Fish Exports and the Growth of the Agricultural Sector: The Case of South and Southeast Asian Countries

Md Ali Emam, Markus Leibrecht * and Tinggui Chen

Abstract: The per-capita demand of fish and fish products, and paired to it, their production and trade, have substantially increased during the last few decades. For many developing countries these developments open a channel for sustainable economic progress. Against this background, this article investigates whether fish exports Granger-cause long-run economic growth of the agricultural sector (“fish export-led growth”) in a panel of eight South and Southeast Asian countries. A dynamic panel autoregressive distributed lag (ARDL) model is estimated based on data for the years 2000 to 2018. The results indicate that fish exports have a significant positive impact on the growth of the agricultural sector in the long run. These findings apply to both the lower- and the upper-middle-income countries included in the analysis. Long-run Granger causality tests within a panel vector error correction model indicate that agricultural value added per worker reacts to deviations from the long-run equilibrium, whereas fish exports per worker are weakly exogenous. Thus, the paper finds supporting evidence for fish export-led growth. The paper concludes with some thoughts about how this finding can help policymakers in their attempt to induce sustainable agricultural development to eradicate poverty and to enhance living standards.

Keywords: fish exports; agricultural sector; export-led growth; panel cointegration; pooled mean groups estimator; sustainable development; Granger-causality

1. Introduction

From 1961 to 2017 the average annual growth in per-capita demand of fish products was 2.4% in developing countries [1]. Fish products are the main source of protein for many less-developed countries [2]. Trade in fish and fish products plays a vital role to ensure food security [2–7]. The export of fish and fish products has now become a lifeline for many coastal, riverine, insular, and lacustrine countries and regions [8]. In addition, the expansion and growth of the fishery sector may be a crucial part of economic development [8,9]. Fish exports provide employment opportunities for millions of low-income families [10,11] and fish exports are a key source of foreign exchange earnings [1,12,13]. Fish products can also help meet the growing demand of food in a world with a steadily and fast-growing population, for instance, by the expansion of economically important aquatic species, grown and harvested based on intensive and semi-intensive aquaculture practices [14].

According to [1], 67 million tons of fish and fish products, worth USD 164 billion, were exported globally in 2018. Worldwide, fish exports represent 11% of total agricultural exports (excluding forestry), which equals 1% of total merchandise exports. In 2018, developing countries received net revenues of USD 38 billion from exporting fish products [1].

In 2018, the estimated total of world fish production reached approximately 179 million tons, worth USD 401 billion. Asian economies contribute 69% of the total global fish production [1]. The biggest Asian fish producer is China, with about 35% of total world production [1]. Roughly 22% of total world fish production stems from economies in Southeast Asia with a value worth USD 51 billion [15]. Twelve percent of total global fish production is contributed by other Asian countries, including South Asia.
Southeast Asian countries, Vietnam and Thailand jointly contributed 9% of the global total export value of fish and fish products and India contributed about 4% in 2018 [1]. These numbers indicate that South and Southeast Asian countries contribute significantly to the world fish market. However, trade in fish and fish products is also of quantitative importance in total exports of these countries. For instance, for India in 2019, the value of exports in fish and fish products equaled about 10% of total export and almost 20% of total agricultural export [16]. For Bangladesh, export of fish and aquaculture is the second largest exporting item to earn foreign revenue [17].

In the light of the broader discussion of the possibility of export-led growth [18], these numbers suggest that exports of fish and fish products may act as a catalyst for long-run economic growth, and, thus, for sustainable economic progress for South and Southeast Asian countries. Fish exports are not only relatively labor-intensive, but exports of fish may also lead to knowledge and technology spillover effects and may exert a positive impact on production efficiency [13].

However, despite the potential importance of exports of fish and fish products for sustainable economic development and growth [13,19], few studies empirically investigate the importance of fish exports for long-run economic growth. Furthermore, studies that investigated the export-led growth (ELG) hypothesis for the fishery sector related fishery export to growth in GDP per capita. Clearly, the growth in GDP per capita is determined by the economic performance of all economic sectors. This makes it difficult to isolate the effects of fish exports and growth, as a multitude of confounding variables must be considered. A more direct test of the ELG hypothesis relates fish exports to growth in agricultural value added. This study, therefore, analyzes the fish export-led growth hypothesis on a more disaggregated level by relating fish exports to the growth in agricultural value added.

The specific research question of this study is the following: Do exports of fish and fish products Granger-cause the long-run growth of agricultural value added per worker in South and Southeast Asian countries? The study uses secondary data for eight South and Southeast Asian countries (Bangladesh, India, Indonesia, Malaysia, Pakistan, Sri Lanka, Thailand, and Vietnam) for the years 2000 to 2018 to investigate the relationship between long-run growth in agricultural value added per worker and exports of fish and fish products per worker. The pooled mean groups estimator [20] is used to derive the long-run cointegration relationship between the key variables as well as the short-run responses to shocks. Long-run Granger-causality testing [21] is applied to isolate the direction of causality. The main finding is that the fish export-led growth hypothesis is valid in the long run for both lower-middle income and upper-middle income countries. This finding is consistent with the view that fish exports can indeed be a motor for sustainable economic progress for the developing countries included in the analysis.

Economic progress may come at the cost of environmental degradation, which is a real threat here in the form of overfishing of wild fish stock. Therefore, the study also discusses ways to implement fish export-led growth with a reduced ecological footprint.

The article is organized as follows: Sections 2 and 3 briefly illustrate the ELG hypothesis and its empirical relevance in general as well as for fish exports. Section 4 details data, variables, and methodology and Section 5 includes the findings of the empirical analysis. Section 6 discusses the findings from an economic policy perspective.

2. The Export-Led Growth Hypothesis and Its Empirical Support

The export-led growth hypothesis postulates that exports are a crucial factor to accelerate the growth of an economy [22]. Export can positively influence the growth of an economy through various channels like technology spillovers, the enhancement of managerial and laboring skills by proving training facilities, increasing foreign currency reserves to import modern technology and equipment, mobilizing additional investment, and utilizing resources properly to be able to compete in global markets as well as enhancing production efficiency through economics of scale [18,23–29].
The validity of the ELG hypothesis has been investigated by a vast number of studies. Cross-sectional, panel, and time-series data are applied to isolate the role of exports for economic growth. The sectoral focus therefore is on manufacturing, but studies dealing with oil, mineral, and agricultural industries are available, too. The empirical evidence regarding the ELG hypothesis is mixed. Giles and Williams [30] reviewed 150 papers dealing with the ELG hypothesis and concluded “that expanding or contracting foreign trade […] can have an impact on growth […] but […] the relationships between foreign trade and growth are varied and complex” (ibidem, p. 335). This conclusion was recently corroborated by [31].

