Working Paper
422

COMPLIANCE, COMPETITIVENESS AND MARKET ACCESS: A STUDY ON INDIAN SEAFOOD INDUSTRY

Jayasekhar S
C Nalin Kumar

February 2010

Working Papers can be downloaded from the
Centre's website (www.cds.edu)

COMPLIANCE, COMPETITIVENESS AND MARKET ACCESS: A STUDY ON INDIAN SEAFOOD INDUSTRY

Jayasekhar S
C Nalin Kumar

February 2010

We thank K.J. Joseph, K.N. Harilal, M. Parameswaran and an anonymous referee for helpful suggestions. We also thank the officials at MPEDA, SEAI and EIA for useful discussions. Usual disclaimer applies.

ABSTRACT

This study attempts to estimate the effects of the sanitary and phytosanitary (SPS) measures in terms of trade elasticity of regulations and competitiveness of exports. In spite of the gener-alized acknowledgment of growing liberalization of trade between countries, there are still numerous obstacles to trade, more of the non-tariff type. This study aims to contribute to the literature on quantifying the eco-nomic impact of health and environmental regulations expressed in the form of SPS measures on international trade in agro-food products, by taking Indian seafood exports as a case study. The gravity analysis, complemented with the constant market share (CMS) model, helped to obtain an insight into the overall dynamics of the export markets, trade flows and competitiveness of fish and fishery products (aggregate level), shrimps and cephalopods. For the regulatory variable, the maxi-mum residue limit (MRL) on cadmium in the model is used as an independent variable. A detailed study on the micro level dynamics of Kerala seafood export sector has been carried out, particularly to understand the industry level changes experienced during the stringent food safety regime. The results indicate that regulations on cadmium appear to be moderately trade restrictive. At the same time, results are divergent at the disaggregate level, which is significant from the point of view of trade policy. The most important aspect of the existing chain in Kerala's seafood sector is the gradual disappearance of the independent preprocessing sector which has been an important stakeholder of the seafood value chain in Kerala. The preprocessing node of the value chain is getting integrated to the processing sector causing a major restructuring of the existing value chain.

Keywords: Competitiveness, Trade models, Seafood Industry, Value Chain

JEL Classification: F14, F18, L15, Q17, Q18

1. Introduction

The proliferation and increased stringency of food safety and agricultural health standards[1] is a source of concern among many developed countries either because these countries lack the technical and administrative capacities needed for the compliance or because these standards can be applied in a discriminatory or protectionist manner. Therefore, it is important to understand the impact of such standards on various agricultural export sectors in the developing countries. Here, we attempt to capture the impact of food safety standards on seafood exports[2] from India. The contribution of Indian seafood industry to the economy is significant in terms of both employment and foreign exchange earnings. The industry employs over one million fishermen and around two million workers (half of them women) mostly in the post harvest stage. The sector earns a foreign exchange of around US $ 1900 million. Any change in international food safety standard would immediately affect the export firms, which become vulnerable to face more stringent scrutiny and possible rejection of their consignments. The contentious debate on the balance between environmental and public health concerns, and multilateral trade obligations necessitates empirical analysis on the various effects of regulations on trade. Indian seafood sector have been facing increased scrutiny by buyers and

---

1 A broad definition of standard includes mandatory technical regulations as well as voluntary agreements on the quality characteristics of goods and services.

2 In this article the terms seafood, marine products and fishery products are used interchangeably.

regulators especially for product quality and microbiological or chemical contaminations, mainly in the developed countries.

Mandatory standards[3] fall within the purview of the World Trade Organization (WTO), specifically the Sanitary and Phytosanitary (SPS)[4] and Technical Barriers to Trade (TBT) Agreements. These agreements have established international rules that aim to prevent mandatory standards impeding trade unless they are required to achieve a legitimate objective and, in such circumstances, to ensure that the measures applied are least trade distortive. Quantifying the trade impact of SPS measures is essential to resolve trade disputes and to provide a basis for calculating compensation claims. As Otsuki *et al.* (2001) pointed out; one major issue in trade policy is to compare the compliance costs of exporters with possible gains from complying. In the survey of the methodologies for quantifying the effects of SPS measures on trade, Beghin and Bureau (2001); Ferrantino (2003) note that estimating the trade forgone as a result of stringent SPS measures is an important step. They mentioned that a comprehensive impact assessment of SPS measures is necessary for the following reasons; 1) to address the role to be given to non-tariff instruments and barriers in a future trade agreement and 2) to inform governments the costs of their SPS policies and provide the tools necessary to define more efficient solutions and regulations. Without quantification of the trade effect of SPS and TBT, it is unclear as to how significant they are as trade barriers. The direction and magnitude of the impact of SPS measures are essentially an empirical issue.

---

3 Mandatory standards are also termed as technical regulations, are standards set by public institutions (in particular regulatory agencies) with which compliance is obligatory.

4 The Agreement on the application of Sanitary and Phytosanitary measures entered into force with establishment of WTO on January 1st 1995. The SPS Agreement establishes international rules on how to apply SPS measures. The purpose of the Agreement is to allow the legitimate protection of life and health to take place, while avoiding giving rise to illegitimate protectionism. Protectionism in this regard is defined as trade barriers over and above what is required to meet desired protection levels.

Unnevehr (2003) documents four cases from developing countries whose access to export markets was denied due to sanitary or phytosanitary issues, resulting in substantial costs in terms of lost sales, market share, and investments required to re-enter export trade. They included fish from Kenya, raspberries from Guatemala, shrimp from Bangladesh and horticultural crops from Guatemala, Jamaica and Mali. Otsuki *et al.* (2001) investigated the effect of aflatoxin[5] standards in the EU on Africa-EU trade flows and health risks. They examine three regulatory scenarios: standards set at pre-EU harmonized levels, the standard set by Codex Alimentarius Commission (CAC)[6], and the new harmonized EU standards. The human health implications of strengthening aflatoxin standards come from risk assessments conducted by the Joint FAO-WHO Expert Committee on Food Additives (JECFA). Using a gravity model, which includes aflatoxin standards as one of the explanatory variables, they predicted the effect of changes in the aflatoxin standard on trade flows between Africa and Europe. They conclude that compared to Codex standards, the implementation of the new harmonized aflatoxin standard in the EU would reduce health risk by approximately 1.4 deaths per billion a year, but would simultaneously decrease African exports to the EU by about US $670 million.

Jaffee and Henson (2005) provide a different picture by arguing that standards are not necessarily barriers for developing countries. They estimate the value of agro-food exports from developing countries rejected at the border due to SPS measures at about US $1.8 billion, 74 per cent of which is accounted for by middle-income countries. The estimated value of low-income country agricultural and food product trade rejected at the border of importing country is US $275 million,

5 Aflatoxins are a group of toxic substances that contaminate certain foods and have been associated with acute liver carcinogens in humans and animals.

6 The Codex Alimentarius Commission was created in 1963 by FAO and WHO to develop food standards, guidelines and related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme.

representing just less than one per cent of the agricultural and food exports of these countries. Other recent works on quantifying the impact of SPS regulations are Bakshi (2003) and Gebrehiwet (2004). Bakshi (2003) looked at the markets for Mexican avocados and examined the effect of demand, supply, imports and prices of partial easing of SPS barriers to trade in the US markets. Gebrehiwet (2004) quantifies the trade effects of SPS regulations on South African exports to the markets of Organization for Economic Cooperation and Development (OECD) countries by employing a gravity model, focusing only on a single regulation.

Marine products have long been the most buoyant among Indian export lines, following the imposition of stringent quality controls for marine products after the SPS regulations came into force. The demand for stringent and high hygienic standards in the production and processing facilities greatly increased, after the stipulation of Hazard Analysis Critical Control Point (HACCP) by United States Food and Drug Administration (USFDA), European Community (EC) directives (especially EC91/493[7]). The Government of India responded to these developments by taking important steps to maintain higher quality standards based on the health safety regulation requirements of the importing countries. The Seafood Exporters Association of India (SEAI) claims to have spent US$25 million on upgrading their facilities to meet the food safety regulations of the importing countries. The resultant impact on the structure of supply chains can have significant economic and social consequences for developing countries. In many cases, this impact reflects the fact that investment in upgrading supplie chains and/or regulatory systems has not been correlated with the expansion of exports. On the other hand, there can be very positive returns in terms of continued and expanded access to high-value markets for those exporters that are able to comply with. The case of seafood exports from Kerala

7 EC Directives (91/493/EEC) for Fish and Shellfish quality

provides a manageable case study that throws light on the challenges faced by exporters in India as a whole. At the same time, it highlights the particular challenges faced by the Kerala seafood sector that reflect the distinct manner in which it has evolved. In the present study we put forth two hypothesis, 1) The evolving stringent food safety standards imposed by the developing country export markets are trade restrictive to the Indian seafood export, 2) such a rise in standard will not only affect the export firms alone but also the entire supply chain will have to adjust accordingly. In other words there would be a possible reshuffling and restructuring of the supply chain.

As far as hypothesis 1 is concerned, for quantifying the effects of stringent food safety standards on Indian seafood export, a gravity analysis is performed and export competitiveness in the overall ambience of regulations is measured using constant market share analysis. To test hypothesis 2, a case study of seafood export sector in Kerala to analyze the implications of standards related parameters on market structures and small-scale farmers, laborers and firms in export oriented supply chain is also conducted.

