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SPEECH

Productivity Growth and the Challenge of Real-Time Policymaking

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Introduction

Thank you for the opportunity to speak today. I'd like to discuss one of the most fundamental challenges we face as economic policymakers: understanding structural economic change as it happens.

There are many types of structural change that create such a challenge, including changes in the famous star variables like the natural rates of unemployment and interest. But today, I'll focus on shifts in the trend rate of productivity growth. I'll boil this topic down to a simple two-part question: how does the economy respond to a shift in the rate of productivity growth, and what does it mean for monetary policy? It may seem like a basic question that should have been long settled by now. But the further you delve into trying to answer it, the more nuanced it becomes.

This question is especially timely today because of all the attention on artificial intelligence and its potential to spur a productivity boom. But this is not our first productivity growth rodeo. Thankfully, history provides important lessons for us to learn from.

Think back to the 1970s, when the United States experienced a pronounced productivity slowdown following a quarter century of remarkable postwar growth. This was followed by an acceleration beginning in the mid-1990s, which itself reversed in the mid-2000s.

These episodes weren't minor statistical curiosities—they fundamentally reshaped the macroeconomic landscape. The productivity slowdown of the 1970s contributed to stagflation. And the productivity boom of the late 1990s and early 2000s was a contributing factor to that decade's economic prosperity with low inflation. The subsequent productivity slowdown, although not associated with high inflation, was a significant influence on driving down the natural rate of interest.[1] Of course, many other influences were at play during these episodes, clouding one's ability to make conclusive inferences regarding the effects of productivity growth in isolation.

I will avoid speculating about the potential of AI for now. Rather, I will take a step back and examine the key implications of a shift in trend productivity growth for the economy through the lens of historical experience. To give you a bit of a spoiler, my answer to the question of the effects of a shift in trend productivity growth on the economy and monetary policy is, unsurprisingly, "it depends." In particular, it depends on the nature and expected duration of the shift in question.

This is the ideal time to mention the usual Fed disclaimer that the views I express today are mine alone and do not necessarily reflect those of the Federal Open Market Committee (FOMC) or others in the Federal Reserve System.

The Recognition Problem

As we try to answer this question, I will point out something I'd call "the recognition problem." This means that while shifts in trend productivity growth may appear crystal clear in hindsight, it often takes years to distinguish them from the normal ups and downs in the data. This gradual recognition of shifts in productivity growth has profound implications for how economies respond.

Of course, forecasters and policymakers possess a wide range of views and perspectives in these situations. But what's important for this discussion is how overall perceptions evolve and how that in turn affects the behavior of the economy.

U.S. productivity growth data reveal that high-frequency fluctuations dominate the picture: Year-over-year productivity growth swings from minus 2 percent to 7 percent, compared to the long-run average of just over 2 percent (Figure 1). An added wrinkle is that productivity data are revised over time, often by meaningful amounts, further impeding one's ability to discern fundamental shifts in real time.[2]

Buried under this volatility are lower-frequency movements in productivity growth (Figure 2). Seen from this perspective, the two eras of rapid productivity growth stand out: the postwar period until the early 1970s, and the internet boom of the mid-1990s to mid-2000s. In each of these episodes, productivity growth averaged around 3 percent. At other times, relatively slow productivity growth of around 1-1/2 percent prevailed. This pattern of extended periods of low and high productivity growth has been verified by formal statistical analyses.[3]

The high proportion of noise in productivity growth data makes it difficult to recognize a shift in trend productivity when they happen. When productivity surges or slows, is it a temporary phenomenon, or does it signal a more fundamental shift in the economy's potential?

1979—many years after the slowdown had begun (Figure 3). This pattern repeated in the mid-1990s and mid-2000s, with professional forecasters only fully recognizing the shifts several years after they started.

This gradual recognition of shifts in trend productivity growth is not due to a failure of imagination, but instead is fully consistent with the underlying behavior of the data. For example, applying a Kalman filter to the data—a standard tool for separating signal from noise in a time series—yields real-time estimates of trend productivity growth that change gradually over time (Figure 3). Note that the estimated Kalman gain—which measures by how much the trend estimate is updated based on new information—implies a relatively cautious approach to revising long-run forecasts.

