Discussant Comments **"Monetary Policy and Innovation by Yueran Ma and Kaspar Zimmermann"**

Comments by John Haltiwanger, University of Marland

This paper explores an important and interesting question. In some respects, it is a relatively novel question as the authors have pointed out. Usually, when we talk about monetary policy, we're talking about price stability and short run economic fluctuations. For the most part, one does not hear the word innovation in the same discussion. In this context, this paper asks this really important question, does monetary policy have an impact on innovation? Their tentative answer is yes! Part of the reason the answer is tentative is that this is a difficult question to answer. Part of the reason that this is difficult is that measurement of innovation and measurement of monetary policy are difficult to measure. In addition, they seek to address this question with aggregate time series variation. This makes the challenge even greater given limited degrees of freedom. In their key charts, they find economically significant effects of monetary policy on innovation but the effects are not very precisely estimated.

The focus of my comments will be on the challenges of measurement, particularly on the challenges of measuring innovation. One limitation is that some of the key measures are only for publicly traded firms. I think we need to move beyond publicly traded firms for this kind of analysis. I think we know this much better now than we knew it 10 years ago or certainly 20 years ago. We've now integrated lots of the innovation measures that are discussed here into the large comprehensive economy-wide databases at the US Census Bureau to try to understand the process of innovation and using exactly the same kind of measures: patents and R&D, but not just for publicly traded firms. Publicly traded firms play a vital role in the economy. They are relatively small in number (less than 1% of firms) but account for a large fraction of activity. And indeed, they made amazing innovations in order to become publicly traded firms, but typically before they were publicly traded firms. So that's the big limitation. So, if we only look at them, we're going to miss most of the story.

Interestingly, publicly traded firms are doing lots of R&D and lots of patenting. Indeed, they dominate R&D and patenting to such an extent that one might think they must be accounting for most of the innovation. However, the careful work of a range of scholars including Ufuk Akcigit and William Kerr (see, e.g., Akcigit and Kerr, 2019) show that large publicly traded firms strategically have an incentive to do more incremental or defensive innovations. Such firms have a large customer base for their current products and they don't want to cannibalize their current product base. In turn, the finding is that the more radical innovations come from young and small firms. The inference is that in order to track innovation, it is critical that we track the dynamics of young and small firms.

The second thing is, even for young and small firms, our measures are quite limited. Patents are great, they're a fantastic resource for certain types of innovation, but they offer a very narrow window into overall innovation. It's useful to recognize that less than 1% of firms ever issue a patent and most patents don't get commercialized. Partly this reflects the right-skewed nature of successful innovation. However, patents tend to be highly concentrated in particular

sectors, particularly manufacturing and in some parts of information services, but not more generally across the economy.

R&D measures have a similar kind of problem. Less than 3% of firms in the United States report any R&D. R&D expenditures are also concentrated in manufacturing. In manufacturing, a small share of firms report R&D but they account for a very large share of manufacturing activity, easily over 50%. That's not true in non-manufacturing. The small share of firms that do R&D account for less than 15% of US economic activity in the entire US economy.[1]

These concerns are related to my earlier point. Young firms are inherently engaged in what lots of us like to call intangible capital investment. That is, they are engaged in investing in their future products, processes and customer base. This is especially true in the innovative intensive sectors. If you go into the innovative intensive sectors and you ask what they're doing, they're not so much producing current products, they're working on developing future products and services. And we don't capture that very well, both given sample design issues. It takes a while to get the young firms into the R&D and other related surveys. Relatedly, the surveys are stratified by firm size but not firm age. A survey that is representative by firm size is not inherently representative by firm age since while young firms are small, many small firms are not young. Also, the questions asked are better suited to large, mature firms. A young tech startup of only 10 employees doesn't have an R&D division and isn't able to answer the questions in quite the same way.

Given these issues (and also challenging questions for identification of monetary policy shocks), does this mean that the results in this paper are understating or overstating out of these results? I don't think we know yet but my prior is that they may be understating. To make this case, I am going to turn to a few patterns in the data.

