

On the Value Added by Operating Lessor: the Case of Aircraft Leasing Market

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The increasing popularity and steady growth of funding capital assets by operating leasing and the diminishing importance of funding capital assets by capital leases has been widely recorded in real world and in academics (for example, see Graham, Lemmon, and Schallheim 1998; Yan 2006, pp. 719-720). Besides its traditional important role in the land and space financing market, i.e. most land and buildings (including commercial and residential) are operating leased to tenants on a short term relative to the asset economic lives, operating leasing is also gaining importance in equipment financing market. For example, Johnson and Waldman(2010) documents that leasing has become popular over time in automobile market and by the end of the first decade of the 2000s roughly one-fourth of new cars marketed directly to consumers were leased (essentially operating leased to consumers by manufacturers). By constructing a model which combines adverse selection and moral hazard, they find that very high income new-car drivers have a higher propensity to lease and used cars that were leased when new sell for more than used cars that were purchased when new. In their model, an important value added by leasing is that it reduces the adverse selection problem in the used-car market by suppressing the private information of new-car drivers while leasing as well as purchasing are associated with moral hazard concerning consumer maintenance.

Leasing also becomes gradually important in other equipment financing market, such as aircraft financing market. Currently about one-third of the aircrafts operated by major carriers are under an operating lease¹. To estimate optimal demand for aircraft lease, Oum, Zhang, and Zhang(2000) develops a model for the airline to determine their optimal mix of leased and owned capacity and their empirical results suggest that the optimal demand for operating lease of aircraft by 23 major airlines in the world would range between 40% and 60% of their total fleet, for the reasonable range of operating lease premiums. For the lessors, this indicates huge potential in the market given strong forecast for the growth of air transportation in the next decade.

Although operating leasing has gradually become an important source of finance for many strategic capital assets, by reviewing literature, we find that very few researches explores the issue of leasing from the perspective of an efficient or competitive operating lessor. This research attempts to address this void in the literature and explore the economic role of a competitive or efficient operating lessor by conducting a comprehensive literature review, which relates to operating leasing and the value added by an operating lessor to the industry and the financial system. To be more specific, this research will put the context into equipment leasing, especially aircraft leasing business, since the commercial aircraft market

¹ The percentage of the global active commercial aircraft fleet under operating lease has increased from 19.6% in 1996 to 38.5% in 2011, representing an average annual growth rate of 8.5%. It is expected that by 2020, half of world airline fleet will be leased.

provides an ideal candidate for general investigation of leasing issues as suggested by Gavazza(2010).

Aircraft lessors play a critical intermediary role between manufacturers and airlines. Lessors reduce capital requirement of carriers and increase fleet planning flexibility to airlines. The world's airlines have increasingly adopted aircraft leases, especially operating lease, also called the "true lease" (to be distinct from capital lease) to finance the acquisition of their strategic assets. Although aircraft leasing, especially operating leasing has gradually become popular in aircraft financing market, the mechanism behind why aircraft leasing is widely accepted among airline operators and the efficiency gained by carriers and the air transportation industry and the whole financial system are poorly explored in the literature.

Aircraft is a general-purpose, *redeployable* and *mobile* equipment as in Williamson (1988) and *cyclical* asset as in Shleifer and Vishny(1992). Gavazza(2011) documents that the annual share of new commercial aircrafts purchased by operating lessors increased substantially during recent years and lessors also account for a large share of secondary market transactions since they frequently buy used aircraft and lease them out several times during their useful lifetime. However, the reasons for this growth in funding capital assets by operating leasing have not been extensively investigated in the academic field. One exception is the theoretical analysis and empirical evidence provided by Gavazza(2010), who illustrates the different roles of operating lease and capital lease and illustrates how operating leasing becomes more popular as the market for an asset becomes more *liquid or less specific*. Gavazza(2010) insightfully focuses on one aspect of asset characteristics – *asset liquidity* that plays a prominent role in leasing theory and explicitly shows how operating leases and capital leases have substantially different characteristics.

As suggested by Oum, Zhang, and Zhang(2000), the airline industry all over the world has been increasing relying on operating leasing. They also conclude that short-term operating lease provides a vehicle for risk shifting or risk sharing between the airlines and the leasing companies. Because of the increasing reliance of carriers on operating leasing, it is important to ask the question: "Does operating leasing add value to the industry?" And if it does, the obvious follow-up question is: "How does it add value?" Although existing literature has given some rationale for the value added by operating lessor, none of the research has given a full picture of the value added by operating lessor. This paper will try to fill in the gap in the literature and seek to extensively explore the whole spectrum of value added by operating lessor.

The plan of the paper is as follows. In Section I, I will give a comprehensive literature review on operating leasing and on durable assets market and elaborate the pervasiveness of using operating leasing to finance capital assets in various industries. The link between operating leasing and asset liquidity and asset liquidity (redeployability) measure will be introduced in Section II. Section III will introduce the rise of independent operating lessor in the financial intermediary industry. In section IV, the value added by aircraft lessors will be surveyed in depth, including the elaboration of the various roles played by lessors. Finally, our

conclusions and suggestions for future research are presented in Section V.

I. Operating Leasing and Durable Assets Market

Related Literature on Operating Leasing

Off-balance sheet financing has been growing in popularity and complexity². Operating leases are a common form of off-balance sheet financing. Traditional finance theories typically treat leases and debt as substitutes, i.e., an increase in the use of lease financing should be associated with a lower level of conventional debt financing. Yet, the empirical evidence on this relation is mixed. Ang and Peterson (1983) present a leasing puzzle showing that leases and debt are complements rather than supplements by conducting a seminal empirical test mainly using capital leases. By contrast, Marston and Harris (1988) and Krishnan and Moyer(1994) provide empirical evidence suggesting that leases and debt are substitutes. Yan (2006) reinvestigates the relationship between leasing and debt financing and presents a model to incorporate different theories on the substitutability and complementarity between leases and debt and then test the model implications empirically. His findings suggest that leases and debts are substitutes instead of complements. He also investigates the variation in the substitutability between leases and debts, and finds that in those firms with more growth options or larger marginal tax rates, or in those firms paying no dividends, the substitutability is more pronounced, i.e. the cost of new debt increases to a larger degree with extra leases. It seems that there is an empirical controversy in the literature regarding the issue of ‘substitutability and complementarity between leases and debt. One possible explanation for this empirical controversy in the literature may be that their chosen objects (either capital lease or operating lease) for empirical analysis and tests may be different, given that capital leases and operating leases have substantially different characteristics. For example, Ang and Peterson(1983) and Krishnan and Moyer(1994) use capitalized leases for their empirical study while Marston and Harris(1988) use both capitalized lease and non-capitalized lease for their empirical study, and in a latest empirical study, Yan(2006) mainly uses operating lease for representing firm leasing propensity.

Due to major difference in transactional nature between capitalized leases and non-capitalized leases, it is thus no surprise to find that empirical evidences regarding substitutability and complementarity between leases and debt in corporate capital structure are mixed. Using a comprehensive measure of leasing (capitalized plus non-capitalized) and debt (short-term and long-term), Marston and Harris(1988) find that leasing and debt display a closer substitutability than is found using less comparable measures of the two categories of debt-like financing. According to them, high-debt firms often do more leasing than low-debt firms but they do so at a cost of reducing their ability to finance with nonleasing debt and leasing displace debt on less than a dollar-for-dollar basis, at least as measured by financial statement data. So leases consumes debt capacity has been confirmed generally. They suggest interesting areas for future research including testing for differences in substitutability between debt and lease financing across different firms and industry groups or across

² The SEC estimates US firms were carrying up to \$1.25 trillion dollars in off-balance sheet operating lease obligations (SEC, 2005).

different types of leases (capitalized versus non-capitalized). Following the spirit of Marston and Harris(1988) and in recognition of the fact that operating leases are estimated to be approximately thirteen times larger than capital leases in UK, Beattie, Goodacre and Thomason(2000) investigates the degree of substitutability between leasing and non-lease debt using a comprehensive measure of leasing, improving on the partial measures used in prior research. Their results imply that leasing and debt are partial substitutes, with £1 of leasing displacing approximately £0.23 of non-lease debt, on average, consistent with the argument that lessors bear some risks which are not inherent in debt contracts. For operating leases, a major source of such risk is asset's "*residual value risk*". Their findings also suggest that substitution effects are not uniform across lease types. At the end of their paper, they point out that academic researchers need to be aware that non-capitalized operating lease finance is an important source of finance which should be included in future studies on capital structure. To study realized lease returns, Lease, McConnell and Schallheim(1990) examine various types of equipment operating leasing contracts and compare realized residual value of the leased equipment with the ex-ante estimated residual value recorded by the lessor and find that *actual residual values* are significantly higher than *expected residual values* for the sample of lease contracts. They contribute this difference in residual value to unexpected inflation over the study period. The empirical evidence also supports this contention. There also exist possibilities that actual residual value can be significantly less than expected residual value for leased equipment. For example, Pirotte and Vaessen(2008) model residual value risk and recovery of automobile lease portfolios and provide one of the first empirical analysis on residual value losses in the automobile lease sector.

Literature on Durable Assets Market

Underlying assets that are using operating lease to finance are often durable assets. The defining characteristics of a durable asset are that it yields consumption or productive services over multiple time periods (Rust, 1985). Rust(1985) further states that secondary markets commonly exist for relatively portable, standardized durables such as automobiles, ships, trucks, aircraft, railroad cars and farm equipment, as well as for some nonportable, nonstandardized durables such as housing. Rust(1985) insightfully point out that in certain cases, rental markets for durables also come into existence and a rental market helps to "complete" the secondary market. He explicitly models the trading process by tracking each durable from its "birth" in the primary market, through its sequence of owners in the secondary market, until its "death" in the scrap market and proves that a stationary equilibrium exists, and characterize the distribution of consumer holdings of durables.

