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Comparing transaction-based and expert-generated price indices in the market for offshore support vessels

Roar Adland ^{*}
Pierre Cariou ^{**}
François-Charles Wolff ^{***}

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(^{*}) Norwegian School of Economics

(^{**}) KEDGE Business School

(^{***}) LEMNA - Université de Nantes



**Comparing transaction-based and expert-generated price indices in the market for
offshore support vessels**

Roar ADLAND (corresponding author), Norwegian School of Economics (NHH), Helleveien
30, 5045 Bergen, Norway, Tel: +47 5595 9467. E-mail: Roar.Adland@nhh.no

Pierre CARIOU, Kedge Business School, 680 Cours de la Libération, 33405, Talence, France.
Tel: +33 (0)5 56 84 55 56. E-mail: pierre.cariou@kedgebs.com

Francois-Charles WOLFF, LEMNA, University of Nantes, BP 52231 Chemin de la Censive
du Tertre, 44322 Nantes Cedex 3, France ; and INED, Paris, France. Tel: +33 (0)2 40 14 17
79. E-mail: francois.wolff@univ-nantes.fr

Abstract: We propose a methodology to generate transaction-based price indices in a heterogeneous physical market and to compare such indices with expert-generated price indices. We apply our framework to the offshore services market using a unique dataset of around 8,000 transactions. We find that the deviation between our transaction-based indices and shipbrokers' market indices is positively impacted by the level of dayrates and negatively impacted by the volume of transactions. Our approach is useful for the quality assurance of expert-generated price indices in heterogeneous physical markets such as transportation services.

Keywords: Hedonic pricing, fixtures, offshore, dayrates, shipbrokers, heterogeneous contracts.

1.0 Introduction

In most physical markets, certainly those where transactions occur in decentralised Over-the-Counter (OTC) markets, the compilation, standardization and dissemination of market price indices is usually provided by price-reporting agencies or intermediaries. In the markets for transportation services, well-known examples are the Baltic Exchange for drybulk and tanker freight rates and price indices compiled by shipbrokers, with perhaps the best known example being the variety of freight rate indices published by Clarkson Research (2017).

In virtually all these cases, the benchmark price (that is, the freight rate or day rate) is set at regular intervals, typically at a daily/weekly frequency, by asking a shipbroker or a panel of such intermediaries to submit their subjective assessment of the prevailing price. The expert's opinion is based on both public information (such as the price agreed in recent transactions or fixtures¹) and private information (such as knowledge of ongoing negotiations between buyers and sellers). The degree of subjectivity in generating indices is likely to rise when markets are characterised by a limited number of transactions and by some heterogeneity in fixtures characteristics (cargo size, load date, origin/destination port, vessels characteristics) as discussed in Alizadeh and Talley (2011) or Adland et al. (2016, 2017).

Veenstra and van Dalen (2008) discuss the issues inherent in such expert-generated price indices as “there is very little consensus on what type of information is required by practitioners” and “the relationship between the available data set on market transactions (fixtures) and the economic indicators is a black box”. It is also well known that publicly available information only covers a limited part of overall market activity (Veenstra and van Dalen, 2008) and that some of these transactions may relate to the speculative re-letting of ships and not end-user demand (Laulajainen, 2006).

¹ The fixture materializes a contract between the seller (vessel owner) and the buyer of the transportation service (charterer) at an agreed price (the freight rate), with the parties usually matched by an intermediary.

Despite these potential drawbacks, empirical research relies heavily on brokers' freight market indices throughout the literature, for instance in continuous-time models (Bjerksund and Ekern, 1995; Tvedt, 1997; Adland and Cullinane, 2006; Koekebakker et al., 2006; Adland and Strandenes, 2007; Adland et al., 2008; Poblacion, 2015, 2017) or time-series models (Kavussanos, 1996; Berg-Andreassen, 1996; Frances and Veenstra, 1997; Kavussanos and Alizadeh, 2001). Our study also complements the very limited literature on the market for Offshore Supply Vessel (OSV) services (Aas et al., 2009; Kaiser, 2014; Eskandari and Mahamoodi, 2016) and, in particular, former work by Adland et al. (2017) on the identification of determinants of OSV price indices.

Reliable price indices of heterogeneous goods, such as real estate (Jiang et al., 2014) or fine art (Bocart and Hafner, 2015), are important for two main reasons. First, brokers reporting their price assessments may collude to manipulate the price index higher or lower than the true market price. This has led the International Organisation of Securities Commissions (IOSCO) to introduce principles to emphasise a focus on actual transactional data, although it accepts that in certain circumstances an expert view may be a valid method to provide a benchmark (Baltic Exchange, 2014). Second, in the freight markets, the increasing use of digital auctioning platforms for the chartering of vessels means that buyers and sellers are by-passing brokers and entering into transactions directly². If such platforms become successful, then a larger share of transactions will be outside the control of traditional brokers, reducing their ability to generate representative indices.

The contribution of our paper is twofold. From a methodological viewpoint, we use a hedonic pricing framework to show how a shipping index based on transactional data can be built so that it provides an informational content equivalent to that produced by a shipbroker index. From an empirical perspective, we investigate how our transaction-based indices

² See for instance <http://splash247.com/bhp-billiton-bypasses-brokers-new-online-auction-platform/>.

behave compared to shipbrokers' indices using about 8,000 fixtures available for the North Sea spot offshore market from 2000 to 2016. We focus on this market because it possesses an interesting combination of high volatility, high liquidity and fleet heterogeneity, which may impact the use of judgments by experts. This offers the possibility to assess the validity of our approach and to test potential determinants (like market liquidity and volatility) that may explain the gap between pure transactional-indices and broker-indices.

The remainder of the paper is organized as follows. In Section 2, we present the hedonic pricing framework to generate different market price indices based on transaction data. Section 3 discusses the data available to construct a representative transactional market index for the OSV North Sea market and presents the resulting price indices derived from our hedonic pricing framework. In Section 4, we discuss how our indices perform both in comparison to each other and to indices generated by experts (shipbrokers), and suggest potential reasons for the observed differences. Section 5 concludes.

2.0 Estimation of broker-equivalent market indices

Two main alternative methods exist to generate price indices from heterogeneous transactions: the hedonic regression method and the repeat sales method (Jiang et al., 2014). The hedonic approach (Rosen, 1974) – which we follow here – is to regress the price of each good on its own characteristics in order to control for variations due to observable differences between heterogeneous goods (Bocart and Hafner, 2015).

We propose a methodology to construct a market index expected to be similar in its informational content to that provided by a shipbroker index. Let us consider a period of T months with $t = 1, \dots, T$ and let S_t be the value of the broker index at month t . The available information set from the broker is $S = \{S_1, \dots, S_T\}$ ³, where each value S_t represents the

³ Without loss of generality, we will normalize the initial value S_1 to 1 (or 100) in our empirical analysis.

broker's estimate of the market freight rate that is published at date t . For transaction data corresponding to fixtures between ship owners and charterers, we denote each fixture by \mathcal{F}_i for the N transactions over the period of length T . The i^{th} fixture is signed at time t so that \mathcal{F}_i refers in fact to $\mathcal{F}_{i(t)}$. For each fixture \mathcal{F}_i , we have information on the freight rate f_i , on the characteristics of the contract X_i (like vessel age, vessel capacity or contract duration) and on the charterer c^4 . In what follows, we turn to a hedonic price regression à la Rosen (1974) to generate several market indices.

