# COMPETITIVENESS OF BRAZILIAN WOOD PULP IN THE INTERNATIONAL MARKET

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**ABSTRACT:** The wood pulp and paper sector is one of the most important and successful branches of the Brazilian forestry industry. The main objective of this work is to analyze the competitiveness of Brazil in the international market of wood pulp, comparing it to the competitiveness of its main market competitors worldwide in the period between 2000 and 2006. The methodology used was the Revealed Comparative Advantage (RCA) and the Relative Position in the Market (RPM) indices. Results indicated that Brazil ranked among the three most competitive countries in the global market of wood pulp.

Key words: Revealed Comparative Advantage, Relative Position in the Market, competitors, Brazil.

## COMPETITIVIDADE DA CELULOSE BRASILEIRA NO MERCADO INTERNACIONAL

*RESUMO: O segmento de celulose e papel é um dos mais importantes do setor florestal e um dos mais bem sucedidos da economia brasileira. Conduziu-se este trabalho, com o principal objetivo de analisar a competitividade do Brasil no mercado internacional de celulose, confrontando com a de seus principais concorrentes, no período de 2000 a 2006. Utilizou-se com ferramenta metodológica o índice Vantagem Comparativa Revelada (VCR) e Posição Relativa no Mercado (PMR). Os resultados obtidos indicaram que o Brasil se manteve entre os três países mais competitivos do mercado internacional de celulose.*

*Palavras-chave: Vantagem Comparativa Revelada, Posição Relativa de Mercado, concorrentes, Brasil.*

## 1 INTRODUCTION

The Brazilian wood pulp and paper sector has had outstanding performance, being the most important sector of the local forestry industry and one of the most successful of the economy, contributing significantly by creating jobs, taxes and exchange value for the country.

In 2007, Brazil had 220 companies in the wood pulp and paper sector, creating 110 thousand direct jobs in factories as well as in the field and 500 thousand indirect jobs. These companies paid R$2.1 billion in taxes and exported US$4.7 billion in the relevant tax year (Brazilian Wood Pulp and Paper Association-Bracelpa 2008).

Brazil caters not only to the domestic pulp market but also occupies a prominent position in the international market. In 2006, it ranked as the largest world exporter of short fiber pulp from eucalyptus and third largest world exporter of wood pulp all types being considered (BRACELPA 2008, FAO 2008). According to FAO (2008), the Brazilian exports of wood pulp increased by an average of 23.19% a year in the period between 1965 and 2006.

The boom in the Brazilian pulp exports can be explained by internal factors affecting competitiveness – including the high productivity of reforestations and favorable climate conditions that facilitate forestry activity in Brazil by allowing fast and high quality growth cycles combined with low production costs in comparison to other countries –, and also by external factors which include the growing world population, the boosting income of pulp consuming markets and the expanding global trade. The open global trading system, the expansion of related businesses and the wide acceptance of Brazilian pulp derived from eucalyptus by the international market, owing to its outstanding quality, all explain the growth in Brazilian exports of wood pulp (MEDEIROS & FONTES 1994, PIZZOL & BRACHA 1998, VALVERDE et al. 2006). According to Silva et al. (2001), becoming more competitive in the international trade can bring internal benefits derived from growing exports or reduced imports.

With the above context, it is important to analyze the competitiveness of Brazilian wood pulp in the international market because this type of analysis can offer contributions to the development of policies to ensure the sector remains competitive, and also to expand its share of the market.

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Thus, this work aims to analyze the competitiveness of Brazilian pulp exports in the period between 2000 and 2006. More specifically it aims to analyze the evolution of Brazilian pulp exports and the evolution of its main competitors worldwide, comparing both over the relevant period.

## 2 MATERIAL AND METHODS

### 2.1 Theoretical framework

The theory of comparative advantage was formulated by Ricardo (1817), as cited by Cardoso et al. (2007), being widely used by economists to analyze the competitiveness of a given country.