Akerlof's (1970) analysis of adverse selection is well known as one of the papers that launched the vast literature on the role of asymmetric information in durable assets markets. Henden and Lizzeri(1999a) present a dynamic model of adverse selection to examine the interactions between new and used car market. They find that the used market never shuts down, the volume of trade can be large even in cases of severe information asymmetries and distortions are lower than previously thought. They further find that new cars prices can be higher under adverse selection than in its absence and that unreliable brands have steeper price declines and lower volume of trade. Their assumptions are based on these lines:

Consumers are long-lived and have heterogeneous valuations for quality. Cars depreciate: used cars are of low-quality than new cars, which implies that high-valuation consumers favor new cars and low-valuation consumers favor used cars. Thus ownership of used cars is *endogenous*. Given that durable assets are long-lived, there exists the possibility of *secondary markets* for used products as well as the potential for product *obsolescence*. Purohit(1992) develops a general model to explore the relationship between primary markets for new cars and secondary markets for used cars. This is an important issue in markets where technology changes rapidly, because the introduction of new versions of a product can make earlier versions *obsolete*. His empirical results suggest that *the depreciation* of used cars is influenced strongly by the types of changes in new model cars. Although the findings of Purohit(1992) and Hendel and Lizzeri(1999a) come from automobile market, their results can be directly applied to aircraft primary market and secondary market. Using data from the market for used business aircraft in North America over the period 1980–99, Gilligan(2004) find an inverse relationship between depreciation and trading volume for less reliable brands of used business aircrafts, which is consistent with Hendel and Lizzeri(1999a)’s model predictions. Gilligan’s study thus confirms that there is also adverse selection in aircraft secondary market.

Ownership and use of durable assets can be distinct economic activities and hence specialization of these roles would presumably lead to greater efficiency. According to Miller and Upton(1976), the rental terms offered by lessors would reflect the inescapable financial costs of owning durable capital assets – *interest* and *depreciation*, which is essentially the same as the financial costs of buying the equipment. The choice between renting or buying for any firm would depend on which method of acquiring the services of capital assets had the lower nonfinancial costs in the sense of the costs of acquisition, maintenance and disposal. In terms of financial cost and nonfinancial cost, Miller and Upton(1976) suggest that the balance of these nonfinancial costs would tend to favor leasing by user firms. To emphasize that owning a capital asset and using it in a production process are, in principle, two distinct economic activities, it is often agreed that title to all capital assets must, by law, be vested in specialized leasing corporations. Miller and Upton(1976) solved how the management of such an independently operated, profit-making leasing company might set the rental on a particular type of capital equipment. They find that the equilibrium rental in a certainty case is equal to the interest foregone on the capital invested in the machine, plus the depreciation of the machine. In this case, the depreciation consists of two parts: a “deterioration” or “operating inferiority” and an “obsolescence”, wherever the new machines of vintage $t+1$ can be produced at a lower cost than those during t .

Durable assets usually play a dual role: not only are they factors of production, but they also serve as collateral for loans. Kiyotaki and Moore(1997) construct a model of a dynamic economy in which lenders cannot force borrowers to repay their debts unless the debts are secured. Borrowers’ credit limits are affected by the prices of the collateralized assets. And at the same time, these prices are affected by the size of the credit limits. The dynamic interaction between credit limits and asset prices turns out to be a powerful transmission mechanism by which the effects of shocks persists, amplify and spill over to other sectors.

They show that small, temporary shocks to technology or income distribution can generate large, persistent fluctuations in output and asset prices. Kiyotaki and Moore(1997)'s model partly explains why commercial aircraft market is a *cyclical* market and why small and temporary shocks in the economy can lead to large fluctuations in aircraft or similar durable asset prices.

The Pervasiveness of Using Operating Leasing to Finance Capital Assets in Various Industries

Firms often lease or rent, rather than purchase, capital assets employed in their production process. Chemmanur, et. al(2010) report that a third of the capital equipment used by U.S. corporations is leased. Devos and Rahman(2014) document that operating leases are important in the US, and during 1980-2011, the average Compustat firm had a yearly lease intensity of about 40% per year. Or, the average firm has present and future (up to five years) rent commitments equal to 16.6% of their total assets. Eisfeldt and Rampini(2009) quantitatively shows that leasing is of first-order importance as a source of financing. They demonstrate that leasing is of comparable importance to long-term debt even for relatively large firms: the fraction of capital that firms lease in merged Census-Compustat data is 16%, which is similar to the long-term debt-to-assets ratio of 19%. Moreover, they show that for small firms, leasing is even more important and firms in the smallest decile lease 46% of their capital.

Transportation and logistics industry is the traditional industry which employs operating lease contracts to provide transportation and logistics services to customers. Vehicle Leasing, truck leasing, ship leasing, and aircraft leasing are often observed in real world. Besides transportation industry, operating leases are commonly used for capital acquisition in many services-producing industries including food catering, wholesale and retail trade industries, hotel industry, office equipment/computers, construction industry, infrastructure and medical service industry etc.

In transportation industry, Hendel and Lizzeri(1999b, 2002), Johnson and Waldman(2003, 2010) all explored the growth of manufacturer leasing in new-car market. Hendel and Lizzeri(1999b) explored four strategies that a monopolist can follow to interfere with secondary markets. The logic is one of market segmentation. Since the monopolist faces consumers with heterogeneous valuations for quality, he can attempt to utilize secondary markets as a tool for extracting more surpluses from consumers. The used goods is a substitute for the new goods, and different vintages appeal to different consumers. They saw that this introduces a substitution effects in the monopolist's choice of durability. *Renting* the good to the customer rather than selling the good can benefit the monopolist because this allows him to gain additional market power in the used market and to make sure that the price of used good does not drop too far below the price of new goods. Despite the fact that used goods are substitutes for new good, the monopolist prefers used market to function smoothly because this permits segmentation of consumers into two classes: new-goods buyers and used-goods buyers. Hendel and Lizzeri(2002) further model the role of leasing under adverse selection and predicts that leased cars have a higher turnover and that off-lease used cars are of higher quality, which are consistent with their empirical data. Moreover, their model

predicts that the recent increase in leasing in automobile market can be explained by the observed increase in car durability. They further show that leasing contracts can improve welfare by reducing adverse selection but that they are imperfect tools. Based on Hendel and Lizzeri(2002), Johnson and Waldman(2003) constructed a competitive model of the new and used-car markets and continue to investigate the relationship between new-car leasing and adverse selection. Besides obtaining the similar results in Hendel and Lizzeri(2002) that new-car leasing reduces adverse selection, they also show that buybacks also improve efficiency in the secondhand market. They provide alternative explanations for new-car leasing and explanation for the growth in the new-car leasing during the last fifteen years. They argue that two of the most important factors determining the extent of new-car leasing are adverse selection and consumer costs of abiding by lease restrictions. Their argument is that since sellers on the used-car market are hurt by their own private information, new-car drivers would have an incentive to lease rather than purchase so as to suppress their private information. Since new-car drivers face a cost of abiding by the standard restrictions found in lease contracts, such as those in concerning maximum mileage, new-car drivers with a low cost of abiding by lease restrictions choose to lease, while those with a high cost choose to purchase.

For food catering industry, publicly traded restaurant companies account for the majority of their leases as operating leases. Marler(1993) shows that restaurant firms prefer disclosure (operation leases) over recognition (capital leases) and suggest reasons drawn from both capital market and positive accounting research. His research results show that operating lease obligations of restaurant companies exceed capital lease obligations by a ratio of 9 to 1. There is also a possibility that smaller restaurant firms use operating leases more than larger firms.

Goodacre(2003) documents the importance of operating leasing in the UK retailing sector and finds that off-balance sheet operating leases are a major source of finance, and far more important (3.3 times higher) than on-balance sheet long-term debt; by contrast, capital leases are immaterial. He further finds that operating leased assets, the major part of which is 'land and buildings' (98%), represent a significant proportion (28%) of reported total assets.

The hotel industry has utilized operating lease not only for operating equipment but also as a financing instrument through "sales and lease back". Koh and Jang(2009) investigate the determinants of using operating lease in the hotel industry and find that less financially distressed hotel firms were more likely to use operating lease, which is contrary to the studies of other industries. Their result suggests the possibility that operating lease can be used for purposes other than financing. Their study also indicated that operating lease decrease as firm size increases, but only up to a certain level, after that level operating lease increase as firm size increases.

According to Chemmanur, et. al(2010) , leasing will be more prevalent in industries where there is a greater extent of asymmetric information between manufacturers of capital equipment and entrepreneurs(users) and that industries making use of newer technologies or

those characterized by more rapid technological change will have a greater proportion of capital equipment being leased compared to those employing more conventional technologies and those having a slower rate of technological change. They develop a model for leasing in a double-sided asymmetric information setting and their rationale for leasing is consistent with an argument often given by practitioners for leasing, namely, that leasing allows the transfer of technological risk from lessee to lessor. Their model suggests that, in a setting where lessors have information superior to lessees about the technology underlying their capital equipment, such transfer of technological risk indeed creates value even when both the lessor and lessee are risk-neutral. Consistent with their prediction, Richter(1998) documents that the proportion of leased capital equipment in the semiconductor manufacturing industry is considerably greater than in other industries characterized by a slower rate of technological change. This implication is also consistent with evidence from many other industries. For example, IBM made its mainframe computers available initially on a lease-only basis. Also, many kinds of medical equipment using the latest technologies are initially made available primarily through leasing.

