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## Conceptual Issues That Influence Measures of Output and Price Change in the Leasing Industry

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# Conceptual Issues That Influence Measures of Output and Price Change in the Leasing Industry[1]

**Abstract:** Relative to mining and manufacturing, the outputs of the service sector have long been recognized as more difficult to define and measure. At the operational level, one must first agree on what constitutes an industry's outputs before one can determine what is to be priced and what methodology for measuring changes in outputs are appropriate. The leasing industry is one of many examples of how the service sector challenges pricing agencies to develop and publish industry price indices with relevant deflation properties based on clearly and consistently defined measures of output.

**What is a leasing service?**

Rentals are often combined with leasing at the industry classification level, but the following discussion excludes and is not intended to be applicable to rentals. The terms of a leasing contract can be complex and full of special clauses that make a simple description difficult. At a generic level, leasing always involves at least two parties, the lessor (leasing company) and lessee. For the purpose of this review, leasing always refers to a true lease which is a type of transaction that qualifies as a lease under the Internal Revenue Code. A true lease, also known as an operating lease, allows the lessor to claim depreciation and the lessee to claim lease payments as tax deductions. Leasing companies almost always describe leases as a financial alternative to bank loans. Some of the key differences between a bank loan and lease that potential borrowers and lessees may consider are:

**Table 1.**

| Lease | Loan |
|---|---|
| Finances only the value of asset expected to be depleted during the lease term=(Present value minus residual value) | Finances the entire value of asset =(Present value minus down payment) |
| At lease end, lessee usually has the option to buy the asset for its remaining (residual) value or walk away. | At loan end, the borrower owns the asset. |
| Lessee transfers depreciation and obsolescence risk to lessor. | Borrower assumes all depreciation and obsolescence risk. |
| Lessee (when lease is structured as true lease) can claim the entire lease payment as tax deduction.* | Borrower may claim tax deductions for interest expense and asset depreciation that is tied to IRS depreciation tables |
| Initial financial outlay is lower | Initial financial outlay is higher |
| Lease payments are usually lower | Loan payments are usually higher |

*To be classified as a true lease, the lease contract must allow the option of buying the asset at the end of the lease term for fair market value. Other leases may provide for $1 buyouts, etc. but are not given favored status (deducting entire lease payment as an expense) and under IRS guidelines are considered a conditional sales contract.

Because leases are marketed as an alternative to bank loans, it should come as no surprise that many of the same inputs to bank loan outputs, such as credit assessments, record-keeping, asset

[1] The NAIC system does not explicitly define Leasing as a single 6-digit industry aggregate. For example, NAICS 532-Rental and Leasing Services is disaggregated into multiple 6-digit industries by the type of product(s) leased, such as NAICS 532112-Passenger Car Leasing or NAICS 532420-Office Machinery and Equipment Rental and Leasing. If establishments accept deposits/offer loans as well as leases, then regardless of the relative importance of leases they are classified into one of the NAICS sector 52-Finance and Insurance industries.

valuations, and payment processing are required in leasing. Both bank and leasing establishments hold an ownership interest or claim on assets that serve as collateral, but an important differentiator is that under a true lease, the depreciation of an asset can be claimed by the leasing company.[2] This last point, the tax advantage or depreciation claim held by the lessor, may be partly responsible for raising the question within and between some statistical agencies of what is the proper measure of leasing outputs? The answer to the output question is fundamentally based on whether leasing is viewed strictly as a financial service or whether leasing outputs are instead tied to the asset(s) covered by a lease. For example, if an automobile lease in period 0 is replaced by a lease for a similar but improved automobile in period 1, should the improvement in the period 1 automobile be used to quality adjust the lessor's period 0 to period 1 price relative? If the answer is yes, then implicitly, the pricing agency has identified the asset (automobile) as a leasing output.[3] One potential issue with this interpretation is that leased assets are usually finished goods that one could argue do not enter a leasing industry production transformation process that converts inputs to outputs as is the traditional assumption applied to other industry outputs in a PPI framework.[4] This rationale could also be applied to the loan services provided by the banking industry because changes in asset quality, such as higher horsepower or more fuel efficient automobiles over time, are not generally thought of as a change in the quality of banking services provided to borrowers. Before continuing with the question of what service is actually produced by the leasing industry it may be helpful to briefly discuss how leases are normally priced.