Figure 1 reports annual labor productivity statistics from the BLS where 4-digit NAICS industries have been aggregated into two broad groups. One group is the high-tech industries of the economy (the STEM intensive sectors as defined by Hecker (2005)). This set of industries is dominated by Information and Communication Technology (ICT) industries. The second group combines all other industries. As we know productivity surged dramatically in the United States in the 1990s, through the early 2000s, and then has been quite anemic since then, particularly post 2010. The surge was very much accounted for by the high-tech sectors of the economy. In the productivity growth slowdown, the high-tech sectors have not done well, particularly in the post 2010 period.

A question suggested by the patterns here is the role of the Great Financial Crisis (GFC) in the productivity growth slowdown. Research has shown and it is evident from this figure that the productivity growth slowdown began before the GFC (see Gordon 2016). However, it may be that the GFC has played a role in the persistence of the slowdown in productivity growth slowdown. To explore this, I want to return to the critical role that young businesses play in

[1] Dinlersoz et al. (2023) have a useful discussion of the alternative measures of innovation with associated references. A related useful reference is

innovation and productivity growth. There is a rich literature on this and I am only going to provide a few suggestive teasers in these comments.

To start, Figure 2 depicts the share of employment accounted for by young firms in both the overall US economy and the high-tech sectors. And you can see, interestingly, just even from this aggregate data, that there was a surge in young business activity in the high-tech sectors in the 1990s but it's fallen considerably over this period of time.

In research, we've used the detailed micro-data that I've talked about to try to help us understand the role of startups in innovation. I think the causality likely runs both ways. I think startups are induced to innovation and they induce innovation, they're drawn to it. This perspective is very much related to the seminal work of Gort and Klepper (1982). They found a surge in startups is part of the early stages of innovation. They are drawn to the innovation and contribute to it. In research, see Foster et al. (2019), we examined the dynamic patterns of startups and innovation in the tech sectors in the 1990s. Interestingly, we found that the leading indicator, about six to nine years before productivity started taking off, is a surge in entry. Entry is kind of like a "canary in the mine" as an early signal for innovation.

The findings indicate that what happened first following the surge in entry was not an increase in productivity growth, it was actually a decrease in productivity growth in those sectors. Instead, the next phase following a surge in startups is an increase in productivity dispersion, consistent with the view that this is a period of experimentation and creative destruction. Six to nine years later, productivity growth emerged.

As an aside, in the Ma and Zimmerman paper there is some evidence that the Venture Capital (VC) market was recovering in the post 2010 period, but this increase has not shown up in the productivity statistics. The question is whether the connection between the VC industry and innovation has changed over this period (post 2010) of time.

Turning back to the theme of this session, the core question is what financial market conditions have to do with the pace of innovation. In recent work with Steven Davis (Davis and Haltiwanger, 2023), we have examined the role of financial conditions for fluctuations in entrepreneurship. We found that in the GFC, housing prices and credit supply collapsed in some places much more than others. The latter we found is because some banks in some parts of the country were in much more trouble than other parts of the country. We used that variation for identification and found that the large decline in young firm activity in the GFC and its aftermath is largely accounted for by the changing financial market conditions.

