Structural Shifts in the Global Economy:
Structural Constraints on Growth

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I really appreciate the invitation to come visit with you today about supply constraints and their interaction with monetary policy. It is always fun to be here, and it is a special treat to be a panelist again. I have four main points to make, so I am going to get right to them.

1. Productivity Is the Long Run Constraint

My first point builds on something that is said a lot, but it is important enough that I will say it again: As the horizon elongates, supply changes from *a* constraint to *the* constraint. Productivity growth is the only way to sustain growth in income per capita over the long run.

We heard earlier about the conventional wisdom that monetary policy has, at best, modest effects on the supply side and no long-run effect on productivity itself. However, as the work of my colleague Yueran Ma and her coauthor Kaspar Zimmermann showed—effectively, in my opinion—this may not be true. When the case is laid out, it makes sense. Investments in innovation are, after all, investments. If we think monetary policy influences investment, it is not surprising that it could affect innovation as well. Now, investments in innovation might have more uncertain outcomes that are realized with longer lags. That makes innovation a harder outcome to conduct monetary policy by, but it does not diminish the monetary-policy-to-innovative-investment channel's empirical influence on outcomes. Productivity's importance means we should closely study the workings of this channel.

There is a broader point about monetary policy and productivity. I do not have to tell anyone in this room that monetary policy, like most decisions large and small with economic implications, is usually an exercise in constrained optimization. You make adjustments in an effort to get closer to the best possible outcome, given inherent limits. Fundamentals change in a way that necessitates tightening or loosening, and you turn the dial a bit this way or that in an attempt to move things closer to the optimum, trading off various considerations.

Productivity growth changes that equation, literally. It is not about trying to do better within a constraint. It *changes* the constraint, by loosening it. This turns a world of inherent tradeoffs into one where those tradeoffs do not bite. It changes this *or* that into this *and* that.

There is some math that says the benefits from loosening constraints tend to be considerably larger than the benefits of getting closer the optimum within a constraint. That is what productivity growth does across all sorts of settings. To my more mathematically oriented friends in the audience, what I am saying is that productivity is the giant Lagrange multiplier on our economic lives. For those of you whom I might have just lost, I am just saying that productivity growth makes everything easier. And reducing inflation is no exception.

Of course, recognizing the importance of productivity does not mean it is easy to manipulate. As I just noted, monetary policy's influence on productivity is uncertain and can act slowly. But its broad influence, especially in the long run, makes understanding productivity growth of immense importance.

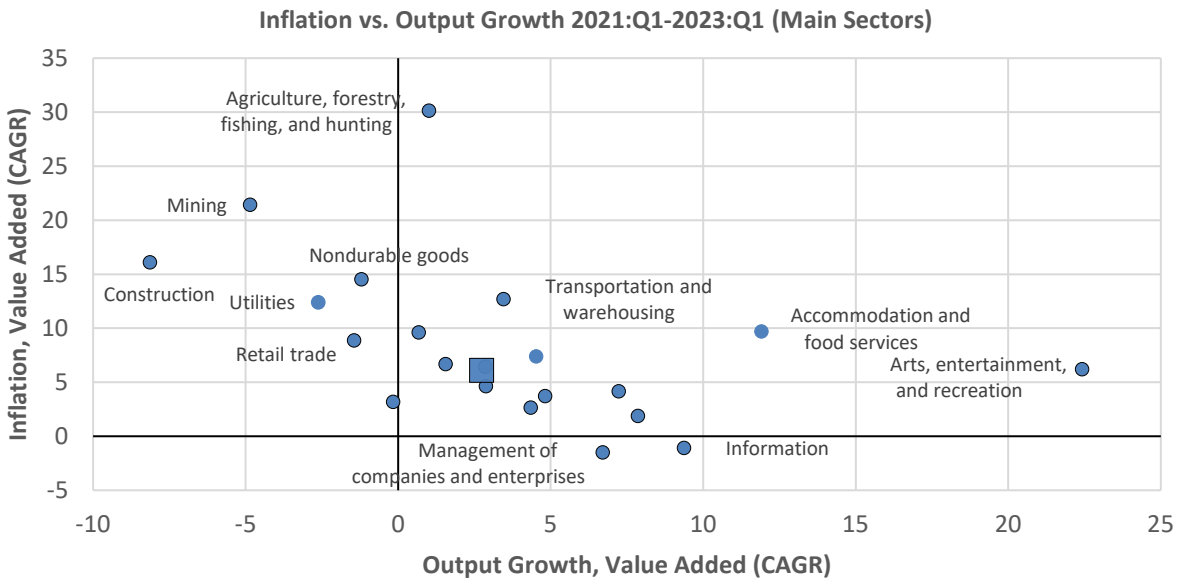
All that said, even if one chooses to focus exclusively on monetary policy's demand effects, practitioners cannot ignore productivity or the supply side more generally. The economic outcomes we observe and care about—inflation, output growth, wage growth, and employment growth—depend on the confluence of supply and demand. Even if you are only thinking of monetary policy as a tool to manipulate demand, the effects of that demand manipulation depend on what supply is doing. That is true in the long run because of productivity. But it is also true in the short run, and that leads me to my second point. It regards data patterns that, while I have not seen anyone yet discuss them, vividly demonstrate how monetary policy's effects depend on the confluence of supply and demand.

