The Role of Lessors in the Airline Input Market: Efficiency-Enhancing Agents or Surplus-Absorbing Intermediaries? *

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Abstract

Lessors are a crucial player in the efficiency of the input market for airlines and therefore in the development of the world economy as affected by commercial aviation. Among the issues lessors are able to improve are: moral hazard with respect to aircraft condition and the incentive for adverse selection arising from information asymmetry, liquidity restrictions faced by airlines, airlines' need to easily switch aircraft, and transaction costs involved in aircraft trading. Nevertheless, due to concentration, the existence of entry barriers and some level of (implicit) coordination, lessors are also able to keep a great share of the economic surpluses generated by the deals with airlines. Moreover, aircraft manufacturers are not able to venture strongly into the leasing business due to the intrinsically complicated nature of the aircraft manufacturing market as well as the market power exercised by lessors.

Keywords: *aircraft, airline, leasing, lessors, intermediaries, efficiency.*

1. A Brief Description of the Commercial Aviation Industry

Among the many manifestations of the technological revolution that has taken place during the 20th century, the first three industries that undoubtedly spring to mind are Telecommunications, Internet, and Aviation; and a case could be made that the development of the latter has boosted the evolution of the former two. The effect on the world economy that commercial aviation has had is indisputable and has been key in making globalization –both economically and culturally– possible.

The commercial aviation industry is capital intensive and is exposed to considerable systematic risk as a result of the great number of economic variables that affect airline performance. Some of these variables that directly impact the airline business are international fuel prices, insurance premiums arising from high-exposure events such as the disappearance of Malaysia Airlines flight MH370, currency exchange rates in the countries where an airline operates, and a non-stable demand. According to the International Labour Office (2013), demand for commercial aviation is highly procyclical yet seasonal, which means that it exhibits constant fluctuations. These fluctuations are especially significant for business travel, which constitutes a great share of total air traffic. The macroeconomic factors that affect commercial aviation demand are "GDP, population growth, political stability, amount of leisure time and market access" (International Labour Office, 2013). Moreover, the very nature of airline production –airlines produce seat-kilometers or seat-miles– makes it an almost immediately perishable service. This means that a

macroeconomic shock affecting the markets on which an airline operates makes the airline's revenues vulnerable to a drop in its load factors (i.e., the percentage of seats occupied by passengers[1]). Therefore, the intrinsic perishability of the service means that a flight that departs with a low load factor has a higher cost per passenger, which makes the airline less efficient. In addition, procyclicality makes airlines dependent on cash flow, and profit margins are generally meager (International Labour Office, 2013), if positive at all. As proof of the procyclicality of the industry it is interesting to note that during the crisis of 2008, the operating losses of the biggest 150 airlines in the world were US$15 billion, whereas in 2011 passenger kilometers grew 6.5% while world GDP increased 3.7%.

The fact that airlines are capital-intensive means there is a huge level of fixed costs that they must be able to cover. At the same time, producer's surplus per unit of production[2] is usually narrow (and, in fact, negative on seats that are not sold). As a consequence, airlines find that they need to reach a high volume of production in order to achieve break-even, which in turn means that profits are indeed very hard to obtain. Therefore, the value airlines create both for their customers and for their providers is not paralleled by similar benefits obtained by their owners. The International Labour Office (2013) reports that although 75% of all airlines are privately owned, shareholders almost invariably have more profitable investment alternatives inasmuch as the profit margin of the airline industry as a whole since 1970 has been a negligible 0.1%. Furthermore, according to IATA (International Air Transport Association), "air transport supply chains deliver very little to the airlines, but some segments –including computer reservation systems, travel agents and freight forwarders– are able to get double-digit percentage returns on invested capital" (International Labour Office, 2013). There are also companies that work on the maintenance, storage and dismantling of aircraft, where the latter has proved to be a profitable activity (Negroni, 2012). Another participant of the air transport supply chain that has regularly enjoyed substantial profit margins is the aircraft leasing company. Airlines do not own all of the aircraft they operate but, instead, may choose to lease some of the aircraft in their fleet. Aircraft leasing companies or, more commonly, *lessors* offer airlines this possibility.

2. A Brief History of the Birth of Leasing Companies and a Description of the Leasing Business

a. The Deregulation Act and the Growth of Commercial Aviation

A major event in the history of commercial aviation was the Deregulation Act that was passed in the United States in 1978. Before the Deregulation Act was passed, the Civil Aeronautics Board (CAB) regulated entry, exit and prices in the commercial aviation

[1] Technically, load factors are computed by dividing RPM (revenue passenger miles) by ASM (available seat miles), which allow for the calculation of load factors on flights with stops.

[2] In order to comprehend the dynamics of airlines' break-even economics, producer's surplus per unit of production is understood as the difference between the price charged for a seat-kilometer and its marginal cost of production. Break-even analysis prefers the term "unit contribution margin" to signify the same, at least mathematically.

industry within the United States, as well as mergers, consumer issues and intercarrier agreements (Smith and Cox, 2008). Some of the consequences of regulation were suboptimal investment and operating decisions. In addition, airlines could only seek to compete on food, aircraft interiors, seating quality, and frequency because prices were dictated by the CAB. As a result of constrained competition, prices were high and load factors were low, at around 50%. Conversely, in 2003 load factors for the U.S commercial aviation industry averaged 74%, and prices were considerably lower than they were before the Deregulation Act. More specifically, according to the Air Transport Association, prices decreased an astonishing 44.9% since the Deregulation Act and several low-cost-carriers (LCCs) are today solid players in the commercial aviation industry besides "legacy" carriers such as American, United and Delta airlines (Smith and Cox, 2008). New market niches have been established, with legacy carriers operating under the hub-and-spoke[3] model and LCCs –which account for around 30% of the market– flying point-to-point. This expansion on the supply side has been matched by an unprecedented growth on the demand side with total air traffic having more than doubled since 1978 (Smith and Cox, 2008).

Regarding the increase in the number of flights offered originating from the deregulation of the commercial aviation industry, Gavazza (2011a) points out that "[the] increase in competitiveness amplified the volatility of firm-level output, implying that carriers needed to adjust their fleets more frequently." A very strong secondary market for aircraft emerged because airlines suddenly found themselves in need of being able to reallocate aircraft more easily in response to the production volatility that characterizes commercial aviation. Coincidentally, lessors genuinely entered the commercial aviation input market in the 1980s, when "the need for market intermediaries to coordinate sellers and buyers became stronger" (Gavazza, 2011a).

The first aircraft leasing company established was International Lease Finance Corporation (ILFC), which was founded in 1973. By 1980, its annual revenue was US$30 million, while in 1990 –one decade after the Deregulation Act– annual revenue was US$500 million and profits were US$ 124 million (almost 25% profitability). In 2000, ILFC's revenue was US$2.5 billion. Likewise, ILFC saw its fleet increase from 106 in 1990 to 911 in 2005 (Morrell, 2007).

The second aircraft leasing company established was Guinness Peat Aviation (GPA), which was founded in 1976 but entered the actual aircraft leasing business in 1984, when it made the first order for new aircraft. By the end of 1991, GPA had 392 aircraft in its fleet and its annual revenue was US$ 2 billion, with profits of US$ 268 million (13.4% profitability). However, due to a reduction in lease rates and lack of demand for certain types of aircraft, GPA went bankrupt in 1993 (Morrell, 2007).

The company that came to the rescue of GPA was GE Capital Aviation Services (GECAS), the aircraft-leasing arm of General Electric. The rescue agreement stipulated that GECAS would manage GPA for a 15-year period with an option to acquire 67% of GPA's shares at

[3] The hub-and-spoke model consists of an airport acting as an operational base -the hub- that collects flights from different cities and distributes traffic through routes to different points in the country -the spokes-.

the end of the period, which it eventually exercised. Presently, GECAS is the largest aircraft leasing company in the world (Morrell, 2007).

b. Categorization of the Different Types of Leases

The three aircraft leasing companies mentioned in the preceding section[4] participate almost exclusively in the *operating* leasing business. Notwithstanding, there are other types of aircraft leasing available. The two broad categories of aircraft leasing are the *capital or financial lease* and the aforementioned *operating lease*.

A financial lease works a lot like a debt contract under which a financial institution lends capital and the borrower has collateral to offer. In that regard, any analysis made about capital leases would probably be better suited for comparisons against the alternatives offered by other financial institutions, such as banks. An operating lease, in turn, constitutes a fundamentally different type of deal. In particular, it allows airlines without sufficient cash and creditworthiness to be able to operate aircraft and generate revenues they would not have been able to generate had they been constrained to purchasing the aircraft either by using their own cash reserves or by seeking to go into debt in order to finance them.

An interesting question therefore arises when considering the decision between buying and leasing, when the airline in question does not have significant liquidity (cash reserves) restrictions. Large airlines that could well decide to own aircraft have significant percentages of their fleet under operating lease agreements, which implies that there must be some sort of analysis that is able to explain such behavior. In this paper, the focus will be only on operating leases. Nevertheless, some of the different types of leases available in the aircraft industry are mentioned below.

