

Supply and demand in the US equity market

This blog is a layman's critique of a, by now famous, paper by Gabaix and Koijen (2020), [In Search of the Origins of Financial Fluctuations: The Inelastic Markets Hypothesis by Xavier Gabaix, Ralph S. J. Koijen :: SSRN](#). The two Economists who wrote it are brilliant, and the paper itself has been heralded as a paradigm shift. JP Bouchaud praised it [here](#) for abandoning the classical efficient market hypothesis in favour of empirical evidence-based modelling. It has received prominence recently as a potential explanation for the inexorable rise in equity prices.

The paper builds on genuine innovation in untangling supply & demand elasticity. Their earlier paper [Granular Instrumental Variables](#) is so exciting I am going to spend the next section explaining it. I will then explain the Inelastic Market Hypothesis (IMH) as I understand it.

In the final section I will make a few related observations and will attempt to tie the paper to trend following. Let me preface my musings: when a new theory comes along, there will be, invariably, some gaps in it, so think of the questions I raise as a way forward to improve our understanding of market dynamics.

Finally, I want to thank the authors. I have sent them two earlier drafts, and they have taken the time and effort to help me understand their theory better and made very insightful comments. Any remaining errors are my own.

Supply and demand curves

What are supply and demand curves?



Figure 1: Supply & demand curves

Butter in the US is produced and consumed. A quantity Q^* is produced and supply and demand are balanced at price P^* . If price increases, we will see supply rising: farmers will switch from selling milk to using it for butter production, or they may order more cows on Amazon and increase overall production. Similarly, if price rises, we typically see less demand. The response of supply and demand to price changes, the gradient, is called price elasticity. We say supply (or demand) is *elastic* if it adjusts meaningfully to a small change in price. Conversely, *inelastic* supply (or demand) yields a small change in supply (or demand) to price moves.



Why should trend followers care?

We usually model supply and demand as “shocks” and the response to these shocks is instantaneous, prices adjusting immediately and cows ordered on Amazon to meet excess butter demand. Real-life supply or demand adjustments to a new equilibrium are *delayed*, causing trends to form. The more inelastic the market is, the more pronounced the asset’s volatility, and the more delayed the response, the slower and more prolonged the trend.

Typically, CTAs treat every asset class [the same](#). But elasticity matters to speed and duration of trend formation and in principle, should affect how we should “harvest” it. Through the lens of “market size” and “liquidity”, markets may seem similar, but when we come to elasticity and underlying dynamics, different asst classes can be very different.

Estimating elasticity

Events happen. Economists refer to these as exogenous shocks. Less rainfalls can create a supply shock for butter or AI could cause a demand shock for electricity. Afterwards, the market will find a new equilibrium, balancing price and quantity. The shift from current equilibrium depends on the shock and the gradient of both curves as they are currently. Therefore, estimating elasticity is important.

However, estimating both gradients is tricky, because our supply shocks and demand shocks are correlated, causing our regression estimates of shocks to be intertwined and biased.

Instrumental variables

Estimating the butter supply/demand curve was a problem facing [Phillip Green Wright](#) in 1928 and his idea was ingenious: What if we had a third variable that is only correlated with supply? For example, rain falls. We can use rain falls as a “ruler”, forcing our estimates of butter supply shocks to “align” with observed rain falls. It turns out that this “ruler” or instrumental variable provides enough structure for the problem to be solved without bias. Alas, finding a naturally occurring instrumental variable is not always easy.

Granular instrumental variables (GIV)

Now fast forward a hundred years to Gabaix and Koijen’s paper on [Granular Instrumental Variables](#). Suppose we are looking at the impact of AI on oil demand. For simplicity, let us assume US consumes 60% of oil and Europe the remaining 40%. Then AI comes along causing a demand shock. We know that price and oil production will shift to a new equilibrium.

If AI has similar impact on US and Europe demand, then in the new equilibrium, the US will still consume 60% and Europe 40%. But what if we observed these shares of demand changing? If we move to a 62%/38% universe, we can think of the difference in demand share as an orthogonal variable, affected only by idiosyncratic demand shocks in either US or Europe. In this simple example, it would go from 60%-40%=20% to 62%-38% = 24%. By construction, that variable is uncorrelated with overall demand, ergo, it can act as an instrumental variable!

The inelastic market hypothesis (IMH)

When money flows into a stock, the value of the stock rises. And rises permanently, or at least until some money flows out. The main innovation in the paper is in asserting that the US equity market is inelastic to

the extent that a \$1 flow into the US equity market in aggregate, turns itself into \$5 rise in the overall valuation.

The authors conduct regression using the granular instrumental variable methodology between different sectors and price changes, and they find a good agreement. Most importantly, the regressions yield somewhere around \$5 change in valuation to \$1 of flow.

