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Original Research Article

Impact of COVID-19 on Air Transport

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Abstract: Since the start of the COVID-19 pandemic, many countries have suffered economically, causing billions of dollars in losses worldwide. In response to this, many countries have taken emergency measures to ensure that the impact does not have huge economic implications in terms of rapid recession. In Africa, where many countries have taken measures to deal with the decline in economic activity, mainly through fiscal and monetary policies, including Tunisia. In addition, socio-economic statuses continued to change instantly and stochastically, more after large numbers of people lost their daily jobs with new measures to stop the spread of the COVID-19 virus. This article attempts to model the effect of the COVID-19 pandemic on tourism and freight in Europe, USA and China using an analysis of the Markov chain in discrete time. In addition, the document seeks to find the ultimate effect of COVID-19 on air transport in the main economic sectors. The results of this document should help government and global investors understand the different economic stimulus planning plans to launch in the "hard hit" sectors of the economy to reduce the impact on tourism and freight. The information should help formulate a post-COVID-19 economic recovery plan for the global economy.

Keywords: Markov chains, Europe, USA, China, tourism, freight, Covid-19.

INTRODUCTION

Since the onset of the Covid-19 Pandemic in China, the global economy has experienced an unprecedented crisis [1]. Indeed, China has a close relationship with most of the world's economies; they depend directly or indirectly on it [2].

Although the economic impact of Covid-19 is not felt only in China and other countries around the world [3], the countries of Europe and America is one of the countries affected by this pandemic and is experiencing an economic recession like everywhere in the world. Today, all of the world's economies have made emergency adjustments to counter potential threats to their economies.

On January 31, 2020, Italy confirmed its very first case of Covid-19, it was one of two Chinese tourists who tested positive for SARS-COV-2 in Rome. A group of Covid-19 cases is then detected, as of February 28 there were 21 deaths and 888 confirmed cases in the country. The government then began to take precautionary measures for citizens and the economy because the virus will have a huge economic impact once it has spread throughout the country.

A few days later, the government of each country banned all public gatherings, which caused enormous economic hardship for businesses and employees across the country. While many countries on the European continent were preparing for the Covid-19 pandemic, they lack the adequate resources to tackle the eventualities of the virus [4], and in particular in the existing economic outlook.

The governments of each country have taken steps to avoid excessive economic disruption. The network of relationships between workers and employers, producers and consumers, as well as lenders and borrowers, should be preserved so that activity will really restart when the medical emergency decreases.

Many travel restrictions have been applied to vital hotels; tourism as well as the horticultural industries are now facing huge challenges, especially with the restrictions. In the past few days, many hotels are closing, especially after the government announced a curfew that has left many businesses dependent on nightlife to survive.

Europe, USA and China must understand to what extent the Covid-19 pandemic will affect tourism and freight, thereby helping to understand how the dynamics of air travel are evolving, thus enabling them to develop a plan that would help these countries recover. knees after the pandemic virus is finished. The purpose of this article is to predict the economic changes that may occur in terms of air transportation.

We used a Markov chain process to model events at the same time determining what happens in the long term once the pandemic subsides, providing economists with an opportunity to suggest appropriate economic stimulus for the future.

METHODOLOGY

Markov chains

s_tis an irreducible, aperiodic Markov chain starting from its ergodic distribution π=(π_1,……..,π_k). The probability that s_t is equal to j∈(1,…..,k) depends only onthe most recent realization, s_(t-1), and is given by

Pr(s_t=j|s_(t-1)=i)=p_ij

All possible transitions from one state to the other can be collected in a k x k transition matrix

P=(■(p_11&…&p_k1@p_12&…&p_k2@⋮&⋱&⋮@p_1k&…&p_kk))

Which governs the evolution of the Markov chain. All elements of P are nonnegative and eachcolumn sums to 1.Hamilton, J. D., &Susmel, R. [5], Frühwirth-Schnatter, S. [6,7].

Markov switching regression models

Consider the evolution of yt, where t = 1; 2; : : : ; T, that is characterized by two states or regimesas in the models below

y_t=μ_1+〖Øy〗_(t-1)+ε_t

y_t=μ_2+〖Øy〗_(t-1)+ε_t

Where μ_1 and μ_2 are the intercept terms in state 1 and state 2, respectively; Ø is the AR parameter;and ε_t is a white noise error with variance σ². The two states model abrupt shifts in the interceptterm. If the timing of switches is known, the above model can be expressed as

y_t=s_t μ_t+(1-s_t) μ_2+〖Øy〗_(t-1)+ε_t

wherest is 1 if the process is in state 1 and 0 otherwise. Estimation in this case can be performedusing standard procedures.