I. Financial Leases

One kind of financial lease that was popular until the 1990's was the *Japanese Leveraged Lease* (JLL). The JLL consisted of establishing a company with the purpose of acquiring an aircraft, with around 30% of the financing coming from Japanese equity investors and the remaining 70% coming from banks. Once the company had been established, an airline would buy the aircraft and sell it to the company. This company would then lease the aircraft to the airline until the full price (plus whatever interest was agreed) had been paid. This scheme made it possible for the airline to claim tax allowances within its country and it also allowed Japanese investors to claim tax allowances on the same asset in Japan (Morrell, 2007). There were other types of leases similar to JLLs, such as the *U.S. Leveraged Lease* and the *European Leveraged Lease*. Another kind of financial lease is the *Extendible Operating Lease*, which functions as an operating lease with several options to "walk-away" from the lease at pre-defined "break-points" (Morrell, 2007). The main difference with true operating leases is that the intention of both the airline and the leasing company is that the aircraft be paid in full by the end of the contract, so that property of the aircraft is eventually transferred to the airline.

[4] These three firms have been consolidated to two, since the acquisition of GPA by GECAS.

II. Operating Leases

An operating lease is one where aircraft property remains at all times with the lessor. Therefore, the deal consists of lessor granting lessee (the airline) the exclusive right of use to the aircraft for the term of the contract in exchange for monthly payments made by lessee to lessor. Although there may be an option for lessee to buy the aircraft at the end of the lease term, it is neither lessor's nor lessee's initial intention to transfer property of the aircraft from the former to the latter. A key difference between operating lessors and financial lessors is that operating lessors bear the risk of aircraft obsolescence and, therefore, must understand the airline business. Financial lessors, on the other hand, are not very different from a bank issuing a loan, which means that as long as they are satisfied with the value of the collateral, they do not need to have an understanding of the airline business per se. Furthermore, because aircraft property remains with lessor under an operating lease, it is of extreme importance to lessor that the aircraft be returned in good condition so that it can be reallocated with a different airline at the end of the lease term, should the current operator not be interested in renewing the contract.

After JLLs were discontinued, their operating variant became available under the name *Japanese Operating Lease* (JOL). JOLs also allow Japanese investors to claim tax benefits, but the difference with JLLs is that tax allowances are only available in Japan and hence the airline has no right to claim any tax benefits (Morrell, 2007).

Another, more interesting type of operating lease, is the *wet lease*. A wet lease consists of leasing an aircraft together with cockpit and cabin crews, as well as other operational services, such as maintenance and insurance. The most common type of wet lease is the ACMI lease, which is an acronym for 'Aircraft, Crew, Maintenance, and Insurance' lease. What is interesting about this type of lease is that both the lessor and the lessee are airlines. A traditional 'non-airline' lessor would never be able to offer a wet lease because it lacks the certification, structure, and *know-how* necessary for the operation of commercial aircraft. Wet leases are particularly useful for airlines that are subject to high degrees of seasonality in their operation. It is not uncommon for airlines operating in the northern hemisphere to have a high season during quarters on which airlines operating in the southern hemisphere have a low season. A situation such as the one described would create incentives for northern hemisphere airlines to wet lease aircraft from southern hemisphere airlines. It is also possible for airlines to use their own crews, and in that case the type of lease is described as a *damp lease* or an AMI lease, which is nothing but an ACMI lease without the crews.

Finally, there is the *sale and leaseback* type of lease. Although JLLs also involve some sort of sale and leaseback action, the difference between the two has to do with the fact that JLLs are financial leases intended to claim tax benefits whereas sale and leaseback leases are genuine operating leases that do not seek to eventually transfer property back to the airline. Under a sale and leaseback type of lease, an airline that owns a certain aircraft decides to sell it to a lessor and enter an operating lease agreement for a given period. Motivations on the airline side may have to do with cash flow problems or with speculation regarding the liquidation value of the aircraft once its useful life is over.

c. Outline of the Terms of an Operating Lease Agreement

As mentioned above, this paper concerns operating lease agreements due to the fact that they are distinct from traditional debt contracts. On the other hand, financial leases are not essentially different from debt contracts, and so may be better suited for other sorts of financial analyses. Following is a list of the key terms that are typically included in an operating lease agreement:

Aircraft Type and Quantity refers to the aircraft model and manufacturer and the quantity of each type of aircraft included under the agreement.

Delivery Date commonly defines the effective date on which the lease begins. This date is influenced by the return date arranged between lessor and the previous operator.

Lease Term defines the duration of the agreement. Many lease agreements include the option to extend the lease term.

Lease Rental Rate contains the structure of payments made by lessee to lessor in exchange for the exclusive use of the aircraft during the lease term.

Security Deposit usually consists of a given number of monthly payments paid in advance by lessee and refunded to lessee after expiration of the lease term.

Maintenance Reserves are provisions paid out by lessee to lessor depending on the level of monthly utilization. The more the airline flies the airplane, the more maintenance reserves it must pay. Maintenance reserves may be used to restore the aircraft back to operating condition if necessary. However, maintenance reserves will only be made available by lessor under certain (often very restrictive) conditions, and are therefore considered by lessor as 'supplementary rent'.

Delivery Condition specifies the agreed condition under which the aircraft will be delivered from lessor to lessee.

Return Condition specifies the agreed condition under which the aircraft will be returned from lessee to lessor.

d. The Leasing Industry Today

In the 1970's, before the deregulation of the commercial aviation industry, aircraft leasing accounted for less than 1% of the aircraft flown by airlines. During the 1980's the share of commercial aircraft operated under lease agreements rose to somewhere around 15%, and in the 1990's it grew to about 22%. Today, around 40% of all commercial aircraft in operation remain under lease agreements (Moorman, 2014).

According to Moorman (2014), some of the reasons operating leases have become increasingly popular are the flexibility they offer airlines, the fact that they do not appear as debt on the balance sheet, the actual possibility to grow without debt that operating leases offer airlines, and the fact that airline management has put leasing aside from the list of costs that must be cut.

The future of the aircraft leasing business looks, in the eyes of industry experts, even more promising than it currently is. Over the next 20 years, The Boeing Company forecasts production and delivery of 36,800 new aircraft with a market value of US$5.2 trillion, and the current world fleet to double in size (Moorman, 2014). Similarly, Airbus SVP-leasing markets Andy Shankland reports that the share of leased Airbus aircraft as opposed to

Airbus aircraft financed by cash or debt grew from 33% in 2010 to 40% in 2011 and 2012, and to 44% in 2013. Also, according to Shankland, 49% of all new aircraft deliveries in 2014 were made to lessors (Moorman, 2014).

The most popular aircraft ordered by lessors presently are Airbus A320neo's and Boeing 737 MAX's, which are the cutting edge single-aisle aircraft, offered by the two main airframe[5] manufacturers. One of the reasons is that, while demand for wide body aircraft has increased lately, airlines often require that this kind of aircraft be customized, which makes it harder to close a deal (Moorman, 2014). As a consequence of being a more specific asset (owing to customization requirements), wide body aircraft are less liquid than narrow body[6] aircraft and may therefore lead to higher transaction costs.

There are still certain threats that must be taken into consideration. There is not, for instance, a generalized consensus as to whether the recent decline in fuel prices is a temporary phenomenon or a permanent one. There tends to be a trade-off between the rental rate for a given aircraft and fuel consumption of its engines. Newer and, hence, more technologically advanced aircraft have higher rental rates but lower fuel consumption. As fuel prices decline, the weight of fuel costs on the total unit cost of production is altered – more specifically, lowered– which in turn means that the current optimal choice of aircraft may not remain unaffected. There is also fear that the astonishing number of aircraft orders being placed might not be supported by such a growth in air traffic. Again, there is no consensus regarding this issue, with some industry specialists claiming that indeed there has been dangerous 'double-counting' on the part of lessors, while others claim that not all new aircraft will add to the current world fleet, but that a great share of them will, instead, replace old aircraft currently in operation therefore renewing rather than enlarging the current world fleet (Moorman, 2014).

In spite of the threats that must be considered, the aircraft leasing industry has been growing steadily since the 1980's. Not only is aircraft leasing an interesting option for airlines, it has also been a highly profitable alternative for investors. In addition, commercial aviation is looking at very promising growth forecasts in the short- and medium-run, and aircraft leasing stands strong chances of remaining a major stimulator of such growth.

3. Why Do Airlines Lease Aircraft?

The previous two sections have offered an introduction to the commercial aviation industry and the aircraft leasing industry. An outline of the airline business has been presented with a brief discussion of its main characteristics. In similar fashion, the evolution of operating lessors during the past 35 years as well as the basic terms that are key to the constitution of an aircraft lease agreement have been set forth.

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[5] Technically, an 'aircraft' as defined in a lease agreement is comprised of an 'airframe' plus the number of 'engines' corresponding to the given aircraft model. This differentiation is important because airframe manufacturers do not produce engines and engine manufacturers do not produce airframes.

[6] Another definition for 'single-aisle.'

