FINAL REPORT

ABIIS IMPORT INDEX -IAI
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ABIIS Aliança Brasileira da Indústria Inovadora em Saúde

Price Index for Medical Device Imports
ABIIS Import Index - IAI

Executive Summary

The present study aimed to verify whether the medical technology available in the Brazilian market is, in fact, becoming more expensive and increasing healthcare costs. The analysis was based on an index that maps the price at the port of the imported health product. The Laspeyres price index was used, and for the calculation of the price indexes, the products that were monitored were defined according to their relevance in the basket of goods of the companies associated with ABIIS. The survey of the data used to calculate the indexes took place at the ComexStat database of the Ministry of Economy, from where the value and quantity of each item in the health care product basket was collected. The product items are based on the Mercosur Common Nomenclature (NCM's) and are the same used in the methodology adopted for analyzing the trade balance of entities affiliated to ABIIS. The study showed that, in the twelve-year period from January 2008 to December 2020, there was an average growth of 0.7% p.a. in the prices of the global basket representing medical devices, which meant a real increase of 9.6% in the prices of imported products, converted to the real and updated by the IGP-M, in the twelve years analyzed, represented by the IAI-Geral.

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Summary

1. Introduction

This work is an initiative of ABIIS - Brazilian Alliance of Innovative Health Industry, which aims to verify if the medical technology available in the Brazilian market is, in fact, becoming more expensive and increasing health costs, since this argument it has been widely used by system actors. The imported product corresponds to 40% of the apparent local consumption, if we consider the entire basket of codes of the Mercosur Common Nomenclature (NCM) imported by the companies represented by that entity. Therefore, it was decided in this first study to build an index of the evolution of the prices of Brazilian medical device imports, which was called: “ABIIS Import Index - IAI”.

Thus, this document presents a detailed description of the methodology that was adopted by the sectorial Web team to calculate the price and quantity index associated with Brazilian imports of medical technology products. The issues addressed here range from discussions on the theory of index number construction, choice and characteristics of data and their sources, composition of the basket of goods to be monitored, among others. Thus, it was possible to provide the reader with a description of the procedures adopted for the construction of the indexes, present the results of their calculations and the conclusions of the analysis of the evolution of the prices of imported health products with data from the period 2008 to 2020 and indexes calculated for the period from 2009 to 2020, according to the tables.

2. Note on number of indexes

The calculation of price or quantity variation is a simple task when the consumer (producer) consumes only one good (input) and consumes (produces) only one product. In this simple case, the variation in cost reflects the variation in the price of the input in question. As more than one item is systematically produced, problems arise with aggregation and weighting of different variations in prices and quantities. This is the discussion on which the so-called index number theory is devoted.

2.1 The types of indexes[1]

Index numbers are used to measure phenomena such as inflation of a basket of goods consumed (measure of variation in the costs of a basket of products consumed by a group of consumers), productivity of companies (variation in the amount of inputs used for the production of a given product unit) or production cost (variation of input costs used to produce a given good). In this sense, an infinity of index numbers can be proposed, as there are countless possibilities of combinations between prices and quantities of the various items produced and their inputs.

[1] POLLAK, Robert A. The theory of the cost-of-living index. Oxford University Press on Demand, 1989.

The indexes seek to break down the variation in value into prices and quantities. In the first case, they are called price indexes, and in the other case, quantity indexes. Therefore, the main indexes used in the literature are presented below. These are the Laspeyres, Paasche, Fisher and Tornqvist-Theil (Divisia) indexes. Laspeyres's consists in comparing the prices of a particular basket of goods (or inputs), evaluated in relation to the prices - or quantities - of the goods (or inputs) in the period to be adopted as a basis or parameter for comparison.

Thus, the Laspeyres-type price index consists of a weighted average of relative prices given by $\frac{p_i^1}{p_i^0}$, applied over weights, which are calculated based on the share of each item in the basket of goods (or inputs) consumed (or used) in the production of the product. in the initial period.

The formula for the Laspeyres price index is given by equation (1):

$$L_p^{0,1} = \sum_{i=1}^{N} \frac{p_i^1 q_i^0}{p_i^0 q_i^0} = \sum_{i=1}^{N} w_i^L \frac{p_i^1}{p_i^0} \qquad (1)$$

In which, $w_i^L = \frac{p_j^0 q_j^0}{\sum_{i=1}^{N} p_i^0 q_i^0}$

The quantity index of the Laspeyeres type is given by equation (2):

$$L_q^{0,1} = \sum_{i=1}^{N} \frac{p_i^0 q_i^1}{p_i^0 q_i^0} = \sum_{i=1}^{N} w_i^L \frac{q_i^1}{q_i^0} \qquad (2)$$

The difference is that, in this case, quantity relatives are used instead of price relatives. The Paasche index consists of comparing the costs of a given basket (of goods or inputs) valued at prices or quantities in the final period. The formula for the Paasche price index is given by equations (3) and (4).

$$P_p^{0,1} = \sum_{i=1}^{N} \frac{p_i^1 q_i^1}{p_i^0 q_i^1} = \sum_{i=1}^{N} \frac{1}{w_j^0 \left(\frac{p_i^1}{p_i^0}\right)} \qquad (3)$$

$$P_Q^{0,1} = \sum_{i=1}^{N} \frac{p_i^1 q_i^1}{p_i^1 q_i^0} = \sum_{i=1}^{N} \frac{1}{w_j^0 \left(\frac{q_i^1}{q_i^0}\right)} \qquad (4)$$

In which, $w_i^P = \frac{p_j^1 q_j^1}{\sum_{j=1}^{N} p_j^1 q_j^1}$

The Paasche-type price index consists of a harmonic average of prices (3), whose weights are calculated based on the share of each item in the basket of goods (inputs) consumed (used) in the final period. The index of quantities of type Paache is given by equation (4). In this case, changes in the index are measured based on the change in quantities between the periods considered.
Fisher's index consists of a geometric mean of the Laspeyres and Paasche indexes, described above. The Fisher price index is given by (5):

$$F_p^{0,1} = \sqrt{P_p^{0,1} L_p^{0,1}} \qquad (5)$$

The Fisher index of quantities is given by equation (6):

$$F_Q^{0,1} = \sqrt{P_Q^{0,1} L_Q^{0,1}} \qquad (6)$$

The Tornqvist-Theil (Divisia) index number measured from price differentials is given by (7):

$$TT_P^{0,1} = \prod_{i=1}^{N} \left(\frac{p_i^1}{p_i^1}\right)^{w_i^{TT}} \qquad (7)$$

In which, $w_i^{TT} = \frac{w_i^P + w_i^L}{2}$.

The weights are given by the average of the share of each expenditure in the product (or input) considered in the basket at the beginning and end of the period. The Tornqvist-Theil (Divisia) index number measured from quantity differentials is given by (8):

$$TT_Q^{0,1} = \prod_{i=1}^{N} \left(\frac{q_i^1}{q_i^1}\right)^{w_i^{TT}} \qquad (8)$$

The weights are the same defined in the same way as in the price index.

