Biological Diversity as a Source of Wealth: Myth or Reality? Lessons from the International Trade Competitiveness of Products from the Brazilian Medicinal Flora

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Abstract

A major justification for preserving biodiversity has been its value as an input to medicinal and pharmaceutical products. Some scholars have argued, however, that the potential for new product development did not provide a compelling economic argument for protecting biodiversity hot spots, and bio prospecting alone would not provide incentives for private landowners or companies to protect land for its pharmaceutical biodiversity values. This paper throws some light upon this controversy analyzing bio prospecting perspective in a mega diverse country: Brazil.The competitiveness of the Brazilian medicinal flora chain is examined using foreign trade indicators. From our results a new Brazilian dilemma emerges: on one hand, the country has one of the planets largest biodiversity reserves, on the other a low level of sector competitiveness is revealed. Brazil has been a frequent net importer of all medicinal flora production chain segments, with growing trade deficits as products have higher values added. The medicinal flora productive chain systemic competitiveness basically goes through the regulatory framework and the national industrial and technological policy. Economic incentives are essential so the great variety of medicinal plants can be transformed into high value added products and have a great effectupon the country´s sustainable economic development.

Introduction

The loss of biological diversity has been considered one of the most relevant global environmental problem for the last three decades. Although extinctions are difficult to observe and verify, the World Conservation Union(IUCN) provides an estimate of threatened species and it lists784 species worldwide that are documented to have gone extinct in the wildsince 1500. Over the past 20 years, 27 documented extensions have occurred (SEDJO, 2007).Major threats to biodiversity include habitat change, invasive alien species, pollution, andclimate change (CBD 2007). Nevertheless, certainly the primary cause of contemporarybiodiversity decline is habitat destruction and the degradation that results from theexpansion of human activities.

From an anthropocentric point of view, the values of biodiversity can be divided into three types: biodiversity as a global publicgood (i.e., biodiversity that provides global public benefits); biodiversity that providesnational or regional benefits, but involves externalities; and biodiversity that providesprivate goods. As argued by Sedjo (2007), the typical approach of economists is to argue thatthe private goods need no special policies outside that of the provision of appropriate andenforced property rights[1]. This third type of biodiversity potential valueis exactly the aspect we explore in this article.

[1] For local and regional public goods, appropriate policies, such as tax or subsidy policies usually are recommended. For global public good, some mechanism to provide global policies and perhaps global funding usually are deemed appropriate.

The global interest in the economic use of medicinal plants is not recently. Nevertheless, an increasing incorporation of medicinal flora in the development of phytotherapeutic products and in the identification of new molecules or basic prototypes for generating new synthetic medications has been observed (ABFITO, 2004). The phytotherapeutic trade is responsible for a significant part of the world medication market. It is calculated that of the world market of medications, estimated at US$ 300 billion per year, approximately 40% of medications are directly or indirectly from natural sources (being 75% from plants and 25% from animals and microorganisms)[2]. There are also studies in the USA that show the efficiency of medication directly originated or synthesized from natural products for the treatment of cancer and other infectious diseases (BRAGA, 2002)..

The trade of phytotherapeutic medication is increasing at an annual rate of 15%, being more evident in European countries such as Germany, France, Italy, and England and of course in Asian countries where medicinal plants are an expressive portion of the form of therapy presently available. In these countries, the present sanitary laws and rules for these products are generally rigorous in terms of quality and clinical efficiency and they are in many cases prescribed by doctors (ABFITO, 2004).Around 25 thousand specimens of plants are used throughout the world for medicine production, not only those synthesized from natural products, but also medications traded as phytotherapeutic.

More than a decade ago, Kate and Laird (2000) pointed out that the public imagination had been fired by the concept of the "medicinal riches of the rainforest". The argument these riches make for forest and biodiversity conservation. In particular, Brazil has been considered one of the countries with the greatest potential to economically explore its biodiversity for medicinal purposes. It is the country with the largest number of animal and vegetal specimens in the world, estimated at 10 to 20% of the world's total. Most existing plants are found in tropical countries and 25% of the specimens originally come from Brazil.

Being one of the mega-diverse countries of the planet, is Brazil competitive in the production of products derived from its medicinal flora? If not, why? In searching for answers to these questions, this article analyzes thecompetitiveness of the Brazilian medicinal flora production chain using foreign trade indicators. Typically, countries are net exporters of products that they have a higher revealed competitiveness and are net importers of products in which they are less competitive. We accept as a working hypothesis that the largest biodiversity economic potential is in the discovery of new drugs directly originated or synthesized from biological resources.

Methods and Procedures

How can the competitiveness of the Brazilian medicinal flora production chain be measured? Are there differences in patterns and competitive indicators between low and high technology content? As a rule, in classic and neo-classic economic traditions, competition is seen as the source of a more intense and efficient use of the production factors, being the most significant indicators for measuring it, production costs and productivity of used inputs. In terms of foreign trade, these arguments are presented in Smith and Ricardo's classic international trade theories, going through the Heckscher-Ohlin-Samuelson neoclassical model. In this model, it is considered that an efficient allocation can be measured from an understanding of which production countries specialize in what in the international trade arena.