In the case of interest, we never know in which state the process is; that is to say, s_t is not observed.Markov-switching regression models specify that the unobserved s_t follows a Markov chain. In thesimplest case, we can express this model as a state-dependent intercept term for k states

y_t=μ_st+〖Øy〗_(t-1)+ε_t

Whereμ_st= μ_1 whens_t=1,μ_st= μ_2 when s_t=2…….. andμ_st= μ_k when s_t=k. The conditional density of y_t is assumed to be dependent only on the realization of the current state stand is given by f(y_t| s_t=i,y_(t-1);θ) where θ is a vector of parameters. There are k conditional densities for k states, and estimation of θ is performed by updating the conditional likelihood usinga nonlinear filter.

Air transport between tourism and freight

We will study the evolution of air transport in the numbers of travelers, 2020. Here are the data:

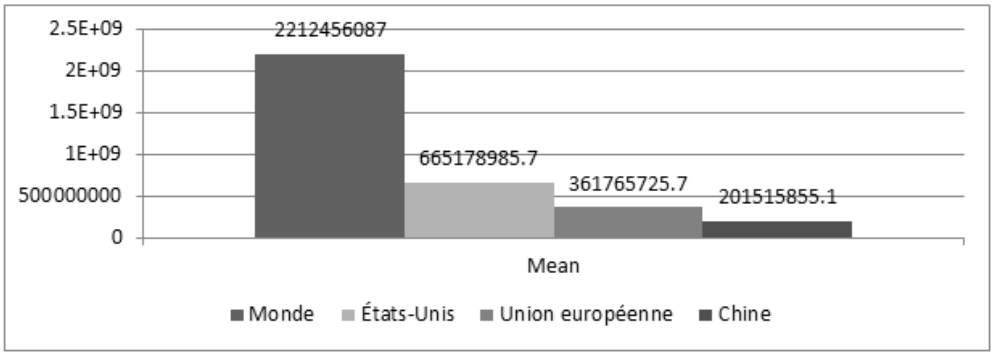

Fig-1: Air transport, passengers transported

Aviation provides the only global rapid transportation network, which makes it essential for global business. It generates economic growth, creates jobs and facilitates international trade and tourism. The United States, European Union and China are among the most visited regions or world since the United States has 66,517,895 travelers and less for Europe with 361,765,725 travelers at the end of China representing 20,015,855 travelers as shown (Figure 1)

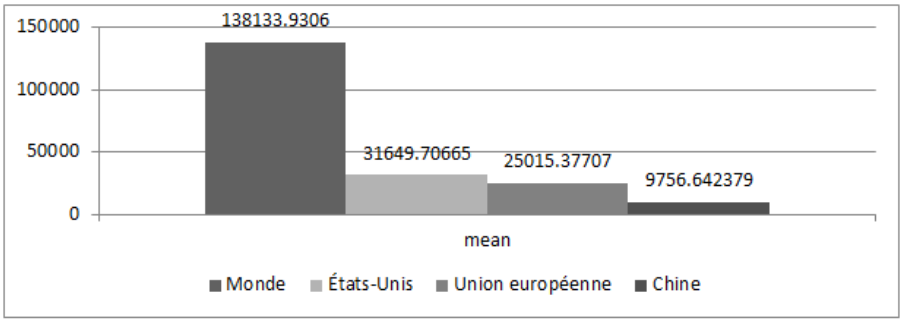

Fig-2: Air transport, freight (million tonne-kilometers)

The air cargo sector has been a vital partner in delivering medicines, essential medical equipment (including spare parts and components) and in keeping the supply chains carrying perishable products functioning. This was done by special cargo planes and by using the cargo capacity of passenger planes, and by carrying out humanitarian flights to affected regions. The global fleet of cargo planes has been mobilized to compensate for this drop in capacity, as shown in (Figure 2)

RESULT

The processes evolve over time with discrete changes, for example recessions and economic expansions. At the start of a tourism and freight recession fall and remain weak, then, later, tourism and freight increase. Also there are bipolar disorders in which there are variant periods followed by depressive periods, and the process repeats.

Means, variances and other parameters change across periods (regimes). Our problem is to estimate when the regimes change and the values of the parameters associated with each regime. Asking when diets change is like asking how long diets persist.