It is said that if a party requires a smaller amount of input to produce a product it has an absolute advantage in producing such product. Comparative advantage, on the other hand, is used for describing the opportunity cost of two parties. If a party decides to produce a specific product to the detriment of various other products it has a lower opportunity cost in producing that product and thus have a comparative advantage in producing that product (PASSOS & NOGAMI 2005).

Differences in opportunity cost and comparative advantage create gains from trade (PASSOS & NOGAMI 2005).

To put it differently, a country has comparative advantage in producing a certain product if it is relatively more efficient at producing such product. According to the Law of Comparative Advantage, all nations could benefit from international trade even if in absolute terms they are less efficient at producing all products. All that is needed is for them to specialize in producing the products in which they are relatively more efficient, that is, the products in which they have comparative advantage, acquiring the products in which they are relatively less efficient (KRUGMAN & OBSTFELD 2005, PASSOS & NOGAMI 2005).

The theory of comparative advantage establishes that specialized production stimulates international trade and benefits consumers (PASSOS & NOGAMI 2005).

Krugman & Obstfeld (2005) took two products (cheese and wine) and two countries (home and foreign) to explain the theory of comparative advantage. And based on their proposed example, Tables 1 and 2 illustrate the above theory.

Table 1 shows that one unit of cheese costs 1 man-hour in the home country and 3 man-hours in the foreign country while one unit of wine costs 8 man-hours in the home country and 4 man-hours in the foreign country.

From Table 1 data, it was noted that the home country has absolute advantage in producing cheese because it incurs a lower cost of production to make cheese, while the foreign country has absolute advantage in producing wine because it incurs a lower cost of production to make wine. Thus, the home country should specialize in producing and exporting cheese while the foreign country should specialize in producing and exporting wine.

Absolute advantage being dependent on cost of labor, it is possible for a country to have absolute advantage in producing the two above products.

While a country can have absolute advantage in producing all products, it is necessary to investigate whether it has comparative advantage in the same activity.

Table 2 shows that one unit of cheese costs 1 man-hour in the home country and 6 man-hours in the foreign country while one unit of wine costs 2 man-hours in the home country and 3 man-hours in the foreign country.

From Table 2 data, it was noted that the home country has absolute advantage in producing both products because it incurs a lower cost of production to make both cheese and wine. However, the opportunity cost of producing wine is greater in the home country, meaning that the home country should specialize in producing cheese. To put it differently, the home country has comparative advantage in producing cheese while the

**Table 1 –** Example of absolute advantage.

*Tabela 1 – Exemplo de vantagem absoluta.*

| Products | Cost of production in home country | Cost of production in foreign country |
|---|---|---|
| Wine | 8 man-hours | 4 man-hours |
| Cheese | 1 man-hour | 3 man-hours |

Source: Adapted from Krugman & Obstfeld (2005).

**Table 2** – Example of comparative advantage.

*Tabela 2 – Exemplo de vantagem comparativa.*

| Product | Cost of production in home country | Cost of production in foreign country |
|---|---|---|
| Cheese | 1 man-hour | 6 man-hours |
| Wine | 2 man-hours | 3 man-hours |
| Opportunity cost of cheese in terms of wine | 0.5 | 2 |

Source: Adapted from Krugman & Obstfeld (2005).

foreign country has comparative advantage in producing wine.

Based on the above study, Ricardo (1817), as cited by Cardoso et al. (2007), proved that each nation would benefit from specializing in the product in which it enjoys a comparative advantage, that way raising the total global output of each product and improving the situation of all participating nations. This would reduce production costs and worker living wages and consequently would maximize profits.

### 2.2 Analytical framework

To attain the defined objectives, the Revealed Comparative Advantage (RCA) and Relative Position in the Market (RPM) indices were used.