Several meaningful criticisms of the classical and neoclassical views on competitiveness have been made by authors inside and outsidethe economic mainstream[3]. Among these criticisms, there are those related to new-institutional economy (NIE) and to the Schumpterian evolutionisttradition. Without going into a deep theoretical discussion, the main argument by NEI scholars has been to emphasize the relevance that institutional ambience has upon production chain productivity, especially due to the existence of transaction costs. By their side, evolutionists´ criticism highlights thatmore significant than evaluating the revealed competitiveness, we must understand how the dynamic process of innovation towards these competitive parameters happens.

[2] In Brazil, the estimate is that this market generates approximately US$ 1 billion dollars per year (BRAGA, 2002)

[3] This is an adjective given to the economic analysis linked free trade and free currency approach to international trade, fundamentally linked to the neoclassical tradition of Walras, Jevons & Marshall (amongst others).

In this context, Gadelha (2006) considers that especially for those activities linked to the health sector, it is relevant to consider the evolutionist arguments of systemic competition, mainly in the production chain where technological evolution is more relevant. We accept this argument and expand it to other sectors that develop biodiversity related products. Therefore, aspects related to innovation and industrial policies are essential in order to understand potentialities and bottlenecks on systemic competitive situations, mainly those in which technological innovation is a fundamental variable.

From an empirical point of view, there is a significant shortage of information on Brazilian biodiversity product chains, particularly on medicinal flora. Nowadays there is no data collected by IBGE (Brazilian Geographical and Statistical Institute – the census bureau) for the sector, which makes impossible to estimate production evolution indicators, number of employment generated, total amount of paid salaries, among others. Usual proxies, traditionally used in studies of the health production complex, are derived from foreign trade data, as in the studies by Ferreira (2002) and Gadelha (2003 & 2006).

In this paper, we have first defined medicinal flora production chain. This definition was based upon information collected through various interviews with specialists and leading investors in the sector. Based upon our elaborated diagram (see Figure 1), it was possible to observe how transactions in the production chain are established, to define the sources of competitive advantages as well as competitive bottlenecks within the production chain. Our methodological perspective based upon medicinal flora production chain design is similar to that of Lazzarini*et. al*. (2001). In their research a perspective based upon network transaction was adopted, which is more adequate for productive chains with high technological content.

Our second step was to adopt a unified commodity terminology (UCT) category classification to define products that constitute our previously definedmedicinal flora production chain. Following the steps of Ferreira (2002), products were re-classified from the previous Brazilian Commodity Terminology (BMT in the Portuguese anachronism) to the unified commodity terminology (UCT). In so doing, we had a significant difficulty in dimensioning some products of the production chain (in special, non-processed medicinal plants, juices and extracts, active principles and medication derived from medicinal flora, due to the existence of many generic categories in the old BMT and, particularly, in the newer UCT. After concluding our classification and verifying import and export values in the Aliceweb System[4], we grouped the data by pre-established productive segments in the medicinal flora production chain:medicinal plants and their parts, juices and extracts, active principles and medications from medicinal flora. After this, we calculated the general trade balance and the trade balance for each category, as well as import/export average prices.

As the third step of our methodological procedures, multiple regressions were estimated to evaluate the explanatory power of independent variables (real exchange rate, economic growth and regulatory framework) for the evolution of imports/exports within the medicinal flora production chain. Two similar econometric models were outlined. The first analyzes the behavior of total imports/exports within the medicinal flora production chain. The second model segments medicinal plants imports/exports*innatura*, its juices and extracts. This specific procedure was adopted particularly to analyze change in the institutional/regulatory framework over the entire production chain and also upon trade of its initial segments.

Thus, we have:

$$\mathbf{IMPT_t = a_0 + a_1T_{ct} + a_2PIB_t + a_3LEG_t + e} \quad (1)$$

$$\mathbf{IMPPM_t = a_0 + a_1T_{ct} + a_2PIB_t + a_3LEG_t + e} \quad (2)$$

Where[5]:

IMPTt= total import values of the medicinal flora production chain;
IMPPMt= medicinal flora, juices and extracts import values;
Tct = real currency exchange rate;

[4]Database belonging to the Ministry of Industry, Trade and Development.For more in depth details check site http://www.desenvolvimento.gov.br.
[5] Analogous equations were drawn for exports.

PIBt = real gross national product;
LEGt = existence of the RDC 17/00 – ANVISA[6];
e = random error or disorderly stochastic.

Models were tested in their specification (signals), that is, a positive proportional relation between Gross National Product (PIB) and the legal benchmarks used for the expected import levels. And an inversely relation was expected between currency exchange rate evolution (currency devaluation) with the import levels. The robustness of econometric patterns of the adjusted models[7]was verified by means of pertinent statistic tests ("t" de Student e "F" de Fisher).