II. Operating leasing and Asset Liquidity

In a typical lease contract, the owner of the asset (the lessor) grants to another party (the lessee) the exclusive right to use the asset for an agreed period of time, in return for periodic payments. Hence, the lessee takes the risks and returns from the use of the asset, and the lessor takes the risks and returns from ownership of the asset. As in any financial contract, the risk of default by the lessee is a primary element in the risk of ownership, with the liquidation value of the asset playing a key role if the lessee defaults. In a capital lease, the lessee acquires ownership of the asset at the end of the lease term, while in an operating lease the asset reverts to the lessor at the end of the lease contract. Hence, in a capital lease, a single lessee provides the returns to the lessor, while in an operating lease, the lessor must arrange more than one transaction over the life of the asset in order to generate returns and to repay the capital investment. Since in an operating lease, the lessor likely needs to redeploy the asset over time to several lessees, *the liquidity of the asset* plays a more relevant role in an operating lease than in a capital lease.

But firstly, what is asset liquidity? According to Keynes (1930), an asset is more liquid if it is “more certainly realizable at short notice without loss,” where loss is defined as the difference between the value that can be realized from an optimal sale (sale with no time constraint) and that from an immediate sale. Lippman and McCall(1986) define asset liquidity to be the optimal expected time to transfer the asset into money and present a precise definition of liquidity in terms of its most important characteristics – the time until an asset is exchanged for money. Myers and Rajan(1998) argue that the liquidity of an asset means the ease with which it can be traded, which imply that the more liquid a firm’s assets, the greater their value in short-notice sales. Morellec(2001) further clearly defines asset liquidity as the ease with which the firm’s assets can be sold or redeployed on a secondary market. To us, Morellec(2001)’s definition of asset liquidity seems more relevant. Schlingemann, Stulz, and Walking(2002) operationalize the measure of asset liquidity and specifically use the volume

of transactions in an industry as a measure of the *liquidity* of that industry's corporate assets and the liquidity of an industry is measured by taking the ratio of the value of the industry's corporate transactions(excluding the divested segments analyzed in the study) to the value of the industry's total assets. They show that differences across firms in *asset liquidity* can help explain why, among apparently similar firms, some firms divest a segment and others do not.

Financing frictions seem to cause asset liquidity. Eisfeldt(2004) analyzes a model in which long-term risky assets are *illiquid* due to adverse selection. Adverse selection causes markets to be *illiquid* because claims sold are likely to be of low quality. She uses "*liquidity*" to describe the cost of transferring the value of expected future payoffs from long-term assets into current income. A lower cost implies higher *liquidity*. She finds that the degree of adverse selection and hence *the liquidity* of these assets is determined *endogenously* by the amount of trades for reasons other than private information and that higher productivity leads to higher investment in risky assets and hence more rebalancing trades, mitigating the adverse selection problem and improving *liquidity*. Higher liquidity implies that investors initiate large-scale risky projects which increase the riskiness of their incomes. Riskier incomes induce more sales of claims to high-quality projects, causing *liquidity* to increase. Eisfeldt and Rampini (2006) further broadly defines *capital liquidity* as the time-varying non-physical reallocation cost of capital and they use the term *liquidity* to encompass the informational and contractual frictions which inhibit capital reallocation, such as adverse selection, agency problems and financing constraints. Their empirical findings imply that capital is less liquid in recessions, i.e., that there are more informational and contractual frictions associated with reallocating capital in recessions than in booms.

Theoretical arguments suggest that more liquid assets make any type of leasing more attractive. The reason is that more-liquid assets are *more redeployable* (as in Williamson, 1988; Shleifer and Vishny,1992) and *less specific* (as in Williamson,1975,1979; Klein, Crawford,and Alchian, 1978), decreasing the expected costs of external financing. Williamson(1988) argues that leasing is the least cost form of finance for assets such as aircrafts. The reason is that, absent moral-hazard issues, there is no need for the owner and the user of the asset to be the same. According to the incomplete contracts literature, contracting with regard to specific assets might create ex post holdup or opportunistic incentives. To mitigate this ex post opportunistic behavior, parties choose ex ante to own assets that are more specific. Hence, Smith and Wakeman(1985) argue that leasing of specific assets is unlikely. Asset characteristics thus will affect the asset leasing/purchase decision. Thus it can be reasonably expected that, as assets become more *liquid*, the share of assets under operating leases will increase more than the share of assets under capital leases. Gavazza(2010) finds strong empirical support for the hypothesis that *asset liquidity* affects aircraft lease contracts. More-liquid aircraft are more likely to be leased and, in particular, more likely to be under an operating lease. More-liquid aircraft also command lease rates with lower markups over prices. Moreover, *asset liquidity* differentially affects operating and capital leases. In particular, more-liquid aircraft have shorter operating leases but longer capital leases. The empirical evidence reported by Gavazza(2010) illustrates how leasing becomes more popular as the market for an asset becomes more *liquid*.

Shleifer and Vishny (1992) explore an industry equilibrium approach to debt capacity based on the cost of asset sales and analyze what prices non-redeployable assets fetch in asset sales or liquidations relative to their value in best use. They call this difference between price and value in best use as *asset illiquidity*. They argue that many assets are *illiquid*, i.e. fetch prices below values in best use when liquidated and that *asset illiquidity* has important implications for capital structure. This is because when a firm in financial distress needs to sell assets, its industry peers are likely to be experiencing problems themselves, leading to asset sales at prices below value in best use. Such illiquidity makes assets cheap in bad times, and so ex ante is a significant private cost of leverage. Their model also implies that forced liquidation can have significant private costs to the asset seller as well as significant social costs to the extent that the assets do not end up owned by the highest value user, i.e. industry insiders. By applying the Shleifer and Vishny (1992) industry equilibrium model of asset liquidation to the commercial aircraft market, Pulvino (1998) finds empirical evidence consistent with Shleifer and Vishny (1992) model. His research shows that airlines with low spare debt capacities sell aircraft at a 14 percent discount to the average market price and that capital constrained airlines are also more likely to sell used aircraft to industry outsiders, i.e. banks and leasing companies, especially during market downturns. His results confirm that investment abandonment is costly. These costs are likely to be greater in industries where used asset markets are less liquid. His results seem to suggest that immediate cash liquidation of insolvent firms may result in socially inefficient outcomes: not only will immediate cash liquidation fail to maximize proceeds to claimholders, but it may also allocate resources to low-value users.

Asset Liquidity (Redeployability) Measure

According to Pulvino (1998), the market for used commercial aircraft is “extremely thin,” with approximately twenty used commercial aircraft transactions per month worldwide. Likewise, Gavazza(2006) finds that between May 2002 and April 2003, 720 commercial aircraft were traded, representing 5.8% of the total stock of commercial aircraft. The thinness of the market for used aircraft reinforces the importance of the size of the set of potential buyers in determining aircraft redeployability. Gavazza (2006) uses the number of aircraft per type and the number of operators per type to proxy for asset liquidity. Benmelech and Bergman(2008) construct three redeployability measures to proxy for liquidation value of aircraft, which compute for every sample-year (1) the number of aircraft per type, (2) the number of operators per type, and (3) the number of operators who operate at least five aircraft per type. They show that when airlines are in poor financial condition, lower fleet redeployability increases their ability to reduce lease payments.

III. The Rise of Independent Operating Lessor

The equipment leasing industry contains at least three types of firms. Manufacturers of durable producer goods establish captive leasing or credit companies to provide outside financing to customers purchasing their parents’ equipment. These kind of lessors are often called as captive lessors in the literature. Banks and bank holding companies undertake direct

leasing as an alternative form of secured loan to industrial customers. Finally, independent lessor companies offer to lease items of equipment under various terms or serve as brokers for placing such leases. The latter two categories of lessors are often grossly classified as independent lessors as compared with captive lessors. When a manufacturer is the lessor, the arrangement has been called direct leasing and the lessor a direct lessor. Indirect leasing involves an intermediary purchasing the asset from the manufacturer or a distributor and then leasing it to the lessee. Several papers have investigated the comparative advantages between direct leasing and indirect leasing. Miller and Upton(1976) assert that the lessor market should be dominated by manufacturers rather than intermediaries when leasing companies have become entities specialized in the maximum utilization of tax subsidies. On the other hand, Smith and Wakeman(1985) point out that there is no clearcut comparative advantage for the manufacturers or the intermediaries acting as lessors. Brick, Fung, and Subrahmanyam (1987) examine the conditions under which a pure financial intermediary benefits from entering the leasing business as a lessor. They concluded that an investment tax credit (ITC) is required to motivate financial intermediaries to act as lessors. More specifically, the present value of the tax benefits of depreciation expense and the ITC must together be greater than the sale price of the underlying asset. They added that financial intermediaries enjoy a net tax advantage only in periods where interest rates are sufficiently low and a significant ITC is available, and at higher interest rate levels, direct lessors should dominate the lessor market. They admit that tax considerations alone would not fully explain the emergence of intermediaries in the equipment leasing market. They propose several reasons for the emergence of financial intermediary in the equipment leasing market, including managing cash flows in a world with interest rate uncertainty and default risk and economies of scales in structuring equipment lease contracts.

It seems that the investment tax credit (ITC) is cited as the primary reason for the emergence and survival of financial intermediaries as lessors. Chew, Baldwin, and Thompson(1994) examine conditions under which financial intermediaries can remain competitive with manufacturers in the lessor market despite the absence of the ITC. Their purpose is to examine why intermediary-lessors continue to exist despite the repeal of this credit by the 1986 Tax Reform Act. Four factors unrelated to the ITC are shown to impact the competitive position of the intermediary-lessor: (1) the lessor's required after-tax yield, (2) the extent to which the lessor's required after-tax yield exceeds that of the lender in a leveraged lease, (3) the proportion of the lease investment financed with debt, (4) the ratio of production costs to sales price of the leased asset. They conclude that the relative competitive position of the intermediary lessor is inversely related to the first of these factors and positively related to the last three factors. Chew, Baldwin, and Thompson(1994)'s study of intermediary lessor more comprehensively analyzes the competitive position of independent lessors than the partial analysis of Brick, Fung, and Subrahmanyam (1987). It can thus be easily reasoned that independent lessors have their own niches in the marketplace for equipment lessor .

