The long run relationship between fish production, marine trade balance and foreign direct investment

An empirical study of Omani economy

Received 27 January 2020
Revised 3 March 2020
Accepted 14 March 2020

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Abstract

Purpose – This paper aims to focus on testing the long-run relationship between fish production and two main variables, the foreign direct investment inflow and the marine trade balance in Oman, which is one of the Arab Gulf countries, during the period 1985-2016.

Design/methodology/approach – This study uses what known as the two-step Engle–Granger cointegration test to give evidence for the long-run relationship among the variables.

Findings – The results show that there are a negative long- and short-run relations between fish production and marine trade balance; moreover, any shocks will be corrected within two periods at the most.

Originality/value – This study is one of few studies in using the econometric models to study the impact of fish production on marine trade balance and foreign direct investment.

Keywords Foreign investment, Trade balance, Fish production, Marine and economic policy

Paper type Research paper

1. Introduction

The food and agriculture organization (FAO) reported that the per capita apparent consumption of total world fisheries and aquaculture was on average 1.88% between the years 2011 and 2016. Nonetheless, the fact that fish production was growing from a

JEL classification – F18, Q22, Q28

This paper forms part of special section "Sustainability challenges in maritime financings", guest edited by Faris Alshubiri and Mohamed Elheddad.

decreasing rate, the world population is increasing at a semi-constant rate, which forced the per capita fish consumption to grow negatively (FAO, 2018).

The OECD Review of Fisheries argue that China produces 63% of the world fish production, six times more than the all OECD countries together; however, out of the top 50 countries of fish producers neither any gulf country nor an Arab country was listed; yet, Israel produced more than 20 million kilograms of fishes on yearly average during the period 1995-2017, in which placed 35th among fish producers in the world (OECD, 2017).

Despite the fact that the Arabian gulf countries output depend mainly on oil production, fish production is the second contributor to the GCC output. During the past years, Saudi Arabia, United Arab Emirates and Oman started to decline their demand for imported seafood; as a consequence, they replace imported seafood by the local production. Recently, the three governments stated several policies and incentives to attract investment in fish farming, as an integrated step in supporting the green economy (Berdikeeva, 2019).

Figure 1 shows the fish production volume in tonnes for eight gulf countries the data were collected from the World Bank development indicators; in this article, we mainly focus on one Gulf country, which is Oman. It is noticeable in Figure 1 that Oman is taking the lead of fish production in the GCC area at the few recent years, and it have the most per capita fish consumption in the region as well.

While roughly most of the GCC countries maintain the same amount of fish production over time, Oman experienced steady growth in fish production starting from 1998 and up to 2010, afterwards, growth grew continuously.

Figure 2 shows a critical growth turn of FDI started in 2005 and continued, while more concerns were paid since 1999 on the marine trade balance.

FDI plays a vital role in Oman ports, according to Ibrahim *et al.* (2019). FDI creates more job opportunities in Omani ports, integrate domestic investment, develop technology and enhance leadership and organizational practices. The local government endorses FDI in aims to boost the role of private sector in the economy; therefore, several regulations were designed including removing any boundaries on currency exchange, capital repatriation or dividends transferring. In addition to that, Oman established several free zones enabling foreigner companies to adore range of motivations, including the ability to own a 100%