Brazilian Medicinal Flora Production Chain: Basic Characteristics.

A general view of the medicinal flora production chain in Brazil is summarized in Figure 1. It comprises several combined production activities, which starts with the medicinal flora extraction, going through the group of industries that use them as raw material (cosmetics, medication and foodstuff). It then goes on to the wholesale firms, which represent a powerful oligopoly sector in this productive chain. From them, products go to retailers and subsequently to final consumers.

It is essential to keep in mind, however, as we have already observed, that in order to understand the dynamics of this production chain, the most appropriate approach is the one proposed by Lazzarini*et al.* (2001). In terms of networks, transactions do not necessarily follow a linear sequence from raw material producer, passing through industrialization and distribution to the final consumer. There are also transactions directly between raw material producers and final consumers, such as in the case of a medicinal plant being sold in fairs/markets throughout the country, often without the proper quality standards or health regulation.

Another striking characteristic of the Brazilianmedicinal flora production chain is its low innovation dynamism. A possible explanation for it is the small quantity of flora elements that are officially registered for industrial production. There are only nine species with this registration for medical production at the National Agency of Sanitary Vigilance (ANVISA). This is a preliminary evidence that the huge biodiversity exploration potential of the country is not used. Why does this happen? We can advance some hypothesis: 1) the great oligopolization of medicine and pharmaceutical production, both nationally and internationally, inhibits investment by small and medium Brazilian laboratories present in the sector; 2) the high cost of legal research procedures required by current legislation generates a large uncertainty in relation toinvestment returns; 3) absence of a more effective industrial and technological policy to stimulate medicinal flora research and its economic productive use; and 4) lack of a modern legislation related to the definition of property rights, allowing Brazilian laboratories to invest in mass production of medicinal flora products.

[6] It is a legal norm that brought in more rigid criteria for the registration of phytotherapeutic medicine, leveling them with other pharmaceutical industry categories.
[7]For analyzing the robustness of econometric models, various simulations were performed with linear and logarithmadjustments among endogenous and exogenous variables.