Studies dealing with South and Southeast Asian countries frequently find that exports indeed spur the growth of the economy. Using a panel of countries, [32] concluded that the ELG hypothesis is supported in the long run for South Asian countries, except Sri Lanka. Likewise, [33] confirmed the long-run validity of the ELG hypothesis for Asian countries, except Pakistan. The findings of [34] support the ELG hypothesis for Korea, Thailand, and Singapore. In contrast, [35] provided evidence consistent with the view that growth leads exports (GLE hypothesis) based on a sample including Malaysia, Indonesia, and Thailand.

Studies based on time series data also frequently find support for the ELG hypothesis. For instance, [36] isolated evidence in favor of export-led growth for the case of India. Shahbaz et al. [37] confirmed the validity of the ELG hypothesis, both in the short run and the long run, for Pakistan. Kurniasih [38] derived a similar finding for Indonesia. Liang and Zuradi [39] found a positive long-run relationship between export and economic growth for Malaysia, and [40] found supporting evidence for the case of Vietnam.

In contrast, references [41–43] isolated a negative impact of exports on growth. These findings are consistent with the early work of [44], who reported that exports exert a negative impact on the economic growth of Asian and African countries. One reason brought forward [44,45] for this negative impact is that less-developed countries primarily focus on exporting primary goods whose prices are heavily volatile, which, in turn, leads to volatile export revenues and increased economic uncertainty.

Moreover, references [41,46] identified that the direction of the impact of exports on growth depends on the level of income. The argument brought forward [46] is that less developed countries lack the basic infrastructure and absorptive capacity that is needed to fully gain from technology and knowledge spillover effects as well as from economies of scale. In this spirit, reference [47] concluded that less-developed countries cannot utilize exports as catalysts for economic growth simply because of their low level of development. Supporting evidence for this view was also provided by [31,48].

Taken together, the empirical evidence regarding the validity of the ELG hypothesis is mixed. The literature is consistent with the view that export-led growth needs a certain extent of infrastructure endowment and absorptive capacity in the exporting nation. Developing countries may not reach the respective threshold values for a positive impact of exports on growth, and thus, for these countries, the impact may be negative or negligible at best. These findings imply that any study exploring the ELG hypothesis for a panel of developing countries needs to pay attention to the development level of the individual countries. This study, therefore, splits the country sample into lower-middle-income and upper-middle-income countries.

3. ELG Hypothesis and Fish Exports

Like exports in general, fish exports may also lead to positive spillover effects and increased efficiency in production. Furthermore, given their quantitative importance, fish exports are a relevant source of foreign currency for many developing countries. The fishery sector also provides employment opportunities for both skilled and unskilled laborers [49].

To date, only three studies have delved into the relationship between fish exports and economic growth. Jawaid et al. [50] used data for Pakistan from the years 1974 to 2013. They applied an autoregressive distributed lag (ARDL) model and tested for cointegration of variables. In that study, gross domestic product (GDP) and labor force, real gross fixed
capital formation, and a proxy of capital stock and fish export were considered dependent and independent variables. Jawaid et al. [50] found that fish exports in the long run have a positive impact on GDP growth. From their impulse–response function analysis, however, it became evident that a shock in fish exports has no significant impact on GDP growth (as impulse–response coefficients do not reach statistical significance), and a reverse effect is given.

Jaunky [51] analyzed the fish export-led growth hypothesis based on a panel of 23 small island developing states (SIDS) for the years 1989 to 2002 by applying various panel unit root and cointegration tests. The author defined the growth rate of real GDP as the dependent variable and the growth rate of real fish exports as the only independent variable. Jaunky [51] used the panel fully modified ordinary least square (FMOLS) estimator to isolate the cointegration relationship. The findings of this study indicate the presence of a relationship between fish exports and the growth of the economy in the long run. Granger-causality tests imply that a bi-directional relationship exists between fish export and economic growth, which means that a “virtuous circle” of causation is given between fish export and the growth of the economy.

Béné [3] used panel data for 47 Sub-Saharan African countries for the years 1990 to 2005 to investigate the relationship between fish exports and economic growth by applying the ordinary least squares estimator and analysis of variance. Béné [3] was unable to isolate a significant correlation between fish exports and economic growth.

To sum up, although fish exports and GDP growth likely move together in the long run (cointegration), the direction of long-run causality is unclear. A notable feature of each of the three studies is that they used GDP as a dependent variable. As stated above, a more direct test of the fish export-led growth hypothesis relates fish exports to agricultural value added. A positive effect of fish exports on long-run growth in agricultural value added may, in turn, also enhance long-run growth in GDP.

4. Data, Variables, and Empirical Methodology

4.1. Data and Variables

The dependent variable in this study was agricultural value added per worker (\(av\)). Independent variables were derived based on economic growth theory and comprised agricultural capital stock (\(k\)), fish exports (\(fx\)), and “other agricultural exports” (\(ox\)), each measured in per-worker terms (cf. Section 4.2). Fish exports consisted of live, frozen, fresh, dried, smoked, salted, prepared, and preserved fish as well as fish meat of any kind. “Other agricultural exports” consisted of exports of crops and livestock products, and variable agricultural capital stock mainly comprised the total value of farmer’s acquisitions of fixed assets (less disposals). This variable did not include depreciation of fixed capital or land purchases [52].

Data were retrieved from [53] (\(k, fx, ox\)) and from [54] (\(av\)). Variables were converted into current USD. In total, the study covered data for eight countries over 19 years (2000–2018), which resulted in a balanced panel with 152 observations. Descriptive statistics are provided in Table 1.

Table 1. Descriptive statistics.

|        | \(av\) | \(k\)     | \(fx\)   | \(ox\)   |
|--------|--------|-----------|----------|----------|
| Mean   | 2791.588 | 5486.277  | 144.646  | 2157.718 |
| Maximum| 22394.5  | 46693.530 | 601.414  | 24268.370|
| Minimum| 276.230  | 159.017   | 5.198    | 3.178    |
| Std. Dev. | 4080.404 | 9782.634  | 168.410  | 4477.418 |
| Observations | 152 | 152 | 152 | 152 |

Table 1 shows that the mean of agricultural value added per worker was about USD 2792 and the maximum and minimum values of \(av\) were USD 22394 and about USD 276, respectively. The maximum value was for Malaysia in 2012, an upper-middle-
income country, and the minimum value was for Bangladesh in 2002, a less-developed country. Average exports of fish and fish products per worker (fx) reached about USD 145, with a minimum of USD 5 in the year 2001 for India and a maximum of about USD 600 for Malaysia in 2011. Figure 1 plots the development of (the logs of) av and fx over time per country. A co-movement of these variables for each country included in the analysis is discernable.

![Figure 1. Plot of lnav and lnfx over time per country.](image)

4.2. Empirical Methodology

The empirical model was derived from neo-classical growth theory and is based on a Cobb–Douglas production function with constant returns to scale [45,55]. Exports were assumed to impact the output via an effect on total factor productivity (TFP).

