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Assessing The Risks Of Imported Inflation In The IOC Case Study Of Madagascar

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Abstract – How the economies of the member countries of the Indian Ocean Commission (IOC) respond to price shocks in the markets of other member countries is an important question that deserves to be raised, even if the level of imports into the region is low. It is important to know which country represents the greatest risk of inflation transmission. The empirical literature on the analysis of the extent of inflation transmission remains very mixed. This paper sets out to answer this question, taking the case of Madagascar. The results show that Mauritius presents the greatest risk, given the level of imports Madagascar makes with this country. Price rises in Mauritius are transmitted more rapidly to Madagascar than to other countries. At the end of our paper, one question remains: does foreign trade alone explain imported inflation?

Keywords – IOC, external shocks, Inflation, Madagascar, Transmissio.

I. INTRODUCTION

Aware of the stakes involved in regional integration, the member countries of the African Union (AU) took the decision to accelerate and foster regional trade and economic integration by creating the Africa Continental Free Trade Area (AfCFTA) in 2018, aimed at eliminating customs duties on most goods, liberalizing trade in key services, but also tackling non-tariff barriers. This free trade zone became effective on January 1, 2021.

The aim of the AfCFTA is to establish a single market for goods, services, capital and people between AU member countries, thereby strengthening continental trade integration. This is despite the existence of numerous overlapping regional trade agreements (CAE, COMESA, SADC, etc.).

The four Indian Ocean countries belong to several Regional Economic Communities (RECs), namely SADC and COMESA, and have signed bilateral agreements with their main partners. However, trade within the zone, and more broadly in Africa, remains low for these countries, which trade mainly with European countries, the United States, China and the United Arab Emirates.

Mauritius is the only Indian Ocean country to have ratified the AfCFTA, with real income gains expected to reach 6.9%. According to the World Bank, Madagascar's share of exports to AfCFTA members would remain virtually unchanged (9% in 2035 without AfCFTA and 10% with AfCFTA), while the impact on imports would be much greater, rising from 10% in 2035 without AfCFTA to 18% with AfCFTA.

The Indian Ocean Community (IOC), created in 1982 and institutionalized in 1984 (5 member states including France), is limited to promoting the economic interests of the island states, with no trade agreements between them. However, for a variety of reasons, the four countries are not reaping the full benefits of these agreements, despite their many comparative advantages.

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Generally speaking, the Indian Ocean islands trade relatively little with each other and with the rest of the African countries, including within the RECs. Indeed, in 2020, imports from IOC member countries, excluding Réunion, represented just 4% of total imports for Seychelles, 3.4% for Madagascar, 2.8% for Comoros and 1.7% for Mauritius. Exports to IOC members (excluding Réunion) represent almost 9% of total exports for Mauritius and Comoros, 1.5% for Madagascar and 0.6% for Seychelles. Despite the low level of imports between IOC member countries, the question arises as to whether there is a transmission of inflation through imports for the five IOC countries. In our study, we have chosen to examine the case of Madagascar, focusing on the mechanisms of inflationtransmission within this commission. Explicitly, our aim is to answer the question: which country presents the greatest inflation risk for Madagascar?

Our article is therefore structured as follows: after the introduction, we present the methodology adopted to conduct the research, after which we review the literature on inflation transmission mechanisms in general and foreign trade in particular. We then present the results and discuss them in relation to the scientific and theoretical literature. Suggestions and recommendations conclude our study.

II. METHODOLOGY

When it comes to inflation transmission mechanism, two methodologies are widely used in the literature. It's all started when in 2006, Yang et al. applied variance decomposition approach to a VAR model to investigate the inflation spillover in the G7 countries (1973- 2003). Although the impulse response analysis of that approach is a handy tool for inflation spillover analysis (Alam and Istiak 2020), the impulse responses may vary according to the order of the VAR. Then come Diebold and Yilmaz (2012) with a much better methodology because their method is based on a generalized VAR model in which spillover results are generated from several responses. And finally, Barunik and Krehlik (2018) come with a much better approach by decomposing the inflation spillover at different time frequencies. The Spillover Index Framework of those researchers is the most common index to study inflation spillover.