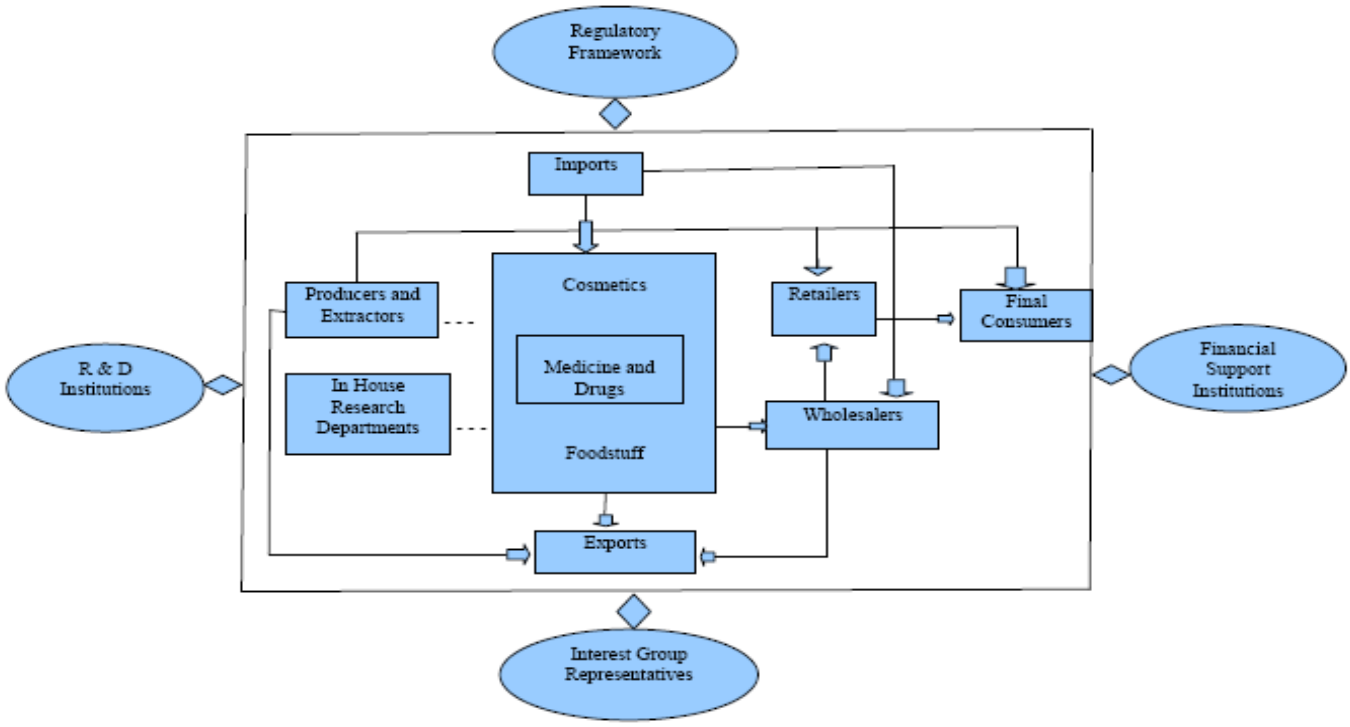


Figure 1: Medicinal Flora Production Chain: General Characterization

For the sector entrepreneurial leadership, particularly among those in national phytotherapic industries, there has been a situation of permanent crisis since the year 2000. In that year, the ANVISA Resolution No. 17/2000[8]was published and brought new criteria for registration of phytotherapic medications. These criteria made the national medicinal flora registration extremely difficult and therefore benefited foreign companies. As a consequence, Brazilian companies were forced to increase their raw material imports with a consequent increase in production costs (ABIFISA, 2007). Presently, another strong barrier for the use of the medicinal flora by the national enterprises is the extremely high costs ofresearch. These costs go from medicinal flora prospection to the pre-clinical and clinical testing phases. Sector representatives argue in favor of a revision the Brazilian industrial/technological sector policy in order to reduce these costs. In this new policy, credit and commercial stimulus instruments need to be reinforced. Another emphasis is on the revision of the phytotherapic medication production standard mechanisms. As matter of fact, in 2002 a proposal to modernize the legislation for registration of Brazilian phytotherapic medication was forwarded to the Brazilian Congress. This proposal was inspired by the Canadian legislation that regulates Natural Health Related Products. It creates new category of products, called Products for Health Promotion (PPS in the Portuguese anachronism), that will embrace the great majority of Brazilian phytotherapic medications. The proposed legislation also eliminates the need to carry out clinical tests on these products. These products must have their quality and security proved, but their effectiveness should be backed up by scientific evidence or by the literature that proves its ethnocultural use. There has been high expectation amongentrepreneurial leadership that this change can boost the entire production chain, stimulating orderly medicinal plant exploration up to the production of phytotherpicmedications. However, after almost ten years, this proposal is still under evaluation by Brazilian Congress members.

Brazilian Medicinal Flora Production Chain: Foreign Trade

Table 1 presents, based upon foreign trade data, revealed competition indicators of the Brazilian medicinal flora production chain. As a rule, Brazil is a net importer in all segments of the production chain. In 2006, imports were proportionally larger in the medical segments frommedicinal plants (79,2%), followed by medicinal plant active principles (17,2%), medicinal plant juices and extracts (2,7%) and medicinal plants and their parts (0,7%).

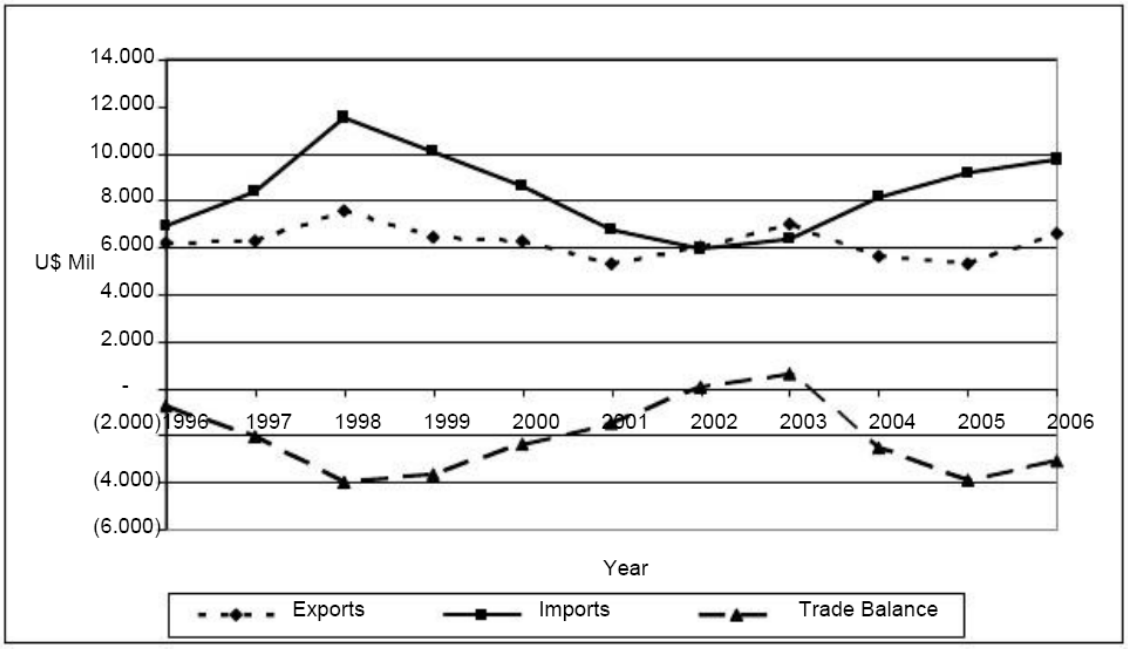
[8]Resolution by the Board of Director Collegiate.