**Lease Pricing Model**

Under a true lease, the lessee has the option, but not the obligation to buy the leased asset at fair market value at the end of the lease term, return the asset to the lessor or extend the lease. In effect the lessee transfers depreciation and obsolescence risk to the lessor compared to a loan that exposes the borrower to this risk.[5] Because the lessee is paying only for the asset value that is depleted during the lease term the functional form of the lessor's "price" can be expressed as:

**Eq. 1** $$P_L = [(AV_S - AV_E), C_F, L_R, T_I]$$

In words, the price function includes the difference between the starting asset value, $AV_S$, and the ending or residual asset value, $AV_E$ (value depleted during the lease term), the cost of funds, $C_F$, used to acquire the asset (interest paid by the lessor to investors providing capital), the lease rate, $L_R$, which includes overhead and profit to the lessor and time, $T_I$, which is simply the length of the lease term in years. The $C_F$ component is included in the price expression for clarity, but is not generally specified in an actual lease contract. On the other hand, all the remaining terms are usually explicitly stated in lease contracts, implying that $C_F$ is subsumed into $L_R$. Using a banking analogy, $L_R$ - $C_F$, can be roughly viewed as the interest rate spread

[2] For leases other than a true lease, such as a finance lease, capital lease or sales-type lease, the lessor does not claim depreciation of assets (the lessor is considered the seller) and transfers ownership to the lessee at the end of the lease term.

[3] For an industry output index such as the PPI, a quality adjustment by definition can only be directly applied to what has been defined as output.

[4] In many leases, the lessor never physically possesses the asset because the lessee takes delivery directly from the manufacturer, which is similar to what occurs with bank loans.

[5] The oil baron, Paul Getty was supposedly quoted in a reference to leasing; "If it appreciates, buy it. If it depreciates, lease it".

between depositors and borrowers, though in the case of leasing, interest paid to investors substitutes for interest paid to depositors.[6]

An example follows of the actual price calculation for a range of asset values (in this case for construction equipment) from a major lessor. Note that the lessor establishes "price" as a rate times a value. Table 1 presents the primary components taken from the lessor's price calculator that is provided to potential customers for the purpose of calculating price in the form of monthly lease payments.

**Table 1**

**Lease Rates***

**(Option to purchase asset for estimated FMV at end of lease term)**

| Equipment Cost | 24Mo | 36Mo | 48Mo | 60Mo |
|---|---|---|---|---|
| $2,000 to $5,000 | 0.0478 | 0.0343 | 0.0270 | n/a |
| $5,001 to $10,000 | 0.0467 | 0.0335 | 0.0265 | 0.0228 |
| $10,001 to $25,000 | 0.0466 | 0.0331 | 0.0263 | 0.0223 |
| $25,001 to $100,000 | 0.0458 | 0.0324 | **0.0258** | 0.0219 |

*Lease rates shown above may change if lessee has been in business less than 2 yrs., has poor credit, interest rates for acquisition funds change or the estimated residual fair market value (FMV) of the asset change. For the purposes of this example, the lessor is estimating FMV as 10% of original equipment cost for a 48 month lease, which may change in an actual contract depending on the type of equipment purchased and the lease term.

From a financial services point of view, table 1 makes clear that the lessor is charging a rate for financial intermediation that varies according to a predetermined range of asset values, the length of the lease term and the end of lease purchase option. Lease rates can be easily converted into monthly lease "prices". For instance if a potential lessee is interested in obtaining a 48 month lease for the services of a model xx bulldozer produced by manufacturer A, then the lessee can contract with the lessor who will purchase the bulldozer from manufacturer A. If the initial cost of the bulldozer is $85,000 and 90 percent of this value is expected to be depleted during the lease term, then the lessee's monthly lease payment **(*MLP*)** can be calculated as shown in eq. 2:

