An Overview of Road Cargo Transport in Brazil

Maria da Penha S. Araujo*, Vânia Barcellos G. Campos*, Renata Albergaria M. Bandeira*

* Departament of Transport Engineering, Instituto Militar de Engenharia - IME, Praia Vermelha, Rio de Janeiro, Brasil

Email: mparaujo14@bol.com.br, vania@ime.eb.br, re.albergaria@gmail.com

Abstract

The current Brazilian economic growth introduces the transport market as an excellent investment opportunity, so knowing the current situation in this market becomes crucial to private investors. In this context, this paper presents an overview of the current situation of road cargo transport in Brazil. There is a general dissatisfaction by road carriers regarding freight rates in the country. Freight rates basically depend on the travel distance, type of cargo shipped, as well as the quality of roads and of the fleet. Therefore, the paper summarizes the main characteristics of Brazilian cargo transport, including its main actors, characteristics of the national truck fleet and conditions of roads. Then, it analyzes the road freight market in the country. Based on primary and secondary data, obtained from a bibliographical and a survey research, this paper presents the main differences between autonomous road carriers and carrier companies in the Brazilian market.

Keywords: road transport, cargo transport, freight rates, autonomous road carriers, carrier companies

1 Introduction

Road transport has been the preference for overland transport of goods in Brazil. Over 60% of the cargo in Brazil is transported by road and, considering only containerized cargo, this share reaches up to 90% (Wanke, 2010). This preference for road transport can be explained by the need to be flexible and the trend towards 'delivery on demand', more suited to the practice of Just in Time. However, as pointed out by ANTT (2011), there are also factors that improperly favors road transport in the country, such as: (i) the practice of overcharging which results in the destruction of highway infrastructure and in high maintenance costs; (ii) lack of regulation for driver's working hours, which enables the journey to be made more rapidly and consequently reducing costs, while simultaneously sacrificing the driver and contributing to the increasing number of road accidents in Brazil (about 30% of traffic accidents in the country have trucks involved), (iii) tax evasion, due to inefficiency in controlling the bill of lading or even the invoice of goods transported by autonomous carriers; and (iv) the practice of low margins in freight charging, which makes fleet renewal difficult (the average fleet age for autonomous carriers in Brazil is 19 years old) and leads to disastrous consequences related to fuel consumption, pollution and accidents.

Low freight rates in the Brazilian market are the result of excessive supply of transport services offered by autonomous road carriers, which mostly are hired by major carrier companies. In general, carrier companies are hired by manufacturers for transporting raw materials to industrial sites or final goods to consumer markets. In order to reduce costs and optimize routes, carrier companies end up outsourcing part of this service to autonomous road carriers, who tend to charge prices below what would be recommended under economic and financial perspectives. These low freight rates generate low revenues for autonomous road carriers, which can lead to problems such as overcharging, excessive working hours and difficulties in fleet renewing and vehicle maintenance. Therefore, this malpractice contributes to increase average fleet age, accident rates and tax evasion (ANTT, 2010). Consequently, it brings many impacts to society, such as increasing accident rates and deaths, excessive emission of pollutants, traffic jams and excessive consumption of fuel (CNT, 2002). This cycle of problems is known as the Vicious Circle of Road Cargo Transport in Brazil (ANTT, 2010).

However, even in this problematic context, transport activity has increased its participation in Brazilian Gross Domestic Product (GDP), rising from 3.7% to 4.3% between 1985 and 1999 (Fleury, 2003). From 1970 to 2000, the transport sector grew nearly 400%, while the increase in GDP was 250%. Such growth has been strongly influenced by the geographical deconcentration of Brazilian economy in recent decades toward the Midwest, North and Northeast areas of the country. Thus, the current Brazilian economic growth introduces the transport market as an excellent investment opportunity. Therefore, knowing the current situation in this market becomes crucial to private investors.

In this context, the paper presents an overview of the current situation of road cargo transport in Brazil. The study is based on primary and secondary data, obtained from a bibliographical and a survey research. Initially, the paper summarizes the main characteristics of the Brazilian cargo transport, including its main actors, characteristics of the national truck fleet and conditions of roads. Then, it analyzes the road freight market in Brazil. Finally, the results of the survey research are present and analyzed, indicating the main differences between autonomous road carriers and carrier companies in the Brazilian market, regarding the following variables: average fleet age, frequency of truck renewal, transported cargo, acquisition of insurance and the need for outsourcing transport services.

