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Can an Individual Large Firm Impact the U.S. Business Cycle?

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Recent research has emphasized the importance of a few large firms in driving overall economic fluctuations, a view known as the "granular hypothesis." I find that the granular hypothesis can explain about 15 percent of aggregate U.S. fluctuations, a smaller share than found in other research. Thus, the granular hypothesis plays a meaningful role for the U.S. economy, but there is still plenty of room for aggregate factors to be relevant.

What drives business cycle fluctuations? Traditionally, macroeconomic models rely on unexpected disturbances that impact the economy as a whole, or "aggregate" shocks. But one could also think about the role of shocks at the firm level. Aggregate output consists of the sum of all firms' output, so shouldn't there be a role for firm-specific shocks?

Earlier research said "no." For example, Robert E. Lucas concluded in his 1977 paper "Understanding Business Cycles" that firm-specific shocks "wash out" in the aggregate. This makes intuitive sense: According to the Census Bureau's Business Dynamics Statistics, the U.S. economy had about 5.25 million employer firms in 2017. Thus, a negative event affecting a single firm would barely be noticeable from an aggregate perspective.

Potential Impacts of Firm Size

However, not all firms are created (or grow) equally in the U.S. economy. In fact, the U.S. firm size distribution is incredibly skewed. The top 0.025 percent of firms (about 1,300) account for about 28.5 percent of aggregate employment.

And even this fraction of firms is considerably skewed. Consider Walmart, the largest private employer in the U.S. with about 1.5 million employees in 2017. This one firm was responsible for about 1.2 percent of aggregate employment.
Thus, in the presence of some "mega" firms, idiosyncratic shocks no longer wash out in the aggregate. The view that a handful of large firms can drive at least part of the business cycle is known as the granular hypothesis, a theory formalized and popularized by Harvard economist Xavier Gabaix.

The million-dollar question then becomes this: What fraction of U.S. business cycle fluctuations can be explained by the granular hypothesis? In this Economic Brief, I explain the conditions necessary so that idiosyncratic shocks do not wash out in the aggregate and justify that there is some role for the granular hypothesis in the U.S. economy. Then, I summarize the attempts and pitfalls of the literature in trying to quantify the exact role of the granular hypothesis. Finally, I propose how to circumvent these pitfalls and quantify that the granular hypothesis can explain about 15 percent of observed U.S. aggregate fluctuations.

**When Do Firm-Specific Shocks Not Wash Out?**

The neoclassical view of business cycles argues that firm-specific shocks do not matter when there are millions of firms. In contrast, the granular hypothesis states that some firms can be so large they impact aggregates.

Both arguments seem reasonable, so which view is right? The key lies in the size (as measured by employment) distribution of firms, or how common mega firms are in an economy.

The implicit assumption under the neoclassical view is that the firm size distribution has a so-called thin right tail, meaning the frequency at which large firms occur in the economy is negligible. For the sake of exposition, let us suppose that all firms regardless of their size have the same volatility, defined as the standard deviation of their growth rates. (We'll discuss the issues with this assumption in more detail later in the article.)

For the U.S., this would mean aggregate volatility of about 0.043 percent, which essentially zero. Note that this is much smaller than the historical standard deviation of U.S. real GDP growth of around 2.4 percent. Under these assumptions, it is reasonable to say that idiosyncratic shocks wash out in the aggregate.

However, Robert Axtell's 2001 paper "Zipf Distribution of U.S. Firm Sizes" showed that U.S. firm size distribution features a fat tail, meaning that mega firms occur with a probability that is no longer negligible. When this occurs, we cannot apply standard statistical insights anymore (as we did with the above example).

Fortunately, Gabaix's 2011 paper "The Granular Origins of Aggregate Fluctuations" included a comparable calculation of aggregate volatility that accounted for fat tail distribution. He showed aggregate volatility at 42 percent.
Obviously, aggregate fluctuations in the U.S. (at the annual level) are not this volatile, but the above calculations show what order of magnitude for aggregate volatility can be generated with idiosyncratic shocks alone. Gabaix’s calculations clearly illustrate that there is scope for the granular hypothesis whenever the firm size distribution features a fat tail, an empirical regularity that has been documented by multiple studies.

**Quantifying the Granular Hypothesis**

To better understand the relationship between firm-level shocks and aggregate fluctuations, it is necessary to impose some assumptions on firm behavior at the micro level. In particular, we need to take a stance on the volatility of firms' growth rates.

A common assumption is that all firms regardless of their size grow at the same rate and are equally volatile, a phenomenon known as Gibrat's law. However, this assumption is convenient but unrealistic, as it is hard to imagine that the growth of mom-and-pop stores and large firms are equally volatile.

Most studies acknowledge this unrealistic assumption and set a relatively low value for firm volatility (again, standard deviation of their growth rates) at 12 percent. In these studies, which also feature a fat-tailed firm-size distribution, firm-specific shocks alone can explain about 35 percent of observed aggregate volatility.

However, even 12 percent might be too high for many large firms, which would imply that we are overestimating the role of the granular hypothesis. The intuition behind this is straightforward: The largest firms — whose shocks drive granularity — are the least volatile. Thus, their influence on aggregates is mitigated.

Most studies providing evidence against Gibrat’s law relied on less-than-perfect datasets. The most prominent of these datasets is S&P’s Compustat, which contains information on publicly listed firms only. These firms tend to be large, so samples in Compustat are heavily biased. Furthermore, data in Compustat are reported at the global level, so it could include revenues generated in foreign countries. This presents an issue for our exercise, which requires measures of firm-level activity on U.S. soil since we are interested in quantifying the role of the granular hypothesis for U.S. aggregate volatility.

To circumvent these issues in my working paper "Revisiting the Origins of Business Cycles with the Size-Variance Relationship," I use confidential data from the Census Bureau (spanning the universe of employer firms) to quantify the relationship between firm-level volatility and firm size. Using a series of regressions, I document a robust size-variance relationship and find that firm-level volatility declines steeply as firms grow in size.

Using the same simulations as before, but allowing for a size-variance relationship, I conclude that the granular hypothesis can explain at most 15 percent of U.S. aggregate fluctuations. Even though this is less than half of what previous studies found, the granular hypothesis still appears to be a robust mechanism to explain aggregate fluctuations.
Conclusion

The drivers behind business cycle fluctuations have been on economists' minds for decades. To this day, aggregate shocks have been the leading paradigm in macroeconomics. The rationale is that firm-specific shocks wash out in the aggregate: Adverse events for a single firm are not important for an economy with millions of firms.

However, this logic applies only when mega firms are extremely scarce, which is not the case for the U.S. The U.S. economy has a significantly skewed firm-size distribution and features a fat tail. Thus, the granular hypothesis comes into play, and large firms can impact aggregate fluctuations.

Previous studies found that the granular hypothesis could explain about 35 percent of U.S. aggregate fluctuations. However, these results depend on Gibrat's law, in which all firms regardless of their size are equally volatile. But this assumption contradicts the data: Firm-level volatility declines steeply as firm size grows.

When this size-variance relationship is considered, the granular hypothesis can explain about 15 percent of aggregate fluctuations instead. Hence, the granular hypothesis plays a quantitatively meaningful role for the U.S. economy, but there is still plenty of room for aggregate factors to be relevant.

This is an important insight since aggregate shocks include stabilization efforts from, for example, monetary and fiscal policy. If most aggregate fluctuations were caused by idiosyncratic factors instead, then the role of monetary and fiscal policy for business cycle stabilization would be severely limited. But the smaller role for idiosyncratic shocks implies a more substantial role for monetary and fiscal policy in business cycle stabilization.

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