

NEW GLOBAL SUPPLY CHAIN PRESSURES INDEX. AN ANALYSIS OF THE INFLATIONARY CHANGES BROUGHT ABOUT BY GLOBAL SUPPLY CHAINS

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Abstract: *This paper aims to demonstrate the causal relationship between the new Global Supply Chain Pressure Index (GSCPI) and the inflationary movements occurring at the global level. The primary focus of this research is to identify patterns and correlations that emerge between these two economic indicators, thereby attempting to mitigate the effects of inflation by analysing indices directly related to global merchandise traffic. Therefore, the terms and concepts used are clarified in the first section within a broader framework, to underscore their relevance within the scope of the paper, as well as to facilitate their further exploration for a more profound comprehension of subsequent scientific and specialized references. The second section provides a brief overview of scientific works on this topic, which have served as the scientific foundation and have prompted us to undertake our study to contribute to the body of scientific knowledge on this relatively underexplored subject, given that the GSCPI is a concept that emerged only in May of the year 2022. Furthermore, in the second section, we conducted a bibliometric analysis to discern trends concerning global supply chains and global inflation, as well as the correlation between them. The result is to provide a deeper understanding of the novel concepts and the prospective utilization of GSCPI.*

Keywords: chain of supply, inflation, management, pressure index

1. Introduction

The rapid growth in both production and, especially, transportation of these goods to consumers in recent decades has resulted in a pronounced increase and diversification of supply chains. The economic crisis of 2008, originating in the United States of America, and the Covid-19 pandemic have disrupted the entire global market for goods and services, such that the effects of these crises have been felt not only by states as financial entities but also by individual consumers. Factory closures, especially in China and the Asian region, mobility restrictions, local lockdowns, and

government-imposed restrictions have led to a long series of price increases in transportation costs, whether maritime, aerial, or terrestrial, as well as a significant increase in delivery times.

The crises of the last two decades have demonstrated how interconnected and complex the structures of supply chains are, with even the smallest deficiency potentially causing, akin to a Markov chain, deficiencies and shortages at the macro level. This has led to a more careful monitoring of processes, policies, and measures taken in both local and cross-border policies.

Observing all these deficiencies and shortcomings directly related to supply chains and their potential effects on the entire capital market, in the year 2022, Gianluca Benigno, Julian di Giovanni, Jan J. J. Groen, and Adam I. Noble, experts from the Federal Reserve Bank of New York, published a paper titled “The GSCPI: A New Barometer of Global Supply Chain Pressures”[1], which proposes an index called the Global Supply Chain Pressure Index. This index aggregates several indices directly related to global supply chains, some of which include the Baltic Dry Index (BDI), referring to the cost of transporting raw materials such as steel, coal, or grains; the Harpex Index, which tracks the price of shipping containers; the U.S Bureau of Labor Statistics (BLS) index, directly correlated with the cost of air transportation to and from the United States; or the Purchasing Managers Index (PMI), which determines the predominant direction of economic trends in manufacturing and service sectors.

Given the multitude of data that the GSCPI compiles within it, it reflects or translates into reality the inflation at the global level. Additionally, in response to supply chain pressures and inflation concerns, central banks can adjust monetary policy by increasing interest rates to reduce inflation. However, these monetary policy actions can also have implications for economic growth and labour force participation.

2. Literature Review. Bibliometric Analysis

Various academic articles discuss the evolution of frameworks and methodologies for evaluating supply chains and how they significantly influence global inflation, resulting in various qualitative and quantitative models, or by generating indices that measure, as I stated in the introduction of the article, the global supply chains pressure. The domain of global supply chains undergoes extensive academic examination and investigation, reflecting its pivotal role in fostering

macroeconomic prosperity. This chapter undertakes a bibliometric analysis of extant literature concerning global supply chains and their impact on inflation, aiming to delineate the academic terrain while identifying pivotal trends, advancements, and lacunae in this domain. Given the growing reliance of global markets on the resilience and adaptability of supply chain networks, comprehending the breadth and depth of scholarly inquiry in this realm becomes imperative.