2 Road Cargo Transport in Brazil

Among all the problems related to cargo transportation in the country, the most alarming is the distortion of Brazilian transport matrix. While large territorial countries, such as the United States, Canada, China and Russia, use predominantly railroad and waterway transport over road transport, exactly the opposite occurs in Brazil, where there is a predominance of the road mode (Figure 1). Trucks account for approximately 61 percent of the general cargo transportation in Brazil, which represents 1.2 billion tons of cargo transported, a figure 5.1% larger than in 2009 (Figure 2).

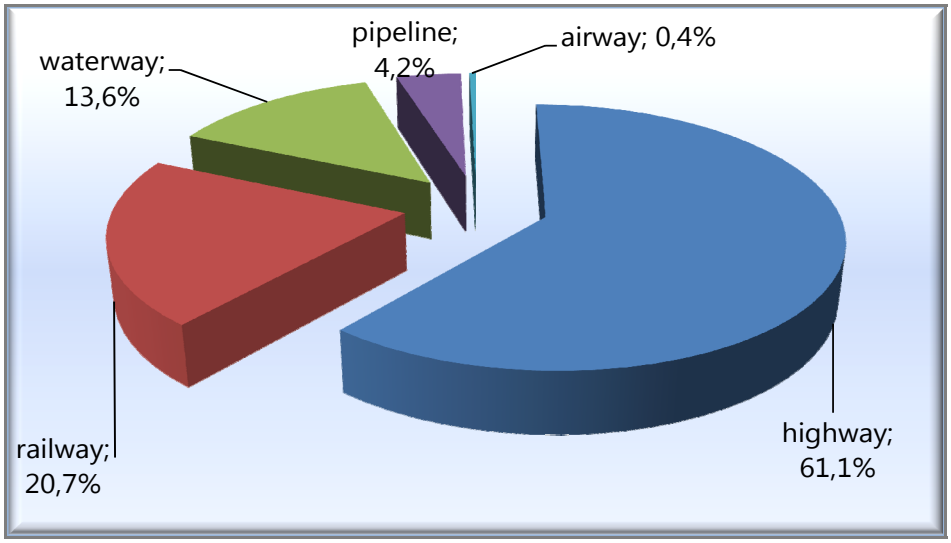

Figure 1: Brazilian Transport Matrix. Source: Plano CNT, 2011.

