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Global markets and the commons: the role of imports in the US wild-caught shrimp market

Frank Asche[1,2], **Atle Oglend**[2] **and Martin D Smith**[3,*]

[1] School of Forest, Fisheries and Geomatics Sciences and Food Systems Institute, University of Florida, Gainesville FL, United States of America
[2] Department of Industrial Economics, University of Stavanger, Stavanger, Norway
[3] George M. Woodwell Distinguished Professor of Environmental Economics, Nicholas School of the Environment and Department of Economics, Duke University, Durham, NC, United States of America
* Author to whom any correspondence should be addressed.

E-mail: marsmith@duke.edu

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Abstract

The commons literature focuses heavily on rules and the behavior of resource users but places less emphasis on the returns to individual effort. However, for most resource settings, market conditions and associated resource prices are key drivers of exploitation effort. In a globalized world, import competition can strongly influence the incentives for individual resource users, a topic largely unexplored in the commons literature. Import competition is especially salient for seafood, one of the most internationally traded food groups. We analyze the US shrimp market, which was once dominated by domestic catches but is now mostly supplied by imports. For domestic producers (users of the commons), lower revenues result, while US consumers eat more shrimp at lower prices. Globalization changed the sources of price risk and compensation that domestic producers face and altered incentives to exploit the commons. In a market dominated by domestic supply shocks, the price response to a shock moderates the effect on revenue and effort. In a market dominated by imports, domestic shocks are buffered by import adjustments, while price movements are determined by global shocks. Despite losses for the domestic fishery, globalization creates new incentives to coordinate effort and capture price premiums determined in the global market.

1. Introduction

Overexploitation of the commons occurs when individual resource users lack incentives to account for the future state of the resource. Incentives depend on the returns to individual resource exploitation effort as well as the formal or informal rules that govern access to the resource. The commons literature focuses heavily on the rules and behavior of resource users but places much less emphasis on the determinants of returns to individual effort (Dietz *et al* 2003). For most resource settings, market conditions and associated resource prices are key drivers of these returns. Yet even in economics, canonical models of the commons abstract away from price determination and assume that the resource can be sold for a constant price, implying perfectly elastic demand (e.g. Cornes and Sandler 1983). Understanding incentives for harvesters of common-pool fishery resources requires a careful analysis of markets, price formation, and product differentiation.

In fisheries, returns to fishing effort depend on harvest choices across species (Birkenbach *et al* 2020), locations (Smith 2012), and even timing within the season (Huang and Smith 2014). Studies of seafood markets demonstrate that prices depend not just on quantity harvested and local demand but also on characteristics such as fish size (Lee 2014) and degree of integration with the global market (Hukom *et al* 2020). In essence, fishers harvest from a suite of highly differentiated products and sell into complex seafood markets. Connections to broader markets

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create dynamics that can exacerbate or reduce incentives for overexploitation of the commons. Here we analyze markets for US Gulf of Mexico (GoM) wild-caught shrimp and how price formation shapes the possibilities for fishers to generate value from effective coordination in the commons.

The GoM shrimp fishery is an ideal application for studying incentives, markets, and common-pool resources because it faces emblematic challenges in modern seafood markets, including globalization, the effects of environmental stressors, and the problem of coordination in the commons. Seafood is the most internationally traded food group, and trade has grown consistently since the 1980s (Gephart and Pace 2015, Anderson *et al* 2018). Although there are many nuances, net trade tends to flow from developing to developed countries with the result that producers in developing nations obtain higher prices from accessing high-value markets and producers in developed nations receive lower prices due to competition from other parts of the world (Asche *et al* 2015). Increased trade also means that even products that are not traded internationally compete domestically with products that are, and thus prices are influenced by global market trends (Tveteras *et al* 2012, Bronnmann *et al* 2020). Moreover, countries dependent on seafood imports are vulnerable to global supply shocks (Gephart *et al* 2016). The backdrop of globalization is critical for understanding the effects of environmental stressors and opportunities for creating value from the commons through better governance.

While we analyze globalization and the commons using market analysis, the interdisciplinary commons literature also examines how globalization affects consumers and producers, albeit using different methods. Although exposure to external markets can undermine effective governance of the commons (Dietz *et al* 2003, Cudney-Bueno and Basurto 2009), external market forces do not always lead to governance failures (Agrawal 2001), and the actual effect is then an empirical question. A related idea is market proximity. Empirical work shows that distance to market can explain exploitation intensity (Liese *et al* 2007, Cinner *et al* 2013). Berkes *et al* (2006) argue that globalization can contribute to overfishing before local governance can respond. The proposed mechanism is a trade-induced increase in demand, whereas in our case trade increases supply, which harms domestic producers by decreasing demand for their product and thereby price. Crona *et al* (2016) also argue that globalization can mask stock depletions as more production sources contribute to global supplies. In our setting, the globalized shrimp market dilutes the potential for price compensation; globalization does not contribute to overfishing of shrimp but rather the opposite. However, it also makes the domestic fishery more vulnerable to ecological shocks and technological disasters.