McGugan and Caves (1974) conducted a questionnaire survey on independent equipment leasing firms in USA and shows the rational for a profitable division of labor between firms

in the ownership and financing of capital goods. Real economics may result both from inventory holding and from low-cost purchasing for the large specialized operating lessor (if the discounts reflect transaction cost savings and not just bargaining power against the equipment manufacturers). Lessor can be in a better position than lessee to invest in specialized market knowledge bearing returns in reduced uncertainty about future values of equipment. This trade in knowledge acquisition and risk bearing would be more profitable for certain classes of lessees and equipment types than others. Trade in risk bearing between lessors and lessees casts the lessors to some degree in the role of pure speculators, but they also find avenues for risk reduction through pooling and portfolio balancing. They suggested that the rise of independent equipment lessors illustrates economically beneficial trade in risk bearing, economics in specialized services and risk reduction through pooling, diversification and the application of specialized knowledge. They find that lessors mitigate their lease portfolio risk by diversifying across equipment types, customers, and regions and that the mutually profitable trade between firms exemplified by the leasing industry seems due only in minor part to reduced tax payments. In McGugan and Caves(1974), risk sharing, portfolio effects(diversification and risk reduction) and specialization seems to dominate the competitive position of independent lessors. Miller and Upton(1976) suggest that the leasing business will gravitate eventually to the firms whose efficiency in fund raising leads to the lowest cost of borrowing and these firms will be or will become “financial intermediaries”. Both McGugan and Caves(1974) and Miller and Upton(1976) suggest that the financing skills of intermediary lessors sharpen the competitiveness of them compared to manufacturer lessor.

Taking a functional perspective of financial intermediation, Merton(1995) views the primary function of any financial system is to facilitate the allocation and deployment of economic resources, both spatially and temporarily, in an uncertain environment. Merton(1995) thus distinguishes six core functions performed by the financial system. Merton(1998) argues that the most efficient institutional structure for fulfilling the functions of the financial system generally changes over time and differs across geographical regions. In my view, the rise of independent operating lessor are mainly relevant to four core functions proposed by Merton(1998), which include pooling of funds to undertake large-scale indivisible project, transferring economic resources through time and across geographic regions and industries, managing uncertainty and controlling risk, and providing a way to deal with the asymmetric information and incentive problems when one party(lessee) to a lease transaction has information that the other party(lessor) does not have.

Pierce(2012) study knowledge-based agency costs from vertical integration in car leasing, where manufacturer-owned captive lessors compete with independent lessors, with the key to profitability being the accurate forecasting of residual values(RV) – the lease-end values of cars. Accurately predicting RV requires extensive knowledge transfer, much of which is proprietary to the manufacturer. Using a data set of 180,000 leases, Pierce(2012) compares contracts of independent and captive lessors to test knowledge-based agency costs of vertical integration. Pierce(2012) find that managers in vertically integrated firms have conflicting incentives on whether to accurately and completely share proprietary knowledge, and show that these incentives appear to generate agency costs inconsistent with corporate profitability

as managers selectively use and share knowledge for personal gain. His findings suggest that most knowledge benefits of vertical integration will be nullified when managerial interests are incompatible with the profit concerns of the manufacturing firm. Although captive lessors appear to exploit some knowledge advantages in anticipating redesigns, they also continue to support low-quality vehicles to increase sales or reduce inventory even while less-informed independent lessors reduce the RV. Pierce(2012)'s study is the first to empirically demonstrate that captive lessors, driven by the sales needs of their parent companies, subsidize residual values, suggesting existing economics model of lease intermediation in the literature exclude critical internal implications of manufacturer leasing. It can be inferred from Pierce(2012)'s study that the rise of independent lessors in the financial intermediary industry can reduce knowledge-based agency costs from vertical integration in manufacturer leasing and increase economic welfare to the society. Pierce(2012)'s paper has implications well beyond the automotive industry.

IV. The Value Added by Independent Aircraft Lessors

Airlines are increasingly turning to aircraft leasing. Over the past twenty years, aircraft transaction consulting expert Ascend estimates that the number of operating lessors has doubled. They further document that lessor fleets have been growing, across all aircraft types and operating lessors have played a significant role in the roll-out of all major aircraft types over the past ten years. Some industry observers assert that the aviation industry is shifting towards the model adopted by the hotel hospitality business with one side specializing in owning the asset, while the other side operates it. Because of the increasing reliance of carriers on operating lease, it is important to ask the question: "Does operating leasing add value to the industry?" And if it does, the obvious follow-up question is: "How does it add value? This section tries to explore these questions in depth and depict a full picture of the value added by aircraft operating lessors. The following part will center on four core values added by aircraft operating lessor to the financial intermediary industry.

LESSOR AS SPECIALIZED OWNER

Assuming no moral hazard problem, Williamson (1988, pp.584) consider the financing of durable, general-purpose assets on wheels. He considers the possibility of procuring the services of these assets by leasing. In his view, general-purpose assets on wheels satisfy the $k = 0$ (where k is the degree of asset specificity) condition in superlative degree. Given, moreover, that measurement problem are assumed to be negligible, there is no need to combine owner and user for user-cost reasons. Since an outside owner that is specialized to this type of equipment (e.g., truck leasing; aircraft leasing) can repossess and productively redeploy these assets more efficiently than could a more specialized debt-holder, Williamson (1988) argues that leasing is the least-cost form of finance for such assets. Recourse to leasing to finance assets on wheels is thus merely a special case of the general transaction cost economics (TCE) asset-based approach to project finance.

As stated earlier, aircraft is a general-purpose, *redeployable* and *mobile* equipment as in Williamson (1988) and *cyclical* asset as in Shleifer and Vishny(1992). But it often become “*illiquid*” in the language of Shleifer and Vishny(1992) if airlines choose to own them directly and are forced to sell them to repay debt because of the very limited number of asset buyers in the industry during bad times. They argue that many assets are often *illiquid*, i.e., fetch prices below values in best use when liquidated. This is mainly because when a firm in financial distress needs to sell assets, its industry peers are likely to be experiencing problems themselves, leading to asset *fire sales* at prices below value in best use. Such *fire sales* can have substantial private and social cost. Eisfeldt and Rampini(2006) also argue that capital is *less liquid* in recessions and their imputed cost of reallocating existing capital implies that it is 2.6 times as costly to reallocate capital in recessions as it is on average based on their implicit assumption that the productivity of a unit of capital is not embedded in the capital itself, but is determined by who deploys it . Such *illiquidity* makes assets cheap in bad times, and so ex ante is a significant private cost of leverage (Shleifer and Vishny,1992).

Sibilkov(2009) tests alternative theories about the effect of asset liquidity on capital structure using data from a broad sample of U.S. public companies and finds that leverage is positively related to asset liquidity. Sibilkov(2009)’s empirical results are consistent with the view that the cost of financial distress and inefficient liquidation of assets are economically important and that they affect capital structure decisions. His findings are consistent with the hypotheses offered by Williamson (1988) and Shleifer and Vishny (1992), namely that, asset liquidity increases optimal leverage, which implies that the cost of illiquidity and inefficient liquidation are economically significant and substantial compared with the benefits of debt and managers attempt to control these costs by adjusting leverage and the probability of incurring liquidation costs. This is consistent with Ju et al.(2005), who argue that bankruptcy and distress costs are higher than previously thought, which may be a factor that drives the seemingly low leverage ratios.

Aircraft, being one major type of *cyclical* assets, seems capable of just sustaining a lower optimal level of debt finance than one would expect for obviating *fire sales* of assets by airlines during industry downturns. Thus leasing gradually becomes a mechanism for evasion of *inefficient liquidation* of assets in the air transportation industry during economic downturns. As Shleifer and Vishny (1992, pp.1355) point out, the institution of aircraft leasing seems to be designed partly to obviate *fire sales* or *inefficient liquidation* of assets: airlines can stop their leasing contracts when they lose money rather than dump airplanes on the market which has no debt capacity albeit breaking a lease is not costless. As they later define in Shleifer and Vishny(2011) , a *fire sale* is essentially a forced sale of an asset at dislocated price. The asset sale is forced in the sense that the seller cannot pay creditors without selling assets. The price is dislocated because the highest potential bidders are typically involved in a similar activity as the seller, and are therefore themselves indebted and cannot borrow more to buy the asset. Indeed, rather than bidding for the asset, they might be selling similar assets themselves. Assets are then bought by non-specialists who, knowing that they have less expertise with the assets in question, are only willing to buy at valuations that are much lower. Assets sold in *fire sales* can trade at prices far below value in best use,

causing severe losses to sellers. According to Shleifer and Vishny(2011), the *fire sale* can set off a cascade of *fire sales* that inflict losses on many institutions. Because of *fire sales*, risk becomes systemic in financial markets. Through this process, asset *fire sales* and the deterioration of the net worth of firms and financial institutions can severely undermine financial intermediation, leading to reductions of real investment and output (Shleifer and Vishny, 2011). *Fire sales* are surely not the whole story of the financial crisis, but they are a phenomenon that binds together many elements of the crisis. Aircraft leasing thus arise naturally as a mechanism to avoid *fire sales* of assets by carriers and can to some degree improve the efficiency of the whole financial system. In this process, aircraft lessors play a vital intermediary role.

