Analysing the COVID-19 disruptive impact on Montevideo's Supply Chains

Analizando el impacto disruptivo del COVID-19 en las cadenas de suministro de Montevideo

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Summary. - Globally, COVID-19 reached unprecedented levels of contagion, affecting the social meetings, public spaces, and many everyday aspects. During the first days of the pandemic, supply chains were severely impacted by a great uncertainty in socio-economic terms, causing irrational variations and the inability to forecast demand. In this paper, the effect of the COVID-19 pandemic on the behaviour of different companies is analysed based on the variation in supply and demand of consumer-packaged goods. The pandemic outbreak disruption, the bullwhip effect caused by demand fluctuations, and the resilience of different companies were studied. A multiple case study methodology is used to analyse the decision-making process of fourteen different companies, from diverse sectors in Uruguay, affronting the pandemic. The paper's main findings include the identification of disruption and operation risks along with coordination in supply chain management during the first four months of the pandemic. Moreover, due to the necessity of sanitation and comestibles, and the fear of stockout, consumers' demand was uncertain, and the bullwhip effect was observed in critical channels of some products. Finally, the resiliency and robustness of the affected companies were studied and good practices for a resilient and robust response to the pandemic were identified and analysed.

Keywords: COVID-19, Logistics Management, Supply chain resilience, Bullwhip effect.

Resumen. - *Mundialmente, el COVID-19 generó niveles de contagio sin precedentes, afectando reuniones sociales, espacios públicos, y muchos aspectos de la vida diaria. Durante los primeros días de pandemia, cadenas de suministros fueron afectadas debido a una gran incertidumbre de factores socioeconómicos, causando una alta volatilidad en la demanda resultándola impredecible. Este artículo analiza el efecto que tuvo la pandemia en el comportamiento de diferentes empresas considerando las variaciones en la oferta y demanda de bienes de consumo*

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envasados. Las perturbaciones generadas por la pandemia, el efecto látigo causado por fluctuaciones en la demanda, y la resiliencia de diferentes empresas son estudiadas. Se utilizan múltiples estudios de caso para analizar el proceso de toma de decisiones de catorce empresas uruguayas, de diversos sectores, enfrentándose a la pandemia. Entre las observaciones realizadas se destacan la identificación de riesgos operacionales y disrupciones, y una alta coordinación en la administración de cadenas de suministro durante los primeros meses de pandemia. Asimismo, necesidades sanitarias y alimenticias, y el miedo al agote de stock, causaron demandas inciertas, ocasionando un efecto látigo en ciertos canales de productos. Finalmente, la resiliencia y solidez de las empresas es estudiada, y se identifican y analizan buenas prácticas para afrontar la pandemia.

Palabras clave: *COVID-19, gestión logística, resiliencia de las cadenas de suministros, efecto látigo.*

1. Introduction. - The COVID-19 outbreak represents one of the major disruptions encountered during the last decades and has drastically impacted most aspects of human activities [1]. It has had a profound impact on supply chains [2], and its unexpected nature has generated new trends in public behaviour, which made decision-making processes challenging for supply chain managers. Moreover, the impact and the duration of the pandemic were completely unpredictable [3].

Disruptive events such as the Coronavirus pandemic can be classified using different criteria [4, 5]. In terms of the disruption's lead time, this crisis was rapid (little or moderate advance notifications, present warning signs), severe considering the impact of loss (causing a high level of economic loss and/or many deaths), and international.

Every disruption has a time component to its effects, which is key for understanding its synergy and predicting its consequences [4, 6]. Generally, in the very first stage, the preparation stage, organizations can predict the event and plan operations to reduce its impact. This is followed by the first response period, where the aim is to control the situation, focusing on protecting lives and preventing further damage. After this, companies start recovery preparations, notifying the rest of the supply chain's links and redirecting resources. Finally, when companies make up for lost production, the recovery phase takes place, but generally, a long-term effect will persist causing a possible improvement in performance or a negative impact as customer relationships and trust may be damaged.

Pandemics and epidemics are a particular kind of disruption, as they are characterized by the three following components of threat: (1) the presence of long-term and unexpected scaling disruption, (2) disruption propagation in the supply chain and epidemic outbreak propagation in the population, and (3) disruptions in the development of logistics, demand, and supply [7]. In contrast to most disruption threats and risks, epidemic outbreaks are minor at the outset and infrastructural impact, but they develop and spread over various geographic areas rapidly. The latest pertinent examples include the MERS virus, SARS virus, Swine flu, Ebola, and the most recent one, COVID-19.

In this research, the effect of the COVID-19 pandemic on the behaviour of different retail and logistics companies was analysed based on the variation in supply and demand specifically in consumer-packaged goods (CPGs). The occurrence of a supply and demand imbalance caused by a major disruption is assessed using a multiple case study methodology, aiming to also identify the potential materialization of the bullwhip effect in the companies that participated in this study. Different actors along the supply chain were interviewed at two different stages of the pandemic to analyse behaviour while the pandemic effects were shifting. In addition, this paper also aims to identify the different risk management decisions taken to affront the pandemic to determine managerial tendencies in terms of logistics and product distribution in such a scenario.

The opportunity to evaluate this phenomenon in the Uruguayan context is key to this analysis, as contagion curves and public policies differed quite notably compared to most countries in the region, mainly in the first months of the pandemic. The government appealed to the social responsibility of citizens, and the mandatory confinement measure was not taken. These decisions, added to aggressive testing (1610 tests per new case in June 2020) and rigorous identification and monitoring of sources of contagion, resulted in the correct management and response to the pandemic [8].

The article is structured as follows. Section 2 presents a literature review in the fields of disruptive events that impact supply chains, causes and consequences of the bullwhip effect, and resiliency

in supply chains. Section 3 outlines the research methodology used for this study. The results and discussion are presented in Section 4, followed by the main research conclusions in Section 5.