2. Supply and Monetary Policy in the Short Run

You can see what I am talking about in Figure 1. It shows, for the major sectors of the private U.S. economy, the relationship between inflation in the sector and the sector's output growth. The growth rates are over the recent inflationary period, which I define as spanning 2021:Q1 through 2023:Q1. I have labeled a few of the sectors at the edges of the data cloud for reference and in case you are curious about the outliers. The larger square data point shows for comparison inflation and output growth for the entire private economy over the same period.

There is a clearly negative relationship between inflation and growth across sectors. Sectors that saw the highest inflation saw the lowest output growth, and those that had the least inflation had the largest output growth.

Figure 1: Product Market Inflation vs. Growth across Industries



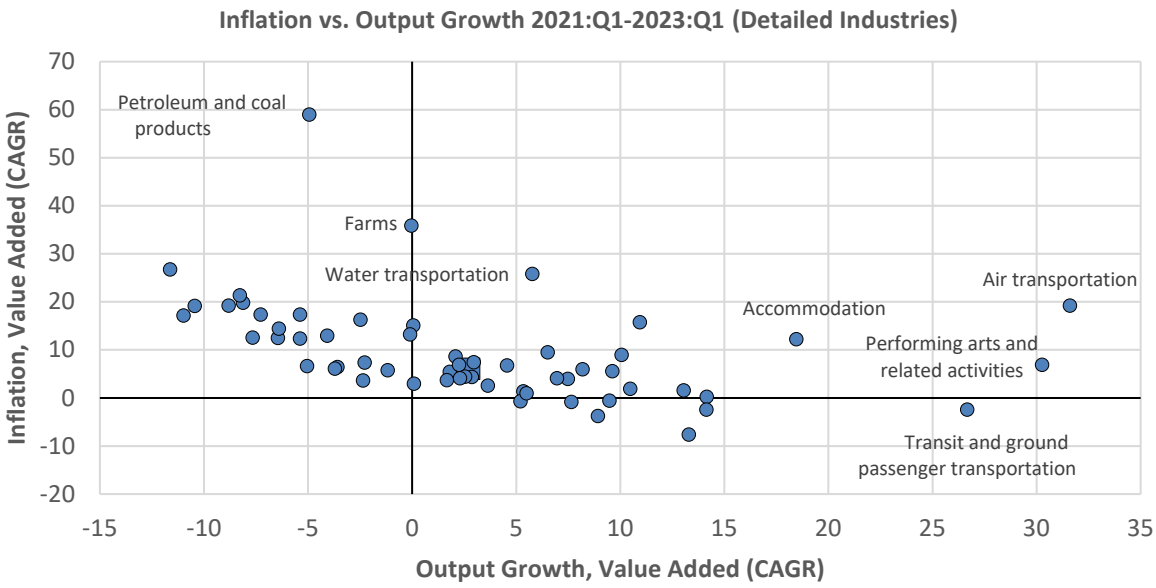
This pattern is not an artifact of aggregation. Figure 2 shows the analogous relationship for more detailed industry definitions (which, combined, are still exhaustive of the private economy, as with the sector-level breakdown in Figure 1). The clearly negative relationship between inflation and output growth remains.