Our first index corresponds to the average freight rate \bar{f}_t for all fixtures occurring at date t such that $\bar{f}_t = \sum f_{i(t)} / n_t$ with n_t the number of fixtures recorded during time unit t . The average freight rates can be generated from the following linear regression model:

$$f_i = \sum_{t=1}^T \mathbb{F}_t * \mathbb{1}_t + \varepsilon_i \quad (1)$$

where $\mathbb{1}_t$ are dummy variables such that $\mathbb{1}_t = 1$ at date t and $\mathbb{1}_t = 0$ otherwise, \mathbb{F}_t are parameters to estimate, and ε_i is a residual perturbation with $E(\varepsilon_i) = 0$ and $V(\varepsilon_i) = \sigma^2$. When the linear model (1) does not include a constant, each parameter \mathbb{F}_t is exactly equal to the average \bar{f}_t . Our first market index is hence $\mathbb{F}^{avg} = \{\mathbb{F}_1, \dots, \mathbb{F}_T\}$ where *avg* stands for average. Such market index is straightforward to implement and gives the possibility to provide some standard errors $\sigma(\mathbb{F}_t)$ for each parameter \mathbb{F}_t and therefore to construct a confidence interval. However, \mathbb{F}^{avg} does not consider the fact that fixtures are heterogeneous (Adland et al., 2016).

For instance, consider the case where charterers are selecting larger vessels compared to those hired during the previous months. As there exists a positive correlation between carrying capacity and freight rate, the average price for that month will rise. Nevertheless, this

⁴ We also know the identity of the ship owner for each contract but we do not account for this information as most ship owners have very few offshore vessels.

increase in the average market index is only due to a change in the vessel characteristics for this specific month. To account for this composition effect, we extend the regression model (1) in the following way. First, we control for observable heterogeneity by adding both the vessel and contract characteristics X_i as covariates. Second, we control for unobservable heterogeneity by adding a charterer fixed effect θ_c , where c is the charterer. The fixed effect θ_c picks up all the observed and unobserved characteristics of the charterers that remain constant over time. The model to estimate is:

$$f_i = \sum_{t=1}^T \mathbb{F}_t * \mathbb{1}_t + X_{it}\beta + \theta_c + \varepsilon_i \quad (2)$$

with β a vector of coefficients to estimate. Using (2), we obtain a new index $\mathbb{F}^{nh} = \{\mathbb{F}_1, \dots, \mathbb{F}_T\}$ where nh stands for net of heterogeneity. The various \mathbb{F}_t provide time-average values of the freight rates that account for heterogeneity in the composition of both vessels and charterers. This is an important feature, especially as our aim is to generate long-term market indices for which composition effects are likely to be substantial. For instance, due to technological development, vessels are larger and more energy-efficient by the end of the sample period.

Keeping in mind that brokers are publishing their market indices on a regular basis (usually weekly or monthly) and cannot change the values retrospectively, a potential shortcoming of the \mathbb{F}^{nh} index is that it is the result of an ex-post assessment. Specifically, we use the whole set of fixtures $f_{i(t=1, \dots, T)}$ to estimate the coefficients \mathbb{F}_t . In doing so, we assume that shipbrokers publish a market index having information for all T periods. This is certainly misleading as, at date t , the information is only available for periods from 1 to t , but not from $t + 1$ to T ⁵. To overcome this shortcoming, we propose a third market index where each

⁵ Also, the estimation of (2) on the whole period constrains the various coefficients β to be the same over the whole period. However, the implicit price of some vessel characteristics may change over time. For instance, this is likely to be the case for fuel efficiency in a context where oil price tends to increase.

coefficient \mathbb{F}_t is estimated from repeated regressions, using observations from 1 to t . This means that we estimate $T - 1$ regressions equivalent to (2), but based on different samples, such that:

$$f_{i,\tilde{t}} = \sum_{t=1}^{\tilde{t}} \mathbb{F}_t * \mathbb{1}_t + X_{it}\beta + \theta_c + \varepsilon_i \quad (3)$$

where $f_{i,\tilde{t}}$ refers to fixtures over the period from 1 to \tilde{t} such that \mathbb{F}_2 is obtained from a linear regression explaining fixtures over the first two periods, \mathbb{F}_3 is obtained from fixtures over the first three periods, and so on. The new market index is referred as $\mathbb{F}^{rnh} = \{\mathbb{F}_1, \dots, \mathbb{F}_T\}$ where *rnh* stands for repeated observation net of heterogeneity. Each index value \mathbb{F}_t is now consistent with what is observable (and known) by shipbrokers at date t .

In what follows, we implement the three market indices using a database of offshore supply vessel (OSV) contracts. We compare the time profiles obtained from \mathbb{F}^{avg} , \mathbb{F}^{nh} and \mathbb{F}^{rnh} to assess the consequences of the underlying methodology on the market indices. Then, we compare the indices provided by shipbrokers with market indices calculated from transaction data.

3.0 Construction of market indices for Offshore Supply Vessels (OSV)

3.1. The OSV dataset

There are two main types of OSVs. Platform Supply Vessels (PSV) are designed to transport supplies and equipment from onshore bases to offshore oil and gas installations (OECD, 2014). Anchor-handling Tug Supply (AHTS) vessels are designed to tow mobile offshore drilling or production units, for handling the rigs' anchors, and sometimes as supply vessels when towing activities are low. These vessels are required during the entire life cycle of an offshore oil and gas field (from exploration, drilling, offshore development, life of field to decommissioning) and represents one of the main cost components of the upstream oil and

gas industry (Aas, 2009).

The global OSV market consists of several regional markets – notably the North Sea, West Africa, Brazil and Southeast Asia. These markets correspond to the major offshore oil producing regions and have their own characteristics due to technical, legal, fiscal and geographic differences (ICS, 2011). For instance, vessels operating in the North Sea must be built to higher technical specifications to cope with the harsh weather conditions, with higher average dayrates than the simpler vessels required in Southeast Asia. The type, complexity and size of the rigs serviced, as well as local taxation, manning and safety regimes, will also affect the dayrates prevalent in the markets. For these reasons, there is only limited fungibility of vessels across geographical markets. The contract duration can also differ substantially, with a portion of vessels being hired for short duration (less than a month) on the spot market and the remainder for longer durations in the term market. The differences in the regional market structure can be illustrated by the descriptive statistics reported in Table 1, based on contract data provided by ODS Petrodata from 2000 to 2015⁶.

Insert Table 1

Out of the 25,844 transactions reported over the period, 75 per cent of contracts are on the spot market, varying from 78 per cent for AHTS to 72 per cent for PSVs. With 20,682 transactions (or 80 per cent of all transactions reported worldwide), the North Sea market is by far the most active market, followed by Southeast Asia (5.7 per cent) and USA-Gulf of Mexico (4.4 per cent). While the term market (the chartering market for contracts longer than 30 days duration) is larger than the spot market when measured by vessel employment (total ship-days per annum), the number of transactions per region is substantially lower and

⁶ For details, see <https://login.ods-petrodata.com/>.

heterogeneity in terms of contract duration is larger, making it less suitable for our empirical approach. Similarly, expert brokers tasked with generating dayrate indices are also dependent on having information on a sufficient number of transactions to produce reliable estimates. Accordingly, the dominance of the North Sea spot market within the global OSV market (by number of transactions) and low liquidity elsewhere means that it is the most appropriate target for our empirical analysis and comparison between transaction-based and expert-generated indices⁷.