1.1 Sources of Data

Data on international trade are sourced from the Commodity Trade Database (COMTRADE) of the United Nations Statistics Division. The data used are for the period 1995 to 2006 (12 years). Select bilateral trade data are also taken from the Statistical bulletin of the Marine Products Export Development Authority (MPEDA), Cochin. The study focused on member countries of the EU, Organization for Economic Co-operation and Development (OECD)[8] and select countries in Asia. As CMS analysis covers a longer period, especially base and current years, the composition of countries varies when compared to that of gravity

8 There are overlapping member countries in EU and OECD. EU has more stringent standards regime compared to general OECD policy on food safety, though EU members are included in OECD.

analysis. The selection of countries in each analysis is also based on the value of trade (with regard to relevant years in the analysis) with India. The commodities covered are (Fish and fishery products, frozen shrimp, squids and cuttle fish)[9]. The variables like gross national product (GNP) and population are taken from the UN Statistical Division's database. They are taken in constant US dollars of 1995. Data on *cadmium* regulations are sourced from a range of databases which include USFDA, Codex reports and the European Commission Regulations (EC) No 466/2001.

2. Quantifying the Trade Effects using Gravity Model

Quantifying the elasticity of regulation is much complex since regulations affect market supply and demand in various ways. Some studies (Otsuki *et al.*, 2001; Wilson and Otsuki, 2004, and Roberts and Unnevehr, 2004) assume a hypothetical relationship between food safety, and the forces of demand for and supply of safe food. Information on regulations (such as maximum permissible levels[10] of contaminants as numerical values) could be used in the model as explanatory variables. Among the regulations on food safety issues, the ones on the maximum permis-sible level of aflatoxin and pesticide residue are unique in a way that can be expressed in terms of numerical values, making them ready to be used in econometric models as independent variables. A positive

9 The Harmonized Commodity Description and Coding System (Harmonized System, or HS), is adopted for fish and fishery products, frozen shrimp, squids and cuttle fish respectively.). Fish and fishery products (HS 92 Code: 03) Frozen shrimp (HS 92) Code 030613, Squids (HS92) Code 30741 and Cuttle fish (HS 92) Code 30749. Squids and cuttle fish added/grouped together and hereafter referred to cephalopods. Fish and fishery products form the aggregate of all marine products while shrimp and cephalopods are disaggregated level marine products. The Harmonized Commodity Descrip-tion and Coding System (HS) is an internationally standardized system of names and numbers for classifying traded products developed and maintained by the World Customs Organization (WCO). HS is a six-digit nomenclature.

10 Maximum permissible level can also be mentioned as maximum residue level (MRL).

coefficient indicates that the regulation is trade restrictive. The coefficient is ex-pected to be positive if this standard impedes trade. This implies that the coefficient for the regulation (maximum permissible level) implies that the change in the value of trade for an incremental change in the regulation (numerical value of maximum permissible level).

Two models are considered from the strand of literature which employed gravity model to arrive at the elasticity of the trade effects of regulations. Otsuki *et al.* (2001) estimated the impact of changes in the standard for the presence of aflatoxin levels in the EU on bilateral trade flows using trade and regulatory survey data for 15 European countries and 9 African countries between 1989 and 1998. The study concluded that a 1 percent reduction in the maximum permissible level of aflatoxin in cereals and dried fruits and nuts would reduce trade flow by 1.1 percent for cereals and 0.43 percent for dried fruits and nuts. In another study, Wilson and Otsuki (2004) have examined the trade restrictiveness of pesticide residue standard on banana exports from 19 developing countries. The study examined the trade impact of the proposed and more stringent standard of the OECD on pesticide chlorpyrifos. An expanded gravity equation was used to estimate the trade elasticity of the proposed regulation. The results indicated a negative effect of chlorpyrifos standard imposed by the OECD countries on banana exports from the select exporting countries. A 10 percent increase in regulatory stringency - tighter restrictions on pesticide residues - leads to a decline of banana imports by 14.8 percent, suggesting that the restrictiveness of higher food safety regulations imposed by importing countries can be considerable.

Otsuki *et al.* (2001); Wilson and Otsuki (2001) have provided valuable inputs to the debate allowing conclusions to be drawn on the effective impact of food safety measures which had significantly reduced international trade for certain sensitive products especially agro-food products. Having reviewed the limited existing literature on the quantification of the effects of public health regulations on commodity trade, it is proposed to employ a similar model to estimate the effect of a similar regulation in the context of Indian seafood exports. This analysis addresses the specific question on how much trade restrictive (trade effect or elasticity of regulation) are the Maximum Residue Limit (MRL) on *cadmium*[11] for Indian seafood export in the export markets in the OECD and Asia. The difficulties in quantifying a range of different types of regulatory standards and restrictions are widely acknowledged. While recognizing the difficulties and limitations of such exercises, it is useful to obtain at least some (admittedly crude) quantitative assessment of the effect of regulations on *cadmium.*

The gravity model in international trade predicts bilateral trade flows based on economic 'mass' (using GDP measurements) and 'force' (using distance) between two units. For long, the gravity equation has been used, with many studies successfully accounting for the variation and over time, in the volume of trade flow across country pairs. The later versions of gravity models have focused more on other variables like tariff lines and preferential trading arrangements (PTAs). Classical gravity models generally use cross-section data to estimate trade effects and trade relationships for a particular time period. But cross-section data observed over several time periods (panel data) result in more useful information than cross-section data alone. The advantages of this method are (1) Panel data can capture the relevant relationships among variables over time, (2) Panels can monitor unobservable trading partner's individual effects, (3) If individual effects are correlated with the regressors, the Ordinary Least Squares (OLS) estimates will be biased. Therefore, it is more ideal to use the Generalized Least Squares (GLS) estimation so that individual effects are captured. This also successfully tackles the problems of heteroscedasticity and autocorrelation. These are the prime considerations in employing panel data for estimations.

11 Appendix 1

Some additional terminology associated with panel data describes whether some observations are missing. A balanced panel has all its observations, and unbalanced otherwise.

Panel data can be estimated using various methods which include fixed effects, random effects and mixed models. Fixed effects[12] estimation is a method of estimating parameters from a panel data set. The fixed effects estimator is obtained by OLS on the deviations from the means of each unit or time period. This approach is relevant when one expects that the averages of the dependent variable will be different for each cross-section unit, or each time period, but the variance of the errors will not. The essential difference between fixed and random effects is that the one associated with the error term. When the individual effects are important for the interpretation then binary variables are introduced to capture either the cross section or time effects, which otherwise simply accrue to the error term. Within effects fixed effects estimator estimates individual effects first which do vary across entities but do not vary across time periods. But time specific effects can be extracted by employing binary variables for time as well. Thus, the model will have n - 1 entity specific binary variables and t -1 time specific binary variables.

2.1. Model Specification and Estimation

Using the available data set, we estimate three gravity models of seafood trade from India: (1) for the total fish and fishery products (aggregate level) exports from India (2) For the shrimp exports from India (3) For the cephalopod exports from India. The shrimp and cephalopods contribute a major share in the value of seafood exports from India. More over, it is very important to look at the disaggregate level of seafood exports to get a better insight on the issue of food safety standards and the trade relations.

12 Appendix 2

To determine the elasticity of food safety on Indian seafood exports (for all the scenarios mentioned above) the following model is considered:

$$ln(X_{ij})^t = b_0 + b_1 ln(GNP_i)^t + b_2 ln(GNP_j)^t + b_3 ln(PCGNP_j)^t + b_4 ln\ (PCGNP_{ji})^t + b_5\ ln\ (TGDP_j)^t + b_6\ ln\ (TGDP_i)^t + b_7\ ln(ER_{ij})^t + b_8\ ln(INF_i)^t + b_9\ ln(TIMP_j)^t + b_{10}\ ln(CAD_j)^t + b_{11}\ ln\ (DIST_{ij})^t + e_{ij} \quad (2.1)$$

where the dependent variable $ln(X_{ij})^t$ denotes value of exports of seafood from India (*i*) to countries (*j*) in year *t*. GNP_i, $PCGNP_i$, GNP_j , $PCGNP_j$ stand for the real GNP (expressed in 1995 US $) and percapita GNP of exporting and importing countries respectively. $PCGNP_{ij}$ is the product of percapita GNP of exporting country and importing countries. *DISTij* is the geographic distance between exporter and importers. Initially the variables *ER* and *INF* are considered so as to capture the effects of changes in exchange rate between the exporting and importing countries and inflation in the exporting country. All these values are in natural logarithms. $TGDP_i$ and $TGDP_j$ are the trade-GDP ratio of the exporter and importer respectively to capture the effects of openness of the economies. A unidirectional gravity model is used where India's exports to 35 countries in case of total seafood exports and shrimp exports and 27 countries in case of cephalopod exports are modeled by taking food safety standard/sanitary regulation as the key independent variable, apart from the typical gravity variables such as size of the economy and geographic distance. For the regulatory variable, the maximum residue limit (MRL) on *cadmium* in the model is used as an independent variable. All observations are annual for the period 2001-2006, making the total number of observations 210 in first two scenarios and 162 in the third scenario. Use of the gravity model is ideal to get the level of trade restrictiveness of the MRL of *cadmium*, which is a numerical value directly employable in the equation. Wherein *ln(CAD)* in equation is the variable for food safety, given as the maximum permissible level of cadmium in OECD and Asia.

