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Global aquaculture growth and institutional quality

Suthamathy Nadarajah*, Ola Flaaten

The Norwegian College of Fishery Science, UiT-The Arctic University of Norway, N-9037 Tromsø, Norway

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ABSTRACT

The global aquaculture sector has grown continuously over the past 40 years, though unevenly among countries. Differences in factors such as inputs, climate, management, technology, markets, social environment, and institutions might be reasons for the disparities in growth. This study focuses on institutions, by analyzing the relationship between annual growth in the production of the major aquaculture countries and the quality of their institutions over three decades (1984–2013). Based on an ex-ante set of criteria, seventy-four aquaculture countries from five different regions - Africa, the Americas, Asia, Europe and Oceania - were selected. Annual percentage change in total aquaculture production, in terms of quantity and value, was used as a proxy for sector development. Three indices - governance, corruption, and competitiveness - were used as institutional quality proxies. Empirical results suggest that the aquaculture growth did not significantly correlate with the quality of institutions. By region, Africa had the fastest growth in the aquaculture sector, though from a low base, with 7.35% and 9.28% higher annual percentage change in aquaculture quantity and value respectively, than the Asian region. While, the European region experienced significantly lower annual percentage change in aquaculture quantity, a difference of 3.78% compared to the Asian region. Furthermore, the study found that total aquaculture production was not positively correlated with eco-label certification. The study is concluded by discussing the "aquaculture paradox."

1. Introduction

Over the past 40 years, the global aquaculture sector has grown continuously and the sector is currently an important contributor to total global seafood production; according to the Food and Agriculture Organization (FAO) of the United Nations, it contributed 44.1% in 2014 [1]. Global supply from aquaculture has grown at an annual average of 8.6% between 1980 and 2012 [2], whereas the capture fish production gradually stagnated. The average annual percentage change in global aquaculture production in terms of value is 3.9% in the period 1984–2014. This development has mainly been driven by productivity growth [3,4] and an increasing demand for seafood [5]. Global food fish production through aquaculture was 73.8 million tons in 2014, and total global aquaculture production, including farmed aquatic plants, was 101.1 million tons, valued at US$ 165.8 billion [1]. Asia dominates this production, accounting for 88.91% by volume in 2014.

The dietary contribution of seafood is important in terms of animal protein and micro nutrients. Statistics on world per capita fish consumption show that the consumption has increased gradually. In 2013, world per capita fish consumption was 19.7 kg [1]. The continuous growth in aquaculture production has boosted the average consumption of seafood at the global level. The global aquaculture sector's contribution to the supply of seafood for human consumption surpassed that of capture fisheries in 2014 [1]. Aquaculture is now more important than fisheries as a source for seafood for human consumption. Fish consumption is estimated to increase further in countries in Asia, Africa, America, and European regions during 2010–2030 [6]. Given the contribution by the global aquaculture sector to food security, the sustainable development of the aquaculture sector is an important requirement to meet future demand from a world population of 9.6 billion by 2050.

Despite the production increase, the overall rate of growth in the aquaculture sector is decreasing on a global scale (see Fig. 1). Furthermore, disparities in aquaculture growth among aquaculture countries has been observed for many years. Generally, aquaculture production depends on several factors, and the interactions between them, including fingerlings, feed, farming area, climatic factors, farming systems, management practices, market factors, social environment, and institutions. An increase in factor inputs increases aquaculture outputs. However, feed waste, feces, escapement and pathogens may cause negative externalities among producers and between the aquaculture industry and other parts of the economy. Differences in input factors in aquaculture production might be reasons for the growth disparities. Marine resource abundance, farming practices, technology,

* Corresponding author.
E-mail addresses: suthamathy.nadarajah@uit.no (S. Nadarajah), ola.flaaten@uit.no (O. Flaaten).

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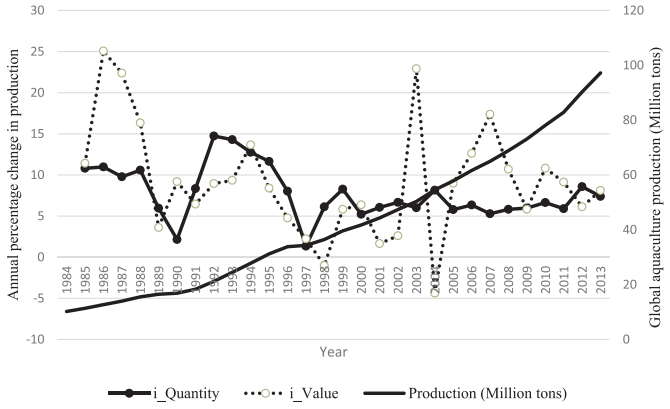

Fig. 1. Average annual change in total global aquaculture production (1984–2013). *Source*: FishStat, FAO, 2015.

and markets have been discussed as critical factors that contributed to the growth experienced in recent decades [7–9].

