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Should they Avoid the Middlemen? An Analysis of Fish Processing Firms in India

Meenakshmi Rajeev
Pranav Nagendran

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SHOULD THEY AVOID THE MIDDLEMEN? AN ANALYSIS OF FISH PROCESSING FIRMS IN INDIA

Meenakshi Rajeev and Pranav Nagendran[1]

Abstract

The supply chain of fish and seafood products in India involves a vast network of intermediaries (primarily distributors) who retain a large share of the price spread between what is paid to fishermen and what is paid by consumers. This results in high fish prices and losses due to spoilage (MOFPI Report 2017). It is deemed beneficial both for producer and consumer to have fish processing firms internalise some of the intermediaries' activities. These firms will undertake such activities only if they get adequate incentive. By considering Indian fish processing firms over three consecutive years, we examine the viability of internalising distribution and other activities using a 2SLS regression. We show that firms, which undertake the responsibility of distribution themselves, raise better returns to the factors of production (within the firm), and enjoy higher profit. These results indicate that policy support aimed at reducing the length of supply chain, for example, by forming fishermen cooperatives and linking them to the processing firms that undertake the responsibility for distribution activity, can be beneficial for both firms as well as consumers.

Keywords: Value chains, food processing, disintermediation, emerging markets, India

JEL Classification: L25, L66, Q22

Introduction

Fisheries are a quintessential source of income, employment and protein rich food, across that developing world, especially for the poor coastal populations in these countries. Among such nations, India is currently the world's second largest producer of fish/seafood (hereafter collectively referred to as fish), with an annual production of 10.79 Mt. Marine fisheries contribute to 33% of this while inland fisheries contribute 66% (Department of Animal Husbandry, Dairying, and Fisheries Annual Report 2016-17, Government of India). The seafood export industry in the country is growing as well and in 2015, India was among the leading exporters of shrimp to the EU (FAO, 2016; MOFPI, 2017). Similarly the fisheries sector is an important source of export for several other developing nations such as Indonesia and Vietnam.

As far as consumption is concerned, while most of the production is domestically consumed, the average per-capita consumption of fish in India remains quite low and is estimated to be 8-9 kg among the fish-eating population, which is only half the global per capita consumption (Salim, 2016).

The fisheries sector in India like in many developing nations such as Bangladesh is characterised by a long supply chain involving fishermen, informal intermediaries, fish processing units, and, at the other end, consumers. Efficient functioning of supply chain requires not only coordination between factors of production and technology but also adequate transport mechanisms, flows of

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[1] Meenakshi Rajeev is Professor and Pranav Nagendran is Research Assistant at CESP, ISEC.

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information, and organised management. In the case of supply chain for the Indian fisheries sector, the presence of long and somewhat inefficient networks of intermediaries has been discussed by scholars working in this field (see Kumar, *et al*, 2008). Some agents in the supply chain, such as, the boat owners or auctioneers, who fix prices, tend to have monopolistic power over individual fish landing centres which eventually leave the fishermen at their mercy (Kumar *et al*, 2008, Rajeev and Bhandarkar 2019)[2]. Studies have found that fishermen only derive a small proportion of the final price of fish while the rest accrues to the middlemen (as Munireddy and Mohan, 2008 find in a study of the supply chain of sardines and mackerel in Kerala). Lack of formal credit further constrains fishermen from improving their working conditions and they consequently have to depend on the same middlemen for loans, as found by Dey *et al* (2001) in the Philippines, whose lessons hold for India as well (for India see Rajeev (2019)). These middlemen often fail to be efficient intermediaries between producers and consumers by not making adequate investments in requisite infrastructure (such as cold storage). Studies have shown that 10.52% of the produce of marine fisheries and 5.23% of inland fisheries produce are cumulatively lost in the harvest and post-harvest stages in India (MOFPI Annual Report, 2017). Therefore, not only do middlemen exploit fisher folk, they also do not create an efficient outcome for the consumers. As a result, consumers often experience an irregular supply of fish, of poor quality and which is unhygienically stored (Prasad, 2011). It is thus fairly evident that systems, to bypass middlemen in fisheries, may be valuable. This is particularly so, as with the growing income levels, consumers are demanding better quality products and more sophisticated retail stores dealing with such perishable food items such as fish today (for more details see Rajeev and Bhandarkar, 2017, www.ssrn.com, Bhandarkar and Rajeev, 2019).

With an emerging consumer base and retail outlets, one possible option for the fish processing firms is to play a larger role by *also taking up the task of distribution* alongside cleaning and processing fish. This would help to ensure that hygienic fish reaches consumers faster and one would expect that fishermen would also to get a better value share if appropriate incentives are put in place. In the case of agriculture produce, for example, observing low earnings of the farmers, the Indian Government is initiating a system of contract farming by linking farmers to the agro-processing companies to provide better value to them (Mohani, 2017), an initiative necessary also for the fisheries sector. Currently in case of several smaller fish processing firms in India, however, one observes an absence of such a direct linkage with the producers for procuring fish, and also dependene on a long chain of intermediaries for distribution of processed products where some firms, after processing, leave distribution activities entirely to independent intermediaries. Given the level of operational efficiency of such intermediaries, it is pertinent to ask: does it really pay to do so (for the processing firm)? While several authors talk about the long supply chain and its impact on the fishermen, its benefits (or otherwise) to the fish processing firms have not been rigorously examined and in this paper we wish to empirically examine this issue.