2. Literature review. -

2.1. Supply chain visibility and bullwhip effect. - Disruptions will, in all likelihood, cause some sort of effect either in consumer behaviour or in the ability of different parts of the supply chain to provide goods or both. A common issue with supply chains is the poor visibility upstream and downstream from a particular link in the chain [9]. Distorted information between ends of supply chains causes inefficiencies such as excessive inventory investment, poor customer service, lost revenues, misguided capacity plans, ineffective transportation, and a loss of effectiveness to comply with predefined production schedules [10].

This phenomenon is widely known as the bullwhip effect. The term was coined by Lee [10], although prior publications already established consequences of lack of visibility and poor demand forecasting. Forrester indicated that it is empirically recurrent that the variance of perceived demand to the manufacturer far exceeds the variance of consumer demand, and the effects of not being able to accurately forecast needs from intermediate players in the supply chain, as they relate to actual customer demand, are observed to be larger for manufacturers than for retailers [11]. In other words, the lack of visibility between participants in a supply chain causes minor shifts in consumer demand to result in large variations in the size of the orders that reach the manufacturers upstream in the supply chain [10, 12].

The bullwhip effect can be caused by several factors. One is demand forecast updating. Forecasting is a decision-making process that is frequently used in every link of the supply chain to predict what the demand for products will be. The combination of inconsistent demand signals, due to different disruptions such as price fluctuation or natural disasters, and forecast-driven organizations that make isolated decisions along the supply chain, causes the real demand to be amplified increasingly as it moves upwards [9].

The demand forecast updating falls into another reason why the bullwhip effect occurs: the lack of communication. Misinformation both inside or outside an organization is reflected in large time lags between reception and transmission of information and deliberates into excessive inventory [11, 13]. Ultimately, the effect consists of a real fluctuation in demand which triggers a forecast-driven response in the last link of the supply chain followed by a forecast-driven response of the second link based on the former forecast and so on. The effect will be aggravated by anything that decreases forecast precision, such as long lead times, or lack of communication with the extreme case being decision-makers relying only on adjacent links' information.

Moreover, order batching is an additional factor that magnifies the bullwhip effect. There are two ways of order batching: periodic ordering, in which an order is placed after a specific period (weekly, monthly, etc), or push ordering, in which the products are ordered prematurely expecting to modify or affect the customers' behaviour [10]. The batching of orders induces demand variance up the supply chain that is not present at lower levels of the chain. Furthermore, order batching can delay orders and thus hinder information flow throughout the supply chain making them less responsive [11].

Rationing and shortage gaming is a managerial resource when demand exceeds supply. If there are not enough products to satisfy customers' requirements, fractioning the number of products available is an existing alternative. In this case, the customers' orders will be excessive in reaction to this shortage and may not reflect the product's real demand to the manufacturer, leading to the bullwhip effect [10].

A system must be well prepared to cope with these imbalances to ensure continued operation and to survive in a world in which supply chains extend throughout the globe [14].

2.2 Supply chain risk management. - To mitigate the disruptions´ effects, or avoid them altogether, supply chain risk management (SCRM) comes into play. SCRM can be defined as ''the management of supply chain risks through coordination or collaboration among the supply chain partners to ensure profitability and continuity'' [15]. For industries that are moving towards longer and more interconnected supply chains (e.g., outsourcing) and facing an increasingly uncertain demand and supply, risk management is vital. As supply chains go leaner and more integrated, it is more probable that accidents in one link of the chain affect the others [16].

The SCRM consists of four key stages: risk identification, assessment, treatment, and monitoring. These four stages are developed by the internal implementation of tools, techniques, and strategies. It also consists of external coordination and collaboration with supply chain members to reduce vulnerability and ensure continuity coupled with profitability, leading to a competitive advantage in adverse situations [17].

2.3 Resilience in supply chains. - Disruptive events and the materialization of the bullwhip effect can directly affect the ordinary activity of companies. External shocks to supply chains that are not optimized to mitigate these situations can cause disruptions that are several orders of magnitude larger than the disruption itself. The resilience of a supply chain can be considered as "its ability to reduce the probabilities of facing a disruption, the consequences of those disruptions once they occur, and the time to recover normal performance" [18]. An additional concept that refers to the adaptability of a supply chain is robustness. Robustness is the ability to continue with operations and to maintain the level of service while sailing through internal or external disruptions [19].

Once a disruption has occurred, the primary source of uncertainty for managers is the demand for products. Hence, the ability to respond to the variability of the demand in disruptive events is tightly associated with resilience [6]. Three kinds of capabilities can lead organizations to be resilient: (1) flexibility, which refers to a quick ability to evaluate and take needs into account responding to end consumers; (2) integration capabilities, which refer to the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra and inter-organizational processes and (3) external capabilities that relate to the collaboration through systems such as Vendor Managed Inventory (VMI) and Collaborative, Planning, Forecasting, and Replenishment (CPFR) with retailers to enhance close cooperation among autonomous organizations engaged in joint efforts to effectively meet end-customer needs [20].

When talking about resilience and robustness of supply chains, it is assumed that the ability to manage risk and to take accurate decisions leads to a better positioning vis a vis competitor to deal with disruptions and, also, to try to take advantage of the adverse situation, to act as a potential source of competitive advantage [21]. In particular, having a vast range of suppliers and preventing or avoiding risks were identified as vital factors to ensure resilience [22].

The planning decisions taken under the demand uncertainty of a supply chain caused by a specific disruption are fundamentally taken to maximize its economic performance. Planning decisions are related to the determination of production rates, inventory levels, forward and reverse flow amounts, and transportation links. These decisions involve actors such as consumers, supermarkets, stores, offices, distribution centres, and factories. In that way, both resilient freight transportation and an effective communication system are critical to standing against disruptions [23, 24, 25].