**Eq. 2**.

$$MLP = AV_S x L_R$$

$$MLP = 85000 x 0.0258 = \$2{,}193 monthly$$

In this example, the residual value is accounted for in the lease rate shown in table 1. Therefore if the residual value changes, then all else equal, so will the lease rate and the monthly payment. Table 1 also presents an interesting conceptual issue. From a sampling perspective, the lessor markets multiple leases of different terms. For instance, over time the revenue received by the lessor is likely to be made up of current period leases as well as continuing payments from leases contracted in prior years, such as a 5 year lease that is in year 2 of lease payments. In other words, lessors report revenue flows to the national accounts that include both new and continuing leases from prior years. One of the conceptual foundations of the U.S. Producer Price Index (PPI) is that sampled prices are representative of the revenue function of a firm or industry.[7] Therefore a price index based on only a sample of current period or new leases, is not

[6] Fixler, Reinsdorf and Smith provide a good review of banking measurement issues in the national accounts-see the Bureau of Economic Analysis publication: Survey of Current Business, September 2003, pgs. 33-44.

[7] Fisher and Shell (1972) helped to define the most relevant output index (in terms of a deflator) as one that "…measures the ratio of maximum revenues associated with remaining on the same production possibility curve in two or more periods…holding inputs and technology constant."

representative of the leasing industry revenue function and as a consequence is likely to bias measures of real output if used as a deflator.

To illustrate the potential deflation bias, assume that over time inflation drives the acquisition cost for assets higher, resulting in new leases that reflect this inflationary effect through higher lease payments. In this example the lessor continues to acquire and lease (for 48 month terms) one bulldozer each year for five years starting in 2001 as shown in table 2. The bulldozers maintain an identical specification over the 5 year span, but higher input costs to the bulldozer production function increase acquisition costs for the lessor by 5 percent in 2003 and 10 percent in 2005.

**Table 2**

| Year | Bulldozer Cost | Lease Rate | Monthly Lease Payment | Lessor Revenue Year 1 | Cumulative Lessor Revenue Year 2 | Cumulative Lessor Revenue Year 3 | Cumulative Lessor Revenue Year 4 | Cumulative Lessor Revenue Year 5*** |
|---|---|---|---|---|---|---|---|---|
| 2001 | 85000 | 0.0258 | 2193 | 26316 | | | | |
| 2002 | 85000 | 0.0258 | 2193 | | 52632 | | | |
| 2003 | 89250* | 0.0258 | 2303* | | | 80268 | | |
| 2004 | 89250 | 0.0258 | 2303 | | | | 107904 | |
| 2005 | 98175** | 0.0258 | 2533** | | | | | 138300 |

*reflects 5 percent increase in acquisition cost of bulldozer

**reflects 10 percent increase in acquisition cost of bulldozer

***reflects lease payments for year 5 plus continuing lease payments from years 1 thru 4.

The lessor revenue data shown above reflects for each year the revenue received from a new bulldozer lease in that year as well as continuing (starting in year 2002) revenue from prior year(s) leases. Over the 5-year span covered in table 2, the lessor continues to lease the same type and quality of asset using the same administrative inputs such as credit analysis, record keeping and payment collection (in other words, output is unchanged).

If a pricing agency introduces an index for the leasing industry in 2004 and updates leases each year to reflect only current period activities then their lease index will show a 10% increase in 2005. However, as a deflator, the price index will overstate inflation and understate real output because the national accounts measure of industry revenue also includes revenue or income flows from 2001-2002 (no price increase), 2003 (5 percent increase) and 2004 (no price increase). Conversely, if a pricing agency samples a 48 month lease in 2004 and strictly follows a matched model to its end, then for the 48 month lease term a price index shows no change. In this latter case, the price index is also biased because it understates inflation which leads to an overstatement of real output when deflating nominal industry revenues. The U.S. PPI program has responded to the multiyear revenue flows reported by lessor's by adopting a methodology that averages the monthly price for new and continuing prior year leases for a fixed asset specification. Requesting average prices that reflect both current and continuing prior year lease transactions capture the real distributed price effects of a temporal flow of multiple lease payments that are more closely tied to the industry revenue function.

**How Should Quality Change Be Measured For Leasing Outputs?**

Now we return to the question of quality change in lessor outputs raised previously. When statistical agencies sample lessor transactions, disaggregation techniques usually result in the

selection of leases that are partly described by the leased asset. In other words, the asset becomes part of the lessor pricing specification. Pricing agencies tend to rightfully view the components of a product or service specification as representing sampled outputs of the target universe. Applying this perspective literally, the asset that is leased and described in a lessor pricing specification, represents the output of the lessor, which implies that quality change in the leased asset represents quality change produced by the leasing industry. However, there are many instances where data elements that are collectable by agencies and used in pricing specifications are not directly tied to industry outputs.