The analysis of transmitted inflation phenomena will lead us to two research stages. Firstly, locating external inflationary pressures should enable us to identify the specific causes of this form of inflation. Secondly, a study of the propagation mechanisms of these tensions will explain how externally-induced inflation is transmitted to the local market. The data used in this article come from the national accounts of IOC member countries, statistics from the African Development Bank and the World Bank, and recent studies carried out by the Indian Ocean Commission.

For the econometric analysis and tests, the two models mentioned above were chosen for their reliability and robustness in responding to our problem. Our methodological approach can therefore be summarized as follows: A review of the theoretical literature on inflation and regional trade, and a review of the empirical literature on regional trade and the transmission of inflation. The aim of these first two steps is to identify potential indicators that could be taken into consideration to address our problem. Our study will be supported by an analysis of indicators relating to trade intensity, as we believe that the country with the highest trade intensity with Madagascar is the most likely to transmit inflation to Madagascar. Most of the data are taken from statistics or reports from the International Monetary Fund (International Financial Statistics Yearbook) and the World Bank (World Development Indicators, African Development Indicators). In this work, we proceed in three stages. The first stage, the subject of the first section, sets out the various theories on inflation and its transmission mechanism. We then present the various econometric results and the discussions that will enable us to validate our hypothesis. We conclude with a section of suggestions and recommendations.

III. LITERATURE REVIEW

Etymologically, the word inflation "comes from the Latin *inflare, meaning to* swell or swell up". It evokes a pathological, abnormal phenomenon that needs to be eliminated. This is why central banks are charged with preventing inflation from taking hold. Until the beginning of the 20th century, inflation remained unknown (not that it didn't exist, but it wasn't measured or taken into account), and the custom was to fix rents in a fixed currency for a long time (sometimes even in perpetuity). The concept of inflation emerged in the late 1970s. Inflation is the loss of purchasing power of money, resulting in a general and lasting increase in prices. It must be distinguished from increases in the cost of living.

1. Theoretical review of inflation

The transmission mechanisms of inflation have given rise to an abundance of debate and sometimes contradictory results in theoretical and empirical literature. Opinions differ on the causes and consequences of inflation. In general, theorists study inflation through the analysis of shocks. Zumer (1998) defines the two terms "*symmetric* shocks" and "*asymmetric* shocks" as follows: A symmetrical shock is one that affects all regions of a country, or all member countries of a union, simultaneously and in identical proportions. An asymmetrical shock affects only one country or group of countries in a region, or even the whole union, but in different proportions.

In the same vein, Gali and Monacelli, 2008, argue that the optimal mix of monetary and fiscal policies in a given union requires the common central bank to stabilize inflation, while national fiscal policies deal with asymmetric shocks. Loungani and Swagel (2001) argue that inflation is the main result of differences in exchange rate regimes between developing countries. The question of the interaction between inflation and uncertain inflation, and their influence on economic activity, is particularly acute in low-income countries. Indeed, the results obtained by these authors (Daal et *al.*, 2005) show that inflation uncertainty is the main cause of rising inflation.

More recently, Chang (2012) considers that the relationship between inflation, inflation uncertainty and economic growth depends on the level of inflation. On the one hand, Hwang (2001) believes in the existence of a positive correlation between inflation and inflation uncertainty. On the other hand, Chang and He (2010) find a positive correlation between inflation and inflation uncertainty in a regime characterized by high inflation.

Inflation is a sensitive phenomenon in every sense of the word. Indeed, it is a sensitive phenomenon for politicians, since inflation is a sign of whether or not the economy is functioning well. A government is judged on whether or not it can keep inflation under control. And yet, despite its importance, the causes of inflation are still the subject of much controversy. Indeed, theoretically, the same consequence can result from radically opposed economic functions. For example, Niyombar (2011) finds that the EAC recorded a 47% growth in trade, and consumer goods prices fell by around 20% on Rwandan markets. This seems to be in line with Grosman and Helpman (1991), who demonstrated that opening up countries increases domestic imports of goods and services between two countries.

2. Empirical review of inflation transmission

Before looking at the causes and consequences of external inflationary pressures and their transmission mechanisms, we need to take an empirical look at how foreign trade can be a source of inflation propagation. Theorists and more empirical researchers alike agree that an economy heavily dependent on foreign trade cannot avoid the transmission of inflationary pressures. This seems inevitable unless the authorities have effective monetary instruments at their disposal, to attenuate export surpluses, or limit subsidy demands, in periods of trade deficit.