Moreover, when facing a pandemic situation, the daily monitoring of global suppliers plays an important role due to the perceived fluctuations and the demand uncertainty. New technologies, such as artificial intelligence and natural-language processing, permit extensive supplier monitoring [26].

2.4 Research gap. - With the world facing the COVID-19 pandemic, an opportunity is presented to analyse the effects of disruption with a scale and reach that has not occurred in the era of globalized global spanning supply chains. This setting is putting enormous pressure on supply chain managers to cope with demand and supply for their companies to be able to survive the disruption in the best way possible. The deep implications of the decisions being made by governments and the uncertainty of the duration of the disruption call for analysis of the effects that supply chains are suffering and what they are doing and planning to do in the future.

Even though there have been worldwide pandemic disruptions in recent decades, none of them has had such a high score both in transmutability and clinical severity as the COVID-19 pandemic when measured with the Pandemic Severity Assessment Framework. For a similar event in severity, we need to reach as far back as 1918 for the Spanish flu pandemic [27]. The world has changed immensely since then, and thus research regarding the situation is valuable.

Moreover, studying the phenomenon in Uruguay is a unique opportunity to study the influence of demand's behaviour and economic shock impact on the reactions of supply chains and their resiliency in a developing country. Valuable information could be obtained to identify strengths and weaknesses displayed by the supply chains as well as to evaluate different measures and decisions made during the first months of the COVID-19 disruption.

3 Methodology. - A multiple case study was undertaken to analyse the impact caused by the COVID-19 on Montevideo´s supply chains during the first four months of the pandemic. To understand the decisions that relevant retail and logistics´ actors had taken, and to understand the reasons for their attitudes and opinions, it was necessary to carry out a qualitative analysis [28]. As the event of the global pandemic had no previous precedent and the entire world was affected, new problems and conflictive situations appeared daily. To face this phenomenon, managers had to constantly make decisions to respond to the fluctuating demand of the market and the unexpected changing in policies and lockdowns. In this case, it was considered relevant to cover contextual conditions by the establishment of personal contact as it was considered strongly pertinent to the phenomenon of study [28, 29].

There are three different methodological approaches to case research: theory generation, theory testing, and theory elaboration [30]. This study was conducted through theory testing. It was expected, for example, that the supply and demand of some specific products responded to the bullwhip effect and, therefore, the different actors within the supply chain would react in consequence. In theory-testing case research, the general theory is contextualized before subjecting it to the empirical test. Moreover, the case study propositions come situationally grounded already in the theory phase of research [30].

For case studies, theory development as part of the design phase is essential, whether the ensuing case study's purpose is to develop or test theory [29]. The case study of the COVID-19 situation is classified as embedded (multiple units of analysis) and multiple-case design because multiple periods (different contexts) and several cases within each period (different companies) were considered to observe several measures and reactions to the affronted crisis.

Regarding the construction of the interviews, the scope of the interviews was defined first, and the theory was developed to gather valid and reliable data relevant to the research [28]. The research aimed to study the effect of COVID-19 on the behaviour of different production, distribution, and

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wholesale companies in Uruguay. In this line, the objective of undertaking interviews was to observe and understand the reactions and decisions taken by the operation and logistic managers due to the pandemic situation.

In this way, it was decided to complete two rounds of interviews to study the supply chain reactions to the pandemic at different stages of the global disease in the country. The first round of interviews was executed in March 2020, within the first four weeks of the arrival of the pandemic in Uruguay, to observe and study the first supply chain reactions. The second round was performed during the third and fourth months after the first COVID-19 case in Uruguay was diagnosed. This round of interviews allowed us to analyse the situation in a clearer and more stable context regarding the pandemic.

The theory to prove considered three points to analyse. In the first place, the influence of the pandemic outbreaks leading to important disruptions in terms of the presence of long-term and unexpected scaling disruption, propagation of the virus in the population, and disruptions in the development of logistics, demand and supply was studied. Secondly, these affectations were deepened to observe the variations in the consumer's behaviour due to the pandemic and how those variations lead to diminishing the businesses' visibility disemboguing in a bullwhip effect situation. Thirdly, the capacity of businesses to be resilient and the importance of coordination among the supply chain to succeed were tested.

Furthermore, both interviews were designed to test the theory. There are different kinds of qualitative research strategies and they can be classified by the type of questions being asked. Generally, what questions may either be exploratory or about prevalence, in which surveys or the analysis of archival records would be favoured. Moreover, how and why questions are likely to favour the use of case studies, experiments, or histories [29]. In the case of the impact caused by COVID-19, it is relevant to observe businesses' reactions and behaviour. In this way, it is relevant to ask what, how, and why questions. The framework and the questions asked in the interviews are presented in Figure I.
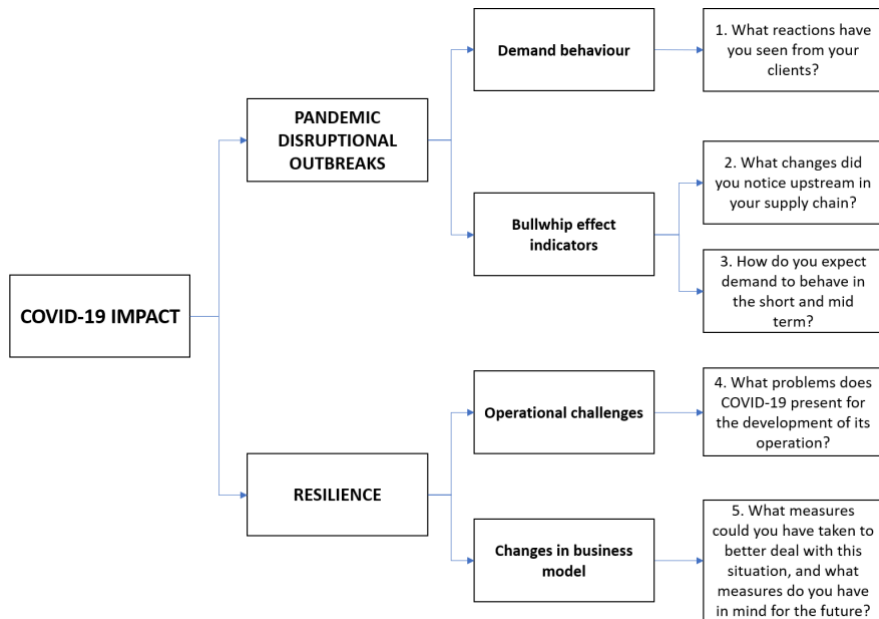