Shrimp in the US exemplifies the challenges of globalization for fisheries in developed nations. GoM shrimp was historically the most valuable fishery in the US, but its value has declined in recent years. In 1980, the total landed value of the three main species caught in GoM (brown, white, and pink shrimp) was $1.104 billion (2018 USD). The economic importance of shrimp continued through 2000, but since then shrimp landings have remained high while real prices have declined dramatically, decreasing revenue to $533 million in 2017. This decline has occurred despite shrimp being the most consumed seafood product in the US. Due to imports of predominantly farmed shrimp, US consumption of shrimp has more than doubled since 1990 (Shamshak *et al* 2019). The US is the world's largest seafood importing country (Garlock *et al* 2020), and by 2017, the domestic share of the US shrimp market eroded to just 15%. Because domestic and imported shrimp markets are highly integrated, competition with farmed shrimp imports is the most important factor explaining the price decline (Asche *et al* 2012, Ankamah-Yeboah *et al* 2017). Our model and empirical findings below help to explain why.

Import competition can also amplify economic losses from domestic supply shocks. When prices are determined in local markets, a decrease in production due to a natural disaster triggers a price increase. The higher price partially offsets the losses for producers but also incentivizes higher fishing effort. When prices are determined globally, imports replace domestic shrimp and moderate the price effect. Since 2000 when real shrimp prices began to decline dramatically, the GoM fishery has endured persistent ecological stress from hypoxia, natural disasters such as Hurricane Katrina, and the Deepwater Horizon oil spill. Previous studies of Deepwater Horizon's effects on the fishery focus on catches (Sumaila *et al* 2012, van der Ham and DeMutsert 2014), whereas we focus on price. When supply decreases due to a shock, we hypothesize that price competition with imports limits opportunities for price compensation to offset production losses. A subdued price response to domestic shocks can also decrease common-pool externalities by reducing incentives for higher effort and thus stabilize fish stocks.

Lastly, the strong environmental dependence of shrimp creates opportunities and challenges for generating value from successful coordination in the commons. Opportunities stem from a weak stock-recruitment relationship (Ye 2000, Smith *et al* 2017) and highly differentiated size-based market categories with prices that span roughly an order of magnitude (Asche *et al* 2012, Smith *et al* 2017). The weak stock-recruitment relationship implies that recruitment overfishing is a limited concern, which reduces the burden of controlling total exploitation effort. The size differentiation implies that targeting size

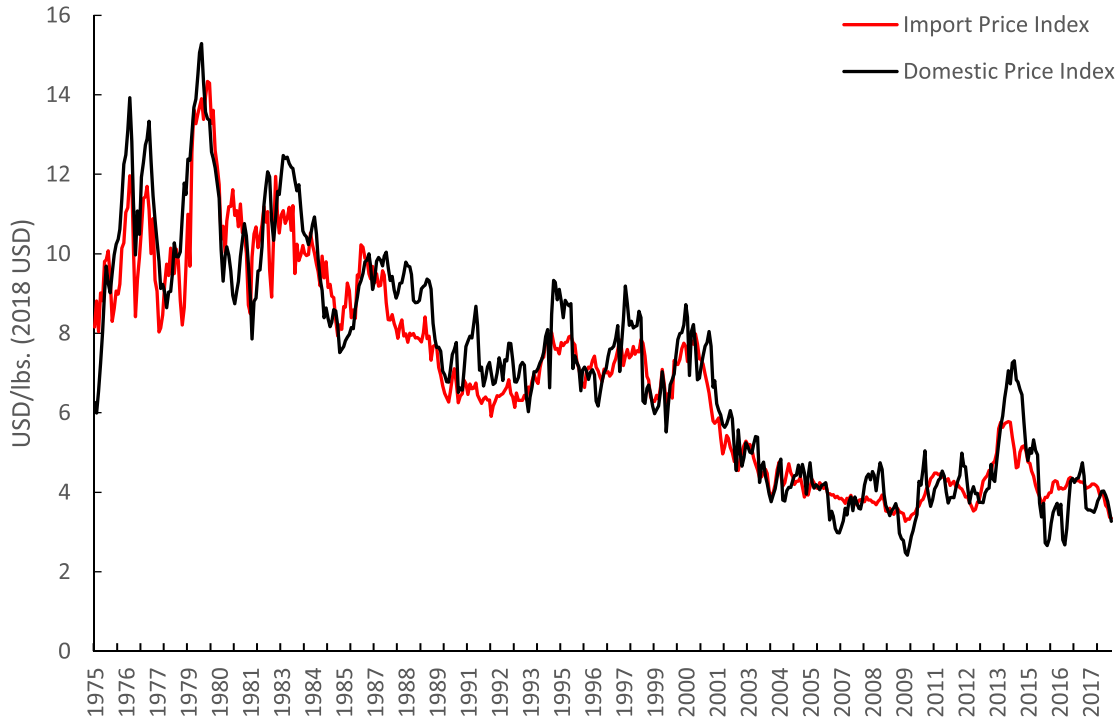

Figure 1. US market domestic and imported shrimp price indices. Monthly data from January 1975 to August 2018. Real 2018 USD/pound.