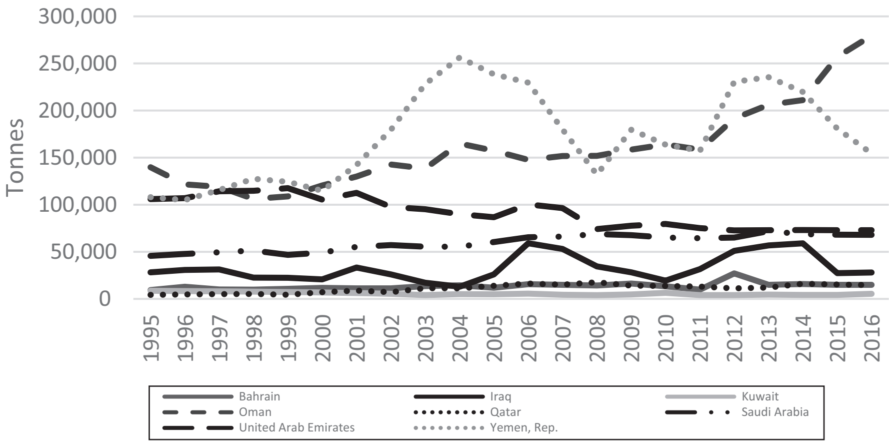

Figure 1.
Fish production in tonnes in gulf countries 1995-2016

Source: Based on World Bank development indicators data

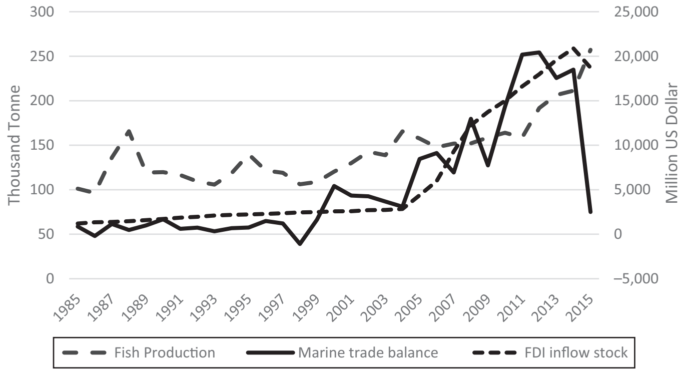

Figure 2.
Fish production, FDI inflow and marine trade balance in Oman 1985-2015

share in companies, free profits repatriation, a reduced initial citizens participation rate and a 10-year tax exemption, which can be extended up to 25 years in certain circumstances (Buckley and Rynhart, 2011).

This study spotlights on the marine sector and its impact on Omani economy, the main objectives in this article are to infer if there is any long-run relationship between fish production and marine trade balance from one side and fish production and foreign direct investment on the other hand. In this study, we are trying to answer if fish productions have a long-run impact on the marine trade balance, and does ongoing growth of fish production in Oman attracts FDI.

This article consists of five parts. Section 1 was a brief introduction, which is followed by reviewing the literature in Section 2 which discusses fish production in the Arab Gulf area. In Section 3, we present the data, Section 4 discusses the Engle–Granger cointegration methodology, results and model diagnostic; finally, in Sections 5, 6 and 7, results, model diagnostics and conclusion are presented.

2. Literature review

The marine food sector is one of the interesting and untapped potential sources of revenue that the six Gulf Cooperation Council (GCC) countries can explore to diversify the economies of countries within the region and create more wealth. Therefore, the formulation of effective segmented marketing policies and strategies is of fundamental importance to key economic players in each country in the bloc (Ayers and Midmore, 2009).

Evidence from the empirical literature Delgado *et al.* (2003) suggests that the costs of fish are caused by the special needs for marine wealth that are reflected in the trading of fish. Relatedly, Hasan and Halwart (2009) take the view that the quality of fish protein supplied from different quality of fish is a function of the development of aquaculture and increased fish production. It is also important to point out that both consumed fish and fish oil have different nutritional value. Furthermore, there are existing studies within the literature, such as Karim and Mimura (2008) suggest, the rise in marine production has not been directly affected by the influence of climate change on fish production policies across different countries in the world.

According to Allison *et al.* (2009), fish production is a great source of animal protein, and for the safety of the community, the per capita percentage must be kept high, and this ultimately will develop into high levels of competitiveness. In the same vein, Sumaila *et al.* (2011) argue that an increase in fish production will lead to competition, provide consumer choice and drive down prices in the long run. Delgado *et al.* (2008) make the point that as obtained in the developed world, composts from fish food can also be used to improve the quality of livestock and increase international trade in fish.

Berkes *et al.* (2006) take the view that there is immense pressure for the maintenance of marine wealth, this is meant to guide against higher prices and can have a negative and indirect effect on the methods used in the production of aquaculture. Baumgartner *et al.* (1992) also pointed out that fluctuations in the production of seafood are lower than climate variability. This means that climate change is not an impediment to increased fish production.

Relatedly, Pauly *et al.* (2003) look at the formalized seafaring policies of several countries and the associated environmental consideration by estimating the quantity of marine output and the size of fishing within the aquaculture industry.