In Markov transition models, in addition to estimating means, variances, etc. of each regime, we also estimate the probability of regime change.

Markov switching models are not limited to two regimes, although two-regime models are common; these models are called dynamic models. Markov models can also adapt to smoother changes by modeling the transition probabilities as an autoregressive process, so switching can be gentle or stiff.

In our study we can be in 2 states of nature S = {1 = bullish, 2 = bearish} the results of the dynamic transition model (abrupt change) to two regimes, are as follows:

Tables-1: Markov chain has two states

	PASSENGER			FREIGHT		
	means of the two states (_cons)		standard deviation (σ)	means of the two states (_cons)		standard deviation (σ)
	State 1	State 2		State 1	State 1	
World	1.62e + 09 (14.86)	3.45th + 09 (21.04)	4.65e + 08	93478.13 (12.23)	181077.4 (24.66)	25259.15
USA	5.57e + 08 (29.85)	7.64e + 08 (43.42)	6.79e + 07	21883.58 (16.98)	38671.92 (35.10)	4161.808
Europe	2.39e + 08 (11.16)	4.94e + 08 (21.88)	7.51e + 07	17266.54 (15.95)	28508.22 (41.19)	2898.615
China	9.20th + 07 (4.20)	4.44e + 08 (12.30)	8.84e + 07	4070.409 (3.78)	18853.29 (12.51)	3684.814

State 1 and State 2 represent the average of the two states for tourism and air freight.σ isa single standard deviation for the whole process and the transition probabilities for state 1 to 1 and state 2 to 1.

Economic behavior is governed by a Markov chain, the transition matrix of which is as follows:

Tables-2: Transition probability

	passengers			Freight		
	From / To			From / To		
World	state	1	2	state	1	2
	1	0.970	0.030	1	0.9651	0.0349
	2	0.0443725	0.9556275	2	0.0342154	0.9657846
USA	state	1	2	state	1	2
	1	0.964	0.0357	1	0.962	0.038
	2	0.0339971	0.9660029	2	0.0320613	0.9679387
European Union	state	1	2	state	1	2
	1	0.966	0.0339	1	0.954	0.046
	2	0.0352746	0.9647254	2	0.0298306	0.9701694
China	State	1	2	state	1	2
	1	0.9702	0.0298	1	0.969	0.031
	2	0.0454551	0.9545449	2	0.0400138	0.9599862

Tables-3: Percentages of evolution after Covid-19

	Passengers		Freight	
	RISE	DROP	RISE	DROP
World	59.65%	40.34%	49.48%	50.51%
USA	48.76%	51.23%	45.65%	54.34%
Europe	50.98%	49.01%	39.58%	60.41%
China	60.38%	39.61%	56.17%	43.82%

The economic implications of the Covid-19 have had a negative impact on the tourism sector (passengers) which has a downward probability of 95.56% most of the time, this will have an effect on the freight also which will fall with a probability by 96.57%.

After Covid-19, the world will experience a slight increase in the number of passengers by 59.65% and it is almost the same for Freight evolution of 50.51%. China and Europe will see an increase in the number of passengers, while China will experience an evolution of 56.17%.

Tourism and freight are only related to global trends. Today, the Covid-19 pandemic has halted global economic activity and forced countries to close their borders and stop all trade with the outside world. This will lead to even a short-lived economic recession. A recession which will certainly affect air transport.

CONCLUSION

It is important to note that according to Table 3, the Covid-19 will have a negative impact on the tourism sector and also on the freight when analyzing the percentages. For example, the upward probability 59.65% and the downward probability 40.34%, the Freight will drop most of the time with a probability of 50.51%. Tourism in China will be the biggest winner. With an upward probability of 60.38% thus increasing the Freight 56.17%.

Based on the above research, it is important that governments take steps that can protect the airline industry from economy if it is to stay in the race compared to other world economies. Certain economic projects for the development of economic growth must be re-examined for a possible economic recession.

Although the government must continue to protect the population, it is important that legislation is put in place to deal with the specific areas affected by Covid-19 infections, particularly at the micro level. A special fund for those who have been directly affected by the virus is vital for a rapid and systematic economic recovery.

This research paper should assist the government in making appropriate planning choices for tourism and freight during the post-Covid-19 pandemic. However, research could be extended to many parts of the economy to determine the general effects of Covid-19 not only on the study sample but also on many other economic parts.

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