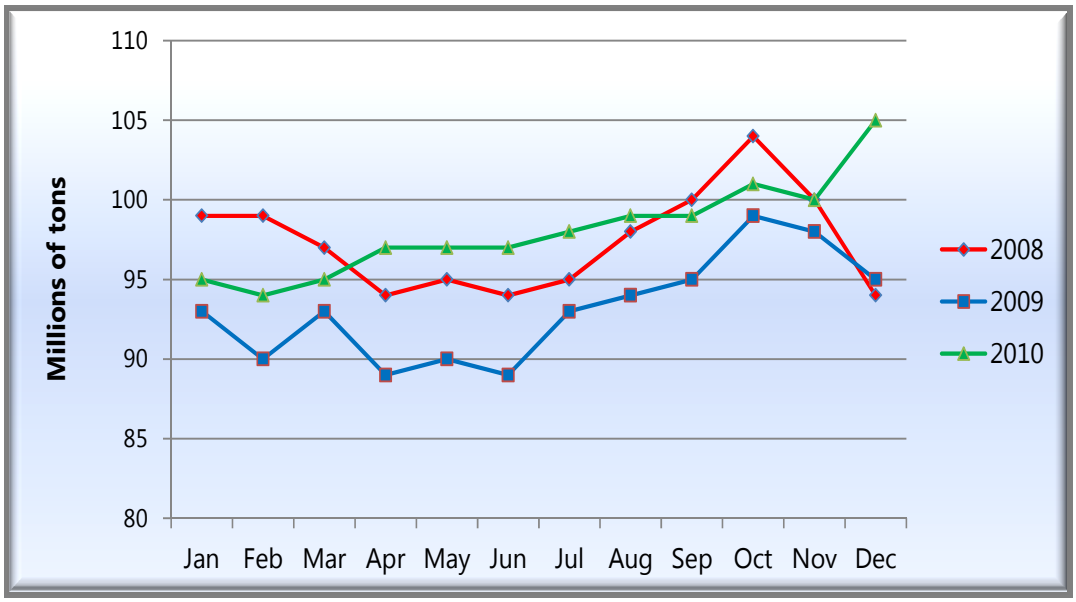

Figure 2: Transported Cargo. Source: Plano CNT, 2011.

Considering aspects related to road safety and restrictions on the volume and weight of cargo transported, the road mode may be considered less efficient for cargo transport than rail. The scale economies of rail over longer distances and for bulk commodities advantage it, over road, for these tasks. However, road mode offers a reasonably fast and reliable delivery for less than truck load (LTL) shipments, besides presenting advantages for transporting smaller cargo loads (Ballou, 2001). The flexibility of road transport for urban goods distribution is unassailable, especially considering door-to-door delivery. In consequence, road mode should be the preference for transporting small volumes of industrial goods, with medium to high aggregate value, in short distances routes. However, due to the low freights rates practiced in Brazil, road mode ends up being a major player in the transport of commodities such as soybeans, oil and cement.

2.1 The Market of Road Cargo Transport in Brazil

Road mode is responsible for 6 of every ten pounds of cargo distributed in Brazil. It is a market that involves the participation of 71,000 carrier companies, 417,000 autonomous road carriers and 203 cooperatives, generating over 3.5 million jobs (ANTT, 2011). Table 1 presents the concentration of these actors in different regions of Brazil.

Table 1: Concentration of Carriers per region. Source: Cibulska *et.al.* (2010).

Amount of Carrier	MW	NE	N	SE	S	Total
Independet Carries	52.439	89.557	18.974	342.582	168.229	671.781
	7,8%	13,3%	2,8%	51,0%	25,0%	
Transport Company	7.193	13.448	5.088	60.196	41.670	127.595
	5,6%	10,5%	4,0%	47,2%	32,7%	
Transport Cooperative	28	76	32	221	266	623
	4,5%	12,2%	5,1%	35,5%	42,7%	100,0%

It can be observed, from Table 1, a high concentration (51%) of autonomous road carriers in the Southeast region of the country. Autonomous road carriers are responsible for most of the trucks in circulation and for transporting over 60% of general cargo in Brazil (ANTT, 2011). These professionals generally work without a contract and they tend to be hired by carrier companies in peak demand or for

long-distance services. In such cases, the ownership of the truck is no longer a responsibility of the carrier company, so the investment and the costs of maintenance are passed on to autonomous carriers (Chahad and Cacciamali, 2005). According to Wake (2010), this practice is a global trend, since, in many countries, drivers have passed from the position of employees to the position of outsourced staff, in which they must have their own truck or lease it.

Instead of working as autonomous carriers, some drivers have organized cooperatives for the provision of freight service. In a typical cooperative, a group of truck drivers, who owns their vehicles, provide cargo transport services in a collective way. The members alternate themselves in providing services and the earned income is divided among these members. The cooperative signs contracts and fulfills legal formalities. According RNTRC (2011), there are 203 cooperatives that provide cargo transportation in the country, with a fleet of 11,000 vehicles with an average age of 14.4 years. Being a member of a cooperative has the advantage of reducing risks and costs, besides increasing value-added services, in comparison to autonomous carriers. Besides, the cooperative, as a legal entity, tend to have better conditions than the individual autonomous carrier to negotiate freight rates, discounts for insurances or for vehicle maintenance.

2.2 Characteristics of National Truck Fleet

The fleet for road cargo transport is currently composed by 1,329,390 vehicles, of which 46% are operated by autonomous carriers, 53% by carrier companies and 1% by cooperatives (ANTT, 2011), as shown in Figure 3.