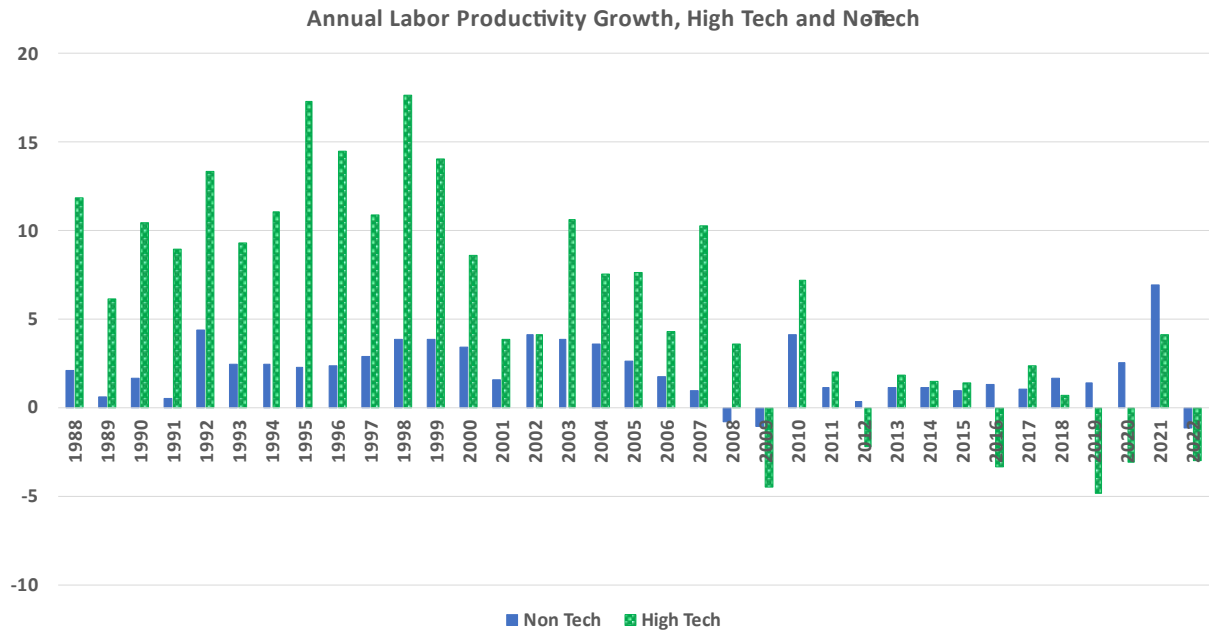
Putting the pieces together, young businesses are critical for innovation. Startups surged in the innovative intensive sectors in the 1990s but have been on decline in the post 2000 period (at least pre-pandemic). Young businesses are incredibly cyclically sensitive and relatedly they're very sensitive financial market conditions. I think that this suggests that the very interesting results in this paper may be understating the role of financial market conditions in innovation.

What about current conditions? The paper presents results that suggest VC industry financing has been taking a hit, particularly in late 2022 and early 2023. I think that's something we should be paying attention to. But I think when we look at that, we need to remember that the tech sector has been going through some fundamental restructuring over the last couple of years. We know big tech isn't doing so well, at least parts of big tech. Twitter/X, Facebook, and other big tech firms are struggling a bit with associated layoffs. Perhaps relatedly the Crypto industry has shown of collapse? Do I think the problems that Facebook, X/Twitter, and Crypto are associated with the monetary policy correction? I don't think so primarily as it looks like big tech was due for restructuring. While there might be some connection in terms of timing but I think the restructuring in big tech reflects structural factors.

To close, consider a different perspective related to my earlier remarks. I have argued that startups more broadly are important, and it is not sufficient to just look at what is happening in the VC industry. Recall one of the points above is that a surge in business formation is an early signal of innovation. On this point, the US Census Bureau has a new data product called the Business Formation Statistics (BFS). The BFS tracks essentially in real time applications for new businesses and new businesses. The form includes information on the intent of the application. For example, "Do you intend to be an employer?"

In Figure 3, the time series for selected sectors through July 2023 are depicted. Quite interestingly, in the pandemic itself, and through 2023, in spite of the monetary policy contraction, there has been a surge in business formation. In collaborative work with Ryan Decker for the September 2023 Brookings Papers on Economics Activity, we have been attempting to glean what we are learning from this new data product. One of the patterns we have detected is there is spatial reallocation within major cities of business activity. This is related to the daytime working population spending time in a different place than they used to pre-pandemic. The BFS shows a surge in business formation and business activity in the areas immediately around the downtown center. So, for example, Brooklyn's doing much better in terms of business formation than is Manhattan.