For instance, the PPI also samples the outputs of the retail trade industry that are defined as distribution services, but such services are difficult to describe and quantify. Distribution services as used in retail trade may be thought of as an aggregation of many discrete services that include risk-bearing (carrying inventory such as perishable foods), display or presentation of products, a comfortable shopping environment, product information and additional conveniences such as accessibility and efficient transactions. The prices of these services at the disaggregate level are usually not directly observable; rather they are imputed en masse from the margins on goods sold by the retail establishment. Margins cover the retailer's overhead and profit and are a measure of industry output revenues for retail distribution services. Therefore, the transactions sampled by the PPI for retail industries are drawn from the margin prices of specified goods such as cereal, coffee, frozen foods, etc. Changes in margin prices for samples of specific products are thought to provide an appropriate measure of retail trade output price change if the level or quantities of retail distribution services are static. However, it is important to remember that the specific retail products sampled do not directly represent the retailer's output, but are nonetheless used in pricing specifications to facilitate the pricing agency's attempt to disaggregate to a specified transaction in order to estimate a margin price (selling price minus acquisition cost). In effect, the selection of a specific product is a pragmatic response to the lack of transparency required to directly price the retailer's true outputs which include multiple elements of a distribution service. A potential problem with this approach occurs if the quality of a sampled retail product change and this change is interpreted as also signaling a change in the quality of one or more elements of the retailer's distribution service. For instance, if a retail establishment sells a new improved coffeemaker, the distribution service or output of the establishment may or may not change.[8] The point here is that quality change in retail distribution services cannot be reliably tied to changes in the quality of specific products that are marketed by retail establishments. Another problem with tying change in product quality with change in the quality of retail distribution services concerns the valuation of quality. It should come as no surprise that retail trade respondents are usually not in a position to provide an explicit valuation for quality improvements made in products produced by others. An explicit quality valuation of a new improved coffeemaker in the PPI Fixed-Input Output Price Index (FIOPI) model is based on the marginal cost of new input requirements for the coffeemaker "producer". Therefore, if a pricing agency uses a quality adjusted index from an earlier stage of processing, such as coffeemaker producers, (as an alternative to lack of data from retail trade) to "quality adjust" a retail services index, then the agency is using a valuation based on the production function of a different industry. Such quality valuations are not supported in concept or theory in the FIOPI model used by the PPI.

The PPI has attempted, with a hedonic model, to reconcile the disconnect between what is sampled and what is "produced" with a more direct measure of quality change in retail trade

[8] If the new coffeemaker requires the retailer to provide more distribution services such as product information and demonstration, then a change in output/distribution services quality may have occurred.

output. A thorough description of the model and its application is beyond the scope of this paper, but the model's specification is based on respondent provided distribution service characteristics (updated annually) that are regressed against the margin prices of sampled products. The available distribution service characteristics are not precise measures of output but are thought to better proxy for distribution service elements and include independent variables such as; number of employees, number of stock keeping units, hours of operation, number of checkouts, automatic or electronic scanning and many others.