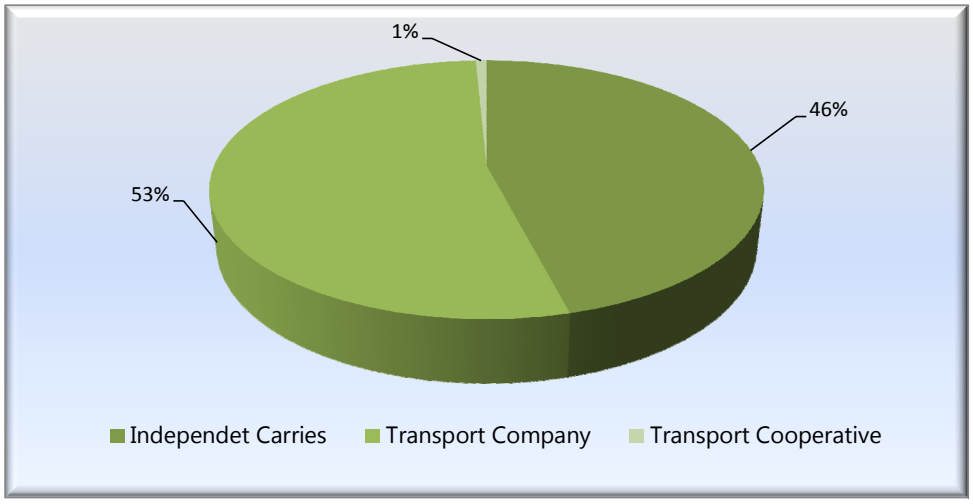

Figure 3: Truck Fleet in Brazil. Source: ANTT, 2011.

According to ANTT (2011), vehicles of autonomous carriers are, on average, 18.9 years old and the average age for cooperative vehicles is 14.4 years, while vehicles of carrier companies are, on average, 8.5 years old. The fleet of carrier companies is significantly newer, more modern, diversified and greater in capacity: 42% of their vehicles are heavy trucks (maximum gross weight of 23 tons), 29% are semi-trailers and 21% are tractor lorries. The car bodies can be opened (37%), closed (24%), tanks (9%) or others. Almost half (47%) of Brazilian carrier companies operate only with one vehicle and another 37% have between two and five trucks (ANTT, 2011). On the other hand, the fleet of autonomous road carriers is composed mainly by heavy trucks (68%) with open bodies (63%). Autonomous road carriers generally have a single truck.

Cooperatives have an advantage over autonomous road carriers for financing the purchase of new vehicles, so their fleet is more modern and diverse than that of autonomous carriers. The fleet of cooperatives is composed by eight thousand vehicles, of which most are heavy trucks, but the share of semi-trailers and tractor lorries is also representative. In fact, the fleet of cooperatives is distributed

homogeneously among these three types of vehicles, which allows them to offer a more diversified transportation service (ANTT, 2011).

2.3 Condition of Roads

Despite an increasing number of roads in Brazil, transportation density indicators are very conservative compared with other countries. In 2000, Brazil average 30.51 miles of paved roads per 1,000 square miles versus an average of 658.38 miles of paved roads per 1,000 square miles in the United States (Caixeta Filho, 2003). Currently, Brazilian highway network has 1.580.890 Km of roads, from which only 212,618 km (13%) are paved (CNT, 2010). A research developed by CNT (2011) analyzed 89,552 km of these paved roads and concluded that 69% of them presented problems such as deficiencies in road pavement, signalling or geometry, compromising thus road security and reducing the possibility of integration with other modes. CNT (2010) also analyzed 90,945 km of the paved roads in Brazil and classified their pavement condition (Figure 4). 58% of them were classified as very poor, poor or regular. Therefore, there is a high level of deterioration of the few paved roads in the country, jeopardizing the entire logistics system.

