

Creating Economic Opportunity for More Americans through Productivity Growth

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ABSTRACT

The U.S. economy in recent years has been characterized by slow average productivity growth and increasing productivity dispersion within industries. These trends have coincided with analogous changes in wages—slow average wage growth and greater wage inequality between workers. In this essay, I discuss research into the potential causes of these patterns and outline several policy changes that would yield expected productivity and wage benefits under general conditions.

1. The Challenges: Slow Productivity Growth and Widening Productivity Gaps

U.S. labor productivity growth has been slow for more than a decade. Since 2005, it has averaged 1.3% per year, less than half its 2.9% annual growth rate in the decade prior. Because labor productivity growth effectively bounds the rate of sustainable per-capita growth of gross domestic product (GDP), this slowdown has critical implications for people's material wellbeing. Considerable potential growth has already been lost in the 14 years since the slowdown began: Had labor productivity growth sustained its 1995-2004 rate, annual GDP would be over \$4 trillion (20%) higher today. The slowdown is therefore costing the United States over \$12,000 per capita annually.

Because there has historically been a tight correspondence between labor productivity growth and wage growth, the slowdown also portends slower real wage growth for workers. This is observable in the data. While real total labor compensation per full-time equivalent employee (calculated using the GDP deflator) increased 2.1% annually from 1995-2004, it has grown only 0.8% per year since then. These compensation trends are driven by two factors: the size of the pie (i.e., total GDP) is increasing at a slower rate because of lagging productivity growth, and workers' share of that pie is falling (e.g., Elsby, Hobijn, & Şahin, 2013).

Workers at the lower end of the wage distribution have faced a double deceleration. Not only has average compensation growth slowed, but wages at the lower end of the distribution have fallen behind even that more sluggish target. Indeed, this trend preceded the overall productivity slowdown of the past decade—lower end wages have trailed productivity growth for about 40 years. One should be clear what "lower end" means here: It is not just the very lowest percentiles that have failed to keep up with productivity growth—even median wages have fallen behind (Bivens & Mishel, 2015).¹

1 It is worth noting that, in addition to these measures of material wellbeing, certain populations have experienced over the same period declines in other measures of welfare, like life expectancy (Case & Deaton, 2017).

The spread in the wage distribution mirrors the productivity trend. The variance of productivity levels across firms has been increasing since at least 2000 in the United States and elsewhere (Andrews, Criscuolo, & Gal, 2015; Decker, Haltiwanger, Jarmin, & Miranda, 2018)—that is, productivity gaps are widening within industries. Producers at the frontier have continued to see relatively brisk productivity growth, while growth in the lower quantiles has slowed. This divergence has accompanied gains in the relative size of high-productivity producers; a small number of superstar companies have continually eaten up more market share (Brynjolfsson, McAfee, Sorell, & Zhu, 2008; Autor, Dorn, Katz, Patterson, & Van Reenen, 2017).

Recent research indicates the simultaneous spreading of the productivity and wage distributions is not a coincidence. Song, Price, Guvenen, Bloom, and von Wachter (2015) demonstrate that two-thirds of the increase in the variance of U.S. workers' earnings from 1978-2013 occurred between firms, rather than within them. A considerable amount of other research has demonstrated that higher productivity firms in an industry pay higher wages (e.g., Faggio, Salvanes, & Van Reenen, 2010; Carlsson, Messina, & Nordström Skans, 2016).

In other words, as firms have diverged in their abilities to turn inputs into outputs, so have their worker compensation packages. Song et al. (2015) develops evidence that this divergence is tied to increasing sorting and segregation of workers across firms, with high-earning workers increasingly concentrating in high-performance companies.

A NOTE ON EMPLOYMENT IMPLICATIONS

The discussion so far has focused on the wage implications of recent productivity trends, but there could also be employment effects. Naturally, if output is fixed, lower labor productivity raises employment. However, output is not fixed, so there are countervailing employment effects of lower productivity growth. Lower productivity levels imply higher costs, and therefore higher output prices—higher prices reduce demand for the both the output and the labor required to produce the output. Further, higher output prices can also reduce demand for products that are complements or inputs of the now lower productivity product. Labor productivity growth's employment effects are therefore theoretically ambiguous.

The potential employment effect of productivity growth that is currently receiving the most policy attention actually concerns not slow productivity growth, but rather rapid productivity growth in the form of automation, which some worry may put massive numbers of people out of work. Of course, in such a scenario, labor productivity would grow tremendously, well above the current languid pace.

