Skewed Business Cycles by N. Bloom, F. Guvenen, S. Salgado

A discussion

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ARC 2020 - Labor Market and Monetary Policy

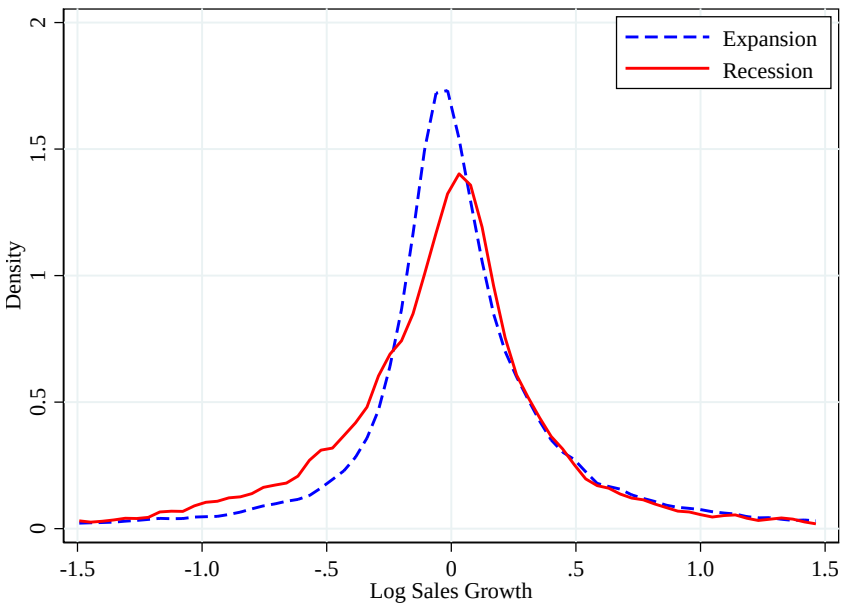
May 29, 2020, Ukraine

Paper overview - an empirical part

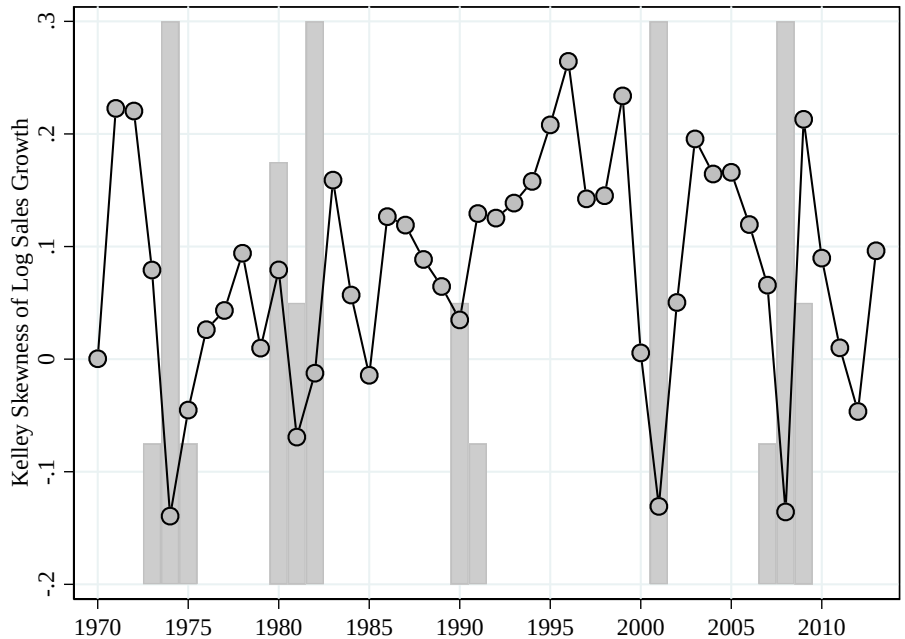
- The paper presents a broad empirical evidence that the dispersion and, what's more important and novel, skewness are cyclical — the former is countercyclical and the latter is procyclical
- The results are really robust
  - micro-datasets for the US
  - micro-datasets for a number of countries
  - industry-level evidence for the US
- Countercyclicality of the skewness is found for both outcome variables (sales, employment, stock returns) and for a shock variable - TFP