What has not been addressed so far is the very nature of the existence of lessors. Considering the spectacular growth and profitability of the aircraft leasing industry, it seems reasonable to examine what sort of value lessors have been offering airlines during the past four decades. In other words, in order to understand the role of lessors in the airline input market, the first question that must be answered is that of why airlines choose to lease aircraft with lessors acting as intermediaries.

a. Why Are Lessors Necessary?

Lessors act as intermediaries who claim to reduce trading frictions. In particular, the efficiency derived from the existence of lessors should have to do with the fact that airlines undergo a fairly seasonal flow of revenue throughout any given year and are, even more importantly, very susceptible to business cycles since the commercial aviation industry is one of the most significantly procyclical industries in the world economy. In that sense, the added value of lessors lies in their ability to match operators in need of acquiring aircraft with operators in need of getting rid of aircraft. Therefore, from an economic perspective, lessors seem to be market efficiency enhancers that facilitate transactions that are almost invariably Pareto-efficient.

Nevertheless, operating lessors are far from being non-profit organizations that altruistically seek to increase aggregate welfare. Given that they have the ability to drive efficiency gains in the market for commercial aircraft acquisition, lessors are in a comfortable position to retain a large share of the economic surpluses generated.

An obvious motivation for airlines' decision to lease applies in cases where the airline is financially constrained and does not have a credit rating that allows it to access debt at reasonable interest rates. Therefore, an argument can be made that airlines that face liquidity restrictions or have bad credit rating are more likely to find leasing attractive. It then follows that Lessors must be absorbing some of the risk that other financial institutions are not willing to absorb. But if that were true, then lease rates should be higher for these kinds of airlines and leasing would no longer be preferred over debt. Therefore, it seems reasonable to conclude that lessors must have an edge in airline-specific risk management technology that allows them to manage risk at a lower premium than other financial institutions would.

Although financial constraints and bad credit rating as a motivation for leasing are more thoroughly discussed in the following section, a critical observer would wonder why airlines that are neither financially constrained nor rated unfavorably for credit access purposes would still choose to lease rather than buy aircraft. Vasigh et al. (2015) propose a numerical analysis of whether it is convenient to lease or to buy. The analysis is presented as *net advantage to leasing* (NAL) and is composed of calculations of the net present value (NPV) of leasing a given aircraft as opposed to the NPV of buying the same airplane. More specifically, once the NPVs of both alternatives have been calculated, the NPV of the purchase alternative is subtracted from the NPV of the leasing alternative, yielding the NAL as a result. Needless to say, a positive NAL value means it is more convenient to lease and vice versa. Below is a numerical example of a NAL calculation, as presented by Vasigh et al. (2015). As can be seen from the table, this sort of NPV analysis is markedly rooted in tax considerations. The

problem with such an analysis is that different countries have different regulations for tax benefits, which means that NAL analysis is not robust to varying regulatory conditions and tax rates around the world. Thus, while NAL analysis is a powerful and useful empirical tool for airlines to decide whether it is more convenient to lease or to buy an aircraft, it does not say much about the more fundamental economic concepts underlying the choice between leasing and buying. In other words, NAL analysis may yield different conclusions depending on where –geographically– it is implemented.

Table 1 – Numerical Example of NAL Analysis

Table 12.5 Buy-vs.-lease NPV analysis (cash financing)

($000s)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Cost of leasing (Operating lease)								
Lease payment	($12,000)	($12,000)	($12,000)	($12,000)	($12,000)	($12,000)	($12,000)	
Payment tax shield	$4,200	$4,200	$4,200	$4,200	$4,200	$4,200	$4,200	
Net cash flow	($7,800)	($7,800)	($7,800)	($7,800)	($7,800)	($7,800)	($7,800)	$0
Discounted cash flows	($7,800)	($7,414)	($7,048)	($6,700)	($6,368)	($6,054)	($5,754)	
NPV cost of leasing								**($47,138)**
Cost of owning (Cash financing)								
Net purchase price	($90,500)							
Maintenance cost		($1,810)	($1,810)	($1,810)	($1,810)	($1,810)	($1,810)	($1,810)
Maintenance tax shield		$634	$634	$634	$634	$634	$634	$634
MACRS depreciation		($12,932)	($22,163)	($15,828)	($11,303)	($8,082)	($8,073)	($8,082)
MACRS tax shield		$4,526	$7,757	$5,540	$3,956	$2,829	$2,825	$2,829
Remaining taxable value	$90,500	$77,568	$55,404	$39,576	$28,272	$20,191	$12,118	$4,036
Remaining book value	$90,500	$84,036	$77,571	$71,107	$64,643	$58,179	$51,714	$45,250
Salvage value sale								$45,250
Taxable salvage value (recaptured depreciation)								$41,214
Salvage value tax								($14,425)
After-tax salvage value								$26,789
Net cash flow	($90,500)	$3,350	$6,581	$4,363	$2,780	$1,652	$1,649	$32,477
Discounted cash flows	($90,500)	$3,184	$5,946	$3,748	$2,270	$1,282	$1,216	$22,776
NPV cost of owning								**($50,078)**
NAL								**$2,939**

Source: Vasigh et al. (2015)

In fact, in the absence of market imperfections, it would be expectable that the NPV of buying and the NPV of leasing would tend to be equalized due to arbitrage. Consequently, there must be an array of microeconomic issues that define the precise way in which the aircraft leasing market diverges from the idealized perfect-market benchmark. The present working paper proposes that it is the understanding of these microeconomic issues that will aid in the comprehension of why airlines may choose to lease aircraft rather than buy them.

b. What Microeconomic Issues Are Directly Influenced (and Improved) by the Existence of Lessors?

There are certain microeconomic concepts that are crucial in the dynamics of markets of durable goods in general and that are key in the airline input market in particular, in observance of the fact that aircraft, which are arguably the single most important factor of production for airlines, undoubtedly qualify as durable goods. These are *financial constraints* such as *liquidity restrictions* and *bad credit rating*, *tax benefits*, *output volatility* in the presence of *trading frictions* in *thin markets, asset liquidity* and *market thickness,* and *information asymmetry* leading to *moral hazard* and *adverse selection*. This section aims to analyze each of these concepts in light of their implications for the airline input market.

I. Financial Constraints

Sharpe and Nguyen (1995) find that firms that have lower credit ratings, do not pay dividends and are cash-poor have a greater share of their annual fixed capital costs in the form of leases. These sorts of companies are subject to higher risk premiums, and find having an option to lease to be of extreme value because it allows them to generate revenues they would have not been able to generate otherwise. In addition, firms that face significant interest penalties when seeking to go into debt may be able to reduce some of the costs that are associated with information asymmetry and the lack of understanding of the airline business on the lender's part. Operating lessors have industry-specific knowledge that helps reduce the degree of information asymmetry and, consequently, the risk premium charged to the airline. It is, then, not surprising that "the total lease share of a low-rated firm that pays no cash dividends is about 25 percentage points higher than that of a highly rated dividend-paying firm" (Sharpe and Nguyen, 1995).

Lin et al. (2013) find evidence to prove that leasing and debt financing are negatively correlated, which suggests that they are used as substitutes. In particular, the authors find evidence that the propensity to lease is positively affected by low internal funds, high variability of internal funds, high market-to-book ratio, low asset tangibility and small size.

In summary, as mentioned above, financial constraints constitute one of the more obvious motivations for an airline to lease and remain an important issue that is alleviated by the existence of operating lessors.

II. Tax Benefits

A significant portion of the literature on the benefits of leasing cites tax benefits as the ultimate explanation for the choice of leasing over the purchasing of durable assets. Sharpe and Nguyen (1995) point out that an exhaustive characterization of the tax considerations affecting a firm's entire capital composition is not a trivial endeavor, even under the assumption of complete markets, although they still recognize that tax benefits may be one component in the decision to lease.

Lin et al. (2013) hold that "low tax rate firms should lease more than high tax rate firms" and Bell and Thomas (2013) develop a specific model to define the mechanism by which tax benefits can be realized. In particular, tax arbitrage is made possible by the existence of "asymmetric treatment of interest expense and interest income" (Bell and Thomas, 2013). In this manner, if the lessee and the lessor face different tax rates, it is possible for the aggregate tax expenditure of the two to be reduced by deducting more tax on the high tax rate firm's balance sheet than on the low tax rate firm's balance sheet. This mechanism is somewhat related to what JLLs used to do until the early 1990s.

Nevertheless, regardless of the actual tax benefits that may arise from choosing to lease as opposed to buying aircraft, authors like Miller and Upton, Myers, Dill, and Bautista (as cited in Sharpe and Nguyen, 1995) point out that, in order for tax benefits to have a significant weight in the decision to lease, a competitive equilibrium in capital markets, without transaction costs or information asymmetries must be assumed. In any case, tax benefits alone can only be a secondary component of the decision to lease, or regulators would have already found a way to eliminate the possibility for tax arbitrage, and leasing

would only be a viable option in certain countries where tax rates made it convenient. The widespread popularity of leasing as an alternative to buying proves this point. Moreover, Gavazza (2011a) states that "[i]f leasing were so favorable from a taxation perspective, we should probably expect all aircraft to be leased" and carries out an empirical analysis that shows that tax benefits are a minor ingredient in the decision to lease.