Each fixture includes information related to the transaction, such as the reported date, the dayrate (in GBP/day), contract duration, operating region, vessel owner and charterer name, as well as the vessel's scope of work (activity). Furthermore, in the ODS Petrodata database, this commercial information has been matched with technical specifications of the vessel regarding carrying capacity (PSV deck area and deadweight), size of the engine installation (AHTS brake horsepower and bollard pull), type of propulsion (diesel electric or conventional mechanical), Year of build (Age), Design speed, Country of build and the sophistication of its Dynamic Positioning system. Additionally, it is noted whether the vessel has special design features such Ice class, Remotely operated vehicle support or Helicopter deck. While not ordinarily required, such features may be required for certain contracts where the vessel is supporting sophisticated marine operations in Arctic areas, for instance. Age is a running value calculated as the difference between the contract date and the date of vessel delivery.

There is a high degree of heterogeneity in transactions, both in terms of the main technical vessel specifications and the main activity provided under a contract (Adland et al, 2017). However, this heterogeneity is reduced when we focus on a specific sub-segment, such as a particular range of deck area for a PSV or engine size range for AHTS. As the purpose of

⁷ We note that there is some positive correlation between dayrates in the spot/term and AHTS/PSV markets, notably 0.362 between the spot and term AHTS markets, 0.546 between the spot and term PSV markets, 0.776 between the spot AHTS and PSV markets and 0.475 between the term AHTS and PSV markets.

our research is to compare transaction-based indices with expert-generated market indices produced by shipbrokers, we further need to narrow down our analysis by vessel size. This should ensure that our transaction-based price indices are directly comparable with those produced by expert shipbrokers. Within the North Sea spot market, Clarkson Research (2017) produces four indices: for AHTS vessel with 16,000-20,000 Brake Horse Power (BHP) and more than 20,000 BHP, respectively, and for PSVs with a deck area between 500-900 m² and above 900 m². From Table 1, AHTS with 16,000-20,000 BHP and more than 20,000 BHP represent 28 per cent and 32 per cent of transactions in the North Sea market, while for PSV between 500-900 m² deck area and more than 900 m², the respective shares of the North Sea market are 65 per cent and 31 per cent. In our analysis we restrict our attention to the smaller vessel sizes, as they have a sufficient number of transactions throughout the sample period.

Figure 1 presents the AHTS and PSV average monthly freight rates and the average number of transactions for these two market segments. AHTS dayrates are higher than PSV dayrates and there are some large fluctuations in rates over time. The large increase in dayrates from 2005 to 2009 can be explained by the boom in the demand for offshore projects in the North Sea and to a shortage in the number of vessels available (OECD, 2014).

Insert Figure 1

This volatility, which is quite common in most shipping markets, can be attributed to the difficulty in adjusting supply to demand: first, in the short run, as it takes time to move a vessel from one area to another (to the extent that it is feasible at all) and second, in the long run, as it also takes time to build new vessels (Kalouptsi, 2014). Another important factor explaining this volatility is the sensitivity of rig activity to oil prices (Ringlund et al, 2008) as well as the sensitivity in demand to weather conditions, which is quite unpredictable in the

North Sea area (Aas et al, 2009). The volatility in the average price can also be explained by the limited number of transactions reported during a given month. For instance, over the entire period and per month, there are never more than 40 AHTS transactions or more than 60 PSV transactions.

The reduced heterogeneity in vessel specifications when we focus on a smaller sub-segment means that many of the covariates show insufficient variation such that they can be dropped from the analysis. To select the most relevant variables amongst the total 14 variables available for the AHTS or PSV market, we rely on market reports (ICS, 2011; OECD, 2014), information from brokers and operators, and the statistical properties of the variables. For instance, we use Brake Horsepower in lieu of Bollard pull for AHTS and Deck area in lieu of Deadweight carrying capacity for PSVs as these measures of size are highly correlated. We drop design speed both because of limited variability and because it need not be a good proxy for the speed at which the vessels are actually operated. We retain ice class and propulsion type as OSV operators maintain that these are important.

In our final set of covariates we are left with six variables for the AHTS market (brake horsepower; age; Remotely Operated Vehicle (ROV) support; ice class; conventional diesel; activity) and six variables for the PSV market (deck area in squared meters; age; dynamic positioning 2; ice class; conventional diesel; activity). For AHTS vessels, brake horsepower, ROV support, ice class and conventional diesel have an expected positive effect on day rates, while for PSVs, deck area, dynamic positioning, ice class, and conventional diesel are also likely to lead to a premium. Age is expected to impact dayrates negatively as the vessel gradually becomes less competitive compared to younger peers.

Table 2 presents some descriptive statistics from the ODS Petrodata dataset for the key variables. The average AHTS Brake horsepower is 17,584 BPH. The average PSV deck area is 709 m². The AHTS fleet is younger than the PSV fleet on average (5.1 years versus 10.3).

Less than 4 per cent of AHTS vessels have ROV support and 68 per cent are ice class vessels. For PSVs, 55 per cent are classified as having a sophisticated dynamic positioning (DP2) system, 9.8 per cent have ROV support and less than 6 per cent are ice-classed vessels. Finally, PSVs are primarily hired to perform cargo runs (73 per cent) and other supply duties (25 per cent), while AHTS are primarily used to move rigs (66 per cent) and secondarily cargo runs (15 per cent). The average contract duration is a mere 3.3 days for an AHTS and 3.1 days for a PSV, illustrating the extremely short-term nature of this spot market.

Insert Table 2

Other sources of heterogeneity can be attributed to differences in chartering practices and preferences among the largest buyers and to the limited number of vessel available on a given date, though we note that because of the very short contract duration there will be a fast turnover of vessels in the market. Nevertheless, the number of unique vessels chartered during a month is lower than the number of transactions, which further reduces the effective heterogeneity in our sample. On average, there are less than 15 distinct AHTS vessels chartered in a month versus around 40 transactions and less than 30 distinct PSVs chartered versus 60 transactions. The ten largest charterers in the North Sea AHTS 16,000-20,000 BHP segment represent 1,428 transactions (46 per cent of all transactions). For the small PSV (500-900 m² deck area) segment, the ten largest charterers account for 2,537 transactions (48 per cent of all fixtures from 2000 to 2015)⁸. For OSV operators, there is less concentration and, over the sample period, various mergers and acquisitions mean that it is more difficult to track

⁸ The main charterers for AHTS vessels are Statoil (235 fixtures), BP plc (200 fixtures), Team (173 fixtures) and Nexens Inc. (131 fixtures). The main charterers for PSVs are Team (502 fixtures), BP plc (337 fixtures), Maersk (314 fixtures), ASCO (284 fixtures) and Statoil (275 fixtures).

who operates the vessel over time⁹. This led us to include a fixed effect related to charterers only.