Table 1
Foreign Trade Evolution – Medicinal Flora Production Chain
(thousand US$ FOB)
1996-2006

Merchandise	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Exports											
Medicinal Plants and parts	6.168	6.268	7.553	6.395	6.227	5.283	6.008	6.952	5.597	5.283	6.574
Medicinal plant juices and extracts	21.811	24.150	29.175	20.889	15.579	16.379	14.546	16.410	21.749	25.021	25.365
Medicinal plant active principle	53.530	54.820	46.868	43.516	45.343	29.994	24.451	27.355	40.625	45.973	43.223
Medicinal plant medicines	34.977	38.182	69.050	98.998	93.016	101.074	114.102	137.055	163.539	220.379	318.695
TOTAL	116.485	123.420	152.646	169.798	160.166	152.730	159.107	187.772	231.510	296.656	393.856
Imports											
Medicinal Plants and parts	6.901	8.341	11.516	10.033	8.573	6.772	5.963	6.352	8.153	9.184	9.695
Medicinal plant juices and extracts	24.171	24.305	26.672	27.167	26.544	28.349	27.433	27.592	29.488	32.914	37.000
Medicinal plant active principle	345.898	338.698	328.113	351.115	288.595	324.674	153.428	157.464	199.732	211.847	238.320
Medicinal plant medicines	366.860	422.947	594.045	737.763	640.967	669.480	646.881	642.536	782.009	811.694	1.082.585
TOTAL	743.830	794.291	960.345	1.126.078	964.679	1.029.274	833.705	833.944	1.019.382	1.065.639	1.367.600
Trade Balance											
Medicinal plants and their parts	(733)	(2.073)	(3.963)	(3.638)	(2.345)	(1.489)	45	600	(2.555)	(3.900)	(3.121)
Medicinal plant juices and extracts	(2.361)	(154)	2.503	(6.278)	(10.965)	(11.969)	(12.887)	(11.182)	(7.739)	(7.893)	(11.635)
Medicinal plant active principle	(292.368)	(283.878)	(281.245)	(307.600)	(243.252)	(294.680)	(128.977)	(130.109)	(159.107)	(165.874)	(195.098)
Medicinal plant medicines	(331.883)	(384.765)	(524.995)	(638.765)	(547.950)	(568.406)	(532.779)	(505.480)	(618.470)	(591.316)	(763.890)
TOTAL	(627.344)	(670.871)	(807.700)	(956.280)	(804.513)	(876.544)	(674.598)	(646.172)	(787.871)	(768.983)	(973.744)

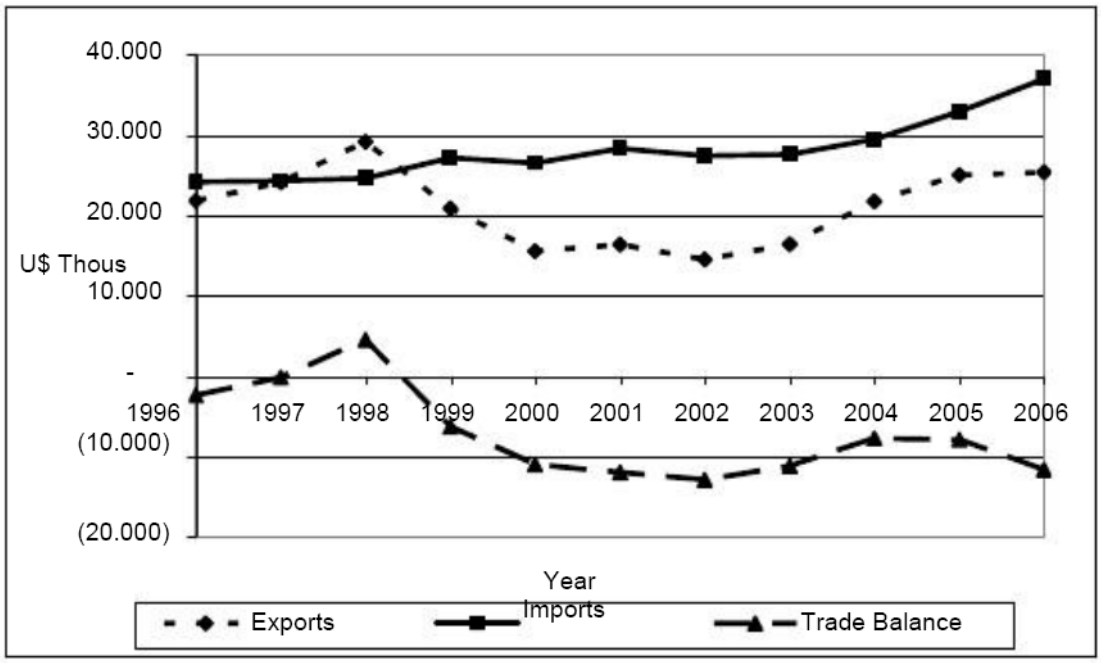
From 1996 to 2006, the foreign trade deficit of the entire production chain increased by 55%. In absolute terms this value was US$ 627 million in 1996, increasing to US$ 974 million ten years later. During this period, imports rose 83.9% reaching US$ 1,4 billion in 2006. On the other hand, exports rose 238,1% reaching US$ 394 million in 2006. Despite the significant improvement in the export performance during this period, Brazil is still a net importer in the medicinal flora production chain.