Figure I - 1st round Interview framework

In terms of the execution, the first round of interviews was completed in the first four weeks of the COVID-19 pandemic. Fourteen managers of fourteen different organizations from the CPGs channels of foods, pharmaceuticals, personal hygiene products and fashion were included in the study. The set of interviewed businesses ranges from manufacturing to transportation service companies.

Business area	Number of managers interviewed
Urban Goods Distribution and logistics	4
Food manufacturers and importers	6
Department stores and supermarket chains	1
Pharmaceutic store chains	1
Textile and clothing sector	1
Tissue paper manufacturer	1

Table I - Number of managers interviewed by business area

Once the interviews were fully transcribed, the mass of qualitative data collected was structured into meaningful and related patterns or categories to explore and analyse the data systematically and rigorously. Interpreting qualitative information is, to a great extent, a challenge in making sense of chaos. A useful technique to see an order from chaos involves structuring the data in a variety of patterns [28, 31]. The generated coding structure is stated in Table II.

1. Pandemic outbreak disruption	*1.1. Disruption risks*	1.1.1. Difficulty to forecast demand
		1.1.2. Migration of consumers to residential areas
		1.1.3. Decrease in general economic activity
		1.1.4. Irrational demand
		1.1.5. Uncertainty regarding the chain of payments
		1.1.6. Price uncertainty
	1.2. Operational risks	1.2.1. Adoption of protection measures
		1.2.2. Reduction of staff and working hours
	1.3. Coordination in supply chain	1.3.1. Response to demand
2. Bullwhip effect	*2.1. Causes*	2.1.1. Low visibility
		2.1.2. Changes in demand
		2.1.3. Human feelings involved
	2.2. Consequences	2.2.1. Breach of orders
		2.2.2. Portfolio reduction
3. Resilience	*3.1. Importance of a resilient SC*	3.1.1. Variety of providers
		3.1.2. Prevention
	3.2. Actions to adapt and take advantage of the crisis	3.2.1. Diversify channels and portfolio
		3.2.2. Decision making according to government recommendations
		3.2.3. Improve the quality of service
		3.2.4. Local suppliers
	3.3. Benefits of having a resilient freight transportation link	3.3.1. Optimize truck frequencies
		3.3.2. Logistics of new sales channels

Table II – Coding structure

The template analysis involved categorizing and unitizing data. The information was coded and analysed to identify and explore themes, patterns, and relationships. The template approach allowed codes and categories to be shown hierarchically to help the analytical process. The process of analysing interview transcripts or observation notes led to some of the codes being revised and even changes to their place or level in the template hierarchy. [28]. After the execution of the first round of interviews, the pandemic situation began to stabilize in Montevideo and the second round of interviews was designed.

The questions included in the second round were adapted to observe the behaviour of the supply chain, making the focus on those points identified after the first round of interviews. The execution of the second round of interviews was completed in the third and fourth months after the diagnosis of Uruguay's patient zero. The same fourteen actors from the specific CPGs channels of foods, pharmaceuticals, personal hygiene products, and fashion were contacted. However, one of the actors was impossible to contact and, finally, the second batch consisted of thirteen interviews.

Once the second batch of interviews was fully transcribed, the mass of qualitative data collected was structured and analysed. The same framework utilized for the first round of interviews was used to develop the coding structure and to analyse the results of the second round.
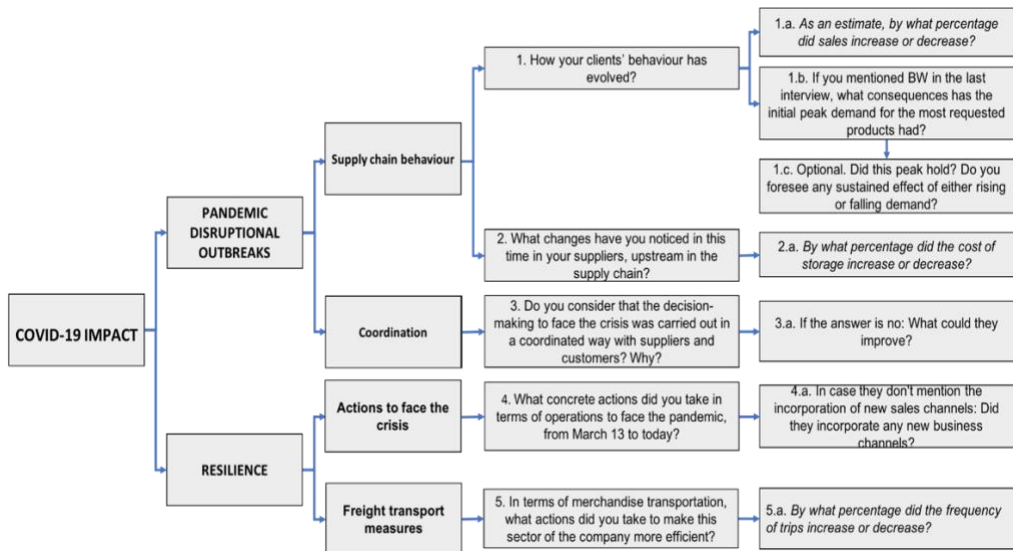

Figure II – 2nd round Interview framework

4 Results and Discussion. - On the demand end of the supply chain, a shock in demand caused by fright buying was initially observed. According to one of the interviewees, in the first days of the pandemic "the reaction was panic, due to the situation of a possible quarantine. This automatically led to a substantial increase in the demand for CPGs". This in turn put supply chains relying on "Just in Time" methodologies under considerable pressure and the sight of empty shelves became normal.