To obtain a theoretical perspective on firms' decisions to internalise value chain activities, we turn to Ronald Coase, who, in his seminal 1937 article 'The Nature of the Firm', describes the mechanism by which firms decide whether to include specific activities within themselves or to contract

[2] Decent work deficiency among fishermen has been discussed by Rajeev and Nagendran (2018)

them out to external agents. The decision boils down to the issue of transaction costs, and firms will expand until the 'costs of organising an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of an exchange on the open market...' (Coase, 1937). In this paper we wish to examine whether taking responsibility of distribution activities by the processing firms themselves really does add value to the factors of production engaged in the firm or add to their profitability (which would imply that the benefits of doing so outweigh the costs). If so, then the processing firms should take the responsibility of distribution and thereby reduce the lengthy supply chain in order to provide better value to the producers and consumers. To examine this aspect the paper utilises firm-level data for fish processing units provided by the Annual Survey of Industries (ASI) in India. This data is collected at the firm-level for the manufacturing sector every year by the Central Statistical Organisation (CSO), Government of India. The survey is conducted for the purpose of estimating gross value added (GVA) for the manufacturing sector, and collects information on a selected set of variables pertinent to this.

Correspondingly, this dataset provides information on "other distributive expenses" incurred by a firm in distributing its output, which we term 'distribution costs'. This includes "outward expenses, rebate, commission, transit insurance of goods sold and packing fees" among other items. We use this variable to represent distribution activity undertaken by a firm, either using its own transport equipment or by hiring an external contractor.

Normally, if distribution costs are high, then the gross value added for the firm will be lower since this item is subtracted from the firm's output value in the GVA computation. However, if a fish processing firm undertakes distribution activity, then it may be able to negotiate better prices for its output with retail/wholesale buyers and this would lead to an increase in sales revenue and possibly result in higher GVA. We show that, after controlling the other pertinent factors such as age, size of the firm, distance to market, and product type, and by using a 2SLS model to address the issue of endogeneity between GVA and distribution cost, firms that have spent more on distribution also have higher GVA. This implies that taking up the responsibility for distribution activity adds value to the factors of production within the firm. A similar exercise on profit has also been carried out and distribution cost was also found to have a significant and positive impact on the profits of fish processing firms, which indicates that it is better for firms to adopt and undertake distribution activity rather than entrusting it to an independent intermediary. Results derived in the paper, we believe, have important implications for other fish producing developing nations.

Needless to say, it would have been similarly illuminating if one can do a parallel exercise for the traders (retailers and/or wholesalers) to examine whether internalisation of certain activities and thereby reducing the supply chain by the traders involved in the chain would be optimal to them. But lack of data prohibits such an exercise.

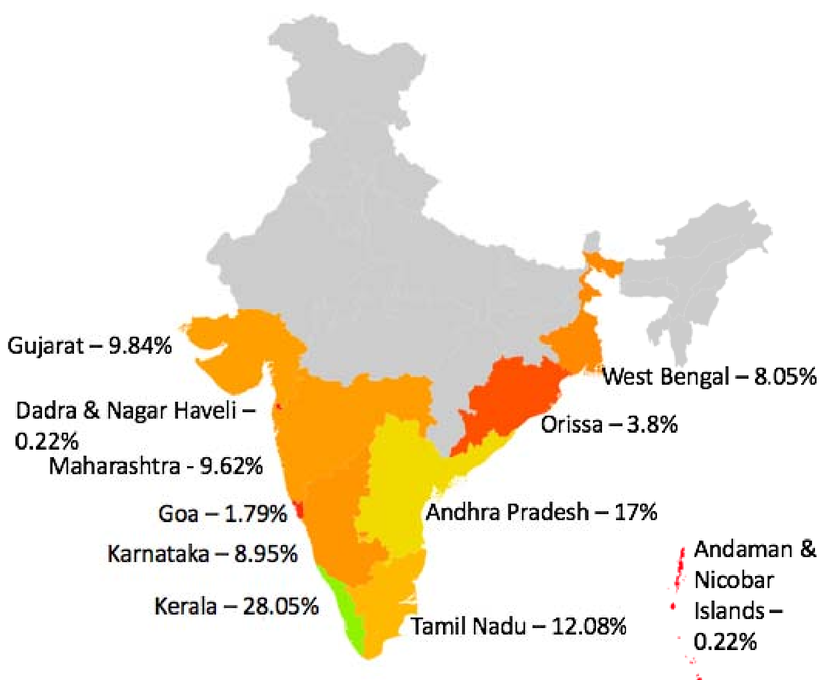
In this backdrop the paper is organised as follows. The next section provides the basic characteristics of the sample observations pertaining to the seafood processing industry in India. Section 3 utilises a regression analysis to test whether undertaking the responsibility of certain activities, like distribution by the processing firms themselves, adds value to the firm and makes it optimal for them to do so. A concluding section follows at the end**.**

Basic Characteristics of the Sample Observations

This paper utilises firm-level information from the Annual Survey of Industries (ASI) data provided by the Central Statistical Office, Government of India, for three years (2011-12 through 2013-14) for fish processing firms, in order to discern a variety of characteristics inherent to this class of industries, and their relationship to value chains in fisheries. This data set contains information upon the industry type, input set, output mix and a variety of other indicators pertinent to understanding the nature of business and operations carried out by each industrial unit. From this data, we find 527 observations on fish processing units in India, spread over the three years (136 in 2011-12, 208 in 2012-13, and 183 in 2013-14), of which 472 are usable for our regression analysis, the rest having zeroes in their GVA, fixed capital, etc. The data has been collected through random sampling each year, and consequently, it is almost certain that the exact sample of units selected differs from year to year. The Annual Survey of Industries provides information based on National Industrial Classification (2008) codes to identify the industry and sub-industry of an industrial undertaking. The sub-industries as well as the distribution of fish processing units for the year 2013-14 together with their NIC codes are detailed in Table A1 in the appendix.

