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Covid-19 and the Health Economic-Industrial Complex: structural fragilities and possibilities of facing the sanitary crisis

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Abstract

The aim of this study is to discuss the global dynamics of the production and innovation system of the Health Economic-Industrial Complex (HEIC), especially how structural fragilities have been made evident due to the emergence of COVID-19 pandemic. Drawing on this discussion, the paper intends to present an introductory reflection, though propositional, regarding measures that can stimulate internalization, development and utilization of some technologies included in the concept of "Revolution 4.0" not only as part of a socio- economic development project, but also as a way to fight the sanitary emergency.

Keywords: Covid-19. Health Economic-Industrial Complex (HEIC). Unified Health System (SUS). Industry 4.0. Production and Innovation System.

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1. Introduction

This article aims to briefly discuss how the global dynamic of productivity and innovation in the Health Economic-Industrial Complex (HEIC) has been affected by the Covid-19 pandemic outbreak. To this end, the present essay offers an introductory and suggestive reflection on how some of the technologies that are part of the "Revolution 4.0" can be promoted and used to fight both the sanitary emergency and integrate a long-term socioeconomic development project.

To achieve this aim, some structural fragilities of HEIC in Brazil will be investigated. We will discuss how its current setting,[1] especially its productive segments, hinders quick responses to the pandemic as much as it poses challenges to overcome structural vulnerabilities of the Brazilian public health system. In the third section, the circumstantial challenges that influence the previously presented structural issue and hinders the mobilization of all sectors at such a critical time. Finally, the last section presents a brief reflection on actions that could contribute to public action not only during the Covid-19 crisis, but also in the long term. This could concern productivity and technology matters regarding some HEIC subsystems in Brazil.

2. Structural Fragilities of HEIC

In Brazil's specific case, the pandemic exposed some structural fragilities in the public and private health care systems, as well as the setup of the other segments that integrate HEIC, especially in the pharmaceutical industry, the medical and hospital equipment industry, the personal protective equipment (PPE) industry and several subsectors associated with health services.

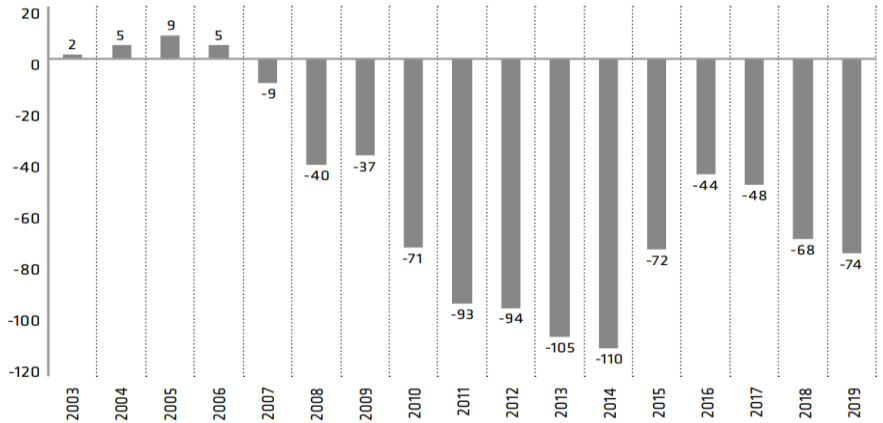
1 It must be mentioned that the HEIC health subsystems classification that was proposed and updated by Gadelha (2003; 2020) transcends the industrial sector, also incorporating the services sector. Three subsystems are identified after the methodology proposed by the author: (i) the chemical and biotechnological subsystem; (ii) the mechanical, electronic, and materials subsystem; and (iii) the services subsystem. This means that this analysis is not limited to the industry, especially the pharmaceuticals one. It also encompasses mechanical and electronic equipment and instruments, specialized and basic care services. Besides, the author highlights a new information and connectivity subsystem, defined from the emergence of "Revolution 4.0" activities.