III. Output Volatility, Trading Frictions and Market Thinness

The high level of procyclicality and seasonality that must be endured by the commercial aviation industry results in many firms exhibiting considerable output volatility. It is natural for a firm with high output volatility to have an incentive to adjust its capacity in response to its productivity. However, market imperfections such as trading frictions shift the efficiency of this process from the theoretical optimum. As noted in Section 3.a, lessors play a role in the airline input market as intermediaries who reduce trading frictions. Gavazza (2011a) finds that the higher the output volatility a given firm experiences, the more inclined towards leasing that firm will be. It is argued that the presence of lessors in the airline input market increases the overall efficiency of the airline market. Ideally, only the most productive airlines should survive in the commercial aviation industry. However, Gavazza (2011b) develops a model that characterizes the divergence from the ideal efficiency scenario that exists in practice. Firms have varying levels of productivity, with a distribution that exhibits low-productivity firms as well as high-productivity firms. It is argued in the model that there is a *buyer's cutoff value* of productivity above which a high-productivity firm that does not own aircraft will be willing to buy one. Similarly, there is a *seller's cutoff value* of productivity below which low-productivity firms that own aircraft prefer to sell them. Trading frictions in the form of transaction costs such as search costs and bargaining costs cause the buyer's cutoff to be higher than seller's cutoff, thus creating a wedge within which aircraft are not traded. The existence of this wedge implies that there are less productive firms operating aircraft and more productive firms not operating aircraft, which clearly is an inefficient market equilibrium. Lessors promote an increase in efficiency by directly reducing transaction costs, both by using their contact network to minimize search costs and their knowledge of the market to drive down bargaining costs.

A fundamental characteristic of the airline input market is market thinness (or its counterpart, market thickness). According to Gavazza (2011a), the used good market for aircraft is a single worldwide market, owing to the fact that aircraft are the only kind of asset that can be repositioned in any part of the world almost immediately. Nevertheless, aircraft are also differentiated products and "[e]ach type of aircraft requires human-capital investments in specific skills –for pilots, crew and mechanics- that increase the degree of physical differentiation" (Gavazza, 2011a). This means that different types of aircraft may not be perfect substitutes for one another, which implies that they may well constitute separate 'sub-markets' in the secondhand market for aircraft. Although market thinness is more thoroughly discussed in the following section, it is important to note that the used good market for different kinds of aircraft may exhibit different degrees of market thinness. The thinner a given market is, the higher the buyer's cutoff will be and the lower the seller's cutoff will be. The implication of this is that market thinness aggravates the effect of trading

frictions. Intuitively, it makes sense that thinner markets have fewer participants, which in turn increases search costs and gives bargaining a more prominent role in the determination of prices. Therefore, an alternative view of the contribution of lessors to the efficiency of the airline input market is that they tend to reduce the degree of market thinness.

IV. Asset Liquidity and Market Thickness

The previous section noted how market thinness is a very important market characteristic that defines the ease of trade within it. An intrinsically related concept to market thickness –the opposite of market thinness–, especially in durable goods markets, is asset liquidity. In general, a high degree of asset liquidity has a high correlation with market thickness. Conversely, asset illiquidity can be understood as sunkenness of the asset.

Gavazza (2010) concludes that more liquid assets are more likely to be leased, and that lessors require lower markups on them. Moreover, more liquid assets have shorter operating leases and longer capital leases. The underlying motivation for shorter operating leases is that liquid assets are more easily redeployable by lessor to a new lessee. Likewise, the reason capital leases of liquid assets have longer durations is that liquid assets are better collateral (Hart and Moore, 1994 as cited in Gavazza, 2010).

Operating leases of illiquid assets tend to have longer periods both because the magnitude of search costs is large and because the illiquidity of the asset creates incentives for opportunistic behavior. For instance, an airline could demand lower rental rates if it anticipates that lessor does not have other alternatives to reallocate the aircraft with a new lessee. On the other hand, lessor could demand an increase in the rental rate upon renewal if it realizes that lessee has made "asset-specific investments in pilots, mechanics and crews" (Gavazza, 2010). It follows that asset-specificity is a significant contributor to the degree of illiquidity of an asset, because the difficulty to find substitutes makes its secondhand market a thin one. It is therefore not surprising that it is in lessors' best interest to possess liquid aircraft. Regarding the desirability of liquid assets that have a thick market, Gavazza (2011b) finds that more liquid aircraft produce greater revenues and have a higher mean and a lower dispersion of capacity utilization, as well as a higher mean and a lower dispersion of transaction prices.

In this manner, aircraft liquidity is related to trading frictions –more specifically, transaction costs–, as well as overall market efficiency, in that more liquid aircraft are more productive and only highly productive airlines will find it profitable to deal with the transaction prices associated with aircraft acquisition in exchange for the relatively lower transaction costs. Another way to look at this is that liquid aircraft have lower option values of holding to them even when productivity is low, which means that the wedge described in Gavazza (2011b) and analyzed in Section 3.b.III is smaller and their market is more efficient. Therefore, inasmuch as lessors are able to contribute to the thickness of a given market by increasing the liquidity of a given type of aircraft –as a result of their capacity to reduce both search and bargaining costs– they can reasonably be thought of as efficiency enhancers in the airline input market. Furthermore, when taking into consideration the fact that monitoring costs incurred by lessors cause rental rates to be higher than the opportunity

cost of ownership (Gavazza, 2011a), it must be true that high-productivity airlines are better off by accepting the excess rental rate in exchange for the reduced transaction costs offered by lessors.

Another interesting trait about aircraft liquidity is that newer aircraft are leased more frequently, which implies that they are more liquid. This is another reason lessors should prefer to own newer, more liquid aircraft and has to do with the nature of aircraft depreciation. In order to understand the concept, a comparison can be drawn between aircraft depreciation and car depreciation (since cars are an immediate example of durable goods involved in transportation). First, it is important to note that while cars are mostly bought by individuals for personal use, aircraft are largely a factor of production for airlines and therefore are used for business purposes, particularly in very competitive markets. This means that the meaning of depreciation in each case need not be analogous. On the one hand, car depreciation is closely related with wear and tear as well as availability of new hedonic attributes whereas, on the other hand, aircraft depreciation has much to do with becoming technologically outdated and, most importantly, no longer being able to satisfy the markets for which they are used as a factor of production. In other words, as the commercial aviation industry develops and grows relentlessly, certain aircraft models that were conceived for a given type of market (for instance, the long-range, low capacity, non-stop kind of market), may no longer be optimally suited for that purpose. This means, that even if neither technological progress nor wear and tear were the main drivers of depreciation, market dynamics could still render a certain type of aircraft obsolete.

Furthermore, the suitability of different aircraft models is also closely related to the international price of oil. The reason is that the higher the price of oil, the more desirable will aircraft with low fuel consumption be. If oil is expensive enough, then an aircraft model that demands a higher initial investment but has better fuel consumption may be well worth the financial effort because it will pay off in the form of higher operating margins. Conversely, if the price of oil were to drop significantly, then aircraft that are cheaper (either in terms of purchase price or lease rental rates) would be more attractive because fuel consumption would be relatively less important (i.e. would be weighted with a smaller coefficient) in the composition of marginal cost. Once again, the usefulness of lessors becomes apparent given that, due to technological reasons coupled with macroeconomic shocks, airlines value the flexibility offered by lessors that allows them to switch aircraft models without incurring prohibitive transaction costs.

V. Information Asymmetry, Moral hazard and Adverse Selection

One of the most valuable assets lessors possess is information that is not readily available to airlines. Due to the fact that aircraft are traded in decentralized markets and that many of their quality attributes are not easily observable (there is a significant amount of paperwork that defines aircraft condition), a problem that arises in the market for aircraft trading is information asymmetry. More precisely, a given airline that is about to release an aircraft has an informational advantage with respect to another airline that is looking to acquire that aircraft. This information asymmetry results in two separate issues, namely moral hazard and adverse selection. Moral hazard can occur if the current operator

anticipates that it will release the aircraft and therefore stops devoting resources to proper maintenance of the aircraft because the selling price will not reflect this improper maintenance. Adverse selection is derived from the fact that, due to incomplete information, the market will set a price that is a function of the average quality of all the used aircraft that are sold in the market. As a result, owners that possess high-quality aircraft will not be willing to sell them because the market price is too low for their value, so they auto-select themselves out of the market and only the inferior quality aircraft are traded.