4.1 Pandemic outbreak disruption. - In terms of disruption risks caused by the COVID-19 outbreak, one of the main problems observed was the difficulty in accurately forecasting the consumers' behaviour in the first weeks of the pandemic [1]. This forecasting problem turned into

uncertainty about the demand´s behaviour, which restricted management's capacity to make operational decisions to accurately balance supply and demand.

The principal difficulty to forecast the consumers' behaviour lay in the irrational consumer behaviour during the initial moments of the pandemic. One of the interviewees mentioned that during the first pandemic days: "We have very unstable demand parameters and that makes planning substantially difficult since it is not possible to determine what was going to be delivered the next day. The level of demand observed these days is not normal and it is changing day by day, so we must adapt daily to meet delivery orders".

This was reflected in specific peaks of consumption, especially in CPGs and personal care products, to avoid potential shortages of items perceived to be of first need. Although in Uruguay the COVID-19 outbreak was not so critical during the first months compared to other countries, the first social reaction was panic, because of the possibility of a national quarantine status, which automatically lead to a substantial increase in the demand for CPGs and personal care products. In the second round of interviews, it was perceived that the demand stabilized.

PANDEMIC OUTBREAK DISRUPTION		Number of mentions in the first round of interviews (within the first month from patient zero)	Number of mentions in the second round of interviews (3 to 4 months after patient zero)
Disruption risks	Difficulty to forecast demand	12	-
	Migration of consumers to residential areas	11	1
	Decrease in general economic activity	10	3
	Irrational behaviour	9	-
	Uncertainty regarding the chain of payments	4	2
	Price uncertainty	1	2
Operational risks	Adoption of personal protection measures	10	13
	Reduction of staff and working hours	9	5
Coordination in supply chain	Response to demand	3	9

Table III - Pandemic outbreak disruptions interview coding

Faced with the unexpected and constantly changing demand situation, companies engaged in manufacturing, import, and distribution of goods commented to have experienced a "survival" mode to meet the operational needs. One of the main difficulties was the migration of consumers to residential areas and the problem of the general decrease in economic activity. Even though there was not a strict quarantine declaration in Uruguay, the government strongly encouraged citizens to remain in their houses. This governmental recommendation had an impact on the migration of the population's activity to residential areas.

This measure impacted negatively on the businesses located in centric and working areas, as fewer customers frequented their stores, and some of them had to close entirely, either temporally or definitively. One of the interviewees contributed: "The activity varied according to the area of the city, given that in residential neighbourhoods the activity increased. In downtown areas where there

is a concentration of offices and public spaces where social activity fell, a consequent drop in merchandise distribution was observed, unlike in residential neighbourhoods".

Department stores and supermarkets located in residential areas perceived an uprise in their demand, as customers visited the stores more frequently, and bought higher volumes per visit. The supermarket chain operations manager stated: "It was a sudden change from one day to the next. Of course, some products were stocked out, not because there were problems in the supply channel, but because the demand doubled from one day to the next. The first weeks were chaotic, fights were detected over certain products in stores".
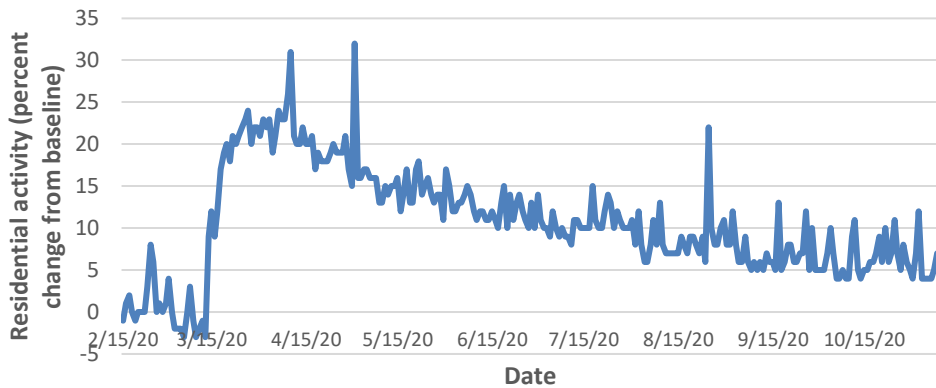

Figure III - Social behaviour in Montevideo (Source: Google LLC "Google COVID-19 Community Mobility Reports")

In terms of perception of a general decrease in economic activity, except for some specific product channels, a general decrease in demand was noticed. The main causes of this decline were the migration of consumers toward essential and basic products and the reduction of people's purchasing ability due to the crisis. As months went by, the loss of income for the average consumer became clear. The interviewees mentioned that a considerable drop was noted in the level of sales.

Moreover, distribution was strongly affected by the drop in the activity of micro, small and medium enterprises (MSMEs) which represented a significant percentage of the customers of the logistics companies that participated in the study. MSMEs were the businesses that were hit particularly hard by the pandemic, due to their reduced scale and low capacity to adapt to abrupt changes. To some extent, MSMEs experienced a reduction in the supply of labour, their ability to function was constrained and they experienced severe liquidity shortages due to a dramatic and sudden loss of demand and revenue [3]. Despite the sudden increase in the volume ordered by supermarket chains during the first weeks, the MSMEs' situation impacted directly the reduction of general supply activity.