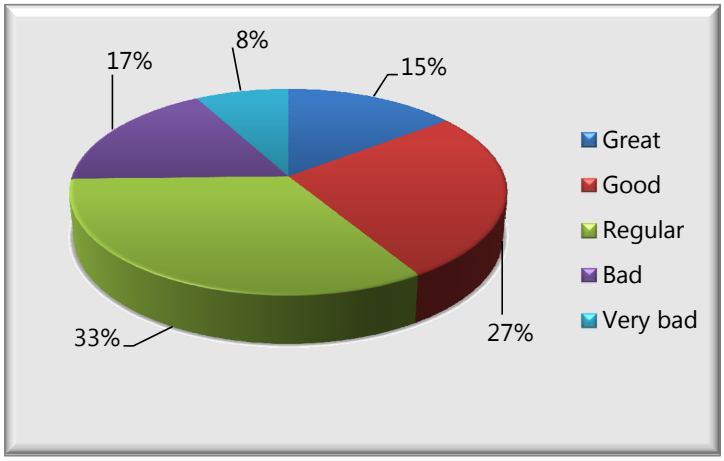

Figure 4: Classification of roads according to pavement conditions. Source: CNT, 2010

Figure 5 presents a classification of Brazilian roads regarding signalling: 41.8% of Brazilian highways have appropriate signalling; signalling in 38% of the roads are considered regular; and in 30.2% of the roads signalling conditions are considered poor or very poor (CNT, 2010). This inefficiency in signalling results in higher susceptibility to cargo thefts since the driver is often forced to reduce the speed, hence becoming more vulnerable to burglary. According to Logistics & NTC (2010), in 2009, there was an estimated loss of 900 million dollars with burglary on Brazilian roads, a figure 12% higher than in 2008.

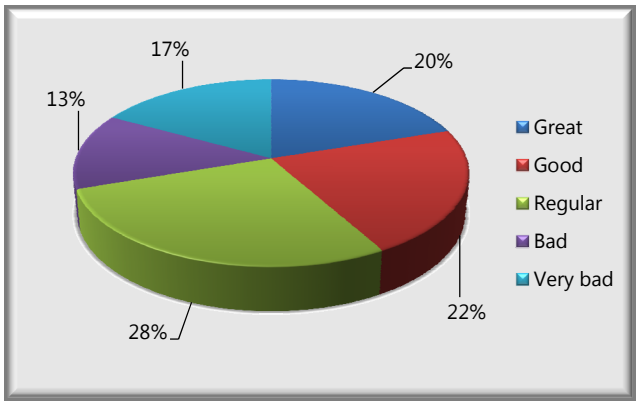

Figure 5: Signalling condition in Brazilian roads. Fonte: CNT, 2010

High accident rates are recorded annually in Brazilian highways, and this figure is still increasing (CNT, 2010). In 2009, 159,400 accidents on federal roads were registered, a figure 13% higher than in 2008. Such

accidents cause major losses, such as late deliveries, customer dissatisfaction, costs with health care, as well as loss of lives. Figure 6 shows the concentration of road accidents by Brazilian regions. A high concentration (65.4%) of accidents in the South and Southeast regions can be observed. Over 60% of the national fleet of vehicles is also concentrated in these regions, which may be one of the reasons for this high figure of accidents (CNT, 2010).

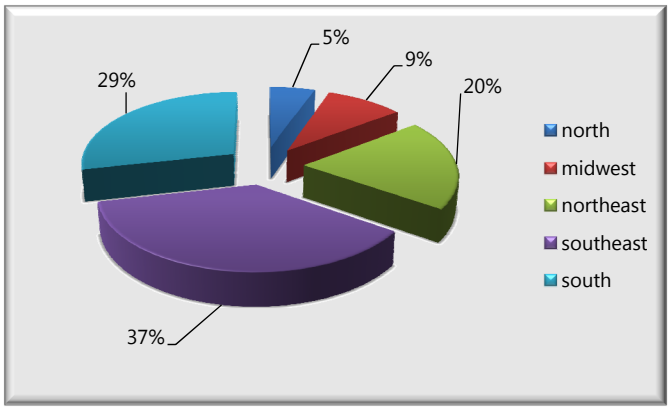

Figure 6: Concentration of Road Accidents per Brazilian Region. Source: CNT, 2010

3 Freight Market for Road Cargo Transportation in Brazil

There has been a historical predominance of the road mode in Brazil due to the larger number of highways built and extended (Caixeta-Filho, 2003). However, a scenario of loose surveillance and operational requirements led to a reduction in quality of services provided and reduced freight rates (Hijjar, 2008). The truck freight market is not under government control; hence, freight prices are determined by supply and demand for the transport service.