The gravity model of India's seafood exports has been estimated taking all the explanatory variables in equation (2.1) for all the observations. There are many variables which are found to be either insignificant or having strong multicollinearity, which were dropped. The variable for ER (Exchange rate) and INF (inflation) were also found to be insignificant and having multicollinearity. Here the variable *TIMPj* is total import of fish and fishery product of importing country j. Thus, dropping out a few variables, the final estimated gravity equation is the following:

Scenario 1

Fish and Fishery Products

$\ln(X_{ij})^t = b_o + b_1 \ln(TGDP_j)^t + b_2 \ln(PCGNP_j)^t + b_3 \ln(CAD_j)^t + b_4 \ln(DIST_{ij})^t + e_{ij}$ (2.2)

In the equation, *i* denote the exporting country, *j* denotes the importing country and *t* denotes year $ln(X_{ij})^t$ is the value of exports of total fishery products from India to various countries (35 countries in the OECD and Asia). $ln(PCGNPj)^t$ stands for the per capita GNP of the importing country. The proxy for transportation costs are captured by the variable $ln(DISTij)^t$ which stands for the geographical distance between exporters and importers. There are some limitations associated with the measure of distance, as they are taken from the Great Circle Distance, and represents the distances between country capitals, which may not represent the actual distances between commercial ports or cities. $ln(CAD_j)^t$ is the variable to capture the trade effects of food safety stringency, given as the MRL on *cadmium* in OECD and select Asian countries. The model employs variable to capture the effects on trade as a consequence of trade liberalization. This is the openness variable represented by trade-GDP ratio, in the equation as $TGDP_j$ and e_{ij} is the error term assumed to be normally distributed.

In the estimation, individual effects are included. The estimation has followed fixed effects specification so as to get individual coefficients for all countries. So fixed effects is estimated after carrying out *Hausman test*[13] (the test to decide whether to adopt fixed effects or random effects specification) which favored the fixed effect model. Dummy variables for countries (*i* " 1, where *i* = 1…35) are employed as independent variables, so that the effects on heterogeneous intercepts (countries) are isolated. The GLS regression is used which is corrected for heteroscedasticity and autocorrelation in the first step of the estimation. As one of the methods of estimating individual effects in the presence of time invariant regressors, transformation is used for estimations. The first step of estimation is done using all variables except distance and regulatory variables for 210 observations. There is a problem with variables such as distance and regulation as the inherent transformation wipes them out if used along with other variables in the first estimation, because they do not vary across time. However, this problem is solved by estimating these variables in a second step, by running another regression with the individual effects as dependent variable and distance and regulatory variables as independent variables as described in the model below:

$$IE_{ij} = b_0 + b_1 ln(DIST_{ij}) + b_2 ln(CAD_j) \qquad (2.3)$$

Where, IE_{ij} are the individual effects, which are the individual country coefficients in the first step of estimation.

Scenario 2

Shrimp Exports

$$\ln(X_{ij})^t = b_o + b_1 \ln(TIMP_j)^t + b_2 \ln(TGDP_j)^t + b_3 \ln(CADj)^t + b_4 \ln(DIST_{ij})^t + e_{ij} \qquad (2.4)$$

---

13 Appendix 2

Here the variable *$TIMP_j$* is total import of fish and fishery product of importing country and the remaining variables are same as mentioned in equation 2.2.

Scenario 3

Cephalopod Exports

$\ln(X_{ij})^t = b_o + b_1 \ln(PCGNP_{ij})^t + b_2 \ln(TGDP_j)^t + b_3 \ln(CAD_j)^t + b_4 \ln(DIST_{ij})^t + e_{ij}$ (2.5)

Here the variable *$PCGNP_{ij}$* is product of percapita GNP of exporting and importing countries.

2.2. Results and Interpretations

The estimated coefficients for the variables are described in table 2.1. Coefficients estimates can be interpreted as elasticities, as the model is estimated in the log linear form. In the model, the coefficient of the GNP per capita is positive and highly significant. This implies that India tends to export more to high income economies. India's export to country *j* increases by 0.628 percent as the per capita GNP of importing increases by one per cent.

Table 2.1: Gravity analysis for fishery exports

Variables	Coefficients	Standard error
$lnTGDP_j$	.807	.402*
$lnPCGNP_j$	.628	.205**
$lnCAD_j$	.714	.328*
$lnDIST_{ij}$	-1.048	.415**
No of Observations	210	
Adjusted R^2	.92	

, indicates significance at 5% and 1% levels respectively*

The regulation is found to be trade restrictive. The coefficient of the regulatory variable is positive and significant. The magnitude of the coefficient, which can be described as the elasticity of *cadmium* MRL, shows moderate response (in comparison with the coefficients of regulations which has been reviewed in this section) to regulations. The value of 0.714 means that a 10 percent tightening of regulatory stringency or a reduction in the maximum permissible level of *cadmium* will result in a reduction of exports by 7.14 percent. The positive sign of the regulatory variable also has to suggest that total fishery imports are greater for a country that has less stringent regulation on *cadmium*. The trade-GDP ratio of importing country, the openness variable, has the expected positive sign and is significant. The coefficient of this variable is 0.807 which means that India can further increase its exports by liberalizing exports. The distance variable is significant and has the anticipated negative sign, which indicates that India tends to trade more with its immediate neighboring countries during the period of food safety regulations. The co-efficient value is -1.048 which indicates that when distance between India and country *j* increases by 1 percent, the bilateral trade between the two countries declines by 1.048 percent.

Table 2.2. Gravity analysis for Shrimp exports

Variables	Coefficients	Standard error
$lnTIMP_j$	1.028	$.254^{**}$
$lnTGDP_j$	-1.732	$.681^{**}$
$lnCAD_j$	0.782	$.424^{*}$
$lnDIST_{ij}$	-1.187	.690
No of Observations	210	
Adjusted R^2	.90	

, indicates significance at 5 %and 1% level respectively*

The variable $TIMP_j$ denotes the total import of fish and fishery products in the importing country *j*. The coefficient was found positive and highly significant which means as the total import of fish and fishery product of the importing country increases by 1 percent the shrimp import do increase by 1.028 percent reflects that the shrimp import of the importing country is directly proportional to the import propensity of fish and fishery products of the country. In tune with what we have already observed in case of total fish and fishery products here also the regulation is found to be trade restrictive. The coefficient of the regulatory variable is positive and significant. The magnitude of the coefficient, which can be described as the elasticity of *cadmium* MRL, shows moderate response to regulations. Here the value 0.782 means that a 10 percent tightening of regulatory stringency or a reduction in the maximum permissible level of cadmium will result in a reduction of exports by 7.82 percent. The positive sign of the regulatory variable also has to suggest that total fishery imports are greater for a country that has less stringent regulation on *cadmium.* Surprisingly on contrary to the result in scenario 1, the trade-GDP ratio of importing country, the openness variable, is negative and significant. The coefficient of this

Table 2.3. Gravity analysis for cephalopod exports

Variables	Coefficients	Standard error
$LnPCGNP_{ij}$	.442	.190**
$lnTGDP_j$	1.48	.507*
$lnCAD_j$	-.97	.525*
$lnDIST_{ij}$	1.9	.987*
No of Observations	135	
Adjusted R^2	.86	

, indicates significance at 5 %and 1% level respectively* variable is 1.732. Considering this result with the coefficient of *cadmium*, it supports the hypothesis that regulation may have a trade diversion effect to less liberated economies during the period under study. However, even among the OECD countries during the period trade must have been diverted to countries which have experienced relatively low trade openness in comparison with other OECD countries. The distance variable is significant and has the anticipated negative sign.

Differing from the earlier results we obtained in scenario 1 and 2, in case of cephalopods export model the coefficient of regulation has significant negative value, which indicates the trade augmentation aspects of stringent standards in case of cephalopod exports. The magnitude of the coefficient, which can be described as the elasticity of *cadmium* MRL, shows value of 0.97 means that a 10 percent tightening of regulatory stringency or a reduction in the maximum permissible level of *cadmium* will result in an increase of exports by 9.7 percent. The negative sign of the regulatory variable also has to suggest that total cephalopod exports from India have positively responded to countries with stringent regulation on *cadmium* during the period under consideration. The product of per capita GNP of India and the importing country was found positive and significant. This implies that India tends to export more to high income economies. India's export to country *j* increases by 0.442 percent as the product of per capita GNP of India and importing country increases by 1 per cent. The trade-GDP ratio of importing country, the openness variable, has an expected positive and significant. The coefficient of this variable is 1.9. The distance variable is significant and has the positive sign, which indicates that in case of cephalopods India tends to trade more with distant countries (mainly OECD Countries) where the food safety regulations are relatively more stringent than the Asian countries. The co-efficient value is 1.9, which indicates that when distance between India and country *j* increases by 1 percent, the bilateral trade between the two countries escalates by 1.9 percent.

The individual country effects[14] indicate the propensity to export which are also the intercepts of the regression. There are several countries which show a high propensity to import from India. The country specific effects are significant for 25 countries incase of total fishery exports and 20 countries in case of shrimp exports. In the case of cephalopod exports 21 countries have shown significant individual effects. They are mostly from the OECD, exhibiting strong effects. Thus, OECD countries are major outlets for Indian fishery products. This reinforces that food safety regulations that these countries impose may have significant impact on Indian exports as the value of the coefficient indicates, adequately reflecting the policies of the OECD with regard to food safety regulations on the imports of agro-food products from developing countries.

Here, we have analyzed three scenarios of seafood exports from India to OECD and Asian countries. The first two scenarios where total seafood export from India at an aggregate level and shrimp exports show the trade restrictiveness of the maximum residue level of cadmium, while in scenario 3 where we considered cephalopod exports from India has shown trade augmenting aspect of the stringent food safety regulations. Thus, the analyses exhibit the dual nature of the stringent quality measures at the disaggregate level of the seafood items. Another point worth emphasizing is that there can be other important variables which are not included in the model (mainly due to data and estimation problems). Here, the gravity analysis is used as a desirable exercise to indicate the direction and magnitude of the effect on exports and has to be seen in this perspective. Thus, one of the arguments of this section also include that dependence on one model alone may not reflect all the theoretically attributed border effects. Thus, the major concern is whether access to growing markets could be retained.