classes to catch the larger individuals can generate substantially more revenue for the fleet. However, targeting larger shrimp creates a unique coordination challenge to control fishing effort within the season (Huang and Smith 2014, Smith *et al* 2017). Even if effort can be coordinated, the availability of shrimp in different market classes is seasonal and sensitive to environmental factors, including ecological stress from hypoxia (Smith *et al* 2014, 2017). Seasonal and environmental factors thus constrain the potential to generate value from successful coordination.

How does increased import competition affect the market for domestic shrimp? To answer this question and gain insights about markets and the commons, we specify and estimate a two-good structural demand model. The two goods directly follow the focus of our study, namely imported and domestic shrimp. By using just two goods, we can preserve degrees of freedom that otherwise would be needed to estimate additional cross-price effects. The two estimated cross-price effects have the virtue of being directly interpretable as the effect of imports on domestic, and vice a versa. A two-good approach is also appropriate because previous research shows that imported and domestic shrimp prices can each be characterized by an index of prices from individual size classes (Asche *et al* 2012). Because total landings are largely driven by the population dynamics, we model domestic supply as exogenous, and domestic shrimp demand is modeled with an inverse demand equation. Furthermore, because US consumption accounts for less than 10% of world aquaculture production and there is substantial international trade for shrimp, the US import demand is modeled with an ordinary demand equation. In summary, our two-good model is parsimonious, lends itself to ease of interpretation, and is supported by industry facts and previous empirical findings.

2. Methods

We create imported and domestic Fisher price indices that incorporate five size-based categories to account for the highly differentiated shrimp market. US domestic shrimp production is measured by aggregating daily landed values and quantities of brown, pink, and white shrimp for the GoM shrimp fishery. The data are from NOAA's ShRCoM database, the primary source of fisheries microdata used for shrimp fisheries management in the GoM (Smith *et al* 2017). Shrimp import volumes and values are from the US Department of Commerce. We use the 'shell-on frozen' category.

Figure 1 shows the domestic (black) and imported (red) fisher price indices. The domestic real price reached a maximum in the late seventies after which prices have declined steadily. While imports were present before our import price measurement starts (1975), the share of imports has steadily increased since 1975. The domestic prices track import prices closely.

We develop a two-good demand model that allows us to identify how domestic product prices and import volumes respond to domestic supply and

import price shocks. Domestic shrimp demand is modeled with an inverse demand equation assuming exogenous domestic supply, while import demand is modeled with a regular demand equation assuming exogenous import prices. This identifies the allocation of aggregate shrimp expenditure across domestic and imported shrimp. Structural model parameters are estimated using maximum likelihood on the monthly shrimp data from 1975 to 2018. The aggregate expenditure effects of domestic supply and import price shocks are estimated separately using a reduced-form double-log functional form. The structural parameters together with the expenditure elasticities pin down the demand elasticities.

Static and dynamic elasticities are estimated to reveal the impact of imports on the domestic shrimp market in the US. Technical details on the raw data, price index construction, conceptual model, and estimation routines appear in the supplemental materials (available online at stacks.iop.org/ERL/17/045023/mmedia).

3. Results

Results indicate that domestic and imported shrimp in the US are close, but not perfect, substitutes. Most of the variation in domestic shrimp prices reflects variation in the world shrimp price. There is little room for domestic supply shocks to translate into price changes for the domestic fishery. For instance, consistent with Petesch *et al* (2021), the data show that Hurricane Katrina and the Deepwater Horizon oil spill had small and only transitory impacts on the monthly GoM shrimp price. The weak price effect from domestic shocks created little incentive for the fishery to respond by overfishing the stock. On the other hand, the disease outbreak in farmed shrimp production (starting in Asia in 2011) had a notable positive impact on the GoM shrimp price.

Results also reveal substantial structural changes in the domestic shrimp market over time. These changes decreased the relative value of domestic shrimp and increased the relative price volatility. Import competition not only had a price impact, but it also triggered structural shifts in consumer preferences for domestic and imported shrimp. The imported shrimp compete with domestic shrimp along non-price attributes such as supply reliability and product quality that have themselves supported market expansion into new product forms and market outlets.

