Note on supply chain pressures in South Africa

By A Wolhuter[1]

1 The views expressed in this note are those of the author and do not necessarily reflect those of the South African Reserve Bank (SARB).

Introduction

Global supply chains were severely disrupted by the coronavirus disease 2019 (COVID-19) pandemic which led to national lockdowns and port closures in many countries, thus restricting the transportation of tradeable goods. Then, as lockdown restrictions were eased from about mid-2020, global demand recovered much faster than anticipated, along with a rapid depletion of inventories, with shortages occurring due to long delays at ports, the displacement of freight containers and, in some instances, shortages of labour such as truck drivers (UNCTAD, 2021). South Africa, as a small open economy, similarly experienced supply chain disruptions and shortages of some imported goods.

Globally, these supply chain disruptions lasted longer than anticipated and largely held back the recovery in economic activity. In addition, the disruptions contributed to an acceleration in inflation due to, among other things, the ongoing mismatch between demand and supply, sharp increases in shipping costs and commodity prices as well as tighter labour market conditions. In the United States (US), inflation accelerated to a multi-decade high of 7.9% in February 2022. In South Africa, producer price inflation for intermediate manufactured goods accelerated to 23.1% in November and December 2021, reflective of raw material shortages, before moderating only marginally to 21.0% in January 2022. Headline consumer price inflation quickened to 5.9% in December 2021, mostly due to the impact of higher international crude oil prices on domestic fuel prices and transport costs, before slowing somewhat to 5.7% in January and February 2022.

This note looks at measuring supply chain pressures in South Africa and then combines individual indicators into a single composite indicator which informs the analysis of whether these pressures are intensifying or easing. The most recent reading indicates sustained elevated domestic supply chain pressures, which intensified further in January and February 2022 as global supply chain bottlenecks persist.

Measuring supply chain pressures in South Africa

Measuring supply chain pressures is complex as suppliers across the world follow diverse sourcing and procurement methods which result in different transportation and logistical challenges. Measures of supply chain pressures can be disaggregated into five dimensions, namely time, volume, prices, inventories and employment (Quinan, House and Seery, 2021). Employment is not regarded as a relevant indicator in the domestic context, given South Africa's high level of unemployment and abundant oversupply of semi- and unskilled labour. Table 1 shows the 10 indicators (8 domestic and 2 global) selected to monitor supply chain pressures in South Africa, categorised according to the four dimensions stated above.

Domestic supply chains were severely disrupted during the initial strict COVID-19-induced national lockdown from 23 March 2020 to 1 May 2020. The worldwide lockdowns led to the shutdown of non-essential service delivery and production, while the production of essential goods and services was restricted due to limited cargo-handling and port-operating capacity (Weber, 2021). This led to a sharp contraction in global economic activity and a lack of availability of tradeable goods, which further disrupted supply chains.

Table 1 Measures of supply chain pressures

Dimension	Indicator	Description
Time	Delivery periods of orders received in manufacturing	Measures the net majority of respondents who state that the delivery times of manufacturing orders received increased or decreased.
Volume	Volumes at ports and docks	Port and terminal throughput, measured as the weight of cargo transported in containers and dry bulk, liquid bulk and breakbulk cargo.
	20-foot container units	Measures the number of 20-foot containers landed and shipped.
Prices	Absa PMI price index	Measures purchasing price increases in the manufacturing sector.
	PPI for intermediate manufactured goods: percentage change over 12 months	Measures price inflation for products used as inputs into domestic manufacturing production.
	Baltic Dry Index	Measures the average price paid to ship raw materials/ commodities among different global trade routes in various dry-bulk cargo ships. Demand for commodities and the availability of bulker ships are some of the factors impacting the index.
	Shanghai containerised freight index	Based on 20-foot container rates, the index measures sea freight rates for import from China, weighted among 12 main trade routes.
Inventories	Ratio of inventories to sales in manufacturing and trade	Measures available inventory levels in the manufacturing and trade sectors relative to sales volumes in these sectors.
	Stock of finished manufactured goods relative to demand	An opinion survey on available stock levels of finished manufactured goods relative to the demand for manufactured goods.
	Shortage of raw materials as a constraint on manufacturing activity	An opinion survey where respondents rate the shortage of raw materials as a constraint to current manufacturing activities, among other constraints.