The Revealed Comparative Advantage index is grounded on the Theory of Comparative Advantage developed by Ricardo (1817), as cited by Cardoso et al. (2007). This index was proposed by Balassa (1965) to demonstrate whether a country has comparative advantage in producing a given product, comparing its share to the volume of domestic and international exports (UNICAMP 1993). According to Barbosa & Waquil (2001), an index greater than unity indicates that a country has comparative advantage in producing product $k$, while an index less than unity indicates that the country has revealed comparative disadvantage. The higher the index, the greater the comparative advantage of the country in international trade.

2.2.1 Relative Position in the Market

The Relative Position in the Market (RPM) index indicates the international rank of a country for a given product, in other words, the competitiveness among countries. The relative position in the market is calculated as proposed by Silva et al. (2001) (equation 1).

$$RPM_{ik}^{t} = 100x \frac{X_{ik}^{t} - M_{ik}^{t}}{W_{k}^{n}} \qquad (1)$$

where:

RPM = relative position in the market

$X_{ik}^{t} - M_{ik}^{t}$ = balance of trade of country $i$ for product $k$ over period $t$

$W_{k}^{t}$ = total output traded worldwide, that is, the total value of world exports and imports of product $k$ over period $t$.

The above procedure helps provide a general overview of the evolution of competitiveness in the international market and, consequently, it helps capture the performance of the Brazilian pulp trade over the years.

2.2.2 Revealed Comparative Advantage

The Revealed Comparative Advantage index (RCA) is expressed by equation 2 (ROPKE & PALMEIRA 2006)

RCA = (X$kcountry$ / X$tcountry$) / (X$kworld$ / X$tworld$)     (2)

where:

RCA = revealed comparative advantage

X$kcountry$ = value of exports of product $k$ by a country;

X$tcountry$ = total value of exports by a country over period $t$;

X$kworld$ = value of exports of product $k$ worldwide;

X$tworld$ = total value of exports worldwide over period $t$.

In a study of the competitiveness of Brazilian and Argentinean leather exports using revealed comparative advantage, Ropke & Palmeira (2006) observed that Argentina had a comparative advantage index of 16.20, against 9.23 of Brazil, for year 2004. This was due to Argentina being highly specialized in producing leather and being renowned for its high quality, high added value leather products. Argentina was thus found to have lower opportunity cost than Brazil for producing leather.

In a study of the competitiveness of agribusiness in São Paulo in the period between 1997 and 2003, using revealed comparative advantage, Vicente (2005) observed decreasing indices in the state, indicating a decline in the competitiveness of forest products over that period.

Indices RCA and RPM were calculated for Brazil and its main market competitors worldwide in recent years, namely Canada, Russia, Indonesia, USA, Belgium, Germany, Finland, Sweden and Chile. It should be noted that these indices have retroactive effect and therefore should not be used for prognosis.

## 2.3 Source of Data

The data used in this work are annual measures and include the period between 2000 and 2006, being expressed in US$ as obtained from the websites of: Ministry of Development, Industry and Foreign Trade-MDIC, Brazilian Wood Pulp and Paper Association-BRACELPA, Food and Agriculture Organization-FAO, International Trade Center-INTRACEN, and World Trade Organization-WTO.

## 3  RESULTS AND  DISCUSSION

### 3.1 Evolution of pulp exports

Figure 1 illustrates the evolution of wood pulp exports as achieved by Brazil and its main competitors worldwide, between 1990 and 2006.

It is noted from Figure 1 that United States and Canada rank as the largest world exporters of wood pulp between 1990 and 2006. In 2006, Canada was the largest world exporter, followed by United States.

Canada, United States, Sweden and Finland are currently pursuing public policies to support the production and export of wood pulp, helping them hold prominent positions in the international market. In Canada there is currently trade incentive through a foreign investment financing program, in addition to data collection and analysis of potential markets. In the United States these public policies are much more comprehensive and include partnerships between the private and public sector concerning forest governance, trade finance facilities, export incentive programs, working capital guarantee, among others (SIQUEIRA 2002).