Furthermore, evidence from the case study shows that different marine products require distinct and niche marketing operations, and this will also depend on the value of the product. Brander (2007) also stresses that in the future, the climate will change from time to time, and this will ultimately affect the production of fish, and this is related to the fact that extreme weather events have a direct impact on the production of fisheries both nationally and in the marine system. Also, the abundant availability of these fishing products will have future economic and geopolitical effects on those countries that have come to rely heavily on the food sector. However, aquaculture output according to Cheung *et al.* (2009) sometimes depends not only on climate change but also on changes in different business sectors and in the social economy.

In determining the concept of fish production, Cheung *et al.* (2009) argue persuasively that there is a need of embracing an adaptive policy to reduce the effects of climate change on fish production and provide the knowledge base for different options. Similarly, Ferreira *et al.* (2014) point out that Europe is presently experiencing a seafood trade deficit. Also with the future expectations of increases in the consumption and purchasing power of the Chinese and Asian economies, this will ultimately lead to aquaculture product becoming rarer and more expensive (Cheung *et al.*, 2009; Ferreira *et al.*, 2014).

There are several retail markets that are not operational as a result of fish trading challenges and wholesale market problems. According to Naylor *et al.* (2000), the general decline in fish stocks in some countries could lead to dependence on grown fish. Nunes *et al.* (2011) establish that the issuing of a license for the exploration of water in Europe leads to concerns about the absorptive number of ecosystems. Additionally, the environmental regulatory regime in Europe has also indirectly promoted the objectives of an ecological approach to aquaculture.

Evidence from recent studies by Campbell and Pauly (2013) and Natale *et al.* (2013) suggests that there is now a renewed interest in how to maintain the current level of supply chain in seafood, and it has been suggested that fish production could be an important tool for the industry in the future. Veiga *et al.* (2016) explained the fall in the market value of fish in different countries to poor incentives for encouraging compliance and poor mechanism for enforcement of rules. All of these have further led to the decline of the sector and weakened its competitive position.

The study of Alshubiri *et al.* (2019) aimed to determine the effect of fish production on the marine trade balance, and FDI in six Gulf countries over the period of 1985-2016, the study found that an increase in fish production approximately will cause the same increase in marine trade balance.

From the foregoing studies, the economic benefits of marine products can be achieved through proper analysis and good access to coastal products. Further studies in a dynamic environment with changing resources such as population could also be considered in analysing these products. This study evaluates the long-run impact of fish output on investment opportunities in Oman.

3. Data collection

This study used data from world bank indicators for Oman, one of the largest countries in production fish at the Arab gulf area for the period 1985-2016. Our main objective is to test the long-run relationship between fish production and two different dependent variables, the marine trade balance and foreign direct investment, both are in millions. We control both models with other variables such as financial development index from zero to one, zero is very low and one is very high, gross fixed capital formation as a percentage of GDP and trade openness as a percentage of GDP. Table 1 shows the descriptive statistics for the collected data; it is clear that fluctuation in trade balance, FDI and fish production is very high, while the volatility in the financial development index does not exceed 5% and the index is not high enough.

4. Methodology

Commonly most of the economic variables are non-stationary – I(1) variables. Hence, the existence of stationary combination is necessary for studying equilibrium among a certain set of variables. Otherwise, any deviation from equilibrium might be permanent or a short run consequence.

A time series is to be integrated of order (d), if it becomes stationary after being differenced (d) times and denoted by I(d); moreover, when two or more series are I(d), then their linear combination said to be I(d). When the disturbance term which results from regressing the dependent variable on the independent variable(s) of that linear combination is of a lower order of integration, I(d-b), where $b > 0$. Then, Engle and Granger (1987) define this regression model to be cointegrated of order (d,b).

Table 2 shows the augmented Dickey–Fuller and Phillips and Perron tests of unit root, and it is clear that all variables under the study are I(1).

The first necessary step to test the long-run relationship in such a model is to run static regression for the model, and the main purpose of this static regression is to generate a new series of the disturbance terms (Harris, 1995).