The observations on the existence of a degree of heterogeneity, even when focusing on specific market segments, highlight the possible differences between our objective transaction-based index generation and how a human expert will subjectively evaluate market conditions. A broker may ignore certain transactions because they are not considered to be representative of the market situation or because they reflect a special relationship between the charterer and owner (filtering data). The broker may also have knowledge about off-market transactions, ongoing negotiations or variables not included in our ODS Petrodata dataset such as the port of origin¹⁰. While such private information or filters are not observable to researchers, these factors mean that the information set used by shipbrokers is different from the fixture dataset on which our estimations are based.

3.2. Estimation of the transactional-market based indices

In Table 3, we report estimates from the hedonic price regressions obtained for AHTS and PSV, respectively. In Model 1, we only account for the time fixed effects and obtain the set of average freight rates at the monthly level, F^{avg} (equation 1). In both markets, the high R^2 (0.73 for AHTS and 0.82 for PSV, respectively) confirms that a large share of the variation in freight rates is explained by time fixed effects, that is, the supply and demand conditions at the time of the transaction.

Insert Table 3

⁹ The main operators are Viking Supply Ships, GulfMark Offshore, Maersk Supply Service, Solstad Shipping and Simon Mokster Shipping for AHTS, Gulf Offshore, Sealion Shipping, GulfMark Offshore, Viking Supply Ships and COH Offshore AS for PSV.

¹⁰ In our dataset, ports where OSVs wait between contracts are Bergen and Stavanger in Norway and Aberdeen in the UK (ICS, 2011). While delivery place is a common variable for deep-sea shipping, this is not the case in the offshore markets, presumably as the services are local (for instance, a voyage from the Norwegian side of the North Sea to the UK side will take less than 24 hours). In the few cases where the loading base is far from the previous port of the vessel, there will be an additional “mobilization” fee included in the contract.

In Model 2, we add the vessel and contract characteristics as well as charterer fixed effects to obtain \mathbb{F}^{nh} (equation 2). The inclusion of the additional covariates leads to an increase in the R^2 by 7.1 percentage points for the AHTS market (from 0.730 to 0.782) and by 4.1 percentage points for the PSV market (from 0.822 to 0.856). For AHTS, a 1 per cent increase in a vessel's brake horsepower leads to a 1.02 per cent increase in the AHTS spot freight rate. For PSVs, a 1 per cent increase in deck area leads to a 0.23 per cent increase in freight rate. AHTS equipped with conventional diesel obtain a freight rate premium and dayrates are lower when AHTS vessels are hired for cargo runs, an activity which is outside their core purpose, and higher for rig moves. In the case of PSVs, dayrates are lower when vessels are used for cargo runs and higher when the vessel has ice class.

Next, we extend the framework by estimating the three price indices \mathbb{F}^{avg} , \mathbb{F}^{nh} and \mathbb{F}^{rnh} proposed in Section 2. We present our results in Figure 2 for AHTS and in Figure 3 for PSV¹¹. For the presentation, we normalize the market index to 100 in January 2000. For each market, we report both the price indices in level and then in difference with respect to \mathbb{F}^{avg} in order to shed light on the influence of the underlying econometric model on the time profile.

Insert Figure 2

Insert Figure 3

A large difference between the price indices produced by the different model specifications will indicate that accounting for the heterogeneity in technical vessel specifications and charterers is important, at least at particular points in time. For the AHTS market, we observe that in 2006 and 2007 the monthly indices associated to \mathbb{F}^{nh} and \mathbb{F}^{rnh} are generally substantially lower than the monthly averages of dayrates. For a few months, the

¹¹ The complete set of estimates (\mathbb{F}^{avg} , \mathbb{F}^{nh} and \mathbb{F}^{rnh}) for AHTS and PSV is available upon request.

gap is as high as 800 points. Accordingly, for this market, we can conclude that controlling for vessel and charterer heterogeneity leads to substantial differences in the value of the market index. The situation is somewhat different for the PSV market. Our estimates show a tendency for \mathbb{F}^{nh} and \mathbb{F}^{rnh} to be higher than average values with a difference of around 50 to 100 points. However, since 2010, the various indices are rather close in absolute values.

Another finding from Figures 2 and 3 is that there is little difference between our two indices that account for vessel and contract heterogeneity. This result is related to the way we account for transactions over time. While \mathbb{F}^{nh} uses a unique regression to estimate the whole set of time effects $\{\mathbb{F}_1, \dots, \mathbb{F}_T\}$, the third model estimate the time effect \mathbb{F}_T sequentially. In the long run, the coefficients \mathbb{F}_T^{nh} and \mathbb{F}_t^{rnh} are expected to converge as t increases since our specification estimates a unique set of coefficients for the vessel and contract characteristics over the period. As more and more information is available with time, this additional information has little influence on our results.

4.0 A comparison of transaction-based and broker-generated market indices

Next, we compare in Figure 4 and 5 our market indices based on transaction data to indices provided by shipbrokers for vessels with 16,000-20,000 BHP for AHTS and vessels with 500-899 m² deck for PSV¹². Compared to model 1 that was based on the average transaction prices for all AHTS or PSV (Figure 2 and 3), some differences exist between the average monthly dayrates and the dayrate indices reported by the broker.

Insert Figure 4

Insert Figure 5

¹² Clarkson Research (2017) also produces these indices at the weekly level, see www.clarksons.net.

The Clarkson monthly indices are less volatile than the simple index comprised of monthly averages of contracted dayrates. For instance, the maximum broker-reported average monthly rate is around GBP 100,000/day for an AHTS in the beginning of 2007, against a maximum at around GBP 195,000/day at the end of 2008 for the transaction-based index. The same applies to the PSV market, with a maximum of GBP 32,000/day at the end of 2006 for the broker price index, against GBP 73,000/day at the end of 2007 when using the average of transaction prices. An explanation of the lower volatility of our indices compared to shipbroker indices could be related to the discussion in Section 3.1, suggesting that some transactions might not be considered by brokers as representative, while our purely transactional-based approach considers all transactions without any filtering.

To ease the comparison, and as \mathbb{F}^{nh} and \mathbb{F}^{rnh} are relatively close, we only report results for \mathbb{F}^{rnh} (model 3) and we calculate the difference $\mathbb{D}_t = \mathbb{F}_t^{rnh} - \text{Clarksons}_t$ and the associated confidence intervals. When the value $\mathbb{D}_t = 0$ does not belong to the confidence interval for a period t , this means that our transaction index and the Clarkson index are significantly different. For the AHTS (Figure 4) segment, \mathbb{F}^{rnh} is relatively close to the index provided by brokers. The situation is similar for the PSV segment (Figure 5). This suggests that our index based on transaction data could provide a good proxy of the broker index. At the same time, some significant gaps are observed during specific periods of time. These differences usually correspond to periods with high volatility, particularly from 2006 to 2009 (Figure 1).

Owing to these observed differences, we finally investigate the potential reasons of such a gap. We argue that two main reasons may exist. First, the difference measured for a given month may be explained by the market level and by the degree of volatility of dayrates. Our assumption is that at a time of high/low dayrates and high/low volatility, the broker might consider some transactions as not representative or may include information that is outside the

transaction dataset (for instance, fixtures that are rumored but not publicly confirmed). This will lead to a gap as our indices are solely relying on reported transaction data, without filtering or considering the existence of potential outliers. Second, the difference may be explained by a limited number of transactions during a given month or occur at times when the utilization rate of vessels is particularly high/low. This may also lead brokers to disregard some datapoints, while we are not. In table 4, we report the results from a linear regression models testing for these two main hypotheses applied to the difference observed for the 192 months under consideration (2000-2016).