By analyzing the case of several South American countries, H. Mercillon has come to the conclusion that inflation in South America is often imported from abroad. He adds that the transmission of inflationary pressures via foreign trade is as much a consequence of underdevelopment as it is of the dependent nature of South American economies. He concludes his study by saying that the situation of South American economies differs from that of developed countries in that the balance of payments deficit is in most cases a cause, rather than a consequence, of inflation. Inflation is therefore transmitted both when the balance of payments is in deficit, and when it is in surplus. In South America, fluctuations in international trade have long been a source of inflation.

Mercillon defines imported inflation as an inflationary process arising from any external imbalance, whether positive or negative; this imbalance is either the immediate and main source of monetary expansion and domestic price rises, or the cause of inflationary thresholds being crossed.

Mundlak and Larson (1992), using price data covering the period 1968-1978, in their study based on a sample of 58 countries, demonstrate a near-perfect transmission of international price variations to domestic prices in developing countries. And more recently, Bakhshoodeh and Sahraeian (2006), using data from 1984 to 2002, analyzed the integration of Iranian agricultural markets after its entry into the World Trade Organization (WTO). They conclude that national markets are not integrated with international markets in the long term.

IV. RESULTS AND DISCUSSION

The section on the empirical review of inflation, the theoretical framework and the study of asymmetric shocks. We now turn to the study of the links between trade intensity and the transmission mechanism of inflation. Table 1 shows the results of inflation rates in the IOC for the period 1985-2020.

Table 1: Summary statistics of the inflation rate of IOC countries

	Mauritius	Seychelles	Réunion	Comoros	Madagascar
Minimum	−0.014	−0.010	−0.01	−0.004	−0.012
Maximum	0.022	0.032	0.012	0.014	0.097
Median	0.0014	0.002	0.0018	0.014	0.07
Mean	0.007	0.0010	0.002	0.022	0.054
Standard Dev.	0.004	0.0012	0.017	0.048	0.067
Jarque-BeraValue	121.8	283.0	153.4	657.8	547.5
Observations	231	231	231	231	231

The summary statistics of the inflation rate indices presented above show that the highest disinflation was found in the Comoros (Min = 0.004) and the highest inflation was found in Madagascar (Max = 0.097). The average inflation was the highest in Madagascar (Mean = 0.054). Inflation was the most consistent in Madagascar (S.D. = 0.067).

The methodology of Diebold and Yilmaz (2012) according to the time-domain inflation spillovers are shown in table 2. Column-wise, we can see the contribution of one country's inflation to the forecast error variance in the other country's inflation. Row-wise, we can see the contribution of the inflation of all other economies to the forecast error variance in a particular economy's inflation. The total spillover index (SI) is found to be 25.03%. This indicates that less than one-fourth of the global forecast error variance in inflation for IOC countries comes from spillover.

Table 2: Time-domain inflation spillover

Contribution From (→) To ()	Mauritius	Seychelles	Comoros	Réunion	Madagascar	Contribution from Others
Mauritius	61.9402	4.64*	1.827	13.272	8.0199	48,08
Seychelles	6.829	70.39	4.102	5.537	5.2703	32,99
Comoros	2.0797	5.81	47.04	18.172	12.88	20,61
Réunion	1.9502	8.2901	5.90	70.77	4.83	19,26
Madagascar	1.3503	3.5301	3.857	7.847	14.298	25,99
Contribution to own and others	19,98	28,35	33,81	20,54	31,64	∑(Contribution to others) = ∑(Contribution from others) = 120.65
Contribution to own and others	78.8501	85.7588	70.826	130.251	128.7236	∑(Contribution to own and others) = 482
Net inflation spillover	−21.14	−1.232	−29.22	40.222	-28.728	

Spillover Index (SI) = (120.65/482) x 100 = 25.03

The figures in the row and column represent the proportion of the forecast error variance in inflation contributed from/contributed to other countries. For example, * indicates that Mauritius' inflation contributes to 4.64% of the forecast error

variance in the inflation of Seychelles. Similarly, the number also indicates that 4.64% of the forecast error variance in the inflation of Seychelles is contributed by the inflation of Mauritius. A negative number in the net inflation spillover row indicates that the country is a net receiver of inflation. The net inflation spillovers are calculated as the difference between the inflation spillovers transmitted to others and the inflation spillovers received from others.