While this spatial restructuring is interesting, it is not clear that this will have much of an impact on innovation and productivity growth. However, Figure 3 shows that that the high-tech sectors of the economy that played such a dominant role in the 1990s, have had a considerable surge in the pandemic through July 2023. To conclude, I will end with a very incredibly speculative remark, and then a caution, of course. The last time we had a surge in high-tech startups like this was in the 1990s. That was an amazing decade for innovation and productivity growth. Is it possible we are on the cusp of another surge in innovation and productivity -- perhaps fueled by Artificial Intelligence (startups in AI will show up in the high-tech sectors in Figure 3). What's the caution? Two reasons. First, it is very difficult to predict surges in innovation and productivity especially since there are often long lags between potential innovations and implementation on a large scale. Second, young businesses are very sensitive to cyclical conditions. The current monetary policy contraction may derail this surge in business entry. Does this suggest that young business activity should be one of the indicators the FOMC examines as they track the economy. The answer I think is yes. This answer is based on the interesting analysis in this paper and also on the remarks that I have made extending the perspective.



Source: BLS, Industry Productivity

Figure 1: Annual Labor Productivity Growth Rates for Industries in High-Tech and Non-Tech.

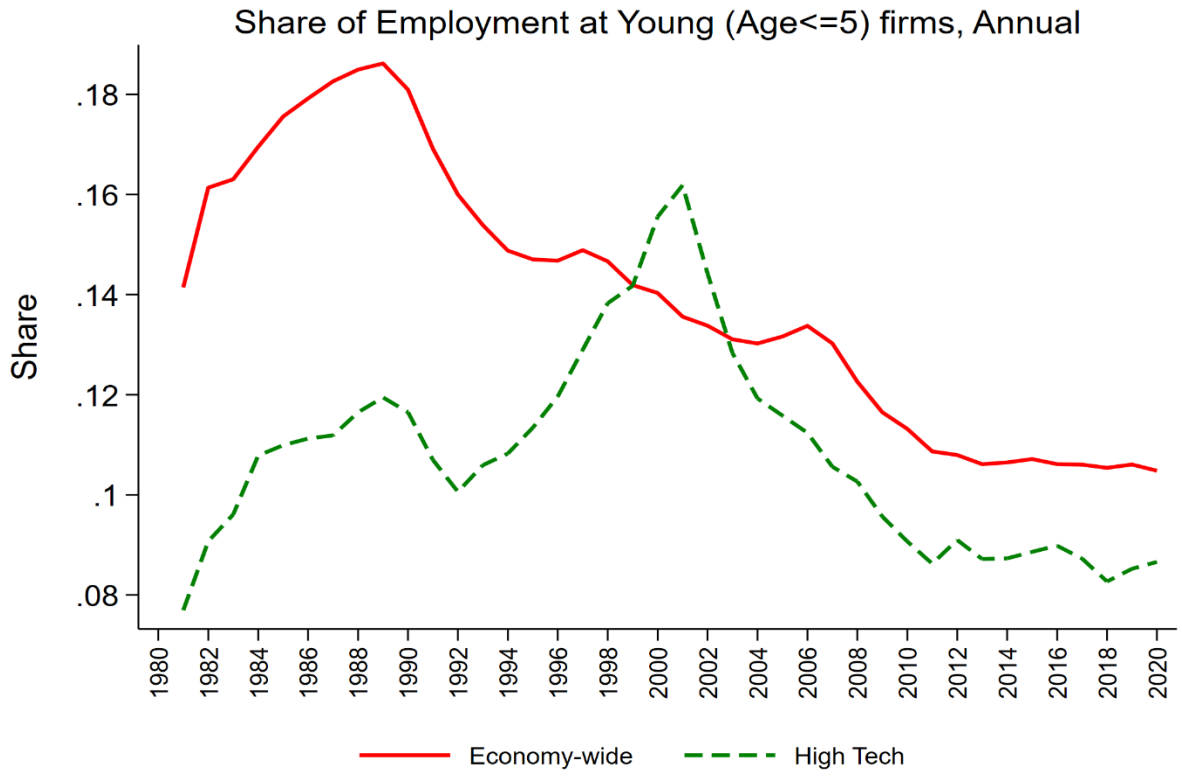


Figure 2: Share of Employment at Young Firms. Source: US Census Bureau, Business Dynamic Statistics