But why lessors choose to own aircraft directly? With the role of lessors as trading intermediaries documented, the natural question to ask is why lessors do not trade aircraft just as brokers/dealers. As indicated by Gavazza(2011a), the answer combines two issues: (1) why aircraft owners are the intermediaries – that is, what are efficiency gains if intermediation is performed by the same firms that own aircrafts? (2) Why carriers would rather not own aircraft – that is, what are the efficiency gains if companies that are not carriers own aircrafts? First, in the event of default on a lease prior to bankruptcy, a lessor can seize the aircraft more easily than a secured lender can in both U.S. and non-U.S. bankruptcies (Krishnan and Moyer 1994; Habib and Johnsen 1999). Eisfeldt and Rampini (2009) further argue that ownership affects the ability to repossess and retaining ownership facilitates regaining control of an asset, which enables increased implicit credit extension. It is thus easier for a lessor to repossess a leased asset from the lessee than it is for a secured lender to recover or foreclose on collateral. Thus, since default and bankruptcies are frequent in the airline industry, leasing enhances the efficiency of redeployment of aircrafts by exploiting its stronger ability to repossess and redeploy assets to more productive asset users. Allocating ownership to the agent who provides financing thus strengthens the financier’s claim by facilitating repossession. The repossession advantage³ of leasing in turn allows the lessor to extend more credit against a leased asset than a secured lender can, which implies that leased capital has a higher debt capacity and leasing “preserves capital” (Eisfeldt and Rampini, 2009). Allocating ownership to the user of the capital, in contrast, is efficient since it minimizes the agency costs due to the separation of ownership and control. It is this basic trade-off that they think determines to a large extent whether it is advantageous to lease, which means that the financier retains ownership, or buy, which means that the financier merely takes a security interest in the asset. Due to the greater ability of the lessor to repossess asset and thus redeploy the asset to other users, Eisfeldt and Rampini (2009) further argue that leasing is particularly attractive to financially constrained operators. Such operators are often young, have volatile capacity needs, and are more likely to default on their leases. Hence, lessors frequently get aircraft returned, which leads them to further specialize in redeployment. The leasing rational

³ Eisfeldt and Rampini (2009), in one of their footnotes, indicate that operating leases typically enjoy the repossession advantage that they argue is crucial, while capital leases typically do not enjoy such an advantage. They further argue that the ability to repossess is an advantage of true leases from the legal perspective, and from the accounting perspective, this advantage is hence primarily enjoyed by operating leases, although some capital leases may enjoy the same advantage (pp.1628).

elaborated by Eisfeldt and Rampini (2009) is particularly suitable for the explanation of the rapid development of low-cost carriers in recent years coupled with the rise of independent aircraft lessors in the financial intermediary industry. Second, Rampini and Viswanathan (2013) consider the role of leased capital in a dynamic model of firm financing and provide a dynamic theory of sale-leaseback transactions. As argued by Rampini and Viswanathan (2013), leasing is *strongly collateralized costly financing* and permits greater leverage. When capital is leased, the financier retains ownership which facilitates repossession and strengthens the collateralization of the financier's claim. Leasing is costly since the lessor incurs monitoring costs to avoid agency problems due to the separation of ownership and control. Leasing tangible assets requires less net worth per unit of capital and hence allows firms to borrow more. Financially constrained firms lease capital because they value the higher debt capacity. More constrained firms hedge less and lease more, both cross-sectionally and dynamically. Indeed, firms with sufficiently low net worth do not engage in risk management at all because the need to finance investment overrides the hedging concerns. Mature firms suffering adverse cash flow shocks may cut risk management and sell and lease back assets. This partly explains why sale-leaseback transactions are so popular with airline operators when they face demand uncertainty and economic downturns. Their findings are consistent with those of Slovin, et. al (1990), who find that the announcements of sale-leaseback transactions of major corporate assets are associated with positive abnormal returns to lessee firms. Sale-leaseback transactions free up net worth and can be an optimal response to adverse cash flow shocks. Their dynamic analysis of risk management shows that for plausible levels of autocorrelation of productivity, firms may not hedge at all and that even dividend-paying firms that are hit by a sequence of adverse shocks eventually become so constrained that they cut risk management. The extent to which firm lease is determined by firm's financial condition, and more constrained firms lease more. Moreover, leasing enables firms to grow faster. They conclude that *the tangibility of assets* and *firms' ability to lease capital* are critical determinants of the capital structure. Over time, as firms accumulate net worth, they grow in size and start to buy capital. They finally point out that leased capital is an important mode of financing, in particular for constrained firms, and should be taken into account not only in corporate finance, but also in studies of the effect of financing on development and growth.

Because the airline industry is highly *cyclical*, both airline profits and aircraft values carry large financial risk, and they are almost perfectly correlated. Leasing allows carriers to transfer some of the aircraft ownership risk, especially *residual value risk*, to operating lessors. The substantial price discounts recorded by capital constrained carriers when selling used narrow-body aircrafts during economic downturns (see Pulvino,1998) show that even the idiosyncratic risk of aircraft ownership can be substantial. Lessors are better suited to assuming this aircraft ownership risk through their knowledge of secondary markets, their scale economies, and their diversification of aircraft types and lessees operating in different geographic regions. Pulvino(1998) also documented that capital constrained airlines are also more likely to sell used aircraft to industry outsiders, especially during market downturns, which causes substantial capital loss. Industry outsiders or specialized owners tend to be lower value user of commercial aircraft (e.g., banks and leasing companies) as suggested by

Shleifer and Vishny (1992). Pulvino(1998) documents that airlines with low spare debt capacities sell aircraft at a 14 percent discount to the average market price. This is the case particularly during industry recessions when competition for used aircraft is weak and the risk associated with finding a lessee for the aircraft is high. During market recessions, financial institutions pay a discount of 30 percent to the average market price. Furthermore, as sellers' financial constraints become more severe, the likelihood of selling to low value users (financial institutions) increases, but only during market recessions. Even leasing companies, however, have a limited debt capacity and, therefore, cannot absorb all the planes put on the market when an industry suffers an adverse shock. The airline and shipping industries illustrate the critical role of deep pocket investors in maintaining some degree of asset liquidity during industry and economy wide recessions.

This asset risk transfer function enabled by leasing has also been empirically confirmed by Mehran, Taggart and Yermack(1999), who, in an empirical study to examine the effect of CEO stock ownership on leasing, find that CEO ownership is positively related to companies' leasing and debt financing activity. This suggests that CEOs with large ownership stakes engage in more leasing to reduce their exposure to obsolescence and other asset-specific risks.

LESSOR AS SPECIALIST ASSET REDEPLOYER AND CAPITAL REALLOCATION FACILITATOR

The efficiency with which that capital can be redeployed to other firms and sectors is an important determinant of the economy's speed of transition after a shock. Efficiency requires that only the most productive carriers operate aircraft. Lessor must identify an asset's next best use or next-best user (redeployability) and be prepared to repossess and redeploy it to a member of the class of next best users. But firstly, what is asset redeployability? Based on a transaction cost approach, Williamson (1988) identifies an asset liquidation value as the asset's redeployability—or its value in its next- best use. In Williamson (1988)'s terminology, lower asset specificity or higher liquidation value are associated with higher asset redeployability. Shleifer and Vishny (1992)'s industry equilibrium model suggest that a larger number of potential users with strong financial condition in the market for the asset increase an asset's liquidation value. Benmelech(2009) argues that physical attributes of an asset jointly with the number of its potential users determine its redeployability- the alternative uses an asset has. However, as noted by by Shleifer and Vishny(1992), the financial strength of its potential users determine its *liquidity* – the ease with which it can be redeployed in its next best use value. According to Pulvino(1998) and Gavazza(2010), aircraft secondary market is extremely thin. The thinness of the market for used aircraft reinforces the importance of the size of the set of potential buyers in determining aircraft redeployability. Using measures of fleet redeployability as a proxy for the liquidation value lessors would obtain upon the default of an aircraft lease, Benmelech and Bergman(2008) show that when airlines are in poor financial condition, lower fleet redeployability increases their ability to reduce lease payments.

Generally assets will be redeployed to more productive firms from less productive firms or will be redeployed to an alternative use after failing in their intended use or assets. Heterogeneity across firms in their ability to use capital productively drive capital reallocation.

But capital reallocation is not costless. Using equipment-level data from aerospace plants that closed during the 1990s, Ramey and Shapiro (2001) study the process of moving installed physical capital to a new use and show that capital is very costly to reallocate. They find that even after depreciation is taken into account, capital sells for a substantial discount relative to replacement cost and that the more specialized the type of capital, the greater the discount. Yet, capital sold to other aerospace firms fetches a higher price than capital sold to industry outsiders. Their findings imply that investment is very costly to reverse, especially during a sectoral downturn, capital displays significant sectoral specificity and firms often engage in costly search and matching to overcome sectoral specificity and market thinness. While Ramey and Shapiro(2001) concentrate on physical cost of reallocating capital, non-physical cost of reallocating existing capital has been studied by Eisfeldt and Rampini(2006). Eisfeldt and Rampini(2006) documents the procyclical nature of the amount of capital reallocation and the contrasting countercyclical nature of the benefits to capital reallocation. They find that the cost of reallocation needs to be substantially countercyclical to be consistent with the observed joint cyclical properties of reallocation and productivity dispersion. Their results imply that non-physical cost of reallocating capital - the informational and contractual frictions which inhibit capital redeployment seem to be much more severe in bad times.