Table 3: IOC: Inflation 2005-2010

Country	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Comoros	3,0	3,4	4,5	4,8	4,8	2,6
Mauritius	4,9	9,0	8,8	9,7	2,5	2,5
Madagascar	**18,4**	**10,8**	**10,4**	**9,2**	**9,0**	**9,0**
Seychelles	0,6	-1,9	5,3	37,0	31,8	-2,4
IOC Average	6,7	5,3	7,3	15,1	12.1	2,9

Source: IMF - Regional economic perspective: Sub-Saharan Africa, October 2010.

rEverything seems to indicate that Réunion Island poses no risk to the Indian Ocean region in terms of inflation, but a more in-depth analysis of the IOC's macroeconomic aggregates cannot be made without mentioning the case of Réunion.

2.1 Reunion Island

The issue of integrating Réunion into regional trade is a delicate one. The island's economic, cultural and linguistic exchanges are mainly with mainland France. As a result, the island's globalization is mainly based on its dual membership of France and the European Union (Laurent Sermet, 2002). Within COMESA, which is open to some twenty countries, including the four IOC members, Réunion has been granted observer status. In 1995, the IOR ARC (Association des États riverains de l'Océan Indien) was created. Fourteen member states belong to it, including Mauritius and Madagascar. France has been granted membership on behalf of La Réunion. All in all, the integration of La Réunion into its regional space remains to be defined.

As far as trade is concerned, the island is more focused on France than on its neighboring countries. In other words, it doesn't carry much weight in terms of trade. On the other hand, its full weight is felt when it comes to the IOC's financial resources.

The IOC budget for 2022 amounts to 1.44 million euros (M€), including 1.35 M€ in statutory contributions and 90,000 euros in donations from China, an observer member. In terms of statutory contributions, France is the main contributor (40%, or 540,000 euros), followed by Madagascar (29%), Mauritius (20%), the Union of the Comoros (6%) and the Seychelles (5%).

The IOC's main technical and financial partners are: the European Union (€87.1 million for the 2018-2022 period), the Green Climate Fund (€53.3 million) , the French Development Agency (€41.3 million), the World Bank (€11 million), the French Global Environment Facility (€3.2 million) and the African Development Bank (€1.7 million). Finally, the analysis of inflation on the island, our focus here, shows a lack of correlation of inflation shocks for Madagascar.

Table 4 Inflation shocks correlation in the IOC from 1985 to 2020

	Madagascar	**Seychelles**	**Mauritius**	**Comoros**	**La Réuion**
Madagascar	1	- 0.023	0.65	-0.074	-0.021
Seychelles	- 0.023	1	-0.054	0.014	-0.018
Mauritius	0.65	-0.054	1	-0.035	-0.365
Comoros	-0.074	0.014	-0.035	1	0.006
La Réuion	-0.021	-0.018	-0.365	0.006	1

Reunion is more oriented towards France than it is towards the IOC countries. It's tempting to draw parallels with what's happening in France to predict what's going to happen on the island. According to INSEE statistics, consumer prices on the island are rising more slowly than in France. Over one year, prices rose by 2.9% on Reunion Island, significantly less than in mainland France (+5.1%), and less than in previous months. As the graph below shows, imported inflation from Reunion (or France) is not to be feared either for Madagascar or for the other IOC countries.

