

Analysis of Aquaculture's Effect on the Regional Environment

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Abstract

Intense discussion over aquaculture's contribution to rural development and poverty reduction has resulted from the fish farming industry's explosive rise over the past three decades. The central issue in these discussions is whether and how aquaculture affects local wages and employment, yet there is little empirical support for this claim. In order to answer this query, we put forth a Local Economy-wide Impact Evaluation model that nests fish farm models inside a general equilibrium model of their local economies. A primary data set of 1102 families in the principal aquaculture zone of Myanmar, which accounts for 60% of the nation's aquaculture farms, was used to calibrate the model. With the help of this model, we look at how aquaculture has affected the earnings and employment prospects of households involved in fish farming as well as households with crop farms and non-farm occupations in the cluster. When we simulate increases in pond/plot surface of one acre, we find that: the retail and labour markets; and (3) small commercial fish farms generate greater spillovers than large fish farms. These findings support the idea that small-scale commercial aquaculture, specifically fish farming, may have a big impact on rural development and poverty alleviation.

Keywords: Aquaculture; Regional environment; Poverty; Fish farming

Introduction

For the past three decades, aquaculture has been the fastest-growing subsector of food production in the world, producing more than half of the fish used for human consumption. As the aquaculture industry has grown in importance on a global scale, interest in its potential to boost economic growth and alleviate poverty in developing nations, where the majority of fish farming is concentrated, has exploded. However, there is a dearth of both a convincing set of empirical data and a cohesive theoretical framework in the literature evaluating the benefits of aquaculture to rural economic development. The purpose of this paper is to fill this gap by estimating the economic effects of aquaculture in a rural economy, including indirect effects through input and factor markets, using a rigorous empirically grounded evaluation methodology based on a well-established body of economic literature [1].

The literature connecting aquaculture with poverty alleviation can be divided into two primary "strands." The first is the "small-scale" tale, so to speak. This highlights the immediate advantages that farming households with limited resources may have when they raise fish for domestic consumption while also selling any surplus to boost their income. The oldest study that connected aquaculture and poverty had this theme. Since then, it has continued to be a common viewpoint and has been the literature's prevailing topic [2].

The second thread is known as the "SME" storyline. On two empirical findings, this departs from the small-scale narrative: (2) the poorest households in communities where fish farming is practised rarely have sufficient resources to participate in aquaculture directly as producers, but are able to benefit from the industry through employment. The SME narrative suggests that a large portion of aquaculture's contribution to poverty reduction is indirect; resulting from business opportunities and employment created both on- and off-farm. This contrasts with the small-scale aquaculture literature, which emphasises the direct benefits derived from small-scale, semi-subsistence fish farming by producers. The SME story represents the notion that rural growth linkages are a crucial mechanism by which poverty is alleviated, even though it is not usually expressed in such terms [3].

In what Dorward, Poole, Morrison, Kydd, and Urey refer to as a "virtuous circle," growth linkages happen when expansion in one sector of the economy produces spillovers to other sectors through the interconnectivity of the production, consumption, and employment markets. Spillovers occur in the context of agriculture when income from farming or associated activity is used to fund productive purchases or consumption. This increases the need for extra commodities, services, and labour, which in turn leads to a cascading increase in demand for those same items. As an illustration, farms frequently need services and intermediate inputs made by businesses outside the agriculture industry. These businesses can give the poor work possibilities and ways to make money in addition to producing cash for their owners. Similar to how demand is formed, "consumption linkages" are created when farm households or workers spend their earnings on consumption products. With an increase in agricultural revenue, these connections usually become stronger [4].

Small-to medium-sized farm households often spend higher percentages of additional income than big farms on locally produced "non-tradable" goods and labour-intensive services, which is advantageous for fostering growth in the local non-farm sector. Commercially oriented aquaculture can produce far better returns than staple crops like rice, but it frequently requires significant manpower and other production inputs. These data together imply that small- and medium-scale commercial aquaculture has a greater chance of fostering close connections between rural areas than either traditional crop agriculture or large-scale aquaculture. All of the analysis that follows in this work is guided by this hypothesis. Analysing indicators of the

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scope and magnitude of production, consumption, and employment links related to aquaculture has been addressed in a few earlier studies. Together, their findings imply the following ideas: (2) Commercial aquaculture can create employment linkages that are greater than those associated with crop farming, and these employment linkages can reduce poverty and income inequality. (3) Small commercial fish farms may create larger multipliers of all types than small non-commercial or large commercial farms [5].