Secondary markets play a potentially important allocative role and it is of some interest to understand the effectiveness of these markets in transferring ownership/user right to the "right" consumers/users. Lessor as specialist asset redeployer can develop specialized knowledge on "placing" off-leased aircrafts to the right users. Trading frictions in secondary markets for capital assets are a key factor in determining an industry's aggregate productivity growth or an industry's speed of adjustment after a shock or a policy intervention. Leasing facilitates trading of used aircraft in secondary market by reducing trading frictions. Adverse selection is one of trading frictions that hinder efficient trading of durable assets in secondary market. Hendel and Lizzeri(1999a) predicts that unreliable brands have steeper price declines and lower volumes of trade in the secondary market. Hendel and Lizzeri(2002) further argue that leasing mitigates trading frictions such as adverse selection in secondary market, thus facilitating trading in the secondary market for leased durable goods. Consistent with the empirical data, their model predicts that leased cars have a higher turnover and that off-lease used cars are of higher quality. Applying Hendel and Lizzeri's model to aircraft secondary market, it can be reasonably predicted that leased aircrafts have a higher turnover and that off-lease used aircraft are of higher quality. Gilligan(2004) tests these predictions in the used business aircraft market and confirms that adverse selection is a prominent feature of the market for contemporary used business aircrafts and that leasing mitigates the consequences of asymmetric information about the quality of used durable assets. Gilligan(2004)'s study suggests that asymmetric information theories of trade in used durable assets provide predictions conditional on the presence of quality uncertainty or counteracting institutions such as leasing contracts.

Besides reducing adverse selection in asset secondary market, leasing also reduces another kind of trading frictions (transaction costs and search costs for potential buyers) in the secondary market, as explored in Gavazza(2011a). Gavazza (2011a) identifies the role of

aircraft lessors as intermediaries that reduce frictions in aircraft trading, especially in secondary markets, and he constructed a model of trading in durable capital to understand the role of lessors when trading is subject to frictions such as transaction costs and search costs. Gavazza (2011a) is one of the few that empirically quantify the gains from institutions that enhance the efficiency of trading in these markets, similar to the study of Hendel and Lizzeri(2002) . Based on the expectation that the costs of capital redeployment or reallocations are lower for more-liquid aircraft, he finds that leased assets trade more frequently and produce more output than owned assets because (1) high-volatility firms are more likely to lease than low-volatility firms; and (2) firms shed leased assets faster than owned assets amid productivity shocks because of lower transaction costs. Gavazza(2011a) also point out that the entry of lessors into the financial intermediary industry in the mid-1980s coincides with a period of trade expansion in secondary markets, when the need for market intermediaries to coordinate sellers and buyers became stronger. When carriers want to shed excess capacity, the lessor takes over the job of finding a new operator. The logic is that specialist can do this job more efficiently while carriers focus on operating the aircraft and servicing the passengers. Gavazza(2011b) further investigated whether trading frictions vary with the size of the asset market and set up a model of a bilateral search market to investigate what implications market thickness has for asset allocation and prices. His empirical findings suggest that, even within a well-defined asset class such as aircraft, capital is moderately specialized, and market thinness generates frictions that are a large impediment to the efficient reallocation of capital. This indicates that assets with a thinner market are less liquid – i.e., more difficult to sell. Instead, when assets have a thicker market, the matching between potential buyers/ sellers and lessors /lessees becomes easier, and assets transfer immediately to the highest-profitability firms. Therefore, assets with a thick market are more efficiently allocated than assets with a thin market. His empirical findings also confirm his theoretical predictions, which prove that the thickness of the asset market reduces trading frictions in input market, thereby increasing the aggregate efficiency of output markets. Thus leasing can mitigate trading frictions such as adverse selection, transaction cost and search cost in asset secondary markets has been documented by Hendel and Lizzeri(2002) and Gavazza(2011a). So lessor as specialist capital redeployer and capital reallocation facilitator has largely been verified in the literature.

It is fairly easy to find examples of assets that were intended for one use and later redeployed to an alternative use. For example, in response to competitive fares, many passenger aircraft designed for full-service use under regulated fares were taken off lease from defaulting airlines and then reconfigured and redeployed for use specifically in low-frills service on high-traffic routes. Habib and Johnson(1999) explore the financing and redeployment of specific assets from its primary use to its next-best use and model the role nonrecourse secured debt play in efficiently redeploying assets whose value is state-specific. They hypothesize that in some cases there is a real trade-off between the costs of identifying the asset's next best use, ex ante, and the ex-post costs of repossession and resale, so that some level of ex ante investment is efficient. Where ex ante investments are noncontractible, they argue that nonrecourse secured debt avoids ex post bargaining and appropriately bonds the redeployer's performance by making him a residual claimant to the asset's highest feasible

bad-state value. They assume that, ex ante an entrepreneur and an asset redeployer make noncontractible state-specific investments in the primary and next-best use of an asset respectively. The redeployer provides a secured nonrecourse loan equal to the value of the asset in the critical state that separates the good and bad states to the entrepreneur who specializes in using the asset in its primary use. If a good state prevails, the entrepreneur retains ownership over the asset and repays the loan as agreed. If a bad state prevails, he gladly allows the redeployer to repossess the asset because its value to him is less than the face value of the loan. According to Habib and Johnson(1999), this contract averts ex post bargaining over the asset's quasi-rents on redeployment and leaves the parties' ex ante investments undistorted if a bad state prevails. Habib and Johnson(1999, pp.703-704) agree that leasing is preferred to secured lending by active redeployers because, among other reasons, it provides the lessor a marginal transaction cost advantage in repossessing the collateral on default by maintaining its full ownership of the asset. This reduces redeployment costs and raises the asset's critical-state value along with the face value of the loan. According to the redeployment hypothesis developed by Habib and Johnson(1999), banks and other commercial lenders specialize in plain vanilla financing of relatively low-order alternative uses of fairly general assets. These lenders' expertise is in pure valuation (and perhaps asset monitoring). In contrast, competitive equipment lessors specialize in fully integrated redeployment – asset valuation, monitoring, repossession, and resale/redeployment. All else equal, Habib and Johnson(1999) predict that pure valuation specialist to lend less than the redeployment specialist against a given asset because they are willing to bear the default risk on only the very lowest-order alternative uses arising from only the very worst states. Because equipment lessors lease against a very general asset amenable to a variety of alternative uses, the market into which the asset is redeployed is likely to be fairly thick, perhaps being characterized by something close to perfect competition. Repossession and redeployment in such a market are fairly routine and can therefore be vertically disintegrated from valuation and performed ex post. Firms specializing in redeployment tolerate much higher “default” rates(including either forced or voluntary repossession) given that the cost to them of realizing the more specialized general asset' next best use is relatively low. For them, valuation must be vertically integrated with repossession and redeployment because the market into which they redeploy the general asset is likely to be much thinner, with successful redeployment depending on effective ex ante investment.

LESSOR AS ORIGINATOR OF ASSET TRANSFORMATION AND LIQUIDITY CREATOR

According to Merton(1998), one of the core functions that financial intermediary must fulfill is to pool funds to undertake large indivisible project. To pool funds, aircraft lessors need to issue liabilities to investors. But what sort of liabilities does a competitive operating lessor issue to fund itself? Bank loans are the traditional stable source of financing for intermediary lessors. Besides securing bank loans, competitive lessors need to have access to capital markets for funding. They usually raise capital by selling securities to outside investors. Start-up lessors often heavily rely on commercial bank loans in the form of secured debt without access to capital market. Acquired aircrafts are pledged as collateral for debt

financing. As leasing business grows and the acquisition of aircrafts increase gradually, the debt levels of aircraft lessors increase to a very high level, aggravating the bankruptcy risk of aircraft lessors. To reduce debt levels and expand business, start-up lessors can access capital market rather than secured borrowing. According to Holmstrom and Tirole(2000), equity is the most accommodating claim with no precise timetable for the payment of dividends. Issuing public equity or going public seems to be one possible way for raising lower-cost capital for aircraft lessors. But why do aircraft lessors issue equity? Issuing equity has numerous benefits. In addition to facilitating the financing of acquisition of new aircrafts, an initial public offering(IPO) subjects an aircraft lessor to outside monitoring (e.g., Holmstrom and Tirole, 1993); improves its liquidity(e.g., Amihud and Mendelson, 1986); reduces valuation uncertainty(e.g., Benveniste and Spindt, 1989; and Dow and Gorton, 1997), which in turn lowers the costs of subsequent seasoned equity offerings (SEOs) (e.g., Derrien and Kecskes, 2007); increases the dispersion of its ownership (e.g., Chemmanur and Fulghieri, 1999); and loosens financial constraints and provides financial intermediary certification and knowledge capital (e.g., Hsu, Reed, and Rocholl, 2010). In addition, an underdiversified risk-averse entrepreneur could benefit from an IPO because diversified investors assign higher valuations to a risky asset (firm equity) than the entrepreneur herself (e.g., Bodnaruk, Kandel, Massa, and Simonov, 2008). Furthermore, transferring firm ownership from a risk-averse entrepreneur to diversified investors could improve profitability because risk considerations generally prevent profit maximization (e.g., Rothschild and Stiglitz, 1971). Dittmar and Thakor(2007) predict that managers will use equity to finance projects when they believe that investors' views about project payoffs are likely to be aligned with theirs, thus maximizing the likelihood of agreement with investors. They also provide strong empirical support for their theory and document its incremental explanatory power over other security issuance theories such as market timing and time-varying adverse selection. Chod and Lyandres(2011) examine a firm's incentive to go public in the presence of product market competition and find that as a result of their greater ability to diversify idiosyncratic risk in the capital markets, public firms' owners can tolerate higher profit variability than owners of private firms because owners of public firms tend to hold more diversified portfolios than owners of private firms. Consequently, public firms adopt riskier and more aggressive output market strategies than private firms, which improves the competitive position of the public firm versus the private firm. This strategic benefit of being public, and thus, the proportion of public firms in an industry, is shown to be positively related to the degree of competitive interaction among firms in the output market, to demand uncertainty, and to the idiosyncratic portion of this uncertainty. Still based on product market competition, Chemmanur and He(2011) develop a new rationale for IPO and find that going public, though costly, not only allows a firm to raise external capital cheaply, but also enables it to grab market share from its private competitors. In equilibrium, even firms with sufficient internal capital to fund their new investment may go public, driven by the possibility of their product market competitors going public. IPO waves may arise in equilibrium even in industries which do not experience a productivity shock. Recently the flurry of Asian financial leasing companies IPOs as evidenced by Asian capital markets seems to some degree testify the predictions of Chemmanur and He(2011)' model⁴. From the selective review of literature on theory about

⁴ Source: Danny Leung, **CDB leasing IPO prepares for take-off**, Finance Asia, 1 March, 2016,

equity issuance, it can be reasonably expected that, to remain competitiveness, mature aircraft lessors should at least achieve a listed company status rather than staying private.