The basic Cobb–Douglas production function with constant returns to scale is shown in Equation (1):

\[ Y_{it} = A_{it} * K_{it}^\alpha * L_{it}^{1-\alpha} \]  

where \( Y_{it} \) is the output, \( L_{it} \) signifies labor input, \( K_{it} \) is capital stock, and \( A_{it} \) indicates total factor productivity. Equation (1) can be rewritten in per-worker form as [56]:

\[ \frac{Y_{it}}{L_{it}} = \frac{A_{it} * K_{it}^\alpha * L_{it}^{1-\alpha}}{L_{it}} \]

or equally as

\[ y_{it} = A_{it} * k_{it}^\alpha \]  

\[ 2 \]
where \( k = K_{it}/L_{it} \). \( A_{it} \) is defined as follows:

\[
A_{it} = A_0 + \frac{FX_{it}^2}{L_{it}} + \frac{OX_{it}^2}{L_{it}} + \varepsilon_t
\]  

(4)

Substituting Equation (4) into Equation (3) and taking the log results in the model, which forms the basis of the empirical analysis:

\[
\ln \text{av}_{it} = \partial_0 + \partial_1 \ln \text{fx}_{it} + \partial_2 \ln \text{ox}_{it} + \delta_{ij} \ln k_{it} + \varepsilon_{it}
\]  

(5)

where \( \delta_{ij} \) equals \( \alpha \). In the analysis, \( \ln \text{av}_{it} \) is measured by the logarithm of agricultural value added per worker (\( \ln \text{av}_{it} \)). \( \ln \text{fx}_{it} \) refers to the per-worker value of fish exports, \( \ln \text{ox}_{it} \) represents other agricultural exports per worker, \( \ln k_{it} \) is the agricultural capital stock per worker, and \( \varepsilon_{it} \) is the error term. Due to log-linearization, the estimated coefficients represent elasticities [56].

Equation (5) is meant to capture a long-run, cointegration relationship and is part of a larger error-correction model (ECM) that simultaneously captures the long-run equilibrium relationship between variables as well as the short-run dynamics back to the equilibrium after disequilibrating shocks. Equations (6) to (8) show the derivation of the ECM from a general ARDL \((p, q)\) model [57].

\[
\ln \text{av}_{it} = \mu_i + \sum_{j=1}^{p} \lambda_{ij} \ln \text{av}_{it-j} + \sum_{j=0}^{q} \beta_{1ij} \ln \text{fx}_{it-j} + \sum_{j=0}^{q} \beta_{2ij} \ln \text{ox}_{it-j} + \sum_{j=0}^{q} \beta_{3ij} \ln k_{it-j} + \varepsilon_{it}
\]  

(6)

where \( i = 1, 2, \ldots, 8 \) signifies country and \( t = 1, t \) is the time index (at the annual frequency); \( j \) (l) is the number of time lags of the left-hand (right-hand) variable; and \( \mu_i \) captures country-specific intercepts. Note that in Equation (6) all coefficients vary by country. By adding and subtracting variables, Equation (6) can be rewritten as:

\[
\Delta \ln \text{av}_{it} = \mu_i + \phi_i \ln \text{av}_{it-1} + \beta_{11} \ln \text{fx}_{it} + \beta_{21} \ln \text{ox}_{it} + \sum_{j=1}^{p} \lambda_{ij} \Delta \ln \text{av}_{it-j} + \sum_{j=0}^{q} \beta_{1ij} \Delta \ln \text{fx}_{it-j} + \sum_{j=0}^{q} \beta_{2ij} \Delta \ln \text{ox}_{it-j} + \sum_{j=0}^{q} \beta_{3ij} \Delta \ln k_{it-j} + \varepsilon_{it}
\]  

(7)

where:

\( \phi_i = -1 - \sum_{j=1}^{p} \lambda_{ij} \), is the error correction term for the \( i \)th country.

\( \beta_{11,2,3,i} = \sum_{j=0}^{q} \theta_{ij} \) is the long-run parameter of the \( i \)th country.

\( \lambda_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}, j = 1, 2 \ldots p - 1, \) and

\( \beta_{ij} = -\sum_{m=j+1}^{q} \theta_{im}, j = 1, 2 \ldots q - 1. \)

Equation (7) can be rewritten in ECM form by further grouping the variables in levels:

\[
\Delta \ln \text{av}_{it} = \mu_i + \phi_i (\ln \text{av}_{it-1} - \theta_{11} \ln \text{fx}_{it} - \theta_{21} \ln \text{ox}_{it} - \theta_{31} \ln k_{it}) + \sum_{j=1}^{p} \lambda_{ij} \Delta \ln \text{av}_{it-j} + \sum_{j=0}^{q} \beta_{1ij} \Delta \ln \text{fx}_{it-j} + \sum_{j=0}^{q} \beta_{2ij} \Delta \ln \text{ox}_{it-j} + \sum_{j=0}^{q} \beta_{3ij} \Delta \ln k_{it-j} + \varepsilon_{it}
\]  

(8)

The long-run equilibrium coefficients are captured by \( \theta_{ij} \). The short-run coefficients are represented by \( \lambda_{ij} \) and \( \beta_{ij} \). Coefficient \( \phi_i \) captures the speed of adjustment, which indicates how quickly \( \ln \text{av}_{it} \) adjusts to its long-run equilibrium after a disequilibrating shock. For cointegration to exist, \( \phi_i \) must be negative and in absolute value below 1.

In its most general form, with all coefficients being country-specific, Equation (8) can be consistently estimated equation by equation. Pesaran and Smith [58] demonstrated that the average of a coefficient over countries is a consistent estimator for the average impact (mean group (MG) estimator). A restrictive form of the model assumes that all coefficients except for the intercepts are identical across countries, which results in a dynamic panel data (DFE) model.
The pooled mean groups (PMG) estimator developed by [20] lies between these two extremes. PMG allows for heterogeneity in short-run coefficients, the speed-of-adjustment coefficient, and the error variances, but it assumes homogeneity of the long-run equilibrium coefficients. Put differently, this estimator assumes that short-run reactions to disequilibrating shocks are country-specific, but the long-run equilibrium is the same across countries. If the long-run homogeneity assumption as well as the other model assumptions are correct, the PMG estimator is more efficient than the MG estimator. Under the assumption that the MG estimator is consistent, the validity of the long-run homogeneity assumption can be tested using a Hausman test. Likewise, a Hausman test can be performed to test whether the DFE estimator is more efficient than the MG estimator.

A key assumption of [20]’s maximum likelihood-based PMG method is that the variables form a stable, long-run relationship (Assumption 2 in [20]). This implies that prior to applying the PMG estimator, tests for panel-unit roots and panel cointegration should be performed. This study applies the Fisher-type panel-unit root test, which is suitable for a panel where $T > N$. Panel cointegration is evaluated using the tests developed by [59,60].