Some of the structural vulnerabilities of the Brazilian economy, in a general way, and the transformation industry, in a particular way, directly affect several HEIC subsystems. This constrains its capacity of responding to the pandemic challenges and the society's demands concerning health.

Firstly, the long dismantling of the Brazilian productivity system deserves highlight. It began in the distant 1980s, also known as "the lost decade", and was accelerated in the liberalization decades, with the valued stock of the 1990-2010 years and deepened in the second decade of the 20th century. This article does not intend to discuss the causes and how extensive the deindustrialization process that harmed the country. However, we are going to mention some of its effects.

A first aspect to be considered relates to reduction or deactivation of the industry park in several industrial segments. This led to a significant increase of the trade deficit of manufactured products (Graph 1).

Graph 1 – Brazil: balance of trade of manufactured products, 2003-2019 (US$ billions)

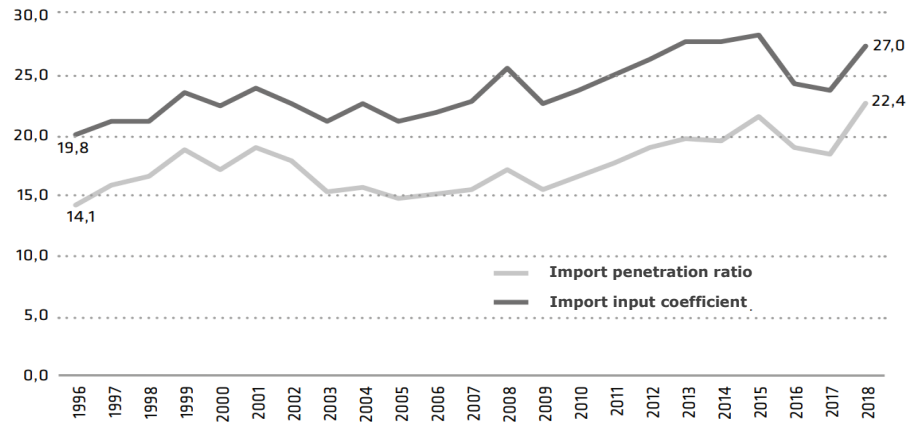


Source: Adapted from Secretariat of Foreign Trade (*SECEX*).

More than the deindustrialization in itself, there is also the issue of the decentralization and dismantling of the productivity chain. It has seen a

systematized increase in both the import finished goods coefficient and the industrial inputs imports. This resulted in the increase in the quantity of imported content. Moreover, a generalized denationalization can be observed. This results in loss of decision-making and strategic authority autonomy of Brazilian companies and the increase in the concentration of capital, with deleterious effects on competition and goods and services prices.

Graph 2 – Brazil: evolution of the import penetration ratio and the import input coefficient for the Transformation Industry, 1996-2018 (%)



Source: Adapted from the National Industry Confederation (*CNI*).

Finally, the ability to conduct research, development, and innovation (RD&I) at companies and public and private research institutions, was strongly affected by the above described processes. Consequently, there was an increase in technological dependency in several segments. Moreover, the insufficient industrial policy actions, which were virtually abandoned in the 1990s and saw a timid return in the 2003-2014 period, also contributed insufficiently to create a national innovation system in Brazil.

Secondly, the growing role of the State deserves highlight, whether it is when it provides public services, or when it articulates, funds, and demands

domestic offer of goods and services. The State had a decisive role in the modernization of Brazil. It led the industrialization effort and build, albeit in an incomplete way, the most advanced welfare state of the periphery of capitalism. The planned articulation between providing public services and offering goods and services, whether via state companies or national and foreign-capital private companies, was key to the Brazilian economic development, despite its incompleteness, especially with regard to reducing socioeconomic inequalities.

