivity slowdown period, indicators of entrepreneurship and dynamism have slowed down and there has been an increase in the concentration of economic activity in large, mature firms. Interestingly, there are initial signs of a reversal in these dynamics as the US has emerged from the pandemic.

The productivity surge in the 1990s and early 2000s was led by innovation in Information, Communication and Technology industries (ICT – often also referred to as High-Tech). An important accompanying component of this surge in innovation and productivity growth was a leading surge in startups and indicators of business dynamism in the High-Tech sectors. Evidence (see Foster et al., 2019) shows that during this productivity surge, the surge in startups in an individual high-tech industry preceded the surge in productivity by six to nine years. In the years prior to the increase in productivity, the initial dynamic following a surge in entry was an increase in within-industry productivity dispersion, an increase in the pace of job reallocation, and a decline in productivity growth.

These patterns are consistent with the dynamics of innovation, experimentation and the shakeout process described by Gort and Klepper (1982) that have been exhibited during major periods

[1] See speeches on the "The American Economy: Poised for a New Century" by Secretary of the Treasury, Lawrence Summers, August 1999 and "Productivity" by Chairman of the Board of Governors of the Federal Reserve Ben Bernanke, August 2006.

of innovation over the last 100 years. Gort and Klepper (1982) document that innovation takes time and has distinct phases. The early innovation phase is dominated by entry and experimentation including investments in changes in organization. During this time productivity growth may decline with a rise in experimentally oriented misallocation. A shakeout process ensues with successful innovators expanding while unsuccessful innovators contract and exit. The successful innovators grow rapidly (becoming the large, successful firms of that wave of innovation) with accompanying productivity growth. Historically, these dynamics can be stretched across many years.

The core hypothesis is that startups and young firms are a critical part of the innovation process in the US. Young firms are inherently experimental, developing new products in processes in some manner. Most young firms fail or don't grow but a small fraction grow very rapidly (Decker et al., 2014). It is these young firms that engage in major innovations that lead to substantial growth (see Akcigit and Kerr, 2018; Akcigit and Goldschlag, 2023). Large, mature incumbents have incentives to make more incremental innovations. At some point in their history such firms made major innovations to develop products or processes that enabled them to become the successful firms they are (typically when they were young). However, they are less likely to engage in major innovations in order to avoid cannibalizing their customer base and market share.

Many factors have been suggested as underlying the slowdown in productivity growth. One hypothesis is that technological innovations are subject to fluctuations over time. The ICT revolution led to many major changes in the products and ways of doing business but the effects dissipated by the mid-2000s (see Gordon, 2014). Under this perspective, the decline in startups and dynamism is attributed at least in part to the decline in technological innovation. That is, the causality may be running in part from the pace of innovation to dynamism and entrepreneurship. Gort and Klepper (1982) emphasize that startups both induce innovation and are drawn to innovation.

The causality may also run from the factors yielding declining dynamism and entrepreneurship to innovation and productivity growth. To provide guidance about this perspective, it is instructive to review structural changes in the economy since the 2000s. As the slowdown occurred, the revenue productivity gaps (i.e., revenue per unit input) among firms within sectors grew substantially (see Decker et al., 2020; Andrews et al., 2016). From the perspective of Hsieh and Klenow (2006), such rising dispersion in revenue productivity implies rising frictions and distortions that are a drag on advances in productivity (see Hsieh and Klenow, 2006). What are these rising frictions and distortions? Rising dispersion in markups across firms with markups rising especially for large firms is one potentially important increasing distortion (see DeLoecker et al., 2020). The responsiveness of firms to changes in their firm-specific realizations of productivity and demand shocks has slowed down (Decker et al., 2020) which may be driven by a number of factors including rising dispersion in markups, increases in political and economic uncertainty (Baker et al., QJE, 2016), slowing diffusion, and increases in the frictions associated with adjusting the scale and mix of operations at businesses including the adjustment of capital and labor. Davis and Haltiwanger (2014) emphasize that impediments to labor market fluidity such as non-compete clauses, increases in occupational licensing and reductions in the employment at will doctrine are contributing factors.

Accompanying the rising productivity gaps across firms has been a decline in measures of business dynamism and entrepreneurship. The rising frictions and distortions discussed above are potential mechanisms underlying this decline in dynamism. There has been a trend decline in the pace of overall job reallocation since the late 1980s but key innovative industries (High-Tech)[2] have exhibited a decline only in the post-2000 period. Preceding and accompanying the productivity surge from the High-

[2] High-Tech is the set of 4-digit industries that are the most STEM intensive (see Decker et al. (2020)). This includes the ICT industries in manufacturing and non-manufacturing and the scientific development industries (new AI firms are often classified in the latter).

Tech industries in the 1990s, the pace of job reallocation rose in those industries from the 1980s through the early 2000s.

The share of employment at young firms exhibits broadly similar trends to the overall pace of job reallocation with entrepreneurship surging in the High-Tech industries in the 1990s through the early 2000s but declining thereafter (see Decker et al., 2020). The flip side of the declining share of activity in young firms is the rising share of activity in large superstar firms (Autor et al., 2020). For example, the rise in Mega firms (firms with more than 10K employees) has been particularly pronounced in non-manufacturing High-Tech industries in the post 2000 period (see Haltiwanger, 2021).

The shift towards large, mature firms likely reflects many factors. Network externalities associated with ICT technologies are likely behind the increased share of activity accounted for by mega firms in the high-tech sector. Relatedly, globalization and information technologies have favored large incumbents in other sectors such as Retail Trade. While rising concentration reflects the substantial innovations by *superstar* firms, the accompanying decline in competition is consistent with the aforementioned rise in the level and dispersion of markups.

In spite of these headwinds to productivity growth, AI may yield a new and sustained surge in productivity. It remains to be seen whether AI yields this surge through disrupting the structural changes discussed in this section and rekindling business dynamism. There is some evidence that the decline in business dynamism in the US is being reversed during the last few years. Business formation has been surging in the U.S. since 2020 (Haltiwanger, 2022; Decker and Haltiwanger 2023). Some of this is undoubtedly associated with the structural changes induced by the pandemic in terms of changes in work and lifestyle (e.g., there has been a surge in business formation in e-commerce). However, this surge in business formation has continued through the present. As of July 2023, applications for new businesses that signal they are likely new employers remain more than 30% higher than in 2019. Moreover, this includes a surge in key High-Tech industries (the Information sector (NAICS 51) and

Professional, Scientific, and Technical Services (NAICS 54)). New AI firms are likely to be classified in one of these two industries.

To conclude, the full implications of the pandemic startup surge will take several years to unfold. This reflects the highly volatile nature of startups, especially over their first five-to-ten years. As discussed above, this surge in startups has occurred in spite of factors that were dampening the pace of business entry—and business dynamism more generally—in the decades leading up to the pandemic. It is unlikely that those factors, while still not completely understood, have disappeared entirely. Whether the countervailing forces driving the pandemic surge are sufficient to change the pre-pandemic trend decline is unclear. The surge in entry that has been seen since 2020 will need to be very persistent, and the new cohorts of entrants would have to feature a sufficient number of high-growth firms, for past trends to be substantially reversed.

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