Sources: BER, Bloomberg, Stats SA, Transnet and SARB

In South Africa, these disruptions persisted in the closing months of 2021 and were evident in both the global purchase order lead times and the availability of raw material indicators. Purchase order lead times, as measured by the delivery periods of orders received in the Bureau for Economic Research's (BER) *Absa Manufacturing Survey*, have lengthened considerably since the second quarter of 2020 and reached a multi-decade high in the first quarter of 2022. Almost 7 out of 10 manufacturers rated the shortage of raw materials as a constraint to production in the fourth quarter of 2021, as the raw materials availability indicator of the BER increased to its highest level since 1974 before decreasing slightly in the first quarter of 2022. The resurgence of COVID-19 infections with the emergence of the Omicron variant towards the end of 2021 and the cyberattack at Transnet's port terminals during the third quarter of the year may have exacerbated this constraint.

Figure 1 Measures of supply chain pressures

Figure 1.1 Delivery periods of orders received in manufacturing

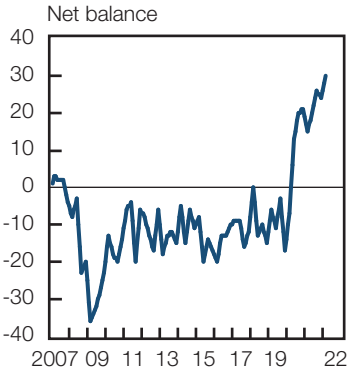


Figure 1.2 Transnet volumes handled at ports and docks

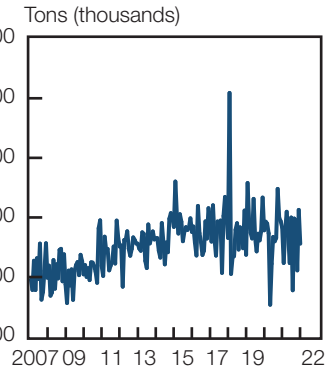


Figure 1.3 Transnet 20-foot container units

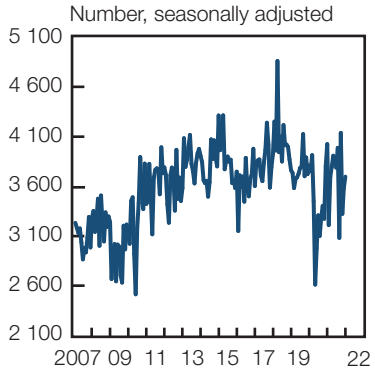