In Brazil the pulp and paper sector has relied since the sixties on finance facilities from the Brazilian Bank for Economic and Social Development-BNDES. The partnership between BNDES and the pulp and paper sector solidified in the nineties. The positive policies to stimulate increased production and adoption of management practices compatible with social and market requirements
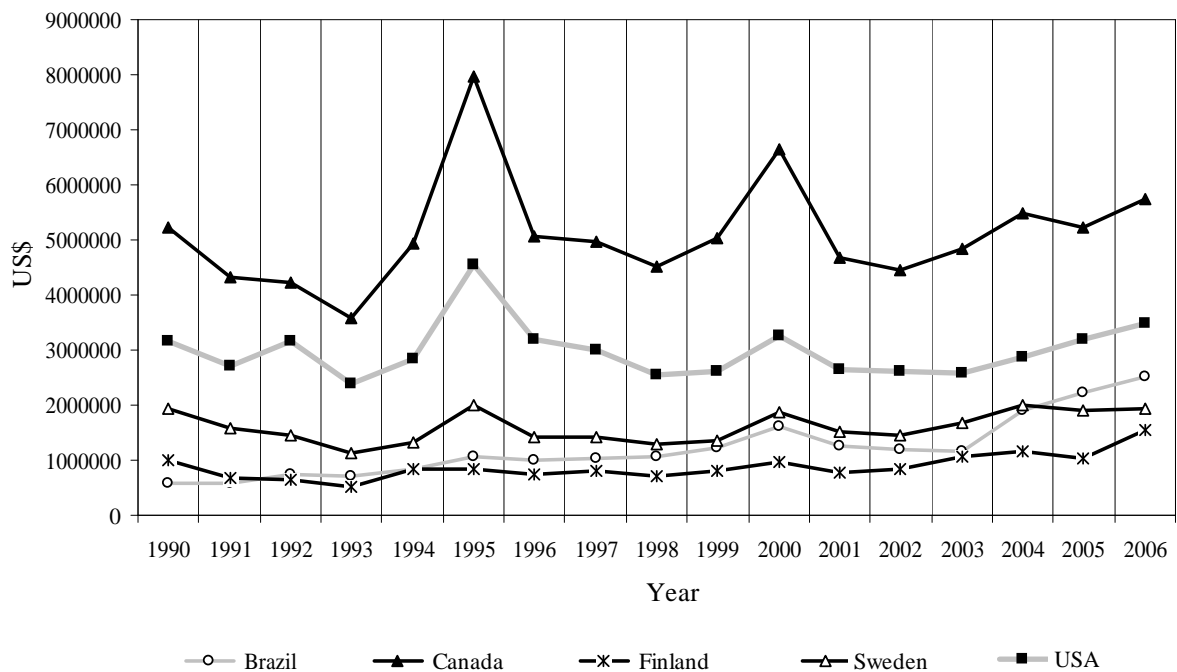


**Figure 1 –** Evolution of wood pulp exports as achieved by Brazil, Canada, Finland, Sweden and USA, between 1990 and 2006.

*Figura 1 – Evolução das exportações de celulose do Brasil, Canadá, Finlândia, Suécia, EUA, entre 1990 e 2006.*

in the period between 1952 and 1992 gave rise to financial innovations and to the development of mechanisms intended to help the sector face international competition (JUVENAL & MATTOS 2001). As of 1995 the government has focused on boosting exports, culminating in better conditions for the export sector which include: improvement of financing mechanisms, for instance, the Export Financing Program-PROEX and FINAMEX, exemption of the 'state sales and services tax' (ICMS) for exporting primary and semiprocessed products, creation of an export credit insurance, reduction of the myriad costs involved in doing business in Brazil—known locally as 'custo Brazil'—especially with port modernization, and creation of the Brazilian Trade and Investment Promotion Agency-APEX (Foreign Trade Chamber-Camex 1999).