3.1. Structural parameters

Structural parameter estimates are reported in supplemental table 2. Results show a robust negative trend in the elasticity of substitution ($\sigma_1 < 0$), and domestic share parameter ($\alpha_1 < 0$). Restricted models with no trend ($\sigma_1 = 0$ and/or $\alpha_1 = 0$) are all rejected by likelihood ratio tests (p-values < 0.0001). The null hypothesis of perfect substitutes is also rejected (p-value < 0.0001). Domestic and imported shrimp are close but not perfect substitutes. Over time and consistent with the growth of imports, preference for domestic has decreased and imported and domestic shrimp have become less close substitutes. In 2018, we find an elasticity of substitution of 6.0 and a domestic share parameter of 0.14 for the domestic shrimp (0.86 for the imported shrimp). This is substantially below the numbers in 1975, when they were 48 and 0.87.

The results reflect the growing role of imports in the US shrimp market. The domestic shrimp price has decreased in both absolute and relative terms as imported shrimp have become cheaper. Figure 2 shows the actual and model predicted relative price of domestic to imported shrimp, highlighting the declining relative price of domestic shrimp. If price was the only competitive dimension in the market, the relative price of the domestic shrimp should rise as it becomes scarcer relative to the growing imported shrimp. However, the data show the opposite. The relative price declined due to a decline in the preference for domestic shrimp as imports grew. This dominated the scarcity effect. Figure 2 shows that variation in the predicted relative price increased over time. Consistent with the increase in the relative preference for imported shrimp, products became weaker substitutes.

3.2. Reduced form expenditure elasticities

On average, monthly total shrimp expenditure increases by 0.73 for a one percent increase in the import price. The domestic supply shock elasticity is lower, at 0.154 suggesting a slight increase in total shrimp expenditures following a positive domestic supply shock. The aggregate total US consumption expenditure elasticity is 1.5, meaning that over time shrimp expenditures increased relative to the growth in the overall economy.

3.3. Dynamic elasticities

Because structural parameters appeared to change over time, we calculate dynamic elasticities each period using ten year windows (figure 3). Summary statistics of dynamic elasticates are reported in supplemental table 4. Results corroborate the trends in supplemental table 2, showing that the elasticity of substitution and the domestic shrimp share declined. The domestic share parameter reached a minimum for the sample starting in 2004, which includes the period of Hurricane Katrina (2005) and the Deepwater Horizon oil spill (2010). There was some recovery in the domestic share parameter towards the end of the sample when aquaculture shrimp experienced major disease outbreaks mostly in Southeast Asia (Anderson *et al* 2019).

The elasticity of total shrimp expenditures with regards to the domestic supply shocks was relatively

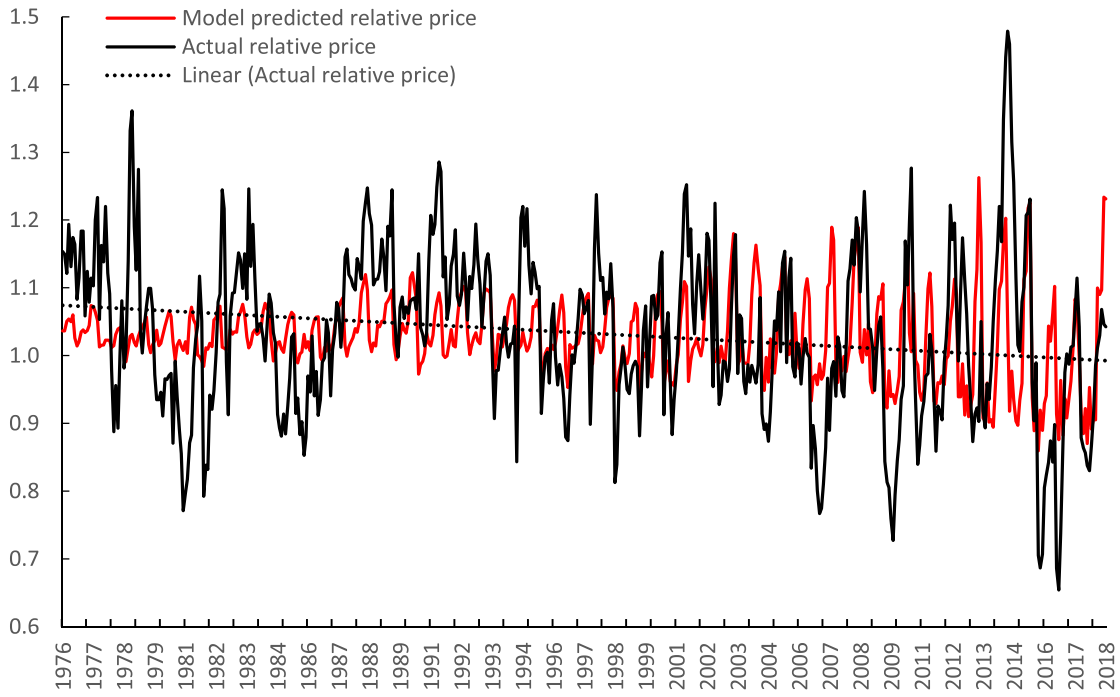

Figure 2. Model fitted and actual relative price of domestic and imported shrimp together with linear trend fit to actual linear trend. Fisher price index used.