Main empirical results of the paper

(B) Compustat: Log Sales Growth



(B) Compustat: Skewness of Log Sales Growth

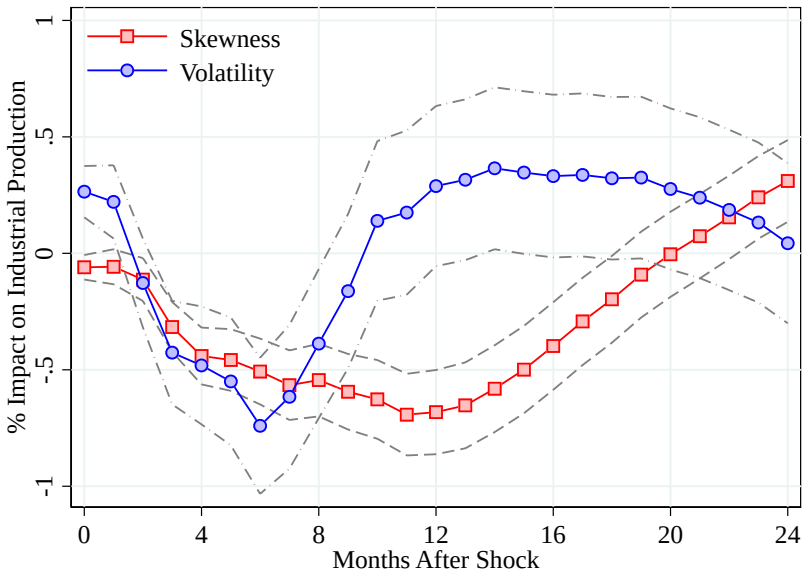


Paper overview - a model part

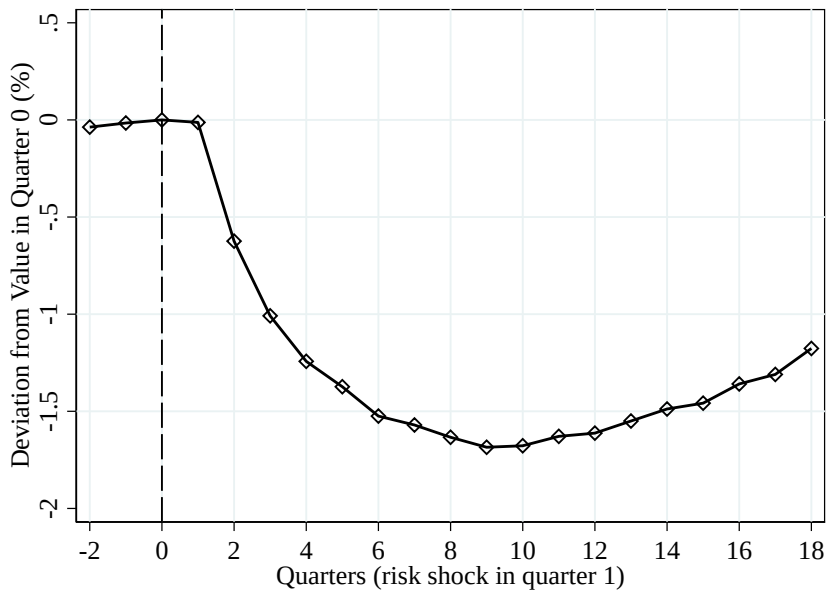
- Evidence from VAR models show that skewness shocks generate persistent output declines, unlike shocks to 2^{nd} order moments
- The authors build a heterogeneous-agent model with capital adjustment costs and specify the process of TFP that allows for time-varying dispersion and skewness
  - Model generates persistent declines of output and labor after a skenwess shock to the distribution of TFP, like in the VAR
  - The decline of economic activity can be generated even with the mean and variance of firms' shocks are held constant
- The persistent drop in output is driven by a decline of investment
  - fixed cost to capital adjustment creates a real options effect that reduces the incentives of firms to invest when skewness declines - only outcomes about the bad state of the world matter for the option value to delay investment
  - the drop in skewness makes capital riskier
  - a decline in skewness results in a widening left tail of the firm productivity distribution without a corresponding widening of the right tail

Main modeling results

(A) Industrial Production



(A) Output



Discussion

- First, it's a great paper!!! Novel, well defined, well written, concise...
- In other words — a discussant's nightmare
- It's really hard to find a point of discussion (but I've found some)
- I'll start with some minor issues, than move to the bigger one (related not quite to the paper but rather to what does it mean)

Remarks and questions #1

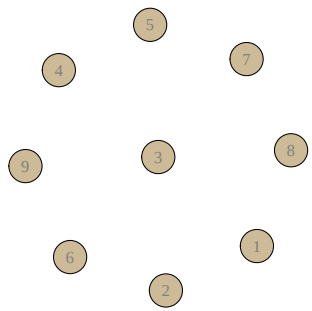
1. The Kelley skewness is neutral to changes in tails of the distribution
   - could be problematic as the right tail is fat and govern by power law
   - what's more important — as shown by Gabaix (2011) firms in the right tail tend to govern business cycle
   - The appendix of the paper shows main empirical results for different cut-off level of the distribution, but still It could be desirable to see the results for the 3^{rd} central moment
2. Endogeneity of GDP in regressions (e.g. in Table II)
   - the point of the paper is that skewness affects real output