The first model describes the impact of fish production on the FDI:

$$\mathrm{Log}(FDI)_t = \beta_0 + \beta_1(\mathrm{Log\ Fish\ Production})_t + \beta_2(\mathrm{GFCF})_t + \beta_3(TO)_t + \beta_4(FD\ index)_t + u_t \quad (1)$$

Variable	Mean	SD	Min	Max
Marine trade balance	5387.073	6467.326	−1093.99	20428.74
Foreign direct investment inflows	6776.777	6988.185	1201.38	20880
Financial development index	0.337	0.054	0.25	0.43
Fish production	147000	43141.43	96353	280000
Gross fixed capital formation % GDP	22.144	7.181	12.327	36.489
Openness % GDP	89.904	14.503	71.36	128.222

Source: Author's work based on World Bank Development indicators

Table 1. Descriptive statistics

Variable/specification	Including	Levels ADF	Levels PP	1st difference ADF	1st difference PP
Log marine trade balance	C	−0.7718	−0.3314	−5.0824***	−17.972***
Log fish production	T&C	−2.5232	−2.6054	−6.2456***	−6.5689***
Financial development index	T&C	−2.1539	−2.2423	−5.5356***	−5.5765***
Trade openness	C	−1.1033	−1.1033	−6.0159***	−6.4188***
Gross fixed capital formation	T&C	−2.1743	−1.9249	−3.9456**	−5.3157***
Log FDI	T&C	−2.6497	−1.9627	−3.6908**	−3.7191**

Notes: * at $p < 0.10$; **at $p < 0.05$; *** at $p < 0.01$
Source: E-Views Version 11 output

Table 2.
Unit root test

The second model describes the impact of fish production on the marine trade balance (MTB):

$$\text{Log}(MTB)_t = \beta_0 + \beta_1(\text{Log Fish Production})_t + \beta_2(\text{GFCF})_t + \beta_3\text{Log}(FDI)_t + \beta_4(FD\ index)_t + u_t \quad (2)$$

where β_i and α_i are coefficients, $i = 1, 2, \ldots, N$, u_t and ε_t are the error terms in both models.

The next step in testing the cointegration is to test the unit root for the estimated series of residuals. Table 3 shows the OLS regression estimation and reporting the augmented Dickey–Fuller test statistic for residuals for the two models. These results have to be compared with certain critical values.

This study follows MacKinnon (1996) in estimating the response surface estimates of critical values without trend at 10% level of significance based on the following equation:

$$\text{MacKinnon (1996)}\ critical\ value = \beta_\infty + \frac{\beta_1}{T} + \frac{\beta_2}{T^2} \quad (3)$$

where $\beta_\infty = -4.1327$, $\beta_1 = -10.638$, $\beta_2 = -5.48$, the previous values are constructed from MacKinnon (1996), for T = 32 based on our sample

Variable	(1)	(2)
Trade Openness (TO)	0.0832	–
Log (FDI inflow)	–	0.6117***
GFCF	−8.2477	−5.1167
Log fish production	0.5852	−1.0571
Financial development Index (FD index)	0.1235	−0.0199
C	−4.9339	18.087**
R-squared	0.9540	0.8862
Durbin–Watson stat	1.1524	1.5059
Augmented Dickey–Fuller test statistic for residuals	−3.5980	−4.3841
MacKinnon (1996) critical value	−3.5980	−3.5405

Notes: * at $p < 0.10$; **at $p < 0.05$; *** at $p < 0.01$, the dependent variable in regression (1) is Log Foreign Direct Investment FDI, in regression (2) Log Marine Trade Balance TB
Source: E-Views Version 11 output

Table 3.
OLS regression

For that

$$MacKinnon\ (1996)\ critical\ value = \ -3.5405$$

As the absolute value of the augmented Dickey–Fuller test statistic in the first model is (3.598) and (4.384) for the second model and both are greater than MacKinnon (1996) critical value (3.5405), then the series of the model residuals are stationary at the level I(0).

The third step in testing the long-run relationship is to run the first difference regression as follows:

$$\Delta\big(Log(FDI)_t\big) = \gamma_0 + \gamma_1\Delta(Log\ Fish\ Production)_t + \gamma_2\Delta(GFCF)_t + \gamma_3\Delta(TO)_t + \gamma_4\Delta(FD\ index)_t + \phi\,(u_{t-1}) + \varphi_t \quad (4)$$

$$\Delta\big(Log\ (TB)\big) = \Gamma_0 + \Gamma_1\Delta(Log\ Fish\ Production)_t + \Gamma_2\Delta(GFCF)_t + \Gamma_3\Delta\big(Log(FDI)\big)_t + \Gamma_4\Delta(FD\ index)_{\mathrm{t}} + \theta\,(\varepsilon_{t-1}) + \nu_t \quad (5)$$

where Y_i and Γ_i are long-run coefficients, $i = 1,2,\ldots,N$, φ_t and ν_t are the error terms, ϕ and θ are the error correction mechanism ECM in the long run for both models respectively.