---

14 Appendix 2

3. Constant Market Share Analysis

The extensive application of Constant Market Share (CMS) norm belongs to two main categories. The simpler version statistically decomposes the source of export performance and distinguishes between changes in market penetration (market share) and changes in the size of these markets (market size). Thus, here CMS analysis uses aggregate export data to measure the difference between constant share norm and actual export performance. By this procedure, export performance is assumed to be invariant regarding commodity disaggregation.

The more comprehensive version of the CMS analysis takes into account the commodity composition effect along with market size effect and competitiveness effects. In this method, competitiveness is actually a residual term. First applied to export growth by Tyszynski in 1951, this approach has since then been employed by many authors. Richardson (1971) gives a critical treatise on the competitiveness term of the CMS analysis. Merkies and van der Meer (1988) provide further theoretical grounding for the CMS approach. It has also been employed in studies (Marjit and Raychaudhary, 1997; Kumar, Sen and Vaidya, 2002; Veeramani, 2007) to analyze India's export performance in terms of general competitiveness. These studies try to explain a country's export performance in terms of general competitiveness.

CMS analysis has been frequently used to examine the various factors behind growth in exports. However, the approach has been subject to limitations that should be kept in mind when interpreting the results of its application. First, the approach is sensitive to the choice of beginning and end-points, and may produce volatile results if the period chosen happen to be exceptional. Here, a period that is long enough is chosen to reduce this possibility. Further, they have been taken as annual arithmetic averages to further reduce any serious inter-year variations. Second, the competitiveness effect is only a catch-up component in export growth, so in addition to competitiveness *per se* it can possibly encompass other factors that may not be directly related to competitiveness (such as peculiar trade policies in exporting and importing countries). In practice, it is rather difficult to separate the impact of pure competitiveness from other factors that may affect the growth in exports. At the same time, it provides valuable inputs and indications on the share of the market, size of the market and the retention of the overall share due to supply conditions and the policies of the exporting and importing countries.

3.1. CMS Model Specification

The following analysis throws light on India's export performance in the importing countries (OECD, and select Asian countries). The method of CMS analysis, modified for a single commodity case, is an ideal complement to the gravity analysis in the previous section. The data requirement, however, remains more or less similar. It should be emphasized that the CMS analysis is merely a measurement technique for decomposing the growth of a variable, and should not be viewed as a behavioural relationship. This model decomposes the source of export performance and distinguishes between changes in market penetration (market share) and changes in the size of these markets (market size). $(x^1 - x^0)$ in equation 3.1 refers to the growth in exports i (individual destination countries), which is decomposed into three components of export performance on the right hand side of the equation. The method is applied to individual markets, so that the country composition effect term is dropped, producing the follow-ing decomposition of export growth:

$$x^1 - x^0 = S^0(X^1 - X^0) + \Sigma_i(S_i^0 - S^0) * X_i^1 + (x^1 - \Sigma^i S_i^0 X_i^1) \qquad (3.1)$$

Where,

x = value of India's exports of seafood to major export markets.

S = India's market-share of total exports of seafood to major export markets

S_i = India's market-share of total exports of seafood to member countries i in major export markets.

X = total exports of seafood to major export markets

X_i = value of total exports to the member countries i in major export markets; the superscripts *0* and *1* refer to the base period and subsequent period respectively.

Size of the market effect refers to the change in quantity of total exports to *i* over the period, (X^1-X^0). If this increases / declines, then even with a constant market share ($S°$), then exports will increase / decline by $S^0(X^1-X^0)$. The size of the market effect results from a shift in the demand in major export markets. Market Composition Effect refers to the changes in the export shares in individual member countries *i* compared to its overall share in the group, in the base period $S_i^0-S^0$. Competitiveness effect measures the difference between actual exports in the subsequent period, x^1 and the level of exports that would have occurred had the same base period market share in each country $(x^1-\Sigma iSi0\ Xi^1)$ been maintained. It indicates the extent to which a country is able to gain international market shares in spite of adverse world demand movements. It is often interpreted as an indication of the dynamic ability of a country to respond to changing environment and adapt its supply situations accordingly. Thus, it decomposes the export growth into the size of the market and market composition effects thereby isolating competi-tiveness effect $(x^1-\Sigma^i S_i^0 X_i^1)$ which is a residual term in the equation.

The underlying assumption of the CMS approach is that base period export shares are maintained in other market periods. The three structural components of the market share are calculated under this assumption. The total growth effect $(x^1 - x^0)$ is equal to what the country's growth in export would have been if it had just maintained its share of total world exports. The market composition effect ac-counts for any additional growth (positive or negative) which takes place because the focus country's exports have grown in pace with the total growth in export of the commodity to the importing region as a whole. These three effects all hypothesize constant export shares. The residual effect $(x^1\text{-}\Sigma^i S_i^0 X_i^1)$, which proves the identity, accounts for all the growth which arises from changes in export shares.

3.2. Results and Interpretation

The constant market share analysis is performed for the exports (quantity) of shrimp and cephalopods[15] to the major export markets in the world (OECD and selected Asian countries) for the period 1995-2006. The analysis covered the whole period as annual arithmetic averages for three consecutive years. For example, 1995-2006 implies that it has covered the period 1995, 1996, 1997 for the base period and 2004, 2005, 2006 for the current period. The results are summarized in Table 3.1.

Table 3.1. Decomposition of Shrimp and Cephalopod Exports

Components	Shrimp	Cephalopods
Size of the market effect	92.62	20.08
Market composition effect	-33.06	25.34
Competitiveness effect	40.43	54.56

In case of shrimp competitiveness effect explains only around 40 percent of the growth in exports during 1995-2006. The market composition effects indicate the loss of market share to other exporters. On the whole, the increase in exports is well explained by the enhanced demand alone. On the other hand, cephalopod export is relatively competitive when compared to shrimps during the same period. The competitiveness effect dominates the increase in exports to major

15 The analysis for fish and fishery product (aggregate level) was not carried out because of the non availability of data on quantity of exports at aggregate level.

markets, which explains around 55 percent of growth in cephalopods export during 1995-2006. Thus the food safety regulations in the EU which is the major importer of cephalopods from India has in fact augmented the increase in competitiveness of the cephalopod exports, while in case of shrimp the competitiveness is less. However, the competitiveness factor cannot be attributed to single factor of export determinant like food safety regulations but these figures are the modest indicators of different export determinants. The structural components are calculated on the assumption that a base period market shares are maintained. However, these components may as a result, encompass a number of residual and other factors that are not necessarily associated with competitiveness such as discriminatory non-tariff barriers. At best, these figures are the modest indicators of the different forces that are in action at the international markets for Indian seafood. However, the main purpose of conducting the CMS analysis was to observe any complimentary /supplementary relation to the gravity analysis conducted in previous section, where we have observed contrasting results at disaggregated commodity level of seafood exports. We have also found that gravity analysis of shrimp exports revealed trade restrictive nature of the stringent food safety regulations while, the analysis of cephalopod exports suggested the trade augmenting facet of food safety standards. In this light, we can argue that the CMS analysis supplements the results of gravity analysis conducted. The dominant competitiveness effect of cephalopods revealed through CMS analysis goes in tune with the trade augmenting results of cephalopods we obtained through gravity analysis. On the other hand the gravity analysis of shrimp exports revealed trade restrictiveness due to food safety stringency in export destinations which goes well with the results of CMS analysis of shrimp where the competitiveness effect explained very less in the overall increase in market share during 1995-2006.

The results obtained from the gravity model and CMS analysis obviously triggered the curiosity on cephalopods, and has lead to the finding that Kerala is the major producer and exporter of cephalopods from India (Appendix 4). Subsequently, we looked for Kerala's sanitary and phytosanitary compliance records *viz a viz* other states in India. Going by the evidences, Kerala has a better record of compliance. It was found that during 2006, Cochin (the major seafood export hub of Kerala) has received only two complaints regarding non-compliance of seafood exports which is the lowest number of complaints among the seafood exporting states (ports) in India (table 2, appendix 4). The number of complaints of non-compliance has reduced drastically during 2002 -2007 (Table 3, Appendix 4).

These evidences solve to a great extent the puzzle generated in section 2 and 3, where we found that in case of gravity analysis the maximum residue limit (stringency) on *cadmium* has a positive impact on cephalopod exports from India. Moreover, the CMS analysis has revealed the dominance of competitiveness in cephalopod marketshare. Kerala is the major exporter of cephalopod from India and food safety compliance ability of seafood exporters in Kerala is far better than other states in India. This would be the logical answer to the puzzle posed during gravity and CMS analyses.

Kerala's seafood export sector presents a positive case of the efforts to comply with the stricter food safety requirements in export markets. However, challenges still remain. To understand the specific industry level changes experienced during the food safety regime, a detailed study on Kerala seafood export sector is been carried out in the next section as a micro level case.

4. The Case Study: Kerala Seafood Export Sector

Since 1997, the EU has been imposing a set of food safety regulations on India's fishery exports, leading to a conditional ban on seafood exports and a subsequent crisis within the fish processing and export industry when the required standards could not be met. The new

EU standards were followed by the enforcement of the seafood HACCP law in the US from December 1999. In response, the fish processing and exporting industry successfully engaged in learning and innovation activities with the support of government institutions. But the institutional finance commensurate with the need was not forthcoming. As a result, many processors had to divert their working capital resources for upgradation of their plants. This coupled with the uncertainty prevailed in the international markets had adversely affected the seafood industry. A large number of seafood units became sick and non-viable. With a large number of seafood exporters facing recovery actions by financial institutions, the industry was looking for an exit route for non viable units.