This is very surprising indeed, but the authors give a-priori reasons why we would *expect* such an impact:

Single stock impact vs factor impact vs overall market impact

If \$1 flows into a company, it is reasonable to expect the value of the company to rise by \$1 (and there is literature supporting that). But stocks are correlated, so a rise in the stock will also pull up the valuation of a “factor” the stock participates in (e.g., if it is a growth stock, all growth stocks will benefit), and also the market as a whole. I have much sympathy with this argument, indeed, to my mind, L/S equity funds trade precisely this contagion effect, one stock price rise affecting its neighbours.

There are not enough flows to justify the price moves we see, so it must be that the multiplier is high

This argument is broken into two parts: Firstly, there are not enough active players (macro arbitrageurs) that can facilitate flows (hedge funds are responsible for perhaps 5% of the overall stock holdings), while the holding of less active investors, like mutual funds, ETFs and pension funds’ equity allocation is remarkably stable: The transfer of demand share between sectors is modest: an estimate of only 0.6% of aggregate equity market value, is transferred quarterly across the less active investor sectors.

Put simply, if we measure overall flows between sectors and they are small, and we measure price moves, and they are large, a large multiplier is needed to make the two “fit” together.

The undergraduate example

The authors give a simple undergraduate example of how this effect would play in practice: Suppose we have some money in a pure bond fund and \$100 in an 80 (equity)/20 (bond) fund. If we now sell \$1 of the bond fund and buy \$1 of the mixed fund, this will translate into \$5 rise in the value of the equity market, and in equilibrium valuations will settle as \$84 in equity and \$21 in bonds in the 80/20 mixed fund; a total of \$105.

Actual equity market elasticity estimated

The authors then delve into estimate the elasticity of equity markets; using GIV; with data derived from quarterly flow of funds data, 13F filings and Morning Star’s monthly mutual funds flows. They emerge with an elasticity estimate of 0.2 or \$5 of returns for every \$1 of flow.

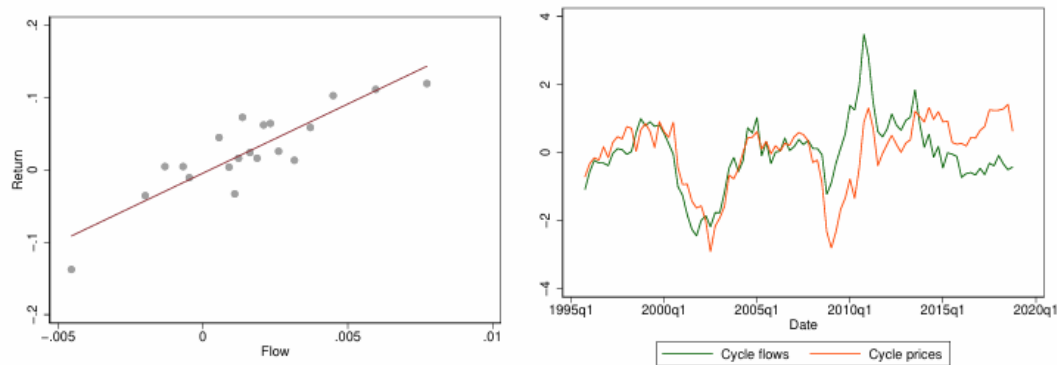


Figure 2: Regression of contemporaneous quarterly flows vs price moves. The authors use GIV and control for flows induced by external factors (e.g. GDP growth) as well as cyclical effects and achieve an impressive R^2 of 0.7

Some comments

Permanent versus transitory price impacts

IMH is not about transitory price impact and is very far from any price impact model I have seen. It is about where the eventual equilibrium is reached following flows. As such, it does not look at volumes, time required for order execution, order book structure, bid ask spreads or current market volatility. All these are the usual inputs that we love to use when we calibrate our (usually non-linear) internal slippage models. Our models do have a linear component: the permanent price impact, which is “most similar” to what the authors refer to as micro elasticity. For what it’s worth, my own permanent price impact estimate is order of magnitude smaller than IMH’s prediction.

The “There are not enough flows to justify the price moves” argument

“Fast and smart investors (perhaps hedge funds) will provide enough elasticity to the market.” This is not true: in part because hedge funds are small (they own less than 5% of the market, see Section 2), they cannot provide much elasticity for the market as a whole, even though they might ensure short term news are incorporated quickly. In addition, those smart-money investors often face risk constraints and outflows that limit their ability to aggressively step in during aggregate downturns.” (IMH paper, p39)

Hedge funds are unimportant to overall market size, but if we want to create uncorrelated GIVs, it is the marginal risk transfer between investor sectors which is important and at that point, I am unconvinced that neglecting active funds when calculating fund flows to construct GIVs is justified.