For the most recent year in the sample (2013-14), we observe that a significant majority of the activities undertaken by industrial units in this sector fall under the categories of 'Processing & Preservation of Fish Crustacean' and 'Processing & Canning of Fish'. Much of the industrial activity takes place in the coastal states, perhaps to allow for easier and quicker procurement of fresh fish. The figure below (Fig 1) illustrates the distribution of fish processing units across different states in the country.

Figure 1: State-wise Distribution of Fish Processing Organisations in India



Source: ASI 2013-14

While southern states do account for a significant share of fish processing units, there are some presence of these units in coastal states in other parts of the country as well. The data also appeared to indicate a tendency for fish processing units to be located in or around urban centres, with 38% in rural areas, and 62% in urban regions.

We turn towards the ownership patterns of units in the fish processing industry next in Table 1:

Table 1: Ownership Patterns of Fish Processing Industries

Ownership Type	Percentage of Units (%)
Individual Proprietorship	12.75
Partnership	24.16
Public Limited Company	1.57
Private Limited Company	47.65
Others	13.87

Source: ASI 2013-14

It can be observed that only a very small portion of the industries in this sector are sole proprietorships. There is a significant presence of partnerships and a large percentage of the units are organised in the form of private limited companies. Thus, there appears to be a significant degree of formalisation in the business organisation of these units, unlike the informal set up of middlemen that operate in the supply chains. These formal organisations are expected to be more able to utilise cold storage infrastructure and employ better supply chain management practices when compared to informal traders. As of 2017, the average age of these firms was approximately 18 years, with some being older than 50 years. Thus, this sector has been in operation for some fair duration, and the results seen here can be expected to be close to equilibrium levels.

In 2013-14, an estimated 44,178 individuals were engaged in the fish processing industry. The total output of the industry was estimated to be Rs 27,061 crores, with approximately 2,460 crores of fixed capital, which leads to a capital-labour ratio that is on average smaller than other enterprises in the country. Therefore, the industry is primarily labour intensive, indicating that an expansion of the industry can have positive effects on regional employment. Industrial expansion, in turn, can be brought about by improving factor earnings and profitability, which we argue, is possible through disintermediation in the supply chain, such as by taking up distribution activity.

To understand whether internalization of distribution activities indeed help a firm we carry out an empirical examination in the next section. Since we do not have data on a fixed set of units over the years, we confine our analysis to one using a pooled sample.

Identifying Value Generating Activities for Fish Processing Firms

1. Dependent Variables

Our interest lies in identifying the set of activities that will allow a fish processing firm to generate better value and earnings for its factors of production from operations in the fisheries value chain. To do this, we consider the gross value added by a firm in a given year as the dependent variable in a regression analysis. The gross value added is the difference between the total output of the firm (which includes the ex-factory value of goods sold, earnings from miscellaneous activities such as repair works, interest, and rent) and total input (which includes the value of indigenous and imported inputs, fuels consumed, expenditure on miscellaneous services including repair and maintenance of plant and machinery, interest paid, rental expenditure, and insurance). A higher gross value added implies a better return to the factors of production and is considered a performance indicator for the firm. In addition, we also consider profit earned by a firm as an alternative performance indicator, but this variable requires different treatment for analysis, which is discussed later in this section.

2. Independent/Explanatory Variables

The set of independent variables in our regression include those variables that can impact the value addition by a firm and these are discussed below.

Value Chain Related Regressors

Distribution Costs: From the perspective of value chains, we are trying to see whether selling the product after processing (and not getting involved in distribution) has an effect on the gross value added, i.e., we are trying to look at the effect of internalising different value chain services (such as transport). We attempt to examine the impact on the GVA for a firm that takes the responsibility of distribution by itself (vis-à-vis ones that leave the distribution work entirely to an independent party) through the use of 'distribution costs' as a regressor in the model. Assuming that all firms have access to distributors of equal cost- and efficiency[3], a higher cost of distribution would indicate that firms are bearing the burden of delivering their produce to final consumers or wholesale buyers themselves, and that there are fewer middlemen between the factory output and the retail buyer. Conversely, if there were middlemen, we would expect distribution costs to be lower for the firm, as these middle agents would be expected to bear these distribution costs.

Normally, as mentioned above, an increase in distribution costs will be expected to reduce the gross value added for a firm, as these costs are subtracted from the value of output. However, by taking up distribution activity itself, if the firm is able to deliver a better quality it may negotiate a higher price for its product; then, its value added may increase rather than decrease. It is therefore an empirical question to examine whether higher distribution cost, which essentially represents internalising distribution activity by a firm, increases its GVA or not.