According to Caixeta-Filho (2011), there is a general dissatisfaction by road carriers regarding freight rates. This dissatisfaction can be partially explained by the lack of constancy in the evolution of operational costs in comparison to the freight rates practiced, causing a direct reduction on profit margin. To negotiate efficiently, carriers and shippers must be aware of current shipping cost variables, but it is not always true in Brazilian market.

Freight rates basically depend on the travel distance, type of cargo shipped, as well as the quality of roads and of the fleet (Caixeta-Filho and Martins, 2011). For Martins (2008), price formation for cargo transport services is quite complex, because, besides its operational costs, it also depends on local and situational factors. Fright rates are directly proportional to variations in decisive factors for the demand for transportation, such as economic performance and certain business strategies. It is also indirectly influenced by decisive factors for operational costs of transport services, such as regulation, fuel prices, among others.

A study developed by Hijar (2008) concluded that transportation services from Sao Paulo usually have higher freight rates than routes that have this city as destination. For example, the freight rate of a route from Rio de Janeiro to Sao Paulo is, on average, 34% lower than the rate for the reverse route. This phenomenon can be partially explained by the fact that São Paulo is the largest industrial city in Brazil and therefore there is a high demand for transport services to distribute its production to other regions. According to Hijjar (2008), freight rates also depend on the fleet used to cargo transportation due to differences on capacity and volumes.

Besides presenting an overview of the current situation of road cargo transport in Brazil, this paper also identifies the main differences between autonomous road carriers and carrier companies in the national market. The research method applied in this study is presented on the following section.

4 Research Method

The investigation uses both primary and secondary data, obtained from a bibliographical and a survey research. The sample assessed by the survey research consisted of 120 carrier companies and 96 autonomous road carries that act on the route São Paulo – Rio de Janeiro. The selection of this particular route is justified by the expressive amount of cargo shipped from São Paulo to Rio de Janeiro. This can be explained by the high concentration of industries in the State of São Paulo that exports goods to the second largest consumer market in the country, Rio de Janeiro. On the other hand, the state of Rio de Janeiro has a smaller industrial estate than São Paulo, so it needs to purchase consumer goods from other industrial areas, such as São Paulo. Most of the exported goods have medium to high value-added, so road transport is prioritized and Via Dutra, the main road connection between these two markets, ends up having a large amount of cargo shipped towards Rio de Janeiro.

Data collection was divided in three stages. In the first stage, an electronic online questionnaire was sent to 100 carrier companies. Meanwhile, face-to-face interviews were conducted to a group of 20 carrier companies. This group of 20 companies is responsible for shipping 60% of the goods transported from São Paulo to Rio de Janeiro. Therefore, face-to-face interviews were conducted in order to obtain more detailed data about this group, as well as other information not yet identified, but that could contribute to a better understanding of the Brazilian market of road cargo transportation. In the third stage, face-to-face interviews were also conducted to 96 autonomous road carriers, since, in most cases, this group does not have easy access to computer resources or internet. A research instrument of 14 questions was used for data collection and SPSS (Statistical Package for Social Sciences) software package was applied in the data analysis.

5 Comparative Assessment

The paper aims to identify the main differences between autonomous road carriers and carrier companies in the Brazilian market. For this comparative analysis, the main variables that differentiate these two actors were considered: average fleet age, frequency of truck renewal, transported cargo, acquisition of commercial vehicle insurance and the need for outsourcing transport services. These factors also influence the freight rates charged by both carrier companies and autonomous road carriers. Analyzing each of these variables, the following results were assessed.