Johnson and Waldman (2010) examine the market for car leasing, and they point out that consumers with a strong preference for quality may choose to drive new cars every period, which strengthens the moral hazard problem, since it is optimal for them to invest nothing in maintenance. In this case, the moral hazard problem persists indistinctly in leasing as well as purchasing scenarios. However, aircraft maintenance is substantially different compared to car maintenance because standardization, airworthiness directives (ADs) elaborated by the aircraft manufacturer and extra-market controls performed by Civil Aviation Authorities make operational safety fairly homogeneous among different aircraft models of different ages. The information asymmetry regarding aircraft quality will have more to do with the condition of the interiors and the quality of the paperwork and documentation available for the aircraft as well as engine life remaining. That is, it is possible that a given aircraft has not been maintained in optimum condition, but it very rarely is safety the component of quality that is affected by said sub-optimum maintenance. The implication behind this argument is that quality as a concept is considerably more complex in the commercial aviation industry than in many other industries and is composed of several aspects, such as safety, comfort and traceability (documentation) among others.

Nevertheless, Gilligan (2004) finds that "adverse selection can survive the types of counteracting institutions present in the market for business aircraft," but still recognizes that leasing can help mitigate the effects of adverse selection on prices and trading volumes, both of which are inversely related to the degree of information asymmetry. In similar fashion, Hendel and Lizzeri (2002) show that leasing both increases the volume of trade in the used durable goods market and attenuates the tendency for a decrease in prices that is generated by adverse selection. Furthermore, the authors find that the quality of the goods that are returned to lessor is higher than that of goods that are bought/sold. Consequently, aircraft operators will tend to feel safer when buying or leasing aircraft that were previously leased as opposed to aircraft that were previously owned. The main reason for this is that separating the previous owner from the previous operator (that is, the lessor as the owner and another airline as the operator) solves the moral hazard problem of not maintaining the aircraft properly. In a way, one of the many functions of lessors as efficiency enhancing intermediaries is to act as quality assurance agents. This, in turn, makes previously leased aircraft more reliable (in the aggregate, less risky[7]) than previously owned aircraft.

[7] It is important to emphasize that the term "risky" is here used in relation with investment risk and not safety-related risk. Airline maintenance standards are self-regulatory and anyway audited by Civil Aviation Authorities. Therefore, poor maintenance in the context of commercial aviation has to do with a lack of conservation of asset value rather than a compromise in operational safety.

Furthermore, when dealing with previously leased aircraft, information asymmetry is reduced and hence adverse-selection loses relative importance. Because the quality of the used durable is more easily observable when said quality has been supervised by an owner/lessor, it is not necessarily only the lesser-quality aircraft that will be traded (either leased or sold/bought), or at least its quality will be reflected either in the purchase price or the lease rental rate.

Hendel and Lizzeri (1999a), state that in order for lessors to be able to reduce adverse selection, they must have a technological advantage in their learning of aircraft condition as well as credibility in communicating the information to lessees. Again, it becomes apparent that one of the most valuable assets lessors have –apart from the actual aircraft– is information that is not readily available to airlines together with their contact network and good reputation in the eyes of their customers.

In any case, lessors' ability to mitigate information asymmetry has substantial positive effects on the airline input market, specifically in that they ensure that aircraft are maintained under rigorous standards as well as increase the average quality of assets traded in the secondhand market. As a consequence, the volume of aircraft traded in the secondhand market is increased by the existence of lessors, which in turn increases asset liquidity and market thickness and, thus, improves the overall efficiency of the market.

4. Why Do Lessors get the Better Part of the Deal?

Section 3.a presented the conceptual framework of NAL analysis. It was argued that a positive NAL value suggests that a given airline will be better off leasing an aircraft than purchasing it. However, nothing was said about the magnitude of the NAL value. In other words, it is irrelevant to the airline whether the positive NAL value is US$ 10 or US$ 10 million. The implication behind this is that there is a range of lease rental rates at which the deal will occur. At the minimum value, lessor is indifferent between leasing and not leasing the aircraft out to lessee. At the maximum value, lessee is indifferent between leasing the aircraft from lessor and purchasing it. Therefore, the actual value within the aforementioned range at which the deal will be signed is determined by the market power each the lessor and the lessee have in the aircraft leasing market.

It appears that due to the low number of competitors and the high level of concentration in the supply of leasing (i.e.: the lessors' side), coupled with the high number of players and a lower level of concentration –at least when compared to the lessors' side– in the demand for leasing (the airlines' side), the lease rate agreed upon in leasing contracts tends to be much closer to the maximum than to the minimum. In addition to concentration, there are entry barriers of different kinds[8] as well as some level of implicit coordination that enable lessors to obtain very favorable conditions on their leasing agreements with airlines. This means, that in general, leasing companies benefit more from the deal than do the airlines.

In particular, the more liquid the aircraft is, the easier it will be for operating lessors to sign deals with lease rates that are close to the maximum in the range. Related to this, Gavazza (2010), states that more liquid aircraft increase the options both for lessor and for

[8] This implies that the market is not perfectly competitive.

lessee and that "lease rates then converge to competitive levels" (Gavazza, 2010). Notwithstanding, it is the definition of 'competitive' that is inevitably subjective because it says nothing about the opportunity costs involved. Gavazza (2011a) implies that highly productive airlines may choose to withstand an implicit rental rate premium as a tradeoff for the reduction in transaction costs. This situation is further stimulated by the fact that airlines with high utilization (usually in high density markets) are able to dilute their overall fixed costs (i.e.: the fixed cost per unit produced is lower), which include the rent component of their leasing expenses[9]. As a result, these airlines may be willing to accept higher lease rates in order to minimize transaction costs –more specifically, search and bargaining costs–, that in the most basic outlook are represented by the time it takes to sign a deal once the airline learns that it needs to lease an additional aircraft.

a. Market Power: The Elements that Nurture it

It was mentioned above that relative industry concentrations in the leasing business and the airline business shape the dynamics of the negotiations between lessors and airlines. It was also stated that there are an array of entry barriers coupled with some level of implicit coordination that allow lessors to obtain more favorable conditions on their leasing agreements than they would in a scenario with no entry barriers and perfect competition. Below, concentration, entry barriers and implicit coordination are more thoroughly analyzed in search of better understanding the elements that nurture lessors' market power in the aircraft leasing business.

I. Concentration

Gavazza (2010) points out that GECAS and ILFC, the two largest players in the operating leasing market, have more than 50 percent market share, when combining the two. The following table, reconstructed from Morrell (2007) provides an illustration for that point.

Table 2 –Concentration in the Supply Side of the Operating Lease Market

Top 9 Operating Lessors	Owned Jet Aircraft	Share of Total Fleet	Value of Fleet (US$ million)	% Share of Total Value
GECAS	1,301	36%	23,986	32%
ILFC	911	25%	27,176	36%
Boeing Capital	349	10%	4,446	6%
AerCap	245	7%	3,069	4%
Aviation Capital Group	222	6%	4,471	6%
Babcock & Brown	156	4%	3,337	4%
AWAS	156	4%	2,559	3%
GATX Capital	139	4%	3,009	4%
RBS Aviation	138	4%	3,508	5%
TOTAL	3,617	100%	75,561	100%

[9] Technically, there is also a variable component to leasing expenses that consists of maintenance reserves, as explained in Section 2.c.

Even though Table 2 is evidently outdated (it is difficult to gather numerical data on the aircraft leasing market), it proves the point that there are two major players that act as market leaders and other smaller players without enough weight to influence market conditions significantly.

However, what is of interest when understanding the commercial relations between aircraft lessors and airlines is the relative concentration in each industry. In other words, concentration in the supply side means nothing if it is not viewed in contrast with concentration in the demand side. For that purpose, below is a table reconstructed from Morrell (2007) that provides an appreciation of the degree of concentration in airlines' demand for leasing. Again, Table 3 is outdated but consistently so with Table 2.

Table 3 –Concentration in the Demand Side of the Operating Lease Market

Region	Airline	Total Fleet	% Under Operating Lease	Fleet under Operating Lease	Share of Total Leased Fleet
U.S.	AMR	1,001	24.0%	240	11.1%
	Delta	649	31.3%	203	9.4%
	Continental	630	76.5%	482	22.2%
	Northwest	580	43.3%	251	11.6%
	United	460	37.6%	173	8.0%
	Southwest	445	18.9%	84	3.9%
	JetBlue	92	33.7%	31	1.4%
	Total U.S.	3,857	38.0%	1,465	67.4%
Europe	Lufthansa	432	16.4%	71	3.3%
	Air France-KLM	397	36.8%	146	6.7%
	British Airways	284	27.1%	77	3.5%
	Alitalia	175	24.0%	42	1.9%
	Iberia	149	59.7%	89	4.1%
	EasyJet	109	83.5%	91	4.2%
	Ryanair	87	14.9%	13	0.6%
	Total Europe	1,633	32.4%	529	24.3%
Asia/Pacific	Qantas	200	26.0%	52	2.4%
	Air China	136	16.9%	23	1.1%
	SIA Group	118	21.2%	25	1.2%
	Cathay Pacific	96	13.5%	13	0.6%
	Air New Zealand	89	49.4%	44	2.0%
	Air Asia	26	84.6%	22	1.0%
	Total Asia/Pacific	665	26.9%	179	8.2%
AGGREGATE TOTAL		6,155	35.3%	2,172	100%

Moreover, Table 4 is composed only of selected airlines in the three larger regions for commercial aviation. Nevertheless, including more airlines and regions would not alter the qualitative implications of the data as presented here.