Is this a big issue? Let us consider the share of overall risk transfer from CTAs alone. CTAs are neither equity focused nor a large part of the active funds universe (managing a mere \$300bn, or ~5% of hedge funds AUM). Assuming CTAs allocate 5% to S&P, running at internal 4x leverage, CTAs will happily switch during a quarter from net long to net short, transferring roughly $\$300\text{bn} \times 5\% \times 4 \times 2 = \120bn of S&P or 0.2% of total market value. This is very comparable to the 0.6% of all passive funds put together.

Many hedge funds trade even more actively than a typical CTA, and CTAs are only a small part of the hedge fund universe. My feeling is that active funds flows may be material to GIV construction.



Equity/bond correlations

If IMH is correct, the undergraduate example demonstrates the near-perfect Ponzi scheme the equity market operates: We borrow \$1 from bonds, use it to inflate prices by 5x, took \$4 into the increased equity valuations and then return the \$1 back into the bond pool.

Intuitively, to me, in such a regime, I would expect a spillover from equity valuations to other asset classes: the “all assets rising” will be the dominant first factor while the “reallocation from one asset class to another” should be a smaller factor. I may be wrong; this is certainly not a bullet-proof mathematical argument.

Perhaps the recent equity-bond positive correlation is a warning sign that a runaway inflationary process *is* at play, but we have not seen positive equity/bond correlation until recently, and certainly not in the dataset the paper uses. To me, negative correlation means that we did not have an inflationary process at play behind the scenes: equities and bonds have been *competing* for capital allocation.

Cause and effect

The analysis the paper carries out is done on contemporaneous price changes and flows on a quarterly scale. GIV is a beautiful mathematical approach, but it does not resolve a key question: does flow drive prices or do prices drive flow?

The paper acknowledges this possibility: “*We re-emphasize once again that these are merely correlations and it may be the case, for example, that they reflect positive feedback trading by investors*” and spends a fair amount of effort on identification.

It is very possible, in my mind, that the paper does not measure just market inelasticity but also the size of the “shadow CTA industry”. Namely, it is possible that for \$5 of price rise in equities, retail and less active investors will inject \$1 of cash into equity mutual funds.

I suspect both processes are at play: flows induce price rises and price rises induce flows.

Responsiveness

If you are a trend follower, as we said earlier, the *pace* of adjustment of flows to market prices is also important: the more delayed the response, the longer the trends we expect. Although very much outside the scope of the original paper, it is possible to gauge this from the ETF markets. Let us hark back to the 80/20 example and imagine the 80/20 fund experiencing positive flows. Once equity is purchased with the flow, equity prices rise, causing the share of equity in the fund to exceed 80%. This will lead to the fund now *selling* equity to rebalance back to 80/20. How quickly does this process play itself in the market?

It turns out we can observe this negative autocorrelation *in flows* happening within a week or so. Flows (or shares creation in ETFs) are strongly mean reverting on a weekly scale, reflecting this rebalancing action.

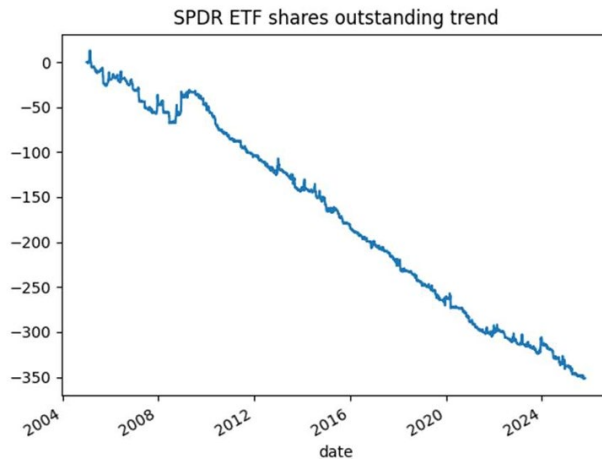


Figure 3: SPY US Equity shares outstanding: The performance of a fast trend flow system on flows is consistently negative, reflecting a strong and consistent negative autocorrelation

Conclusions

I like the paper and I like the methodology it uses even more. The bold move away from the efficient market hypothesis is truly groundbreaking. But the headline interpretation of \$5 of valuation per \$1 of flow is, I suspect, overstated. The authors may have been too quick to dismiss active flows when constructing instrumental variables. The “shadow” trend following activity amongst the less active funds may also be explaining at least part of what they observed. These niggles aside, if you are a trend follower, you may want to spend some time pondering the implications of their results to your equity trend following implementation.

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