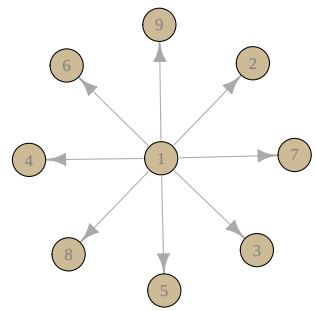
Remarks and questions #2

3. The nature of the shock is important
   - The paper concentrates on TFP shock, but the time-varying skewness may apply also to demand shocks
   - Kumar and Zhang (2019) uses information on inventories to filter out demand shocks and than utilizes approach similar to Ackerberg, Caves, and Frazer (2015) to identify TFP shocks, controlling for the demand shock
   - Their approach allows to identify both demand and supply shocks
   - Acemoglu, Akcigit, and Kerr (2016) showed that in a sectoral network supply shocks propagate downstream (as the costs are passed to customers) an the demand shocks propagate upstream (as production increases are passed to suppliers)
4. Are there any differences in skewness changes of shocks and outcomes measured at firm-level, and outcomes at industry level?
   - The propagation of shock, which I'll discuss in a moment, implies that skewness changes at these 3 levels should differ
5. What does the procyclicality of skewness actually mean?

What does the procyclicality of skewness mean?

- There are some attempts to interpret movements in skewness in the paper but the authors mostly treat it as a technical feature of the distribution
- My point is that it could be a reduced form of an economic structure not present in the model
- Shifts in the mass of distribution indicate that firms shocks (and outcomes) are similar, especially during recessions
- The recent literature on production networks (see e.g. Acemoglu, Carvalho, Ozdaglar, and Tahbaz-Salehi, 2012; Carvalho and Tahbaz-Salehi, 2019) shows that firm and sector interconnections could be the source of such a co-movement of shocks





Production networks

- Carvalho and Tahbaz-Salehi (2019) proved (see Theorem 4) that average pairwise correlation of (log) outputs is higher in the more interconnected economy
  - network connections imply firms (and sectors) depend on each other in non-linear way
  - it generates substantial comovement and may be visible in the data as both outcome and shock comovement
- Baqaee and Farhi (2019) showed that production networks with CES non-linearities can generate significant negative skewness and excess kurtosis in aggregate output dynamics even when the underlying structural shocks are symmetric and thin tailed
- The evidence is mainly for sectors but there are some papers that use microdata (see e.g. Carvalho, Nirei, Saito, and Alireza Tahbaz-Salehi, 2016)
- It suggests that the heterogenous-agent model that is used in the paper can generate skewness (or amplify skewness) when firms are allowed to affect other firms in a production network

Skewness can also arise in aggregation

- When we denote S_X as a skewness of X, we know that for uncoreelated X and Y we have $S_{aX+bY} = a^3 S_X + b^3 S_X$ and skewness is hard to generate, especially negative
- But in a general case, utilizing the definition of coskewness, for two random variables X and Y the skewness of their sum S_{X+Y} is given by