This simple model yields estimates that track remarkably well with those of forecasters. You can see this correspondence when comparing the model estimates to those from the Council of Economic Advisers during the 1970s and the Survey of Professional Forecasters over the past 35 years. This is not to say that forecasters literally use this model and ignore all the other information at their disposal. Instead, it shows that simply filtering the productivity data accounts for a good deal of the information they used in assessing productivity trends.

Finally, I should emphasize that this correspondence between the model's predictions and the views of experts isn't mere curve-fitting; rather, it's evidence that a simple, disciplined framework captures how forecasters process productivity information in real time. Indeed, this model was developed over 20 years ago, so the subsequent correlation between the model estimates and the survey results is a true out-of-sample test.

Macroeconomic Implications of Gradual Recognition

The macroeconomic implications of gradual recognition of shifts in productivity growth are profound. Assuming immediate recognition, standard macroeconomic theories predict a paradoxical result: an increase in trend productivity growth drives up real interest rates and causes an economic downturn, with hours worked, investment, and output declining.[4] This "perverse" result, in the words of John Campbell (1994),[5] stems from the combination of a strong wealth effect and higher expected real interest rates, which contribute to a transition period during which households enjoy greater consumption and leisure. These predictions are at odds with the real-world experience where periods of high productivity growth are associated with a strong economy and elevated investment, not the opposite.

Model simulations of an economy-wide increase in productivity growth using the New York Fed's dynamic stochastic general equilibrium (DSGE) model[6] show that real consumption growth and real interest rates jump at the onset of the productivity surge, while hours worked dip and investment declines sharply (Figure 4). In this simulation, wages and prices are assumed to be flexible. After a couple of years, the transition dynamics are mostly completed, and the economy adjusts toward its longer-run balanced growth path with higher growth and real interest rates.[7]

Incorporating gradual recognition dramatically alters these predictions. When trend productivity accelerates but agents only gradually recognize this, they initially interpret the rise in productivity growth as primarily a one-time shift not to be repeated. As a result, the wealth and interest rate effects from persistently higher productivity growth that act to depress investment are muted and delayed (Figure 5). The solid lines show the results with the estimated Kalman gain, while the other lines show the results for more rapid paces of recognition.

With gradual recognition consistent with empirical evidence, an acceleration in productivity results in faster growth of both consumption and investment. The rise in real interest rates is delayed as beliefs about future productivity growth only gradually rise. And the initial decline in hours worked is much smaller than with immediate recognition. Over time, the economy transitions to the same balanced growth path. Note that with a faster rate of recognition, real interest rates rise more quickly and the rise in employment and investment is delayed.

The Nature of Productivity Acceleration

So far, I have been describing a world where the economy benefits from faster productivity growth that suddenly falls like manna from heaven. This is just one illustrative case, and shifts in productivity can differ in their transmission to the economy, which affects the timing and magnitude of the macroeconomic effects.

For example, improvements in productivity must often be embodied in new capital investment, as is typically the case with information technology. In this case, the main components of the story are the same. In particular, a negative investment response is associated with immediate recognition. The economy's response aligns better with experience by incorporating gradual recognition. There is an added twist that the shift generates a sizable and sustained investment boom and an earlier increase in real interest rates than in the case of disembodied productivity improvement.[8]

Wage and Price Adjustment

In addition to the effects on growth, an increase in productivity growth also reduces costs that businesses face, contributing to downward pressure on inflation until prices and wages fully adjust.[9] The presence of sticky wages and prices generates a sustained disinflationary impulse (Figure 6). The size and duration of this impulse depend on how quickly businesses and households recognize the shift in productivity growth, with more rapid recognition implying a smaller and more short-lived effect. Indeed, with immediate recognition (not shown), the depressing effect on the inflation rate is trivial, less than one tenth of a percentage point. In addition, real interest rates rise immediately upon the onset of the shift in productivity growth.

supply during the transition, which depends on the factors I have discussed as well as model dynamics.[10]

Robust Policy

I'll close with a note on robust policy, which is related to what I discussed at last year's conference here in Reykjavik.[11] History—informed by economic theory and evidence—teaches us that the macroeconomic effects of a shift in productivity growth depend on the nature and expected duration of the shift. Although each historical episode is unique, they also share regularities.

