

to the input used. With a more complicated production process, productivity is measured as aggregate output divided by aggregate input, and is called Total Factor Productivity (TFP). TFP is the most general measure of productivity, and changes in TFP can be measured at the firm level or at the aggregate industry level.

Fishing vessels typically catch multiple species on a trip using multiple inputs. For example, vessels use labor (crew), capital stock (vessel length and horsepower), and energy (fuel) on fishing trips to harvest a variety of fish and shellfish species. Because of this multiple output, multiple-input fishing technology, index numbers which combine outputs and inputs into a single number are necessary to measure TFP.

A Malmquist Index (MI) was therefore constructed to examine changes since 2007 in TFP for groundfish vessels.²⁴ A value greater than one for the MI indicates an improvement in productivity, while a value less than one signifies a decline in productivity. Yearly MI values were then used to construct a Malmquist Chained Index (MCI) with 2007 as the base year.²⁵ Productivity, as measured by the MCI, decreased by 10% in 2012 to a five-year low (Table 18). This decrease can be attributed in large part to the substantial reduction in groundfish landings in 2012.

5. ACE LEASING

Every limited access groundfish permit has a potential sector contribution (PSC) based on its fishing history. The PSC is a percentage share of the total allocation for each allocated groundfish stock. Every limited access groundfish permit also has a tracking identification number called a Moratorium Right Identifier (MRI). PSC is technically allocated to MRIs, which are subsequently linked to vessels through Northeast Multispecies limited access fishing permits. When fishermen join a sector, their PSC is pooled and becomes the sector's annual catch entitlement (ACE). Each sector determines how to distribute its ACE among its members. All groundfish catch on sector fishing trips counts towards that sector's ACE. ACE is transferable between sectors via approved annual leases, while PSC is transferable within sectors using lease arrangements. ACE and PSC are generally leased because one fisherman or sector wishes to catch more than their initial allocation for a particular stock. Importantly, some sectors or

²⁴ The Malmquist Index (MI), which was introduced by Caves, Christensen and Diewert (1982), is an index well suited for measuring TFP change. Because only outputs and inputs are needed to construct the MI, this index is particularly advantageous for estimating changes in productivity of fishing vessels. Other productivity metrics require data on output and input prices. Although price data for landed species are extensive, data on input prices are only available for a subset of vessels. Since both input and output quantities are readily available for all vessels, the Malmquist index approach was chosen to estimate TFP change.

Landings for each vessel were aggregated into three broad output groups: roundfish, flatfish, and all other species. Inputs included vessel length, gross tonnage, horsepower, days absent, and average crew size. The MI was calculated for three gear groups: trawl, hook, and gillnet. Lack of sufficient observations precluded calculation of the MI for other gear groups. Next, the average productivity change per vessel in each fishing group was calculated. Individual vessel index numbers were then aggregated to derive an overall index value. The contribution of each vessel's productivity to the overall value was weighted by its nominal revenue.

²⁵ A chain index uses successive years of data. For example, the MCI for 2010 is calculated as $MCI_{2010} = MI_{2010} \times MI_{2009} \times MI_{2008} \times MI_{2007}$. The interpretation of this allows one to compare productivity in 2010 against a given base year, such as 2007 in our case.

fishermen may choose to lease most or all of their ACE/PSC rather than catch it.²⁶ ACE and PSC leases result in transfer payments within the industry. If there are no transaction costs—that is, no costs associated with these transfers²⁷—the payments are not a cost to the industry. Every pound of ACE or PSC leased represents a cost to the lessee and a reimbursement to the lessor, both of whom are industry members or, in some cases, permit banks. A frictionless lease market²⁸ allows industry members to better align their allocated PSC portfolio with their actual catch. It is particularly important to note that the ability to lease allows fisherman to use improved technology such as selective gears to target stocks for which they may not have been allocated sufficient PSC. But the benefits of leasing decrease as transaction costs increase: imperfect information on lease quantities and prices, for example, may cause fisherman to hold PSC when they should lease, or vice versa. Other structural aspects of the sector system such as operating rules that require multiple rights-of-refusal within sectors and between affiliated sectors may increase transaction costs, decreasing market liquidity and reducing efficiency in this nascent market. This section evaluates how ACE and PSC moved within and between sectors with an emphasis on market structure and size, prices, total transfers, and transaction costs.