2.2 Desired Index Number Properties

Price indices must satisfy some basic properties considered ideal.
They are, namely: (i) Identity; (ii). Homogeneity; (iii) Proportionality; (iv) Determination; (v) Reversibility; (vi) Circularity.
The identity criterion says that if there is no change in prices (in the case of price index) and quantities (in the case of quantity index), the variation in the period must be zero, that is, the index number in the initial period must equal the index number in the final period.
The homogeneity criterion says that the index number must not change if the unit of measurement of the goods is changed. For example, if a certain item is now measured in pounds instead of kilograms.
The proportionality criterion concerns the fact that, if all price relatives (or quantities) are equal, that is, the variations in all items are equal, then the index must be equal to the variation value. For example: if all prices rise by “x” percent in a given period, the index must be equal to “x” percent.
The determination criterion says that the index cannot be null, infinite or indeterminate if a single price or quantity is null, that is, the index result cannot depend on a single item to be satisfactorily calculated. Finally, there is the criterion of reversibility. Calculating the price variation between the period between 0 and 1 and between period 1 and 0, the inverse result must be obtained, in such a way that both results cancel each other out, that is, if the index at 1 is “x” percent , bigger then
that of period 0, so the index between 0 and 1 must be “x” percent smaller.
The Laspeyres and Paasche indexes satisfy properties (i) to (iv). Fisher's index satisfies the properties of (i) to (v). Whereas the Tornqvist-Theil (Divisia) index satisfies them all.

2.3 Feasible index numbers

In many practical cases, surveying the weights each period is unfeasible due to operational and cost issues. This is the case, for example, with the consumer price index, which requires a detailed survey of the consumption habits of a large group of consumers who are monitored during a certain period. There is also a need to survey weights at every moment for the construction of cost indexes under the modalities: Paasche, Fisher and Tornqvist-Theil (Divisia) are calculated.
Technically, the answer to this type of restriction consists in using an update of the weights based on the global information of the index and on the relative prices of inputs.
At each period, the weights are modified, assuming that there were only variations in input prices and not in the amount used in them. In price indexes, this is a strong assumption, although it is widely used across all institutes. As for the calculation of a cost index, such a hypothesis – of no variation in the amount of inputs used – is much more reasonable since major technological changes do not occur during the periods in which the research for the initial definition of weights is carried out.
Items whose variations occurred above the global average have their weights corrected upwards, while items whose variations occurred below the average have their weights reduced.
This is the procedure also adopted by research institutes such as BLS (Bureau of Labor Statistics), IBGE (Brazilian Institute of Geography and Statistics), FGV (Getulio Vargas Foundation) and FIPE (Institute of Economic Research Foundation) among others.

3. Calculation of IAI price indexes

For the purposes of this study, the Laspeyres price index was used, and for the calculation of the price indexes, the products that were monitored according to their relevance in the basket of goods of companies associated with entities affiliated to ABIIS were defined.

3.1 Data collection

The survey of the data used to calculate the indexes took place at the ComexStat database of the Ministry of Economy, from where the value and quantity of each item in the health care product basket was collected. The product items are based on the Mercosur Common Nomenclature (NCM's) and are the same used in the methodology adopted by the Web setorial to analyze the trade balance of entities affiliated to ABIIS. The index maps the port price of the imported health product.
With the calculation of the price index, the quantity index can be implicitly calculated, discounting such variation from the variation in value. As the chosen price index is of the Laspeyres type, then the quantity index was Paasche.

3.2 Disaggregation level

In the case of the price index of imported products, it was decided to work at the eight-digit level of NCM's nationally. Although it is possible to work at an even higher level of disaggregation, such as by region of origin or destination, the level of disaggregation proved to be sufficient for the analyzed objectives. Value data were collected in monthly dollars and the relative price was calculated from the variation in the average price per unit of kilogram.
The weights were defined based on the participation of each item in the total imported by Brazil for the index universe in the first year for which the index was calculated.
Therefore, the calculated index was of the Laspeyres type of price.
The data sample covers the period from January 2008 to December 2020. Due to the discontinuity of data in the original source and the change of some nomenclatures, the index was calculated using the initial basket until December 2017.
From there, the basket was recomposed and the indexes were linked. This is a common procedure when there are relevant changes to the basket.
Another point to note is that the item weights remained relatively constant over time. SECEX original data are provided in foreign currency (USD).
Thus, to carry out its conversion into BRL, the average nominal exchange rate for BRL sales per USD provided by the Central Bank of Brazil was used.
The temporal evolution of the data can be seen in Figure 1.
The conversion of the index in current USD to BRL is made by multiplying the relative prices by the exchange rate variation in the period analyzed.

Finally, considering the need to adjust the index to remove the effects that inflation had on prices, data from the Broad Consumer Price Index calculated by the IBGE and the General Price Index calculated by the Getúlio Vargas Foundation were collected. The evolution of the index is given in Figure 2.

Figure 1: Exchange rate - sale - term average - BRL X USD

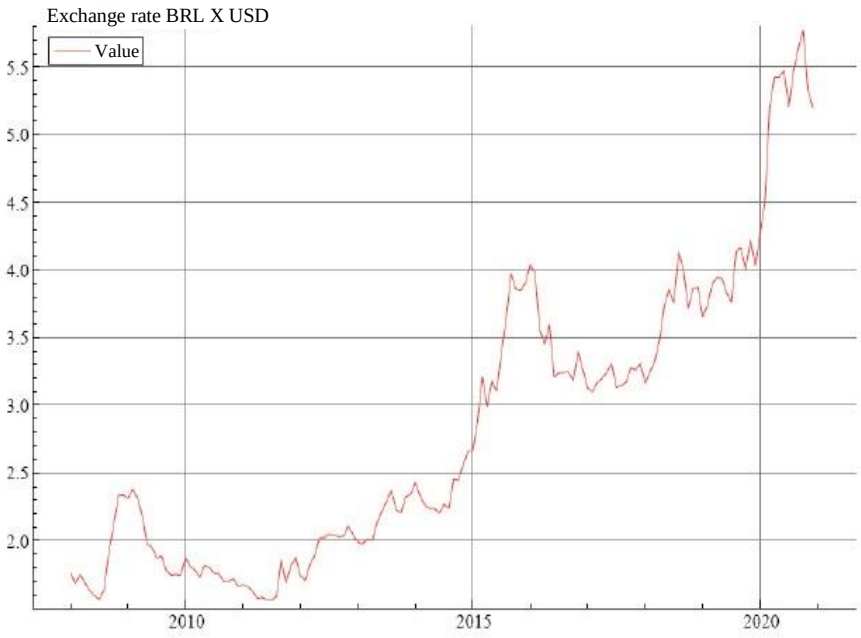
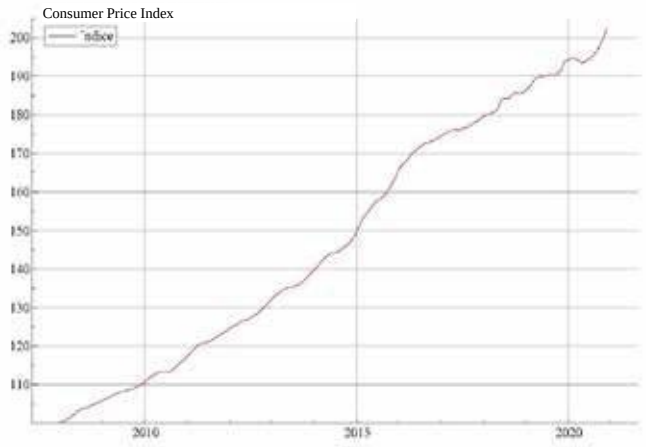
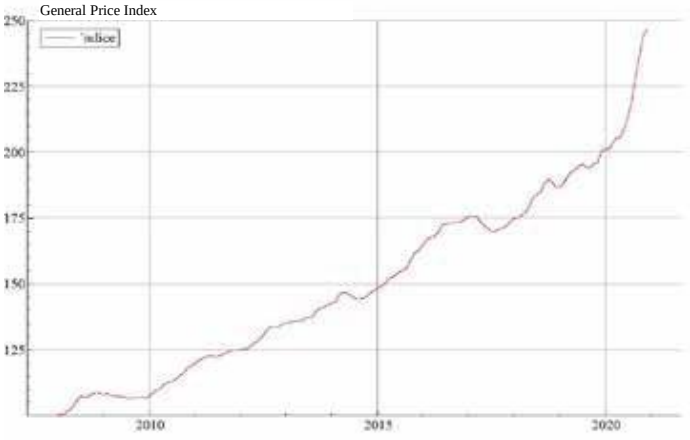