Lastly, retailers tended to ask for higher credits from wholesalers, caused by uncertainty of the significant slump in the customers' revenues caused by the pandemic, which resulted in an important delay of the payments cycle. This condition augmented the difficulty to manage the company and increased the risk of going bankrupt, causing a considerable amount of businesses to close their doors.

Overall, the principal disruption risks observed were difficult to forecast demand during the first weeks of the pandemic which turned into uncertainty about the demand´s behaviour and restricted

management's capacity to make operational decisions. The situation stabilized and in the second round of interviews, this disruption risk was not mentioned.

The main cause of the difficulty to forecast demand was the irrational consumer behaviour during the initial moments of the pandemic. This irrational consumers' attitude was specifically spotted during the first weeks of the pandemic. In the second round of interviews, the observed "new normality" caused changes in customers' behaviour, yet explainable and manageable when making decisions within the supply chain.

In addition, a decrease in the general economic activity was attributed by the interviewees to the migration of consumers towards essential and basic products, and the reduction of people's purchasing ability due to the crisis. The contacted companies' sales levels, although they increased in some specific sectors such as essential products that refer to personal care and hygiene according to the pandemic, generally dropped.

Operational risks were mainly related to the adoption of operational changes to adjust to the COVID-19 situation. Public health measures such as self-isolation and movement restrictions in addition to actual COVID-19 cases among the workforce posed an uncertain scenario not only for manufacturers but also for transportation and distribution networks. Extra resources have been put in place to implement contingency plans to mitigate risks. Furthermore, international trade has been affected by "thicker borders" [32], impacting all products that have imported components.

All running businesses had to implement personal protection measures to make sure their workers and customers were safe to continue operating. Specific actions such as adaptation of the work shifts, spacious workplaces, providing workers with facemasks, gloves, sanitiser, sanitation spots with soap to wash their hands, training sessions to understand the seriousness of the matter, and contingency plans in case of contagion were undertaken. Another action taken to reduce contact was to carry out remote selling and avoid visiting customers.

This adoption of specific measures taken to guarantee personal protection was highly mentioned in both rounds of interviews. Moreover, in the second round of interviews, in which the demand situation and production and logistics activities had stabilized, it can be seen that the sanitary and protection measures embraced were, in some way, motivators of such stability.

Furthermore, personnel and workload shortcuts were identified as operational risks. The decrease in general demand, and the financial hit caused by the crisis, lead to an important reduction in working activity. In this aspect, some companies decided to reduce the personnel and the workload. For example, numerous companies were affected directly by the decrease in the sales capacity, leading to a reduction in the company's structure in the commercial sector. At the operations level, some had to reduce personnel to lessen the preparation and delivery capacity. Finally, at the administrative level, the same happened. The general reduction of the economic activity generated reductions in the companies' structures in terms of personnel and time.

Finally, to stand against the suffered crisis, the coordination between the supply chain actors is considered substantial. Even though uncertainty levels were high in the first weeks of the outbreak, and no prediction of the near future could be made, many companies made decisions without sufficient coordination among other impacted links of the supply chain. For example, due to the excessive demand for sanitation products, imported product flow was shortened as external companies strategically decided to supply their country's demand and reduce product export. In one of the interviews, it was mentioned that during the first moments it was difficult to coordinate

within the supply chain not because there was no communication, but because of the level of uncertainty at hand.

Moreover, the pandemic situation caused a global impact and all the links in the supply chain were aware of it. Some of the interviewees mentioned that there was more coordination now than before the pandemic, as it favoured the growth of communication. One of the managers from a food distributor commented that they had the objective to not cut the food supply. To guarantee the delivery and service with the suppliers that the communication presented a greater complexity, a more intensive communication was used: "For the links that are more resistant to communication, our team was in charge of frequently contacting the different managers to generate that flow of information".

One of the interviewees catalogued the COVID-19 as a new problem that was summed to the habitual problems in supply themes: "We have an effective communication system regardless of this specific topic: COVID-19. This is one more issue that adds to the usual ones, there will always be problems to solve".

The pandemic was an opportunity for some companies to work collaboratively. In general terms, in the first round of interviews, it was observed that collaboration between the different links of the supply chain was scarce. However, in the second round of interviews, a higher level of coordination upstream and downstream in the supply chain was mentioned.

4.2 Bullwhip effect. - Some specific sectors experienced an exponential rise in demand that led to shortages and the necessity to take important decisions to adapt their distribution plans. The main sectors that perceived an increase in demand in the first weeks of the pandemic were cleaning, personal hygiene, and food products. This increase was attributed to the declared sanitary emergency by the government, to the motivation to adopt personal care measures due to the ease of contagion presented by the virus, and finally to the imminent threat of compulsory lockdown.

A misperception of excessive demand increase was perceived by suppliers, which was caused by this sharp and sudden upgrowth in demand on the side of retailers (and a consequent placement of excessive orders to suppliers), together with the buyer's tendency to over-supply in anticipation of a possible total quarantine. This tendency, known as panic buying [33], distorts suppliers´ demand perception, is frequently observed in disruptions and natural disasters, and causes inventory struggles.

According to literature, this phenomenon is called the bullwhip effect and it can lead to severe consequences for the businesses' development in terms of inventory, operations, and logistics management [12]. One of the interviewees mentioned that a sudden peak in demand was perceived, especially in the area of personal care and household hygiene products. The first fifteen days were complex in aligning demand with capabilities and the demand exceeded the capacity several times.

BULLWHIP EFFECT		Number of mentions in the first round of interviews (within the first month from patient zero)	Number of mentions in the second round of interviews (3 to 4 months after patient zero)
Causes	Low visibility	12	4
	Changes in demand	9	13

	Human feelings involved	3	3
Consequences	Breach of orders	5	3
	Portfolio modification	2	3

Table IV - Bullwhip effect interview coding

The factories, importers, and wholesale companies that took part in the study mentioned that, during the first fifteen days of the pandemic, they did not have real visibility of end-customer demand, but an exaggerated version produced by their downstream customers. The shortage of customers and the consequently reduced sales paired with the erratic behaviour of participants in the supply chain led to highly variable production schemes in factories and high inventory costs. In terms of personal care, household hygiene, and some essential food products the bullwhip effect was definitively observed, and the different companies had to adapt and respond to a variable and unexpected demand.