This pattern is what we would expect to find if demand were (essentially) fixed across industries, and what varied across industries was supply. Sectors experiencing the most negative supply shifts would see the highest inflation and slowest output growth. Those experiencing outward supply shifts, on the other hand, would see faster output growth and lower inflation. (This is a similar logic to that behind why one uses a supply-shifting instrument to trace out the demand curve.)

I can think of no mechanical or conceptual factors that would make this negative relationship inevitable. If, instead, demand variations in the face of fixed supply were the primary determinant of output and price growth across sectors, the figure would show a positive relationship. The most inflationary industries would be those experiencing the most output

growth, because they faced outward demand shifts. Industries with inward demand shifts would experience low inflation and low output growth. In still another possible scenario, if demand and supply shifts were about equally important across industries, we would see a shotgun-blast pattern rather than a clear negative or positive slope. These scenarios were certainly possible—nothing I know of about how the economy works or how monetary policy affects it would preclude them from happening. They simply did not.

Figure 2: Product Market Inflation vs. Growth across Industries, Detail



The data indicate supply shifts, rather than demand, appear to explain the considerable majority of variation in inflation in the cross section.

Two questions naturally emerge from the patterns in Figures 1 and 2.

First, if supply shifts explain most of the inflation variation across industries, does this mean supply was the primary determinant of overall inflation? I think it is reasonable to argue that if supply matters so much in the cross section, it might also have mattered a lot for aggregate inflation. That said, an honest empiricist knows Figures 1 and 2 do not offer any evidence about that supposition; they have only a single data point regrading overall inflation.

Second, if supply shifts explain differences in inflationary pressure across sectors, what are the sources of such shifts? In thinking about this question, it is worth noting first that the

sector-specific quantity and price indexes used here are for value added. Value added has the benefit of avoiding double counting. We know that holds for output, but it also holds for prices. Value added price indices should not double count the effect of a few inflationary commodities running down the supply chain and raising costs and prices for many industries. The inflation patterns in Figures 1 and 2 are therefore not simply separate manifestations of a single underlying price shock to a key input. Instead, value added prices should reflect only the price effects of an industry's value added components: labor, capital, and value added total factor productivity.

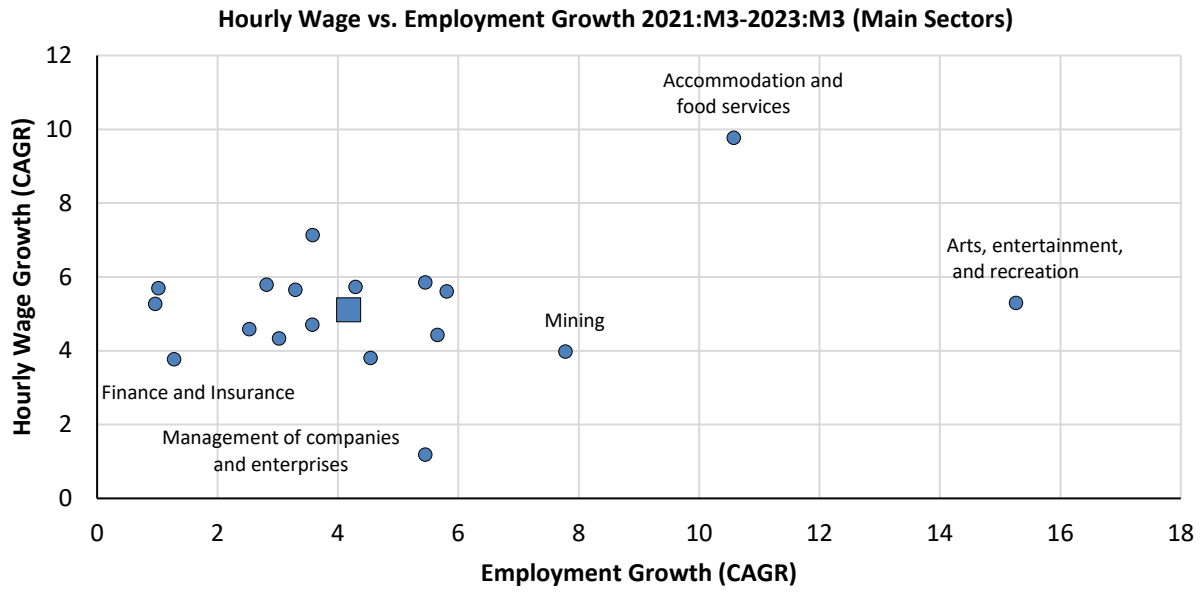
Labor is a major component of value added. Could it be that the industry-specific supply shifts in the product market actually reflect industry-specific *labor* supply shifts? I can explore this hypothesis in a similar fashion to the sector-level inflation and output growth comparison I just discussed. In this case, however, rather than comparing an industry's inflation to its output growth, I look at the relationship between an industry's wage growth and its employment growth over the same period using BLS data.