Figure 2: Evolution of the broad consumer price index (IBGE) and the general price index IGP-M (FGV)

Broad consumer price index (IBGE) General price index IGP-M (FGV)





1.1 Calculated indexes

The price indexes for imported products were calculated for 3 large aggregations. The first concerns the union of all NCM codes considered as medical devices. The sub aggregations were calculated for the product baskets of the key market segments of the sector. There is an overlapping of NCM's between the last two groups and therefore the "Total of ABIIS medical devices" index does not sum overlapped NCMs and cannot be viewed with the aggregation of the other indexes.

Table 1: Calculated indexes and their disaggregations

Aggregate	First Disaggregation	Second Disaggregation
Price index of imported medical devices		
ABIIS Import Index - General IAI	Health materials and equipment	Audiology
		Cardiovascular
		Other devices and equipment for hospital use including laser
		Equipment for diagnostic by imaging and its inputs
		Personal protective equipment (PPE)
		Equipment for laboratory
		Materials and supplies of medical-hospital use
		Materials and devices for dentistry
		Furniture for dental-medical hospital use
		Ophthalmology
		Orthopedics
	Implantable medical devices	OPME - Orthotics, Prosthetics, and Special Materials
		Support Material Equipment for OPME
	Reagents and analyzers for *in vitro* diagnostics	Reagents for In Vitro Diagnostics (IVD)
		Equipment and analyzers for IVD (excl. IT)

Source: Web setorial Consultoria Econômica

2. Results

2.1 ABIIS Import Index: IAI - General

Figure 3 presents the evolution of the ABIIS import index, General IAI in the following modalities: in current USD, current BRL and deflated by the IPCA and IGP-M. In the case of price indexes in USD, a certain stability was observed until 2014, with a decrease in 2015 and 2016, followed by a recovery and new decrease in 2016. When the index is corrected by the exchange variations of the period, it is possible to note a trend of continuous increase of the index in current BRL, due to the trend of depreciation of the Brazilian exchange rate, aggravated in conjunction with the process of tax deterioration, the political instability in the country, and the Covid-19 pandemic. Finally, when the correction occurs based on the Brazilian inflation, it is possible to note three cycles of prices throughout the entire period, one of ascension, before 2010, another from 2011 to 2016, and the third from 2017 to early 2020, with substantial oscillations in certain months. This suggests that the General IAI price index does not present a defined direction.

Figure 3: Evolution of the ABISS Import Index: General IAI | in current USD, current BRL, and deflated by the IPCA and IGP-M

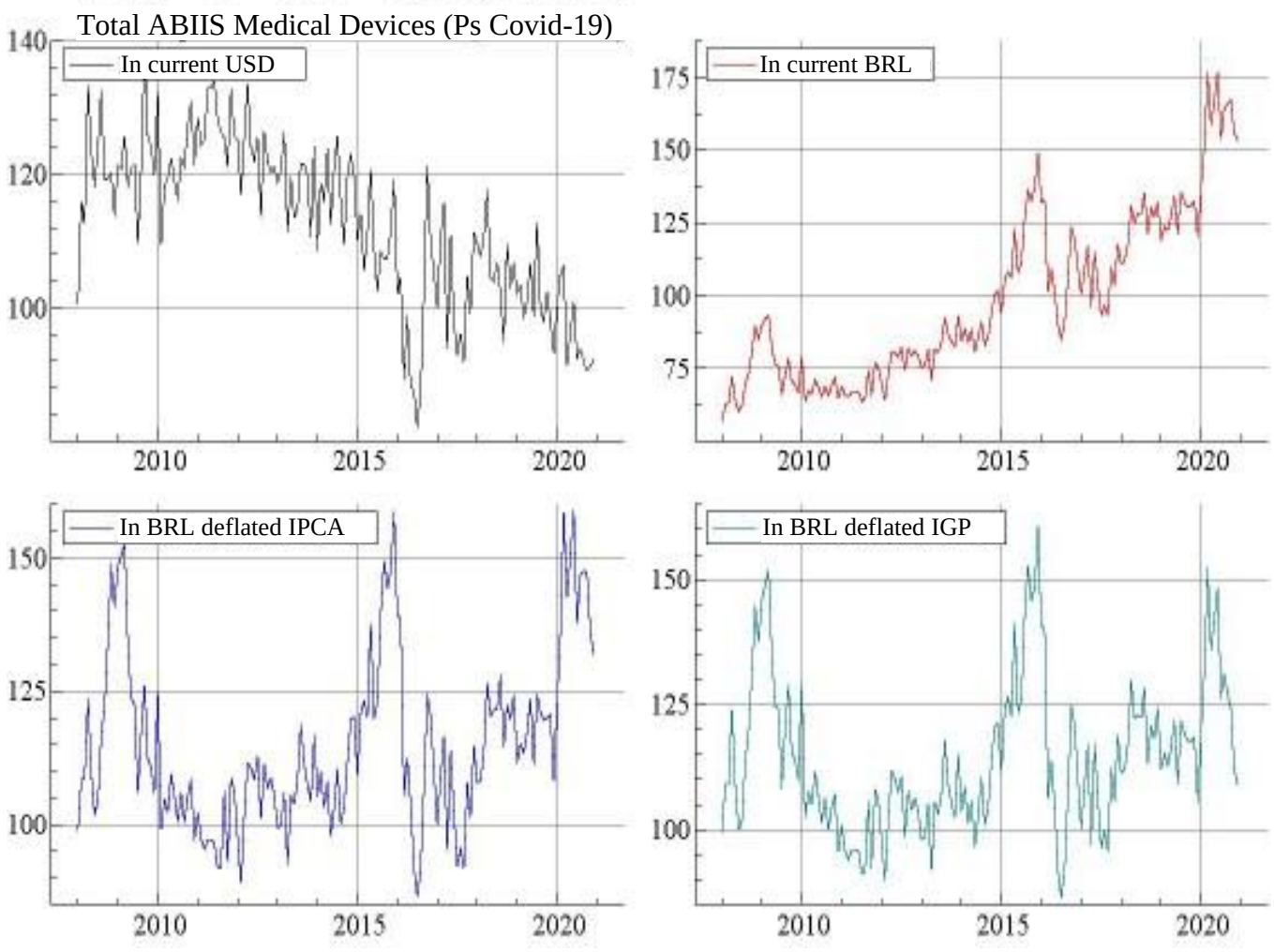


Table 2 presents the annual variations of the indexes represented in Figure 3, and Table 3 describes the annual and accrued average growth rate from 2009 to 2020 of the General IAI.