EU has been the major destination of Kerala's marine exports. EU holds around fifty percent share of Kerala*'s* exports during 2005-2006. Thus, any policy shock from the EU can have significant impact on Kerala*'s* seafood exports. Japan and US are other major markets with around 12 percentage shares in value of export (table 4.1).

Table 4.1: Market wise export share of marine products from Kerala

Export value (in percentage)

Country/Year	2001-02	2002-03	2003-04	2004-05	2005-06
Japan	18.75	13.1	18.74	15.40	11.76
USA	17.5	18.37	12.92	12.01	11.56
EU	42.37	48.35	47.77	49.50	50.32
China	6.7	7.14	7.01	6.41	7.98
South East Asia	6.5	5.31	4.46	5.18	5.53
Middle East	2.84	3.22	3.28	5.04	4.86
Others	5.36	4.52	5.55	6.45	8.00

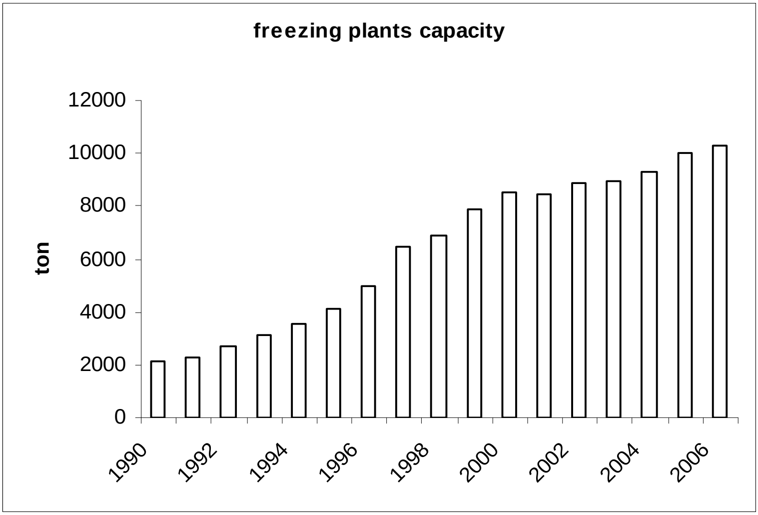
Source: Kerala Planning Board Economic Review 2007

EU is the predominant driver behind the food safety controls being implemented in Kerala. There seemed to be a continuous flow of emerging challenges, most of which originally come to light through border detentions. Currently, controls on residues of antibiotics in the EU are a major concern, not only for India but also for its major competitors. Additional issues include limits on heavy metals (like *cadmium*) and other environmental contaminants. For all of these concerns, it is clear that the EU imposes significantly stricter controls than Japan and US. Kerala is more dependent on EU and US markets than the rest of India, and the state is dominated by exports of shrimp and cephalopods. EU's food safety requirements related to general hygiene controls and limits on antibiotics, as well as biological and chemical contaminants, have emerged as the dominant challenge.

4.1. Impact on Seafood Processing Sector

Seafood processing facilities in Kerala traditionally procure the raw material in pre-processed form from the peeling sheds. Products have traditionally been frozen in block form, although an increasing number of plants have installed capacity to manufacture Individually Quick Frozen (IQF) products. How ever, in most cases the value addition is very less and the products exported to EU and US is further processed in the importing countries before they reach final consumer. The evidences from the survey as well as MPEDA records point out that majority of export firms operates with one freezing plant, although there is a shift toward consolidated businesses that operate multiple plants. The seafood industry in Kerala is highly export oriented where a very little share finds its way to the domestic markets The period from 1990s to 2006 has witnessed significant increase in processing plant capacity as may be seen from Figure 4.1, but the availability of raw material for processing has not kept in pace with the capacity build up in processing sector which has ultimately resulted in less than 25 percent capacity utilization of the processing plants.

Figure 4.1 freezing plants capacity during 1990-2006



Source: MPEDA

The rapid expansion of the processing sector during the 1990s, did not keep pace with the emerging requirements of India's export markets, especially the EU. Even the new export processing facilities established during the period did not pay much attention to the importance of food safety standards and quality parameters. The standards of hygiene in the processing sector have shifted to an entirely different platform only after the EU ban on Indian exports in 1997. The compliance cost across the surveyed plants varied from US$0.057 million to $0.88 million. The average compliance cost across the seafood processing firms was found to be US$0.40 million, which is at least a modest indicator of the investment cost spending per processing units for maintaining market access to the EU. The changes required to comply with the hygiene requirements varied significantly among fish processing plants. In extreme cases, plants had to be extended and/or the entire layout needed to be changed. According to the majority of the exporters the integrated pre processing facility was the major item among the compliance cost components. In fact the integrated pre processing facility is a mandatory requirement according to the Export Inspection Council (EIC).

More over the Processing plants also had to implement significant changes to their operational procedures. The majority had not implemented HACCP. These plants were required to establish the necessary plans, control procedures, and documentation systems. Furthermore, cleaning, maintenance, and rodent and pest control procedures had to be enhanced. In many cases, quite extensive programmes of workers' training had to be undertaken. The cost of implementing these new procedures has, in many cases, been considerable including laboratory analysis, record-keeping, ongoing staff training, and maintenance of worker medical records. To undertake these tasks, new technical and supervisory staff had to be employed, and/or better qualified (and more expensive) personnel were needed. Monitoring fee paid to the Export Inspection Agency (EIA) has also increased significantly. In addition, the costs of preprocessing had to be internalized within each processing plant. These costs are significantly greater than purchasing ready preprocessed raw material.

4.1.1 The Levels of Concentration

The levels of concentration in share among the seafood exporters from Kerala are presented in table 4.2. The concentration in market share is evident, as a few firms hold a large share of exports. Nevertheless, the pattern of change in concentration is very interesting. During the year 2002-03 there was only one firm holding more than INR 500 million[16] business turn over, while during 2006-07 there were nine firms having a share of more than INR 500 million businesses turn over. The number of firms over the years has declined, or more specifically a consolidation of export firms is happening.. The concentration ratio is

16 INR is the abbreviation used for Indian Rupees

found to be stable without any increase; rather the concentration ratio has declined during 2006-07 in comparison with the 2003-04 (table 4.3). It seems that the dominant trend over the next few years in fish processing node of the export value chain will be both consolidation and concentration.

Table 4.2: Distribution of seafood firms in Kerala according to their business turnover (Firm size measured in Indian Rupees million)

Firm size/year	2002-03	2003-04	2004-05	2005-06	2006-07
500 >	1	2	4	3	9
250-500	6	1	5	9	8
100-250	15	11	17	17	24
50-100	22	18	22	22	22
10-50	54	45	42	22	36
< 10	118	101	71	73	52
Total number of firms	216	178	161	146	151

Source: Authors' compilation

Table 4.3: Change in concentration of seafood firms in Kerala

Year	Total Number of firms	Industry (US $ million)
2002-03	216	215
2003-04	178	243
2004-05	161	257
2005-06	146	285
2006-07	151	339

Source: Authors' compilation

4.2. Impact on the Preprocessing Sector in Kerala

Preprocessing of seafood has been undertaken by independent preprocessing facilities that supply preprocessed materials to the processing plants. These units are called *peeling sheds* and they operate with lower capital and are less organised. Recently, many of the preprocessing units are getting integrated with the processing units. Shrimp, squid, cuttle fish, etc. are brought by the *peeling shed* owners who employ large number of women to peel them. Thus, peeled products are graded and sold to the processing factories for further processing and export. The independent preprocessing sector has played an important role in the fishery economy by absorbing much of the risk associated with fluctuations in raw material prices and carrying the significant fixed and variable costs associated with preprocessing. The stability of the export companies directly affects the depending peeling sheds. With the new regulations based on the EU stipulations more and more factories are needed to have their own pre processing facilities, however even now the pre processing is still done largely in the pre processing centers. It is found that today hardly 50 percent of the sheds operate regularly round the year.

In 2002, around 265 preprocessing units were deregistered from business (MPEDA, 2003). While the number of preprocessing facilities declined during 1997-2006, installed capacity actually increased to around 100 percent per day during that period. Consequently, the average preprocessing plant capacity increased from 2.9 tonnes per day in 1997 to 9.2 tonnes per day in 2006. It could be inferred that the new preprocessing facilities registered have sufficiently large processing capacity.

A survey covering 32 preprocessing establishments was conducted across *Aroor - Chandiroor*[17] belt to get an in depth understanding on the impact of international food safety regulations on seafood preprocessing sector. Out of 32 preprocessing facilities surveyed seven were functioning without MPEDA registration. About 72 percent of the

---

17 *Aroor-Chandiroor* belt is the area where majority of pre processing units in Kerala are located.

labour force was women who worked on a casual basis. The pre processing facilities procure the raw materials either directly from the landing sites or through agents. Most of the pre processing facilities supplied the processed material to one or two exporters on a regular basis for many years thus having a trust based relationship between the exporters and pre-processors. The average annual turnover of the surveyed facilities was around US $ 1 Million. The rough estimate of average capacity utilization was found to be 58 percent. Scarcity of raw materials and working capital were observed as the main reasons for the lower capacity utilization of these preprocessing facilities. Moreover, it was observed that more than 95 percent of labour employed is on a casual basis. In fact, the casualization of the labour has increased over last four years. Thus, the controlled workforce cultures in tune with the improvements in hygienic measures are found to be lacking in these facilities.