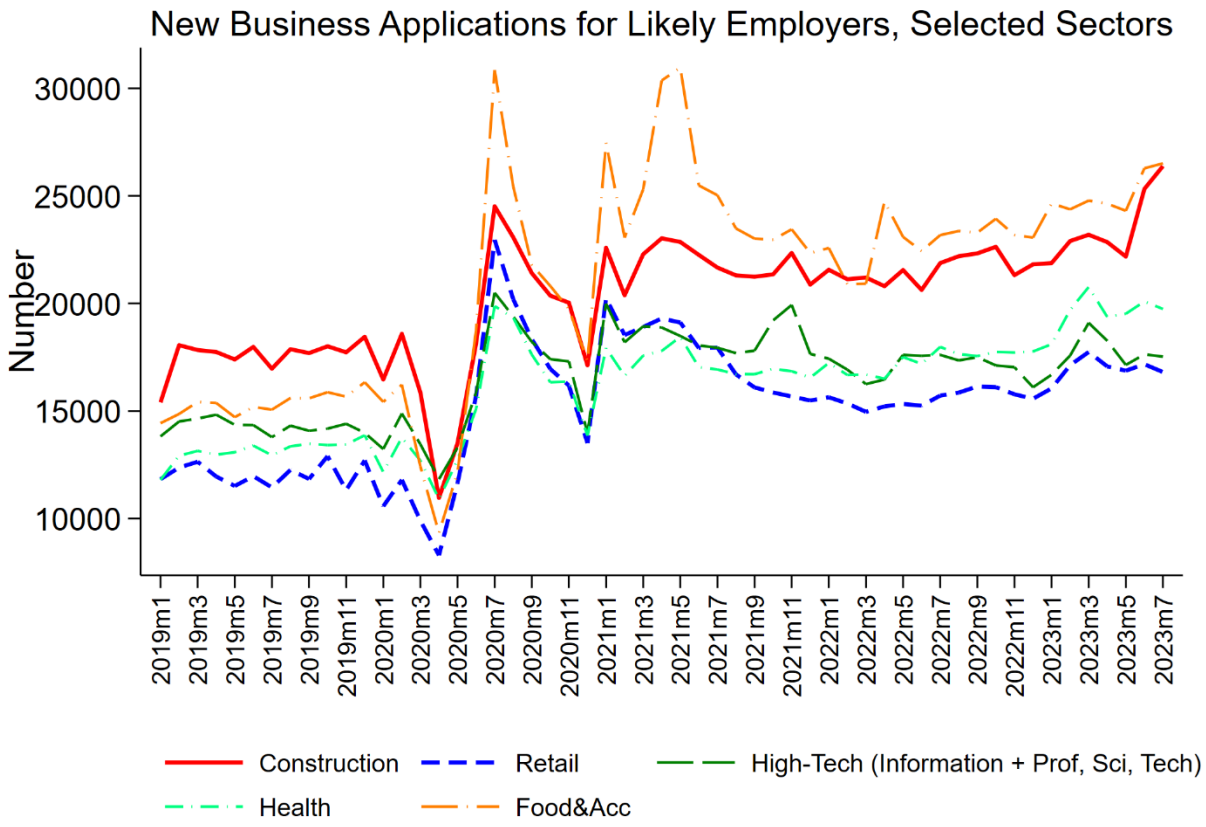


Figure 3: Applications for New Businesses During the Pandemic. Source: US Census Bureau, Business Formation Statistics.

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