First, real-time identification of structural change is extraordinarily difficult, and expectations of future growth tend to adjust gradually to changes in underlying productivity growth. As a result, in the initial stages following a shift, the economy is likely to behave more like a temporary increase in productivity growth than a permanent one.

Second, an increase in trend productivity growth raises real interest rates in the long run. However, the path of real interest rates depends critically on three factors: how quickly the shift is recognized by households and businesses; the nature of the shift in productivity and its implications for the relative responses of demand and supply during the transition; and the speed of adjustment of wages and prices.

Third, shifts in productivity growth are relatively infrequent and inherently highly uncertain. The confidence bands around any estimates are large. Therefore, as in the case of any type of structural change, robust policy approaches have an especially favorable cost-benefit calculus.

Thank you for your attention. I look forward to the discussion.

Presentation PDF

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[1] Holston, Kathryn, Thomas Laubach, and John C. Williams. 2017. "Measuring the Natural Rate of Interest: International Trends and Determinants," *Journal of International Economics*, 108(S1), May, S59-S75; Williams, John C., "The Global Growth Slump: Causes and Consequences," Federal Reserve Bank of San Francisco Economic Letter 2017-19, July 3, 2017.

[2] Edge, Rochelle M., Thomas Laubach, and John C. Williams. 2007. "Learning and Shifts in Long-Run Productivity Growth," Journal of Monetary Economics, 54(8), 2421-38.

[3] See Kahn, James A. and Robert W. Rich. 2007. "Tracking the New Economy: Using Growth Theory to Detect Changes in Trend Productivity," *Journal of Monetary Economics* 54(6): 1670–1701; and Cline, Alexander, James A. Kahn, and Robert W. Rich. 2025. "Is High Productivity Growth Returning?," Federal Reserve Bank of Cleveland, Economic Commentary, 2025-01.

[4] See references in Edge, Rochelle M., Thomas Laubach, and John C. Williams. 2007. "Learning and Shifts in Long-Run Productivity Growth," Journal of Monetary Economics, 54(8), 2421-38.

[5] Campbell, John Y. 1994. "Inspecting the Mechanism: An Analytical Approach to the Stochastic Growth Model," Journal of Monetary Economics,33(3), 463 – 506.

[6] Federal Reserve Bank of New York, The New York Fed DSGE Model.

[7] Qualitatively similar results are obtained in other models, as discussed in Edge, Rochelle M., Thomas Laubach, and John C. Williams. 2005. "Monetary Policy and Shifts in Long Run Productivity Growth," Mimeo, Federal Reserve Bank of San Francisco; and Edge, Rochelle M., Thomas Laubach, and John C. Williams. 2007. "Learning and Shifts in Long-Run Productivity Growth," Journal of Monetary Economics, 54(8), 2421-38.

[8] Edge, Rochelle M., Thomas Laubach, and John C. Williams. 2004. "Learning and Shifts in Long-Run Productivity Growth," Federal Reserve Bank of San Francisco Working Paper 2004-04. Relatedly, one can imagine scenarios where the increase in productivity growth is expected to occur in the future once the new technologies are fully developed, as analyzed by Barsky, Robert B. and Eric R. Sims, 2011. "News Shocks and Business Cycles," *Journal of Monetary Economics,* 58(3), 273-89; and Beaudry, Paul and Franck Portier, 2014. "News-Driven Business Cycles: Insights and Challenges," *Journal of Economic Literature*, 52(4), 993-1074.

[9] See Edge, Rochelle M., Thomas Laubach, and John C. Williams. 2005. "Monetary Policy and Shifts in Long Run Productivity Growth," Mimeo, Federal Reserve Bank of San Francisco, May 9, 2005.

[10] For example, in the model simulations of the Federal Reserve Board's macro model presented for the FOMC meeting in February 2000, the near-term demand response outweighs the supply response, and real interest rate need to adjust upward more quickly than absent the productivity acceleration, see Board of Governors of the Federal Reserve System, "Monetary Policy Alternatives (Bluebook)," January 28, 2000.

[11] John C. Williams, "Uncertainty and Robust Monetary Policy," remarks at the Reykjavík Economic Conference, Reykjavík, Iceland, May 9, 2025.