Table 3 shows that, of the airlines selected, Continental is the only one with a share of more than 20% whereas only AMR and Northwest stand above 10%. In short, there is a considerable degree of atomization in the demand side for aircraft leasing. It could be

argued that there is some concentration in terms of regions, with the U.S. being a clear leader. Notwithstanding, because the market for aircraft leasing is a single, worldwide, decentralized market (Gavazza, 2011a), a regionalized analysis is irrelevant.

In order to better see the differences in the level of concentration in both the supply side and the demand side of the operating leasing business, Table 4 shows the Herfindahl-Hirschman Index (HHI) for each. The HHI is here calculated as: $\sum_{i=1}^{N} \propto_i{}^2$, where N is the number of firms in the sample and $\propto_i$ is the market share of firm i. Therefore, the range of possible values for the HHI goes from 0 to 1, with HHI=0 representing a situation of perfect competition and HHI=1 representing a situation of monopoly. The values for market share in the supply side and the demand side are taken from column 3 ('Share of Total Fleet') of Table 2 and column 6 ('Share of Total Leased Fleet') of Table 3, respectively.

Table 4 – HHI Measure of Concentration in the Operating Lease Market

Concentration in the Operating Lease Market	N	HHI
Supply Side (Lessors)	9	0.217
Demand Side (Airlines)	20	0.104

Table 4 shows that the supply side of the operating leasing market is moderately concentrated and considerably more concentrated than the demand side of the operating leasing market. It would be interesting, however, to repeat the calculation for larger values of N.

In sum, it has been shown that there is a greater degree of concentration among lessors than there is among airlines, in both cases with respect to the operating leasing market. However, concentration alone may imply that there are entry barriers to new entrants in the supply side of leasing but not necessarily implies that there is coordination –implicit or not– among incumbents. The fact that there is concentration together with double-digit profitability is what constitutes a hint that there may be both entry barriers as well as some level of coordination.

II. Entry Barriers

Many authors in the realm of industrial organization propose that sunk costs constitute an entry barrier. For instance, Asplund (2000) explains that, when considering investment decisions, the sunk cost component is very important because a low salvage value[10] implies that the NPV of the project will be low. In addition, if uncertainty is significant for the project being considered, the existence of sunk costs creates an option value of waiting until new information is obtained and hence reducing the probability of incurring irreversible costs that could have been avoided by considering the optimal timing for investing (or abstaining from doing so). In addition, Asplund (2000) finds that asset-specificity and sunk costs tend to be positively correlated.

[10] That is, how much of the invested capital will be recovered, net of all cash flows generated by the investment. The difference between the initial investment and the salvage value constitutes a sunk cost of investment.

Baumol and Willig (1981) make a careful differentiation of fixed costs and sunk costs. The authors explain that whereas large fixed costs and market contestability can coexist, the existence of large sunk costs necessarily creates barriers to entry. When a market is not contestable, market power arises and price mark-ups over marginal cost can be substantial. According to Baumol and Willig (1981), long-run fixed costs cannot be reduced by reducing output but can, nevertheless, be eliminated by total cessation of production. On the other hand, sunk costs cannot be eliminated –or recovered for that matter– even if production is discontinued altogether. Similarly, the authors define an entry barrier as something that requires entrants to incur expenses but generates no costs for incumbents, assuming that both the entrants and the incumbents have identical technologies. Likewise, Kessides (1990) states that sunk costs represent an entry barrier inasmuch as "the entrant's incremental cost includes the irrecoverable portion of the entry investment that is bygone to the incumbent." Moreover, entry barriers can be deliberately created by incumbents by performing "legal countermoves, capacity expansion, or advertising" (Baumol and Willig, 1981). Regardless, the key point is that a market with no entry barriers is a perfectly contestable market, which means that even in a situation of oligopoly or monopoly, entrants could reversibly and costlessly enter such a market. This, in turn, means that no price mark-ups can exist because incumbents will not want to allow entrants the possibility of making instantaneous profits by marginally undercutting the incumbents' price and leaving the market once the incumbents react by further decreasing their price[11]. Conversely, a market with significant entry barriers and thus, non-contestable, creates the possibility for oligopoly or monopoly profits to exist.

Kessides and Tang (2010) find that "increased market contestability, as signified by low sunk costs, tends to reduce the dispersion of firm sizes." It was shown in Table 2 that there exists significant size dispersion in the supply side of the aircraft leasing market, as measured both by fleet size and by fleet value. In order to analyze the degree of contestability of the leasing market, in light of the existence of sunk costs, it is useful to consider some of the defining traits of a perfectly contestable market, as proposed by Kessides and Tang (2010). These traits are full-reversibility of all entry investments, homogeneous technology of production among producers, and lack of consumer goodwill –which means that consumers have no loyalty and only care about price–. As for the investment directed to the acquisition of aircraft, there invariably are sunk costs regardless of how liquid (and hence non-specific) the aircraft are. Also, it will be discussed below that technology is not necessarily homogeneous. Finally, even though airlines are many times financially constrained, price alone will not determine preference for a particular lessor because, in the aircraft leasing business, relationships and trustworthiness fostered over the years are valuable intangible assets that complement price as motivators for signing a deal.

In fact, considerations about what portion of the entry investments required are sunk costs cannot be constrained to an exclusive analysis of tangible assets; more specifically, the aircraft. Kessides and Tang (2010) highlight the importance of intangible capital and the

[11] All of this implies that a perfectly contestable market yields a Bertrand equilibrium in a situation of either oligopoly or monopoly, because the sole threat of entrants yields zero profits for incumbents.

degree to which it can generate sunk costs. Kwoka and White (2001) cite R&D and advertising expenditures as examples of expenditures on intangible assets that constitute sunk costs. In the aircraft leasing market, R&D expenditures are definitely present in the form of resources put into acquiring *know-how* (i.e. learning costs) of both the leasing and the airline business and the time, money and effort that are put into establishing a contact network. In the case of advertising, what is relevant in the aircraft leasing market are investments in brand recognition and trustworthiness among clients. These kinds of intangible assets are highly specific, which means that they exhibit a high level of sunkenness. In addition, according to Kessides and Tang (2010) "entry and competition in knowledge-intensive industries requires high R&D expenditures." Therefore, because the aircraft leasing industry is definitely knowledge-intensive, not only are sunk costs present, but also their magnitude is considerably large. Finally, Kessides and Tang (2010) find that the easier the leasing of a given type of capital is, the lower the sunkenness of that capital is. This proves that, regarding entry barriers in the leasing market, the sunkenness of tangible capital (the aircraft) is not important. What is important is the sunkenness of the intangible capital, in the form of *know-how*, brand recognition, trustworthiness and contact network.

III. Implicit Coordination

It is a widely known notion that multimarket contact creates incentives for tacit collusion or implicit coordination. According to Degl'Innocenti et al. (2014), "multimarket contact is common in the financial services industry." Although leasing companies are not financial services providers in the purest sense, they do offer solutions to financially constrained airlines and thus share many traits with financial institutions, at least in their market structure.

The reason multimarket contact provides incentives for implicit coordination is that aggressive price undercuts or improvements in contracting conditions offered by 'firm a' in a submarket where 'firm b' is a strong player can cause 'firm b' to retaliate in another submarket where 'firm a' is a strong player. Therefore, the situation can be framed as one of an infinitely repeated *prisoner's dilemma* in which firms end up realizing that it is optimal for them to cooperate[12] and maximize both aggregate and individual profits. In addition, competitors' strategy and behavior can be easily observed because airlines will promptly show leasing companies proposals from their competitors in order to obtain better prices and contracting conditions. Therefore, if in any period a firm where to choose the non-cooperative behavior, its competitors would almost immediately learn about it and react by punishing the non-cooperative firm by not cooperating and leaving everyone worse off, thus drifting away from the Pareto-efficient outcome[13] that can be realized by mutual cooperation.

In conclusion, given that multimarket contact acts as an incentive for implicit coordination and that the aircraft leasing market is not a significantly contestable one, it

[12] The assumption of an *infinitely repeated* game is key in assessing the optimality of cooperation for the firms.

[13] In this analysis, Pareto efficiency only takes into consideration the welfare of lessors, more specifically in the context of a *prisoner's dilemma*.

does not seem necessary for lessors to incur substantial concessions in order to win deals with airlines. Also, because competitors' behavior is quite easily observable, it should be relatively easy for the cooperative equilibrium to emerge among lessors. This implies that, although very hard to prove, implicit coordination among lessors is likely, if not highly probable.

IV. An alternative to Market Power: Efficiency and Production Technology

An alternative to concentration, entry barriers and implicit coordination as market power stimulators when understanding why lessors get such good deals is mentioned in Degl'Innocenti et al. (2014): "[A]cademic researchers as well as antitrust authorities have often relied on industry's profitability to infer competitive conditions. Yet the exercise of market power can be considered as one of several possible reasons why firms earn excessive and persistent profits. Firms may be more profitable because they are better managed and thus more efficient; and/or, they may be acting more as risk-takers and be better innovators in a particular market." In other words, the homogeneous technology assumption is many times violated, which means that there is the possibility that a firm may earn significant profits simply by being more efficient without the need for the existence of welfare-decreasing entry barriers.