The use of different methodologies, restrictions on the size, representativeness, and quality of the data used, the context-specificity of the cases chosen, and variations in how growth linkages are conceptualised, assessed, or inferred limit the generalizability and comparability of the results from these studies. Béné offers a similar critique of the larger body of literature that connects aquaculture with eradicating poverty [6].

By modelling production, consumption, and employment linkages within the confines of a precisely defined rural economy² in Myanmar using a sizable dataset collected specifically for this purpose and statistically representative of nearly half of all aquaculture ponds in Myanmar, the current paper contributes methodologically and empirically to the literature. We build a local economy-wide effect evaluation model for the areas that were studied, outlining the relationships between fish farms and crop farms as well as with other local economic players. The model is used to run simulations that assess the full economic impact of various-sized crop and fish farms. With this strategy, we can: (1) quantify the growth links created by aquaculture and compare them to the ones produced by crop agriculture; (2) examine the differences between the size and nature of the links made by small- and large-scale aquaculture farms; and (3) evaluate changes in income (in) equality linked to the expansion of each of these activities [7].

We find that aquaculture: (1) creates greater overall revenues than agriculture on a per-acre basis; and (2) generates stronger income spillovers in the local economy by simulating a one-acre increase in the land holdings of various types of households. Fish ponds produce significant spillovers in comparison to their direct impact. Additionally, we discover that tiny fish farms have greater spill over effects than large fish farms, and that whereas large farm expansion increases income inequality locally, small farm expansion decreases it. These findings are in line with the SME narrative on aquaculture growth and emphasise the value of looking at the economy as a whole when analysing how fish farms contribute to rural development and poverty reduction [8].

Results

The results also add to the on-going policy discussions in Myanmar. The creation of very large fish farms has historically been encouraged by Myanmar's agriculture policy, which grants land concessions. At the same time, development of smallholder-led fish farms has been hindered by severe laws limiting the use of agricultural land. As a result, huge farms account for the majority of the farmland and production in Myanmar. Following Myanmar's democratisation in 2016, governmental goals have changed, encouraging agricultural diversification outside the core rice crop while continuing to impose limitations on the use of agricultural land for fish ponds. Our findings show aquaculture generates significantly more spillovers than crop farming and that small-scale aquaculture generates more favourable spillovers than large-scale aquaculture have significant ramifications for agricultural policy and the future growth of aquaculture in Myanmar [9].

The remaining sections of the essay are structured as follows. The context for the characteristics of Myanmar's aquaculture sector is provided in the next section. The survey methodology, data, and model specifications are covered in Section 3. The model results for the magnitude and kind of growth linkages related to both large- and small-scale commercial aquaculture and crop farming are shown in section four. The analysis of the implications for Myanmar's agriculture policy and the literature on aquaculture and poverty finishes section five [10].

Conclusion

The following conclusions came from this analysis: First, as was predicted, farmers in Myanmar receive substantially larger returns from fish farming than from agriculture per acre. Second, and this is crucial to the discussion of aquaculture's role in economic growth, fish farming generates income spillovers for nearby households, with landless farmworkers benefiting most. Third, compared to large farms, small commercial fish farms produce significantly higher spill over profits and somewhat higher direct incomes per acre of pond. This results from the former's tendency to rely more heavily on labour and locally generated inputs, whilst the later uses more external inputs and capital. Fourth, whereas the growth of huge fish farms increases inequality, expanding the size of ponds used for fish farming by smallholders has the opposite effect.

Three important contributions are made by our work. First, the analytical framework created enables aquaculture to be examined through an economic lens that places fish farms into the networks of forward and backward linkages that ultimately determine their effectiveness as rural growth drivers. It is possible to approach the discussion of aquaculture's economic effects within a theoretical framework that can produce reliable empirical results by formalising these links in a structural model based on general equilibrium theory.

Second, the research adds to on-going discussions about aquaculture's potential to reduce poverty. Our findings provide significant empirical support for the "SME narrative" on the contribution of aquaculture to rural development by demonstrating how commercially oriented fish farms can benefit the local economy through revenue spillovers.

Third, the outcomes of the simulation have significant policy ramifications, both for Myanmar and elsewhere. The discovery that aquaculture can produce much higher farm incomes and greater economic spillovers than crop farming is relevant for Myanmar, where it is forbidden to convert agricultural land to ponds, as well as for many other nations that impose restrictions on the expansion of aquaculture in an effort to protect cropland. The finding that large fish farms produce fewer spillovers than small commercial fish farms and increase local income inequality is especially significant for Myanmar, where agricultural and land use policy has historically favoured the development of industrial-scale fish farms. This suggests that a shift in policy support towards smallholder-led aquaculture development is necessary.

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