Such a productivity surge would be a good thing for the economy and the workers in it. It is certainly true that over long horizons, productivity growth due to capital deepening has coincided with reductions in employment in sectors like agriculture

and manufacturing. Further, recent work has highlighted instances of specific technologies substituting for labor in a manner that leads to a net decrease in employment and average wages (Acemoglu & Restrepo, 2017). However, the balance of evidence suggests that this is not yet a sizable, economy-wide phenomenon (Autor & Salomons, 2017). Thus, to the extent that a new wave of automation could create an unemployment problem as a side effect, such concerns might best be left until there are signs that productivity growth is accelerating again while aggregate employment growth is slowing. As a result, I will not discuss this topic further in this memo.

EXPLANATIONS FOR THE PRODUCTIVITY AND WAGE GROWTH SLOWDOWN

Research has not yet definitively identified which specific forces have caused the slowdown in average productivity and wage growth and the increase in their dispersion. I discuss several plausible candidates.

Mechanically speaking, labor productivity growth can come from two sources: capital deepening and total factor productivity (TFP) growth. Capital deepening is an increase in capital per worker. TFP growth is often interpreted as technological progress—it takes the form of producers in the economy developing ways to make more or better products from the same amount of inputs. I interpret it similarly here, though one should be mindful that, as a residual, TFP can also reflect factors such as market power, nonconstant returns to scale, and measurement error. A deceleration in capital investment relative to labor force growth, or a reduction in the pace of technological change, will reduce labor productivity growth.

I consider, in turn, the possible roles of slowing investment and technology in the productivity slowdown. Before doing so, however, I focus briefly on why the bulk of evidence suggests that the slowdown is *not* just an illusion of mismeasurement.

Arguments for this “mismeasurement hypothesis,” such as Mokyr (2014) and Hatzius and Dawsey (2015), point out the rising prominence of IT-based goods—such as smartphone cameras and GPS systems, online social networks, and downloadable media—that cost consumers little but seemingly deliver considerable surplus. The main argument is that productivity statistics miss these goods because they do not involve a monetary transaction, at least per unit consumed on the margin. However, a number of recent studies (Cardarelli & Lusinyan, 2015; Byrne, Fernald, & Reinsdorf, 2016; Nakamura & Soloveichik, 2015; Syverson, 2017) suggest that the slowdown is not primarily a mismeasurement problem. Using different data and approaches, these studies demonstrate that while mismeasurement certainly exists, there is no indication that it became systematically worse in the necessary direction and with enough magnitude to account for the slowdown.²

2 Though as a policy matter, improving economic statistics would be helpful for many reasons.

Research is somewhat mixed regarding the importance of a slowdown in the growth of one of the largest and most commonly measured capital stocks: tangible private capital. Ollivaud, Guillemette, and Turner (2016), for example, calculate that reduced capital deepening played a substantial role in the labor productivity slowdown in the United States and many other OECD economies. McKinsey Global Institute (2018) comes to a similar conclusion. On the other hand, recent calculations by Fernald, Hall, Stock, and Watson (2017) suggest that tangible private capital stocks per worker are at the level one would expect given the Great Recession and the following recovery. Syverson (2016) finds in U.S. manufacturing that while decade-long changes in labor productivity and capital intensity were aligned, their year-to-year correlations were much weaker.

A possible reconciliation of these disparate findings is that a recession-driven slowdown in private investment probably contributed to the labor productivity growth slowdown. It is less clear going forward that a dearth of private investment will be a millstone around the neck of productivity growth.

It is arguable that investment in a particular type of *public* capital—infrastructure—has lagged for some time, has not yet recovered, and is acting as a drag on productivity growth. While private, nonresidential capital per worker averaged 1.4% annual growth over the past 20 years, publicly owned capital per worker grew only 0.7% per year. It is not just the *quantity* of public capital seeing a relative decline. Almost every type of publicly owned capital—equipment and structures at the federal, state, and local level—has aged substantially over the past 20 years. The dollar-weighted average age of public capital grew from 20.3 years in 1997 to 24.4 years in 2016, an increase of 20%. The average highway is almost six years (25%) older than it was 20 years ago, and other transportation infrastructure is 3.5 years (21%) older. Transportation infrastructure is a publicly provided factor of production. When it becomes more thinly stretched or effectively obsolesces, productivity can decline.

The case for slowing technological progress (reflected in TFP growth) weighing down labor productivity growth has been made in related but slightly different guises by Cowen (2011) and Gordon (2015). The core narrative of their research is that the economy has picked the low-hanging technological fruit and now must make continually greater efforts to progress at a given rate. This notion has found some empirical backing recently in Bloom, Jones, Van Reenen, and Webb (2017). This study shows that multiple specific technologies have recently experienced a pattern of increasing effort-per-unit-progress.