- **Average Fleet Age**: The fleet of carrier companies acting on the route São Paulo-Rio de Janeiro is, on average, 5 years old, while the fleet of autonomous carriers acting on the same route is, on average, 19 years old. 52% of the vehicles that belong to autonomous carriers present an average fleet age between 15 and 24 years. Therefore, one can conclude that the average age for the fleet of autonomous road carriers that act on the route São Paulo - Rio de Janeiro is significantly higher than that of carrier companies. This phenomenon is not exclusive from the market of São Paulo – Rio de Janeiro. As shown in section 2.2, in the Brazilian market, the fleet of carrier companies is significantly newer, more modern, diversified and greater in capacity than that of autonomous road carriers. However, this research shows that, on average, the fleet of carrier companies that act on the route São Paulo – Rio de Janeiro is newer and more modern than that of other Brazilian carriers, with average fleet ages of 5 and 8.5 years old, respectively. This is due to the expressive amount of cargo shipped from São Paulo to Rio de Janeiro and to the economic importance of both these cities in Brazil. However, no difference was found for the average fleet age of autonomous carriers that acts in this particular route in comparison to others in the Brazilian market. It can be explained by the fact that autonomous road carriers face many difficulties for financing the acquisition of new vehicles everywhere in Brazil and that the general dissatisfaction regarding freight rates is a national problem.
- **Frequency of Fleet Renewal**: As observed in the previous topic, the fleet of carrier companies is newer and more modern than that of autonomous auto carriers. Therefore, it is no surprise that

they renew their fleet more frequently than autonomous carriers. Carrier companies that act on the route São Paulo – Rio de Janeiro renew their fleet, on average, every five years, while the frequency of fleet renewal by autonomous road carries that acts on the same route is, on average, every 16 years.

- **Transported cargo**: Certain uniformity can be observed in the characteristics of the cargo transported from São Paulo to Rio de Janeiro by autonomous road carriers and by carrier companies, since both are subjected to the same demand pattern for cargo transport in the route. Thus, there is a predominance of general cargo (50% of the cases), which is packed and packaged for shipment, transportation and unloading.
- **Commercial Vehicular Insurance:** 70% of autonomous road carriers that act on the route São Paulo – Rio de Janeiro do not contract vehicular and those who do (only 30%) are members of insurance cooperatives, which offer discounts on hiring policies. This is not an exclusive phenomenon of the São Paulo – Rio de Janeiro route, but a characteristic of the entire Brazilian market due to the high insurance costs for commercial vehicles in the country. On the other hand, all the assessed carrier companies had insurance contracts that covered their vehicles as well as the transported cargo. These companies usually get high discount rates on insurance because of the large number of vehicles covered.
- **Outsourcing of Transportation services**: most carrier companies that act on the route São Paulo – Rio de Janeiro outsource part of their service to autonomous road carriers on peak seasons, such as the holiday season or when closing a large distribution contract. This seasonal demand pattern was pointed out by 63% of the assessed carrier companies as the main reason to hire the services of autonomous carriers. Another factor, pointed out by 12% of respondents as a major motivator for outsourcing, is the long travel distances. Most carrier companies tries to keep their vehicles available for more profitable services, so they outsource this type of service, which tend to be more costly and time consuming, to autonomous road carries. Moreover, about 18% of the assessed carrier companies affirm that they outsource transport services to autonomous carriers when they consider that the profit will not be sufficient to perform the service with their own fleet. This shows the general dissatisfaction regarding freight rates.

Finally, significant differences were observed in the data surveyed for both carrier companies and autonomous road carriers. Such differences demonstrate discrepancies in the service of road cargo transport offered in Brazil, depending on who is performing the service. Analyzing the assessed variables, one can conclude that carrier companies have a more reliable fleet and offer a more reliable service than those of autonomous road carriers, who usually act on an outsourced basis under the rules of carrier companies. This relationship does not always translate into lucrative contracts for these autonomous road carriers.

6 Conclusion

This paper presents an overview of the current situation of the road cargo transport in Brazil. It also points out the main differences between autonomous road carriers and carrier companies in the Brazilian market, regarding the following variables: average fleet age, frequency of truck renewal, transported cargo, acquisition of insurance and the need for outsourcing transport services. The results show that, for all evaluated items, the fleet of autonomous carriers performed well below than the fleet of carrier companies. For that reason, autonomous road carriers offer a less reliable service and hence do not have conditions to compete with carrier companies for contracts. Therefore, they end up working for these carrier companies, who outsource transport services which they choose not to perform with their own fleet. Generally these outsourced services have more complicated and costly routes or cargo, which ends up rapidly depreciating vehicles of autonomous carriers as well as increasing the risks involved. As a result, carrier companies often impose their own rules and conditions for the autonomous carriers. Finally, one can conclude that the service of road cargo transport in Brazil may present discrepancies depending

on who is performing it. These problems, associated with an unbalanced transport matrix, lead to disastrous consequences for society, such as an increasing number of road accidents, deterioration of road infrastructure and higher cost for cargo distribution.