Bibliometric analysis, characterized by its quantitative approach to literature review, offers a distinctive lens through which to comprehend this multifaceted domain. By scrutinizing data from numerous research papers, this chapter unveils discernible patterns and correlations, including influential authors, seminal works, and prevailing research themes that have shaped the comprehension of supply chains and their ramifications on inflation.

This bibliometric review not only serves as an essential tool for academics and researchers to navigate the vast literature, but also aids policymakers in grasping the contextual nuances and prospective trajectories of the global supply chain and its day-to-day economic ramifications.

Employing the search query: subject: (“supply”) AND (“chain”) AND (“inflation”) in the Scopus database resulted in a total of 456 scientific papers, including literature from 1985 to the present.

Bibliometric analysis applies statistical, visual, and mathematical methods to summarize research patterns and trends in scientific publications. Using metadata from the Scopus database and VOSviewer visualization software, 3 maps were created illustrating the structure of the knowledge domain. It was applied as a means of analysis and counting the co-occurrence method, a method frequently used in scientometric analyses for various purposes, such as co-authorship and co-citation. From the sample of examined articles, which includes 3052 keywords, 107 keywords with more than 5 co-occurrences were

selected, resulting in 3406 connections in 5 major clusters. These connections are represented on the map by circles, the size of which varies according to the frequency

of occurrence, and are connected by lines that highlight the strength of the connections between them.

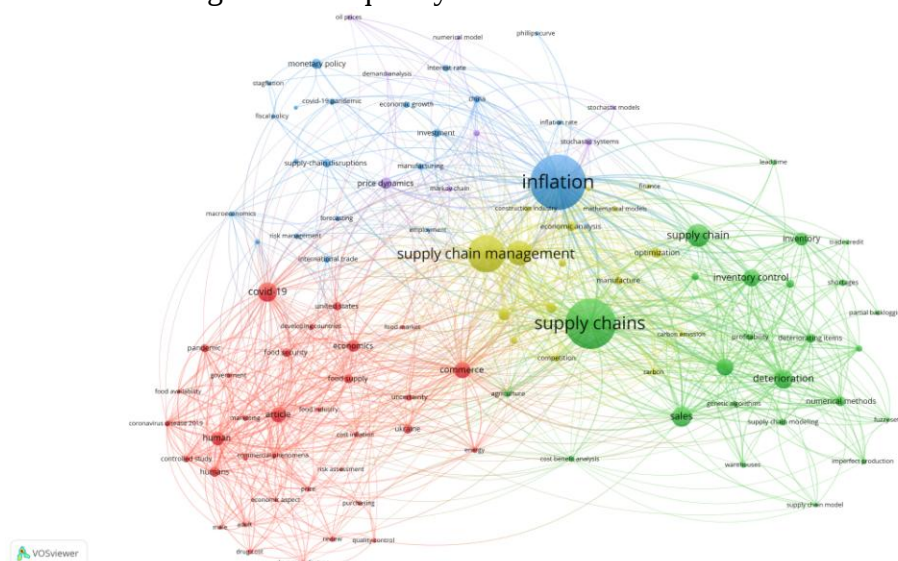


Figure 1: Map of keyword co-occurrence networks
Source: Author's

Figure 1 map created using VOSviewer illustrates the complex relationships between various keywords in the scientific literature related to supply chains and inflation. We note that the theme of „supply chains”, „inflation” and „supply chain management,, are central and interconnected with a variety of relevant topics, indicating their cross-cutting importance across multiple fields of study. Also, the term “Covid-19” stands out as a major cluster, highlighting the strong effect the pandemic has had on supply chains and also on inflation.

The colour of the circles determines the cluster to which they belong, with 5 major clusters in the present example, while the size of the circles indicates the size or frequency of co-occurrence. The lines connecting these nodes represent the relationships between terms, with a minimum criterion of at least 5 occurrences required for connections.

