# CHAIRMAN'S STATEMENT

**Over the years, I have tried to make my Chairman's letters interesting and relevant to topical events and describe how we address them at Smiths. Last year, I described why we believed that, by the summer of 2022, the coronavirus's mutations would become less virulent, and COVID-19's impact on society and business would gradually decline and disappear into the background of other infectious diseases we live with in perpetuity, like colds or influenza.**

The big issues that have unfolded for Smiths and other companies in 2022 are:

- Supply chain shortages;
- Inflation; and
- The effects of the Ukraine war, particularly its impacts on food and energy supply.

This set of topics is incredibly complex and connects the fiscal and monetary policies of the world's governments, economic growth expectations, energy shortages, social dislocation, food shortages, personal safety, labour shortages, global migration patterns and societal pressures. This is obviously not something I can cover in a short letter. So, I will try to deal with just one or two confusing pieces of this puzzle. So, supply chain shortages and related inflation will be my focus for this year's letter.

In any commodity situation, only three factors impact a commodity's price at any time: supply, demand, and inventory. Price fluctuations occur continuously in globally traded commodities like copper and aluminium, and on any day there can be significant differences in spot and future pricing, depending on expected future demand. Oil prices are especially sensitive to an imbalance in supply and demand because most contracts never result in the actual delivery of oil, only in speculation. But pricing variations like these appear everywhere, even in non-commodity items.

The war in Ukraine has caused energy and food inflation to worsen both locally and globally. But in the longer term, energy is a zero-sum game. Suppose Russia sells more energy to countries such as India or China. In that case, assuming they sell a full allotment, those volume demands are missing from the world marketplace and, given time, that volume will be available to others.

There will be some temporary spikes in oil prices, but they should not last because there is a well-developed shipping network for oil supply worldwide and rebalancing regional supply and demand is possible. There may be incremental costs due to the difference between oil shipped via ocean cargo versus that transported by pipeline, but it is unlikely to last. Natural gas is more problematic because pipeline infrastructure from Russia is more well-developed than LNG shipped by sea. Syngas can also be made from coal and, along with fracking, these might offer a solution if the gas supply does not resume from Russia. Nuclear power generation is also possible in countries where nuclear units have been mothballed for political or environmental reasons. But these issues are as connected to political decisions as to economic or technological ones.

During any economic or secular disturbance, executives face two primary challenges. The first is to predict how long a disturbance will last, and the second is to predict how deep it will get. We saw this in the 9/11 attacks, the '08-'09 debt crisis, and again in the COVID-19 pandemic, plus recent supply chain shortages and inflation. Without a sensible forecasting model, we don't know whether we are falling into a 1m deep ditch or off a 1,000m cliff.

When we speak about a 'supply chain', we refer to the flow of inbound materials to a company and its conversion into finished goods via a manufacturing process. There is a complementary outbound flow from the company through various distribution channels until the product eventually reaches the final customer. Every manufacturing company has these building blocks, the inbound flow of raw material, conversion via a manufacturing or assembly process, and then outbound delivery of finished goods to their customers.

Understanding supply chains is a problem in dynamics, not in statics. Just like the vibrating string of a violin, when it is figuratively 'plucked', everything in the supply chain is moving up, down, backwards, and forwards. Perhaps the closest analogy to supply chain dynamics is the pulsating noise we hear when our plumbing at home experiences a 'water hammer'. This is caused by pressure waves oscillating backwards and forward between discontinuities in the plumbing system and is analogous to the waves of demand that ripple up and down dynamically in a supply chain.

On the outbound side of this process, companies sell their products to customers through various forms of distribution. Some go directly to customers to be built into product platforms such as vehicles or electronics, some through distribution channels that hold buffer inventory to smooth out supply and demand imbalances, and others sell their products direct to consumers online. The dynamics are different in detail, but they all suffer varying degrees of transient problems.

## What happens to orders when end-market demand falls?

Let's perform a thought experiment on our supply chain. Let's consider a make-to-stock original equipment manufacturer (OEM) and imagine there are three or four inventory storage locations in the outbound supply chain. Let's imagine a reduction in end-market demand by 100bps and examine what happens in our supply chain.

The management at the inventory storage location closest to the end-market sees demand fall by 100 basis points. Local management knows they must cut orders; otherwise, they will have too much inventory. So, to be conservative, they cut their orders by 200 basis points, say. The management at the next location further up the supply chain sees their demand fall by 200 basis points, and they also worry they will have too much inventory, so they cut orders by 300 basis points, and so on. The order reduction numbers chosen here are just illustrative, and the actual numbers will differ depending on a company's risk tolerance, distribution method and the number of inventory storage locations. The greater the number of inventory storage locations in your supply chain, the more likely there will be an overreaction. Even with 'just-in-time' pull system ordering, it's natural that management overreacts to some degree in controlling inventory. So, the net effect is that there's always an amplification in the supply chain of any fluctuation in end-market demand.