The preprocessing facilities witnessed a very drastic change in the operational structure. For example, even the way the workers used to do the pre processing activity has changed. Earlier, the workers used to sit on the floor to do the peeling operations, but due to the mandatory hygienic requirement the peeling operations has to be conducted on a table. Facilities like potable running water, change rooms, cold store, hand wash basins, toilets, staff uniforms and clothing and air conditioning has become mandatory for obtaining the MPEDA approval and subsequent registration. The respondents duly acknowledge the demand and requirements of the exporters in this regard. Thus, the importance of international food safety and quality measures has been properly diffused to this particular node of the seafood value chain of Kerala.

The annual average cost of sanitary improvements of the surveyed pre processing facilities was found to be INR 95,000. The amount spent was ranging between INR 16,000 to INR 0.51 million. The surveyed respondents have reported a rise of 6 percent in production costs. It was also noted that seafood exporters are maintaining a close relationship with the preprocessing facilities and imparting training regarding hygienic standards of the workers and quality measures to be practiced in the pre processing facilities.

Scarcity of adequate financial capital for modernizing the preprocessing facilities and problem of volatile working capital were the major constraints expressed by the respondents. Apart from this the scarcity of fresh water and good quality ice were also expressed. *Peeling shed* operators usually procure seafood from the landing centers from agents or directly from the boat owners on a payment on the spot mode. The raw material is transported to the pre processing facilities and processed in a day or two. Subsequently the raw material is transferred to the seafood processing units. The payment usually takes 3 weeks to 2 months in most cases. On an average, a preprocessor requires INR 0.4 million to 0.6 million per day. Thus, to be in business he has to borrow money from private financials at exorbitant interest rates. This ultimately resulted in the acute financial instability in many cases.

Although most of the pre processing facilities in the business have achieved the required mandatory standards stipulated by MPEDA, the unhygienic house and hut peeling still continues in the surveyed area. These practices lack good quality water and ice and has been carried out without proper supervision and quality checks. Though these facilities are not registered with MPEDA, the exporters do procure from these facilities at cheap rates. The co existence of few unhygienic pre processing operations along with the approved pre processing facilities may deteriorate the improvements made in the quality front.

5. Summary and Conclusions

The present study employs gravity analysis to find out the trade elasticity of a particular regulation (here the maximum residue level of *cadmium* on seafood export at aggregated and disaggregated commodity level). The main purpose of this exercise is to estimate the trade restrictiveness of regulations in the popular econometric framework. In earlier literature, the studies which employed gravity model in the similar context yielded results which indicated a positive coefficient for the regulatory variable suggesting that the tighter regulations will be trade limiting. In the context of Indian seafood exports too, a typical gravity model is employed (choice of variables was mainly drawn from previous literature). Here, we have analyzed three scenarios of seafood exports from India to OECD and Asian countries. The first two scenarios where total seafood export from India at an aggregate level and shrimp exports shows the trade restrictiveness of the maximum residue level of *cadmium*, while in scenario 3 in which, we considered cephalopod exports from India has shown trade augmenting effect of the stringent food safety regulations. Thus, the analyses exhibit the dual nature of the stringent quality measures at the disaggregate level of the seafood items. Here, the gravity analysis is used as a desirable exercise to indicate the direction and magnitude of the effect on exports and has to be seen in this critical viewpoint. The constant market share analysis is performed for the exports (quantity) of shrimp and cephalopods to the major export markets in the world (OECD and selected Asian countries) for the period 1995-2006. The dominant competitiveness effect of cephalopods revealed through CMS analysis goes in tune with the trade augmenting results of cephalopods we obtained through gravity analysis. On the other hand, gravity analysis of shrimp exports revealed trade restrictiveness due to the increased food safety stringency in export destinations which goes well with the results of CMS analysis of shrimp where the competitiveness effect explained very less in the overall increase in market share. At best, these figures are the modest indicators of the different forces that are in action at the international markets for Indian seafood. As far as International food safety regulations and compliance are concerned, Kerala has a better record compared to other states in India.

In Kerala, it is seen that concentration and consolidation is taking place at the processing node of the chain where the number of exporters has come down and professional players are upgrading their position in the value chain. The most important aspect of the existing chain is the gradual disappearance of the independent preprocessing sector which has been an important stakeholder of the seafood value chain. The preprocessing node of the value chain is getting integrated to the processing sector causing a major restructuring of the existing value chain. The dominant response to the imposition of stricter food safety standards for seafood exports in Kerala has been reactive, loyal and defensive, both by the government and the private sector. Thus, hygiene and antibiotic controls have been upgraded largely in response to regulatory change in EU and US, or on demand from major customers. In Kerala, substantial drive to upgrade hygiene controls occurred as a sudden response when market access to EU was threatened or curtailed.

We have initiated the study by formulating two hypothesis, 1) The evolving stringent food safety standards imposed by the developing country export markets are trade restrictive to the Indian seafood export, 2) such a rise in standard will not only affect the export firms alone but also the entire supply chain will have to adjust accordingly, in other words there would be a possible re-shuffling and restructuring of the entire supply chain. As far as hypothesis 1 is concerned it was found that food safety regulations imposed by developing countries is trade restrictive for the Indian seafood sector. But at disaggregated commodity level, the stringent regulations can be trade augmenting as well. This emphasizes the need to look at more disaggregated level analysis of commodities for better insights and interpretations. Regarding hypothesis 2, the study shows that the pre-processing node of the seafood value chain is getting integrated to the processing sector causing a major restructuring of the existing value chain. India would have to upgrade the national system for testing, certification and laboratory accreditation so as to be at par with the prevailing international trade regulatory and safety parameters.

Jayasekhar S *was a Doctoral Scholar at the Centre for Development Studies, Thiruvananthapuram and presently with the Central Plantation Crops Research Institute, Regional Station, Vittal. His research interests include Economics of Plantation Crops, International trade and food safety standards.*

Email: jsekhar@cds.ac.in

C. Nalinkumar *was an UNCTAD Post Doctoral Fellow at the Centre for Development Studies, Thiruvananthapuram, and presently with the Indian Institute of Plantation Management at Bangalore. His research interests include agricultural exports, non-tariff barriers and trade facilitation.*

Email:nalin.kumar1@gmail.com

APPENDIX 1

Use of *Cadmium* Standards as the Proxy of Stringency in Food Safety Regulations

Cadmium (Cd) is a heavy metal which has no known essential function in human life and is toxic even at low concentration when ingested over a long period. Therefore, many consumers regard any presence of these elements in fish as hazard to health (Oehlenschlager 2005). Food products account for most of the human exposure to cadmium, except in the vicinity of cadmium emitting industries. Cadmium concentrations in most foods range from about 0.01 to 0.05 mg/kg. Seafood, such as mollusks and crustaceans can be a major source of cadmium. In fact most foods, including shell fish have trace elements of contaminants and heavy metals. For most species the level of these contaminants is well below the established standards at which adverse health effects might occur. Recently, there has been an increasing concern, mainly in the developed world about exposures, intake and absorption of *cadmium (Cd)* by humans, where increasingly affluent populations are demanding a cleaner environment in general, and reductions in the amounts of contaminants reaching people as a result of increasing human activities.

Table 1: Alerts relating to Exports of seafood to EU

Year	Bacterial inhibitors	Antibiotics	Cadmium	Others	Total
2003	12	10	6	17	45
2004	2	12	5	6	25
2005	3	12	7	10	35
2006	-	13	9	4	26

Source: India Export Inspection Council (EIC)

Quantifying the elasticity of regulation is much complex since regulations affect market supply and demand in various ways. Information on regulations (such as maximum permissible levels of contaminants as numerical values) could be used in the model as explanatory variables. Among the regulations on food safety issues, the ones on the maximum permissible level of aflatoxin (one of the microbial contaminants) and pesticide residue are unique in a way that can be expressed in terms of numerical values, making them ready to be used in econometric models as independent variables. In our pursuit to select a regulatory variable as a proxy of the stringency of food safety standards, we found that at least in case of sea foods this is a difficult task. Because, mostly the prohibited contaminants of the seafoods are expressed in *'zero tolerance'*. In such cases it is impossible to take the contaminant as an independent variable. But later, it was found that *cadmium* could be used as a proxy variable for two reasons, 1) the emerging importance of *cadmium* standards (see table) and 2) *cadmium* is expressed as a numerical value and it varies across countries. The toughest part was to extract the maximum residual limits of *cadmium* across various countries. For this we have relied on multiple sources which include USFDA, Codex reports, European Commission Regulations (EC) No 466/2001 EU, Country specific food safety and health related websites and published research articles on cadmium and food safety.The *cadmium* (MRLs) of important countries is presented in table 2.

Table 2: Maximum residue limits of Cadmium

Country	mg/kg
Switzerland	0.05
New Zealand	0.2
Australia	0.2
Spain	1
EU	0.5
Japan	1
USA	2
China	3
Pakistan	6
Codex	1

Sources: USFDA, Codex reports and European Commission Regulation (EC) No 466/2001

APPENDIX 2

Model Selection Test - Fixed *vs* Random Effect Models

Fixed effects regression is the model to use when we want to control for omitted variables that differ between cases but are constant over time. If we have reason to believe that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then we can include both types by using random effects. The generally accepted way of choosing between fixed and random effects is by running a *Hausman* test.

Statistically, fixed effects method is always reasonable to do with panel data (they always give consistent results) but they may not be the most efficient model to run. Random effects will give better P-values as this is a more efficient estimator, so we should run random effects if it is statistcally justifiable to do so. The *Hausman* test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results.