By analyzing the map, we can observe certain topics of interest revolving around key domains, areas, or interests related to “Inventory control,” “deterioration,” or “sales,” which are directly associated with

the “supply chain” cluster. Additionally, we also have a major cluster referring to the “Covid-19” pandemic [2], where terms such as “food security,” “commerce,” or “humans” appear, along with a significant node, with 32 co-occurrences, related to “Ukraine.” This node connects with other words and key domains such as “uncertainty,” “supply-chain disruptions,” and “inflation,” indicating a possible slight influence of the Russo-Ukrainian war within the global pressure on supply chains, particularly felt by the European Union with a focus on Ukraine’s neighbouring countries.

These nations experienced excessive exports of grains and raw materials from Ukraine to the European Union and the Near East following the onset of the war.

This visualization serves as a valuable tool for discerning prevailing trends and for directing future research and progress into the relationships that supply chains develop on inflation. It edifies focal points that warrant further exploration and highlights potential interdisciplinary collaborations leading to innovation. Moreover, it provides a lucid visual representation of the

interrelationships between various topics, providing researchers and practitioners with a basis for exploring fertile intersections across different fields of interest.

Simultaneously, by conducting an analysis of keyword co-occurrence, we have generated the following graph, as depicted in Table 1. Based on the frequency of keyword occurrences, we will now present the top 20 words with the highest occurrences within the examined dataset. Among the top-ranking terms in terms of frequency of occurrence, “Inflation” stands out with 119 occurrence and 403 links, followed closely by “supply chains” with 106 occurrences and 427 links. The

domains of “cost” and “sales” underscore their significance and delineate foundational characteristics pivotal to both supply chains and inflationary computations, representing fundamental aspects of the financial milieu [3]. Similarly, terms such as “Covid-19” [4], “sensitivity analysis” [5] and “sustainable development” [6] suggest a holistic perspective characterized by interconnectedness, envisaging a future marked by uncertainty yet also a proclivity towards sustainability and green economy initiatives [7].

No.	Key word	Co-occurrence	Number of links
1	Inflation	119	403
2	Supply chains	106	427
3	Supply chain management	73	254
4	Costs	44	210
5	Supply chain	40	108
6	Sales	33	193
7	Covid-19	32	147
8	Deterioration	31	186
9	Sensitivity analysis	28	200
10	Inventory control	28	148
11	Commerce	26	162
12	Article	24	172
13	Human	21	153
14	Inventory	20	87
15	Economics	18	123
16	Decision making	17	111
17	Price dynamics	17	71
18	Sustainable development	15	68
19	Humans	14	118
20	Numerical methods	14	114

Table 1. Frequency of keywords co-occurrence
Source: Author's

At the conclusion of this chapter dedicated to bibliometric study, it can be asserted that the in-depth analysis of specialized literature, conducted through bibliometric and scientometric methodologies, has provided a comprehensive perspective on the current contours and dynamic evolution

within the analyzed domain. Visualization tools, such as VOSviewer, have not only enabled the mapping of relationships among different concepts and key terms but also facilitated the observation of how these interconnections have evolved over time, reflecting paradigm shifts and the

progression of knowledge.

By identifying thematic clusters and assessing the co-occurrence of keywords, we have successfully detected both well-established domains and emerging niches, thereby opening new horizons for future research endeavours. This analysis has been particularly valuable in highlighting areas where academic discourse is most intense and in identifying areas that have been less explored thus far.

Bibliometric study significantly contributes to understanding the structure and trajectory of research in our area of interest, enriching the theoretical foundation and indicating future directions for investigation.

3. Global Supply Chain Pressure Index and Global Inflation Rate

GSCPI offers a novel instrument for monitoring and evaluating global supply chain dynamics. In this study, we undertake an examination of the index's efficacy in elucidating inflationary patterns, employing the macro level projection method for our analysis. Our findings indicate a strong correlation between recent inflationary trends and the movements observed in the GSCPI, particularly evident in the context of producer price inflation within the United States and the euro area. This empirical evidence underscores the potential utility of the GSCPI as a predictive tool for inflationary outcomes, thereby shedding light on the intricate interplay between supply chain dynamics and inflationary pressures in key global economies.