[3] We show that the firms that take responsibility for distribution activity have higher GVA, *vis-a-vis* the firms that do not involve in the distribution activity. This indirectly implies that doing distribution activity on its own is beneficial for a firm. We have controlled for location of the firm, age, size, and inputs used, and then looked at the effect of distribution cost on GVA. Distribution cost being higher in one firm between two firms having these same characteristics, we assume, implies that the distribution activity is taken care of by the firm itself.

Other Variables[4]

1. Age: The age of the firm is likely to have an influence on its gross value added owing to the accumulated experience that the unit has garnered through operations, as well as familiarity with input suppliers and purchasers of output, who may provide preferential contract terms that can help improve earnings and we look to test whether such relationships indeed have a positive impact on output. The variable 'age' is constructed by finding the difference between 2017 and the initial year of production (as provided by the ASI data) rounded up to the nearest year.
2. Fish state: A binary variable indicating whether the unit operates in one of the six major fish-consuming states in India, including: West Bengal, Orissa, Goa, Kerala, Tamil Nadu or The Andaman & Nicobar Islands. Operation in these states is expected to reduce the physical distance to a large base of final consumers, and including this in the regressor list allows us to isolate the variation in GVA due to distance to major markets (that may help to shorten the supply chain). This statement is further supported by the observation that the (Pearson's) correlation coefficient between 'fishstate' and real distribution costs for the sample observations was equal to -0.1623, which is statistically significant at the 1% level, indicating that as the values of 'fishstate' move from 0 to 1 (indicating that the unit is in a major fish consuming state), there is a decrease in distribution costs, which further implies that operation in a fish consuming state decreases distance to most final consumers.
3. Fixed Capital (proxy for the size of the firm): The net closing value (as on each accounting year) of the fixed assets of the unit, including the value of land & building, plant & machinery, transport equipment, computers & software, equipment for pollution control and capital work in progress. We utilise this variable to isolate the effect of unit size on gross value added and expect that this is positively related to fixed capital.
4. ISO: A binary variable indicating whether the industrial unit has ISO Certification, 14000 series. This certification seeks to ensure that industries adhere to certain environmental standards in their production process. Environmental Management Systems may be important to international trade partners and allow access to more markets for the unit. Growing literacy around the world has led to consumers placing increased emphasis on the issues of resource depletion, climate change, and social responsibility, and as a result are willing to pay a premium for fish and fish products from a sustainable resource base (De'Silva, 2011). However, as adherence to environmental standards increases costs as well, its impact on GVA is indeterminate and will be an empirical question.
5. Non-Fish Share: The share of value of non-fish inputs in total output. The coefficient of this variable seeks to capture the marginal effect of increasing expenditure on processing inputs upon the gross value added.
6. Year: The year in which the data for the particular sample was collected. Using this variable, we seek to isolate the year-specific constant terms (separated from the overall regression's constant term) through the use of two dummy variables for the years 2013 and 2014 over the base year 2012.

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[4] We had included ownership pattern in the regression, but the coefficient was not significant. Further, qualitatively the results with respect to other variables remained the same.

7. Use of Preservatives: A binary variable indicating whether the fish processing unit utilises any inputs of chemical preservatives in its production process.
8. Use of Fish feed: A binary variable indicating whether the unit had used any inputs of fish feed. We assume that usage of this indicates that the unit is utilising live fish as an input, or is involved in supplying live fish to final consumers. Live fish often fetch a higher price in markets. Indeed, one of the world's largest fish consumers, Japan, places increased emphasis on fresh fish, which fetches a higher price than processed or older fish (De'Silva, 2011). Owing to the informal nature of intermediaries in fisheries currently, there may exist problems of storage where live fish are concerned. Firms may need to undertake transport themselves, if this activity is profitable, as informal intermediaries may lack the adequate infrastructure it requires.
9. Trading Income: The difference between the sale value of goods sold in the same condition as purchased, and the purchase value of goods sold in the same condition as purchased, indicating the level of income earned by the unit from trading activity. Participation in trading activity may indicate integration of different aspects of the value chain in the unit, and we wish to look at the possible effects that this has on value addition by the firm.

3. The Model

We utilise regression analysis to separate the effects of different factors or aspects of the value chain on the productivity of the firm captured by its gross value added in a given year.

Some of our data is in value form and we normally require a conversion from nominal terms to real terms for effective analysis. However, Woolridge (2012) suggests an alternative to deflating value figures by instead utilising their logarithmic forms. Assuming that the deflator remains constant across cross sectional units for a given year, then the common deflator would simply be absorbed into the year specific dummy variable's coefficient, thus, allowing us to interpret coefficients of other value variables as we would have if they had been deflated. Thus, the gross value added, as well as the other variables in rupee terms have been utilised in their logarithmic forms to avoid issues of differing estimates of price levels influencing the analysis through the selected deflator.

Resultantly, our model assumes a log linear formulation, as given below:

$$\log(GVA) = \beta_0 + \beta_1 * age + \beta_2 * iso + \beta_3 * fishstate + \beta_4 * \log(trading) + \beta_5 * \log(distribution_{cost}) + \beta_6 * uses_{preservatives} + \beta_7 * uses_{fishfeed} + \beta_8 * nonfishshare + \beta_9 * year_{2013} + \beta_{10} * year_{2014} + \varepsilon \ldots.(1)$$

Where β_i is the elasticity of a unit increase in the i^{th} variable

ε is the random error term, with $\varepsilon \sim N(0,1)$

log(.) is the natural logarithm function.