To run a *Hausman* test comparing fixed with random effects in *Stata*, we need to first estimate the fixed effects model, save the coefficients so that you can compare them with the results of the next model, estimate the random effects model, and then do the comparison.

- xtreg dependentvar independentvar 1 independentvar 2 independentvar3 ... , fe
    - estimates store fixed
- xtreg dependentvar independentvar 1 independentvar 2 independentvar 3 ... , re
    - estimates store random
    - hausman fixed random

The *hausman* test tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator. If they are (insignificant P-value, Prob>chi2 larger than .05) then it is safe to use random effects. If we get a significant P-value, however, you should use fixed effects.

The essential difference between fixed and random effects is that the one associated with the error term. When the individual effects are important for the interpretation then binary variables are introduced to capture either the cross section or time effects, which otherwise simply accrue to the error term. Within effects fixed effects estimator estimates individual effects first which do vary across entities but do not vary across time periods.

Scenario 1

Gravity Analysis for Fish and Fishery Products

Hausman fixed random

	—— Coefficients ——			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
lntgdpj	.8077811	.5205203	.2872608	.1461312
lnpcgnpj	.6284183	.5580541	.0703642	.0890374

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B) [(V_b-V_B)^(-1)](b-B) = 6.50

Prob>chi2 = **0.0389**

Since Prob>chi2 is larger than 0.05 the test favours fixed effects estimates.

Scenario 2

Gravity Analysis for Shrimp

Fixed-effects (within) regression

lnxportind |	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnimpfish |	1.028683	.2267385	4.54	0.000	.5811534	1.476213
lntgdpj |	-1.732073	.6377353	-2.72	0.007	-2.990816	-.4733288
_cons |	2.202044	4.514293	0.49	0.626	-6.708139	11.11223

Random-effects GLS regression

lnxportind |	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnimpfish |	.8322155	.1132598	7.35	0.000	.6102303	1.054201
lntgdpj |	-.709155	.3509689	-2.02	0.003	-1.397041	-.0212686
_cons |	1.564108	2.794724	0.56	0.576	-3.913451	7.041668

. Hausman fixed random

	—— Coefficients ——			
|	(b) fixed	(B) random	(b-B) Difference	sqrt(diag (V_b-V_B)) S.E.
lnimpfish |	1.028683	.8322155	.1964678	.1964244
lntgdpj |	-1.732073	-.709155	-1.022918	.5324727

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(2) = (b-B) [(V_b-V_B)^(-1)](b-B = 3.73

Prob>chi2 = 0.1550

In this case although Prob>chi2 = 0.1550 is larger than 0.05, since our p values are significant the test favours fixed effects estimation

Scenario 3
Gravity Analysis for Cephalopods
hausman fixed random

	—— Coefficients ——			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag (V_b-V_B)) S.E.
lnexpgdpj	1.923659	-.1329876	2.056647	.658208
lnpcgnpjind	.4477754	.5948393	-.147064	.1014744

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic
chi2(2) = (b-B) [(V_b-V_B)^(-1)](b-B = 9.82
Prob>chi2 = **0.0074**

Since Prob>chi2 is larger than 0.05 the test favours fixed effects estimates

APPENDIX 3

Table 3.1: Estimated country specific effects

Gravity analysis for Fish and fishery products exports

Country	Coefficient	Standard error
Australia	1.604	0.612*
Austria	-3.408	0.585*
Bahrain	-2.090	0.930*
Bangladesh	2.214	1.067*
Belgium	1.277	0.629*
Canada	1.496	1.780*
China	5.153	0.561*
Denmark	-1.662	0.572*
France	1.602	0.573*
Germany	1.063	0.980*
Greece	1.453	2.854
Hong	0.253	0.639*
Indonesia	1.622	0.486*
Italy	2.131	2.129
Japan	4.970	1.620
Lebanon	-0.719	0 .650*
Malaysia	1.450	0.820*
Maldives	-1.758	0.517*
Mauritius	-0.031	2.990
Mexico	-1.482	2.795
Netherlands	0.399	1.763
New Zealand	-1.178	1.063*

cont'd.....

Country	Coefficient	Standard error
Portugal	1.109	1.776
Rep. of Korea	1.049	0.782*
Saudi Arabia	-1.982	2.832*
Singapore	6.160	0.537*
South Africa	1.803	0.534*
Spain	2.902	2.329
Sri Lanka	1.758	2.015
Switzerland	-2.110	0.555*
Thailand	2.811	8.209
UAE	1.773	.435*
UK	2.523	.769*
USA	4.481	1.072*
Viet Nam	2.817	.717*

* Significant at 10 percent level.

Table 3.2: Estimated country specific effects: Gravity analysis for shrimp exports

Country	Coefficient	Standard error
Australia	-2.772	1.917
Austria	-5.156	1.212*
Bahrain	-2.61	.472*
Bangladesh	-6.058	1.727*
Belgium	-0.502	1.519
Canada	-2.893	1.884
China	-4.148	2.116*
Denmark	-5.2	1.758*
France	-4.821	2.254*

cont'd.....

Country	Coefficient	Standard error
Germany	-3.811	2.007*
Greece	-4.935	1.834*
Hong	-3.761	1.393*
Indonesia	-2.699	1.34
Italy	-5.1	2.254
Japan	-4.792	2.992
Lebanon	-3.768	1.187*
Malaysia	-1.133	1.187*
Maldives	5.637	3.494
Mauritius	-2.683	1.038*
Mexico	-6.221	1.581*
Netherlands	-2.934	1.614
New Zealand	-2.779	1.138*
Portugal	-5.296	1.900*
Rep. of Korea	-5.79	1.960*
Saudi Arabia	-5.1	1.297*
Singapore	-1.823	1.144
South Africa	-1.303	1.255
Spain	-5.687	2.325*
Sri Lanka	-3.557	1.205*
Switzerland	-4.636	1.549*
Thailand	-2.59	1.647
UAE	0.9	0.964
UK	-2.67	2.078
USA	-4.23	2.921
Viet Nam	0.333	1.032

* Significant at 10 percent level.

Table 3.3: Estimated Country Specific Effect Gravity analysis for Cephalopods exports

Country	Coefficient	Standard error
Australia	3.411	2.01*
Austria	0.006	1.269
Belgium	4.825	0.931*
Canada	5.812	1.567*
China	6.901	1.78*
France	7.312	1.482*
Germany	4.720	2.033*
Greece	8.401	0.515*
Hong	1.071	1.783*
Italy	7.725	2.326*
Japan	8.711	1.951*
Lebanon	4.942	0.731*
Malaysia	2.082	0.899
Maldives	0.321	1.144*
Mauritius	2.730	1.087*
Netherlands	4.300	1.681
New Zealand	2.851	1.678*
Portugal	7.016	1.422
Rep. of Korea	2.620	4.769
Singapore	-6.004	1.646*
South Africa	4.122	1.764*
Spain	9.390	1.56*
Sri Lanka	4.630	1.391
Switzerland	1.792	1.048*
Thailand	4.656	1.777*
UK	6.046	2.534*
USA	10.320	2.01*

* Significant at 10 percent level.

APPENDIX 4

Table.4.1: Kerala's share in cephalopod* exports from India (2005-06)

Value (US $ in million)

	Value		
Item	India	Kerala	Kerala's share (in percentage)
Cuttle fish	124.48	57.38	46.1
Squid	130.49	43.32	33.2

Source: MPEDA (http://www.mpeda.com), Kerala planning board

*Cephalopod include cuttlefish and squid

Table 4.2: Region wise status of complaints related to seafood exports from *India*

Region/ Reason	Antibiotic residues	Heavy metals (cadmium)	Others	Total
Cochin	1		1	2
Chennai	8	1	1	10
Mumbai		8	2	10
Kolkota	4			4
Total	13	9	3	26

Source: Export Inspection Agency, Cochin

Table 4.3: Status of complaints related to seafood exports from Kerala

Year/Reason	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Bacterial contamination	16	2	3	4	9	8	4	1		1	
Antibiotic residues	0	0	0	0	0	5	6	2	1		
Bacterial inhibitors	0	0	0	0	0	9	4				
Heavy metals	0	0	0	0	0	0	1	1	1		
others										1	1
Total	**16**	**2**	**3**	**4**	**9**	**22**	**16**	**4**	**2**	**2**	**1**

Source: Export Inspection Agency, Cochin

References

Bakshi, N. (2003). 'Sanitary and Phytosanitary Measures: The Case of Mexican Avocados,' Unpublished Masters Thesis, Virginia Polytechnic Institute and State University, Virginia.

Beghin, J. C. and C. Bureau (2001). 'Quantitative Policy Analysis of Sanitary and Phytosanitary, and Technical Barriers to Trade,' *Economie Internationale*, 87(3), 107–1 30.

Eugenio Figueroa B (2008). 'Are More Restrictive Food Cadmium Standards Justifiable Health Safety Measures or Opportunistic Barriers to Trade? An Answer from Economics and Public Health,' *Science of the Total Environment*, 389(2008) 1-9.

Ferrantino, M. J. (2003) 'Analytical Approaches to Quantifying Economic Effects of Non-tariff Measures' Conference on WTO: Competing Policy Issues and Agendas in Agricultural Trade, Washington DC.

Gebrehiwet, Y. F. (2004). 'Quantifying the Trade Effect of Sanitary and Phytosani-tary Regulations in OECD Countries on South African Food Exports,' Unpublished Masters Thesis, University of Pretoria, South Africa.

Henson S, Saquib, M, Rajasenan D. (2005). 'Impact of Sanitary Measures on Export of Fishery Products from India: The Case of Kerala,' Agriculture and Rural Development Discussion Paper, World Bank.