Figure 3 shows the result for broad sectors, and Figure 4 shows the analogous figure for the more detailed industries. The clear downward-sloping relationship across industries seen in product markets is not present in the labor market. Industries that experienced the highest wage growth did not see systematically lower employment growth. Nor did they see systematically higher employment growth. The wage-employment growth relationship across industries exhibits a shotgun-blast type pattern. Supply and demand variations appear to matter roughly equally in determining industry-level labor market outcomes. The correlation between industries' wage growth and employment growth is statistically zero.

To understand more about why the patterns in industries' product markets do not match up with what is going on in their labor markets, consider the following. The correlation between industry output growth and employment growth is around 0.7, at either level of aggregation shown in the figures. Industries that produced more, hired more. The quantities are in alignment. The break between the product and labor markets arises in the patterns of product-market inflation and wage growth. Industry inflation and wage growth are statistically uncorrelated. Wage increases in an industry do not predict price increases in that industry.

By the way, the patterns seen in Figures 1-4 hold if I weight sectors or industries by their GDP share.

Figure 3: Wage vs. Employment Growth across Industries



Does this mean labor supply does not matter at all? No, in some industries it does appear to be about labor supply movements. At the same time, however, in other industries labor demand drives outcomes. This combination leads to the disconnect between inflation and wage growth across industries.

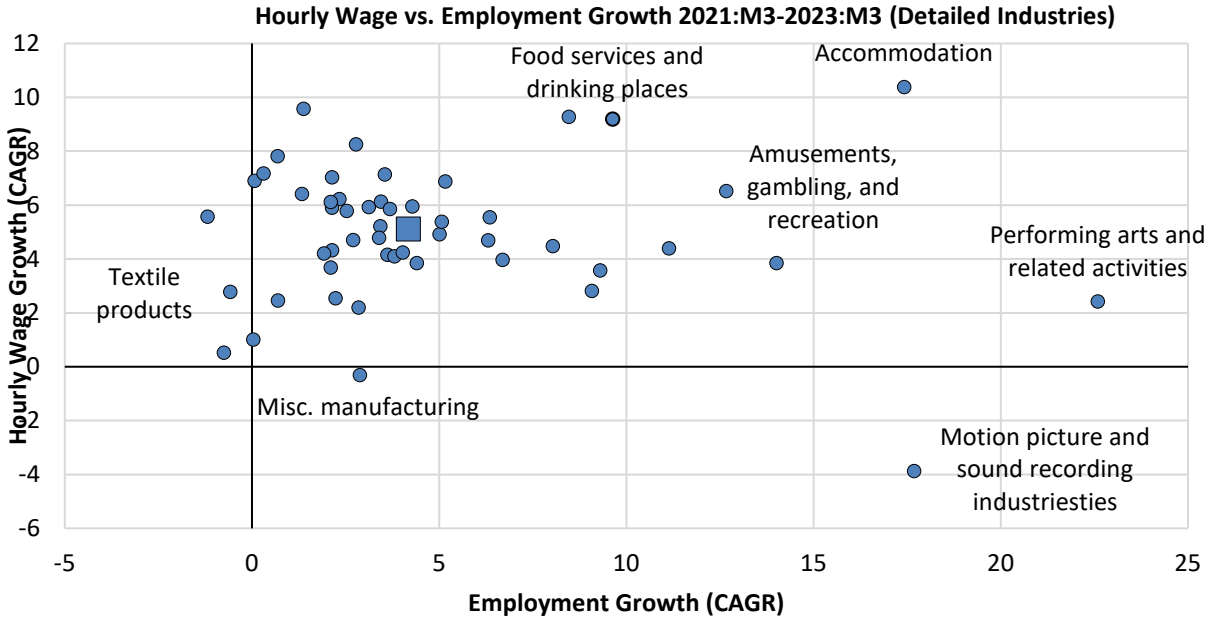
If labor supply shifts are not the sole source of the output supply shifts that drive variations in industry-level inflation, this leaves two other possibilities.