However, although there may be some smaller firms with non-homogeneous production technologies, it is very unlikely that the major leasing companies differ too much in their knowledge of the industry, and their ability to provide the leasing service to airlines. Therefore, it is here proposed that concentration, entry barriers and implicit coordination must all play a part in the market structure of the aircraft leasing business, that allows the supply-side to exercise market power in order to maintain non-negligible and long-lasting profits.

b. Why Do Lessors (or manufacturers) Not Eliminate the Secondhand Market for Used Aircraft?

After having discussed the factors that allow lessors to enjoy a level of market power that allows for non-negligible, long-lasting profits, it seems reasonable to consider why the largest lessors, such as GECAS, ILFC, or even Boeing Capital (Boeing's leasing arm), do not close the leasing market for used aircraft in order to force old aircraft out of the market and thus charge higher rental rates on new aircraft. Regarding this, Waldman (1997) discusses a more extreme situation in which the secondhand market for either leasing or purchasing is eliminated altogether, paradoxically by the implementation of a lease-only policy. One of the more obvious reasons why the aircraft secondhand market has not been eliminated has to do with legal considerations. Hendel and Lizzeri (1999b) explain that there have been many antitrust cases in which manufacturers were found guilty of tampering with secondhand markets only to achieve monopolistic, aggregate-welfare-decreasing benefits. In similar fashion, Waldman (1997) mentions that "the current state of the law is that for a monopoly seller of a durable good it is illegal to pursue a policy of solely leasing rather than selling its output." Regardless, even if there were no legal and regulatory concerns arising from manipulation or even elimination of secondhand markets, there is another reason why

manufacturers and lessors might find it optimal not to interfere with such secondhand markets.

Hendel and Lizzeri (1999b) claim that "despite the fact that used goods are substitutes for new goods, the monopolist prefers used markets to function smoothly because this permits segmentation of consumers into two classes: new-good buyers and used-good buyers." This means that whether a monopolist or coordinated oligopolists decide to close the secondhand market depends on the demand-side valuation of the used good. A higher valuation means a higher price and hence the absence of a threat to the price of the new good (due to substitution). Therefore, the higher the valuation of the used good, the more beneficial it is for the monopolist or coordinated oligopolists to keep the secondhand market alive and functioning smoothly.

The fact that there are so many small, financially constrained airlines in the world suits the explanation proposed by Hendel and Lizzeri (1999b). If there were no market for the leasing of secondhand aircraft, even leasing (of only new aircraft) would be a prohibitive option for these types of airlines owing to extremely high rental rates. Therefore, the existence of a secondhand market is used both by manufacturers and lessors as a successful means of vertical differentiation and price segmentation. In addition, smaller airlines that manage to survive because of secondhand inexpensive leasing alternatives might grow to become mid-size or even large firms and thus contribute to an expansion in the demand for new aircraft that are more profitable both for lessors and for manufacturers.

5. Why Do Manufacturers Not Lease Aircraft Out Directly?

So far, lessors' role as efficiency enhancing agents who reduce trading frictions has been discussed. It has been pointed out that the existence of lessors allows for the possibility of more solid growth in the airline industry. However, it has also been shown that, due to the aircraft leasing market structure, lessors are able to make generous profits, thereby absorbing a great portion of the economic surpluses generated by the deals with airlines. Hence, a natural question that arises is that of why aircraft manufacturers do not take over the leasing business themselves by eliminating lessors as intermediaries and, as a consequence, keep both the producer's surplus obtained by selling aircraft and the surpluses generated by the current market intermediaries, namely the lessors. There are several reasons aircraft manufacturers have not been able to do this, and they range from the market structure of aircraft manufacturing to antitrust regulations to the entry barriers already discussed in Section 4.a.II.

a. Airframe Makers vs. Engine Makers

The very physical composition of aircraft is arguably the most significant issue that must be considered when analyzing the role of manufacturers in the airline input market. It was mentioned in Section 2.d that an aircraft is actually defined as an airframe or *fuselage* plus the number of engines that the aircraft model requires. It is of key relevance for the market structure on the manufacturers' side that airframes and engines are not produced by the same firms. While the largest and most famous commercial airframe manufacturers are

Boeing and Airbus[14], there is an engine-manufacturing trio composed of General Electric (GE), Pratt & Whitney and Rolls Royce. Therefore, although engine manufacturers have to participate in a bidding process in order to get airframe manufacturers to choose their engines to build aircraft, it can be argued form a technical perspective that aircraft are not fabricated by a single producer but are, instead, jointly produced by the airframe manufacturer and the engine manufacturer. This, in turn, means that any strategic decision made by an airframe manufacturer will be subject to actions undertaken by engine manufacturers.

As analyzed in Hendel and Lizzeri (1999b) and in Waldman (1997), a manufacturing monopolist may have an incentive to interfere with or even eliminate the secondhand market for the goods it produces. In particular, Waldman (1997) proposes that it may be beneficial for the monopolist to employ a lease-only policy, which would allow it to control the optimal duration of the assets produced and maximize profits by choosing when to renew the assets and consequently sustain high prices. Apart from legal considerations, which are reviewed in the following section, and even if it were indeed beneficial for airframe manufacturers (which constitute an oligopoly rather than a monopoly) to interfere with secondary markets, there is a constraint imposed by the market structure. More specifically, the fact that airframe manufacturers depend on engine manufacturers in order to produce an actual *aircraft* means that coordination would be extremely complicated. In other words, Boeing and Airbus would have to be able to cooperate in their lease-only strategy, but at the same time there would exist competition for the best deal with engine manufacturers. If, for instance, Pratt & Whitney were to develop a more efficient engine that fit a given Airbus model perfectly and, consequently, Airbus were to place an order with Pratt & Whitney that made it temporarily impossible for Pratt & Whitney to work on Boeing orders, Boeing may face an incentive to break the implicit cooperation with Airbus and realize immediate profits by offering the market better contracting conditions. That is, Boeing may be willing to temporarily refrain from its lease-only policy taking advantage of any sunk costs that may have been incurred by Airbus and Pratt & Whitney in signing their deal. Even worse, Boeing could now sign deals with GE and Rolls Royce, who would definitely have an incentive to aggressively compete with Pratt & Whitney by making use of Boeing's temporary advantage over Airbus and Pratt & Whitney.

The hypothetical situation described is only one of many scenarios that could emerge if Boeing and Airbus sought to reach an implicit coordination agreement that allowed them to take over the aircraft leasing industry. Moreover, in actuality, Boeing and Airbus are aggressive competitors and, although it can be argued that they constitute a duopoly, there does not seem to be any intention on their part to reach forbearance. Furthermore, the relation between airframe manufacturers and engine manufacturers is the most important one in the aircraft manufacturing industry, albeit not the only one. Aircraft also have electronic systems components, commonly referred to as avionics, that are not built 'in-house' and that constitute an indispensable element in aircraft manufacturing. Companies in the avionics industry include Honeywell, Rockwell Collins, Garmin and Universal Avionics,

[14] There are other minor players such as Bombardier, Embraer, Mitsubishi and Saab, among others.

among others. The existence of these companies further complicates any mechanisms for implicit coordination that may tend to materialize.

b. The Case of the GE-Honeywell Attempted Merger

In the preceding section, it was discussed that because aircraft are not entirely produced by one single manufacturer, the necessary coordination that would allow manufacturers to take over the leasing business is intrinsically complicated. In addition, there are regulatory complications. One example of such regulatory complications has to do with antitrust policies. A widely covered antitrust case was the attempted merger between GE –as an engine manufacturer closely related with GECAS– and Honeywell –the leading supplier of avionics– that took place in 2001. The case of the GE-Honeywell attempted merger was a very controversial one because different authorities with jurisdiction over competition had opposing views regarding the case. In particular, after the U.S. Department of Justice (DOJ) and the Canadian Competition Bureau had approved the merger between GE and Honeywell, the European Commission prohibited the transaction.

Elliott (2001) explains that the reason the European Commission had jurisdiction over a merger of two U.S. companies is that GE employed 85,000 thousand people in Europe and collected revenues for a total of US$ 25 billion. However, the author argues that it still was the first time an antitrust commission outside of the U.S. vetoed a merger between two American companies that had previously been approved by the DOJ. To further complicate the issue, both Rolls Royce –a British company– and United Technologies –the parent company of Pratt & Whitney– were active lobbyists who tried hard to persuade the European Commission to proscribe the merger. According to Patterson and Shapiro (2001), in addition to Rolls Royce and United Technologies, Rockwell Collins –Honeywell's competitor in the avionics industry– also posed significant opposition to the merger. Furthermore, the European Commission also "registered concern from 15 airlines, whose identities were kept secret from GE" (Elliott, 2001). Nevertheless, Patterson and Shapiro (2001) state that neither Boeing nor Airbus opposed the merger.