5. Results
5.1. Panel-Unit Root and Cointegration Tests

To determine which deterministic terms to include in the unit-root tests, time-series plots of the various variables (in levels and in first differences) were inspected. The plots signaled that a deterministic trend should be included for variables in levels. For first differenced variables, only individual intercepts were included. The panel unit-root tests applied were consistent with the view that all variables are I(1), that is, stationary in first differences (detailed results are available upon request).

The presence of cointegration was tested using the panel cointegration tests of [59,60]. For this aim, Equation (5) was estimated, and the residuals were tested for stationarity using appropriate test statistics. Table 2 includes the results. Pedroni’s [59] “within dimension” is based on pooling of the residuals of the regression along the within dimension (time-series dimension). His “between dimension” focuses on pooling the residuals of the regression along the between dimension (country dimension). Four out of seven test statistics rejected the null hypothesis of “no cointegration.” Pedroni [59] also pointed out that among the seven test statistics, the panel ADF and group ADF statistics provide the most powerful results. From these results, it was concluded that the variables follow a long-term, cointegration relationship. Similarly, the outcome from [60]’s cointegration test also indicated the presence of a long-run relationship among the variables. Taken together, the panel cointegration tests indicated that the residuals in Equation (5) are stationary, which allows for the application of the PMG estimator.

Table 2. Panel cointegration tests.

| Pedroni Panel Cointegration Tests: H0: No Cointegration |
|---------------------------------------------------------|
| **Within Dimension** | **Between Dimension** |
| Panel | Statistics | Prob. | Group | Statistics | Prob. |
| v-statistics | 0.669 | 0.251 | rho-statistics | 1.078 | 0.869 |
| rho-statistics | 0.175 | 0.569 | PP-statistics | –5.759 | 0.000 |
| PP-statistics | –2.123 | 0.016 | ADF-statistics | –3.113 | 0.000 |
| ADF-statistics | –2.943 | 0.001 |

| Kao Cointegration Test: H0: No Cointegration |
|---------------------------------------------|
| t-Statistics | Prob. |
| ADF | –5.879 | 0.000 |
5.2. Estimation of the ECM

Table 3 displays the results when the PMG, MG, and the DFE estimators were applied to estimate Equation (8). Table 3 signals that in the long-run variable capital stock ($lnk$) and variable fish export ($lnfx$), both were positively related to agricultural value added per worker. This result was robust across the three estimators applied. Similarly, $lnox$ was positively related to agricultural value added, but $lnox$ showed a significant association only in case where the MG estimator was applied.

|                  | (1) PMG |          | (2) MG |          | (3) DFE |          |
|------------------|---------|----------|--------|----------|---------|----------|
|                  | $D.lnav_{it}$ |          | $D.lnav_{it}$ |          | $D.lnav_{it}$ |          |
| **Long Run**     |         |          |        |          |         |          |
| $lnk_{it}$       | 0.722 *** | (0.065)  | 0.424 ** | (0.170)  | 0.640 *** | (0.117)  |
| $lnfx_{it}$      | 0.453 *** | (0.071)  | 0.343 *** | (0.106)  | 0.244 **  | (0.107)  |
| $lnox_{it}$      | 0.005   | (0.057)  | 0.273 ** | (0.139)  | 0.102    | (0.109)  |
| **Short Run**    |         |          |        |          |         |          |
| $SoA$            | $-0.303$ *** | (0.0929) | $0.700$ *** | (0.0991) | $-0.307$ *** | (0.0548) |
| $D.lnk_{it}$     | 0.492 **  | (0.203)  | 0.270    | (0.213)  | 0.469 *** | (0.101)  |
| $D.lnfx_{it}$    | $-0.0417$ | (0.0395) | 0.124 *** | (0.0463) | 0.0495   | (0.0304) |
| $D.lnox_{it}$    | 0.181 **  | (0.0800) | 0.0672   | (0.0762) | 0.115 *** | (0.0421) |
| $Cons$           | 0.0324   | (0.0970) | 0.281    | (0.299)  | 0.260 **  | (0.122)  |
| **N**            | 152      | 152      | 152     |          |         |          |

Notes: $SoA = speed of adjustment; standard errors in parentheses ** $p < 0.05$, *** $p < 0.01$; the Hausman-test PMG vs. MG has a test statistic of 5.31 and a $p$-value of 0.15; the Hausman-test DFE vs. MG leads to a negative test statistic of $−9.56$.

The estimated coefficients of $lnk$ and $lnfx$ were 0.72, 0.42, and 0.64 and 0.45, 0.34, and 0.24, respectively. Thus, a 1% change in capital stock per worker and a 1% change in fish export per worker enhanced agricultural value added per worker between 0.72 and 0.42 percent ($lnk$) and between 0.45 and 0.24 percent ($lnfx$) in the long run. The long-run impact of a 1% increase in $ox$ was 0.27 percent according to the MG estimator.

Turning to the short-run impacts, Table 3 indicates that the coefficient of $lnk$ was positive and statistically significant according to the PMG and the DFE estimators. The coefficient of $lnfx$ was negative for the MG estimator and insignificant for the PMG and the DFE estimators. Like $lnk$, $lnox$ was also positively related to $lnav$ in the short run.

The speed-of-adjustment coefficients were negatively signed and statistically significant with an absolute value below 1. The coefficients ranged between $−0.303$ and $−0.700$, which implies that up to 70% of the total impact of disequilibrating shocks are removed within one year.

The notes to Table 3 include the outcomes of Hausman tests, which, provided that the MG estimator was consistent, signal that the null hypothesis of efficiency gains from applying the PMG was not rejected. However, in case of the DFE vs. MG test, the assumptions underlying the Hausman test were not fulfilled, as indicated by a negative Chi-square test value. Given these results, the PMG estimator was preferred over both the MG and DFE estimator and is used in the rest of the paper.
5.3. Country-Jackknife Analysis

A jackknife analysis was applied to evaluate the robustness of the long-run PMG results with respect to the exclusion of individual countries. For this aim, each sample country was excluded from the regression one-by-one and the PMG model was re-estimated. Table 4 contains the results. This table includes for each of the three independent variables the maximum and the minimum value as well as the corresponding country excluded from the sample.

Table 4. Jackknife analysis for long-run coefficients (based on PMG).

| Variable | Range   | Coefficient | Country Excluded |
|----------|---------|-------------|------------------|
| lnk      | Maximum | 0.938 ***   | Pakistan         |
|          | Minimum | 0.654 ***   | Bangladesh       |
| lnfx     | Maximum | 0.537 ***   | Bangladesh       |
|          | Minimum | 0.186 ***   | Pakistan         |
| lnox     | Maximum | 0.002       | Vietnam          |
|          | Minimum | -0.087 ***  | Pakistan         |

Note: *** p < 0.01.