Consequently, if you are an OEM in a downturn, you will almost always see your demand temporarily fall by multiples of that seen in the end-market as the supply chain adjusts to new demand conditions. The downstream effect is different for make-to-order manufacturers than for make-to-stock. But we must remember this is a two-sided problem, both on the inbound supply chain and on the outbound one. So, an upstream supply chain's impact can still cause problems, particularly when there is an increase in demand. I've seen this amplification phenomenon happen at every B2B company I have worked at. The same phenomenon also happens when, instead, there is an increase in demand, which I will explain later.

In one case, an industrial manufacturer I'm familiar with sells through extended distribution channels and has an amplification of 2.84. So, if their end-market demand falls by 100 basis points, they see their orders temporarily fall by 284 basis points. In steel distribution, that amplification number is about 400 basis points. The amplification factor in seasonal businesses with lower inventory turns is about 160 basis points. Consumer electronics can be as high as a staggering 2,000 basis points.

## How long do these temporary supply chain transients last?

The next question is, how long will this transient reduction in demand last? If the supply chain were 100% efficient, it would clear the excess inventory in one turn. But we know that supply chains are never 100% efficient. When I was making these calculations earlier in my career, because I didn't know the exact supply chain efficiency number, like any typical engineer, I chose 50% as my working hypothesis. Fill rates are a complex function of demand and inventory and weren't always valid in highly disturbed situations.

Let's make the numbers easy in our thought experiment. The 50% efficiency number means that a four inventory turn company would experience a transient fall in demand lasting for six months, in other words, two inventory turns. Although the end market has only fallen by 100 basis points, it feels like your company is selling into an artificially much worse market than it really is. The industrial company I mentioned earlier felt like the end-market – and sales – had temporarily fallen by 284 basis points, not 100 basis points. But correspondingly, when there's an increase in demand, it feels like your company is selling into an artificially much better market than it is. That overshoot in demand is only a temporary illusion, and we'll deal with that case shortly.

Order demand falls until supply and demand come into equilibrium. Meanwhile, the transient reduction in orders has removed the excess inventory from the supply chain and, in my example, demand returns to a new quiescent value, albeit now 100 basis points smaller.

So, in this simple case of falling demand, the sales challenge of this hypothetical make-to-stock company is made worse by ordering undershoot. This has important financial impacts because it artificially reduces a company's reported growth. In public companies, we report to the market periodically and, if a temporary undershoot in demand – one not reflective of the real end-market conditions – lasts six months, it can seriously affect the projected growth rate in the full-year results, depending on which quarter of the fiscal year the disturbance happens.

## What happens when there is an increase in demand?

Now let's consider the opposite case, one where there is a sudden increase in demand, which we've seen recently, particularly in electronics. The simple answer to why this is happening is an imbalance in supply and demand. But I will show now that the problem is again mostly artificial and temporary, and so are the associated inflationary tendencies as people over-order to fill an illusionary high demand.

## The case of increased demand

When there is a sudden increase in demand, manufacturing capacity is limited, so the supply chain cannot fully respond unless there is excess idle capacity. Normally, manufacturers load factories to somewhere between 85% and 90% capacity for fixed cost absorption reasons. So now the efficiency of our supply chain is, de facto, only about 10%. So even if we can increase capacity temporarily, say from 85% to 95% or even 100%, unless we add new capacity, the time for supply and demand to return to equilibrium is extended. Some companies may have extra shifts available, but then they might not have trained workers to staff them, and with labour shortages driven by this excess demand, automation is often the answer, but that is a long-term solution.

In my earlier case of demand reduction, I used 50% as the efficiency number for the supply chain. But now, because of manufacturing capacity limits, that efficiency is effectively only 10%, so the recovery time for equilibrium to be reached is nominally five times as long as it did with 50%. So, a company that once experienced a six-month recovery on falling demand could now experience a 2.5 year transient before complete recovery. This is an extreme case; naturally, companies take every possible corrective action to reduce this timing. But this problem partly explains why we see extended recoveries and shortages in our supply chains.

In practice, the supply chain may take 18 months to recover as we engage in countermeasures. Meantime, a massive amount of new fixed capacity is being added to the supply chain, especially in the semiconductor area, which will also help gradually reduce these disturbance times and inflation along with it.

## Companies must control the temptation to over-order

In this increased demand case, our supply chain manager's temptation is to over-order out of fear of experiencing component shortages. After all, you can't ship a car with even one missing door handle. That new demand temporarily increases a company's growth, but it can have serious financial consequences, particularly on our inventory's pricing. We can end up with long-dated orders at much higher-than-normal pricing. This is a problem queuing for an unhappy ending.