An example of this phenomenon could be seen in one of the interviews with a manager of a bathroom tissue factory at the beginning of this pandemic. Toilet tissue, being a product with a low price-to-volume ratio causes merchants generally not to hold large inventories, and the supply chain tends to be tight and efficient. When the first cases of COVID-19 appeared in Uruguay, the demand exceeded the production found in the stocks of the selling companies, even though the physiological needs of the people did not change due to the pandemic.

The increase in demand for household products was almost instantaneous, and the shortage of stores caused the public to over-supply. This peak in demand caused retailers and distributors to demand a significantly larger stock of inventory than usual. In response, the factory ceased to produce a wide range of products and focused instead its production schemes towards the most demanded products.

However, the increase in demand for these specific items did not continue indefinitely. These peaks were clear in the second half of March and some localized peaks in April, causing stock problems as the industry was not prepared to supply the present demand.

Another effect that allows determining that the bullwhip effect occurred was the human feelings being involved in decision-making processes [10]. The shocking situation caused fear and desperation in society, mainly associated with the fact that there was no historical record of such a global pandemic, and it was impossible to predict the progress of contagion. These feelings, when present in decisions, distort real demand numbers and snowball through the supply chain causing inventory struggles and misuse of production capacities. In the first round of interviews, it was said that this kind of crisis generates nervousness in all areas, causing excessive decision-making or a lack of prudence in situations of tension.

In terms of the consequences of the bullwhip effect, the breach of orders and the portfolio reduction, which are considered consequences of the bullwhip effect [10], were identified.

As retailers perceived an extremely high demand in an exceedingly short time, they had to prioritize clients and concentrate on certain channels to supply these regularly. Companies that delivered healthcare products and basic foods experienced an extremely high demand in a short time, for which they had to prioritize clients and channels, to define whom to deliver to supply all channels as far as possible.

Regarding portfolio reduction, some companies generated a list of a few dozen critical articles that strictly have to do with the needs related to the COVID-19. Other companies reduced their products catalogue and adopted a push selling strategy with the remaining products. For instance, one of the interviewees mentioned that they "went from forty-four to less than half of the product codes, and sales are being concentrated on those products, guiding customers to buy those specific products".

To sum up, the bullwhip effect was identified during the first four weeks after the first COVID-19 case in Uruguay, and consequences were perceived. Low visibility of demand, changes in consumption, and the influence of human feelings in critical situations were observed. The product brunches that suffered the bullwhip effect were personal care and household hygiene and basic foods. According to the interviewees, these kinds of products were considered indispensable by customers to overcome the pandemic and, consequently, people overstocked, leading companies to struggle against shortages and excessive orders.

4.3 Resilience. - Finally, in terms of resilience and robustness in the situation of the COVID-19 pandemic, three important aspects were assessed: the importance of a resilient supply chain to respond to the crisis, actions to adapt and take advantage of the crisis, and the benefits of having a resilient freight transportation link [19, 22].

RESILIENCE		Number of mentions in the first round of interviews (within the first month from patient zero)	Number of mentions in the second round of interviews (3 to 4 months after patient zero)
Importance of a resilient SC	Variety of suppliers	5	4
	Prevention	3	4
Actions to adapt and take advantage of the crisis	Diversify channels	6	6
	Decision making according to government recommendations	4	8
	Improve the quality of service	3	3
	Local suppliers	2	1
Benefits of having a resilient freight transportation link	Optimize truck frequencies	2	5
	Logistics of new sales channels	2	6

Table V – Resilience interview coding

Resilience and robustness were critical characteristics that organizations had to show to survive and even take advantage of this crisis. Particularly, having a vast range of suppliers and preventing or avoiding risks were identified by interviewees in both rounds of interviews as vital factors to ensure resilience. One of the interviewees mentioned in both rounds of interviews that the benefit of having a variety of strong suppliers in different product channels resides in the fact that, in case of disruptions, some of them may fall, but others will stand or grow and stabilize the economic activity of the business.

Furthermore, developing risk mitigation plans such as considering local suppliers (higher costs but lower lead times) and investing in online channels were remarked prevention strategies to affront the crisis between the interviewed companies.

To evaluate resilience, the actions taken to adapt and take advantage of the crisis were analysed. The most frequent action was the decision to diversify sales channels. Due to the reduction in commercial activity, companies were forced to adopt new distribution and commercial practices. For instance, a vast number of businesses started or accelerated their development on delivery or non-personal channels, to avoid contact and possible contagion or to gain access to clients that migrated to residential areas [34].

One of the interviewees noticed that: "We migrate to the use of the website, the generation of product baskets, to that type of variants that allow us to reach the final consumer which we cannot reach by other means". The interviewed companies migrated to familiar formats and product baskets and the e-commerce channel. According to one of the interviewees "the e-commerce channel was substantially enhanced. What had grown in 3 or 4 years, doubled in 2 months".

Furthermore, another observation from the interviews was the influence of governmental recommendations on business decision-making. In the case of Uruguay, the government proposed a new format of partial unemployment insurance and some companies decided to follow this proposal so as not to fire people or send full unemployment insurance. Being COVID-19 a national emergency, the government's proposals to return, step by step, to normality turned into a considerable point to take decisions and design plans to face the pandemic.

Another noted action was the improvement of the existing service due to the demand decrease. One of the interviewees commented that "to the extent that we have fewer delivery points we have improved the service as much as possible in some way given that there is a competition to win. Also, there is a service to provide the essential products at the right time and place, it is not only a business issue but a critical social issue".