Insert Table 4

The results show many similarities across the two vessel types. First, all coefficients for dayrates are positive and significant at the 1 per cent confidence level both for PSV and AHTS, while the volatility of dayrates does not significantly influence the gap between the Clarksons and our transaction-based market indices. Second, the number of transactions and the utilization rate of vessel reported during a given month are negatively related to the gap. Therefore, during a month with many transactions, our transaction-based indices are closer to the indices reported by brokers, with the added advantage of objectively taking into account the heterogeneity in transactions. All told, our empirical evidence suggests that the deviations between transaction-based and expert-generated market price indices are greater in times of illiquid markets.

5.0 Concluding comments

In this paper, we have developed a methodology that enables us to extract market price indices from fixture data, subject to different assumptions about the information set. We provide, for the first time, a comparison of such transaction-based indices with those reported

by a leading shipbroker company. A key issue is that there is no transparency regarding the type of information brokers are relying upon. In our contribution, we show that there can be substantial differences between expert-generated indices and those based on reported transactions data.

There are several competing hypotheses for the observed differences between the expert-generated indices and those derived from public fixture data. The most common one is that the expert shipbrokers have private information about “off market” transactions that are not in the public domain (and therefore not in our dataset). In traditional spot freight markets, such as those for crude oil tankers, this would be a valid criticism, as the share of public fixtures compared to overall fleet activity is known to be very low. However, the North Sea OSV markets that we deal with here are highly transparent in comparison. Another possible explanation is that the differences between the indices are driven by heterogeneity in the composition of the fleet or the market players involved, or even in the composition of the experts setting the price benchmarks over time, which the expert-generated indices may not properly account for. Importantly, the proposed hedonic pricing methodology allows us to build OSV price indices that account for heterogeneity of vessel characteristics. This is crucial when dealing with an industry, such as the OSV market, where technical specifications and market composition can change substantially in the medium and long run.

We further investigated under which conditions the two indices differ. From our analysis, we identify two main situations to explain an increase in the observed gap: when dayrates are high and when the number of transactions is relatively low. We suggest that during such extreme market conditions or periods with fewer contracts, subjectivity in experts’ judgement of which information to include may play a greater role.

We do not suggest that our market indices should replace those provided by shipbrokers, but that there is a need for more empirical analysis as these indicators are

extremely important for both practitioners and academia. Despite the difficulties in establishing transaction-based indices in markets with limited and heterogeneous transactions, we suggest that the need for a better understanding of how price indices are generated will increase in the future for two main reasons. First, the regulatory environment requires ever-increasing transparency and objectiveness of market price reporting, particularly in markets where there exist financial derivatives settled on such price indices. Second, digitalization and the possible automation of the chartering process will increase our reliance on data-driven market index generation. Most importantly, nearly all maritime economic research that deal with macroeconomic analysis (the analysis of time-series properties of freight rates) take these broker indices at face value, so that knowledge of any potential shortcomings is of crucial importance.

Finally, we note that both our transaction-based market indices and the expert-generated price indices estimated by brokers only give an indication of the prevailing dayrate assuming that a contract can be obtained. In poor spot markets, an equally important question is whether there is actually employment for the vessels available, or whether vessels will end up unemployed for a prolonged period of time waiting for the next contract. Future work in this area should attempt to account for the demand/supply balance and develop indices that may give a better picture of the true cashflow from OSV operation after unemployment risk is accounted for.

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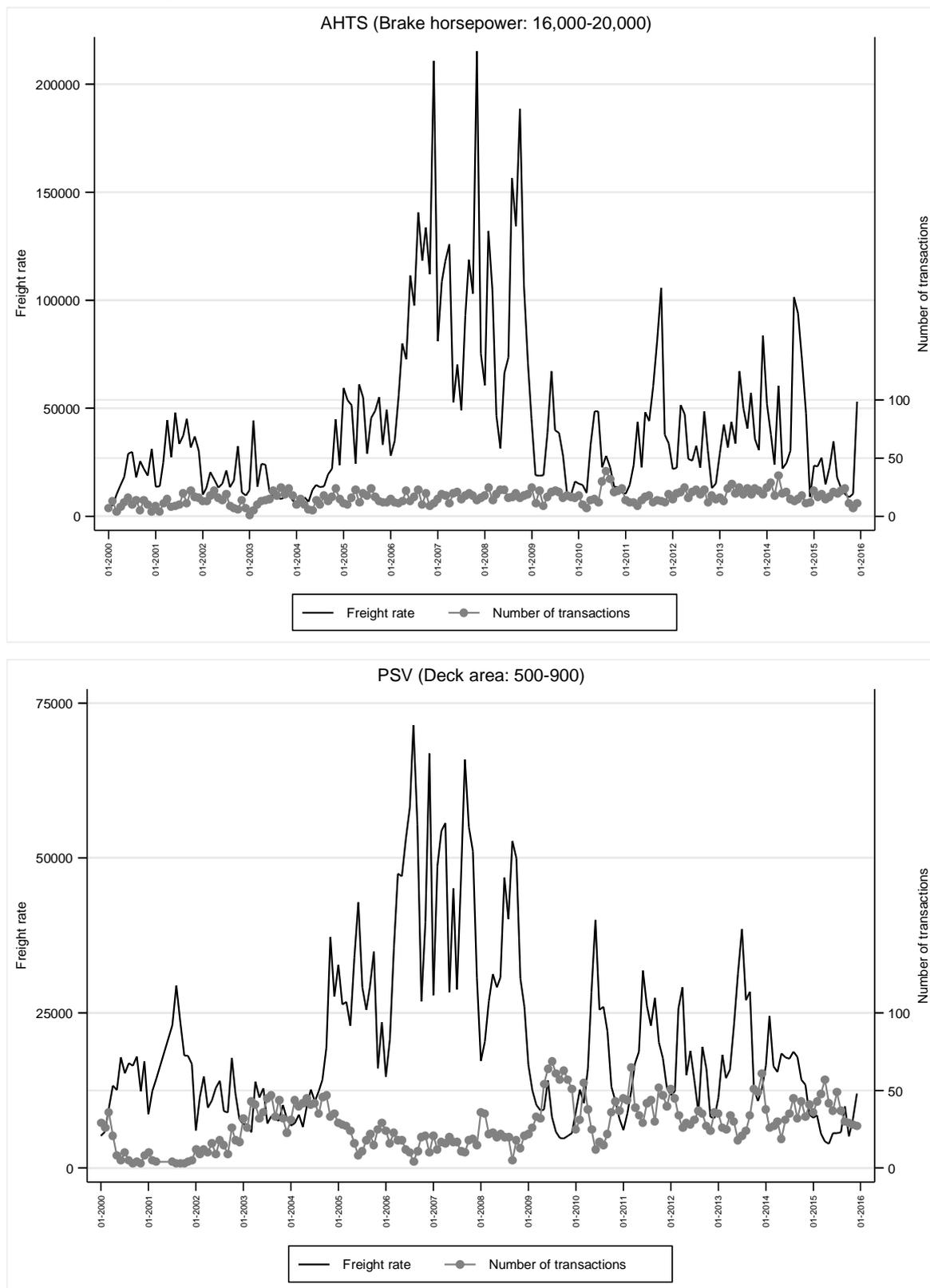
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Table 1. Description of OSV fixtures (2000-2015)