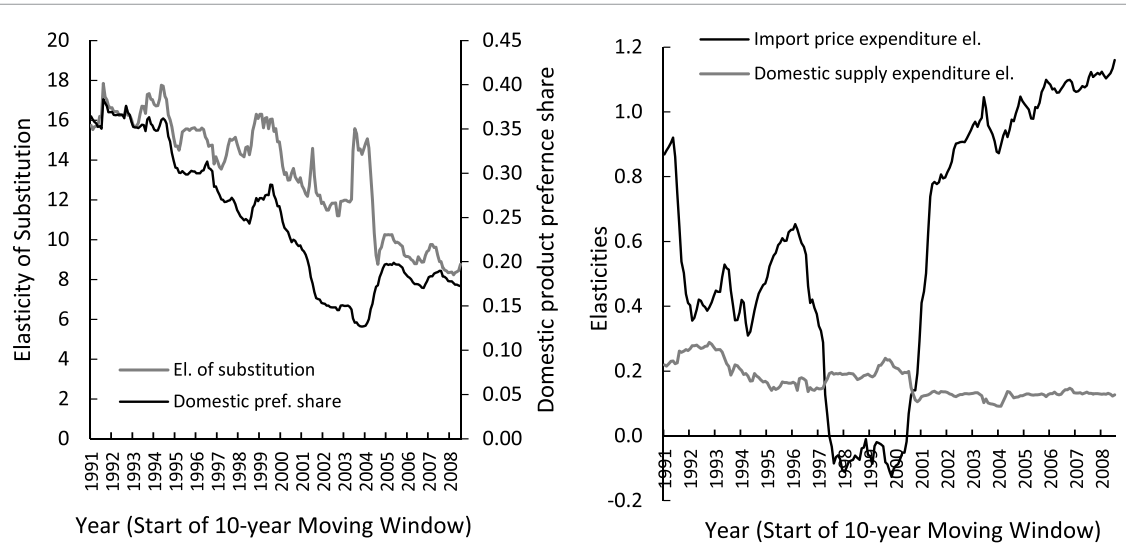

Figure 3. Ten year moving window estimates of elasticity of substitution and domestic product preference share (left panel), and reduced-form expenditure elasticities with regards to the import price and domestic supply expenditure.

stable over the period (right panel figure 3, grey line). However, the expenditure elasticity with regards to the import price varied substantially. Specifically, the period starting at the end of the 1990s lasting until around 2001 showed zero expenditure elasticity. The declining prices in this period were associated with increases in imports, keeping total expenditure largely fixed. Following this import growth, the expenditure elasticity increased back to unity. Import price changes in this period were absorbed by domestic consumers through total expenditures changes.

3.4. Elasticities with regard to import price shocks

The left panel (a) of figure 4 shows the domestic price elasticity with regard to the import price. A change in the import price translates into nearly the same magnitude change in domestic price. The right panel (b) shows the own price import elasticity. The pattern in the import elasticity was similar to the domestic price elasticity and mainly driven by the changes in the expenditure elasticity over the sample. In the expansion period of declining import prices, import volumes grew strongly in response to

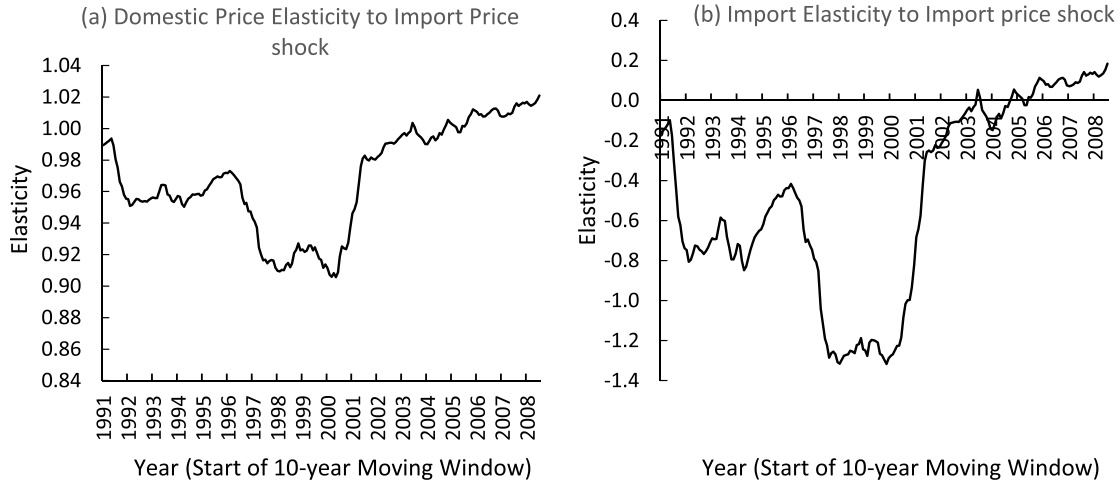

Figure 4. Elasticity of domestic price with regard to the import price change (left) and elasticity if import quantity with respect to the import price change.