In terms of the import of goods, the complexity of this activity increased due to the border restrictions with neighbouring countries. Uruguay is highly dependent on activity in Brazil and Argentina since many products are manufactured there, so border closure and reduction of working hours in neighbouring countries directly affected local supply chains.

The fact that the Uruguayan market is smaller than other countries in the region also has an influence, so importers cannot be as demanding in terms of the volume of orders. In this scenery, to reduce the risk of shortages, many companies, mainly manufacturers and distributors, turned to local suppliers as a strategic measure, even when the prices offered were not as competitive as international ones. This change of suppliers towards locals, although it normally increases the manufacturing cost, allows to shorten production and delivery times, and therefore become more sensitive to respond to the changes in demand.

It was observed that in the first round of interviews, during the first fifteen days of the pandemic in Uruguay, the low visibility and the impossibility to foretell the demand enforced the resiliency of the different companies to endure the pandemic crisis and uncertainty. This enforcement motivated resilient and robust decisions that permitted the different companies to put up with the controversial situation and to develop new business channels.

Finally, regarding the benefits of having a resilient urban distribution, two phenomena were observed. In the first place, some companies commented on the actions taken to optimize the distribution fleet frequencies. A reduction in the truck frequencies was observed, to adjust cargo and take full advantage of the available capacity per truck in the transportation of products. During the first round of interviews, it was noted that the way to respond to the decrease of the goods and

lumps to deliver was to unify deliveries, reducing the frequency of vehicles. Throughout those first days, part of the transport staff did not go out on the street.

Moreover, the issue of all precautions both in the delivery and in the handling of goods was identified in the interviews. This protocolary delivery activity meant that at many points the delivery has been slowed down. One of the interviewees mentioned: "in some sectors, if you did 10-12 deliveries on the day, today you do 8. The trucks are forced to stop further away because businesses do not receive the invoice and do not allow the unloading of merchandise until the previous supplier has finished their unloading work".

On the other hand, measures to adapt the logistic activity to new sales channels were identified, particularly in the remote or online channel. One of the interviewees highlighted the necessity to have a much more efficient web order logistics, constantly adapting to customers' behaviour and evaluating the level of service that is expected. "We first looked for transportation to be effective to respond to our perceived need, and transportation was effective but very inefficient. Next, an attempt was made to improve efficiency by controlling the number of carriers, working hours, and task management, thus adjusting the transport price ratios about sales".

5. Conclusions. - The Coronavirus outbreak impacted deeply supply chains, and its disruptive nature made managerial decision-making challenging. During the first four months since the first COVID-19 case was identified in Uruguay, it is possible to conclude, in the first place, that the outbreak seriously affected the structure dimension and the operations of supply chains during the first stages of chaos and uncertainty. The high level of uncertainty generated in the first period of the pandemic, causing struggle to predict consumers' behaviour, made it essential for supply chains to enhance coordination between links, work on improving resilience and manage risks to reduce their impact and, in some cases, even take advantage of this crisis.

Particularly, the difficulty to forecast demand during the first weeks of the pandemic was perceived, which turned into uncertainty about the demand´s behaviour and restricted management's capacity to make operational decisions during those first two weeks. Moreover, the irrational consumer behaviour during the initial moments of the pandemic and the migration of consumers to residential areas were observed. In this controversial situation, businesses had to adapt and respond to overpass the pandemic situation.

In the period time studied, a decrease in the general economic activity was observed. According to the interviewees, it was attributed to the migration of consumers towards essential and basic products and the reduction of people's purchasing ability due to the crisis. The contacted companies' sales levels, although they increased in some specific sectors such as essential products that refer to personal care and hygiene according to the pandemic, generally dropped.

Several procedures to manage the identified risks due to the pandemic were implemented in the different interviewed companies. For instance, the adoption of personal protection measures and the reduction of staff and working hours were identified as a response to operational risks and were implemented to maintain production and transportation services active.

Moreover, the bullwhip effect was present in some critical channels of products, such as personal care and hygiene, and essential foods. Such a sudden peak of demand caused by both an objective necessity of sanitation or food provision, and a subjective feeling of panic or fear of stockout delivered important shortcut situations and came along with modifications at the placed orders to respond in a certain way to an unknown and variable demand. Furthermore, impacted supply chains had to enhance communication and visibility and, in some cases, reduce the product portfolio to avoid stockouts.

This disruptive event also showed supply chains how important resiliency is to adapt to the crisis and get through it in the best possible way. A survival attitude, understood as taking important day-by-day decisions during the first weeks of the pandemic, was a must. Also, some of the companies modified their sales channels to adapt to the new normality. In particular, the online channel experienced an interesting increase during the crisis, and some of the companies started to develop this commercial method or improved their past experiences with online sales. In a way, this can lay the foundations for the establishment of e-commerce as a strong sales channel.

All in all, it is essential to highlight the importance of incorporating the concepts of risk management, resilience, and robustness into day-to-day operations to face the different problems occurring daily in supply chain management. This research provides deep insights observed in the first months of this disruption and offers companies considerations to bear in mind when making decisions within this kind of event. In that way, it would be possible to face adverse situations in a coordinated and effective way, along the supply chain to respond to demand fluctuations.

This study is limited principally by the time-lapse in which the interviews were developed and by the constrained number of interviewed businesses. It may not be fully representative of the global situation of the COVID-19, but it may apply to developing countries in which the pandemic was successfully controlled and in which the mandatory quarantine was not established.

Further research about risk management, resilience, and robustness of the supply chain should be carried out on understanding good practices and effective strategies to respond to the pandemic. The concept of success in terms of businesses overcoming this disruption is directly linked to sustainability and resilience, so time has to pass to see clearer successful measures. As it is a unique pandemic situation, which had no registered precedents, it is fundamental to generate scientific knowledge on how to respond to future similar scenarios in case they exist.

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