There is typically one overshoot, and one undershoot in any dynamic system like the one I describe here. For the mathematically inclined, when simplified, the dominant mode makes the dynamic response look like a second-order system. The precise effect of these temporary increases in demand depends very much on the company's distribution method.

The inevitable outcome is that companies can end up with too much inventory, possibly at higher prices, producing variances against standard manufacturing costs. In an extreme case, companies may face expensive excess and obsolete (E&O) inventory write-offs when the inevitable demand falls later in the transient cycle, with its own overreaction tendancies.

## The effects of container shortages

This artificial and synchronised surge in demand has resulted in a shortage of shipping containers on some routes worldwide. Instead of the historical $2,000 for a container transit from China to Europe or the United States, container costs peaked at $23,000 in 2021. Today it's around $13,000. China's zero-COVID policy caused holdups and delays in the major East Coast China ports and factories, with similar inefficiencies in other ports in the US and Europe. So, in part, container pricing is a proxy for supply chain shortages and inflation, making the artificial demand problem even worse.

## Synchronised demand

Clearly, the world economy has not suddenly grown by 15% or 20%, so why have companies experienced this sudden increase in demand, particularly for electronics? The cause lies squarely in the synchronised economic 'start up' after the COVID-19 pandemic, plus the transient artificial demand described earlier. Although we have been using videoconferencing tools for many years, COVID-19 forced unpractised staff into the user population and accelerated acceptance of this as a way of working – and a substitute for some face-to-face meetings at the office. That, in part, drove part of the high demand for electronics. Likely, we will not fully return to pre-COVID-19 ways of working ever again.

But there is an additional factor at work here; synchronisation. Although the world's major connected economies have similar periodicity in their economic cycles, they are not normally all in phase. In the same way that demand fell precipitously in late 2008, it did so because of the synchronised collapse in all debt markets. Similarly, here we have a synchronised increase in demand in most markets, made worse by an illusory demand curve. However, global economies will gradually settle into historical phasing patterns, easing some of this synchronisation problem.

So, the '08-'09 downturn occurred because of a debt crisis happening simultaneously across the world, which produced a synchronised economic downturn. Here, we had a similar but opposite problem: a synchronised upturn and, to make it worse, synchronised artificial excess demand.

## Inflation

Some economists argue that inflation has been caused by excessive stimulus packages that crashed headlong into supply chain shortages. However, they are two sides of the same coin. But the real problem is much more complex, and the solutions are possibly simpler. Inflation has been made worse by artificial synchronised demand that created shortages, combined with high-cost slow-moving containers and the war in Ukraine, which has driven up food and energy prices. Additionally, zero-COVID-19 policies in China have plugged up or slowed supply chains and attendant labour shortages were caused by all the above. I have described here why we are experiencing some parts of these supply chain difficulties and why they have lasted so long.

It's important to remember the maxim that the solution to high prices is high prices. Similarly, the solution to low prices is low prices. Companies redesign their products, re-source suppliers and use lower-cost substitutes for expensive materials, which is part of the companies' mechanism to control inflation. The size of the US economy is approximately $21 trillion, and the US uses approximately 6.9 billion barrels of oil a year. So each $10 increase in the price of a barrel of oil reduces spending power in the US economy by about 30 basis points. A $60 increase in the price of a barrel of oil, which we saw at its peak, if maintained, reduces spending power in the US economy by 180 basis points. Similarly, increasing interest rates simultaneously increases inflation and later reduces it by cooling demand.

Those companies suffering the greatest near-term challenge are those in process industries that use a lot of energy. Smiths does not have high energy-intensive manufacturing processes.

## So how does all of this end?

The Chinese Communist Party Congress will take place in October. It may be when China declares victory over COVID and eliminates its zero-COVID policy. That will gradually free up plugged ports, ease supply chain shortages, reduce container costs, and ease some pressure on component supply from China. Supply chain transients will end naturally with time, though not without some pain, and artificial demand will reduce. A reduction in economic stimulus will also help, though I have reservations that a rapid increase in interest rates may work against policymakers and create recessions in some economies across the Western world. Together, these factors will reduce labour shortages and ease the pressure on pricing and inflation.

Lastly, problems that Western economies have suffered over the past two years will almost certainly create a swathe of manufacturing repatriation initiatives. That is likely to reduce economic growth in China and other parts of the Asian economy. But it will also create new jobs and investments in Western economies and drive efficiency initiatives and automation investments. My grandmother would have said, "it's an ill wind that blows nobody any good".

I hope this letter has helped readers, in some small way, to understand the complexities and effects of this very unusual time.

**Sir George W. Buckley**
CHAIRMAN