However, years of privatizations, deregulations, and fiscal austerity led to a growing underfunding and poor conditions of universal access to public services. Despite the prominent role played by HEIC globally as one of the productivity systems with the biggest opportunities regarding investments and innovation, the Unified Health System (SUS) structure has become vulnerable in the past few decades. This was also influenced by the widened access and the internal demand for health services. The technologies linked to the "Revolution 4.0," such as artificial intelligence and big data, have been playing an increasingly important role in the prevention, diagnosis, and disease treatment systems. This would highlight not only the changes that HEIC has been going through, but also the challenges posed to SUS, especially access to goods and services, its costs, and the growing dependency of import products, services, and technologies.[2]

These economic policy measures also resulted in the loss of the ability to stimulate companies. This stimulus was reduced both in the sphere of the then fundamental public funding to investment (not only in productivity capacity, but also in innovative activities), and in the coordination and integration of public policies (including purchasing power) and entrepreneurial activity.

These transformations caused structural fragilities in the Brazilian economy were intensified by processes that had been occurring in contemporary capitalism in the past decades. The following processes deserve highlight:

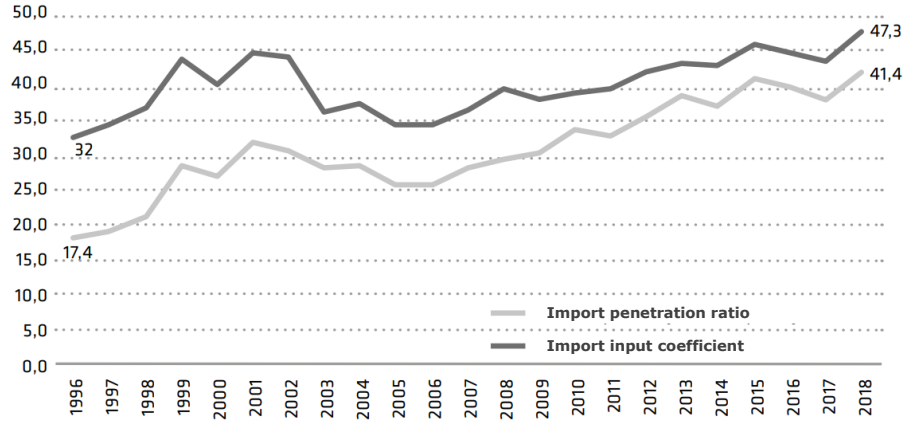
2 An adequate measure of the structural vulnerability of HEIC is the health balance of trade, which exposed the high import coefficient of the Complex.

a) The growing "financialization" of the capitalist activity, with influence on the scale and the international financial/bank system stability, as well as on the entrepreneurial activity. In this case, the growing concentration and centralization of capital and the big world corporations' changes in management, investment, and innovation strategies must be mentioned.
b) The technological revolution, which started in the 1980's "Third Industrial Revolution", was based on the expansion of microelectronics and telecommunications. From the 2010s on, it expanded towards other knowledge areas, e. g., artificial intelligence, biotechnology, and nanotechnology, evolving to the so called "Revolution 4.0".
c) The world production was reorganized and moved towards Asia. It was followed by productive deverticalization processes and an increase in trade flows and direct investments from abroad.

All these processes intensified the productivity and technological vulnerability that were mentioned above. Consequently, denationalization and concentration of capital, the deindustrialization and the weakened productivity chain, the imports dependency (Graph 3), and the technological gap with regard to what was most advanced in the world.[3]

3 For a discussion on the Brazilian industry technological delay, see IEDI (2017a, 2017b e 2017c).

Graph 3 – Brazil: evolution of import penetration and the coefficient of import industrial inputs for pharmachemical and pharmaceutical products, 1996-2018 (%)



Source: Adapted from the National Industry Confederation (*CNI*).

Both in the domestic and international fronts, the Brazilian economy has been facing even bigger challenges than those that it faced at the beginning of its development. HEIC was not immune to such fragilities and structural vulnerabilities even though its segments had a relatively higher degree of freedom to act in the past decades.