Similar trends are observed for each component of the production chain. Specifically considering the raw stage medicinal plant segment, an export growth of 6.6% was verifiedbetween 1996/2006. In the same period, imports grew 40.5%. The trade balance varied, therefore, from a deficit of US$ 733 thousand to a US$ 3.1 million deficit. These changes represented an increase of 325.8% during the 10 years-period studied (see Graph 1).Another segment is the medicinal plants, juices & extracts one. For it, exports grew 16.3% and imports grew 53.1%between 1990 and 2006. Sectorial foreign trade balance, therefore, went from a deficit of US$ 2.3 million to US$ 11.6 million, meaning a rise in the deficit of 392.8% for a period of 10 years. Data is summarized in Graph 2.



Source: MDIC (2007). Data worked with by the authors.

Graph 1
Foreign Trade Evolution – Raw stage medicinal flora and their parts
(Values in thousands US$ FOB) – 1996-2006



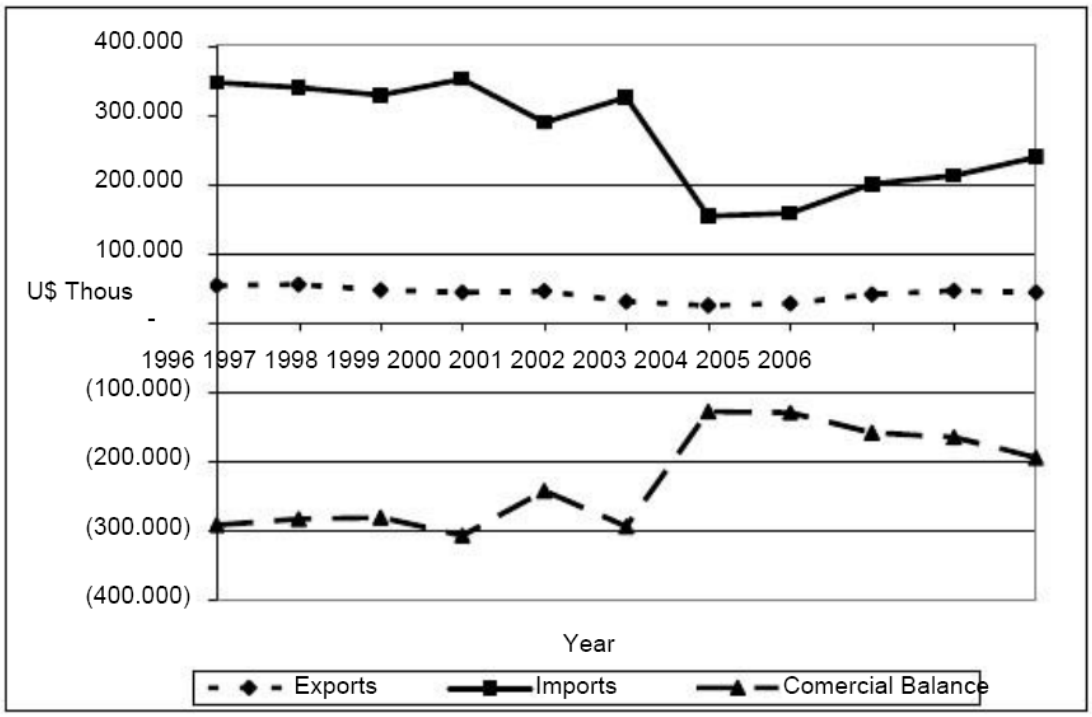
Source: MDIC (2007). Data gathered by the authors.

Graph 2
Foreign trade evolution – Juices & Extracts from Medicinal Plants
(Values in thousands US$ FOB) – 1996-2006

Considering the medicinal flora active principles segment, exports decreased19.3%, between 1996& 2006. During the same period, imports decreased 31.1%. Nevertheless, the foreign trade deficit went from a US$292.3 million deficit to US$ 195 million in the decade.