Post-estimation statistics of this simple log-linear regression indicated the presence of heteroscedasticity through the Breusch-Pagan test for heteroscedasticity. Therefore, a robust standard error cluster has been estimated and utilised for this regression model.

4. Issues of Endogeneity

In our model, the gross value added is the dependent variable and distribution costs is a regressor. However, the gross value added is a function of total output and when total output increases, distribution costs can also be expected to increase. This is because a higher value of total output is caused either by a larger quantity of output (which will naturally require higher distribution costs), or increased per unit price of output (which may be due to dealing in exotic or live fish which require more careful handling and transport, also increasing distribution costs). This implies that distribution costs are themselves a function of gross value added, possibly giving rise to the problem of endogeneity in the linear regression model.

Endogeneity test:
The robust Chi^2 value to test for endogeneity yields a value of 2.854, which supports the alternative hypothesis that endogeneity exists between the two variables.

Attempting to solve the problem, we utilise the instrumental variable approach, using the predicted values of distribution costs on the other variables in the model. We formulate that distribution costs are dependent on the gross value added, value of transport equipment, and the share of total output exported, in the following way:

$$log(distribution_{costs}) = \gamma_0 + \gamma_1 * log(GVA) + \gamma_2 * log(transport_{equipment_{value}}) + \gamma_3 * share_{exported} + \varepsilon' \ldots (2)$$

Thus, we have a system of simultaneous equations. Transport equipment value and share of exports provide identification to the estimation of the original regression line on gross value added and thus, allows us to construct an instrumented version of distribution costs that is related to the original distribution cost, but not to gross value added. Table 2 below provides some descriptive statistics and explanations of some of the variables used.

Table 2: Variables Description and Basic Statistics

Variable	Description	Mean	S.D
log(GVA)	Natural logarithm of the gross value added by a fish processing unit in a given year	15.3378	5.4907
age	The number of years (rounded) that have elapsed between the unit's initial year of production and 2017	19.546	11.154
log(distribution cost)	The natural logarithm of the distribution cost	13.0591	7.0326
log(fixed capital)	The natural logarithm of the net fixed capital as on the closing date of the accounting year	17.0399	2.7607
iso	=1 if the unit has ISO 14000 series certification, and 0 otherwise	0.0753	0.2642
fish state	=1 if unit is located in West Bengal, Orissa, Goa, Kerala, Tamil Nadu, or Andaman & Nicobar Islands, and 0 otherwise	0.4372	0.440
log(trading)	The natural logarithm of the difference between the sale value and purchase value of goods sold in the same condition as purchased	2.0884	5.1348
uses preservatives	=1 if the unit utilises preservatives as an input, and 0 otherwise	0.07322	0.2608
uses fish feed	=1 if the unit utilises fish feed as an input, and 0 otherwise	0.0628	0.2428
non fish share	total value of fish inputs/total output	0.3095	0.3417
Year = 2013	=1 if observation was made in 2012/13, and 0 otherwise	0.3947	0.4892
Year = 2014	=1 if observation was made in 2013/14, and 0 otherwise	0.3472	0.4765

Source: Annual Survey of Industries (2011-12 to 2013-14)

Based upon 478 observations spread over three years

A 2 stage least squares (2SLS) regression is employed here to estimate the coefficients in the presence of endogeneity.

To demonstrate this method, consider the following equations (see Woolridge (2012)):

$$y_1 = \beta_0 + \beta_1 y_2 + \beta_2 z_1 + u_1$$

$$y_2 = \gamma_0 + \gamma_1 y_1 + \gamma_2 z_2 + \gamma_3 z_3 + u_2$$

Solving these simultaneous equations, we can obtain the reduced form expression for y_2, which will take the following form:

$$y_2 = \pi_0 + \pi_1 z_1 + \pi_2 z_2 + \pi_3 z_3 + v_2$$

Where $E(v_2) = 0; Cov(z_1, v_2) = 0; Cov(z_2, v_2) = 0; Cov(z_3, v_2) = 0$

In this case, the best instrumental variable (that is correlated with y_2 but not with u_1) would be:

$$y_2^* = \pi_0 + \pi_1 z_1 + \pi_2 z_2 + \pi_3 z_3$$

Provided that either $\pi_2 \neq 0$ or $\pi_3 \neq 0$.

This instrumental variable is found by the method of ordinary least squares, so that in the analysis we use:

$$\hat{y}_2 = \hat{\pi}_0 + \hat{\pi}_1 z_1 + \hat{\pi}_2 z_2 + \hat{\pi}_3 z_3$$

In the regression below, the endogenous dependent variable log (distribution cost) is regressed on all exogeneous variables found in both equations (1) and (2) to obtain the IV estimator of log (distribution cost). The estimated values of distribution costs are then used in the ordinary least squares regression of log (GVA). We find that empirically, by carrying out an OLS regression of log (GVA) on the other independent variables, the share exported is not a significant determinant of GVA (i.e, the coefficient is not statistically significant). However, this variable is significant in the OLS regression on log (distribution costs), and so it is a variable that is correlated with distribution costs but not with GVA, and provides identification to the model.