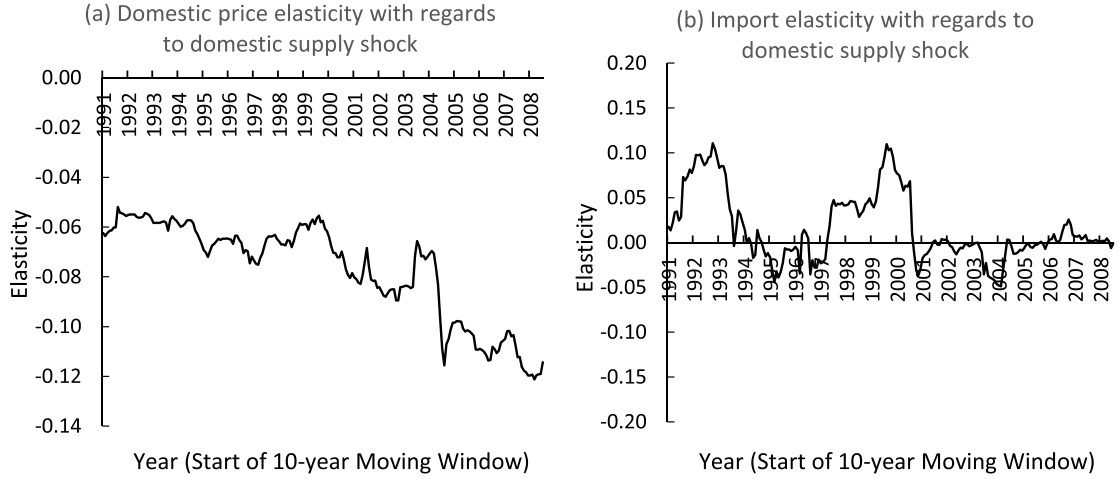

Figure 5. Elasticity of the domestic price to domestic supply shocks (left panel). Elasticity of imports with regard to the domestic supply shock (right panel).

the declining import price. However, during the more recent regime of disease problems in shrimp farming, import volumes remained largely inelastic to import price shocks. Moreover, the cause of the import price shock affects the import response. The import price decreases due to productivity gains expanded imports (e.g. around 2000), while the price increases due to disease (e.g. around 2013) did not noticeably reduce imports.

3.5. Elasticities with regard to domestic supply shocks

The left panel (a) of figure 5 shows the elasticity of the domestic price with regard to the domestic supply shock. The elasticity is negative and declining over time due to the declining elasticity of substitution between domestic and imported shrimp over time. Domestic prices became more responsive to domestic supply shocks over time. Even so, the price response remained quantitatively small. For instance, with a sensitivity of −0.1, a 25% decline in fisheries catches in a given month leads only to a 2.5% increase in the domestic price. This is consistent with the above finding that the domestic price was mostly determined by the import price, as well as the observation that major GoM fisheries events such as Hurricane Katrina or Deepwater Horizon had little impact on the shrimp price.

The right panel (b) of figure 5 shows the elasticity of imports to domestic supply shocks. On average, import responses to domestic supply shocks at a monthly frequency fluctuated around zero. The low import elasticity suggests that domestic supply conditions are less relevant to import demand.

4. Discussion

Results from our two-good model illustrate the dramatic effect that increased imports can have when the market moves from one dominated by domestic

wild-caught supply to one dominated by mostly farmed imports. Revenues in the US shrimp fishery plummeted despite relatively steady landings. The elasticity of substitution indicates that domestic and imported shrimp are strong but not perfect substitutes. The magnitude of the elasticity declined as imports grew, increasing the potential for domestic product to segment itself from the imports. However, the import price largely dictated the domestic price. For domestic producers, this yielded lower prices and revenues, which triggered anti-dumping complaints but also reduced incentives for overfishing. On the other hand, US consumers could eat more shrimp than ever at lower prices, and the sources of price risk and compensation changed significantly. Compared to a market dominated by domestic supply, domestic supply shocks have moderate effects on price and fishing effort. In a market dominated by imports, domestic supply shocks are buffered by import adjustments, and prices are determined by global shocks.