5.1. Market Structure, Size and Characteristics

There are two forms of leasing: ACE leases between sectors, and PSC leases within sectors. Although by regulation ACE is pooled within sectors, most sectors seem to follow the practice of assigning catch allowances to member vessels based on PSC allocations. If this is standard practice for all sectors, catching more fish than an individual PSC allocation must require either a lease of ACE (between-sector) or PSC (within-sector)²⁹. Within-sector PSC leases data were reported voluntarily and comprehensively for the first time in 2012. These data however are not uniformly traceable to the individual permit or MRI level. Section 8 contains a more comprehensive analysis of the impacts of within-sector leasing.

Between-sector leases are formally reported, noting the stock, total weight and, often but not always, compensation. Catch and individual allocation data at the MRI level can be combined with between-sector lease data to estimate the size of these two components of the lease market.

Two hundred and forty-one sector-affiliated MRIs had catch that exceeded individual PSC allocations for at least one stock, down from 256 in FY 2011. These MRIs leased in over 23 million pounds of ACE and/or PSC in FY 2012 (Table 19). A similar comparison at the vessel affiliation level³⁰ shows 185 affiliations leased in nearly 11 million pounds in 2012 (Table 20).

²⁶ Presumably because the benefit from leasing the quota outweighs the expected benefits from catching it (revenues from landing ACE less the cost of catching the ACE). Often, ACE is transferred in order to achieve an optimal balance of species/stocks since many species/stocks are caught jointly.

²⁷ Transaction costs include, for example, payments to a broker, the cost associated with finding buyers or sellers, or the opportunity costs associated with leases that didn't happen due to poor market information, or other factors.

²⁸ A lease market with no transaction costs.

²⁹ In FY2011 this became more difficult as FY2010 carryover was allocated to sectors and the method of re-allocation within a sector is not reported. For the purposes of this analysis, it was assumed that the total amount of sector-level carryover was re-allocated to individual sector members proportional to their unused PSC from the prior year.

³⁰ Groups of vessels connected by common ownership. Note that these data may not be comprehensive, as vessel affiliation data are not currently collected on CPH permits.

Of all the major home ports, Gloucester, Massachusetts had the largest number of lessees with 39. The largest percentage of the 242 lessees identified (44%) were attached to vessels in the 30' to <50' vessel length category (Table 21).

The difference between the 23.3 million pounds at the MRI level and the 10.9 million pounds at the vessel affiliation level, which is 12.4 million pounds, is the transfer of ACE among MRIs within a vessel affiliation. A vessel affiliation could be a single owner with multiple MRIs and these “leases” could simply be transfers of ACE from one MRI to another.

While lessee fishermen and/or ownership groups can be determined by comparing catch to allocated PSC at the MRI level, the fishermen on the other side of those transactions (lessors) are more difficult to identify. Fishermen who failed to convert their allocated PSC into catch may be easily identified (of 848 Sector-based MRIs, 545 had zero catch in FY 2012), but these permits create a pool of potential ACE/PSC that is much larger than aggregate lessee requirements (Table 22). Further, many active fishermen chose to lease ACE/PSC for particular stocks while targeting others, so those with zero catch are not the sole pool of potential lessors. Some broad conclusions may be reached. For example, Table 23 shows that while the largest vessel size category (75' plus) was allocated 37% of all ACE, this size category caught 51% of total catch, indicating a broad shift of ACE/PSC from smaller to larger vessels.

Figure 6 reveals that the distribution of catch and ACE among vessel size categories changes considerably across the 16 allocated stocks, but confirms the conclusion that the smallest vessel size category, most likely inactive skiffs, were a primary source of leased ACE/PSC. Additionally, CPH permits are a significant source of leased ACE/PSC.