Type of OSV	Worldwide			North Sea		
	Spot	Term	Total	Spot	Term	Total
AHTS						
All	75.8%	24.2%	15,088	96.9%	3.1%	11,501
16,000-20,000 BHP	89.11%	10.9%	3,538	97.6%	2.4%	3,186
20,000+ BHP	95.6%	4.4%	3,873	98.1%	1.9%	3,766
PSV						
All	71.2%	28.8%	11,736	86.3%	13.7%	9,449
500-900 m ²	76.6%	23.4%	7,043	88.7%	11.3%	5,978
900+ m ²	72.7%	27.3%	3,491	81.4%	18.6%	3,093
Total	73.8%	26.2%	26,824	92.2%	7.8%	20,950

Source: authors' calculations, OSV database

Figure 1. Average monthly freight rates and number of transactions for AHTS and PSV



Source: authors' calculations, OSV database.

Note: the sample of fixtures is restricted to the North Sea spot market.

Table 2. Northwest Europe OSV fixtures (2000-2015)

Variables	AHTS (Brake horsepower: 16,000-20,000 BHP)		PSV (Deck area: 500-900 m ²)	
	mean	st.dev.	mean	st.dev.
Dependent variable				
Freight rate (GBP/day)	44,153	46,724	16,584	13,022
Explanatory variables				
Brake horsepower (BHP)	17,584	1,080		
Deck area (m ²)			709	95
Age (in years)	5.120	4.723	10.347	10.093
Dynamic positioning class 1 (%)			0.248	0.432
Dynamic positioning class 2 (%)			0.548	0.498
Remotely operated vehicle support (%)	0.035	0.185		
Ice class (%)	0.678	0.467	0.054	0.226
Conventional diesel (%)	0.630	0.483	0.442	0.497
Activity cargo run (%)	0.146	0.353	0.737	0.440
rig move (%)	0.658	0.474		
supply (%)			0.248	0.432
other (%)	0.196	0.397	0.015	0.123
Contract duration (days)	3.260	3.927	3.057	4.453
Number of observations	3,109		5,302	

Source: authors' calculations, OSV database. North Sea spot market only.

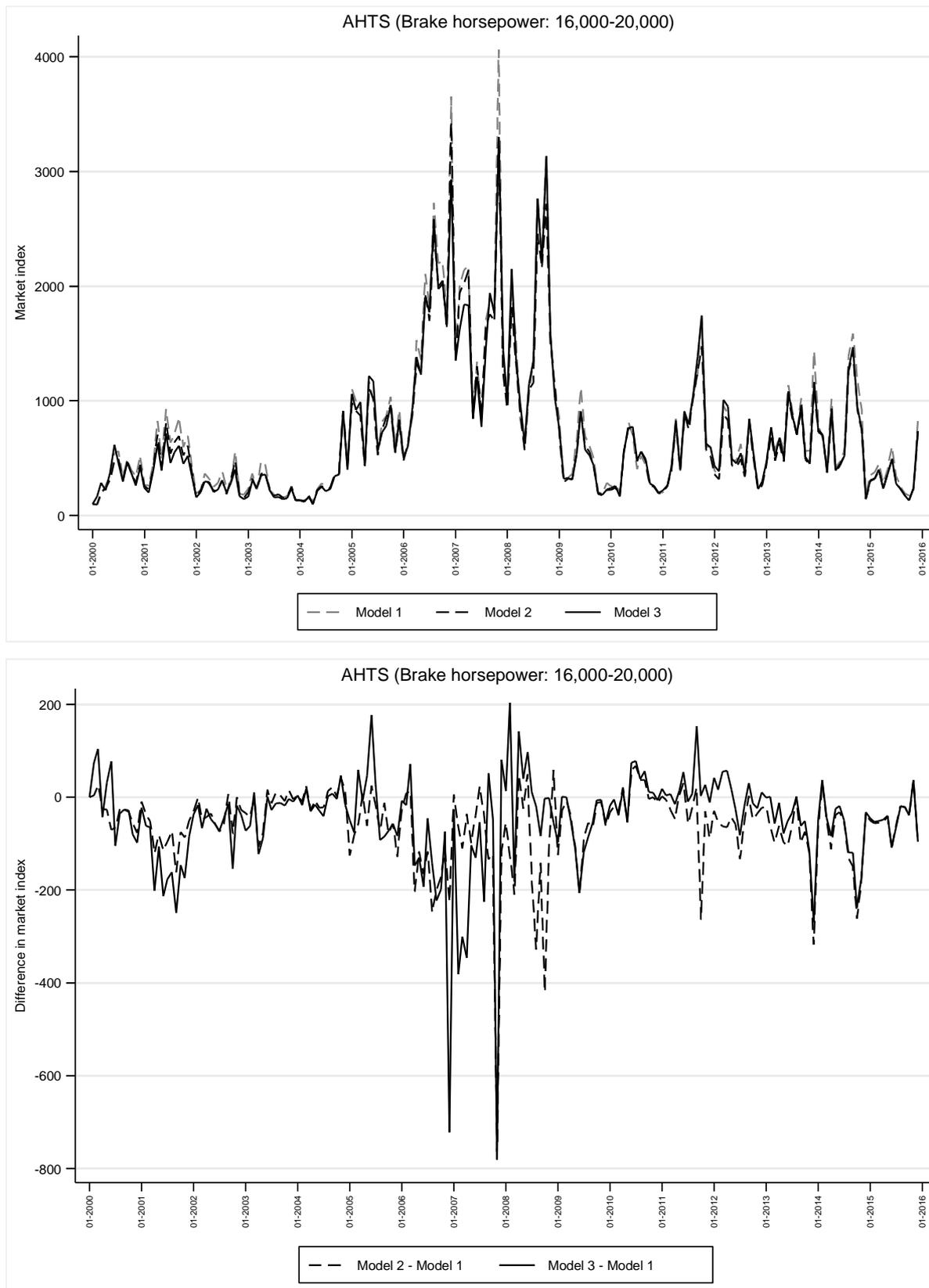
Table 3. Estimates of the log of freight rate (2000-2015)

Variables	AHTS (Brake horsepower: 16,000-20,000 BHP)		PSV (Deck area: 500-900 m ²)	
	Model 1	Model 2	Model 1	Model 2
Constant	8.531*** (0.078)	-1.158 (1.582)	8.529*** (0.045)	7.082*** (0.257)
Brake horsepower (BHP in log)		1.017*** (0.162)		
Deck area (m ² in log)				0.229*** (0.034)
Age (in years /10)		-0.002 (0.055)		0.024 (0.015)
Age ² (in years /100)		-0.020 (0.028)		-0.021*** (0.005)
Dynamic positioning class 1				-0.047*** (0.014)
Dynamic positioning class 2				0.026* (0.015)
Remotely operated vehicle support		0.185*** (0.061)		
Ice Class		0.026 (0.021)		0.060** (0.023)
Conventional Diesel		0.038** (0.019)		-0.010 (0.009)
Activity: cargo run		-0.208*** (0.035)		-0.173*** (0.045)
Activity: rig move		0.156*** (0.027)		
Activity: supply				-0.083* (0.044)
Contract duration (days in log)		0.043* (0.026)		-0.023** (0.011)
Monthly fixed effects	YES	YES	YES	YES
Charterer fixed effects	NO	YES	NO	YES
Number of observations	3,109	3,109	5,302	5,302
R ²	0.730	0.782	0.822	0.856

Source: authors' calculations, OSV database.