3.1 Methods

Data collection process:

The data utilized for this study consists of qualitative secondary data obtained through a review of specialized literature. The primary focus is to identify the relationships between the global supply chain pressure index and inflation, and whether we can somehow anticipate global inflation fluctuations through the GSCPI.

Data Analysis Techniques:

The qualitative data collected from the

review of specialized literature and the analysis of reference indices were subjected to both comparative and deductive analyses, resulting in the proposal of a model for relating GSCPI to the Global Inflation Rate (GIR).

Initially, based on the information gleaned from the literature, which was considered in the earlier stages of the study, we identified the most common components and subcomponents of the analysed domains. The identified links between the supply chain and inflation warrant special attention, as they lead to significant social changes and, consequently, a domino effect in all global financial markets.

The graph presented in Figure 2 is a collection of data processed by the authors, where the data were systematized and synthesized so that we can observe the similarities between the two indexes. The GIR was taken and processed according to the indices provided by the International Monetary Fund [8] and the Statista platform, and the GSCPI was taken from the Federal Reserve Bank of New York, an index subsequently processed by us [9].

3.1. Observations

Based on bibliographic analyses within the discipline, alongside empirical data, graphical representations, and pertinent indexes, notable correlations emerge concerning the influence exerted by the Global Supply Chain Pressure Index (GSCPI) on global inflation rates. Among these correlations, several effects stand out as particularly significant, given the discernible magnitude of their impact on a global scale:

Supply chain disruption and price escalation:

Elevated levels of pressure within the supply chain, as indicated by a high GSCPI, often stem from disruptions such as transportation delays, production shortages, or heightened costs. These disruptions can lead to higher production costs for goods and services, which are subsequently passed on to consumers in the form of price increases, thereby contributing to inflation [10].

Transportation costs:

Supply chain pressure, particularly concerning the escalation of transportation costs, can directly impact inflation. When transportation costs increase due to factors such as fuel price hikes or capacity constraints, businesses may transfer these costs onto consumers, resulting in higher prices for goods and services [11] [12].

Input costs:

Supply chain pressure can exert an

influence on the expenses associated with raw materials and intermediary goods utilized in manufacturing procedures. In the event of heightened supply chain disruptions or scarcities, businesses may encounter elevated costs for inputs. Consequently, to safeguard profit margins, firms might opt to augment prices, thus engendering inflationary tendencies within the economy.