Besides initial public offering, aircraft lessors can originate asset transformation to issue asset-backed securities(ABS) such as equipment ABS. This can be achieved mainly through securitization. Asset securitization is one major form of structured finance⁵, which aims to separate an activity from the originating or sponsoring firm. Assets generating cash flows are placed in a bankruptcy-remote Special Purpose Entity (SPE) formed specifically to hold those assets. Such SPE raises fund on its own merits by selling securities that are collateralized by the cash flows of the transferred assets in the form of commercial paper or debt securities. Graff(2006) explores the economics of securitization and insightfully recognize that the asset transformation by securitization enhance asset value by raising the demand curve for the asset without impacting the supply curve. He further notes that wide variation in securitization methodology reflects wide variation in asset investment characteristics.

In terms of its design, ABS most resembles secured debt since the firm identifies in advance an asset or pool of assets and uses them to back a loan. As a consequence, investors in ABS need to be concerned primarily with the quality of assets backing the loan rather than the firm's assets as a whole. Unlike secured debt, securitization involves the transfer of ownership of assets to a bankruptcy-remote SPE, which then sells claims on the assets to outside investors in exchange for liquid funds. Ayotte and Gaon (2011) argue that the transfer of ownership is crucial because it allows the firm to establish the bankruptcy remoteness of the SPE and the transferred assets from the borrowing firm. This provides lenders with protection from dilution that is not available with contracts such as secured debt. In their view, ABS allows firms to commit to more efficient investment decisions in bankruptcy. They further find that ABS is most valuable when the underlying assets are replaceable assets such as accounts receivable or other nonspecific inputs(i.e., assets that the firm can easily obtain from outside sources at a competitive price). With respect to necessary assets, such as fixed assets, inventory, or intellectual property, they find that ABS can produce significant ex post inefficiencies, which raise the firm's overall cost of capital. Thus securitization of replaceable assets prevents inefficient continuation, but securitization of necessary assets can produce ex-post inefficiency, which favors secured debt. There are many potential benefits to the issuer of ABS. Hess and Smith (1988), Greenbaum and Thakor (1987), and Pavel and Phillis (1987) suggest that securitization provides a means to reduce risk, to diversify portfolios, and to fund new assets and operations. Rosenthal and Ocampo (1988) suggest that securitization usually offers lower cost financing for the firm by separating the credit risk of securitized assets from the risk of the firm, regardless of the firm's credit ratings. Securitization also offers the firm expanded borrowing capacity, freeing the firm to pursue additional positive NPV project. Securitization has also been justified as a means of economizing on regulatory capital requirements, but many unregulated financial and nonfinancial firms also employ the technique. Furthermore, recent empirical research(Calomiris and Mason, 2004; Minton, Sanders, and Strahan, 2004) confirms that securitization seems motivated more by efficient

<http://www.financeasia.com/News/406218,cdb-leasing-ipo-prepares-for-take-off.aspx> www.

⁵ Another form of structured finance is project finance.

contracting motives rather than by regulatory arbitrage. Leland (2007) provides a straightforward rationale for *structured finance* based on purely financial synergies. In his model, the sources of synergies can be clearly identified, quantitatively verify the vague claims that structured finance can *unlock asset value*. His theory explains the use of these techniques for both low-risk and high-risk assets. According to him, asset securitization permits the use of very high leverage on the subset of low risk assets and securitization is even more desirable when the originating firm is riskier. Gorton and Souleles (2007) further argue that an important consequence of securitization is the separation of the credit risk of the originating firm from the credit risk of the SPE and thus the primary benefit of asset securitization is the lower bankruptcy (default) costs associated with the SPE structure. Nadauld and Weisbach(2012) documents that the securitization of corporate loans lead to a reduction in the cost of corporate borrowing. Lemmon, et al.(2014) examine the characteristics of nonfinancial firms that use securitization and the economic consequences for firms that originate a securitization program and find that securitization is used by a select set of nonfinancial firms that are not among the most risky in the economy and that these firms experience notable benefits upon origination. Upon initiation, firms experience positive abnormal stock returns and zero abnormal bond returns, and largely use the securitization proceeds to repay existing debts. Thus, asset securitization by nonfinancial firms provides a valuable form of financing for shareholders without harming debtholders. Compared with the existing literature on securitization which focuses on negative effects created when financial institution originate mortgages and subsequently securitize them, Lemmon et al.(2014)'s paper highlights the benefits of securitization. For nonfinancial firms, securitization appears to have functioned quite well by helping to reduce financing frictions without exacerbating incentive problems. They conclude that securitization minimizes financing costs by reducing expected bankruptcy costs and providing access to segmented credit markets. Nonfinancial firms using securitization tend to be larger, have substantial amounts of accounts receivable to finance, and are in the middle of the credit quality distribution. As firm credit risk increases, the benefit from using securitization increases as firms can minimize costs associated with bankruptcy and access investment-grade bond markets and commercial paper markets that are restricted to very low- risk firms. However, very risky firms do not use securitization, as covenants in existing credit agreements and ABS governing contracts limit the access of very risky firms to securitization. Securitization appears to create firm value that is not generated at the expense of existing bondholders. Competitive lessors thus are expected to be frequent securitizers since securitization allow lessors to specialize in the activities of their comparative advantages as originator of asset transformation and liquidity creator and access lower-cost capital market.

Securitization has so far been justified as a means of efficient financing for low-risk assets or *replaceable assets* using the terminology of Ayotte and Gaon (2011). But what are the wealth effects for securitization? Thomas(1999) finds that securitization is significantly wealth creating for stockholders and for the frequent securitizers, the realization of a comparative advantage in *asset origination* and *servicing* but not wealth appropriation from bondholders explains the gains from asset securitization. Thomas(2001) further analyzes effects of asset securitization on seller claimants and finds that shareholders' returns are increasing in

shareholder capitalization and that securitizers with actively traded bonds enjoy substantial and significant shareholder gains, which are greater the poorer the creditworthiness of the seller. Wealth transfer from bondholders to shareholders occurs in asset-backed securities among sellers with low credit ratings. Lockwood et al.(1996) show that securitization increases shareholder wealth in well-capitalized banks and finance companies but reduces shareholder wealth in weak banks.

Equipment asset-backed securitization is on the upswing, according to Whelan(2015). Goukasian and Miller (2012) reports that during the 2008 financial crisis, equipment lease and loan backed securities performed better than almost any other asset-backed securities and equipment lease asset-backed securities had a return on equity of 11% and 5.2% in 2008 and 2009 respectively, whereas almost all other asset classes suffered big losses during the same period. Although equipment lease asset-backed securities achieve a spectacular performance during the financial crisis, many academics paid little attention on research in this field compared with research on mortgage-backed securities (MBS) (see Schwartz and Toros, 1989; Stanton, 1995) and collateralized debt obligations (CDO)(See Duffie and Garleanu, 2001; Longstaff and Rajan,2008). So research on the valuation of ABS, especially for equipment lease asset-backed securities and how to operationalize the securitization of leased assets and design appropriate securities warrants further investigation.

LESSOR AS DELEGATED MONITOR

Lessees are the agents of lessors, a relationship fraught with conflicting interests as the conflict relationship between corporate managers and shareholders as explored by Jensen(1986). It is commonly accepted that agents (or principals) may not always act in the best interest of principal (or agent) if both parties are utility-maximizing. Both principal and agent thus incur costs to manage counterparty incentive conflicts in agency relationships. Agency relationships create a demand for monitoring. Pretorius et.al (2003) identified two key incentive conflicts embedded in commercial real estate leases: bilateral monopoly exploitation and residual value expropriation. According to him, the bilateral monopoly exploitation incentive is related to asset specificity. With respect to residual value expropriation incentive, according to Pretorius(2003), lessee decisions that adversely affect asset residual value and go undetected, directly expropriate residual value from lessor. Pretorius(2003) further states that the lessee is best viewed as an agent who must take care of and not abuse the asset, and also maintain it under a net lease(i.e. not expropriate residual value) and a lessor is characterized as a potential exploiter with specific assets, and as an agent with an incentive to exploit any potential bilateral monopoly. For leased aircraft assets , residual value expropriation seems to be the dominant incentive conflict relative to bilateral monopoly, since leased aircraft assets are usually *liquid* and *redeployable* assets, and asset specificity does not pose a problem.