This study focuses on institutions and investigates empirically whether the quality of national institutions has influenced aquaculture growth and development. The role of the qualitative factor institutions, in aquaculture production could also be a determinant, in particular in the long run. Institutions are key components in the overall management of natural resource industries, guiding the people involved in their task of production and marketing. Institutions include governmental policy, laws, rules and regulatory measures, planning, programs (training, extension services, and financial assistance) and controls. Institutions may change over time to create improved environment for technological change and economic development [10].

2. Background

"Why do some countries produce so much more output per worker than others?" was the key question posed by Hall and Jones [11], as well as in the voluminous literature in the field of growth and development economics. This cross-country study of 127 entities found that designated social infrastructure (institutions and government policies) is of great importance for economic development and productivity. A good social infrastructure creates a favorable environment that supports production, encourages capital accumulation, skill acquisition, invention, and technology transfer. There is a "powerful and close association between output per worker and measures of social infrastructure" [11], considering input and output data.

The role of institutions in the performance of resource economies has been discussed in the "resource curse literature" [12–14]. The resource curse - that natural resource abundance is harmful to economic growth- is a finding from an earlier study on the economic development history of resource economies conducted by Sachs and Warner [15]. They concluded that resource abundance is not a blessing, but rather it hampers economic growth. The main causes of this, identified based on theory and the study of many countries, include rent-seeking behavior, civil war, armed conflict, political instability, and the decay of institutional quality. Empirical studies have identified a negative correlation between resource abundance and economic growth [14,15].

However, researchers who later studied the same research questions partly argued the findings of earlier studies and partly introduced new elements to explain the anomalies found.[1] They have suggested that a hidden factor determines whether natural resource abundance is a blessing or a curse, namely the quality of institutions [12,13]. These studies demonstrate, both theoretically and empirically, that a country could attain economic growth through its abundant natural resources if it maintains high-quality institutions. Weak institutions provide opportunities for rent seekers to keep some production outside the formal economy and to employ resources for unproductive rent seeking, causing negative impacts for the overall economy and low economic growth [12]. However, institutions alone do not determine the outcomes of resource use. The type of resource also influences economic results [13]. The natural resources considered in the literature as contributors to economic growth are mainly valuable mineral resources, including crude oil, gas and diamonds, all of which are highly traded internationally.

Marine renewable resources are also valuable natural resources. The fishery and aquaculture sectors play a significant role in achieving socioeconomic development. Seafood products are highly traded internationally, about 78% of seafood products estimated to be exposed to international trade competition [16–18]. In 2014, more than 200 countries reported exports and imports of seafood products [1]. Since the quality of institutions is proved to be a crucial factor contributing to economic growth through non-renewable resource-based industries, what would be the effect of institutions on the performance of limited renewable resource-based industries? This question was recently studied for the fishery sector, but in a different manner than that of previous studies on nonrenewable resources, as fisheries in most countries play a minor role in the national economy [19]. A major finding of this empirical study was that national institutions do not play a significant role in the harvest growth rate, and this statistical finding contrasts with the previous finding in the resource curse literature that institutions have a significant influence on the contribution of resource industries to the growth of the gross domestic product (GDP). In this context the fisheries sector is a special case compared to other natural resource-based industries.

Although both fisheries and aquaculture are similar industries in producing food fish, the aquaculture sector differs from the fishery sector in some important ways [9]. The aquaculture sector is a man-made ecosystem, generating both positive and negative consequences for the surrounding natural ecosystems [20]. Aquaculture is in some respects more similar to agriculture than to fisheries, in particular since the stock of animals is private property [9]. On the other hand, aquaculture fish are to a high degree exposed to and create externalities, as noted above [20]. This is particularly the case for cage-reared fish, such as salmon in Chile and Norway [21], but also for pond-raised species, such as shrimp in Sri Lanka and Vietnam. This distinct industry requires special management measures to overcome the externalities. As a component of the management system, institutions might influence aquaculture production in different ways. Therefore, this study aims to examine the extent to which national institutions influence aquaculture production and value (see Fig. 2).

Comparative analyses of the determinants of the general economic performance of countries traditionally use macroeconomic indicators such as GDP per capita (level and change) as the dependent variable [11,12,15]. On the other hand, there are numerous sectorial studies where the sector output (net or gross, level or change) is the dependent variable. This literature includes studies of the primary industries agriculture [22,23] and fisheries [19]. The quoted agriculture studies focused on output levels whereas the quoted fishery study focused on annual change. The main reasons for this difference appears to be the availability or lack of cross-sectional data as well as time series data. For aquaculture, input data, to the best of our knowledge, is not available the same way internationally, and we have rather to perform a study of output growth for quantity and value. The relationship between the annual growth rate in aquaculture production of the major aquaculture countries and the quality of institutions in those countries over the last three decades (1984–2013) is analyzed using econometric models.

[1] These research questions ask why growth rates differ among resource-rich countries even though they depend on similar natural resources, and why the growth rates of many resource-rich economies are lower than those of economies less abundant in valuable natural resources.