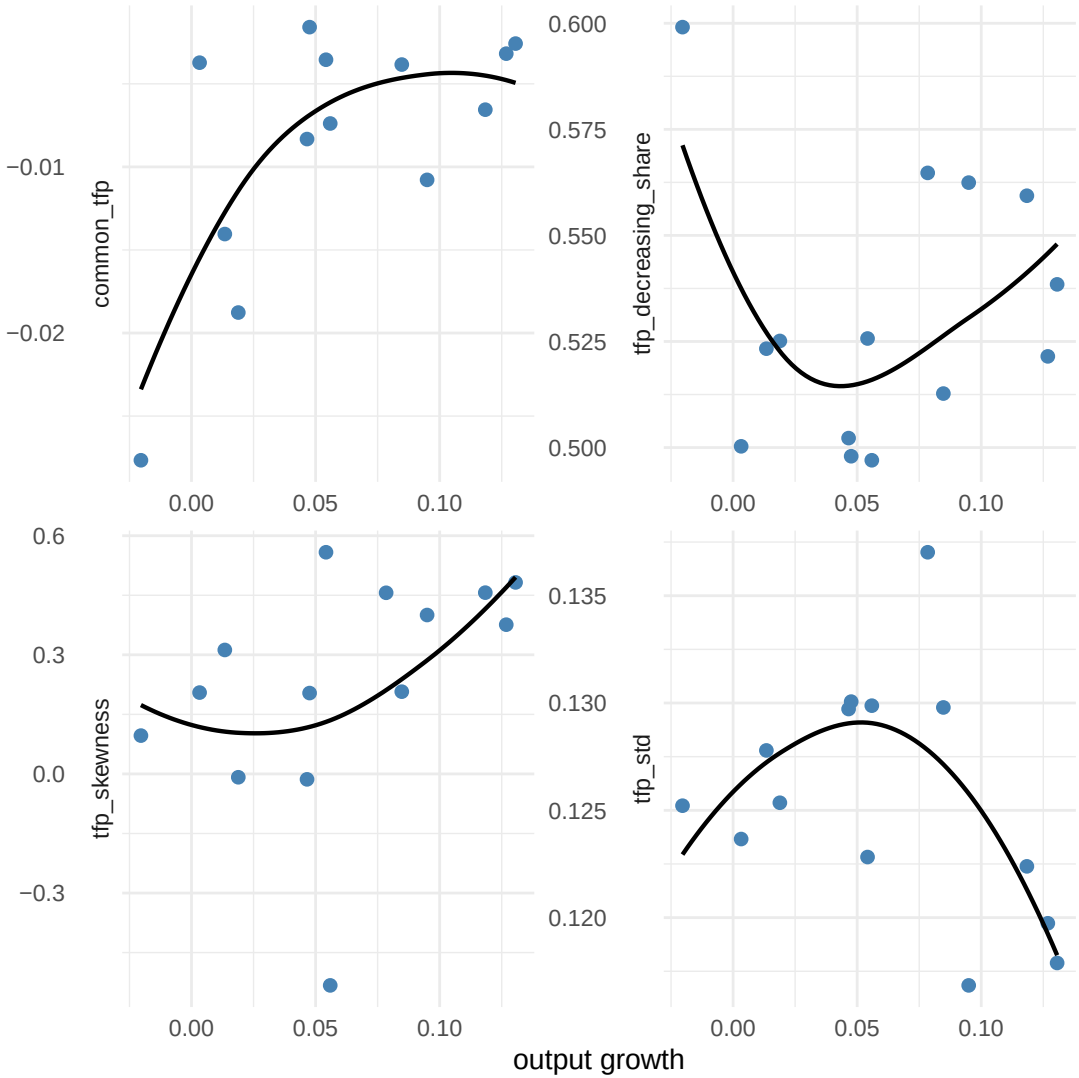
$$S_{X+Y} = \frac{1}{\sigma_{X+Y}^3}\left[\sigma_X^3 S_X + 3\sigma_X^2\sigma_Y S(X,X,Y) + 3\sigma_X\sigma_Y^2 S(X,Y,Y) + \sigma_Y^3 S_Y\right] \quad (1)$$

  where $S(X,Y,Z) = \dfrac{\mathrm{E}\left[(X-\mathrm{E}[X])(Y-\mathrm{E}[Y])(Z-\mathrm{E}[Z])\right]}{\sigma_X\sigma_Y\sigma_Z}$ is the coskewness and σ's are standard deviations
- With this notation the skewness of X is $S_X = S(X,X,X) = \dfrac{\mathrm{E}\left[(X-\mathrm{E}[X])^3\right]}{\sigma_X^3}$
- It follows that the sum of two random variables can be skewed ($S_{X+Y} \neq 0$) even if both random variables have zero skew in isolation ($S_X = S_Y = 0$) and if they co-move in a non-trivial way.
- Of course similar kind of argument applies to dispersion, as $\sigma_{X+Y}^2 = \sigma_X^2 + \sigma_Y^2 + 2\rho_{XY}\sigma_X\sigma_Y$

Measurement of shock-comovement

- I use the firm-level TFP data for Poland from Gradzewicz and Mućk (2019), which utilizes identification scheme of Ackerberg, Caves, and Frazer (2015)
- I use the system dynamic panel-data estimation to infer TFP shocks ϵ_{it} from firm-level TFP measures
  - it follows that $logTFP_{it} = 0.75 logTFP_{it-1} + \epsilon_{it}$, tightly estimated
- It's not easy to measure comovemement in this context
  - the usual correlation-like measures fail as there is nothing to correlate with
- I take 2 measures:
- $tfp\_decreasing\_share_t = \frac{1}{N} \sum_i \mathbb{1}_{\epsilon_{it}<0}$
- time fixed effect α_t from a simple regression $\epsilon_{it} = \alpha_t + \omega_i + \eta_{it}$

Some firm-level results from Poland



- Skewness is procyclical - it falls with output declines
- Dispersion is rather countercyclical
- TFP shock common across firm (*common_tfp*) is also procyclical (and correlated with skewness)
- The share of firms with negative TFP shocks (*tfp_decreasing_share*) also tends to move procyclically

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