In Finland, long-term sustainable forestry is secured by legislation for the next hundred years. If after tree felling, for instance, reforestation is planned inappropriately, the use of the forest becomes temporarily suspended and the costs involving tree planting can be legally charged to the landowners. By the same token, the local government grants loans and subsidies to forest landowners engaged in sustainable forestry and in production of wood pulp and paper, thus securing protection of new forests, maintaining biological diversity and improving the condition of production forests (FINLAND 2009).

Sweden is internationally renowned for exporting forest products, providing subsidies to encourage forestry activity. Without these subsidies, the planning and development of forestry activities in the country would be unfeasible (CARRERE 2003).

**3.2 Relative Position in the Market and Revealed Comparative Advantage**

Table 3 illustrates RPM results for Brazil and its main market competitors worldwide, over the period between 2000 and 2006.

As can be noted, the RPM index for United States is very low. This may result from it being the largest world importer of wood pulp. Despite featuring among the largest world producers, the United States is also one of the largest consumers of wood pulp, which explains the large volume of pulp imports by the country (Table 3).

The country presenting the highest RPM index was Canada. This may result from Canada being the largest world exporter of wood pulp, with the volume of pulp imports being relatively low. It was however noted that the RPM of Canada dropped in the period under analysis, possibly as a result of the growth in imports, according to FAO (2008).

Table 3 reveals that Brazil improved its RPM over the years, ranking second in 2006 after Canada. Table 3 also shows that up until 2004 Brazil ranked third after Sweden. This result was expected, as in recent years domestic exports have increased, with a further increase of around 15% expected for the period between 2006 and 2008, according to Bracelpa (2008).

Germany and Belgium had negative indices, probably due to the superiority of their imports over their exports (Table 3).

**Table 3 –** Relative Position in the Market (RPM) of the 10 largest world exporters of wood pulp.

*Tabela 3 – Posição Relativa no Mercado (PRM) dos 10 maiores exportadores de celulose do mundo.*

| RPM | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Canada | 14.83 | 13.19 | 13.01 | 12.80 | 12.46 | 11.34 | 11.31 |
| Brazil | 3.13 | 3.14 | 3.05 | 2.72 | 4.01 | 4.56 | 4.63 |
| Sweden | 3.88 | 3.93 | 3.86 | 3.97 | 4.12 | 3.69 | 3.39 |
| Chile | 2.52 | 2.47 | 2.43 | 2.37 | 2.81 | 2.69 | 2.79 |
| Finland | 2.02 | 1.93 | 2.34 | 2.66 | 2.44 | 1.96 | 2.74 |
| Russia | 1.24 | 1.47 | 1.61 | 1.65 | 1.61 | 1.67 | 1.50 |
| Indonesia | 0.18 | 0.47 | 1.03 | 1.19 | 0.20 | 0.90 | 1.26 |
| USA | -0.04 | 0.18 | 0.96 | 0.19 | 0.06 | 0.51 | 0.79 |
| Belgium | -0.55 | -0.61 | -0.58 | -0.51 | -0.45 | -0.47 | -0.27 |
| Germany | -5.10 | -5.46 | -5.30 | -5.45 | -5.21 | -4.95 | -4.67 |

Source**:** Survey results.

As for the other countries, the RPM index remained constant, since the increase in their exports was not so significant and followed the general trend of global trade.

In a nutshell, RPM results revealed that Brazil is competitive in the global market of wood pulp.

Table 4 illustrates RCA results for Brazil and its main market competitors worldwide.

From Table 4, it was noted that all countries under analysis have comparative advantage in the international market of wood pulp, except for Belgium and Germany.

It was however noted that Chile had the highest RCA index, since its wood pulp sector contributes a large share of total exports, even if the total exports of the country are small in comparison to other countries such as Canada, USA and Russia. Yet over the years its RCA dropped considerably, probably as a result of the boost in pulp exports by other countries, with local exports also rising.

In most countries, except for Brazil and Finland, the RCA index revealed very minor variations and remained constant over the years. Brazil had the third highest RCA index in 2006, only second to Chile and Finland, indicating that Brazil is competitive in the international market of wood pulp (Table 4).