A related, yet distinct, explanation for slowing technological progress cites a loss of dynamism in the economy. Economic dynamism of multiple types—business formation and closure, job reallocation, worker mobility—has been in steady decline in the United States for decades (e.g., Davis & Haltiwanger, 2014; Molloy, Smith, Trezzi, & Wozniak, 2016; Decker, Haltiwanger, Jarmin, & Miranda, 2017; Kaplan &

Schulhofer-Wohl, 2017). While dynamism need not be inherently related either positively or negatively to growth, hundreds of studies have shown that market-driven reallocations of activity across producers, whether among existing producers or through replacement of exiting firms by entrants, tend to raise average productivity by shifting resources to more productive uses. This, in effect, is technological progress through compositional effects: markets reward with growth producers that figure out how to do things better. If reduced dynamism slows this process, average productivity growth falls.

A somewhat more optimistic explanation for the slowdown in technological progress is that the economy is undergoing an adjustment period between major technologies, with artificial intelligence in particular being a candidate for the next general-purpose technology (GPT) (Brynjolfsson, Rock, & Syverson, 2018). The driver of this “implementation lag” is that two things must happen before new GPTs can have notable effects on aggregate productivity growth. First, the GPT stock must be accumulated to a sufficient size to move aggregates. Second, the complementary processes and technologies necessary to fully harness the GPT must be discovered, developed, and implemented. Historical evidence from earlier GPTs (e.g., David, 1990) indicates both processes can take considerable time. Productivity growth slows in the adjustment period while inputs are used to build capability rather than produce output.

Elements of each of these explanations probably play some role in explaining the slowdown. Infrastructure growth per worker has faded in both quantity and quality. The low-hanging fruit technological slowdown story has some credence. However, the pessimistic implications for future productivity growth that often accompany this narrative would be tempered if the implementation lag explanation is partially accurate because the latter implies the current slowdown is a temporary but necessary predicate for accelerated future growth. As for dynamism, there is no doubt that it has fallen; the still unanswered question is how large of an effect this fall has had on productivity and wage growth.

EXPLANATIONS FOR GROWING PRODUCTIVITY AND WAGE DISPERSION

As with the overall productivity and wage growth slowdowns, researchers have proposed several explanations for the growing productivity gaps among producers within industries. Here, too, these explanations need not be mutually exclusive.

Increasing market power and rents may be one source of the spread. Multiple studies have proposed this theory, including Furman and Orszag (2015), Barkai (2017), and De Loecker and Eeckhout (2017). This explanation asserts that certain companies have been able to better separate themselves from both their competitors and from

competition (including from potential entrants) more generally. This separation has, in turn, led to growing disparities in outcomes like productivity, profitability, and wages. Such competition-limiting ability could have multiple sources: rent-seeking that favorably shapes institutional or legal environments, natural winner-take-all effects in network goods markets, old-fashioned antitrust violations missed or ignored by the authorities, or shifts in consumer tastes that raise brand loyalty. Relatedly, these factors can create a skewed distribution of the gains from technological progress, which may lead to dissipative efforts on the part of companies to attain or preserve those gains. If this were the case, even if average productivity growth were holding at a decent pace, the benefits to the median worker (or, more generally, those at lower wage quantiles) could be nil.

The evidence consistent with the market power story includes broad-based increases in accounting margins and profits, as well as declining entry rates. On the other hand, Karabarounis and Neiman (2018) argue that interpreting increasing accounting margins as profits relies on a narrow definition of capital costs. Moreover, if the same interpretation were applied to historical data, it would imply that profits today, while increasing over the last three decades, are still actually lower than their implied levels in the 1960s and 1970s. In addition, Autor et al. (2017) find some patterns consistent with increasing within-industry skewness being related to more competition rather than less. This is still an area in need of further research. While the market power story appears plausible, current evidence is considerably short of dispositive.

An alternative explanation for increasing productivity dispersion is that something damaged the processes that diffuse best practices and technologies. Companies at the frontier may be successfully innovating, but diffusion frictions may be preventing less productive firms from keeping up. Andrews et al. (2015) show evidence of this. They find that companies at the frontier of the productivity distribution (defined as the top 50 to 100 firms globally in an industry) still experience reasonably robust productivity growth, while those at the median stagnate. Thus, it may be that technological progress itself may not have slowed that much, but rather that the economy's ability to distribute the gains of that progress has faltered. The upshot of this diffusion failure is both slower aggregate productivity and wage growth (both of which, after all, are averaged across all producers, not just those on the frontier) and increasing disparity in productivity and wages.

