Safeguard Measures and Fresh Produce Trade: The Case of U.S. Blueberry Imports

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Abstract

Safeguard measures are used to limit excessive import growth and protect domestic producers from unfair import competition. The global safeguard investigation for blueberries highlights these concerns and raises questions about the relationship between imports, prices, and the well-being of U.S. producers. Although the U.S. International Trade Commission (USITC) ruled that imports have not caused serious injury to U.S. blueberry producers, it was important to further examine this issue. In this study, we employ an inverse demand model and dynamic Vector Autoregressive (VAR) procedure linking source-specific fresh blueberry imports from countries like Mexico and Chile to U.S. blueberry prices. Our results mostly support the USITC ruling. Results indicate that declines in U.S. prices are small when compared to the level of import growth. Impulse response functions indicate that import price shocks are not long lasting.

Keywords: blueberries, imports, international trade, inverse demand, safeguards, United States

JEL codes: Q11, Q17

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Abstract

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1. Introduction

U.S. safeguard policy (Section 201 of the Trade Act of 1974) focuses on protecting domestic industries from the consequences of excessive import growth and providing temporary relief to producers injured by imports (Becker and Hanrahan 2002). While safeguard policies apply to all goods, agricultural products are especially vulnerable to import competition given the perishability and seasonal nature inherent in agricultural production. In fact, about a quarter of all U.S. safeguard investigations from 1975 to 2018 were for agricultural products (Becker and Hanrahan 2002).

In September 2020, the U.S. Trade Representative issued a request to the U.S. International Trade Commission (USITC) to initiate a global safeguard investigation to determine whether fresh, chilled, or frozen blueberry imports cause serious injury to U.S. growers. The safeguard investigation was prompted by agricultural producers expressing strong concerns about the potential negative impacts of increased blueberry imports on prices and profitability. U.S. blueberry imports from Mexico and South America have persistently increased, while domestic blueberry prices have decreased in recent years, leading many to question whether imports were the cause of this decline (Office of the U.S. Trade Representative 2020a). This has been a heightened concern for U.S. blueberry farmers, especially producers in Florida and Georgia who directly compete with imports from Mexico (Office of the U.S. Trade Representative 2020b). At the time, President Trump emphasized the importance of protecting farmers and noted that this investigation was one of many actions sought to ensure their protection. In the end, the USITC terminated the investigation by a unanimous vote in February 2021 and issued a ruling that U.S. producers did not incur significant injury from blueberry imports (U.S. International Trade Commission 2021).
The global safeguard investigation for blueberries and USITC ruling raises questions about the relationship between U.S. blueberry imports and the viability of domestic producers. The final ruling suggests that domestic price declines are not necessarily due to imports, or that price declines overall from import growth have been minimal. We consider this issue in this study, with a particular focus on fresh (including chilled) blueberry imports. In 2020, fresh blueberry imports exceeded one billion dollars and was the third leading U.S. fruit import behind avocados and bananas. Frozen blueberry imports were smaller by comparison ($234 million in 2020) (U.S. Department of Agriculture 2021). The uniqueness of the fresh produce market justifies a distinct focus for this analysis. Fresh fruit producers face unique challenges because of the short marketing window for sales. Import surges before or during this marketing window could depress prices and ill effect producer profitability (Office of the U.S. Trade Representative 2020b).

The primary objective of this study is to assess how fresh blueberry imports affect U.S. prices. It must be noted that the impact of imports on U.S. prices necessarily depends on the impact of imports on import prices. For instance, if increases in fresh blueberry imports from Chile or Mexico – which tend to occur when U.S. blueberries are not in season – do not result in lower import prices, then it would be difficult to argue that imports put downward pressure on in-season domestic prices. Past studies of the effects of import competition on prices have appealed to the law of one price (Miljkovic 1999), and have primarily focused on import price transmission, i.e., the impact of import prices on domestic prices (Pincinato and Asche 2018; Warr 2008). However, given our focus on how import quantities affect domestic prices, we take a two-step approach in studying this issue (Brester, 1996). First, we examine the relationship between import quantities and import prices. We then examine the relationship between import
prices and U.S. prices. Given these relationships, we can infer how fresh blueberry imports affect U.S. prices.