Another example of service specifications that include features not directly related to industry output is encountered in transportation industries such as General Freight Trucking (NAICS code 484122). As in retail trade, the pricing specifications developed for General Freight Trucking includes features not directly tied to outputs in order to facilitate the repricing of a matched transaction. General Freight Trucking outputs are primarily the provision of "over-the-road" trucking services, i.e. transportation of goods. When the PPI samples a transaction from the General Freight Trucking industry the pricing specification usually describes the type of good that is transported, such as a truckload of new automobiles, along with other features of the service. If quality change in automobiles occurs then under an all else equal scenario, PPI methodology does not interpret this type of quality change as a change in the quality of transportation services. In this example, the all else equal qualification is crucial in deciding whether a quality change in automobiles has any connection to a quality change in transportation services. For instance, if automobiles become more corrosion resistant due to better quality steel, then one could argue that the output of General Freight Trucking is unchanged. However, other types of automobile quality change may violate the all else equal assumption. For example, if air-conditioning is added to automobiles, then this type of quality change may signal that transportation services have changed. To see the difference, assume that a sampled transportation service includes the shipment of 12 automobiles for a specified distance. In the reference period, each automobile weighs 4,000 pounds but in the comparison period air-conditioning (and related components) adds 200 pounds. The addition of air-conditioning represents a quality change in automobiles, but also indicates a change in transportation quality. The change in transportation quality occurs in the comparison period because the sampled transaction has changed to include the shipment of an additional 2,400 pounds (200lbs. X 12 automobiles). The significant weight increase requires more fuel and increases wear and tear on transportation equipment relative to the reference period price. Therefore, some portion of the current period transportation price includes a quality change component, but this quality change cannot be valued by the marginal cost to the automobile producer from adding air-conditioning. The marginal cost of air-conditioning could be as much as $1,000 or more, but the marginal cost of shipping the extra 200 pounds, may be as little as $20 per automobile. If the total cost of shipping an automobile averages roughly $700, then applying the air-conditioning valuation results in a negative transportation price and provides an example of why pricing agencies must be vigilante in maintaining a consistent view of what is actually produced by the sampled industry. In this example, the correct quality change valuation is $20 per automobile because it is directly tied to the marginal cost of transporting the additional 200 pounds and unlike the value of air-conditioning is consistent with outputs produced by the General Freight Trucking industry.

The main point of introducing retail trade or transportation in a discussion on leasing is that the data available for lessor pricing specifications suffers from similar ambiguity. In the case of leasing, the asset and its characteristics are identified in the pricing specification. As in retail trade, the asset may not directly represent lessor outputs, but helps facilitate the collection of pricing data for an otherwise opaque financial intermediation service. If changes in the quality of a leased asset are taken as a measure of the change in leasing outputs, the same problems

discussed above for retail trade and transportation may apply to leasing. If the services provided by lessors are primarily viewed as tax and accounting benefits relative to bank loans (which lessors claim), then assets acquired through leases are no more outputs of leasing industries than assets acquired through lending are outputs of the banking industry.

**Implications for Measures of Real Outputs**

If a pricing agency determines that leased assets do in fact represent lessor outputs, then of course any change in asset quality over time should be explicitly accounted for in a price index. However, an extreme example may help illustrate the implications of this approach from the perspective of measuring changes in real output.

Assume that a lessor receives $1 million in lease payments for office furniture in period 0 that is made up of 100 furniture lease contracts. In period 1, the lessor discovers that demand for computers has increased relative to office furniture and therefore shifts to leasing computers and receives $1 million in lease payments that is made up of 100 computer lease contracts. Because computer quality changes rapidly (relative to office furniture), a pricing agency that treats computers as part of the lessor's output will consequently need to apply more frequent quality adjustment starting in period 2 for technological change.[9] If the estimated value of computer quality change is a constant 25 percent of lessor revenues (not unreasonable considering past advances in computer technology), then by period 3 a quality adjusted lessor price index falls 50 percent (assuming unchanged nominal prices from period 0 to 3). In the national accounts, a deflator that falls 50 percent has an opposite sign effect on measures of real output, $[\left(\frac{\$1{,}000{,}000}{0.50}\right) = \$2{,}000{,}000]$. By period 3, the deflation of the $1 million nominal revenue with the quality adjusted lessor index leads to a doubling of estimated real revenue/output. In all price measurement periods (0 thru 3) the lessor processes (credit analysis, record-keeping, payment processing, etc.) 100 lease contracts that generate $1 million in revenue. Triplett (1988) presented a historical review of price index methodologies and commented that … "<statistical measurement> that is not accepted by, or is not understood by, broad user groups does not meet all the requirements for a public economic measurement."[10] One might ask the lessor in the above example whether a statistical measure that shows a doubling in output while the lessor continues writing the same number of leases for the same dollar amounts is a reasonable or acceptable portrayal of the real world. Most lessors are at least somewhat agnostic to the actual asset (within a class of assets) to be leased, but instead respond to changes in demand from prospective lessees. If simply shifting from leasing furniture to leasing computers leads to massive increases in measured lessor output due to applying quality change valuations to services or assets not directly produced or consumed by lessors, then such measures may strain the credibility of an output index for broad user groups.