Except for one aspect, the PMG-based results contained in Table 3 were rather robust to the exclusion of individual countries. The most pronounced impact was on the coefficient of lnox, which became negatively signed and statistically significant in the case of Pakistan being dropped from the sample. Excluding Bangladesh or Pakistan generally had the most pronounced impact on the results. Bangladesh and Pakistan are two of the least developed middle-income countries included in the analysis. Prior studies [27,29,61] indicated that the potential for export-led growth is different across countries with different development levels (see also Section 2). To cope with the possibility of parameter heterogeneity across countries with different development levels, the next subsection presents results based on a sample split along World Bank’s lower-middle-income and upper-middle-income grouping.

5.4. Split by Income Level

The World Bank classifies countries into four income groups: low, lower-middle, upper-middle, and high-income countries. As of 2020, the low-income group comprises countries with a gross national income (GNI) per capita that is less than the current USD 1036. Lower-middle-income and upper-middle-income countries’ GNI per-capita lay between USD 1036 and 4045 and between 4046 and 12535, respectively [62]. Given these numbers, among our sample countries of Bangladesh and Pakistan, along with India, Sri Lanka, and Vietnam, belong to the group of lower-middle-income countries and Malaysia, Thailand, and Indonesia to the upper-middle-income group.

Table 5 includes the results, again based on the PMG estimator. As in the full sample, lnk and lnfx showed a significant and positive long-run relationship with lnav. Although lnox was positively related with lnav in the long run for upper-middle-income countries, it had a negative impact for less-developed countries. For both groups, the speed-of-adjustment coefficient was consistent with cointegration. Adjustment speeds were rather similar across groups, with about 50% of shocks being corrected after one year.

The results in Table 5 provide evidence consistent with the view that for lower-middle-income countries, agricultural exports, excluding fish and fish products, do not spur economic growth in the long run. This supports the early findings of [44] as well as the more recent conclusions by [31,47]. However, Table 5 also signals that export of fish and fish products might be a catalyst of long-run growth even in lower-middle-income countries. For upper-middle-income countries, exports of both types of agricultural products were positively related with agricultural value added in the long-run. Thus, although the development level matters for the long-run relationship of the export of other...
agricultural products with agricultural value added, this is not the case for exports of fish and fish products.

Table 5. Split by income level (PMG).

|                  | (1) LMI Group | (2) UMI Group |
|------------------|---------------|---------------|
|                  | $D.\ln a_{lt}$ | $D.\ln a_{lt}$ |
| **Long Run**     |               |               |
| $\ln k_{lt}$     | 0.956 ***     | 0.454 ***     |
|                  | (0.053)       | (0.080)       |
| $\ln fx_{lt}$    | 0.183 ***     | 0.263 **      |
|                  | (0.023)       | (0.116)       |
| $\ln ox_{lt}$    | -0.095 ***    | 0.437 ***     |
|                  | (0.032)       | (0.091)       |
| **Short Run**    |               |               |
| SoA              | -0.504 **     | -0.457 ***    |
|                  | (0.208)       | (0.064)       |
| $D.lnk_{lt}$     | 0.161         | 0.683 **      |
|                  | (0.257)       | (0.317)       |
| $D.lnfx_{lt}$    | 0.048         | -0.149 **     |
|                  | (0.049)       | (0.060)       |
| $D.lnox_{lt}$    | 0.145 ***     | 0.124         |
|                  | (0.054)       | (0.204)       |
| Cons             | -0.032        | -0.348 *      |
|                  | (0.065)       | (0.178)       |
| **N**            | 95            | 57            |

Notes: LMI = lower-middle income; UMI = upper-middle income; SoA = speed of adjustment; standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

The results contained in Tables 3 and 5 implicitly assume that long-run causality runs from exports to agricultural value added. To investigate the validity of this assumption, a panel-vector ECM model was used to test for long-run Granger-causality [21].

5.5. Panel-Vector ECM-Type Granger-Causality Test

Equation (9) shows the panel-vector ECM (PVECM) that was used to test for long-run Granger-causality. The PVECM estimates an ECM for each variable included in the analysis. Therefore, all right-hand variables enter in lagged form. The variable of main interest in the PVECM was $ECT_{it-1}$, which is the one-year lagged residual in Equation (6), as estimated by the PMG estimator (cf. Table 5). If the coefficient of $ECT_{it-1}$ is statistically significant in a particular equation, then the null hypothesis of weak exogeneity of the left-hand variable is rejected [21].

Evidence in favor of the validity of fish export-led growth is given if coefficient $a_1$ is negatively signed and statistically significant (and lower than 1 in absolute value), and at the same time coefficient $a_3$ is statistically insignificant, which implies weak exogeneity of variable $lnfx$.

$$
\begin{bmatrix}
\Delta ln a_{lt} \\
\Delta ln k_{lt} \\
\Delta ln fx_{lt} \\
\Delta ln ox_{lt}
\end{bmatrix} =
\begin{bmatrix}
\mu_{1i} \\
\mu_{2i} \\
\mu_{3i} \\
\mu_{4i}
\end{bmatrix} + p \sum_{j=1}^{p} \Gamma_j 
\begin{bmatrix}
\Delta ln a_{lt-j} \\
\Delta ln k_{lt-j} \\
\Delta ln fx_{lt-j} \\
\Delta ln ox_{lt-j}
\end{bmatrix} + 
\begin{bmatrix}
a_1 \\
a_2 \\
a_3 \\
a_4
\end{bmatrix} ECT_{it-1} + 
\begin{bmatrix}
\vartheta_{1it} \\
\vartheta_{2it} \\
\vartheta_{3it} \\
\vartheta_{4it}
\end{bmatrix}
$$

(9)

The optimal order of $p$, the optimal lag length, was determined by the Schwarz information criterion, which suggests that one lag is optimal. The results from estimating Equation (9) with $p = 1$ and using the seemingly unrelated regression (SUR) estimator are
provided in Table 6. According to the coefficients of $ECT_{it-1}$, $lnk$, $lnfx$, and $lnox$ were weakly exogenous, a result valid for both country groups. Thus, in the long-run, only $lnav$ reacts to deviations from the long-run equilibrium relationship. This finding implies that the fish export-led growth hypothesis is supported for both country groups.