One is capital supply shifts. I could not think of a way to test easily given the available data— finding credible industry-specific capital prices is tricky, and in any case industry-level capital stocks come out with large lags. That said, I am not aware of work or even anecdote-based arguments that might suggest these are important.

The other, and I think more likely, potential source of supply shifts involves total factor productivity. I suspect the specific mechanisms through which industry productivity shifts likely vary across sectors, making a simple unified explanation for industry supply shifts elusive. Nevertheless, the patterns I just discussed point to the importance, even in the near term, of understanding sector-specific supply factors when considering monetary policy's effects. In that

vein, for my third point, I highlight a particularly salient case of sector-specific productivity shifts.

Figure 4: Wage vs. Employment Growth across Industries, Detail



3. Construction Productivity

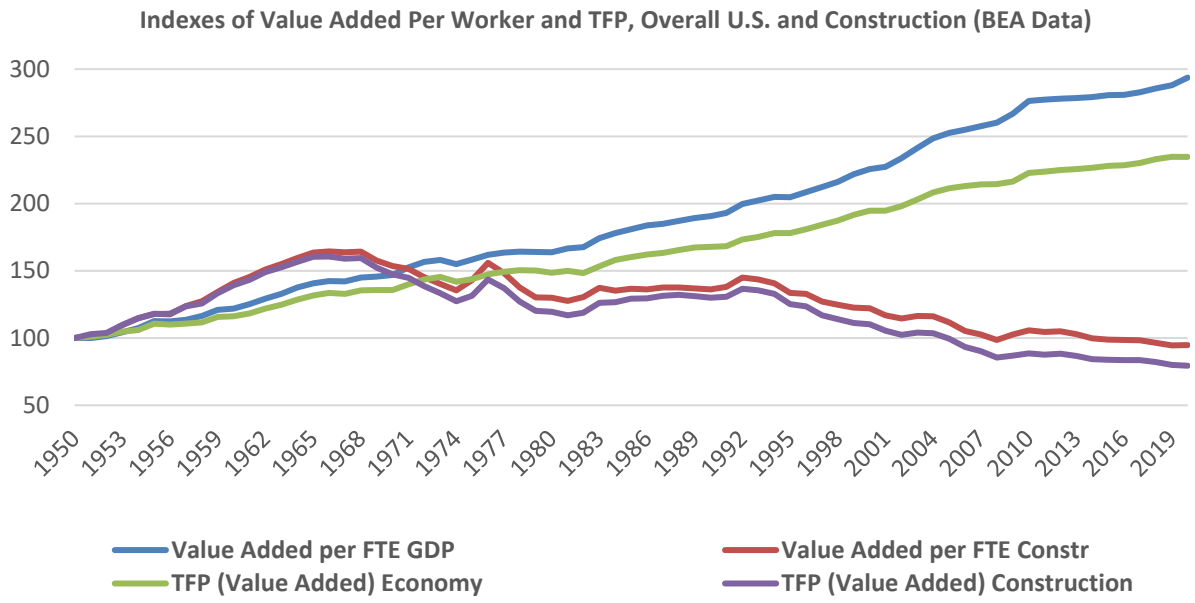
Negative productivity shocks are inward supply shifts. As just discussed, given stable demand conditions, they cause lower quantity growth and higher prices. In recent work, Austan Goolsbee and I draw attention to the construction sector, which has been experiencing poor productivity performance over a long period.

Figure 5 compares the evolution of labor and total factor productivity in the U.S. construction sector and the total economy over 1950-2020. After construction productivity grew faster than economy-wide productivity for almost two decades, it abruptly slowed and changed directions in the late 1960s. Average productivity growth in the sector has been negative since then. Yes, negative productivity growth. And yes, for over 50 years.