Our model and results raise a number of questions for the shrimp fishery, and industries like it, that face growing competition from imports. First, why did the domestic share parameter decline over time? Although our model cannot answer this question directly, developments in seafood retail suggest an explanation. A growing share of seafood consumption is purchased in large retail grocery chains like Wal-Mart and retail chain restaurants like Red Lobster. This trend is similar in other high-income countries such as the UK and France (Murray and Fofana 2002, Guillotreau *et al* 2005). Large retailers prefer supply chains in which they can buy large volumes of consistent quality product from a small number of producers. Farmed seafood is better able to match its production processes to these supply chains (Kvaløy and Tveteras 2008, Asche and Smith 2018), suggesting that the domestic share really reflects underlying preferences for convenience and consistency offered by large retailers. Even when disease problems restricted the world supply of shrimp, the desirability of imports to serve well-developed supply chains in the US led to little change in total imports and simply more product from importers that did not have disease problems.

Second, why did the domestic share parameter recover somewhat in recent years? One apparent explanation is that domestic shrimp producers have had some success segmenting the market, arguing for the quality of US wild-caught shrimp and against the quality of imported farmed shrimp. The timing of improvements in the share parameter after 2004 aligns with country-of-origin labeling that took effect in the US in 2005 for fish and shellfish. This result indicates that successful labeling schemes can provide some protection against import competition through market segmentation. However, the effect is limited, as the recovery in the share parameter appeared to plateau within a couple years well below its historic high. This recovery is consistent with the literature on seafood eco-labels and health labels showing only modest effects of positive messages on consumer demand (Uchida *et al* 2017, Roheim *et al* 2018).

Third, why did the elasticity of substitution decline over time? In essence, domestic and imported shrimp become weaker substitutes. It may be that the trend in large retail consolidation favoring imported shrimp (and accounting for most of the overall shrimp market), partly segmented the market. Roadside wild-caught shrimp and community supported fishery subscriptions are undoubtedly segmented from the grocery chain sales to an extent and may even be trending upward. These market outlets can be expressions of preference for local that some consumers value (Onozaka and McFadden 2011). However, our analysis suggests that the import price still constrains what producers ultimately receive for these growing market segments.

5. Conclusions

Our analysis has several policy implications for the shrimp fishery and other common-pool resource industries facing growing import competition. First, the consequences of a sizable tariff on imports are clear. Consumers and shrimp stocks would bear the entire cost of the tariff, as consumers would pay higher prices for shrimp and consume less. Higher prices would incentivize more fishing effort and potentially negatively affect stocks. Given a global market, exporters to the US market would pay no part of the tariff and would simply sell less shrimp to the US market due to the global nature of the shrimp market, albeit not much less given that shrimp demand is inelastic (Chidmi *et al* 2012). These conclusions are consistent with our results but stem largely from our assumptions—exogenous import price and exogenous domestic supply. The first assumption is justified because US total shrimp consumption accounts for less than 10% of shrimp supplied by world aquaculture production. We justify the latter assumption on the basis of stable total domestic wild-caught supply as real price increased sharply and then declined dramatically after 2000. That said, our empirical findings do inform the consequences of a hypothetical tariff for domestic producer prices. We find a high degree of pass-through from import price to domestic price such that domestic producers would experience higher prices, but historical data suggest that there would be little room to expand domestic production.

Second, a dominant strategy for the GoM shrimp fishery is to coordinate fishing effort differently to catch large shrimp, which fetch a price premium, or otherwise lobby for regulation that would facilitate

fishing for large shrimp. Domestic producers could realize higher prices effectively by adjusting the shares of size classes. The problem is that shrimp fisheries in the GoM (and in North Carolina) exert too much effort early in the season when shrimp are small, leaving potential economic rents on the table if effort were redirected (Huang and Smith 2014, Smith *et al* 2014). Previous findings suggest that such gains would not be transitory; when the relative price of large shrimp increased due to hypoxia, relative prices eventually returned to long-run equilibrium, suggesting that premiums for large shrimp are determined outside the GoM market (Smith *et al* 2017). Catch timing in other fisheries can also increase value by improving product quality (Larkin and Sylvia 1999).

Following the dominant strategy means more successful within-season coordination of effort, whether that be through regulation or informal agreements among fishers. Both state and federal regulations govern GoM shrimp fisheries, including gear restrictions, monitoring and reporting requirements, and some seasonal and area closures. However, these regulations largely maintain open-access incentives (Smith *et al* 2014). Only the state of Texas enforces an inshore closure that effectively shifts the size distribution toward higher value shrimp. The fact that imports drive shrimp prices implies that shifting production toward larger shrimp in other states would not necessarily decrease prices of the larger shrimp (or not by much). However, inshore closures de facto prioritize the offshore fishery, which is dominated by larger vessels, so another approach to coordination may be necessary to avoid harms to small-scale inshore fishers. Ultimately, this would require solving a collective action problem or regulation such as temporally delineated effort quotas (Huang and Smith 2014). By contrast, anti-dumping complaints, tariffs, and countervailing duties have not yielded price benefits for GoM shrimp because alternative shrimp-producing countries replace import reductions from the targets of trade sanctions (Keithly and Poudel 2008).