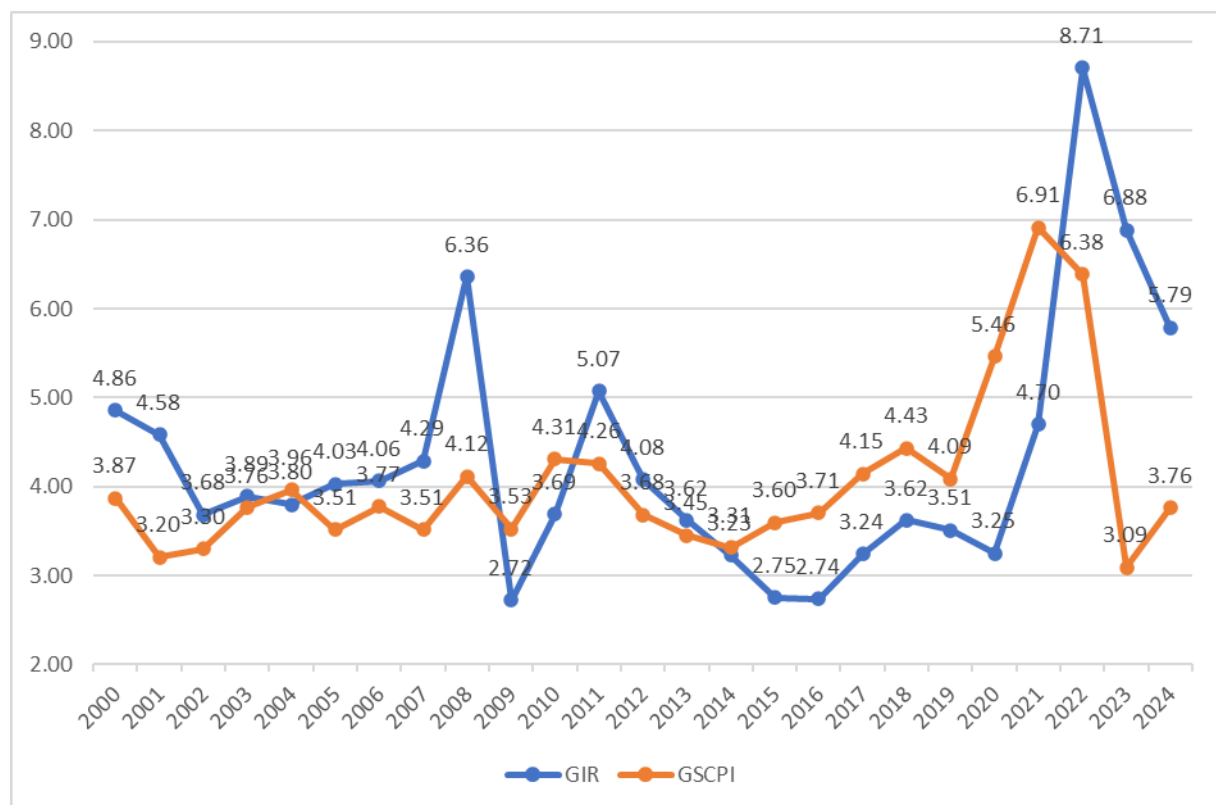


Figure 2: Annual fluctuations of the GSCPI and the Global Inflation Rate

Source: Author's

Global Economic Conditions:

Fluctuations in global economic conditions, such as changes in demand, currency fluctuations, or trade policies, can impact both supply chains and inflation rates. Disruptions in global supply chains can amplify inflationary pressures, especially if they affect essential goods and services.

Government Policy Responses:

Government policies aimed at addressing supply chain disruptions or stimulating economic activity can influence both the GSCPI and inflation. For example, monetary policies such as quantitative

easing may affect inflation rates, while trade policies can impact supply chain dynamics and prices [13].

4. Conclusions

It is pertinent to note from the outset that while the relationship between the Global Supply Chain Pressure Index (GSCPI) and the Global Inflation Rate (GIR) may not demonstrate absolute precision, it nonetheless underscores a significant interconnection between the dynamics of the global supply chain and inflationary tendencies.

Disruptions in supply chains, arising from various factors such as transport delays, production shortages or increased raw material costs, often trigger a chain reaction that leads to higher prices for goods and services. These disruptions can arise from a multitude of global economic conditions, including changes in demand patterns, fluctuations in currency values, changes in trade policies, or, more recently, conflicts involving powerful financial and consumerist state actors.

Disruption of global supply chains not only affects the availability and cost of goods, but also exacerbates inflationary pressures, especially when it affects essential commodities or industries. When supply chains are challenged, companies face the dilemma of either absorbing the increased costs or passing them on to consumers through higher prices. In many cases, companies opt for the latter to protect profit margins, thus contributing to inflationary trends.

In addition, governments response to supply chain disruptions and economic

challenges can further influence inflation rates. Government policies, such as monetary measures aimed at stimulating economic activity or trade policies aimed at easing disruptions, can have significant ramifications for both supply chains and inflation. For example, monetary policies such as quantitative easing can affect inflation rates by influencing the cost of borrowing and the money supply, while trade policies can directly affect supply chain dynamics and prices through tariffs or trade agreements.

Overall, while the correlation between the GSCPI and global inflation rates may have nuances and complexities, it underscores the intrinsic links between supply chain dynamics and inflationary pressures. Understanding and addressing these interconnections is essential for policymakers, businesses and economists in addressing economic challenges and formulating effective strategies for managing inflationary pressures in the global economy.

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