5. Results

The results of this 2 stage least squares approach regression are provided in Table 3 below. In the table, we provide estimates from the pooled regression using data from all three years, as well as individual regressions run for each year separately to verify that coefficients do not change sign between the years. Further, robustness has been checked by excluding groups of variables and checking that the remaining explanatory variables do not change sign in Table A3. With the exception of the constant term, and the binary variable 'fish state', we find that the coefficients of all other variables do not change sign between years. First stage estimates have been provided in Table A4 in the appendix.

Table 3: Regression Results - Dependent Variable: log (GVA)

Dependent Variable: Log (Gross Value Added) at the Enterprise (Unit) Level. Based on a 2SLS Regression using an instrumental variable.				
Variable	**2012**	**2013**	**2014**	**All Years Combined**
Age	0.0706** (0.0331)	0.0922*** (0.0311)	0.0516* (0.0271)	0.0656*** (0.0181)
ISO Certification	0.7491 (1.3285)	2.1111*** (0.7513)	1.1505* (0.6446)	1.0063* (0.5797)
Fish-consuming State	-0.1748 (0.7928)	-0.7931 (0.9223)	0.9910* (0.5304)	0.0801 (0.4526)
Log(Net Value of Trading Activity)	0.1111*** (0.0404)	0.0238 (0.0744)	0.0134 (0.0612)	0.0290 (0.0361)
Log(Fixed Capital)	0.4839 (0.6918)	0.4750 (0.3481)	0.3085 (0.2626)	0.3665* (0.2155)
Log (Distribution Cost) (Instrumented)	0.2885 (0.3222)	0.4441* (0.2687)	0.3698** (0.1851)	0.4116*** (0.1477)
Use of Preservatives as an Input	-2.2136 (2.5375)	-1.5476 (1.4167)	-3.7320** (1.6568)	-2.4403** (0.9850)
Use of Fish feed as an Input	2.7362** (1.3385)	0.2885 (1.8281)	2.8395*** (1.0002)	1.9457** (0.8514)
Share of Non-fish Inputs	0.0963 (3.4702)	1.9679 (3.9305)	2.0416 (2.9528)	1.9242 (2.0119)
Year = 2013	-	-	-	-0.1826 (0.5363)
Year = 2014	-	-	-	0.3674 (0.5221)
Constant	0.3538 (10.1646)	-1.1300 (2.9151)	3.6292 (3.6561)	1.6933 (2.2943)
No. of Observations	126	178	168	472
R^2	0.1928	0.3103	0.2867	0.2566

Source: Based on Author's Computations from ASI Data

Note: Figures in parentheses are robust standard errors. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

We have utilised an instrumented distributive costs to indicate the effect of the costs of distribution (including transport and other related sundry charges) of factory output in this regression, to compensate for the effect that gross value added has on the regressor. Further, we have controlled for the effect of distance to final consumers to some extent by utilising the variable 'fish state', which was negatively correlated to distribution costs, indicating that firms in fish consuming states have lower distribution costs than firms in other states, and thus, this variable is a reliable indicator of distance to final markets. Therefore, we may infer that the variance in distribution costs is related to firm specific decisions to take up responsibility for distribution. A higher level of distribution cost implies that firms are undertaking distribution activities themselves *vis-à-vis* limiting its activity to processing alone and selling the product to a third party thereafter. Thus, if distribution cost is lower for the same distance, it indirectly implies that the firm has possibly only carried out processing activity and does not engage in distribution. We can see that the coefficient of distribution costs is positive and significant, implying that firms spending more on distribution have higher GVA, ceteris paribus and controlling for other factors such as size and distance. Thus, we infer that firms that undertook more of the distribution activities together with processing have gains in terms of value added. In other words, firms can improve returns to the factors of production by undertaking distribution activity as well.

Further we also found that firms that use fish feed as an input, too, have significantly higher GVA than others. Therefore, the move towards live or fresh fish, which fetches higher prices in markets, does significantly improve firms' gross value added. In the value chain, this also has the implication that those firms that are capable of capturing and providing live fish to firms are more likely to fetch better prices for their output than others. Investments in infrastructure that can procure and deliver live fish are likely to command attractive returns. This observation is further supported by the negative coefficient of the binary variable 'uses preservatives', indicating that the provision of fresh fish rather than preservative used is more remunerative to firms.

The analysis also suggests that there exists a positive relationship between the age of the firm and the gross value it adds annually, keeping other things constant. Thus, age is an important factor in influencing the gross value added by a firm, and older firms enjoy greater GVA than younger firms, ceteris paribus. However, the effect of age manifests both in the relationships with input suppliers and output purchasers, as well as in the form of experience, and the influence of the two cannot be separated.

Firms that possess an ISO 14000 certification, indicating adoption of better environment friendly practices would attract economically better off emerging environment conscious buyers, had higher GVA on average than those that did not. These buyers are often ready to pay higher prices that possibly compensated firms for the extra costs of certification.

Fixed capital has been included as an independent regressor to control for variation in the gross value added brought about by the size of the firm, and, as can be expected, larger firms have a larger gross value added ceteris paribus, indicated by the significantly positive relationship between log (fixed capital) and log (gva).

However, the share of value of non-fish inputs did not appear to significantly augment gross value added in the regression model, suggesting that the value created by the firm is more reliant on the type of business model (i.e, live vs preserved fish) used by it rather than the quantity of non-fish inputs utilised (i.e., preservatives or packing materials) in modifying the fish inputs for sale.