Table 6. Panel VECM.

|                | (1)          | 2          | (3)          | (4)          | (5)          | (6)          | (7)          | (8)          |
|----------------|--------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                | $D.lnav_{it}$ | $D.lnk_{it}$ | $D.lnfx_{it}$ | $D.lnox_{it}$ | $D.lnav_{it}$ | $D.lnk_{it}$ | $D.lnfx_{it}$ | $D.lnox_{it}$ |
| **Lower-middle-income countries** |              |            |              |              |              |              |              |              |
| $D.lnav_{it-1}$ | -0.352 ***   | -0.009     | -0.376       | -0.130       | 0.188        | 0.381        | 0.139        | 0.695 *      |
|                | (0.131)      | (0.104)    | (0.251)      | (0.293)      | (0.288)      | (0.200)      | (0.400)      | (0.380)      |
| $D.lnk_{it-1}$ | 0.321 **     | 0.084      | 0.682 **     | 0.377        | 0.006        | 0.0784       | 0.294        | 0.266        |
|                | (0.162)      | (0.129)    | (0.311)      | (0.251)      | (0.295)      | (0.200)      | (0.410)      | (0.389)      |
| $D.lnfx_{it-1}$ | 0.080        | -0.008     | -0.178 *     | -0.035       | -0.078       | -0.046       | -0.183 *     | -0.012       |
|                | (0.049)      | (0.039)    | (0.095)      | (0.111)      | (0.069)      | (0.047)      | (0.096)      | (0.091)      |
| $D.lnox_{it-1}$ | 0.014        | 0.078 *    | 0.037        | 0.079        | -0.509 ***   | -0.270 **    | 0.109        | -0.729 ***   |
|                | (0.054)      | (0.043)    | (0.104)      | (0.121)      | (0.172)      | (0.116)      | (0.238)      | (0.226)      |
| $ECT_{it-1}$   | -0.233 ***   | -0.018     | 0.082        | 0.067        | -0.492 **    | 0.042        | 0.309        | -0.104       |
|                | (0.088)      | (0.070)    | (0.169)      | (0.197)      | (0.249)      | (0.169)      | (0.346)      | (0.328)      |
| **Upper-middle-income countries** |              |            |              |              |              |              |              |              |
| $ECT_{it-1}$   | -0.492 **    | 0.042      | 0.309        | -0.104       | (0.249)      | (0.169)      | (0.346)      | (0.328)      |
| $Cons$         | 0.024        | 0.110      | 0.067        | 0.059        | -0.425       | 0.114        | 0.344        | -0.025       |
|                | (0.021)      | (0.030) *** | (0.072)      | (0.046)      | (0.263)      | (0.178)      | (0.365)      | (0.346)      |
| **N**          | 90           | 90         | 90           | 90           | 54           | 54           | 54           | 54           |

Notes: standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; country-fixed effects included.

6. Summary and Conclusions

Exports of fish and fish products may be a catalyst for the sustainable economic progress of developing countries. The purpose of this study was to test the fish export-led growth hypothesis for the agricultural sector in eight South and Southeast Asian middle-income countries. The specific research question of this study was the following: Do exports of fish and fish products Granger-cause the long-run growth of agricultural value added per worker in selected developing Asian countries? The study’s main findings were consistent with a positive cointegration relationship between agricultural value added per worker and exports of fish and fish products per worker as well as a unidirectional long-run Granger-causality running from fish exports to agricultural value added.

South and Southeast Asia are known hotspots for biodiversity [63] and, thus, provide ample opportunities for capturing fish from freshwater and marine water and for becoming the leading fish producers and exporters in the world along with China. According to the findings of this study, investing in the fishery sector will also pay off in terms of long-run economic growth and development. Moreover, enhancing their fishery industries can also halt the recently witnessed drop in agricultural productivity in South and Southeast Asian countries [64], which jeopardizes the sustainable catching-up of the countries in these regions.

From a policy perspective, the results indicate that governments and other policymakers of South and Southeast Asian middle-income countries, in their attempt to eradicate poverty and to enhance living standards, need to pay attention to technological skill transformation and infrastructural development, specifically catering to the needs of the fishery industry to fully benefit from the vast potential of the global fish and fish products market and not to jeopardize future agricultural growth. For instance, governments could subsidize the upgrading of fishing vessels and fishing technologies used. In addition, the digitalization of fish feeding (“eFishery”), where sensors detect the hunger level of the fish and initiate their feeding, could improve production efficiency substantially [65].
Government and fishery departments should arrange training facilities to ensure food safety and could encourage inward foreign direct investment (FDI) to sustain the growth of the fishery industry [64]. According to [66], for developing countries the most significant barrier to the realization of their export potential in the fishery sector is the inability to meet international standards, especially those related to food safety and quality. Therefore, [66] recommended harmonizing national and regional standards and simplifying as well as realigning standards with internationally agreed-upon ones. FDI can be used, in addition to an improvement in the capital stock, to enhance developing countries’ capabilities to meet international standards in food security and quality. The latter, in turn, will likely spur fish exports.

Asian countries should work collaboratively to achieve sustainable management of the region’s precious fishery resources by sharing information and technology. For instance, regular meetings could be held to share best practices in achieving international standards or to exchange best practices for tapping into the global fishery value chain. In this respect, collaboration with China is also advisable.

However, governments and policymakers of middle-income countries also need to pay attention to proper coastal management to avoid exploitation of marine fish stocks, a common resource property [67], inter alia by avoiding illegal finishing practices from small-scale local fishermen and large-scale enterprises alike. A strict enforcement of strict fishery laws aiming at reducing over-fishing is conducive in this respect.

The promotion of climate and eco-friendly aquaculture practice systems is an important feature of a pro-fishery-focused public policy. For sure, aquaculture, which is fish farming, can reduce the problem of exploitation of wild fish stocks. However, conventional fish farming still has a substantial ecological footprint [68]. Biofloc technology, as recently surveyed by [14], could be one promising avenue for achieving sustainable production of economically important fish species in fish farms. Biofloc is based on recycling and reusing waste nutrients, for instance from poultry farms, to feed fish [14]. As fish farming is energy intensive [68], the adoption of energy from renewable sources should be integral part of climate and eco-friendly fish farming.

To sum up, long-run, sustainable, economic progress initiated through fish exports needs to be accompanied first by strict coastal management that targets the sustainability of the scarce resource of wild fish stock and second by eco-friendly and sustainable aquaculture systems to reduce the ecological footprint of fish farming.

Author Contributions: Conceptualization, M.A.E., M.L. and T.C.; methodology, M.A.E., M.L.; software, M.A.E.; validation, M.L., T.C.; formal analysis, M.A.E.; investigation, M.A.E. and M.L.; resources, M.L. and T.C.; data curation, M.A.E.; writing—original draft preparation, M.A.E.; writing—review and editing, M.L.; visualization, M.A.E.; supervision, M.L. and T.C.; project administration, M.L.; funding acquisition, M.L. and T.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Only publicly available datasets were analyzed in this study as described in the text.

Conflicts of Interest: The authors declare no conflict of interest.