Important to this study is how source-specific imports (e.g. fresh Chilean blueberries) affect import prices and domestic prices. A price-dependent demand framework (inverse demand) is clearly more suited for this type of analysis. The predetermined nature of fresh fruit availability and the likelihood that short-run supply is highly inelastic suggests that an inverse demand framework is conceptually more applicable (Brown, Lee, and Seale 1995). Regarding inverse demand models, the literature offers several functional forms to choose from and studies have provided methods for optimizing on this choice (Barten and Bettendorf 1989; Brown, Lee, and Seale 1995; Holt 2002). As Asche and Zhang (2013) note, there is a lack of consensus on the most suitable functional form in spite of the many studies employing selection methods. In this study, we simply use the most common functional form developed by Eales and Unnevehr (1994) and Moschini and Vissa (1992), the Inverse Almost Ideal Demand System, which is the inverse version of the more popular Almost Ideal Demand System (AIDS model) developed by Deaton and Muellbauer (1980). To derive the relationship between import prices and U.S. prices, we employ a Vector Autoregressive (VAR) model to estimate the dynamic relationship between domestic and import prices. Using the inverse demand and VAR estimates, we assess the impact of import quantities on U.S. prices.

The remainder of this paper proceeds as follows. In the following section, we discuss U.S. global safeguard policies, select investigations for agricultural products, and the research on the implications of safeguard policy. We also provide background information on U.S. blueberry imports. We then present the empirical model, followed by a discussion of the data, estimation procedure, and results. Lastly, we discuss findings in the context of the global safeguard
investigation and USITC ruling. We close the paper with final remarks regarding the investigation and analysis.

2. Background

2.1 U.S. Global Safeguard Policy

Safeguard policy under Section 201 of the Trade Act of 1974 focuses on protecting domestic industries from import competition. Most noted investigations that led to remedies included solar panel and washing machine imports in 2017, which marked the beginning of the U.S. trade war with China (Jones 2021; Williams 2020). Although the blueberry investigation was initiated by the Office of the U.S. Trade Representative based on producer complaints, the process typically starts with a company or industry participants filing a petition with the USITC. The USITC then examines the industry to determine present and/or expected injury from imports based on three factors: significant idling of production, inability to sustain an adequate level of profit, and changes in unemployment (Jones 2021). If the USITC makes an affirmative determination, recommended remedies can include an increase in import duties or tariffs, implementation of tariff-rate quotas, import quantity restrictions, and financial support to producers. However, the actual remedies are based on recommendations by the USITC and are implemented upon approval by the President (Jones 2021).

Between 1975 and 2018, there were 75 Section 201 cases, including 20 cases covering agricultural products. During this timeframe, 28 investigations led to findings of evidence of negative injury to the industry in question where the U.S. President approved relief. There have been 7 instances where agricultural products were provided relief including mushrooms, shrimp, sugar, broomcorn brooms, wheat gluten, and lamb meat (Becker and Hanrahan 2002). More
recent affirmed agricultural investigations resulted in remedies for wheat gluten in 1998, where the USITC found that imports from the EU injured domestic producers and recommended an increase in tariffs and other forms of industry assistance (U.S. International Trade Commission 2001). The lamb meat case in 1999 was filed by the American Sheep Industry Association and the USITC ruled in its favor, which resulted in tariff increases largely affecting imports from Australia and New Zealand (U.S. International Trade Commission 1999).

2.2 Safeguard Research

The research related to the implementation of safeguard measures in quite extensive. Studies have addressed the potential damage to industries from import competition, the effects of temporary protection on welfare and imports across countries and industries, the efficiency of trade remedies implemented through Section 201 actions, and the potential for individual country safeguards to be upheld within the WTO. Messerlin (2004) examines both the exposure and use of antidumping and safeguard measures by large developing economies focusing on China and its accession to the WTO. Bown and Tovar (2010) find that countries use antidumping and safeguard measures to reverse commitments of lower tariff bindings, using India as a case study. Nelson (2006) provides an extensive survey of the political economy use of protection including antidumping and safeguards, and subsequently uses a structural gravity modeling framework to show that import volumes and welfare effects of antidumping and safeguard mechanisms are negative, but relatively minor. Similarly, Bown (2009) found that use of safeguard measures increased substantially during and shortly after the 2008 financial crises. Vandenbussche and Zanardi (2010) find much larger negative effects on import volumes across countries from the use of antidumping and safeguard measures, with import volumes decreasing as much as 5.9%
for new users of these mechanisms. Beshkar (2010) investigates the role of the WTO’s ability to reduce trade skirmishes given its safeguard policies; however, Pickard and Kimble (2007) question whether use of temporary protection under Section 201 will be upheld given the current WTO framework.