2. Policy Proposals

The discussion above has elucidated two problems facing American workers: slow average productivity growth and increasing productivity gaps between firms. Both of these productivity patterns are related to analogous patterns in workers' wages.

Research points to several candidate policies to address these phenomena. The best policy to apply depends, of course, on the specific mechanism(s) driving the problems. Because that question is yet unsettled, it is difficult to identify with precision the optimal policy response. As such, a multi-faceted approach to the problem is sensible. This is prudent in other ways, as well—many of the policies proposed below have limited implementation costs and would improve other elements of the economy's functioning, even if they do not end up having a large direct influence on productivity.

Invest in Infrastructure

If, as discussed above, a dearth of public productive capital is reducing labor productivity, infrastructure investment could reverse this. Fernald (1999) and Baum-Snow (2007) document examples of such gains in the United States; many other studies have shown similar qualitative effects in other countries (for reviews, see Crafts (2009) and Calderón and Servén (2014)).

Care should be taken to place infrastructure where it provides the greatest benefit-to-cost ratio; examples of projects that have notably failed to do so are well known, from the trivial (the “bridge to nowhere” in Alaska), to the considerable. Note that “where” refers not just to geographic location but also to the type of infrastructure (e.g., transportation, water, telecommunications, electrical). These can be complex, situation-specific details but addressing them could bring substantial productivity benefits by making workers in infrastructure-using industries more efficient. The work of Agrawal, Galasso, and Oett (2017) suggests a potential further benefit. They find that infrastructure might raise productivity growth not through capital deepening, but rather by spurring technological innovation. I now turn to other mechanisms to do the same.

Policies can influence TFP growth through many potential mechanisms (I discuss several below), all of which act through two channels. The first channel is the stimulation of innovation among existing producers; the second channel is compositional. In the second channel, no single producer needs to raise its own TFP for aggregate TFP to grow—instead, average productivity growth occurs through the reallocation of activity toward producers with higher TFP levels. This second channel is, by nature, tied to the variance in productivity across producers discussed above and, as such, policies that influence it interact with this dispersion. Of course, mechanisms in practice can act through both channels simultaneously.

Improve Managerial Practices

One mechanism with broad potential to raise TFP levels across producers is the improvement of managerial practices. There is a mounting evidence that certain

management practices are causally related to productivity (e.g., Bloom & Van Reenen, 2007; Bloom, Eifert, Mahajan, McKenzie, & Roberts, 2013; Bruhn, Karlan, & Schoar, 2018). Bloom, Sadun, and Van Reenen (2017) offer an overview of this research. While U.S. businesses are on average some of the best managed companies in the world according to one of the most comprehensive measures available, most still hold plenty of room for improvement. Furthermore, there is considerable dispersion in management practices across firms—reducing these gaps would raise average productivity and wage levels and reduce variance across firms.

The management practices that would be the most beneficial to implement will vary across companies, so blanket prescriptions are not straightforward. There is also a limit to how directly policy can influence companies' management practices. However, partnerships and networks can allow for the transmission of better practices across firms (National Academy of Engineering, 2015). Policies can shape these networks and the institutional frameworks that underlie them; those that encourage effective transmission networks should be implemented.

The next set of recommended policies focuses on the economy's ability to shift activity toward more productive producers. This is the key to the second, composition-based channel through which technological-innovation-boosting policies act. But it can affect the first channel, too. A market's greater capability to moderate such shifts can incentivize otherwise laggard producers to innovate, for fear of being overtaken.

This reallocative capability of the economy is also closely tied to the decline in economic dynamism. Falling dynamism impedes the reallocation process. While an aging population likely accounts for some of the decline in dynamism, and as such creates a component that is less movable through policy, there is clear evidence that other mutable factors are at work (Hyatt & Spletzer, 2013; Kaplan & Schulhofer-Wohl, 2017). Institutional or market frictions that limit reallocation and are addressable by policy should be the target of action. There are many, both on the product (customer-facing) and input (supplier-facing) sides of the market.

Encourage Competitive Product Markets

The most obvious product-side element is to encourage competition and consumer choice. The easier it is for consumers to find and, if necessary, switch to their preferred product, the better the market functions and the better are welfare outcomes (Syverson, 2004a; Syverson, 2004b).

As noted above, there is currently extensive debate about whether product markets have recently become less competitive on average and on the implications—for the labor market and otherwise—of any such economy-wide shift. While this is not a settled matter, it is true that encouraging greater competition in any given market can raise productivity, both by making it easier for the market to reallocate activity to lower cost

producers and by heightening the incentive for firms to take actions that raise their productivity levels. Policies that encourage competition are not limited to antitrust enforcement; they also include trade policy and prudent regulation (see Syverson (2011) for a survey of the evidence on how these mechanisms influence productivity).