The European Commission's ruling itself had to do with the conglomerate character of the merger given that "the merger was neither horizontal nor vertical, but conglomerate" (Patterson and Shapiro, 2001) as well as "remarkably 'clean' in terms of horizontal overlaps, given the magnitude of the merger itself and the strong presence of both companies in the civil aerospace industry" (Patterson and Shapiro, 2001). More specifically, the European Commission feared that the GE-Honeywell conglomerate would incur in 'mixed bundling', hence reducing package prices and becoming a stronger competitor. The problem with that argument is that what the European Commission saw as a threat of future market foreclosure, the U.S. DOJ judged as procompetitive and welcomed as an increase in consumer welfare, even if it implied that the GE-Honeywell conglomerate would gain market share. According to Patterson and Shapiro (2001), the European Commission never undertook to quantifying the effects of the merger and also judged GE as dominant in the engine manufacturing market simply because it won more bids than its competitors. Nevertheless, there was one argument presented by the European Commission that was robust and it was related to the fact that GE is able to leverage its financial strength through

GECAS in order to influence airlines' behavior by offering financial relief in tacit exchange for brand loyalty.

Grant And Neven (2005) find that the European Commission's judgment was not robust to alternative definitions of the market involved and that it overlooked significant efficiencies that could have been generated by the merger. Moreover, the authors raise the question of whether the European Commission's decision was biased by "bureaucratic capture" in sight of the fact that it was not sound from an economic perspective. Grant and Neven (2005) go even further in making a comparison between the U.S. DOJ, which has 50 Ph.D. economists as part of its staff and the European Commission, where economists are not given a central role. In addition, according to Grant and Neven (2005), one European Commission economist stated that "you are a civil servant first, then an economist." Finally, the authors conclude that there is evidence that suggests that the European Commission may have been subjected to self-confirmation bias or that they might have pursued a different objective than the regulation of the merger demanded, especially considering that the procedure seems unfair towards GE and Honeywell in that they were not given enough time to prepare an appeal to the case presented by Rolls Royce, United Technologies, Rockwell Collins, and other opposing parties. Similarly, Patterson and Shapiro (2001) indicate that the ruling was discretionary because it lacked solid arguments that were backed by economic theory.

Regardless of whether the European Commission was a neutral and competent judge in the rejection of the GE-Honeywell merger, it is interesting to note how the complex structure of the aircraft manufacturing market is further complicated by the existence of potential antitrust regulations that may be set forth by worldwide authorities with jurisdiction over companies that are not necessarily established within the authorities' geographical location. In fact, in the case of the GE-Honeywell attempted merger, both the complex market structure and the potential antitrust implications became interrelated as GE's engine manufacturing competitors, Honeywell's avionics competitors and some customers (15 airlines) deliberately called upon antitrust authorities in order to protect their interests from their competitors' (or suppliers') strategical moves.

c. Lessors' Market Power

The previous two sections discussed how it would be difficult for manufacturers to challenge lessors' business due to the intrinsic complexity of the aircraft manufacturing market structure and potential antitrust implications. Nevertheless, even if it were possible for manufacturers to attain a significant degree of implicit coordination as well as elude antitrust restrictions in order to extract some of the profits obtained by leasing companies, they would still face the same difficulties any other entrant to the leasing market would.

Gavazza (2011a) explains that "leasing companies have technical, legal and marketing teams that accumulate extensive knowledge of the market, keep track of carriers' capacity needs, and also monitor the use of their aircraft." These installed capacity represents significant sunk costs, as discussed in Section 4.a.II, which constitute barriers to entry. Furthermore, lessors have better risk management technologies, owing to their knowledge of the leasing market as well as a great diversity of aircraft types and customers all around

the globe, which allows them to have better credit rating and thus access funds at a lower cost.

Another advantage possessed by lessors, according to Gavazza (2010a) has to do with the fact that upon bankruptcy of an airline, lessors are legally favored to repossess aircraft more easily than other secured lenders. In similar fashion, because bankruptcies are frequent in the airline business, lessors have specialized in repossession and redeployment of aircraft.

It is true that aircraft manufacturers could get over entry barriers such as brand recognition and trustworthiness more easily than other entrants, because of the prestige involved in being one of the few companies in the world that are technologically capable of producing aircraft. Likewise, an aircraft manufacturer could acquire the *know-how* as well as develop a contact network more easily than other entrants. However, even if aircraft manufacturers could overcome their market structure complexity, antitrust regulations, and entry barriers to the leasing business, there is another potentially prohibitive cost that must be withstood and that is lessors' reaction to such an attempt. In other words, by deciding to enter the aircraft leasing market aggressively, aircraft manufacturers –be it airframe manufacturers of engine manufacturers– may find that the incumbents decide to retaliate by favoring the competitors' aircraft. For instance, if Boeing Capital –an existing leasing arm of Boeing– decided to threat ILFC's markets, ILFC may favor Airbus by offering better contracting conditions on their aircraft as a way of harming Boeing. In fact, it is likely that aircraft manufacturers are also part of the implicit coordination among lessors that was discussed in Section 4.a.III, and that they view the tradeoff between attempting to squeeze out a portion of lessors' profits and the potential costs of retaliation to be non-favorable. A case could be made that GE, an engine manufacturer, has been able not only to successfully enter the leasing business, but also actually become the leader in the industry. The key difference, though, lies in the fact that GECAS has been a player since the onset of the aircraft leasing business and has become large enough that the threat of retaliation towards any market player seeking to harm its dominant position is enough to guarantee that it can remain in a fairly comfortable position as a leader both in the leasing industry and in the aircraft engine manufacturing industry.

6. Conclusion

This paper has provided an analysis of the aircraft leasing business and its role in the aircraft input market as an efficiency enhancer. The growth of commercial aviation originating form the U.S. Deregulation Act of 1978 demanded a mechanism that allowed airlines to easily adjust capacity and, as a consequence, smoothly reallocate aircraft around the world. Aircraft leasing companies provided said mechanism and have since been able to influence an array of microeconomic issues that affect the airline input market. In particular, lessors are able to ease financial constraints faced by airlines due to their better risk-management technology. In addition, although a secondary effect, under certain conditions leasing can generate tax benefits for airlines. Moreover, lessors offer airlines the aforementioned invaluable possibility of quickly adjusting capacity. Airlines often find this

necessary due to the output volatility that is common in the commercial aviation industry, which is one of the most procyclical industries in the world economy and is also affected by acute output and, thus, revenue seasonality. In this sense, lessors' ability to reduce trading frictions and improve market thickness and asset liquidity constitutes an indisputable element in their contribution to the efficiency of the airline input market. Furthermore, aircraft leasing companies are also a fundamental resource in the mitigation of information asymmetry, which in turn alleviates adverse selection and moral hazard. This is also key for the efficiency of the airline input market.

Nevertheless, lessors enjoy hefty profits that contrast with airlines' scanty –if positive– operating margins. The fact that lessors are intermediaries that improve the efficiency of the airline input market means that they are in a comfortable position to keep a great share of the economic surpluses generated. Among the factors that allow lessors to exercise market power and enjoy long-lasting profits are a higher relative concentration in their industry than in the airline industry, entry barriers generated by the existence of sunk costs such as investments in know-how, brand recognition, trustworthiness and contact network, and a certain degree of implicit coordination among competitors.

As for the potential intention of manufacturers' to aggressively enter the leasing market, several factors have been identified that render the probabilities of success low. First, there is not really one single manufacturer of aircraft given that airframes, engines and avionics are each produced by different firms. This makes the implicit coordination necessary to dispute lessors' dominant role in the leasing business very unlikely. Moreover, antitrust implications have been an important issue in the past as it was illustrated by the discussion of the GE-Honeywell attempted merger. Finally, it was argued that it is probable that aircraft manufacturers actually play a part in the implicit coordination present in the aircraft leasing industry because becoming enemies with incumbents (lessors) would probably do manufacturers more harm than good.

In conclusion, airlines are definitely better off with than without the existence of lessors, owing to the efficiencies generated by the latter. However, airlines could be even better off if the aircraft leasing market were less concentrated and presented fewer entry barriers than it does because that would cause lessors to offer better conditions to airlines. In this sense, there could exist an equilibrium in which leasing companies were still profitable but where the economic surpluses generated by the deals with airlines were shared a bit more evenly. Nevertheless, the implementation of policies that promote such an equilibrium would require that the welfare of airlines be weighted more heavily than the welfare of lessors. Such considerations would have to be supported by fairly sophisticated economic analysis, which exceeds the scope of this paper.

Finally, future work could be directed towards the identification of measurable variables that represent the microeconomic issues outlined in Section 3.b so that a numerical econometric model that explains airline's propensity to lease can be derived. In addition, a more sophisticated analysis, with better data, could be performed on the concentration of the supply-side and the demand-side of the aircraft leasing market, such as the one presented in Section 4.a.I but otherwise including information on every lessor and every airline in the world as well as numerical measures of operating margins and profits.

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