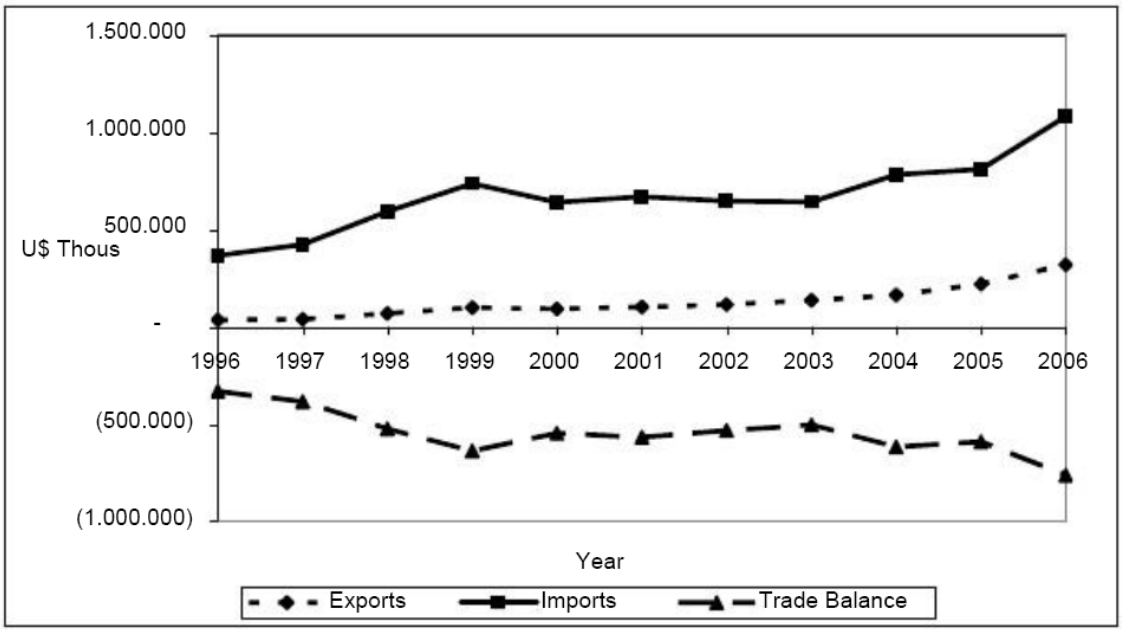
The reduction in the deficit was smaller (decrease of 33.3%) than expected due to the significant drop in the value of imports for the segment (See Graph 3). Finally, in segment of medications and pharmaceuticals derived from medicinal flora, exports grew 811.2% while imports grew 195.1%between 1996 and 2006. The foreign trade balance went from a deficit of US$ 33.8 million to US$ 763.8 million. This represented an increase in deficitof 130.2% during the period studied (Graph 4).

It is important to emphasize that in this last segment (medications and pharmaceuticals derived from medicinal flora), two simultaneous processes were observed: 1- the beginning of an import substitution processof principle actives from medicinal plants; 2 – a relative strengthening of Brazilian exports on medications from medicinal plants, which demonstrates a reasonable increase in Brazilian competitiveness in this sector. Nevertheless, this does not undermine Brazil's condition of being a large net importer of this segment of themedicinal flora production chain.



Source: MDIC (2007). Data gathered by the authors.

Graph 3
Foreign trade evolution – Principle actives from Medical Plants
(Values in thousands US$ FOB) – 1996-2006



Source: MDIC (2007). Data gathered by the authors.

Graph 4
Foreign trade evolution – Medications & Pharmaceuticals from Medicinal Plants (Values in thousands US$ FOB) – 1996-2006

Brazilian Imports in the Medicinal Flora Production Chain: Main Determinants

These surprising results for the international trade behavior in medicinal flora of a mega diverse country must be explained. What are the economic factors influencing the evolution of Brazilian imports[9] in the medicinal flora production chain? Have institutional factors - as Brazilian legislation changes in 2000 with the ANVISA RDC 17/2000 - affected import levels in this segment? Answers for these questions are provided in this final section of this paper. To do so we used the ordinary minimum square root (OMQ) method to estimateimport behavior models for the medicinal flora production chain, relating it with variation of the real exchange rate, economic (GNP) growth rate and adoption of the RDC17/2000 as a regulatory framework for the sector (See equations 1 e 2 presented earlier). This last variable was considered as a dummy type; that is, zero for when legislation did not exist and one as from legislation enactment.

Comparison of models was done by the significance level of the parameters, that is, through "t" Student test. The model that presented the largest number of significant variables, at a certain level of significance, was chosen.The inflation factor variation (VIF) test was applied to the models aiming at confirming if there was or not an elevated multicolinearity; that is, if there were values greater or equal to five. Considering that the values stayed below 5, it was demonstrated that there was no multicolinearity in the chosen models. Therefore, based upon the previously described process, two models were chosen. One has asdependent variable, the medicinal plant production chain total import level. The other model presents a cut out of the medicinal plant imports, their juices & extracts, because they represent a larger proximity than may have happened at the start of the production chain, especially with the legislation change.

In the first model (results in Table 2), with IMPTt (total import values of the medicinal flora production chain), the logarithmic form with exogenous and endogenous variables was chosen.

[9]Results presented in the previous section provide clear evidences that Brazil is a strong net importer of products of the medicinal flora production chain. In consequence, we have decided to present in this paper exclusively analyses for the determinant of import levels of the country and avoid the analysis of export determinants.