Table 2: General IAI index: Average in the year in relation to the average of the previous year | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	In Current USD	In Current BRL	In BRL deflated by the IPCA	In BRL deflated by the IGP-M
IAI - General				
2009	2.3	11.3	6.4	9.2
2010	-0.5	-12.0	-16.3	-16.3
2011	5.3	-0.1	-6.3	-8.2
2012	-3.9	12.7	6.9	6.5
2013	-3.7	6.9	0.7	0.7
2014	-0.6	7.9	1.5	2.5
2015	-6.2	34.6	23.2	26.0
2016	-11.1	-9.4	-16.4	-17.6
2017	3.9	-3.6	-6.9	-4.8
2018	4.3	19.4	15.2	13.1
2019	-4.9	2.1	-1.6	-3.8
2020	-5.1	25.9	22.1	12.4

Source: Web setorial Consultoria Econômica

Table 3: General IAI index: Annual and accrued average in the period | In annual and accrued average variation rates in the period (%) from 2009 to 2020

Medical device sector	Average annual growth rate 2009-2020	Accrued growth rate in the period 2009-2020
IAI – ABIIS Global Index		
In Current USD	-0.7	-8.4
In Current BRL	8.0	170.4
In BRL deflated by the IPCA	2.3	33.5
In BRL deflated by the IGP-M	0.7	9.6

2.2ABIIS Import Index: IAI- Health materials and equipment

Figure 4 presents the evolution of the ABIIS index of imports IAI- Health material and equipment – in current USD, current BRL and deflated by the IPCA and IGP-M. Table 4 presents the annual variations of the indexes represented in Figure 4, and Table 5 describes the annual and accrued average growth rate in the period from 2009 to 2020 of such index.

Figure 4: Evolution of the ABISS Import Index: IAI - Health materials and equipment | In current USD, current BRL, and deflated by the IPCA and IGP-M

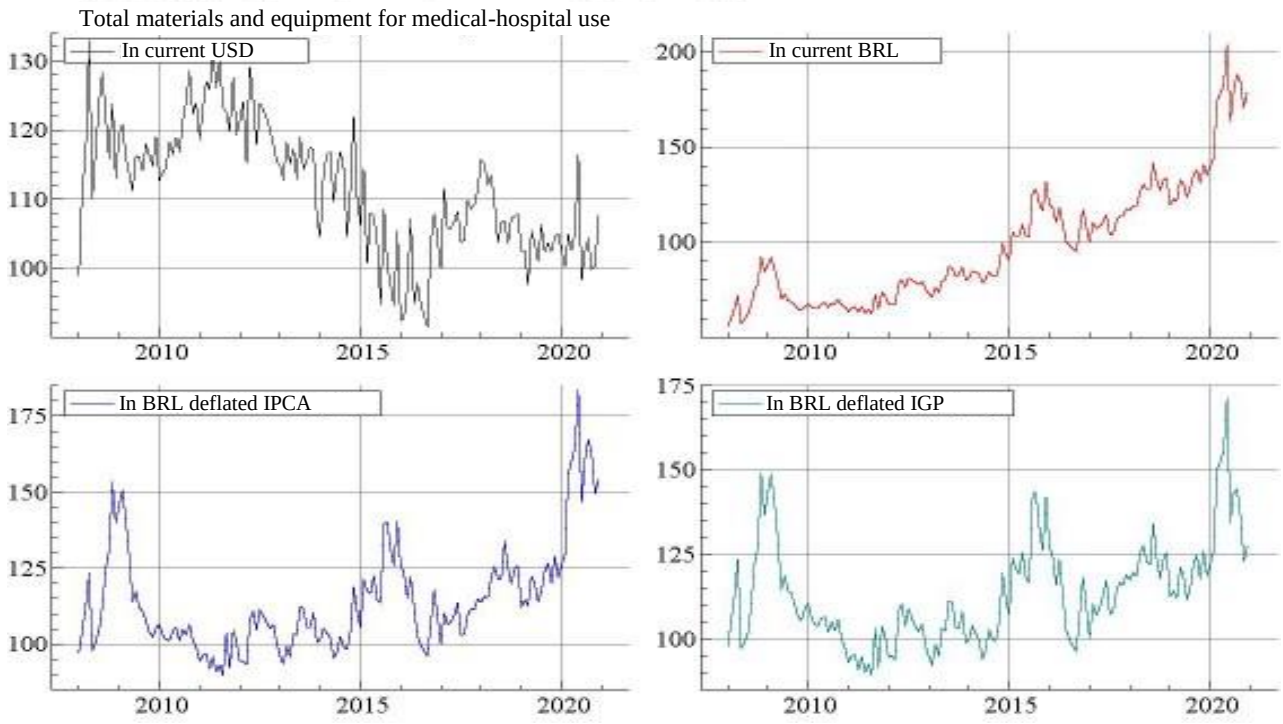


Table 4: IAI Index - Health materials and equipment: Average in the year in relation to the average of the previous year - Part I | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - Total of health materials and equipment												
In current USD	-1.3	2.6	4.4	-2.7	-5.0	-1.9	-8.3	-5.2	9.0	1.9	-5.5	0.7
In current BRL	7.3	-9.5	-0.8	14.1	5.5	6.4	31.2	-3.2	1.4	16.7	1.6	33.8
In BRL Def. IPCA	2.6	-14.0	-7.1	8.3	-0.7	0.1	20.2	-10.8	-2.1	12.6	-2.1	29.7
In BRL Def. IGP-M	5.3	-14.0	-8.8	7.9	-0.6	1.0	23.0	-12.1	0.3	10.5	-4.3	19.2

Source: Web setorial Consultoria Econômica

Table 4: IAI Index - Health materials and equipment: Average in the year in relation to the average of the previous year - Part II | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - Audiology												
In current USD	-23.6	13.0	12.2	-6.8	-12.9	6.7	-19.8	14.6	-8.1	-12.7	2.8	-14.1
In current BRL	-17.4	0.3	6.3	8.5	-3.4	15.9	13.3	17.8	-13.7	-0.6	11.1	12.7
In BRL Def. IPCA	-21.1	-4.4	-0.8	3.1	-9.0	9.1	4.1	8.0	-16.5	-4.1	7.0	9.2
In BRL Def. IGP-M	-19.2	-4.1	-3.0	2.8	-9.0	10.0	6.5	6.3	-14.5	-5.8	4.4	0.8
IAI - Cardiovascular												
In current USD	-6.1	-7.7	5.1	0.4	-13.9	-3.4	-11.4	-34.7	-3.0	3.4	-14.3	-1.6
In current BRL	2.1	-19.1	0.1	17.8	-4.4	4.9	26.7	-32.7	-10.7	18.3	-7.9	31.2
In BRL Def. IPCA	-2.3	-23.1	-6.1	11.7	-10.0	-1.4	16.0	-37.8	-13.9	14.1	-11.2	27.1
In BRL Def. IGP-M	0.2	-23.3	-7.7	11.3	-9.9	-0.4	18.6	-38.7	-12.0	12.0	-13.2	16.3
IAI - Other devices and equipment for hospital use - including laser												
In current USD	-9.7	9.8	0.1	2.1	-7.2	-3.2	-12.3	-5.9	-1.0	9.9	-11.6	1.7
In current BRL	-1.0	-2.7	-5.1	20.5	2.9	4.7	25.5	-3.7	-8.1	25.7	-4.9	35.2
In BRL Def. IPCA	-5.4	-7.4	-11.0	14.2	-3.1	-1.4	15.0	-11.2	-11.3	21.3	-8.3	31.2
In BRL Def. IGP-M	-2.9	-7.6	-12.7	13.8	-3.0	-0.6	17.7	-12.5	-9.2	19.0	-10.4	21.2
IAI - Imaging Equipment and its inputs												
In current USD	5.1	0.1	3.5	-5.0	1.4	1.0	-8.4	13.8	17.9	1.8	-1.8	2.0
In current BRL	13.3	-11.5	-1.9	11.5	12.6	9.8	31.0	15.3	10.2	16.6	5.5	35.7
In BRL Def. IPCA	8.4	-15.8	-8.0	5.7	6.0	3.2	20.1	6.1	6.6	12.4	1.7	31.4
In BRL Def. IGP-M	11.3	-15.8	-9.9	5.3	6.1	4.2	22.8	4.6	9.1	10.4	-0.6	20.8
IAI - Personal protective equipment (PPE)												
In current USD	-8.2	-15.1	-2.4	-10.1	-1.6	3.9	-3.3	-8.2	-17.2	5.0	-10.0	104.7
In current BRL	-0.6	-24.6	-6.9	4.7	9.7	11.8	40.4	-7.0	-23.4	20.3	-3.4	177.9
In BRL Def. IPCA	-5.2	-28.1	-13.0	-0.4	3.1	5.3	28.4	-13.9	-26.1	16.0	-6.9	169.3
In BRL Def. IGP-M	-2.9	-28.1	-14.9	-0.8	3.1	6.3	31.5	-15.2	-24.3	13.8	-9.0	145.3
IAI - Equipment for laboratory												
In current USD	-9.5	-7.6	1.3	-8.6	1.8	0.0	-1.4	-13.3	62.0	-6.0	-7.0	-0.7
In current BRL	-0.8	-18.9	-3.7	7.2	12.8	8.8	40.6	-11.2	50.7	7.3	0.1	31.8
In BRL Def. IPCA	-5.1	-22.9	-9.8	1.7	6.2	2.3	28.9	-18.1	45.4	3.6	-3.6	27.9
In BRL Def. IGP-M	-2.7	-22.9	-11.5	1.3	6.3	3.3	31.8	-19.3	48.9	1.7	-5.9	17.8