Taken together, these results indicate that if firms integrate direct links along the value chain (such as transport), there are significant gains to be made in terms of value added, which are not present when engaging in ancillary businesses such as trading activity.

6. A Note on Profitability of Undertaking Selected Activities

Our original regression utilised the gross value added as the dependent variable, which is a measure of the total returns to all factors of production: land, labour, capital and organisation, within the industrial unit. However, returns to factors of production are little incentive for a firm to undertake certain activity. Business decisions are often taken by entrepreneurs based upon the profits of the firm. Thus, activities are likely to provide incentive for adoption only if they improve the profits of the industrial unit.

Since certain profit figures are negative we run the model in levels (not in log form) by appropriately deflating the values. We consider profit before depreciation and tax to get a proper figure for profit actually earned by a firm.

The same formulation is retained as before, except with deflated level figures rather than logarithmic ones. The results of the pooled regression are provided in Table A2 in the appendix.

The results of the pooled regression strengthen our assertion. The marginal effect of (instrumented) distribution costs continues to be statistically significant in this regression as well, thus, outlining the incentives for entrepreneurs and managers to expand firm activities into this area. Furthermore, utilisation of fish-feed has a significant positive effect on the firm's augmented profits, indicating that the move to higher value business models such as live fish are profitable as well as value-generating.

Conclusions

While not all supply chain services would prove to be productive if integrated into firms, we see that distribution activity certainly yields benefits. Firms that have undertaken distribution activity have drawn significantly higher gross value added than others. We also observe that firms dealing with live fish have better value added. For this segment, too, having internal distribution systems will be helpful since a long chain of agents may not be feasible. Processing industries may also have access to better refrigeration during transport which can reduce wastage, and by extension, stress on local resources to satisfy demand. Further, if processing firms engage more in distribution activity, this may help build relationships with forward supply chain agents, which can in turn lead to more agile or lean production systems (depending on market requirements) and Co Managed Inventories for fish processors and retailers, which can further reduce wastage and better satisfy consumer demand. Our results further indicate that policy support, aimed at reducing the length of supply chain, for example, by forming fishermen cooperatives and linking them to the processing firms that undertake the responsibility for distribution activity can be beneficial for both firms as well as consumers.

Export activity was concentrated among the larger firms (going by quantiles of fixed capital), while smaller firms did not export , and are thus focused on satisfying domestic demand. Since the issues with hygiene are likely to apply only to domestic demand as exports are already stringently tested, additional support such as subsidised credit to enhance distribution networks or cold storage infrastructure to small firms may better help to improve quality of fish to domestic consumers, and simultaneously increase earnings and profitability of these firms. We also observe that it is the small firms that utilise preservatives, much more so than medium or large firms. This is possibly owing to inadequate distribution and storage infrastructure. Usage of preservatives reduces factor earnings of a firm, as the regression exercise revealed. This observation also leads us to infer that improved incentives, in terms of subsidised credit to invest in distribution and storage among small firms, can perhaps check the extensive use of preservatives when processing fish, which can further improve prices, quality and earnings of the sector.

References

Coase, R H (1937). The Nature of the Firm. *Economica*, 4 (16): 386-405

Department of Animal Husbandry, Dairying, and Fisheries (2017). Annual Report 2016-17. DADH, Ministry of Agriculture and Farmers' Welfare, Government of India.

Dey, M M, F J Paragus, and Md. F Alam (2001). Cross-country Synthesis, Production, Accessibility, Marketing, and Consumption Patterns of Freshwater Aquaculture Products in Asia. A Cross Country Comparison. *FAO Fisheries Circular. No. 973,* Rome. P 27.

Food and Agricultural Organization (FAO) (2016). *Globefish Highlights: A Quarterly Update on World Seafood Markets*. United Nations: FAO.

Kumar, B G *et al* (2008). Domestic Fish Marketing in India - Changing Structure, Conduct, Performance, and Policies. *Agricultural Economics Research Review*, 21: 345-54.

The Marine Products Export Development Authority (2017). India's Seafood Export at an All-time High in 2016-17. Press Information Bureau News Report 07-June-2017. Available online at: http://pib.nic.in/newsite/PrintRelease.aspx?relid=164454. Last accessed on: 08/09/2017

Ministry of Food Processing Industries (MOFPI) (2017). *Annual Report 2016-17*. Available Online at: http://www.mofpi.nic.in/sites/default/files/english_annual_report_final-ilovepdf-compressed_1.pdf. Last Visited: 30/01/2019

Mohani, V (2017). Centre to Come out with Draft Law on Contract Farming. *Times of India,* September 11, 2017. 3:00 IST.

Munireddy, R and A Mohan (2008). Price Spread in the Marketing of Marine Fish in Coastal Karnataka for Mackerel and Sardine. *Environment and Ecology*, 26 (3): 1170-75.

Prasad, D (2011). *Supply Chain Management of Marine Fish - A Study in Karnataka.* Thesis submitted to University of Agricultural Sciences, Bangalore

Rajeev, M and S Bhandarkar (2016). A Study of Domestic Marketing Channels of Fisheries in Bangalore City. *Social Science Research Network.* Available online at: https://ssrn.com/abstract=2747782

———— (2019). Traders in Food Value Chain: Fisheries Sector in India. ISEC Monograph 62. Bangalore: ISEC.

Rajeev, Meenakshi (2019). Fish Processing Sector in Kerala: Concerns and Policies. *ISEC Policy Brief.* Bangalore: ISEC.