References
1. FAO. The State of World Fisheries and Aquaculture 2020. Sustainability in Action; FAO: Rome, Italy, 2020. Available online: http://www.fao.org/3/ca9229en/ca9229en.pdf (accessed on 4 April 2021).
2. UNCTAD. Fishery Exports and the Economic Development of Least Developed Countries; UNCTAD: Geneva, Switzerland, 2017.
3. Béné, C. Global Change in African Fish Trade: Engine of Development or Threat to Local Food Security? OECD Food, Agriculture and Fisheries Working Papers; OECD: Paris, France, 2008; Volume 10.
4. Béné, C.; Macfadyen, G.; Allison, E.H. Increasing the Contribution of Small-Scale Fisheries to Poverty Alleviation and Food Security; FAO Fisheries Technical Paper; FAO: Rome, Italy, 2007.

5. UNCTAD. Appraisal of the Implementation of the Brussels Programme of Action for LDCs for the Decade 2001–2010; United Nations Publication: New York, NY, USA; UNCTAD: Geneva, Switzerland, 2010.

6. UNCTAD. Export Competitiveness and Development in LDCs; United Nations Publication: New York, NY, USA; UNCTAD: Geneva, Switzerland, 2008.

7. World Bank/FAO/WorldFish 2012. Hidden Harvest: The Global Contribution of Capture Fisheries; World Bank Report, No. 66469-GLB; World Bank: Washington, DC, USA, 2012.

8. Kumar, R.; Kumar, R.R.; Stauvermann, P.J. Effect of fisheries subsidies negotiations on fish production and interest rate. J. Risk Financ. Manag. 2020, 13, 297. [CrossRef]

9. Béné, C.; Barange, M.; Subasinghe, R.; Pinfstrup-Andersen, P.; Merino, G.; Hemre, G.-I.; Williams, M.J. Feeding 9 billion by 2050—Putting fish back on the menu. Food Secur. 2015, 7, 261–274. [CrossRef]

10. Béné, C. Small-Scale Fisheries: Assessing Their Contribution to Rural Livelihoods in Developing Countries; FAO Fisheries Circular, Food and Agriculture Organization (FAO): Rome, Italy, 2006.

11. FAO. The State of World Fisheries and Aquaculture (2020); Food and Agriculture Organization (FAO): Rome, Italy, 2020. Available online: http://www.fao.org/fishery/sofia/en (accessed on 5 May 2021).

12. FAO. Responsible Fish Trade. In FAO. Technical Guidelines for Responsible Fisheries; Food and Agriculture Organization (FAO): Rome, Italy, 2009.

13. Golub, S.; Varma, A. Fishing Exports and Economic Development of Least Developed Countries: Bangladesh, Cambodia, Comoros, Sierra Leone and Uganda; UNCTAD: Geneva, Switzerland, 2014.

14. Mugwanya, M.; Dawood, M.A.O.; Kimera, F.; Sewilam, H. Biofloc systems for sustainable production of economically important aquatic species: A review. Sustainability 2021, 13, 7255. [CrossRef]

15. SEAFDEC. Overview of the Fisheries Sector of Southeast Asia in 2018. Available online: http://www.seafdec.org/fishstat2018 (accessed on 10 May 2021).

16. Siby, K.M.; Arunachalam, P. Growth, Instability and Demand Elasticity of Indian Fish Exports; Munich Personal RePEc Archive 107747: Munich, Germany, 2021.

17. Ghose, B. Fisheries and aquaculture in Bangladesh: Challenges and opportunities. Ann. Aquac. Res. 2014, 1, 1–5.

18. Balassa, B. Exports and economic growth. Further evidence. J. Dev. Econ. 1978, 5, 181–189. [CrossRef]

19. World Bank. World Development Report 2008: Agriculture for Development; World Bank: Washington, DC, USA, 2008.

20. Pesaran, H.; Shin, Y.; Smith, R. Pooled mean group estimation and dynamic heterogeneous panels. J. Am. Stat. Assoc. 1999, 94, 621–634. [CrossRef]

21. Dreger, C.; Herzer, D. A further examination of the export-led growth hypothesis. Empr. Econ. 2013, 45, 39–60. [CrossRef]

22. Seok, J.H.; Moon, H. Agricultural exports and agricultural economic growth in developed countries: Evidence from OECD countries. J. Int. Trade Econ. Dev. 2021, 30, 1004–1019. [CrossRef]

23. Bahmani-Oskooee, M.; Economidou, C. Export-led growth Vs. growth-led exports: LDCs experience. J. Dev. Areas 2009, 42, 179–212. [CrossRef]

24. Ee, C.Y. Export-led growth hypothesis: Empirical evidence from selected Sub-saharan African countries. Procedia Econ. Finance 2016, 35, 232–240. [CrossRef]

25. Ekanayake, E.M. Exports and economic growth in Asian developing countries: Cointegration and error-correction models. J. Econ. Dev. 1999, 24, 43–56.

26. Mei-Chu, W. Tests of causality and exogeneity between exports and economic growth: The case of Asian NICs. J. Econ. Dev. 1987, 12, 149–159.

27. Michaely, M. Exports and growth: An empirical investigation. J. Dev. Econ. 1977, 4, 49–53. [CrossRef]

28. Murindahabi, T.; Li, Q.; Nisingizwe, E.; Ekanayake, E.M.B.P. Do coffee exports have impact on long-term economic growth of countries? Agric. Econ. 2019, 65, 385–393. [CrossRef]

29. Vohra, R. Export and economic growth: Further time series evidence from less-developed countries. Int. Adv. Econ. Res. 2001, 7, 345–350. [CrossRef]

30. Giles, J.A.; Williams, C.L. Export-led growth: A survey of the empirical literature and some non-causality results. Part 1. J. Int. Trade Econ. Dev. 2000, 9, 261–337. [CrossRef]

31. Odhiambo, N.M. Is export-led growth hypothesis still valid for sub-Saharan African countries? New evidence from panel data analysis. Eur. J. Manag. Bus. Econ. 2021. forthcoming. [CrossRef]

32. Shirazi, N.S.; Abdul Manap, T.A. Export-led growth hypothesis: Further econometric evidence from South Asia. Dev. Econ. 2005, 43, 472–488. [CrossRef]

33. Hye, Q.M.A.; Wizarat, S.; Lau, W.Y. Trade-led growth hypothesis: An empirical analysis of South Asian countries. Econ. Model. 2013, 35, 654–660. [CrossRef]