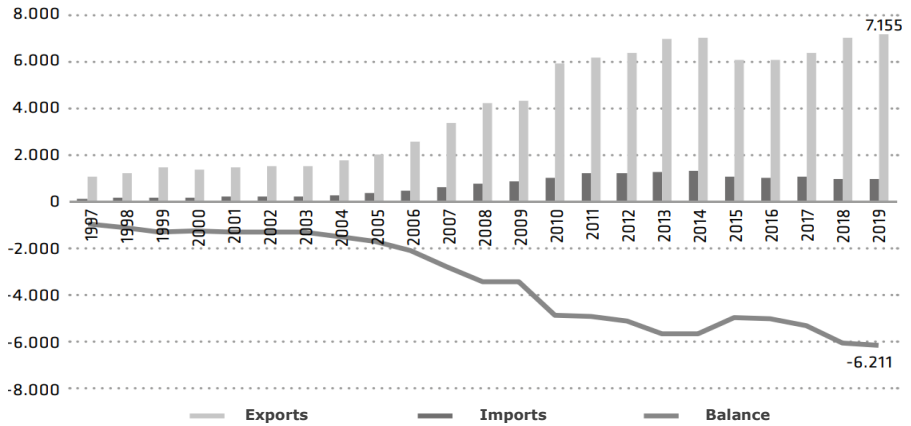
The existence, scale, and purchasing power of SUS, albeit underfunded; the growth of the private health care assistance sector, boosted by the increase in wealth in the 2003-2014 period; and the relative success of productivity and technology development policies[4] enabled sectors of HEIC to be a little less affected by increase of Brazil's productive and technological fragility. This was because the demand scale was noticeably expanded.

Nevertheless, this relatively better position did not prevent deindustrialization processes, denationalization, concentration of capital (with impacts on prices,

4 HEIC highlights in public policies coordinated by the Health Ministry, the public policies of the Greater Brazil Plan, the Productivity Development Policy, the financial lines of the Brazilian Development Bank (BNDES) and the Studies and Project Financing (*FINEP*), among others.

oftentimes due to international patents), and an increase of the productive and technological dependency from foreign countries. This particularly occurred in pharmaceutical, medical, and hospital equipment (see Graphs 4 and 5).[5] Likewise, the Complex's innovative capacity has been affected negatively. This took place in the entrepreneurial realm, led by big multinational companies that focus their RD&I efforts abroad, and at public research institutions, which are increasingly less funded.

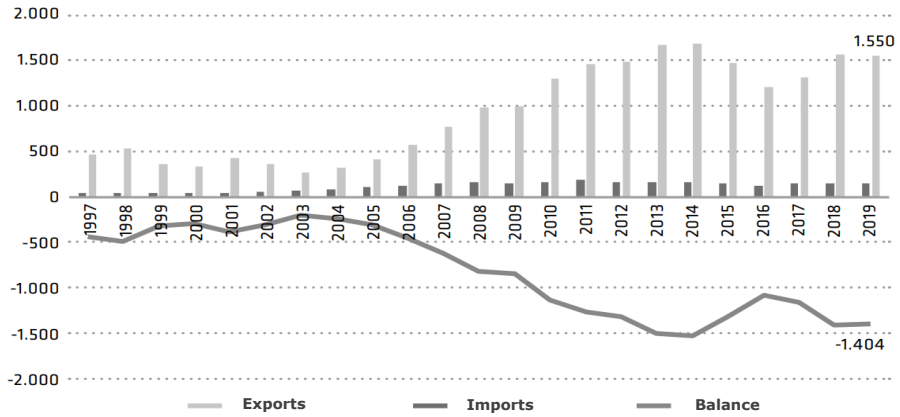
Graph 4 – Brazil: foreign trade of medicines and antibiotics, 1997-2019 (US$ millions)



Source: Adapted from Secretariat of Foreign Trade (*SECEX*).