Reduce Frictions in Markets for Inputs—Labor, Capital, and Ideas

Reducing barriers to the efficient movement of inputs across producers should be a priority. These include policy-amenable institutional barriers like occupational licensing requirements and noncompete agreements, both of which have seen notable increases in frequency of use over the past decade or two. While in principle such devices could have efficiency-enhancing effects (occupational licensing can improve safety, and noncompete agreements might give employers more incentive to invest in workers' human capital, for example), recent research has demonstrated that they have clear productive efficiency costs in many settings.

Kleiner, Marier, Park, and Wing (2016) find that occupational licensing raises the price of (constant-quality) medical care. Johnson and Kleiner (2017) show state-level occupational licensing considerably reduces interstate migration of workers.³ Jeffers (2018) and Starr, Balasubramanian, and Sakakibara (2018) both find in different empirical settings that noncompete agreements reduce new business formation. Kleiner (2015) and Marx (2018) describe and recommend policies to improve regulations surrounding occupational licensing and noncompetes, respectively. While there may as yet be insufficient evidence to determine if these factors have actually served to reduce aggregate employment (Abraham & Kearney, 2018), they might still reduce aggregate productivity due to the mismatch they create between workers and jobs when labor markets are unable to allocate workers to their most efficient use.

Additional labor market frictions are also present. One is the interaction of labor markets with distortions in the housing market. There is now well-developed evidence that regulation-related supply constraints are raising the price of housing in certain metropolitan areas (e.g., Glaeser & Gyourko, 2002; Gyourko & Molloy, 2014; Shertzer, Twinam, & Walsh, 2016). Moreover, these areas tend to have higher labor productivity levels than less constrained areas. As a result, aggregate productivity losses occur because of the economy's inability to allocate labor to locations with the greatest economic benefit (Hsieh & Moretti, forthcoming). Separately, underdeveloped markets for childcare may make it difficult for some to work at the jobs for which they are most suited.

3 Occupational licensing also tends to yield wage premia to those in licensed occupations (Kleiner & Krueger, 2013). However, to the extent that this is the result of rent-seeking (such as reducing competition to raise output prices, such as in the Kleiner et al. (2016) study) rather than a productivity advantage, the higher wages that result will be socially inefficient.

Markets for capital, both tangible and intangible, are sometimes laden with frictions that prevent productive firms from expanding or unproductive ones from ending operations (Caballero, Hoshi, & Kashyap, 2008; Manaresi & Lenzu, 2018). While these capital misallocations are not always a direct result of policy, policymakers should build an institutional structure for capital markets that has as a prime goal the efficient allocation of inputs across producers.

This relates to the earlier discussion about improving management practices. These practices—or perhaps more precisely, the knowledge of what they are and how to implement them—are also an input. Policy should strive to reduce frictions in ideas markets. The notion of frictional ideas markets highlights potential problems with the legal structure underlying intellectual property, which is obviously influenced by policy choices. Research has documented a growing disconnect between patenting and innovation (Congressional Budget Office, 2014), for instance, and distortions in the patent system create various other inefficiencies (Budish, Roin, & Williams, 2015).

A useful thing to remember here is that policies that reduce frictions on one side of the market are complementary to those that work on the other side. If product markets are completely sclerotic, beneficial reallocations will not happen even if input markets are friction-free. The reverse is also true: frictionless product markets do no good unless the best firms that consumers would prefer to flock to are able to obtain the inputs they need to expand. Thus, addressing both product and factor market frictions simultaneously creates a benefit that is bigger than the sum of its parts.

3. Discussion and FAQ

The goals of the proposed policy changes are straightforward enough: to raise the average productivity growth rate and help close the gaps between the highest and lowest productivity firms.

The costs of implementing the policies varies. Infrastructure investment is costly. If done prudently—and prudent planning is, in itself, a cost—the expected return is high. Significant resources would, however, be needed to accomplish this.

Policies to improve management practices would not be inherently costly. Forums and networks where best practices can be shared, taught, and learned need not consume a lot of resources. However, there are doubtless many internal costs within firms to improving these practices (otherwise, they would have presumably implemented many of the practices already).

Removing frictions in output and input markets through policy would involve some institutional changes that, while not directly requiring the use of many real resources, would be time-consuming. Perhaps the greatest cost element is that any

policy changes made would destroy rents of those who currently benefit from the status quo. This will probably foment considerable opposition, which would require committed effort to overcome.

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