Third, there are risks for domestic shrimp producers that current institutions do not address. Production shocks like Hurricane Katrina and Deepwater Horizon introduce quantity risks that are largely uncompensated by price changes. Modeling work on Deepwater Horizon predicted large and lasting quantity losses in the Gulf fisheries attributable to the spill (Sumaila *et al* 2012), while empirical work showed that shrimp size and abundance actually increased in estuaries affected by the spill, potentially reflecting hydrocarbon-induced delayed migration of shrimp offshore or stock benefits from the reduction in fishing effort associated with fishing closures (van der Ham and DeMutsert 2014). In contrast, domestic producers face price risk from expanding world aquaculture markets. Innovation that lowers production costs shift world supply outward and decrease prices for domestic producers. Shrimp disease crises, including the recent EMS outbreak starting in 2011 that decreased farmed shrimp production globally, should pass on higher prices to domestic producers. Empirical evidence suggests this happened to some extent, but changes in imports and farmed shrimp production quickly offset the price gains for domestic producers (Petesch *et al* 2021). The global price risk facing domestic producers suggests that they could benefit from a well-functioning futures market for farmed shrimp.

Our analysis sheds light on three classes of challenges in the commons literature. First, there is debate about whether demand growth, especially growth resulting from trade liberalization, causes overfishing (Crona *et al* 2016, Erhardt 2018, Bronnmann *et al* 2020, Eisenbarth 2022). The theoretical mechanism is that trade increases the price for exports, mostly in small or low-income countries, and that encourages more fishing effort that decreases stocks (Brander and Taylor 1998). However, that same process works in reverse for importers and decreases the price, mostly in high-income countries (Asche *et al* 2015), suggesting the possibility that trade dampens incentives to overfish in these countries. Institutions and fish biology in general mediate the potential for price changes to incentivize overfishing (Asche and Smith 2010, Li *et al* 2021). These same mediators also introduce biases into the metric used to measure overfishing, further complicating inferences about the effects of trade (Li and Smith 2021). In our case, despite a predominantly open access institutional setting, lower prices do not appear to reduce overexploitation because shrimp biology prevents recruitment overfishing in the first place.

Second, there is a wide range of coordination problems in the commons that is shaped by market dynamics, including intensity and timing of fishing effort, species- and sized-based targeting, and fishing location choices. In some fisheries, incentives to target larger fish can alter size distributions of the population in complex ways and undermine long-run harvest potential (Smith *et al* 2008, Li *et al* 2021). This creates the need to coordinate targeting that avoids large size classes or spreads out targeting across size classes. In our case, the central coordination challenge is the timing of fishing effort to catch larger shrimp deliberately and capture price premiums dictated by the global market. Unlike many other fisheries, this would create value without undermining the health of the resource.

Third, market dynamics strongly determine what kinds of institutions can improve economic outcomes for fishers. This creates the need for commons scholars to incorporate market analysis and the need for economists to incorporate institutional analysis. In our case, the nature of the shrimp market means

that a tariff on the major shrimp producing countries cannot maintain high domestic prices. In other settings, a tariff can be mutually beneficial to both trading partners if trade liberalization otherwise triggers overfishing (Brander and Taylor 1998). Similarly, a catch share with annual quotas tends to alleviate the race to fish (Birkenbach *et al* 2017). However, an annual catch share would do little to address timing problems in the shrimp fishery and would require substantial customization to delineate effort within the season (Huang and Smith 2014, Smith *et al* 2014).

As globalization increases international trade in products harvested from the commons, import competition is a growing challenge. The commons literature has focused on how market connectivity, particularly export markets, can destabilize effective governance of the commons or incentivize overexploitation (Agrawal 2001, Dietz *et al* 2003, Berkes *et al* 2006, Cinner *et al* 2013). Market analysis in economics can refine this understanding by quantifying the strength of incentives that change as resource markets globalize. Market analysis also reveals that imports are consequential for governing the commons, a dimension less emphasized by commons scholars. By changing the price determination process, increased imports alter incentives for overexploitation. The US shrimp market is illustrative. Before 2000, US shrimp were primarily supplied by domestic catch but now primarily come from imports. We find that the relative preference for imports has grown, and the most plausible explanation is the combination of consistent quality and reliability of farmed seafood with supply chain demands driven by large retailers. Attempts to use trade policy are ill-suited to help domestic producers because prices are determined globally. However, global price determination creates new economic opportunities for local producers. Investments to facilitate coordination in the commons could allow producers to capture price premiums that are sustained in a global market but that would be transitory in an exclusively domestic market.

Data availability statement

The data generated and/or analyzed during the current study are not publicly available for legal/ethical reasons but are available from the corresponding author on reasonable request.

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ORCID iDs

Frank Asche https://orcid.org/0000-0002-1540-9728

Martin D Smith https://orcid.org/0000-0002-4714-463X

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