Figure 1.4 Absa PMI price index

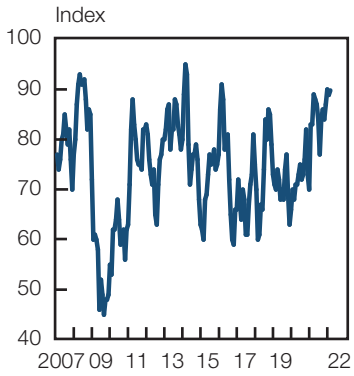


Figure 1.5 PPI for intermediate manufacturing goods

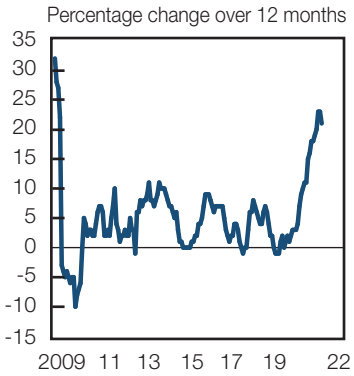


Figure 1.6 Baltic Dry Index

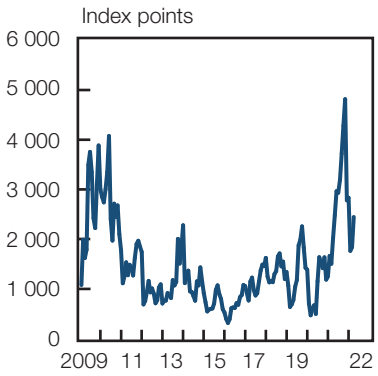


Figure 1.7 Shanghai containerised freight index

Figure 1.8 Ratio of inventories to sales in manufacturing and trade

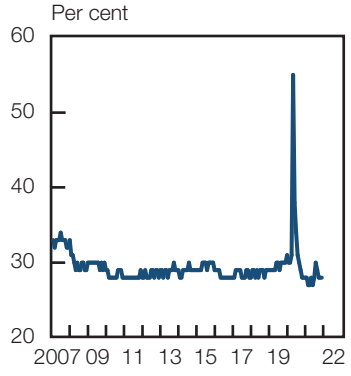


Figure 1.9 Manufacturing stocks of finished goods relative to demand

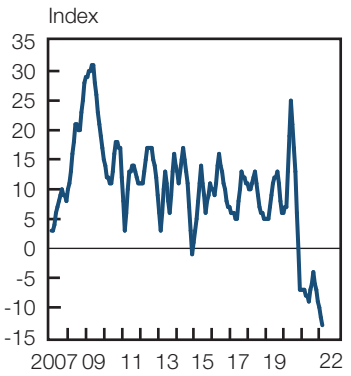
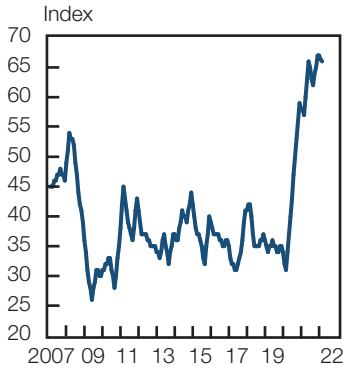


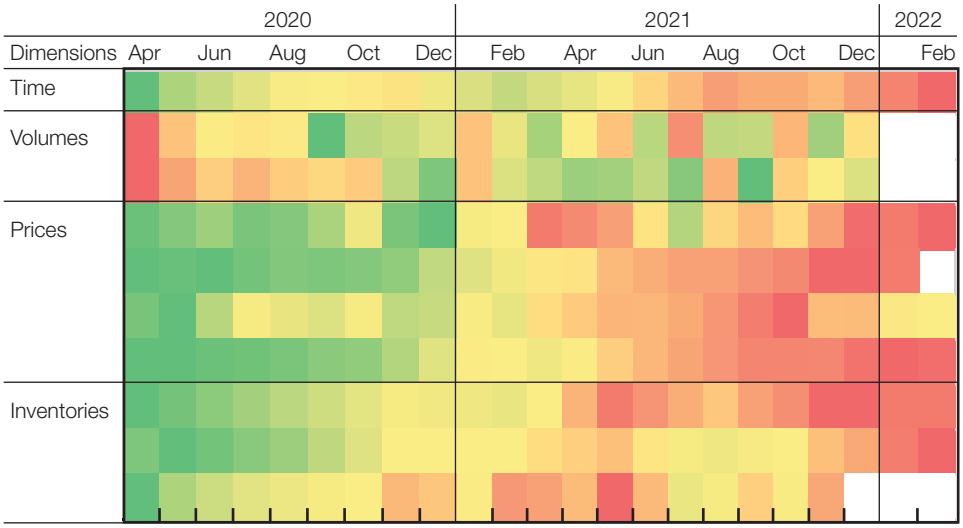
Figure 1.10 Shortage of raw materials as a manufacturing constraint



Sources: BER, Bloomberg, Stats SA, Transnet National Ports Authority and SARB

A heatmap of domestic supply chain pressures constructed from the month-to-month changes in the 10 selected indicators, as proposed by Quinan, House and Seery (2021), and depicted in Figure 2, shows an intensification from the end of 2020, which then became broad-based in 2021. This suggests that supply chains remain under pressure and that bottlenecks have yet to ease as longer delivery times, stock shortages and price pressures persist. In November 2021, supply chain pressures eased slightly as the volume dimension improved, but in the first two months of 2022 most of the available component indicators deteriorated again.