There has also been research to determine whether outcomes are different given the use of nondiscriminatory safeguard measures versus discriminatory antidumping policy. Evidence shows that either policy has essentially the same result when considering U.S. steel imports (Bown 2013). Grossman (1985) questioned whether imports have been the most substantial cause of injury to the U.S. steel industry and finds that for the time-period 1976-1983, relief from imports was not warranted, but that when investigating a shorter time frame, 1979-1983, it is less clear whether imports cause substantial harm to the industry. Ryan (2012) investigated the effectiveness of the safeguards implemented for wheat gluten, lamb meat, and circular welded carbon-lined pipes and found that in all three cases, the industries were not restored to sustained competitiveness after the temporary trade barriers under Section 201 were lifted.

2.3 U.S. Blueberry Sector

In the United States, cultivated blueberry production for the fresh market has increased by about 50% over the last decade (currently around 179 thousand metric tons). However, demand growth has outstripped supply, increasing the need for imports to satisfy demand (Kramer 2020; Kramer, Simnitt, and Calvin 2020). Table 1 shows U.S. fresh blueberry imports from 2011 to 2020 and market share for major suppliers during this period: Chile, Mexico, other South America, and the Rest of World. Imports have increased over time both in terms of volume and value. The quantity of fresh blueberry imports more than doubled since 2011 (currently 182 thousand metric
ton), while import values are nearly 2.5 times higher in 2020 ($1.1 billion) compared to 2011.

Chile, Mexico, and other South American countries dominate the market, though there has been a change in competition as Mexico and countries like Peru have gained a much larger market share at the expense of fresh blueberries from Chile. In 2011, Chile held the largest share of the U.S. import market (59%), followed by other South America (21%), Rest of World (17%), and Mexico (2%). Chile steadily lost market share over time, as imports from Mexico and other South American countries continually increased. In 2020, Mexico held 37% of the U.S. fresh blueberry import market, only surpassed by other South America at 38%. Within the last two years, Peru has emerged as the leading supplier of fresh blueberries to the United States and now accounts for almost all imports from South American countries other than Chile. This substantial growth, primarily driven by increased imports from Mexico and Peru was the catalyst for the Section 201 global safeguard investigation for blueberries (U.S. International Trade Commission 2021).

The volume of U.S. fresh blueberry imports by sources from 2011 (first quarter) to 2020 (fourth quarter) are reported in Figure 1. Note that imports are smallest in the second quarter when U.S. blueberries are in season. Imports are larger in the first and fourth quarter. In 2020, for instance, first and fourth quarter imports were 59 thousand and 71 thousand metric tons, respectively. Whereas, second quarter imports were only 16 thousand metric tons. Latin American countries dominate the import market in the first and fourth quarters, while blueberries imported in the third quarter have primarily been from the Rest of World (namely Canada) until 2020 when third quarter imports were relatively large for South America.

Import prices by source are reported in Figure 2. Prices are highest for fresh blueberries sourced from Mexico and other South America, followed by Chile, while blueberries prices for
the Rest of World have been the lowest from 2013 onward. Import prices increased from 2011 to a high in 2015 for all Latin American sources, increasing from $5,000-$7,000/metric ton in 2011 to as high as $13,000/metric ton by 2015. Overall, prices decreased in the following years to 2020 and are now on par with 2011; slightly higher for Chile and other South America and slightly lower for Mexico. Interestingly, prices decreased for Rest of World blueberries from 2013 to 2018 followed by a minor recovery through 2020. Given that Canada accounts for a major share of these imports, lower prices during this period is likely due the U.S. dollar appreciating relative to the Canadian dollar (Federal Reserve Bank of St. Louis 2020).

3. Inverse Demand Model
The Inverse Almost Ideal Demand System (IAIDS) is used to assess how total and source-specific fresh blueberry imports affect import prices in the United States (Eales and Unnevehr 1994; Moschini and Vissa 1992). For the analysis, fresh blueberries from the ith or jth source (exporting country) are considered a distinct product (e.g., fresh Chilean blueberries) that is part of the product group imported fresh blueberries. Denote the price and quantity of imported fresh blueberries from the ith source as \( p_i \) and \( q_i \), respectively, and total expenditure on all fresh blueberry imports as \( E = \sum_{i=1}^{n} E_i \), where \( E_i = p_i q_i \) is the value of fresh blueberries imported from the ith source; \( n \) is the total number of sources where both \( i = 1,2,\ldots,n \) and \( j = 1,2,\ldots,n \). Also, denote the conditional import share for the ith source as \( w_{it} = E_i / E \). Given these terms, the IAIDS is specified as follows (Moschini and Vissa 1992).

\[
w_{it} = \alpha_i + \beta_i \log Q_t + \sum_{j=1}^{n} \gamma_{ij} \log q_{jt} + \mu_{it} \quad (1)
\]
Equation (1) states that the share of imports from the $i$th source ($w_i$) is a function of aggregate imports as measured by a quantity index ($\log Q_t$) and source-specific imports ($\log q_{jt}$). $\mu_{it}$ is a random error term.