The last steps are to ensure that the regression is not spurious; they confirm that residuals are normally distributed and not serially correlated. Yet, after checking the level of significance and the negative sign of the error correction term coefficient.

5. Results

In equation (1), we fail to find a long-run relationship between fish production and FDI inflow, as such result is not surprising as FDI inflow in Oman mainly concentrates on the oil sector.In equation (2), we find a high negative elastic long-run relationship between fish production and marine trade balance, in which a 1% increase in fish production will decrease marine trade balance by 1.9%. The error term coefficient infers that 70.6% of that disequilibrium is dissipated before the next year and approximately 29.4% remains.

6. Model diagnostics

For testing whether the regression is spurious, we have to compare the estimated R-square with Durbin–Watson statistic test, to check if the latter is greater than the former so that the regression is not spurious.

From equation (2), Table 4, we can find that the Durbin–Watson statistic is greater than the R-square, which indicates that the model is not spurious.

Henceforth, to test residuals normality distribution, we use Jarque–Bera test; the null hypothesis states that the residuals are normally distributed. Table 4 shows that we cannot reject the null hypothesis, which confirms that the model residuals are normally distributed.

The final test for model's validity is to test the serial correlation; to do so, we use Breusch–Godfrey serial correlation LM test; in this case, the null hypothesis for LM test is that there is no serial correlation at up to two lags. By checking the Chi-square probability of Breusch–Godfrey LM test which is reported in Table 4, we cannot reject the null hypothesis. Thus, our results conclude that there is a long-run relationship between regressors in the model (2) with the marine trade balance.

7. Conclusion and discussion

For testing the impact of fish production on FDI inflow, we found that the model fails to give any evidence if there is a long-run relationship between fish production and FDI inflow. This result is supported as the FDI inflow in Oman mainly concentrates on the oil sector and not sufficiently for the marine industry.

On the other hand, in equation (2), the response to shocks is very fast, that if the system is going to receive a shock, it will return to equilibrium within less than two periods, and we find that a one per cent change in fish production will react negatively with marine trade balance in Oman by 1.9%. In addition to that, we find that the short-run elasticity about to be perfect but negative as well.

The previous result was not surprising as developing the fish production industry requires developing infrastructure, fishing vessels and other equipment and tools, despite fish production experienced significant growth in Oman during the period under study, but this development demanded new technologies, which in most cases were imported, and therefore affected negatively the marine trade balance. In this case, we argue that the marginal value of imports which belonged to fish production development will exceed the value of the exported surplus of fish production.

Our results demonstrate that Oman has a potential for asset diversification if policymakers use the marine sector through promoting special incentives to attract the FDI inflow. Our findings suggest further researchers not to limit their studies with the macro level but to be extended into micro-level as well; therefore, policymakers can pay more attention on how to use the marine sector in Oman to develop a more vital contribution to the economy and diverse the Omani assets.

Table 4.
First difference regression

Variable	(1)	(2)
D(Trade Openness (TO))	0.0230	–
D(Log (FDI inflow))	–	0.187105
D(GFCF)	1.0309	−6.798287
D(Log Fish production)	0.6161	−1.936460*
D(Financial development Index)	0.0331	0.187105
Error term(−1)	−0.0874	−0.7065***
C	0.1421	0.056682
R-squared	0.1138	0.886205
Durbin–Watson stat	1.4558	1.505931
Jarque–Bera	10.228	0.90044
Jarque–Bera Probability	0.0060	0.63748
Breusch–Godfrey LM Test Prob. Chi-Square (2)	0.0783	0.2392

Notes: * at $p < 0.10$; ** at $p < 0.05$; *** at $p < 0.01$; the dependent variable in regression (1) is Log Foreign Direct Investment, in regression (2) Log marine Trade Balance both are in first difference
Source: E-Views Version 11 output

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