34. Kubo, A. Trade and economic growth: Is export-led growth passed? Econ. Bull. 2011, 31, 1623–1630.

35. Lim, S.Y.; Ghazali, M.E.; Ho, C.M. Export and economic growth in Southeast Asia current newly industrialized countries: Evidence from nonparametric approach. Econ. Bull. 2011, 31, 2684–2693.
36. Love, J.; Chandra, R. Testing export-led growth in India, Pakistan and Sri Lanka using a multivariate framework. *Manch. Sch.* 2004, 72, 483–496. [CrossRef]
37. Shahbaz, M.; Ahmad, K.; Asad, M.A. Exports-led growth hypothesis in Pakistan: Further evidence. *Asian Econ. Financ. Rev.* 2011, 1, 182–197.
38. Kurniasih, E.P. The long-run and short-run impacts of investment, export, money supply, and inflation on economic growth in Indonesia. *J. Econ. Bus. Account. Ventur.* 2019, 22, 21–28. [CrossRef]
39. Liang, H.S.; Zuradi, J. Is The Export-Led Growth Hypothesis Valid for Malaysia? Working Paper; Universiti Sains Malaysia, Department of Statistics: Kuala Lumpur, Malaysia, 2012.
40. Pham, H.M.; Nguyen, P.M. Empirical research on the impact of credit on economic growth in Vietnam. *Manag. Sci. Lett.* 2020, 10, 2897–2904. [CrossRef]
41. Kim, D.-H.; Lin, S.-C. Trade and growth at different stages of economic development. *J. Dev. Stud.* 2009, 45, 1211–1224. [CrossRef]
42. Lee, C.H.; Huang, B.N. The relationship between exports and economic growth in East Asian countries: A multivariate threshold autoregressive approach. *J. Econ. Dev.* 2002, 27, 45–68.
43. Kalaitzi, A.S.; Chamberlain, T.W. Fuel-mining exports and growth in a developing state: The case of the UAE. *Int. J. Energy Econ. Policy* 2020, 10, 300–308. [CrossRef]
44. Myint, H. The gains from international trade and the backward countries. *Rev. Econ. Stud.* 1954, 22, 129. [CrossRef]
45. Kalaitzi, A.S.; Chamberlain, T.W. Merchandise exports and economic growth: Multivariate time series analysis for the United Arab Emirates. *J. Appl. Econ.* 2020, 23, 163–182. [CrossRef]
46. Kim, D.-H.; Lin, S.-C.; Suen, Y.-B. Nonlinearity between trade openness and economic development. *Rev. Dev. Econ.* 2011, 15, 279–292. [CrossRef]
47. Sannasee, R.; Seetanah, B.; Jugessur, J. Export-led growth hypothesis: A meta-analysis. *J. Dev. Areas* 2014, 48, 361–385. [CrossRef]
48. Gries, T.; Redlin, M. Trade and economic development: Global causality and development- and openness-related heterogeneity. *Int. Econ. Econ. Policy* 2020, 17, 923–944. [CrossRef]
49. Kurien, J. Responsible Fish Trade and Food Security. Toward Understanding the Relationship between International Fish Trade and Food Security (Report of the Study on the Impact of International Trade in Fishery Products on Food Security); Food and Agriculture Organization (FAO) and the Royal Norwegian Ministry of Foreign Affairs: Rome, Italy, 2005.
50. Jawaid, S.T.; Siddiqui, M.H.; Atiq, Z.; Azhar, U. Fish exports and economic growth: The Pakistan’s experience. *Glob. Bus. Rev.* 2019, 20, 279–296. [CrossRef]
51. Jaunky, V.C. Fish exports and economic growth: The case of SIDS. *Coast. Manag.* 2011, 39, 377–395. [CrossRef]
52. FAO. *Capital Stock in Agriculture, Forestry and Fishery*, FAO: Rome, Italy, 2015. Available online: www.fao.org/fileadmin/templates/ess/documents/stocks/Ag_Capital_Stock_-_FAO_Statistical_Analysis_-_Key_findings_from_the_dataset.pdf (accessed on 27 August 2021).
53. FAO. Food and Agriculture Data. 2021. Available online: http://www.fao.org/faostat/en/#data (accessed on 27 August 2021).
54. World Bank. World Development Indicators. Open Access Data. Available online: http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed on 27 August 2021).
55. Herzer, D.; Nowak-Lehmann, F.D.; Siliverstovs, B. Export-led growth in Chile: Assessing the role of export composition in productivity growth. *Dev. Econ.* 2006, 44, 306–328. [CrossRef]
56. Emam, A.; Chen, T.; Leibrecht, M. Inward worker remittances and economic growth: The case of Bangladesh. *Appl. Econ.* J. 2021, 28, 43–62.
57. Kim, D.-H.; Lin, S.-C. Dynamic relationship between inflation and financial development. *Macroecon. Dyn.* 2010, 14, 343–364. [CrossRef]
58. Pesaran, M.; Smith, R. Estimating long-run relationships from dynamic heterogeneous panels. *J. Econ.* 1995, 68, 79–113. [CrossRef]
59. Pedroni, P. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxf. Bull. Econ. Stat.* 1999, 61, 653–670. [CrossRef]
60. Kao, C. Spurious regression and residual-based tests for cointegration in panel data. *J. Econ.* 1999, 90, 1–44. [CrossRef]
61. Singer, H.W.; Gray, P. Trade policy and growth of developing countries: Some new data. *World Dev.* 1988, 16, 395–403. [CrossRef]
62. Serajuddin, U.; Hamadeh, N. New World Bank Country Classifications by Income Level: 2020–2021. Available online: https://www.alltech.com/blog/8-digital-technologies-disrupting-aquaculture (accessed on 2 October 2021).
63. Hughes, A.C. Understanding the drivers of Southeast Asian biodiversity loss. *Ecosphere* 2017, 8, 1–33. [CrossRef]
64. Liu, J.; Wang, M.; Yang, L.; Rahman, S.; Srboonchitta, S. Agricultural productivity growth and its determinants in South and Southeast Asian countries. *Sustainability* 2020, 12, 49–81.
65. FAO. Food and Agriculture Data. 2021. Available online: http://www.fao.org/faostat/en/#data (accessed on 27 August 2021).
66. World Bank. World Development Indicators. Open Access Data. Available online: http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators (accessed on 27 August 2021).
67. Hughes, A.C. Understanding the drivers of Southeast Asian biodiversity loss. *Ecosphere* 2017, 8, 1–33. [CrossRef]
68. Liu, J.; Wang, M.; Yang, L.; Rahman, S.; Srboonchitta, S. Agricultural productivity growth and its determinants in South and Southeast Asian countries. *Sustainability* 2020, 12, 49–81.
69. Alltech. 8 Digital Technologies Disrupting Aquaculture. Available online: https://www.alltech.com/blog/8-digital-technologies-disrupting-aquaculture (accessed on 2 October 2021).
70. UNCTAD. Inter-Regional Training and Capacity Building Workshop on Fisheries Trade, Management and Development in Selected Least Developed Countries; Albion Fishery Research Center: Mauritius, April 2017. Available online: https://unctad.org/system/files/official-document/aldc2017_mauritius_outcome.pdf (accessed on 2 October 2021).
71. Sumaila, U.R. *Trade and Sustainable Fisheries*; ADBI Working Paper Series No. 676; ADBI: Tokyo, Japan, 2017.