Note: estimates from linear regression models, with robust standard errors in parentheses. Significance levels are 1% (***), 5% (**) and 10% (*). The sample is restricted to the North Sea spot market.

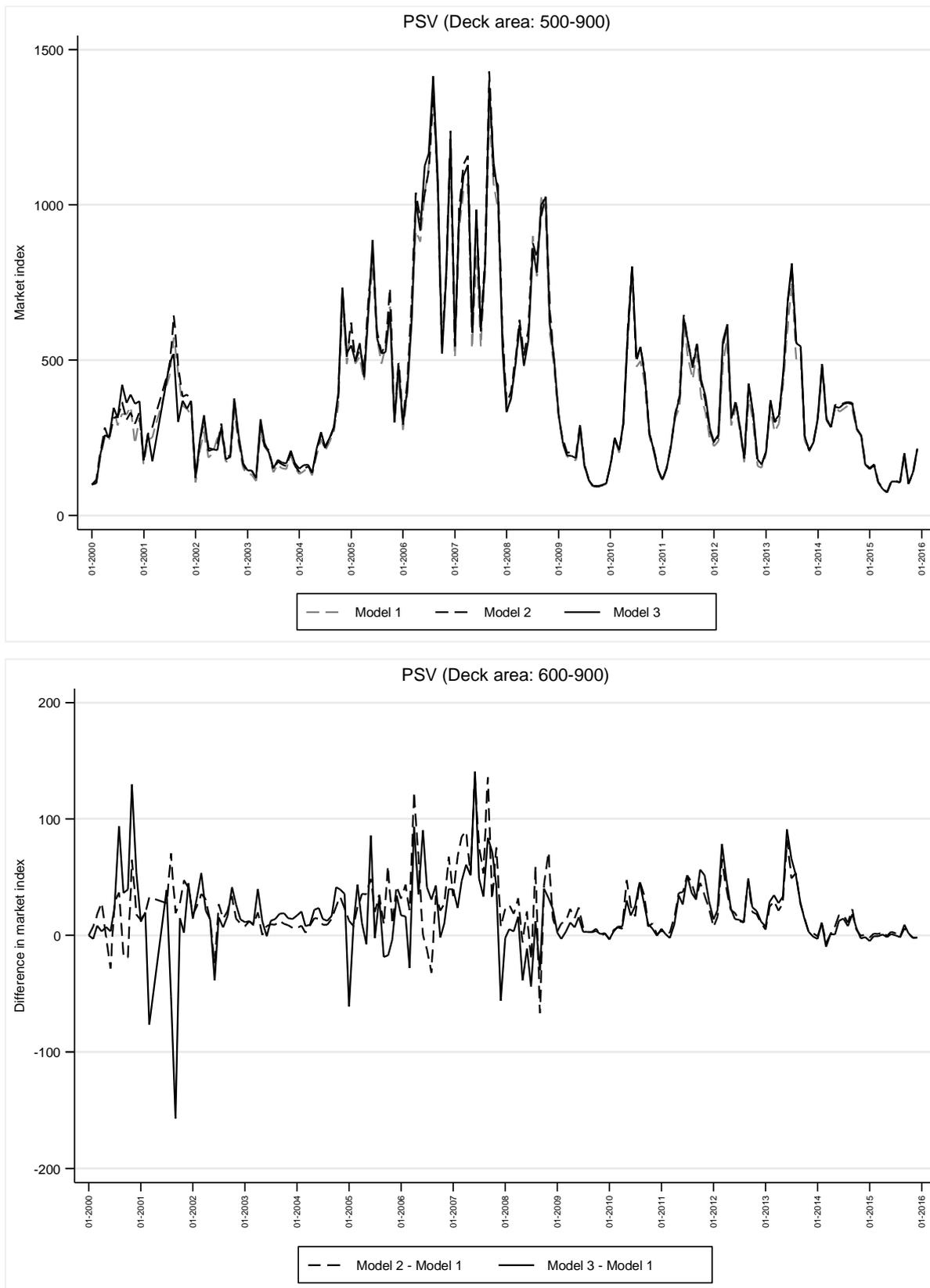
Figure 2. Estimated market indices AHTS



Source: authors' calculations, OSV database.

Note: the sample of fixtures is restricted to the North Sea spot market. The various indices are set to 100 in January 2000.