Table 4: IAI Index - Health materials and equipment: Average in the year in relation to the average of the previous year - Part III | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - Materials and supplies of medical-hospital use												
In current USD	3.3	6.5	10.1	-3.3	-4.6	-7.7	-6.5	-7.4	-0.2	3.0	-0.5	1.1
In current BRL	11.5	-6.1	4.7	13.4	5.9	0.0	34.3	-5.5	-7.4	18.4	6.6	34.6
In BRL Def. IPCA	6.7	-10.8	-1.8	7.6	-0.3	-5.9	22.9	-12.7	-10.7	14.1	2.8	30.3
In BRL Def. IGP-M	9.5	-10.8	-3.7	7.2	-0.2	-5.0	25.7	-14.0	-8.5	11.9	0.5	19.1
IAI - Materials and devices for dentistry												
In current USD	-24.4	34.2	1.4	-5.9	-14.6	4.4	-5.1	-5.8	34.3	10.6	-7.3	14.8
In current BRL	-16.1	18.6	-3.2	9.8	-5.4	14.3	35.3	-4.6	25.7	27.1	-0.4	53.2
In BRL Def. IPCA	-20.1	12.8	-9.3	4.4	-11.0	7.3	24.2	-12.1	21.4	22.6	-4.0	48.5
In BRL Def. IGP-M	-18.1	12.6	-11.0	4.2	-11.1	8.4	26.9	-13.4	24.3	20.3	-6.2	36.6
IAI - Furniture for dental-medical hospital use												
In current USD	-5.1	24.3	-7.8	7.2	-15.9	4.6	1.7	-20.0	38.6	5.7	-9.0	-17.6
In current BRL	4.4	10.4	-12.1	26.4	-7.5	12.9	42.5	-16.5	29.6	21.2	-2.5	10.0
In BRL Def. IPCA	0.0	5.0	-17.6	19.9	-12.8	6.1	31.3	-23.5	25.1	16.9	-6.0	6.8
In BRL Def. IGP-M	2.9	4.8	-19.2	19.2	-12.5	7.1	34.3	-24.6	28.0	14.7	-8.1	-1.8
IAI - Ophthalmology												
In current USD	22.3	0.6	-0.1	4.4	-3.3	3.4	-4.5	-18.1	-5.6	-9.9	-5.0	-2.3
In current BRL	34.9	-12.3	-4.8	21.1	8.4	11.3	37.2	-15.6	-13.3	3.4	2.0	30.6
In BRL Def. IPCA	29.1	-16.7	-10.9	15.0	2.0	4.9	25.5	-22.0	-16.4	-0.3	-1.7	26.7
In BRL Def. IGP-M	32.2	-16.5	-12.7	14.7	2.0	5.7	28.6	-23.1	-14.5	-2.1	-3.9	16.6
IAI - Orthopedics												
In current USD	45.9	2.2	6.5	0.2	-0.7	-0.1	-9.8	-13.8	16.1	-8.4	-0.7	-4.9
In current BRL	58.8	-9.6	1.1	16.6	11.1	7.8	29.9	-11.9	7.7	4.7	7.1	25.8
In BRL Def. IPCA	51.5	-14.0	-5.2	10.8	4.4	1.5	18.9	-18.7	4.0	1.0	3.2	22.0
In BRL Def. IGP-M	55.2	-14.0	-7.1	10.6	4.3	2.4	21.7	-19.9	6.3	-0.8	0.7	12.3

Source: Web setorial Consultoria Econômica

Table 5: IAI Index - Health materials and equipment: Annual and accrued average in the period - Part I | In annual and accrued average variation rates in the period (%) from 2009 to 2019

Segments	Average annual growth rate 2009-2020	Accrued growth rate in the period 2009-2020
IAI - Total of health materials and equipment		
In current USD	0.6	8.7
In current BRL	9.4	220.8
In BRL Def. IPCA	3.6	58.4
In BRL Def. IGP-M	2.1	30.0
IPiDM - Audiology		
In current USD	-2.7	-29.7
In current BRL	5.8	107.4
In BRL Def. IPCA	0.2	2.4
In BRL Def. IGP-M	-1.3	-15.9
IPiDM - Cardiovascular		
In current USD	-2.8	-30.3
In current BRL	5.7	105.8
In BRL Def. IPCA	0.1	1.7
In BRL Def. IGP-M	-1.4	-16.6
IAI - Other devices and equipment for hospital use - including laser		
In current USD	-3.2	-34.2
In current BRL	5.3	94.3
In BRL Def. IPCA	-0.3	-4.0
In BRL Def. IGP-M	-1.8	-21.3
IAI - Equipment for diagnostic by imaging and its inputs		
In current USD	4.6	78.8
In current BRL	13.7	427.9
In BRL Def. IPCA	7.7	160.7
In BRL Def. IGP-M	6.1	114.0
IAI - Personal protective equipment (PPE)		
In current USD	-3.0	-32.1
In current BRL	5.5	100.5
In BRL Def. IPCA	-0.1	-1.0
In BRL Def. IGP-M	-1.6	-18.7

Table 5: IAI Index - Health materials and equipment: Annual and accrued average in the period - Part II | In annual and accrued average variation rates in the period (%) from 2009 to 2020