The inter-sector lease market grew again in FY 2012, with volume up more than 22% from the previous year, to almost 22 million lbs (Table 24).

5.2. Prices

Using price and quantity data for the between-sector component of the market, a hedonic price model was used to estimate lease values for all 16 stocks of leased ACE (Table 25, Table 26).³¹ Statistically significant prices were estimated in 2012 for 13 of the 16 stocks. Three stocks, East and West GB haddock and American plaice, were traded at a price no different from zero.³² East Georges Bank cod obtained the highest lease price at an annual average of \$2.48 per pound. It is interesting to note that this value appears to exceed the ex-vessel value for this stock (Table 28). Pollock and redfish traded at the lowest (non-zero) prices, between \$0.03-\$0.05 per pound.

³¹ ACE leases between sectors take three forms: 1) single-stock leases with single-value cash compensation (single stock leases); 2) multi-stock leases with single-value cash compensation (bundled leases); and 3) single or multi-stock leases with single or multi-stock compensation (swap leases). This model decomposes the lease arrangements into constituent parts representing the sixteen individual stocks, where a price (P) is a function of various quantities of the sixteen stocks for which ACE is traded.

The specification of the model is $P = \beta_0 + \beta_1\chi_1 + \dots + \beta_n\chi_n + \varepsilon$. The weights, β , are the portion of the total price (P) attributable to each quantity of ACE stock leased (x) and represent the marginal price of ACE lease. In this case n is the sixteenth ACE stock. Additional variables were added to estimate the contribution of bundled and swap leases, as well as the effects on prices for ACE leased by Northeast Fishery Sector IV and State permit banks. To include swap leases in the model, price was set at zero dollars and one side of the swap recorded negative lease quantities while the other recorded positive quantities. By using swap, bundle and single-stock lease data it is possible to provide a comprehensive estimate of ACE lease values.

³² This could be because the quota were truly valueless (likely the case for the GB haddock stocks) or because data were insufficient to allow the model to estimate a non-zero price.

GOM cod values declined from \$1.10 in 2011 to \$0.68 in 2012. GB yellowtail flounder increased from \$0.23 in 2011 to \$0.97 in 2012.

Table 27 contains mean price estimates from single stock lease data only. Relative to single stock lease values, the hedonic model predicted higher lease prices for all stocks except white hake, a notable departure from years past when modeled prices were predominantly lower than single-stock price estimates. This implies that fishermen perceive a different value for quota when traded as a basket or swap than when traded as fish-for-cash. In any case, this large discrepancy between model-estimated and single-stock-estimated prices implies that model-estimated prices likely overstate quota values, inflating the size of the quota market by some degree. This may imply that the quota market was even smaller than it appears to have been in 2012.

That said, prices based only on one portion of the lease market (between sector ACE leases) may be biased due to structural issues affecting the lease markets.³³ Further investigation of the information on intra-sector PSC leasing contained in the sector end of year reports will be provided in Section 8 of this report.

5.3. Transfer Payments

At the MRI level, the total value of ACE/PSC lease market transfers in FY 2012 is estimated at over eight million dollars, down over 45% from FY 2011 (Table 29). When collapsed to vessel affiliations, the total transfer payment due to leasing is estimated at just over four million dollars, implying that roughly half of all leasing (by value) is occurring within vessel affiliations (Table 30). Both of these numbers represent significant declines in the value of leased quota from 2011 to 2012. The proportion of leases within and between vessel affiliations varies considerably at the homeport and state level (Table 31). For example, in Boston and New Bedford the vast majority of leasing occurs within vessel affiliations, while in Gloucester, Portland and Point Judith the great majority of leasing occurs between vessel affiliations.