5 The smallest margin for goods production and price negotiation occurs although a considerable percentage of products is not restricted to national production (regarding patients), and the World Trade Organization (WTO) endorses flexibility in the production of innovative products to address public health needs (Gadelha, 2020).

Graph 5 – Brazil: foreign trade of medical and hospital equipment, 1997-2019 (US$ millions)



Source: Adapted from Secretariat of Foreign Trade (*SECEX*).

The extension of the HEIC structural fragilities and the growing vulnerability of SUS emerged during the Covid-19 pandemic outbreak, especially in early 2020, as presented in the discussion in the following.

3. The pandemic outbreak and the emerging vulnerability

The Covid-19 pandemic had immediate impacts on both public and private health care systems, in Brazil and worldwide. Poor response of the public and private entities; hospital capacity overuse (a consequence of SUS's poor funding and fiscal austerity); lack of specialized workforce; and especially, the shortage (and the exponential increase in prices) of medical equipment such as test reagents, inputs, and PPEs revealed and amplified the structural fragilities of HEIC in Brazil (and particularly, SUS) at a critical moment. The imbalance between the emergency demand, which expanded and may continue at least in the next months, aligned with the insufficient (or excessively expensive) offer of goods produced in several segments of HEIC is a function of the loss of domestic productivity capacity, the dependency of

imports and the monopolistic and financial strategies of the great international players. This constitutes all structural fragilities mentioned in section 2 above.

These fragilities are amplified by an international context that deeply affected the already concentrated[6] world supply chain of goods that compose HEIC. The imbalance between supply and demand for these goods is a worldwide phenomenon. This led to an opportunist increase in dollar prices and caused a generalized shortage. There was not a sufficient growth in the offer so that it could keep up with the demand. Moreover, there has been a "regime of exception" among the main producer countries' trade policies and several consumer nations, particularly the richest and most affected by the pandemic (for example, the USA).

Measures such as forbidding/restricting exports to guarantee that domestic demands be met) and an almost predatory import contract violation to divert orders became commonplace. This has threatened several international cooperation initiatives to fight the pandemic.

In both cases, Brazil has been among the countries that were affected the most by such beggar-thy-neighbor policies, especially because dependency of import offer, even regarding simple goods such as PPEs. This dependency has never been so high as in the current exponential evolution of the pandemic in Brazil. Also, Brazil's diplomatic image has never been so tarnished, which pulls the country away from such a restrictive production and export circle of essential goods during the pandemic crisis.

Finally, the import goods offer is physically restrained by these predatory trade policies and is subject to a high increase in dollar and reais prices. The maxi-exchange devaluation[7] the Brazilian real has been suffering due to the financial-economic crisis that has been in gestation since 2019 also contributed to the escalating costs of product imports whose demand increased during the pandemic.

6 According to the WTO, Germany, the USA, and Switzerland concentrate 35% of the international offer of medical products (medical and hospital equipment, medicines, and medical inputs). However, China, Germany, and the USA are responsible for 40% of the world PPE exports. The international trade of essential products to curb the pandemic totaled almost US$ 600 billion in 2019 (WTO Secretariat, 2020).

7 PTAX800, the free exchange rate (sale) registered by the Brazilian Central Bank, saw a 38% devaluation between the last working day of May 2019 and that of 2020.

4. Actions towards mobilizing HEIC segments to fight the pandemic

The Brazilian health system's responses to the major challenges Covid-19 posed are below expectations, but close to what is possible. Considering the poor response of the economic and sanitary authorities and the vulnerabilities mentioned above, the professionals' and institutions' effort while executing actions to prevent and treat the pandemic deserves highlight.

By analyzing the most successful responses worldwide, it is noticeable that a universal health care system is crucial to mitigate the pandemic effects. Another relevant aspect is the decisive articulation between this system (in the public and private segments) and the other HEIC segments in order to execute successful sanitary defense actions and develop treatments and medicines.