Graph 1 : Inflation rate in Maurice, Madagascar and France

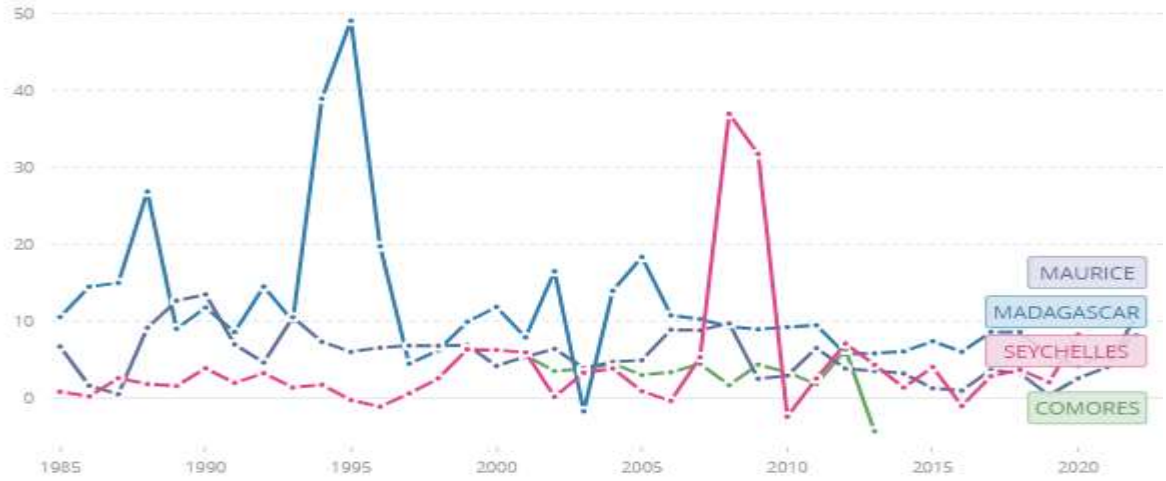
Source: Word Bank, database, 2020

A closer look at this graph shows an interesting fact; the curve of inflation in Mauritius follows similar pattern compared to what happened in Madagascar. In the next sub-section, we'll take a closer look at the extent to which Madagascar must follow the inflation trend in this neighboring island.

2.2 Mauritius

Over the past 58 years, the inflation rate for consumer goods in Mauritius has fluctuated between 0.3% and 42.0%. For the year 2022, an inflation rate of 10.8% has been calculated. From 1964 to 2022, the average inflation rate was 7.3% per annum.

Graph 2 : Inflation rate in the IOC (without La Reunion)



Source : Word Bank, database, 2020

An analysis of the structure of Malagasy exports to IOC member countries. Since 2010, Madagascar's main customer has been Mauritius. Madagascar's exports to Mauritius average around 73 billion Ariary (one euro is worth around 4500 Ariary). Reunion and Seychelles are in second and third place respectively.

Table 5 : Madagascar export towards IOC country members from 2010 to 2017 (Billions of Ariary)

Pays	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Comoros	12,989	22,207	21,902	19,185	17,170	14,869	18,237	4,320
Mauritius	51,762	35,973	36,95	51,984	76,294	85,245	157,679	95,566
Réunion	37,61	43,167	30,747	38,067	48,705	54,675	51,295	8,304
Seychelles	11,162	8,297	9,904	11 ,989	7,263	13,51	23,401	2,086
Total	**113,523**	**109,644**	**99,458**	**121,225**	**149,432**	**168,299**	**250,612**	**110,276**

Source : INSTAT, 2018 authors'calculation (CREAM)

Three groups of goods dominate Malagasy exports to the IOC: (i) mineral products made up of petroleum products and derivatives, (ii) textile products, mainly cotton, and (iii) animal products including shrimps and shellfish. In addition to petroleum products, shrimps and shellfish, the goods shipped to Reunion Island include textile products made up of clothing and accessories, as well as vegetable products including vegetables and spices (onions, garlic and pulses), petroleum products and derivatives, and timber.

Table 5 shows the structure of trade between IOC member countries and Madagascar, with goods from Mauritius predominating. These imports average around 206.545 billion Ariary, and even in 2017, when there was a drop in imports from IOC member countries, Mauritian goods continue to be the leading products imported from the IOC zone to Madagascar. They mainly comprise (i) textile products in the form of cotton yarns and fabrics, as well as knitted goods, (ii) stationery products and (iii) food preparations including pasta and noodles, salt and alcoholic beverages.