Segments	Average annual growth rate 2009-2020	Accrued growth rate in the period 2009-2020
IAI - Equipment for laboratory		
In current USD	1.1	15.5
In current BRL	10.0	241.0
In BRL Def. IPCA	4.1	68.4
In BRL Def. IGP-M	2.5	38.2
IAI - Materials and supplies of medical-hospital use		
In current USD	1.7	25.1
In current BRL	10.6	269.2
In BRL Def. IPCA	4.8	82.3
In BRL Def. IGP-M	3.2	49.7
IAI - Materials and devices for dentistry		
In current USD	6.7	131.5
In current BRL	16.0	583.4
In BRL Def. IPCA	9.9	237.6
In BRL Def. IGP-M	8.2	177.0
IAI - Furniture for dental-medical hospital use		
In current USD	3.2	50.2
In current BRL	12.2	343.6
In BRL Def. IPCA	6.3	119.1
In BRL Def. IGP-M	4.6	79.8
IAI - Ophthalmology		
In current USD	-5.9	-54.5
In current BRL	2.3	34.4
In BRL Def. IPCA	-3.1	-33.6
In BRL Def. IGP-M	-4.6	-45.5
IAI - Orthopedics		
In current USD	-2.3	-25.7
In current BRL	6.3	119.2
In BRL Def. IPCA	0.6	8.3
In BRL Def. IGP-M	-0.9	-11.1

Source: Web setorial Consultoria Econômica

2.3ABIIS Import Index: IAI - Implantable medical devices

Figure 5 presents the evolution of the ABIIS index of imports IAI- Implantable medical devices – in current USD, current BRL and deflated by the IPCA and IGP-M. Table 6 presents the annual variations of the indexes represented in Figure 5, and Table 7 describes the annual and accrued average growth rate in the period from 2009 to 2020 of such Index.

Figure 5: Evolution of the ABISS Import Index: IAI - Implantable Medical Devices | In current USD, current BRL, and deflated by the IPCA and IGP-M

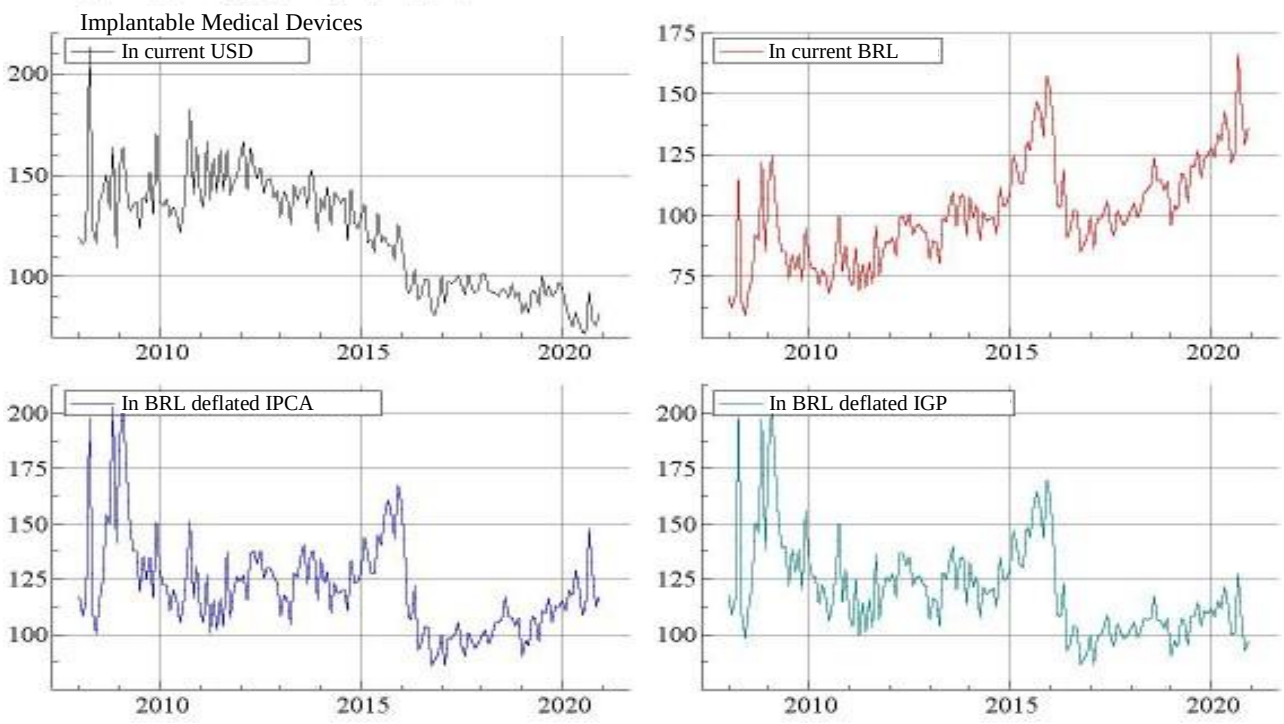


Table 6: IAI Index - Implantable medical devices - Average in the year in relation to the average of the previous year - Part I | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - Implantable medical devices												
In current USD	4.2	-1.1	4.8	1.5	-8.1	-3.1	-10.2	-21.0	0.6	-2.0	-3.2	-11.0
In current BRL	13.3	-13.0	-0.2	18.7	2.4	4.8	28.5	-18.7	-7.2	12.3	4.1	17.7
In BRL Def. IPCA	8.4	-17.3	-6.4	12.6	-3.7	-1.3	17.7	-24.9	-10.5	8.3	0.4	14.1
In BRL Def. IGP-M	11.1	-17.4	-8.1	12.3	-3.6	-0.4	20.4	-26.0	-8.5	6.3	-1.9	5.0

Table 6: IAI Index - Implantable medical devices - Average in the year in relation to the average of the previous year - Part II | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - OPME - Orthotics, Prosthetics, and Special Materials												
In current USD	18.2	-5.5	3.3	-4.1	-10.8	-1.2	-11.9	-24.6	3.2	-2.4	-5.9	-8.4
In current BRL	26.7	-16.1	-1.5	11.7	-0.5	6.7	26.2	-22.3	-4.8	11.6	1.5	21.1
In BRL Def. IPCA	21.1	-20.2	-7.7	6.2	-6.4	0.4	15.6	-28.3	-8.2	7.7	-2.2	17.4
In BRL Def. IGP-M	24.4	-20.3	-9.5	5.8	-6.4	1.3	18.4	-29.3	-6.1	5.7	-4.5	7.9
IAI - Support Material Equipment for OPME												
In current USD	-13.0	6.3	7.1	9.6	-4.7	-5.4	-8.2	-16.9	-1.6	-1.4	0.3	-14.2
In current BRL	-3.5	-7.8	1.8	28.7	5.9	2.6	31.4	-14.5	-9.2	13.2	7.5	13.8
In BRL Def. IPCA	-7.7	-12.6	-4.4	22.0	-0.2	-3.4	20.2	-20.9	-12.5	9.1	3.6	10.3
In BRL Def. IGP-M	-5.5	-12.6	-6.1	21.6	-0.2	-2.6	23.0	-22.1	-10.5	7.0	1.3	1.4

Source: Web setorial Consultoria Econômica

Table 7: IAI Index - Implantable medical devices - Annual and accrued average in the period | In annual and accrued average variation rates in the period (%) from 2009 to 2020

Segments	Average annual growth rate 2009-2020	Accrued growth rate in the period 2009-2020
IAI - Implantable medical devices		
In current USD	-2.9	-31.5
In current BRL	5.6	102.4
In BRL Def. IPCA	0.0	-0.1
In BRL Def. IGP-M	-1.5	-18.0
IAI - OPME - Orthotics, Prosthetics, and Special Materials		
In current USD	-3.9	-40.4
In current BRL	4.5	76.0
In BRL Def. IPCA	-1.1	-13.1
In BRL Def. IGP-M	-2.6	-28.7
IAI - Support Material Equipment for OPME		
In current USD	-1.3	-15.9
In current BRL	7.3	148.3
In BRL Def. IPCA	1.6	22.7
In BRL Def. IGP-M	0.1	0.7

Source: Web setorial Consultoria Econômica

2.4 ABIIS Import Index: IAI - Reagents and analyzers for *in vitro* diagnostics

Figure 6 presents the evolution of the index of IAI - ABIIS prices - Reagents and analyzers for *in vitro* diagnostics – in current USD, current BRL and deflated by the IPCA and IGP-M. Table 8 presents the annual variations of the indexes represented in Figure 6, and Table 9 describes the annual and accrued average growth rate in the period from 2009 to 2019 of the IAI Index - Reagents and analyzers for *in vitro* diagnostics.