To conclude, several technologies associated with the "Technological Revolution 4.0" gained more ground during the fight against Covid-19. For instance, technologies such as artificial intelligence and big data built in medical and hospital equipment, mobile devices, or assembled on software of different functions have been extensively used in controlling virus propagation, diagnoses, treatment monitoring, and developing and testing vaccines and medicines to fight infection effects.

Likewise, technologies such as additive manufacture (along with open source project diffusion) have been frequently used to decentralize (and expand due to this emergency) the offer of medical and hospital equipment, and above all, some types of PPE. The same thing applies for the growing use of sensors and other communication solutions to collect, compile, analyze, and diffuse of data that are key to treatment actions and develop pharmaceuticals. Not only do the recent technologies expand the efficacy of pandemic control processes, but also enable offer expansion, and in some cases, a reduction in HEIC goods and services prices.

However, the emergency use of these recent technologies in Brazil is restricted by circumstantial and structural fragilities alongside productivity and technology issues mentioned above. This revealed the challenges the

Brazilian public health system has to face in a more blatant way.

This study aims to be propositional, and it acknowledges that the critical situation Brazil is faced with must restate how important it is to expand SUS, reconfigure public policies, and reduce productivity and technological vulnerabilities. These measures must be taken to face Covid-19 and especially, reestablish the HEIC subsystems.

In this context, reflecting on the industrial policy as well as the necessary measures to overcome the very sanitary crisis does involve overcoming the obstacles to implementing a modern productivity system that will integrate the changes imposed by "Revolution 4.0." The system must be centered on productivity not the industry, as these changes are found in all HEIC subsystems. This is the reason the systemic character of such complex gains importance. The demand for high-complexity goods and services is also increased, as well as the demand for a highly-skilled workforce.

Overcoming the vulnerabilities faced by SUS while accessing and internalizing the above mentioned technologies, products, and services must be regarded as guarantee of citizenship to the population and sovereignty to the country. This will impede access to health from being subject to the international market conditions. Public policy proposals that will make HEIC restructuring viable as a dynamic, modern system transcend productivity and technological issues. Because these policies are focused on higher investments, job and wealth generation and innovations, they become the very strategies of a national development policy.

Despite the numerous challenges to overcome the structural fragilities of HEIC in Brazil, some actions could be either implemented or expanded during the pandemic or because of it. However, they must be maintained after the crisis. Some possible measures are listed below:

- Use of purchasing power and public bank credit to foster productive reconversions and/or initial investments to expand priority PPE equipment production.
- Mapping the needed competencies to manufacture them locally and reduce import dependency to a minimum.
- Stimulating RD&I to manufacture artificial intelligence technologies internally and analyze non-structured data (big data analytics), which

may have a profound effect in prevention, sanitary control, diagnosis, treatment, and other applications associated with Covid-19 and other transmissible diseases.
- Supporting development and massive production of tests to identify problems with inputs, capital goods, and other productivity capacities.
- Stimulating the use of new communication technologies built in mobile device applications for monitoring risk groups in large scale.
- Mobilizing and managing the use of additive manufacturing equipment to manufacture PPEs and equipment parts in a decentralized form.
- Participating in an effort to create vaccines and medicines to support treatment, especially through the Osvaldo Cruz Foundation (Fiocruz), other public laboratories with a likely cooperation with pharmaceutical companies.
- Mapping production capacity and probable issues with vaccine and medicine mass production, considering the probability of breaking patents.
- Stimulating the creation and traction of small, technology-based companies (startups) in the health segment, called "medtechs", to contribute with the development of recent technologies. They could either be linked with HEIC's big companies or not.

To conclude, the pandemic crisis helped emerge the urgent need to devise a national development strategy. Instead of deepening HEIC's dependency of import goods, it would promote the fight against denationalization of key sectors and the national apparatus that will drive public and private capital (whether national or foreign) to investments in the Complex subsystems.

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