Our study is able to eliminate some possible explanations for this strange and awful performance. The sector has not underinvested in capital. Its inputs have not become more expensive relative to other sectors' inputs. It is not just measurement problems due to bad deflators or other issues. For example, the number of square feet of housing built per year by a

worker in single-family housing construction is the same now as it was in the mid-1970s. Adjusting for measures of housing quality, as we and Garcia and Molloy (2022) have done, does not turn this fact around. It moves measured performance from terrible to merely awful.

Figure 5: Productivity in the U.S. Construction Sector



But to be honest, we could not in the end point to a single, critical factor as responsible. It may well be a problem created by combination of many factors. If you allow me to step away from the paper and data for a moment, my conversations with people in and around the sector make me suspect part of the problem is that firms in the sector have little incentive to become more efficient. Rather than viewing operational discombobulations and change orders as costly, they appear to view them as great profit opportunities. Furthermore, an increasing number of folks have recognized that political economy surrounding the industry may not be healthy. We seem to have achieved a sort of learned helplessness when it comes to building things. Hopefully future work will teach us more about the roles of these factors.

Whatever the causes, we must contend with a major sector of the economy that has been struggling for half a century. Construction's poor productivity performance is particularly concerning in that it produces a large share of the economy's physical capital stock, the bedrock upon which future growth is built. That is costing us all.

4. A Case for Productivity Optimism

Having sounded that pessimistic note about productivity in an important sector, my fourth and final point is a case, grounded in the data, for productivity optimism over the medium run. We could use it. The world is 15-20 years into a productivity growth slowdown that has cost us trillions of foregone output.

One of the most concerning productivity-adjacent trends before the pandemic was a decades-long decline in measures of dynamism: labor market turnover, new company formation, and the like. Dynamism is important because of three facts research has established across hundreds of industries, periods, and countries. One, there are large productivity differences across producers, even within narrowly defined markets. Two, the churning process supported by dynamism shifts activity across those producers with their varied productivity levels. Three, the direction of this churn on average rewards productivity. More productive businesses are more likely to grow and survive, less productive ones are more likely to shrink and exit. This shift in activity from less productive to more productive businesses creates productivity growth, even in the absence of productivity growth within any given producer.

The downward trend in dynamism meant this productivity-boosting churning process had been slowing. Pandemic-related business- and job-preservation polices, while having many benefits, compounded this concern given their potential to further impede dynamism and the productivity growth it produces.

As we emerge from the pandemic, however, there are encouraging signs. The shorter-run concern does not seem to have bitten. Pandemic policies did not cause the gears of dynamism to gum up. There are no indications that we are near a zombie firm apocalypse. Better yet and tied more to the long-run, the decades-long decline in churn appears to have stopped or even turned around. Multiple metrics of churn have increased from their pre-pandemic values. This is certainly true in the U.S., and where data is available, one sees similar changes in other OECD countries.

Figure 6 shows pre- and post-pandemic values for some U.S dynamism metrics. Gross labor flows—hires plus separations as a share of employment—are about 10 percent higher than their 2015-19 average. If we look within separations, the ratio of quits to layoffs is at historic highs. I know folks look at quit and layoff rates as indicators for many phenomena, but I view

their ratio as an indicator about future productivity growth. Quits mean workers are voluntarily leaving their old jobs to move to ones that, via revealed preference, they like better. While revealed preference is about utility, utility is correlated with wages, and wages are correlated with productivity. Labor market churn powered by quit rates that are just coming off historical highs means to me that workers are moving at unprecedented rates into jobs where they are more productive.

Figure 6: A Resurgence of Dynamism?

Metric	**2015-19**	**2022-23**
Average hires + separations rate, U.S.	7.4	8.0
Quits per layoff, U.S.	1.8	2.7
Business formations per month, U.S. (thousands)	270	430
"High propensity" business formations per month, U.S. (thousands)	100	140

This notion is supported by some work coauthors and I have done looking at Chilean data linking workers to companies. We find that workers do in fact on average move to firms that are more productive. That "on average" proviso hides a lot of variation; in fact, only 53% of worker moves are to higher-productivity employees. But this is enough to grow economy-wide productivity by a large amount. Even a modest increase from 53% to 55% or 56% would have huge effects on productivity growth.