5.4. Transactions Costs

The transfers described thus far do not represent a cost to the industry as a whole. Any costs associated with ACE and PSC leasing result from two primary sources: the direct costs of getting buyers (lessees) and sellers (lessors) to negotiate lease prices and quantities, and the indirect costs associated with leases that would have made both buyers and sellers better off but did not happen. Together, these are considered transaction costs.

³³ Most sectors maintain rights of first refusal when a sector member wishes to lease ACE out of the sector, and the Northeast Fishery Sectors maintain an additional second-refusal right for all members of their affiliated sectors. These structures place frictions in the market by concentrating liquidity into small pools before opening the market to all participants. The impact of this on lease prices is uncertain, but within-sector markets may clear at lower prices than between-sector markets and therefore estimates based on between-sector transactions may be biased upwards. This is not certain, however, as the large pool of available ACE for most stocks should be sufficient to meet leasing demand and erode any between-sector price premium. Permit banks and similar privately funded ACE leasing organizations may choose to lease ACE at below market rates, which might create an additional upward bias on the price estimates. These leases typically take place within sectors, and therefore the proportion of total ACE leased out by such entities is unknown. Such lease arrangements are not factored into price estimates reported here since no data are available for them.

It was not possible to estimate the value of transaction costs for three reasons. The first is a structural impediment. The fact that ACE is held at the sector level but leases almost universally occur at the individual permit (MRI) and/or vessel affiliation level means that lease market data are opaque, leaving only the lessee side of the transaction obviously discernible from official NOAA records. Second, while most sectors included some perspective on some forms of transaction costs in their annual reports, no comprehensive data are available on all of the costs associated with orchestrating leases between individuals, firms, or sectors. Such costs may include fees paid to sector managers or brokers, costs associated with advertising ACE availability, or the cost of time spent searching for and completing suitable leases. The third and final reason for being unable to estimate transaction costs is that no data are available on which to base estimates for the cost of lost leasing opportunities³⁴, the largest form of transaction cost in this market. Primarily these lost opportunities are due to search frictions and/or structural market impediments that prevent or impair lease negotiation. That is to say, it is not possible to estimate which fishermen or vessel affiliations wanted to lease quota but could not, and what the impact of any inability to match buyers and sellers may have been on the potential for increasing the catch of non-binding stocks. The fact that only 32% of total allocated ACE/PSC was caught, and that less than 50% of these allocations were caught for 9 of the 16 stocks implies at first glance that the potential for efficiency gains from improving lease markets may be large (Table 32). In fact, the inability of sectors to catch their allocated ACE is not likely attributable to any one factor. For example, it may be due to search frictions and/or structural impediments, but it may also be due to fish availability and/or imperfect quota setting, insufficient technology to target particular stocks, expectations about future market conditions, or other factors altogether.

6. DISTRIBUTIONAL ISSUES

Considerable attention has been given to consolidation in the groundfish fishery, and whether the degree of consolidation has been heightened by Amendment 16. There is concern also that consolidation may generate a loss of diversity in the fishery. The term “consolidation” can be used to refer to many possible events including: a reduction in the number of vessel affiliations (i.e. ownership groups), a reduction in the number of active vessels, a narrower range of vessel sizes, or fewer landed or home ports. To avoid confusion, this report uses the term “consolidation” to mean fewer active vessels or fewer active vessel affiliations earning total nominal revenues for all species and groundfish. In discussing how nominal revenues for all species and groundfish are distributed among existing active vessels and active vessel owners in a given fishing year, we either use the term “concentration” or refer to revenue distributions as being relatively more or less equally distributed.

It is important to note that this section addresses the consolidation and concentration of all species and groundfish revenues from landings by active vessels and vessel affiliations, which earned through use of the fishery resource. It does not address concentration and consolidation of quota or permits, which allows for access to the fishery resource. A fisherman may not be actively landing fish, which means that he would not earn a share of the landings revenues discussed in this section. However, he may still be earning revenues from leasing his quota to other fishermen, and those earnings are not reflected in the discussion in this section.

³⁴ Leases that would have left both lessee and lessor better off had they occurred.