In the second model (see Table 3) with IMPPM t (import values ofmedicinal flora juices and extracts) the form chosen was logarithmic with exogenous variables and linear for endogenous because they present more significant statistic result.The econometric model results show that imports are largely influenced by currency regime changes, especially the constant currency valorization as from 2001. They were also largely influenced by variation in the economic growth rates. This was a tendency during the period analyzed (1996 to 2006). All the econometric tests ("F" Fisher & "t" Student), as well as the determinant coefficients (R^2) in Model 1 of 0,87 and Model 2 of 0,99, show that the explainable variable, in particular the real exchange rate and Gross National Product, detain great influence upon the variation of imports during the studied period.

Contrary to our expectations, however, changes in the regulatory pattern on registration phytotherapic medication generated by ANVISA RDC 17/2000 have had a relatively smaller effect on import increases of products of the medicinal flora production chain. Nevertheless, it is estimated that imports rose by U$2.91 million due to the regulatory framework change, which had a relatively small impact over the total value of imports (0,21%)[10].

Table 2
Estimate of the parameter of the total imports function within the Brazilian medicinal flora production chain. 2000–2006
Logarithmic form with the exogenous and endogenous variables (Model 1)

Explainable variables	Regression rate	Student test "t"
Constant	-4,410212134 NS	-0,929761438
Exchange rate	-0,644426784***	-2,536358669
GNP	1,21762899**	1,612410272
LEG	0,055860729 NS	0,835733236
Determination rate (R_2)	0,868657	
Statistical value F (6,613631558)	4,93*	

Source: Elaborated by the author
Significance level * significant at 1%
** significant at 5%
*** significant at 10%
NS non significant

[10] Note that the (LEG) variable did not achieve a significant level sufficient to infer in the accepted statistical error patterns. Nevertheless, this does not invalidate the realized inference but limits its reach.

Table 3
Estimate of import function parameters for
Brazilian raw stage medicinal flora and their juices and extracts.
2000–2006,
Logarithmic form on exogenous variables and linear endogenous variables
(Model 2)

Explainable Variables	Regretion rates	Student test "t"
Constant	-900,1681***	-10,95764342
Exchange rate	-14,0507353**	-3,193137592
GNP	148,728522***	11,37198646
LEG	0,272391203NS	0,235307434
Determinant coefficient (R_2)	0,989865635	
Statistical value F (97,6741652141334)	4,93*	

Source: Elaborated by the author.
Significance level: * significance at 1%
** significance at 5%
*** significance at 10%
NS non significant

Conclusion

A major justification for preserving biodiversity by the specialized literature has been its value as an input to medicinal and pharmaceutical products. Conserving species preserved an option value for the future since species might contain valuable compounds that would yield valuable pharmaceuticals in the future has been a frequent argument by specialists since the beginning of the 1990s (see for instance Wilson, 1992). As Sedjo (2007) affirms early studies estimated the value of conserving a species for pharmaceuticals use varying from $44 to $23.7 million per untested species.

In the 1990s bioprospecting was viewed as a vehicle by which developing countries could capture some of the rents that would accrue to their biodiversity. However, Simpson *et al*. (1996)note that the potential for new product development did not provide a compelling economic argument for protecting biodiversity hot spots, and bioprospecting alone likely would not provide incentives for private landowners or companies to protect land for its pharmaceutical biodiversity values. Simpson´s results have been challenged by many, among them Rausser and Small (2000). The controversy has remained alive up to nowadays. Once more, Sedjo (2007) argues that regardless of the initial enthusiasm about benefit-sharing agreements and their use for biodiversity conservation, their success has been limited.

Our results in this study provide evidences that Brazil is a (mega diverse) country with a low level of competitiveness in the production chain of medicinal flora. It is also a traditional net importer in all production chain segments. Between 1996 and 2006, the trade deficit increased by 55.2%. The almost continuous evolution of Brazilian imports in the production chain was fundamentally influenced by the short term behavior of the exchange rate, and in the medium and long terms by the economic growth process. That is, as the Brazilian economy achieves a sustained growth rhythm it is expected that there will be larger expenditures onmedicinal flora and its derivatives. Change in the regulatory framework through ANVISA RDC 17/2000 resulted in a small increase of US$ 2.91million in Brazilian imports within the production chain, which represents a relatively small percentage of import expenditures (0.21%).

However,effects of the regulatory milestone were more noticeable on the medicinal plant juices and extracts imports than on the principle active and medications from the medicinal plants. The increase of systemic competitiveness in the production chain passes fundamentally through the regulatory milestone and the technological/industrial policy. The transformation of the large variety of medicinal plants into products with high aggregate value should be stimulated, resulting in great repercussions on the countries sustainable economic development. Nowadays, one of the strongest barriers for the use of medicinal plants in the national industry is, on one side, the high research costs that goes from medicinal plant prospection to the pre-clinic and clinical testing. To face this problem a national industrial and technology policy revision for this sector is greatly needed, where credit and commercial promotion instruments need to be reinforced and phytotherapic medication production normative need to be reviewed.

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