Figure 6: Evolution of the ABISS Import Index: IAI - Reagents and analyzers for *in vitro* diagnostics - in current USD, current BRL, and deflated by the IPCA and IGP-M

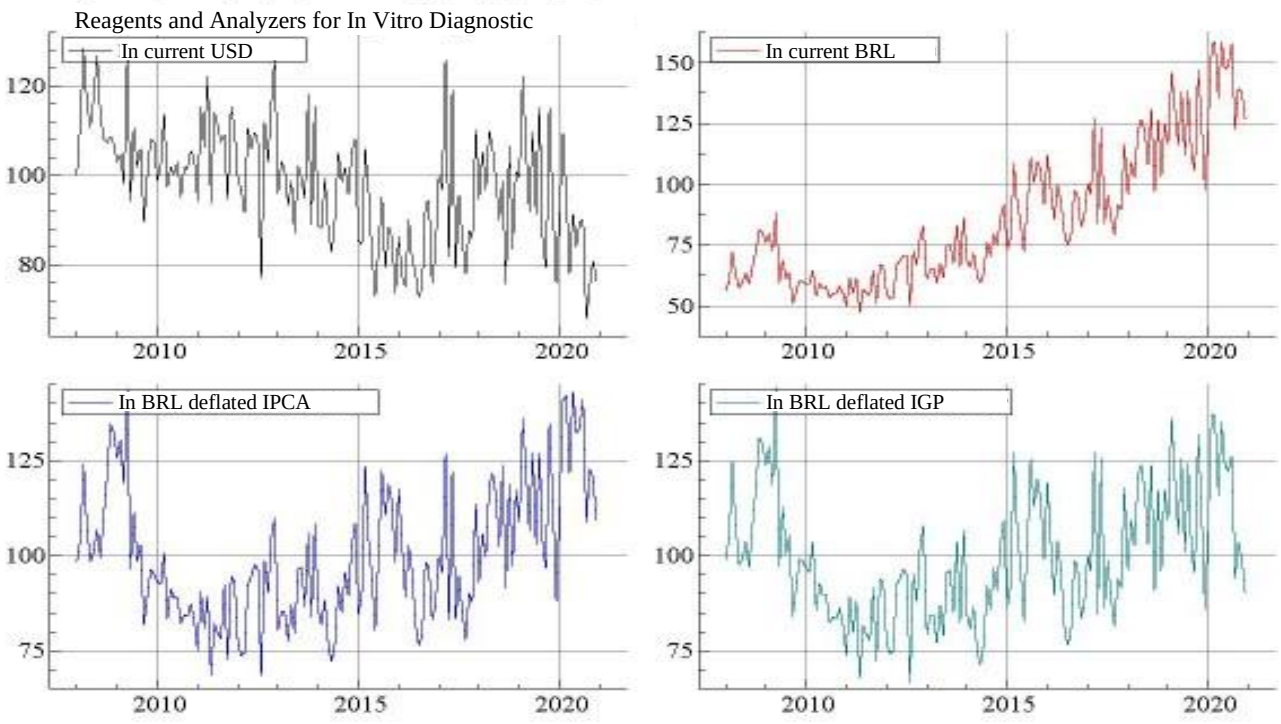


Table 8: IAI Index - Reagents and analyzers for *in vitro* diagnostics: Average in the year in relation to the average of the previous year - Part I | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - Reagents and analyzers for *in vitro* diagnostics												
In current USD	-7.7	-2.0	5.7	-2.9	-4.6	-3.9	-10.1	-5.0	16.4	1.9	1.3	-12.9
In current BRL	0.9	-13.6	0.4	14.1	5.6	4.6	28.4	-3.0	8.1	16.7	8.5	15.5
In BRL Def. IPCA	-3.6	-17.8	-5.9	8.1	-0.5	-1.7	17.7	-10.6	4.4	12.6	4.7	11.9
In BRL Def. IGP-M	-1.1	-17.8	-7.8	7.7	-0.4	-0.7	20.4	-11.9	6.7	10.7	2.3	3.2

Table 8: IAI Index - Reagents and analyzers for *in vitro* diagnostics - Average in the year in relation to the average of the previous year - Part II | Variations (%) in USD, in current BRL, deflated by the IPCA and IGP-M - Period 2009 to 2020

Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
IAI - Reagents for *In Vitro* Diagnostics (IVD)												
In current USD	-3.1	0.5	14.0	0.6	-7.0	-13.6	-6.4	-8.0	2.2	5.6	4.6	-25.0
In current BRL	5.5	-10.8	8.3	18.4	3.0	-5.9	33.5	-6.1	-5.2	21.1	11.8	-1.4
In BRL Def. IPCA	0.8	-15.1	1.5	12.1	-3.0	-11.5	22.5	-13.4	-8.5	16.8	7.9	-4.5
In BRL Def. IGP-M	3.4	-15.2	-0.5	11.7	-2.9	-10.6	25.2	-14.7	-6.5	14.8	5.5	-11.4
IAI - Equipment and analyzers for IVD (excl. IT)												
In current USD	-8.7	-0.5	-4.6	-4.4	-3.1	4.7	-14.9	-3.1	48.6	-8.7	-0.9	-6.2
In current BRL	-0.1	-12.3	-9.5	12.2	7.3	14.1	21.7	-1.0	38.1	4.3	6.7	24.5
In BRL Def. IPCA	-4.5	-16.6	-15.2	6.4	1.0	7.3	11.5	-8.7	33.3	0.7	2.8	20.7

Source: Web setorial Consultoria Econômica

Table 9: IAI Index - Reagents and analyzers for *in vitro* diagnostics - Annual and accrued average in the period | In annual and accrued average variation rates in the period (%) from 2009 to 2020

Segments	Average annual growth rate 2009-2020	Accrued growth rate in the period 2009-2020
IAI - Reagents and Analyzers for IVD		
In current USD	-2.1	-23.8
In current BRL	6.5	124.9
In BRL Def. IPCA	0.8	11.1
In BRL Def. IGP-M	-0.7	-8.8
IAI - Reagents for IVD		
In current USD	-4.0	-41.0
In current BRL	4.4	74.3
In BRL Def. IPCA	-1.2	-13.9
In BRL Def. IGP-M	-2.7	-29.3
IAI - Analyzers for IVD		
In current USD	-1.72	-20.1
In current BRL	6.87	136.0
In BRL Def. IPCA	1.19	16.6
In BRL Def. IGP-M	-0.34	-4.3

Source: Web setorial Consultoria Econômica

Table 10: IAI Index - Annual and accrued average in the period in BRL, deflated by the IGP-M | In annual and accrued average variation rates in the period (%) from 2009 to 2020