**An Alternative View of Leasing Outputs**

The previous example of a shift from leasing office furniture to computers may have been somewhat extreme, but the main point was that in both cases the lessor's primary activity could be viewed as providing a financial intermediation service between investors (usually insurance

[9] Measuring change in quality starts in period 2 because there is no practical method to compare the relative quality of furniture and computers in period 1.

[10] Jack Triplett, 1988. "Price Index Research and Its Influence on Data: A Historical Review", Presented at the Summer Workshop, National Bureau of Economic Research, July 1987.

companies or banks) and lessees. Whether it was furniture or computers, the lessor obtains and then commits $1 million to purchase assets which are directly consumed by lessees in the lessee production function. The lessor pays investors a return ($C_F$ in equation 1) or if funds are internally generated the lessor calculates an opportunity cost. In both cases the lease rate is set by the lessor to cover $\boldsymbol{C_F}$ and provide for overhead and profit.

However, the lease rate by itself is not sufficiently transparent for the purpose of sampling lessor transactions and measuring price change over time. For instance the bulldozer inflation example in table 2 showed increasing acquisition costs with a constant lease rate. A portion of table 2 is reproduced below as table 3 to help make explicit the basis of the monthly lease payment sampled from lessor transactions.

**Table 3 (Bulldozer lease payments for 48 month term)**

| Year | Asset Cost ($\boldsymbol{AV_S}$) | Lease Rate ($\boldsymbol{L_R}$) | Residual Value ($\boldsymbol{AV_E}$) | Amount Financed $\boldsymbol{AV_S - AV_E}$ | Monthly Lease Payment |
|---|---|---|---|---|---|
| 2001 | 85000 | 0.0258 | 8500 | 76500 | 2193 |
| 2002 | 85000 | 0.0258 | 8500 | 76500 | 2193 |
| 2003 | 89250* | 0.0258 | 8925 | 80325 | 2303* |
| 2004 | 89250 | 0.0258 | 8925 | 80325 | 2303 |
| 2005 | 98175** | 0.0258 | 9818 | 88358 | 2533** |

*reflects 5 percent increase in acquisition cost of bulldozer

**reflects 10 percent increase in acquisition cost of bulldozer

Several of the most important components from the lessor price function described in equation 1 are now shown explicitly in table 3. The only pricing component not shown is the lessor's cost of funds, which are implicitly accounted for in the lease rate. Two columns, Residual Value and Amount Financed, have been added to the original data from table 2. The residual value is based on the lessor estimate of a 10 percent market value for the leased asset at the end of the lease term (48 months). The amount financed is the difference between the asset cost and residual value. In this example the lessor leases one bulldozer each year but higher lease payments in 2003 and 2005 are due to higher acquisition cost (inflation) for the same model bulldozer. In this example measuring price change solely by the constant lease rate will impart a downward bias to a price index and a upward bias in the national accounts. A price index using a methodology that recognizes the dollar value financed ($\boldsymbol{AV_S - AV_E}$) combined with the appropriate lease rate will correctly record the inflationary effect through changes in the monthly lease payment. Note that in the scenario provided by the lessor in table 3, $\boldsymbol{AV_E}$ changes proportionally with $\boldsymbol{AV_S}$ but this is not the only possibility. Suppose that demand increases for used bulldozer's resulting in higher estimates for residual value. In theory, $\boldsymbol{AV_E}$ could increase the same dollar amount as $\boldsymbol{AV_S}$. If both $\boldsymbol{AV_S}$ and $\boldsymbol{AV_E}$ increase by the same value, then the amount financed is unchanged, but the lease rate, all else equal, will be adjusted so that the monthly lease payment is also unchanged.[11] Therefore higher asset values, whether from inflation or quality change, but all else equal, do not necessarily result in higher values for the amount financed or the monthly lease payment. From

[11]At lease end the lessee has the option of extending the lease, purchasing the asset or returning the asset. If the lessee is indifferent to acquiring the asset (and perhaps extends the lease) then the residual value has been correctly estimated by the lessor. If the lessee gains value from purchasing the asset, then the lessor has underestimated the residual value. If the lessee declines the purchase option because of insufficient value, then the lessor has overestimated the residual value.