Table 6: Madagascar import from IOC country members from 2010 to 2017(Billions of Ariary

Pays	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Comoros	1,336	0,231	0,438	2,433	0,975	0,453	0,074	0,017
Mauritius	159,820	201,173	163,904	188,66	267,12	292,609	314,02	65,057
Réunion	6,017	3,264	3,843	3,816	17,29	11,151	50,552	10,948
Seychelles	15,247	38,781	21,503	13,81	13,684	12,602	34,452	1,559
Total	**167,173**	**243,449**	**189,688**	**208,719**	**299 ,069**	**316,815**	**399,098**	**77,581**

Source : INSTAT, 2018 authors'calculation (CREAM)

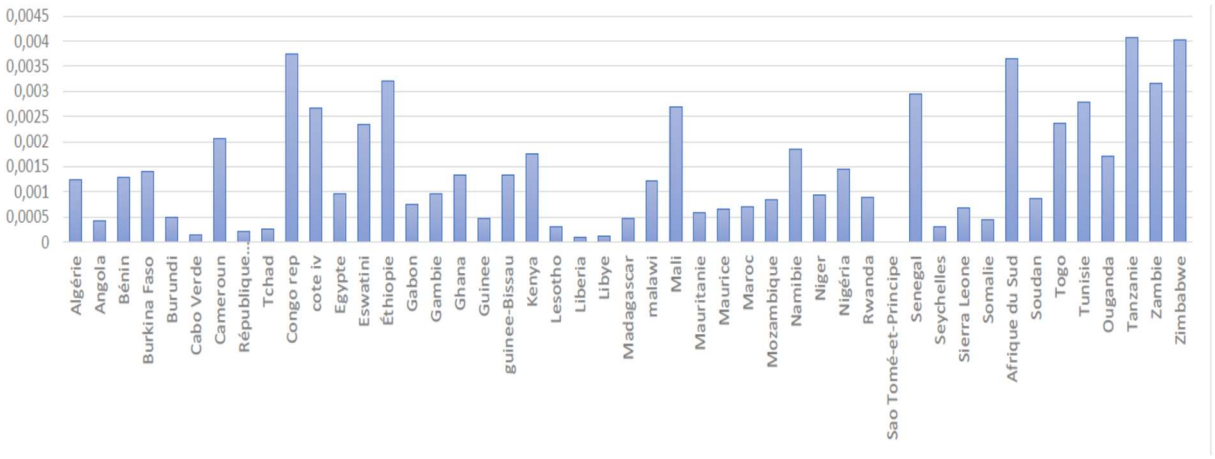
Imports from Seychelles include frozen fish, refined petroleum products and animal feed. Generally speaking, petroleum products and their derivatives, as well as cotton fabrics, account for the bulk of Madagascar's imports. Given that petroleum products are the main drivers of inflation in Madagascar. This corroborates the results of the econometric tests.

Basically, in terms of trade between Madagascar and IOC member countries, the Malagasy trade balance remains structurally in deficit, with the exception of trade with the Comoros. Products exported to the IOC zone are dominated by low-tech agricultural, animal and vegetable commodities and mining products, and are not really the most job-intensive. Imports far exceed exports. This deficit cannot be reduced without the implementation of reforms aimed at improving Madagascar's competitiveness in relation to other member countries.

2.3 The intensity of trade in the IOC

In the introductory part of our paper, we put forward the hypothesis that the country with which Madagascar trades the most presents the greatest risk of imported inflation.

Graph 3 : Trade intensity of African countries



Source : *Al SAMBOU and S. DIOP, from the data of the Direction of Trade StatisticsYearbook,2018*

Data from National Statistics from IOC countries allow us to deepen the analysis about inflation in the region. Analysis of regional integration in Africa shows that the majority of Indian Ocean countries are members of SADC and COMESA.

Table 7 : Intra regional trade(Billion USD)USD)

REC	Intra regional trade	Share of regional trade
SADC	34.7	84.9 %
COMESA	10.7	59.5 %

Source: AFrica EConomic DEvelopment Report, 2019

According to the data in that table, the intensity of regional trade within SADC makes this REC vulnerable to exogenous shocks. Indeed, if we consider only the transmission of inflation, we can say that the contagion effect would be minimal for COMESA (with only 59.5% of regional trade share) compared to SADC (with 84.9%). In our case, that of Madagascar, the Great Island can therefore expect more imported inflation from SADC than from COMESA if we're talking about intra-African trade. The information in above table reinforces the data in the following graph concerning countries and their trade intensity. Mauritius leads the IOC, followed by Madagascar and the Seychelles.