Of all the signs of increasing churn, however, perhaps most exciting is the fact that business formation rates have risen. In the U.S., at least, they have risen a lot. They have averaged about 430,000 a month since 2022, up from 270,000 over 2015-19. These are not just people starting eponymous consulting companies in their spare bedrooms. The pattern holds even if we focus on only "high-propensity" business starts: those having attributes known to be predictive of future growth. Monthly values of these are up 40% relative to pre-Covid averages.

Somewhat beyond, but perhaps also related to, these hopeful signs about renewed dynamism is another potential marker of future productivity growth, the productivity J-curve. This is a measurement phenomenon Erik Brynjolfsson, Daniel Rock, and I exposited in recent work.

The story of the productivity J-curve starts with the notion that harnessing the full benefits of a new general-purpose technology requires a large amount of investments in complementary capital. Often, this capital is intangible. Think of AI as a candidate general

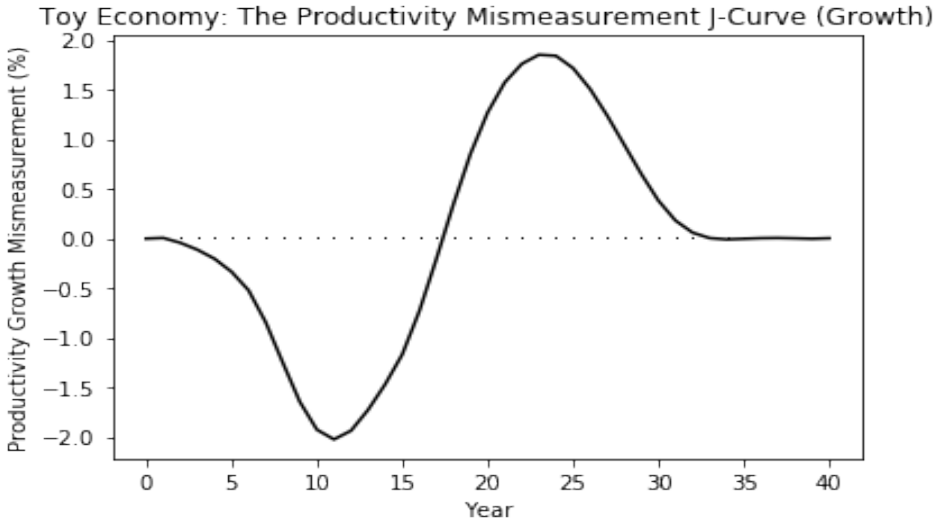
purpose technology. To exploit AI, companies have rewrite software, retrain employees, create new procedures, and even reconfigure their organizational structures, just to name a few things. All these intangible-building activities take resources.

While in concept these expenditures reflect new capital creation, an output, both company and national accounts treat them as expenses rather than investments. This missing output causes measured productivity to understate true productivity. In short, the data make it look like producers are spending a lot of resources doing AI-related things but are getting little for it.

That is the initial part of the J-curve story. Later, when that newly built intangible capital is in place and yielding output, the productivity mismeasurement goes the other way: we observe the output but we undercount the inputs used to make it. As a result, measured productivity overstates true productivity.

Therefore the productivity J-curve is a story of productivity mismeasurement across time. Productivity is understated during the emergence of a general-purpose technology, and it is overstated later. Figure 7 shows a stylized view of J-curve mismeasurement in a model economy.

Figure 7: The Productivity J-Curve, Stylized



While the figure is stylized, we chose the parameters of the model to be somewhat realistic. To that point, note time horizon on the horizontal axis. The mismeasurements—both initial productivity understatements and later productivity overstatements—last a decade or

more. We dug into this further and did some calculations for the J-curves tied to more mature general purpose technologies, like computer hardware and software. There too, we found mismeasurement periods that lasted decades. Therefore a technology can be present, well known to users and consumers, diffusing quickly and becoming ubiquitous, yet productivity metrics can still be understating true output.

If AI fits the bill as the next general purpose technology, and I think the developments of the past year or two have only indicated this is more likely than ever, measured productivity growth might start to understate true productivity growth. In fact, some back of the envelope calculations indicate we may just now be getting to the point where AI-related intangible investments are large enough to miss a few tenths of a percentage point of aggregate productivity growth. Time will tell, of course, but I believe this is something worth keeping an eye on for now.

That upbeat note closes out my fourth and final point. Thank you very much for your attention.