Segments	Average annual growth rate 2009-2020	Accrued growth rate in the period 2009-2020
General IAI Index	0.7	9.6
IAI- Health materials and equipment	2.1	30.0
IAI - Audiology	-1.3	-15.9
IAI - Cardiovascular	-1.4	-16.6
IAI - Other devices and equipment for hospital use, including laser	-1.8	-21.3
IAI - Equipment for diagnostic by imaging and its inputs	6.1	114.0
IAI - Personal protective equipment (PPE)	-1.6	-18.7
IAI - Equipment for laboratory	2.5	38.2
IAI - Materials and supplies of medical-hospital use	3.2	49.7
IAI - Materials and devices for dentistry	8.2	177.0
IAI - Furniture for dental-medical hospital use	4.6	79.8
IAI - Ophthalmology	-4.6	-45.5
IAI - Orthopedics	-0.9	-11.1
IAI - Implantable medical devices	-1.5	-18.0
IAI - OPME - Orthotics, Prosthetics, and Special Materials	-2.6	-28.7
IAI - Support Material Equipment for OPME	0.1	0.7
IAI - Reagents and analyzers for *in vitro* diagnostics	-0.7	-8.8
IAI - Reagents for *in vitro* diagnostics	-2.7	-29.3
IAI - Equipment and analyzers for IVD (excl. IT)	-0.34	-4.3

3. Conclusions

The study presented that, in the period of twelve years from January 2008 to December 2020, there was an average growth of 0.7% p.a. In the prices of the global basket representative of medical devices, meaning an effective increase of 9.6% in the prices of imported products, exchanged into the BRL and updated by the IGP-M, in the twelve years analyzed, represented by the General IAI.

The basket “Health materials and equipment” is expressed in Table 1 and is composed by products such as: catheters, suturing threads, syringes, needles, furniture for medical-hospital use, equipment for imaging diagnostic, etc. The analysis of this basket shows the effective growth rate in the prices of imported products, with an annual average of 2.1% and 30% accrued in the 12 years, with the following segments imposing conditions to raise the prices of the products represented by this segment, influencing its output: Furniture for medical-hospital use (4.6% p.a. and 79.8% in 12 years); Materials and devices for dentistry (8.2% p.a. and 177% in 12 years); Imaging Equipment and its inputs (6.1% p.a. and 114% in 12 years); Materials and supplies of medical-hospital use (3.2% p.a. and 49.7% in the twelve years in analysis). However, according to information of the 2020 Observatory, of the National Association of Private Hospitals - ANAHP [2], these materials and supplied represent 5.7% and the depreciation of the investments of approximately 2.8% of hospital costs, therefore representing the health Material and equipment of both being 8.5% of these costs. Therefore, an effective increase of 30% in the prices of health products, materials, and equipment will have an impact of 2.5% of the hospital costs accrued in the twelve years of analysis.

The basket of implantable medical devices, formed by orthotics, prosthetics, and special materials necessary for their use, has exercised an attenuating effect to the prices of the general index, with an average decrease of 1.5% p.a. and 18% in the 12 years. Consumers and agents payers of these products have claimed that they have been the main cause of the increase of health costs, but that was not revealed by the analysis of the aggregate basket of the IAI index - Implantable Medical Devices. Such finding does not impede one or other product composing the basket from presenting more substantial positive variations in the period. In global terms, the sum of imported OPMEs, considering them in separate in relation from the material necessary for their use, presented an annual average decrease of 2.6% in their prices and of 28.7% in the total of the past 12 years, always observing the indexes formed by the values of import operations in USD, exchanged into BRL and deflated by the IGP-M of the period. Equipment and materials of support, necessary for the implementation of these OPMEs or devices, such as bolts, threads, and other products, showed a decrease in their effective prices, of 0.1% p.a. and 0.7% in the twelve years of analysis. It is worthwhile noting that, according to data of the “Observatory of the National Association of Private Hospitals – ANAHP[2] of 2020, the OPMEs represent 6.6% of hospital costs.

2 http://anahp.com.br/produtos-anahp/observatorio/observatorio-2020 page 7, accessed on November 26, 2020.

Regarding the basket of Reagents and analyzers for *in vitro* diagnostics, the analysis shows an effective decrease in the price of imported products, with an annual average of 0.7% p.a. and of 8.8% in 12 years. It should be noted that reagents and analyzers, considered as "direct material and intermediation of exams" represent around 19.9% of the composition of ambulatory expenses in a clinical ambulatory[3]. Reagents, key products of the sector of *in Vitro* Diagnostic (IVD), presented an effective, average annual deflation of 2.7% p.a. and of 29.3% in twelve years. The imported Equipment and analyzers, necessary for the conduction of the in vitro tests, or IVD (excluding IT) also presented an average deflation of 0.34% p.a. and of 4.3% in twelve years, in the calculation of the products categorized in this segment.

The variations estimated by the General IAI and their sub-indexes refer to the prices of the products at the port. They do not carry the final values of these same products and adopted by the companies, neither the public procurement of public systems or private procurement, which provide medical services using these products.

The final prices of the products include the margins of profitability and additional values necessary to compensate the manpower allocated in the technical sale, the infrastructure of distribution and logistics, and the several gaps of efficiency of the Brazilian health system, such as: taxes, provision of non-paid services, disallowances, imposition of discounts, withholds, and delays of payments by specific payers.

However, an analysis of the deficiencies of the chain of value of health and its impacts to the final prices of medical devices is not the object of this study. Therefore, the general conclusion is that it is not possible to attribute the imposed pressures of costs in the public or private health to the increase of the effective prices of medical devices of only 9.6% accumulated in the period of twelve years, considering the restrictions of these conclusions regarding the final prices adopted by hospitals and clinics, as previously mentioned.

Moreover, the macroeconomic context has imposed additional pressure over the price of imported items due to the ongoing appreciation of the exchange rate, above inflation, since circa 2015. Such factor has contributed with the imposed pressure on medical devices, however it is an aspect beyond the players involved in the sector.

3 Extracted from Group Fleury - Report by the Management 2020, page 23, in: https://ri.fleury.com.br/fleury/web/conteudo_pt.asp?tipo=28880&idioma=0&conta=28 accessed on April 4, 2021

Table 11: IAI Index - Accrued in the period in BRL, deflated by the IGP-M | In accrued variation rates in the period (%) from 2015 to 2020

Jan-2015 to Dec-2020	Accrued growth rate in the period 2015-2020
IAI - GENERAL	-10.1
IAI - Health materials and equipment	13.9
IAI - Audiology	7.0
IAI - Cardiovascular	-30.2
IAI - Other devices and equipment for hospital use, including laser	-19.7
IAI - Equipment for diagnostic by imaging and its inputs	88.8
IAI - Personal protective equipment (PPE)	27.9
IAI - Equipment for laboratory	18.3
IAI - Materials and supplies of medical-hospital use	21.4
IAI - Materials and devices for dentistry	30.4
IAI - Furniture for dental-medical hospital use	4.1
IAI - Ophthalmology	-31.0
IAI - Orthopedics	1.1
IAI - Implantable medical devices	-22.9
IAI - OPME - Orthotics, Prosthetics, and Special Materials	-19.8
IAI - Support Material Equipment for OPME	-26.3
IAI - Reagents and analyzers for *in vitro* diagnostics	-17.5
IAI - Reagents for *in vitro* diagnostics	-47.4
IAI - Equipment and analyzers for IVD (excl. IT)	11.0

Source: Web setorial Consultoria Econômica