Figure 2 South African supply chain pressure heatmap

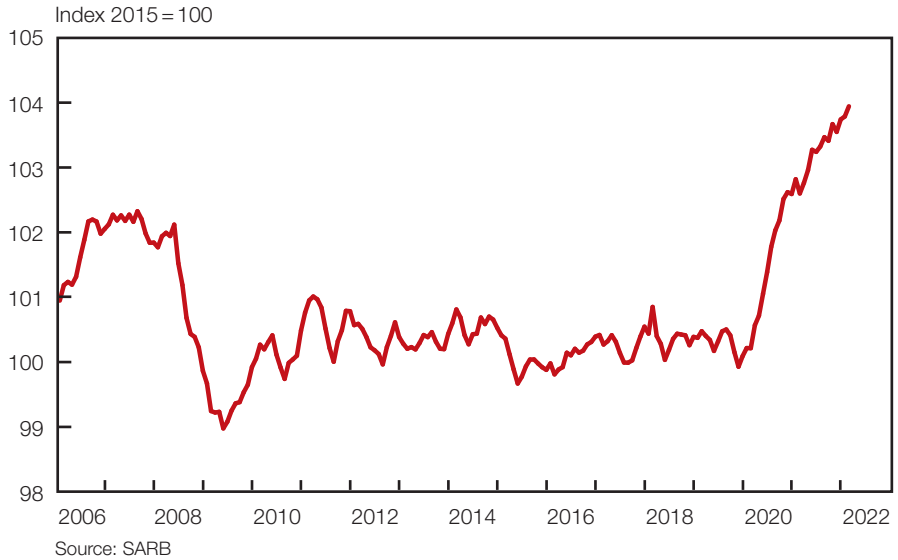


Source: SARB

Compiling a single composite indicator

A composite supply chain pressure index (CSCPI), as shown in Figure 3, was compiled from January 2006 from these 10 component indicators (see the appendix for the methodology). A composite index facilitates the measurement of multidimensional components by combining individual indicators into a single measure. This index can then be tracked as a gauge to monitor whether pressures are intensifying (an increasing index level) or easing (a decreasing index level).

Figure 3 Composite supply chain pressure index



Source: SARB

Analysis

South Africa's CSCPI increased sharply from June 2020 onwards after moving broadly sideways within a fairly narrow range for more than 10 years. The increase in CSCPI followed the initial COVID-19-related hard lockdown and reflected falling inventory levels and supply shortages as demand rebounded. The second wave of COVID-19 infections at the end of 2020 and in early 2021 likely intensified supply shortages. From mid-2021, supply chains were further impacted by the surge of the Delta variant and idiosyncratic domestic factors such as the civil unrest and Transnet port disruptions in July. All the while, global supply chain pressures persisted as international shipping costs increased along with an intensification of raw material shortages. The CSCPI increased to its highest level in February 2022 as supply chain pressures intensified further with the spread of the Omicron variant, the implementation of a 'zero COVID-19' policy in China, and the Chinese Lunar New Year impacting on absenteeism among employees along with the further depletion of already low inventory levels. The conflict between Russia and Ukraine could prolong global and domestic supply chain constraints further.

As demand for consumer goods remains strong, these inventory and container shortages will likely further elevate freight costs. The accumulation of empty containers at some ports has also delayed the repositioning of containers to major ports. Despite monetary incentives to increase the speed of container pickups, the slow container turnaround times at certain ports in the US, the United Kingdom (UK) and even in South Africa have compounded supply chain disruptions.

Although the CSCPI was also at an elevated level in 2007 and 2008, just before the global financial crisis (GFC), the current supply chain pressures differ from those at the time of the typical boom/bust business cycle during the GFC. Prior to the GFC, the global economy had experienced a very strong and synchronised business cycle expansion, as evidenced by the marked increase in international commodity prices and the rapid rise in world trade volumes, among other factors. This caused a gradual depletion of inventories and pushed up shipping costs as well as the prices of most other goods and services around the world as demand exceeded supply. At the time, many new shipping vessels were built to increase capacity (Mefford, 2009). However, the ensuing GFC and economic recession caused a sudden drop in demand and the pressure on global supply chains eased abruptly. The excess capacity led to a decrease in shipping costs and vessels were temporarily laid off or removed from service. The decrease in the demand for goods also resulted in a slower drawdown of inventories, a marked decrease in commodity prices and shorter lead times to fill orders.