V. CONCLUSION

Our aim in this paper was to assess the mechanisms of inflation transmission, while highlighting the external factors likely to amplify or diminish the degree of transmission. The main hypothesis is based on the role of foreign trade as a genuine means of transmitting imported inflation. This hypothesis assumes that the intensity of inter-regional trade accentuates the transmission of inflation. To test this hypothesis, we used data supplied by the various ministries and national statistics institutes of the IOC member countries. Regional economic integration has never been the objective of the Indian Ocean Commission. Unlike *de jure regionalization* (also known as regionalism), de jure regional integration corresponds to a well-understood and legitimized initiative by the civil societies of nation-states, to that of the political powers. Regionalism is thus the result of a voluntary political initiative and gives rise to an institutional entity known as a regional organization), while *de facto regionalization* is the fruit of market dynamics. It is largely due to new forms of production organization, which favor the segmentation of the productive process (Oman, 1994), with companies as the main players.

At the end of this study, given the low intensity of trade between IOC member countries, the special status of Reunion Island and the multiple regional affiliations of IOC member countries, the results of our analysis show that Mauritius presents the greatest risk for Madagascar. Although the risk is minimal, we still need to keep a close eye on consumer price trends in this neighboring island. All the more so as Mauritius is the only Indian Ocean country to have ratified the FTA, with prospects for real income gains of 6.9%. According to the World Bank, Madagascar's share of exports to AfCFTA members would remain virtually

unchanged (9% in 2035 without AfCFTA and 10% with AfCFTA), while the impact on imports would be much greater, rising from 10% in 2035 without AfCFTA to 18% with AfCFTA.

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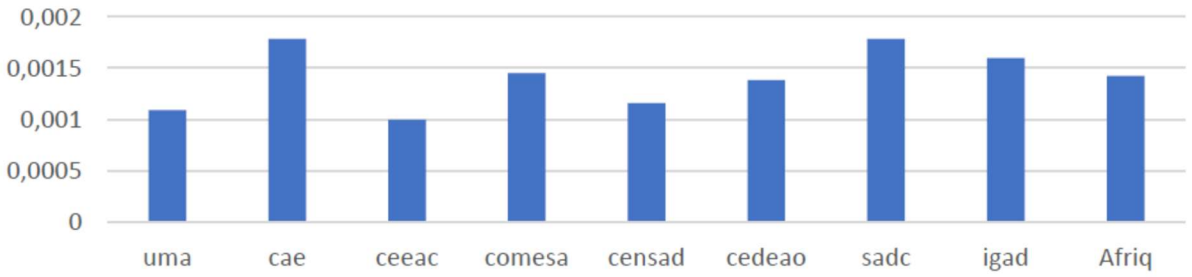
APPENDIX

Table: Volume of export and import of COI countries (without La Reunion) 2017

Country	Export		Import	
	Volume US 2017	**Var.% 2017/2016**	**Volume US 2017**	**Var.% 2017/2016**
Comores	-	29	0.3	15.1
Madagascar	2.8	20.3	3.6	22.8
Mauritius	2.4	0.1	5.3	13
Seychelles	0.6	23.5	1.4	29.9

Source : *Al SAMBOU and S. DIOP, from the data of the Direction of Trade StatisticsYearbook,2018*

Graph : Intra-REC trade intensity



Source : *Al SAMBOU and S. DIOP, from the data of the Direction of Trade StatisticsYearbook,2018*

Table : IOC – Convergence Index (Without Reunion)

Pays	Budget practices	Indebtment risk	Trade integration	Mean
Comoros		High (3)	Slow (3)	3
Mauritius	High (1)	Low (1)	Average (2)	1,3
Madagascar	Low (3)		Average (2)	2,5
Seychelles	Low (3)	High (3)	Slow (3)	3

Source ; IIRA, 2019

Table : Convergence group within the IOC (Without Reunion)

High	Medium	Low
Mauritius	Madagascar	Comoros
		Seychelles

Source ; IIRA, 2019

Graph : Inflation rate in the IOC

Source : Word Bank, database, 2020

Graph : Inflation rate of Madagascar and Comoros

Source : Word Bank, database, 2020