Jaffee, S. and S. J. Henson, (2005). 'Agro-food Exports from Developing Countries: The Challenges Posed by Standards,' in A. Aksoy and J. C. Beghin (eds.), *Global Agricultural Trade and Developing Countries*, The World Bank, 2005.

Kumar A (2004). 'Export Performance of Indian Fisheries: Strengths and Challenges Ahead,' *Economic and Political Weekly,* September 18, pp: 4264-4270.

Kumar, Sen and Vaidya, (2002) ‘International Competitiveness, Trade and Finance: India,’ in Jose M. Fanelli and Rohinton Medhora (eds.) *Finance and Competitiveness in Developing Countries*, Routledge, London.

MPEDA, Statistics of Marine Products Exports, various years, MPEDA Cochin, India

Merkies, A. and T. van der Meer (1988). ‘A Theoretical Foundation for Constant Market Share Analysis,’ *Empirical Economics,* 13(2), 65–80.

Oehlenshlager, J (2005). ‘Identifying Heavy Metals in Fish,’ In: *Safety and Quality Issues in Fish Processing,* (ed.) Bremner, H.A., Woodhead Publishing Limited and CRC Press LLC. pp.95-108.

Otsuki, T., J. S. Wilson, and M. Sewadeh (2001) ‘Saving Two in a Billion: Quan-tifying the Trade Effect of European Food Safety Standards on African Exports,’ *Food Policy,* 26(5), 495–5 14.

Richardson, D. J. (1971) ‘Constant Market Shares Analysis for Export Growth,’ *Journal of International Economics,* 1(2), 227–239.

Roberts, D. and L. Unnevehr (2004) ‘Resolving Trade Disputes Arising from Trends in Food Safety Regulation,’ In J. C. Buzby (ed.), *International Trade and Food Safety: Economic Theory and Case Studies.* ERS, US Department of Agriculture.

Unnevehr, L. (2003) ‘Food Safety: Setting and Enforcing Standards,’ *Choices Magazine*, American Agricultural Economics Association.

Veeramani. C, (2007) ‘Sources of India’s Export Growth in Pre and Post-Reform Periods,’ *Economic and Political Weekly*, pp. 2419-2427.

Wilson, J. S. and T. Otsuki (2001). ‘Global Trade and Food Safety,’ Development Research Group, The World Bank, Washington D C

Wilson, J. and T. Otsuki (2004). ‘To Spray or not to Spray: Pesticides, Banana Exports, and Food Safety,’ *Food Policy,* 29(2), 131–146.

PUBLICATIONS

For information on all publications, please visit the CDS Website: www.cds.edu. The Working Paper Series was initiated in 1971. Working Papers from 279 can be downloaded from the site.

The Working Papers published after April 2007 are listed below:

W.P. 421 S. IRUDAYA RAJAN, V.J. VARGHESE, M.S. JAYAKUMAR *Overseas Recruitment in India: Structures, Practices and Remedies,* February 2010

W.P. 420 V.J. VARGHESE, *Land, Labour and Migrations: Understanding Kerala's Economic Modernity,* December 2009.

W.P. 419 R.MOHAN, D. SHYJAN *Tax Devolution and Grant Distribution to States in India Analysis and Roadmap for Alternatives,* December 2009.

W.P. 418 WILLIAM JOE & U. S. MISHRA *Household Out-of-Pocket Healthcare Expenditure in India Levels, Patterns and Policy Concerns,* October 2009.

W.P. 417 NEETHI P *Globalisation Lived Locally: New Forms of Control, Conflict and Response Among Labour in Kerala, Examined Through a Labour Geography Lens.* October 2009.

W.P. 416 SUNIL MANI *High skilled migration from India, An analysis of its economic implications,* September 2009.

W.P. 415 SUNIL MANI *Has India Become more Innovative Since 1991? Analysis of the Evidence and Some Disquieting Features,* September 2009.

W.P. 414 WILLIAM JOE, PRIYAJIT SAMAIYAR, U. S. MISHRA *Migration and Urban Poverty in India Some Preliminary Observations,* September 2009.

W.P. 413 K. N. NAIR, T.P. SREEDHARAN, M. ANOOPKUMAR, *A Study of National Rural Employment Guarantee Programme in Three Grama Panchayats of Kasaragod District,* August 2009

W.P. 412 B.S. SURAN, D. NARAYANA, *The Deluge of Debt: Understanding the Financial Needs of Poor Households*. July 2009

W.P. 411 K. NAVANEETHAM, M. KABIR, C.S. KRISHNAKUMAR *Morbidity Patterns in Kerala: Levels and Determinants*. April 2009.

W.P. 410 ARINDAM BANERJEE, *Peasant Classes, Farm Incomes and Rural Indebtedness: An Analysis of Household Production Data from two States.* March 2009.

W.P. 409 SUNIL MANI, *The Growth of Knowledge-intensive Entrepreneurship in India, 1991-2007 Analysis of its Evidence and the Facilitating Factors.* February, 2009

W.P. 408 M. S. HARILAL, *Home to Market: Responses, Resurgence and Transformation of Ayurveda from 1830s to 1920.* November 2008

W.P. 407 HRUSHIKESH MALLICK, *Do Remittances Impact the Economy ? Some Empirical Evidences from a Developing Economy.* October 2008.

W.P. 406 K.C.ZACHARIAH, S.IRUDAYA RAJAN, *Costs of Basic Services in Kerala, 2007, Education, Health, Childbirth and Finance (Loans)* September 2008.

W.P. 405 SUNIL MANI *Financing of industrial innovations in India How effective are tax incentives for R&D?* August 2008.

W.P. 404 VINOJ ABRAHAM *Employment Growth in Rural India: Distress Driven?* August 2008.

W.P. 403 HRUSHIKESH MALLICK, *Government Spending, Trade Openness and Economic Growth in India: A Time Series Analysis.* July 2008.

W.P. 402 K. PUSHPANGADAN, G. MURUGAN, *Dynamics of Rural Water Supply in Coastal Kerala: A Sustainable Development View,* June 2008

W.P. 401 K. K. SUBRAHMANIAN, SYAM PRASAD, *Rising Inequality With High Growth Isn't this Trend Worrisome? Analysis of Kerala Experience,* June 2008

W.P. 400 **T.R. DILIP,** *Role of Private Hospitals in Kerala: An Exploration,* June 2008

W.P. 399 **V. DHANYA,** *Liberalisation of Tropical Commodity Market and Adding-up Problem: A Bound Test Approach,* March 2008

W.P. 398 **P. MOHANAN PILLAI, N. SHANTA,** *ICT and Employment Promotion Among Poor Women: How can we Make it Happen? Some Reflections on Kerala's Experience.* February 2008.

W.P. 397 **K.N.NAIR, VINEETHA MENON,** *Distress Debt and Suicides among Agrarian Households: Findings from three Village Studies in Kerala.* December 2007

W.P. 396 **K.N.NAIR, C.P. VINOD, VINEETHA MENON,** *Agrarian Distress and Livelihood Strategies: A Study in Pulpalli Panchayat, Wayanad District, Kerala* December 2007

W.P. 395 **K.C. ZACHARIAH, S.IRUDAYA RAJAN,** *Migration, Remittances And Employment Short-term Trends and Long-term Implications.* December 2007

W.P. 394 **K.N.NAIR, ANTONYTO PAUL, VINEETHA MENON,** *Livelihood Risks and Coping strategies: A Case Study in the Agrarian Village of Cherumad, Kerala.* November 2007

W.P. 393 **S. IRUDAYA RAJAN, U.S.MISHRA,** *Managing Migration in the Philippines: Lessons for India.* November 2007.

W.P. 392 **K.N. NAIR, R. RAMAKUMAR** *Agrarian Distress and Rural Livelihoods, a Study in Upputhara Panchayat Idukki District, Kerala.* November 2007.

W.P. 391 **PULAPRE BALAKRISHNAN,** *Visible hand: Public policy and economic growth in the Nehru era.* November 2007.

W.P. 390 **SUNIL MANI,** *The Growth Performance of India's Telecommunications Services Industry, 1991-2006 Can it Lead to the Emergence of a Domestic Manufacturing Hub?* September 2007.

W.P. 389 **K. J. JOSEPH, VINOJ ABRAHAM,** *Information Technology and Productivity: Evidence from India's Manufacturing Sector.* September 2007.

W.P. 388 **HRUSHIKESH MALLICK,** *Does Energy Consumption Fuel Economic Growth In India?* September 2007.

W.P. 387 **D. SHYJAN**,*Public Investment and Agricultural Productivity: A State-wise Analysis of Foodgrains in India.* July 2007.

W.P. 386 **J. DEVIKA,** *'A People United in Development': Developmentalism in Modern Malayalee Identity.* June 2007.

W.P. 385 **M. PARAMESWARAN,** *International Trade, R&D Spillovers and Productivity: Evidence from Indian Manufacturing Industry.* June 2007.

W.P. 384 **K. C. ZACHARIAH, S. IRUDAYA RAJAN** *Economic and Social Dynamics of Migration in Kerala, 1999-2004 Analysis of Panel Data.* May 2007.

W.P. 383 **SAIKAT SINHA ROY** *Demand and Supply Factors in the Determination or India's Disaggregated Manufactured Exports : A Simultaneous Error-Correction Approach.* May 2007.

This work is licensed under a
Creative Commons
Attribution – NonCommercial - NoDerivs 3.0 Licence.

To view a copy of the licence please see:
http://creativecommons.org/licenses/by-nc-nd/3.0/