The competitiveness of Brazil in the international market of wood pulp owes to the high productivity of reforestations and to favorable climate conditions that facilitate forestry activity in the country, allowing fast and high quality growth cycles combined with low production costs in relation to other countries, in addition to the good

acceptance of Brazilian pulp from eucalyptus by the international market for its high quality (MEDEIROS & FONTES 1994, PIZZOL & BACHA 1998, SOARES et al. 2007, VALVERDE et al. 2006). The specialization of Brazilian industrial businesses in producing short fiber pulp from eucalyptus could be influencing competitiveness in that with specialization businesses are capable of producing larger amounts of the product for lower costs and with improved quality.

In 2007, for instance, the average productivity of eucalyptus forests in Brazil was 40 m³/ha.year, possibly reaching 50m³/ha.year in the future, while in Chile productivity reaches no more than 30m³/ha. In other countries this yield is even lower, mainly due to climate conditions. In Finland productivity is 4 m³/ha, ten times less than Brazil. As regards pine, the average productivity of *Pinus spp* forests in Brazil is 30 m³/ha.year, while *Pinus radiata* forests in Chile and New Zealand yield up to 22 m³/ha.year of timber. In the United States, the average productivity of *Pinus elliotti* and *Pinus taeda* forests is 10 m³/ha.year, while in Canada the average productivity of *Pinus oregon* forests is 7 m³/ha.year (BRACELPA 2008).

In 2007, the rotation period of eucalyptus forests in Brazil was 7 years, which is lower than South Africa (8 - 10 years), Chile (10 - 12 years), Portugal (12 - 15 years) and Spain (12 - 15 years). In the same year, the rotation period of pine forests in Brazil was 15 years, against 25 years in Chile, New Zealand and United States, and 45 years in Canada (BRACELPA 2008).

**Table 4 –** Revealed Comparative Advantage (RCA) of the 10 largest world exporters of wood pulp.

*Tabela 4 – Vantagem Comparativa Revelada (VCR) dos 10 maiores exportadores de celulose do mundo.*

| RCA | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|
| Chile | 18.11 | 18.35 | 18.64 | 18.49 | 17.25 | 15.15 | 12.44 |
| Finland | 6.31 | 6.58 | 7.56 | 8.62 | 8.47 | 7.63 | 10.01 |
| Brazil | 8.63 | 7.92 | 7.73 | 6.74 | 8.66 | 9.17 | 9.13 |
| Canada | 7.13 | 6.64 | 6.97 | 7.50 | 7.61 | 7.02 | 7.40 |
| Sweden | 6.44 | 7.38 | 6.94 | 6.83 | 7.11 | 7.04 | 6.58 |
| Indonesia | 3.46 | 3.70 | 4.89 | 5.45 | 4.02 | 5.13 | 5.74 |
| USA | 1.24 | 1.33 | 1.49 | 1.51 | 1.54 | 1.72 | 1.69 |
| Russia | 1.64 | 1.88 | 2.07 | 2.00 | 1.70 | 1.52 | 1.26 |
| Belgium | 0.71 | 0.73 | 0.55 | 0.49 | 0.53 | 0.57 | 0.90 |
| Germany | 0.16 | 0.15 | 0.17 | 0.15 | 0.16 | 0.22 | 0.25 |

Source: Survey results.

## 4 CONCLUSIONS

Brazilian exports boosted in the period between 1990 and 2006, and so did the exports of its main market competitors worldwide.

Brazil ranked among the top countries for competitiveness in the international market of wood pulp, in the period between 2000 and 2006.

Brazil achieved higher competitiveness in the international market of wood pulp than countries with more long-standing forestry tradition such as Canada, United States, Sweden and Indonesia.

Brazil ranked among the three most competitive countries in the world in the period between 2000 and 2006.

## 5 ACKNOWLEDGMENTS

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