Rajeev, M and P Nagendran (2016). Decency of Primary Occupations in the Indian Fishing Industry. *International Centre for Decent Work and Development Working Paper No. 21*. University of Kassel, Germany, DOI: 10.19211/KUP9783737604536

Salim, S S (2016). Fish Consumption Pattern in India, Exports – Overview. *Food & Beverage News* August 1-15 2016: 25-28. Available online at: http://eprints.cmfri.org.in/10991/1/Food%20and%20Beverage%20News_Shyam%20Salim%202016.pdf. Last accessed on: 08/09/2017

Wooldridge, J M (2012). *Introductory Econometrics: A Modern Approach*. Boston: Cengage Learning.

Appendix

Table A1: Sample of Fish Processing Industries in ASI 2013-14

Industry (with NIC Code)	Estimated No. of Factories/Units	% of Population No. of Units
Artificial Dehydration (10202)	3	0.67
Radiation Preservation (10203)	2	0.45
Processing & Preservation of Fish Crustacean (10204)	188	42.06
Processing & Canning of Fish (10205)	139	31.10
Production of Fishmeal (10207)	19	4.25
Processing & Preservation of Other Fish Products (10209)	96	21.48

Source: Annual Survey of Industries 2013-14

Table A2: Regression Results - Dependent Variable: Augmented Profits

Variable	Coefficient
Age	149253.1 (300811.1)
ISO Certification	33300000** (16200000)
Fish-consuming State	5548775 (8584152)
Log(Net Value of Trading Activity)	-0.1786 (0.3975)
Log(Fixed Capital)	-0.0171 (0.05455)
Log (Distribution Cost) (Instrumented)	0.9716* (0.5437)
Use of Preservatives as an Input	6315151 (11300000)
Use of Fish feed as an Input	25300000* (13000000)
Share of Non-fish Inputs	7990845 (20100000)
Year = 2013	1207229 (7045794)
Year = 2014	-15200000 (10000000)
Constant	-13600000 (15600000)
No. of Observations	478
R^2	0.3305

Source: Based on Author's Computations from ASI Data

Note: Figures in parentheses are robust standard errors. *, **, and *** indicate significance at the 10%, 5% and 1% level respectively.

Table A3: Robustness of Results

Dependent Variable: Log(Gross Value Added) at the Enterprise (Unit) Level. Based on a 2SLS Regression using an instrumental variable.				
Variable	**Subset 1**	**Subset 2**	**Subset 3**	**All Variables Combined**
Age		0.0474*** (0.0176)	0.0709*** (0.0166)	0.0656*** (0.0181)
ISO Certification		1.0386* (0.6417)	0.9900* (0.5687)	1.0063* (0.5797)
Fish-consuming State		0.0342 (0.4608)	0.1837 (0.4392)	0.0801 (0.4526)
Log(Net Value of Trading Activity)		0.0368 (0.0394)	0.0484* (0.0293)	0.0290 (0.0361)
Log(Fixed Capital)	0.2670 (0.2148)		0.4631*** (0.1625)	0.3665* (0.2155)
Log (Distribution Cost) (Instrumented)	0.4987*** (0.1404)	0.5774*** (0.1020)	0.3058*** (0.0642)	0.4116*** (0.1477)
Use of Preservatives as an Input	-2.1847** (0.9697)		-2.4880** (1.0435)	-2.4403** (0.9850)
Use of Fish feed as an Input	1.7032** (0.8668)		2.1954*** (0.8346)	1.9457** (0.8514)
Share of Non-fish Inputs	2.9938 (1.8711)	3.9412** (1.6518)		1.9242 (2.0119)
Year = 2013	-0.2347 (0.5548)	-0.3138 (0.5662)		-0.1826 (0.5363)
Year = 2014	0.3642 (0.5402)	0.3932 (0.5555)		0.3674 (0.5221)
Constant	3.3879 (2.2231)	5.5553*** (1.9586)	1.9201 (2.3426)	1.6933 (2.2943)
No. of Observations	472	472	472	472

Source: Authors' Computations from ASI 2011-12, 2012-13, and 2013-14 data.

Table A4: First Stage Estimates of Pooled 2SLS Regression in Table 3

Dependent Variable: Log(Distribution Costs)	**Coef.**	**Robust Std. Err.**	**t**	**P>t**
Age	0.025	0.014	1.770	0.078
ISO Certification	0.425	0.604	0.700	0.482
Fish-consuming State	0.666	0.368	1.810	0.071
Log(Net Value of Trading Activity)	0.070	0.034	2.040	0.042
Log(Fixed Capital)	0.723	0.131	5.530	0.000
Use of Preservatives as an Input	0.533	0.815	0.650	0.514
Use of Fish feed as an Input	-0.325	0.989	-0.330	0.743
Share of Non-fish Inputs	-8.023	1.203	-6.670	0.000
Year = 2013	-0.157	0.445	-0.350	0.724
Year = 2014	-0.153	0.467	-0.330	0.743
Share of Output Exported	0.011	0.004	2.810	0.005
Log (Transport Equipment Value)	0.373	0.072	5.190	0.000
Constant	-3.323	2.023	-1.640	0.101

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Dr V K R V Rao Road, Nagarabhavi P.O., Bangalore - 560 072, India
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E-mail: manjunath@isec.ac.in; Web: www.isec.ac.in