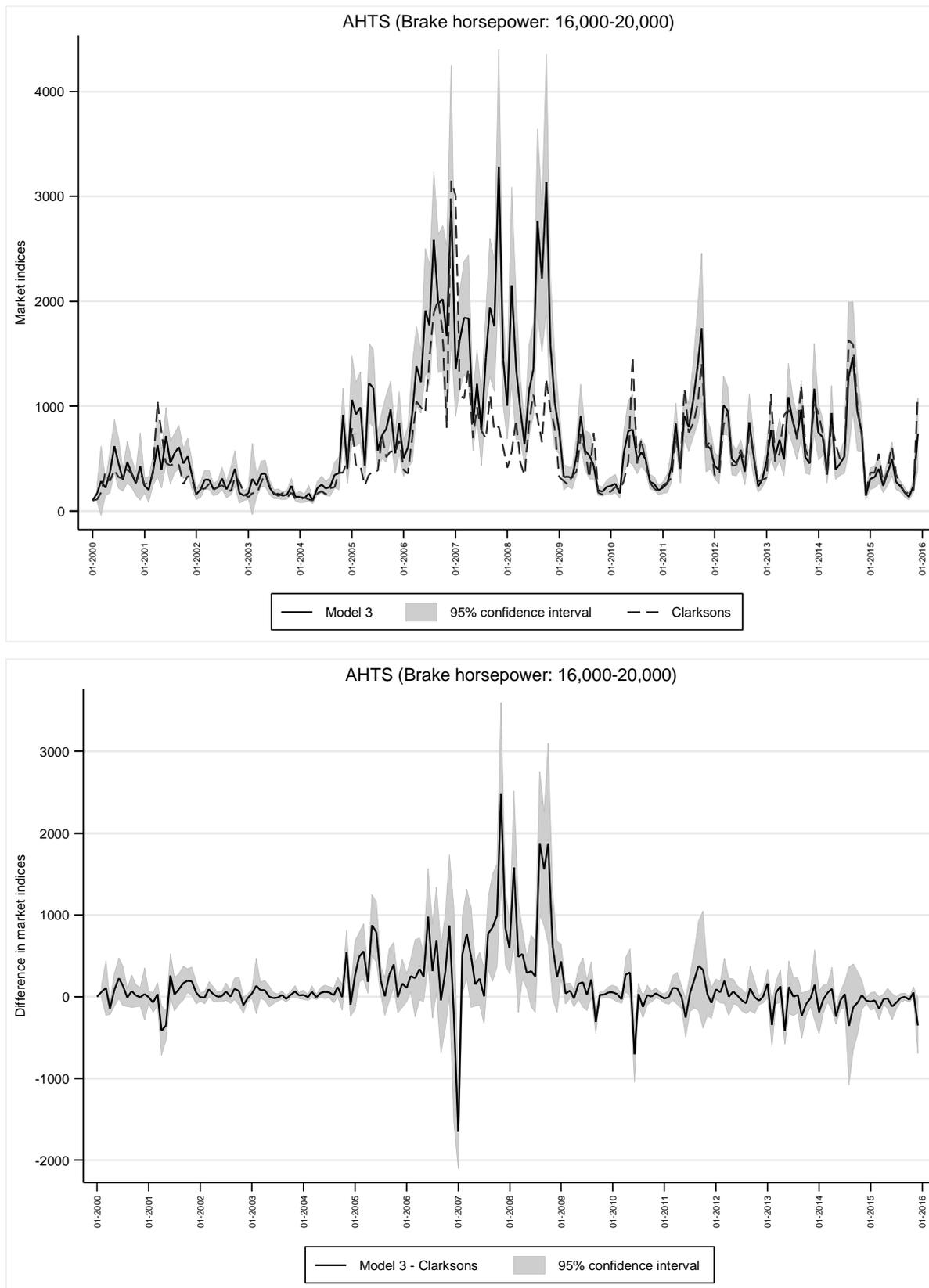
Figure 3. Estimated market indices PSV



Source: authors' calculations, OSV database.

Note: the sample of fixtures is restricted to the North Sea spot market. The various indices are set to 100 in January 2000.

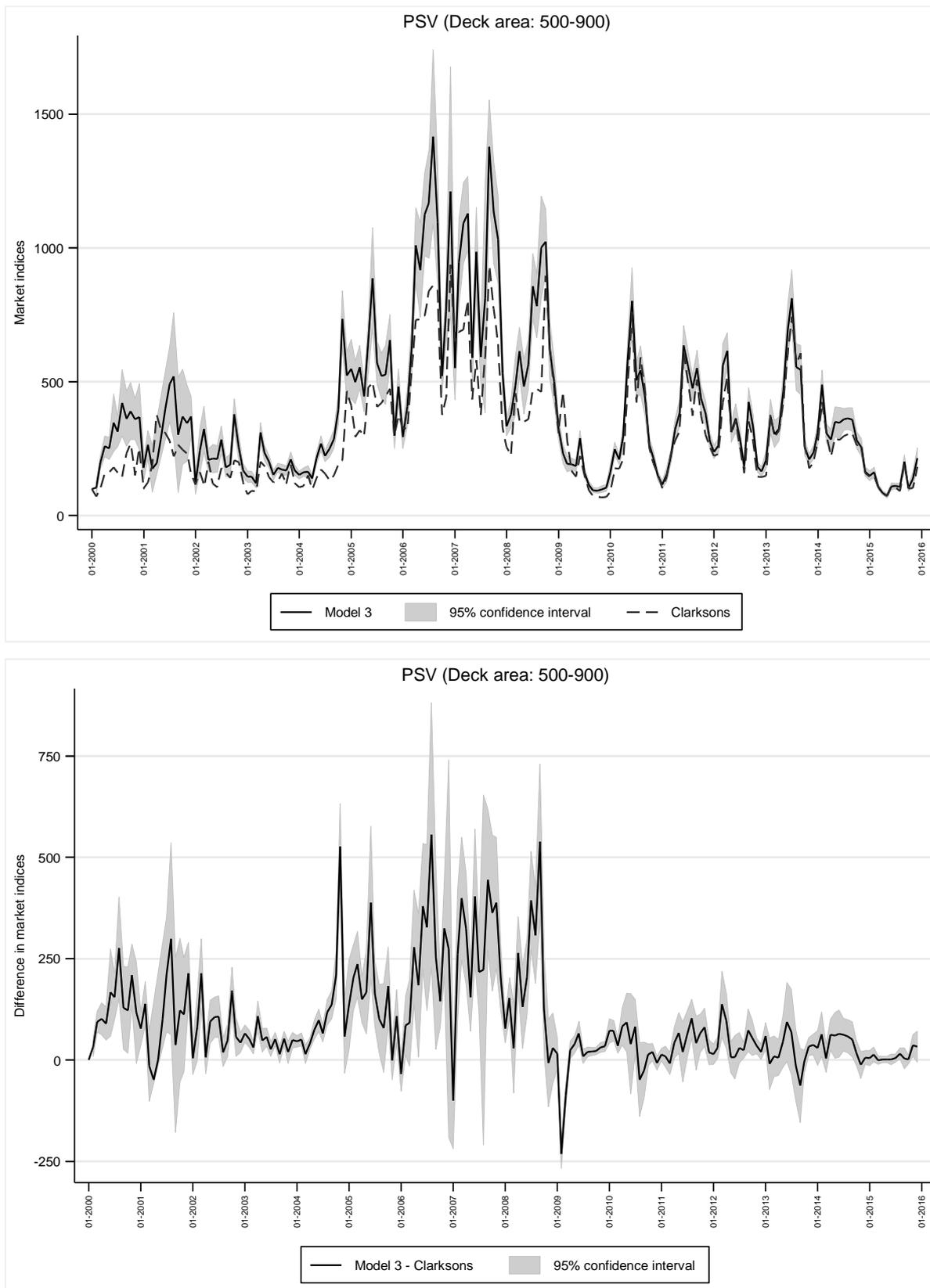
Figure 4. Comparison of Clarksons and estimated market indices for AHTS



Source: authors' calculations, OSV database.

Note: the sample of fixtures is restricted to the North Sea spot market. The various indices are set to 100 in January 2000.

Figure 5. Comparison of Clarksons and estimated market indices for PSV



Source: authors' calculations, OSV database.

Note: the sample of fixtures is restricted to the North Sea spot market. The various indices are set to 100 in January 2000.

Table 4. Estimates of the distance between Clarksons and transaction-based market indices

Variables	AHTS (16,000-20,000 BHP)			PSV (500-899 m ²)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	-2,585.493*** (453.785)	-2,562.437*** (447.991)	-2,452.654*** (405.802)	-973.136*** (109.060)	-697.780*** (91.377)	-930.618*** (104.482)
Average of freight rate (GBP)	271.473*** (44.549)	279.915*** (46.233)	287.915*** (43.951)	110.732*** (11.474)	91.522*** (9.802)	124.396*** (12.182)
St. deviation of net freight rate	80.062 (95.934)	58.393 (100.481)	90.552 (99.317)	46.639 (99.549)	-145.359 (95.893)	-154.427 (108.671)
Monthly number of transactions AHTS		-6.233** (3.068)				
Monthly number of transactions PSV					-2.029*** (0.342)	
Monthly use rate of AHTS			-719.837*** (151.699)			
Monthly use rate of PSV						-244.957*** (47.089)
Number of observations	192	192	192	192	192	192
R ²	0.363	0.372	0.445	0.451	0.507	0.496

Source: authors' calculations, OSV database.

Note: estimates from linear regression models, with robust standard errors in parentheses. Significance levels are 1% (***), 5% (**) and 10% (*). The sample is restricted to the North Sea spot market.