References

ANTT (2011). Agência Nacional de Transportes Terrestres*, RNTRC - Registro Nacional dos Transportadores Rodoviários* de *Cargas*, Obtido em abril de 2011. http://www.antt.gov.br.

ANTT (2010). Agência Nacional de Transportes Terrestres*,* disponível em, Obtido em outubro de 2010. http://www.antt.gov.br.

BALLOU, R. H. (2001*). Gerenciamento da Cadeia de Suprimento, Planejamento, Organização e Logística empresarial*. 4ª Edição, Ed. Bookman, Porto Alegre, RS.

CAIXETA FILHO, J. (2003). Transportation and logistics in Brazilian agriculture. *Proceeding of the Agricultural Outlook Forum 2003*. Available at: http://EconPapers.repec.org/RePEc:ags:usaoth:33141.

CAIXETA FILHO, José.V.; Martins, Ricardo.S. (2011). *Gestão Logística do Transporte de Cargas*, 1ª Edição, Ed. Atlas, São Paulo, SP.

CHAHAD, José Paulo Z.; CACCIAMALI, Maria C. (2005*). As transformações estruturais no setor de transporte rodoviário e a reorganização no mercado de trabalho do motorista de caminhão no Brasil,* Obtido em setembro de 2011. http://www.fea.usp.br/feaecon//biblioteca.

CIBULSKA, Pedro. C. M. V. et al.,(2010). *Panorama da frota dos transportadores rodoviários remunerados de cargas no brasil,* XVI PANAM, Lisboa, Portugal.

CNT (2010). Confederação Nacional Dos Transportes*. Pesquisa CNT de Rodovias 2010: relatório gerencial.*

CNT (2002). Confederação Nacional Dos Transportes – *Transporte de Carga no Brasil, Ameaças e Oportunidades para o Desenvolvimento do País – Diagnóstico e Plano de Ação*. Obtido em Fevereiro de 2011. http://www.cnt.org.br/Paginas.

CNT (2011). CONFEDERAÇÃO NACIONAL DOS TRANSPORTES. *Plano CNT de Transporte e Logística*. Obtido em Fevereiro de 2011. http://www.cnt.org.br/Paginas.

FLEURY, Paulo F. (2003). *Nota Sobre o Setor de Transporte de Cargas no Brasil* – ILLOS- Instituto de Logística e Supply Chain. Obtido em Janeiro de 2011. http://www.ilos.com.br/web/index.php.

GIL, Antônio C.(2002). *Como elaborar projeto de pesquisa*. 4. ed. São Paulo: Atlas, 2002.

HIJJAR, Maria F., (2008). *Preços de Frete Rodoviário no Brasil*. – ILLOS- Instituto de Logística e Supply Chain, www.ilos.com.br ,

MARTENS. Cristina. D. P.; FREITAS, Henrique.; ANDRES, Rafael.; COSTA, Ricardo. S. (2010). *Pesquisa Survey: um estudo sobre a Tecnologia de Informação (TI) em pequenas empresas industriais do Vale do Taquari/RS*. Revista Quanti & Quali. 2010. Obtido em agosto de 2011. http://www.quantiquali.com.br/revista/index.php .

MARTINS, Silveira R. (2008). *Estudo da Formação do Frete Rodoviário e Potencial de Conflitos em Negociações em Cadeias do Agronegócio Brasileiro*. Obtido em outubro de 2011. http://revista.dae.ufla.br.

NTC&LOGISTICA (2010). Associação Nacional do Transporte de Cargas. *Roubo de Cargas*. Obtido em Maio de 2011. http://www.cnt.org.br/Paginas/index.aspx

WANKE, Peter F. (2010). *Logística e Transporte de Cargas no Brasil: Produtividade e eficiência no Século XXI*. Ed. Atlas, São Paulo-SP. 2010.