the lessor's perspective it is generally not a meaningful distinction whether changes in the amount financed for a class of assets is driven by inflation or quality change. In both instances, the starting asset value minus the residual value is simply a formulaic input to a calculation that provides the lessor with a margin (embedded in the lease rate) for a financial intermediation service. So long as the financial intermediation service is unchanged, then cost changes for providing this service that are passed on to lessees should be shown as price change. From a deflation standpoint, this has the desirable feature of NOT showing an increase in lessor outputs and productivity simply due to an increase in the cost (whether from inflation or quality change) of providing the same financial intermediation service.

The discussion of lessor outputs to this point has avoided an explicit description of a recommended pricing methodology that could be operationalized. Since lessor outputs are generally viewed as substitutes for bank loans, it may be desirable to develop a lessor pricing methodology that is more symmetric with the current methodology used by the PPI for banking. The PPI measures bank loan prices by asset class on a portfolio basis that takes into account new loan activity as well as continuing revenue from previous period loans. The total interest income (plus fees) from loans are divided by the average loan balance to estimate an important component of loan prices. Similarly lessors establish useful delineations of asset values in their pricing schedules. Recall that the lessor of construction equipment established lease rates based on ranges of asset values and lease term. For example, table 4, using data extracted from table 1, shows the lease rates for a range of asset values for 48 month leases.

**Table 4.**

| Asset Values | Lease Rate |
|---|---|
| $2,000 to $5,000 | 0.0270 |
| $5,001 to $10,000 | 0.0265 |
| $10,001 to $25,000 | 0.0263 |
| $25,001 to $100,000 | 0.0258 |

One of the necessary assumptions for a pricing methodology similar to that used for bank loans is that the amount/quality of financial intermediation services is comparable within a specific asset value range established by the lessor. For instance, economies of scale may help explain why lease rates are inversely related to the dollar value ranges of assets in table 4. Differences also exist between value ranges for credit analysis requirements, delinquency policy and asset tracking/valuation. Therefore, disaggregating to a specified value range would be useful for ensuring comparability of financial intermediation services. One possible pricing methodology is to estimate the lessor's price as the total value of lease payments for a specified asset value range and specified lease term divided by the number of lease contracts for a class of assets that can be expressed as:

$$\text{Price for Asset Values from \$10,001 to \$25,000*} = \frac{\textit{MonthlyLeasePayment Receipts}}{\textit{\# of LeaseContracts}}$$

**(i.e. all 48 month leases for bulldozers within the specified asset value range.)*

**Conclusion**

Statistical agencies that view leasing as a financial intermediation service do not view the asset described in a lessor pricing specification as a direct measure or quantification of the lessor's true output. As with many service industries, the type of data collected in a sample to describe transactions is a pragmatic response by the statistical agency for what is otherwise a difficult to

define and measure output. When little or no change in pricing specifications occurs, then proxy measures of lessor output prices may provide a reasonable basis for price comparisons. However, if assets in leasing transactions undergo quality change, such change may not provide a reliable indicator for change in the services "produced" by lessors. Until further research enables a more direct measurement of lessor outputs the initial price indexes published by statistical agencies should perhaps be viewed as part of a challenging learning process (as it is with many service industries) that will hopefully lead to improved price measures in the future.[12] A potentially valuable direction for further research would focus on the task of strengthening the connection between collected price measures and the lessor's revenue function which could be viewed as a type of margin business. One possibility is to treat the difference between the cost of funds (which lessors generally do not disclose) and the lease rate as the lessor's margin.[13] This margin is what covers the lessor's overhead and profit for providing a financial intermediation service that is similar to the margin that defines the revenue boundary for the distribution services that makeup the outputs of the retail trade industry.

[12] Katherine Abraham, past commissioner of the BLS, once commented at a NBER conference that "One major problem area is service sector measurement. Measurement can't begin without an output definition, and, for many services, there is no consensus regarding the appropriate definition." … "The nature of these problems is such that no general solution to them is possible. Rather, much of the work to improve our price and output measures must proceed on an industry-by-industry, product-by-product basis."

[13] A close estimation of the lessor's cost of funds may be available from secondary sources.