Aircraft lessors are agents or groups of agents, who are delegated by outside security holders the authority to invest in financial assets and monitoring of lease contracts written with lessee

firms. To remain competitive, aircraft lessors need to be capable of detecting and monitoring residual value expropriation incentives by lessees. Monitoring incurs costs. Diamond (1984) develops a theory of financial intermediation based on minimizing the cost of monitoring information which is useful for resolving incentive problems. The information production task delegated to the intermediary by outside investors gives rise to incentive problems for the intermediary and Diamond(1984) termed these *delegation costs*. He analyzes the determinants of delegation costs and develops a model in which a financial intermediary has a net cost advantage as delegated monitor on behalf of investors. He proves that *diversification* within the intermediary is key to the possible net advantage of intermediation. Diamond(1996) further stresses that portfolio diversification within financial intermediary is the financial-engineering technology that facilitates a bank(he call the financial intermediary as “bank”)'s transformation of loans that need costly monitoring and enforcement into bank deposits that do not. He further confirms that financial intermediaries such as banks can centralize costly monitoring and avoid the duplication of effort of the monitoring of borrowers by small investors. Thus the role of banks is monitoring debt (loan) contracts and issuing unmonitored debt (deposit) contract. Williamson (1986) analyzes an environment with asymmetrically informed lenders and borrowers, costly monitoring , and investment project indivisibilities and insightfully shows that intermediation drives direct lending out of the system in equilibrium and financial intermediation dominates direct lending as a result of costly monitoring and large-scale investment projects. As in Diamond(1984), intermediation performs a *delegated monitoring* role, and diversification is critical to the function that intermediation performs. Financial intermediaries in Williamson(1986)'s model share several of the important features of intermediaries in real world: they issue securities which have payoff characteristics which are different from those of securities they hold; they write debt contracts with borrowers; they hold diversified portfolios and they process information. However, a crucial difference between Williamson(1986)' framework and Diamond(1984)'s is that monitoring occurs only in the default state and consequently credit rationing may be a feature of the equilibrium. Krasa and Villamil(1992) consider an economy with a finite number of agents, and consequently their delegated monitor has a finite-sized portfolio with default risk that is not necessarily perfectly diversified away, which is more realistic than Diamond(1984)'s limit economy model. Thus the intermediary's asset transformation problem involves not only the choice of a rate of return on deposits but also the non-trivial choice of a risky portfolio, which implies a particular bankruptcy probability. They use the large deviation principle rather than the large numbers principle in Diamond(1984) to characterize how “large” a finite-sized intermediary must be to achieve sufficient default risk diversification. Their theoretical model further confirms that *delegated monitoring* dominates direct investment and that two-sided simple debt is optimal in a costly state verification model with non-trivial default risk. Besides the above strand of literature which mainly explains the existence of specialized monitoring institutions as a result of market failures in direct credit market, another strand of literature focuses on the role of contractual covenants as mechanisms to control agency problems between firm insiders and outside investors. For example, Smith and Warner (1979) document that control rights from covenants reduce borrower adverse selection or moral hazard. Berlin and Loeys(1988) examine alternative contracting arrangements available to a firm seeking to finance an investment project and

consider the choice between loan contracts with covenants based on noisy indicators of the firm's financial health(a bond) and loan contracts enforced by a monitoring specialist(a bank loan). The firm's choice is shown to depend upon the firm's credit rating, the accuracy of the financial indicators of the firm's condition, the loss from premature liquidation of the firm's project and the cost of monitoring. Rajan and Winton(1995) further investigates how the loan contracts made by lending institutions can be structured so as to best enhance the institution's role as delegated monitors. They argue that covenants make a loan's effective maturity and the ability to collateralize makes a loan's effective priority, contingent on monitoring by the lender. Thus both covenants and collateral can be motivated as contractual devices that increase a lender's incentive to monitor. Their results suggest that the need to give lenders incentive to monitor and the ability to control borrowers may partly explain important features of loan contracts. They also imply that although they call the monitoring lender a bank for simplicity, in practice it could be any financial institution. As argued by Rampini and Viswanathan (2013), leasing is strongly collateralized costly financing because the lessor retains ownership which facilitates repossession and strengthens the collateralization of the lessor's claim. Thus competitive lessors must be capable of efficiently structuring their lease contracts and utilizing lease covenants and collaterals(the ability to repossess assets) to increase their incentive to monitor lessee firms' residual value expropriation incentives. Although lessor as delegated monitor has been largely confirmed theoretically in the literature, how lease covenants and collateral are efficiently structured to prevent residual value expropriation incentives is an unexplored territory. This awaits further investigation.

V. Conclusions

This paper tends to comprehensively explore the value added by a competitive operating lessor by a case study of aircraft lease market. It begins with the observation of the increasing popularity of using operating leasing to finance capital assets in various durable assets markets, especially for mobile aircraft assets. Then a selective review on operating leasing and durable assets market and the pervasiveness of using operating leasing to fund capital assets in various industries has been conducted. Next it follows by introducing the link between operating leasing and asset liquidity and how to measure asset liquidity. Then the rise of the independent operating lessor in the financial intermediary industry is explored and reviewed. The core section of this paper concentrates on four essential roles played by a competitive operating lessor. These four roles are explored and elaborated respectively and in-depth. These are lessors as specialized owner; lessor as specialist asset redeployer and asset reallocation facilitator; lessor as originator of asset transformation and liquidity creator; lessors as delegated monitor.

Within each role, a comprehensive literature review is conducted firstly, and suggested future research direction is proposed. For the role of lessor as originator of asset transformation and liquidity creator, lessor characteristics such as the ability to access public equity market through initial public offering and the ability to issue asset-backed securities (or securitization) to transform illiquid assets into liquid securities have been emphasized in lieu of other financing options. Competitive lessors are expected to be frequent securitizers. Also

important research gaps have been identified. It has been found that the valuation or pricing of equipment lease asset-backed securities warrants further investigation, especially for the operationalization of securitization of leased asset and the designing of appropriate securities. For the role of lessor as delegated monitor, residual value expropriation incentive by lessee firms has been stressed. Although lessor intermediary as delegated monitor has been largely confirmed theoretically in the literature, how lease covenants and collateral are efficiently structured to prevent residual value expropriation incentives is an unexplored territory. This awaits further investigation.

Appendix – Commercial Aircraft Market

The commercial aircraft market provides an ideal candidate for general investigation of leasing issues. First, more than half of all commercial aircraft are currently leased (approximately one third of the aircraft are under operating lease and one-sixth under capital lease). Second, there is an active secondary market for aircraft. Aircrafts are among the easiest assets to redeploy across users. The secondary market for aircraft is a single, worldwide market that is more active than the market for other capital equipment. All airlines in the world use the same types of aircraft, and aircraft can be redeployed to an operator anywhere in the world within a day. These characteristics mean that there is a single global market for aircraft, and the market is, in principle, thicker than markets for other capital equipment. Third, the market for used commercial aircraft might seem relatively liquid compared to the market for other, more specialized equipment. All airlines around the world use the same types of aircraft and there are relatively few types. Moreover, the aircraft market is a market with almost perfect information about potential buyers/users and the quality of the assets. Sometimes governments and air-cargo companies purchase aircraft, but the major players are airlines and lessors. However, the absolute number of transactions remains very small compared to financial markets and other equipment markets. Fourth, aircraft are traded in decentralized markets and the market is organized around privately negotiated transactions. At least for the time being, the structure of the used commercial aircraft remains, as it has been for the past 20 years, dominated by privately negotiated transactions (Pulvino, 1998). Hence, prices are very sensitive to a party's individual shocks, and the bargaining power of sellers and buyers is an important determinant of transaction prices. For example, Pulvino(1998) finds that sellers whose financial status is poor sell aircraft at a 14% discount relative to the average market price. Hence, aircraft markets share many features with other *over-the-counter* markets for financial assets (mortgage-backed securities, corporate bonds, bank loans, derivatives, etc.) and for real assets (real estate), in which trading involves material and opportunity costs (Duffie, Garleanu, and Pedersen 2005). Therefore, major carriers have staff devoted to the acquisition and disposition of aircraft, which indicates that trade is not frictionless. Fifth, compared to financial markets and other equipment markets, the number of transactions is small. For example, in the 12 months between May 2002 and April 2003, of the total stock of 12,409 commercial aircraft used for passenger transportation and older than 2 years, only 720 (5.8 percent) are traded. Thus, compared to financial markets, the market for used commercial aircraft is extremely "thin." This makes it difficult for buyers and sellers to establish "market values." Because of difficulty in establishing a benchmark market price, the relative bargaining powers of buyers and sellers are potentially important determinants of transaction price. Motivated sellers are more likely to agree to a low transaction price and motivated buyers are more likely to agree to a high transaction price. Pulvino(1998) focuses on one particular source of motivation, namely, the financial condition of the seller. Sixth, aircrafts are differentiated products, and product differentiation generates economic rents. Each type of aircraft requires human-capital investments in specific skills for pilots, crew and mechanics that increase the degree of physical differentiation. As a result, carriers tend to minimize the number of types of aircrafts they operate. Product differentiation also implies that aircrafts are imperfect substitutes for one another, and this has important implications for the differential liquidity of different aircraft types. Different types are

designed to serve different markets and different ranges. For example, a Boeing 747 is suited to markets in which both demand and distance are large. For a given aircraft type, the number of annual transactions can be small. For example, only 21 Boeing 747s traded in the 12-month period ending April 2003. In thin markets, the search costs to find high-value buyers are large (Ramey and Shapiro 2001). Industry experts and market participants consider these frictions a fundamental characteristic of aircraft markets. Finally, the liquidity of a given aircraft type also varies over time, as aircraft follow the typical life cycle of products. Thus, two main factors affect the liquidity of aircraft types over time: the production of new units and the retirement of old units. For example, the Boeing 727 was the most popular and liquid commercial aircraft during the 1970s, when production rates were high, but it is rather illiquid today, as it has been phased out of production and many units have been retired.

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