The impact on the global supply chains during the GFC and the COVID-19 lockdowns respectively differs in origin, severity and duration of the demand and supply shocks. The COVID-19 lockdowns – which halted production and led to supply shortages, backlogs at ports and the displacement of shipping containers – were followed by a significant rebound in economic activity and demand. Unlike the GFC, the COVID-19 pandemic is a completely exogenous and unprecedented shock that suddenly and severely impacted on both the supply and the demand of goods and services without warning, and which solicited considerable monetary and fiscal stimulus (Attinasi et al., 2021). The sudden sharp recovery in demand following the relaxation of the restrictions, particularly for goods, saw trade volumes and prices surge abruptly while supply could not keep up, causing supply chain pressures and bottlenecks.

Conclusion

The COVID-19 pandemic has had an unprecedented impact on global supply chains, which has lasted longer than initially anticipated. This note attempts to quantify supply chain pressures by aggregating various measures into a single composite index of domestic supply chain pressures.

Apart from disrupting production processes and causing product shortages, the ongoing supply chain bottlenecks have pushed up global inflation. The CSCPI is useful to monitor whether supply chain pressures are intensifying or easing, which could assist in evaluating the transitory or more permanent nature of rising inflationary pressures emanating from this source. The most recent reading of the CSCPI indicates that domestic supply chain pressures remain elevated and have intensified further in the opening months of 2022.

Appendix: composite index methodology

1. Calculate the symmetrical percentage change (SPC), or difference (DIF), from month to month for each component indicator:

   $SPC = 200(X_t - X_t\text{-}1) / (X_t + X_{t-1})$

   or

   $DIF = (X_t - X_{t-1})$ *(used for negative or zero values, percentages, ratios)*

2. Calculate the standardised symmetrical percentage change (SSPC), or difference, for each component indicator:

   $SSPC = (SPC*W) / (STDEV)$

   where

   W = the weight assigned to the indicator

   STDEV = the standard deviation of the symmetrical percentage changes, or differences, over the full calculation period

3. Calculate the total percentage change (TPC) for each month of the calculation period:

   $TPC = \sum SSPCi\ (i=1…n)$

   where

   n = the number of component indicators available

4. Calculate the average percentage change (APC) for each month of the calculation period:

   APC = TPC / n

   where

   n = the number of component indicators available

5. Construct the composite index by assigning a base value of 100 to the first month and then apply the SPC formula and the APCs to calculate the subsequent months' index values.

6. Rebase the composite index to the desired base period (2015 = 100 in this case).

References

Attinasi, M G, Balatti, M, Mancini, M and Metelli, L. 2021. 'Box 1: Supply chain disruptions and the effects on the global economy'. *European Central Bank Economic Bulletin* Issue 8/2021.

Mefford, R N. 2009. 'The financial crisis and global supply chains'. *Academy of International Business (AIB) Insights* 9(3): 8–11.

Notteboom, T, Pallis, T and Rodrigue, J P. January 2021. 'Disruptions and resilience in global container shipping and ports: the COVID-19 pandemic vs the 2008–2009 financial crisis'. *Maritime Economics and Logistics* 23: 179–210.

Quinan, T, House, S and Seery, S. July 2021. 'The chains that bind: introducing the Pressure Gauge'. *Wells Fargo Economics*. https://wellsfargo.bluematrix.com/links2/html/948f8fa9-1d53-4344-bfbc-7aa1062d9636#bm-img-1fd7ecbe-f320-4e90-b7f6-900b57821877 (accessed 13 September 2021).

United Nations. 2020. *Review of maritime transport 2020*. United Nations Conference on Trade and Development. New York: United Nations.

United Nations. 2021. *COVID-19 and maritime transport, impacts and responses 2021*. United Nations Conference on Trade and Development. New York: United Nations.

Weber, A N. September 2021. 'Responding to supply chain disruptions caused by the COVID-19 pandemic: a black swan event for omnichannel retailers'. *Journal of Transport and Supply Chain Management* 15(0), a628.

Wilding, R, Dorhmann, K and Wheatley, M. 2020. 'Post-coronavirus supply chain recovery: the journey towards the new normal'. *DHL report*. https://www.dhl.com/global-en/home/insights-and-innovation/thought-leadership/white-papers/post-coronavirus-supply-chain-recovery.html (accessed 5 October 2021).