Following Brown, Lee, and Seale (1995), we use the differenced IAIDS for estimation.

$$\Delta w_{it} = \beta_i \Delta \log Q_t + \sum_{j=1}^{n} \gamma_{ij} \Delta \log q_{jt} + \Delta \mu_{it}$$  \hspace{1cm} (2)

$\Delta w_{it} = w_{it} - w_{it-4}$ is the differenced conditional import share and $\Delta \log q_{jt} = \log q_{jt} - \log q_{jt-4}$ is the $j$th import quantity in log differences. $\Delta \log Q_t$ is the Divisia volume index:

$$\Delta \log Q_t = \sum_{i=1}^{n} \bar{w}_{it} \Delta \log q_{it}$$, which is a measure of change in aggregate imports; $\bar{w}_{it} = 0.5(w_{it} + w_{it-4})$ is the average conditional import share between periods $t$ and $t-4$. $\Delta \mu_{it}$ is a random error term. Note that the data used for this analysis are quarterly and the 4th difference is used to correct for seasonality.

There are two important benefits of using equation (2) over equation (1). The quantity index often used when estimating the linear version of equation (1) results in estimates that can vary with unit of measure (e.g., pounds versus kilograms) (Moschini and Vissa 1992), which is not the case for the Divisia volume index. Additionally, differencing variables for estimation can alleviate problems of nonstationarity (Matsuda 2005).

$\beta_i$, and $\gamma_{ij}$ are fixed parameters to be estimated. According to demand theory, the following parameter restrictions should hold true: $\sum_i \beta_i = \sum_i \gamma_{ij} = 0$ (adding-up); $\sum_j \gamma_{ij} = 0$ (homogeneity); and $\gamma_{ij} = \gamma_{ji}$ (symmetry). The adding-up condition is automatically satisfied since the differenced import shares sum to zero ($\sum_i \Delta w_{it} = 0$). The homogeneity and symmetry restrictions must be imposed on the parameters (Brown, Lee, and Seale 1995).
Using the parameters in equation (2), we can derive price flexibilities with respect to the total imports (scale) and source-specific imports (Eales and Unnevehr 1994).

\[ f_i = -1 + \frac{\beta_i}{w_i} \]  
\[ f_{ii} = -1 + \frac{\gamma_{ii}}{w_i} + \beta_i \]  
\[ f_{ij} = \frac{\gamma_{ij}}{w_i} + \frac{\beta_i}{w_i} w_j \]  

The scale flexibility, equation (3), measures how the price of fresh blueberries from the ith source responds to changes in total fresh blueberry imports. The uncompensated own and cross-price flexibilities, equations (4) and (5), measure how the price of fresh blueberries from the ith source responds to changes in source-specific imports. Whereas equation (4) measures, for instance, how the price of fresh Chilean blueberries responds to imports of fresh Chilean blueberries, equation (5) measures how that same price would respond to imports from a competing source such as Mexico.

4. Estimation and Results

Data on U.S. fresh blueberry imports in quantity (metric tons) and value (U.S. dollars) are obtained from the U.S. Department of Agriculture, Foreign Agricultural Service Global Agricultural Trade System (GATS). Unit values (value ÷ quantity) are used as proxies for import prices. The data are quarterly and span the following period: first quarter of 2012 to the fourth quarter of 2020. We limit the data to this time period to avoid excessive zero observations for selected countries, which are problematic when estimating a log-differenced model. Fresh blueberries are defined according to HS Code: 0810.40.0029 blueberries, cultivated (including...
highbush), fresh, other than certified organic. This category accounts for the majority of U.S. fresh blueberry imports. For instance, imports under this code were valued at $1.1 billion in 2020, whereas fresh wild blueberries (HS Code: 0810.40.0024) were only $8 million in 2020. Imports of certified organic fresh blueberries (HS Code: 0810.40.0026) were $264 million in 2020. However, this is a fairly recent phenomenon; organic imports were mostly negligible throughout the data period. To account for the competition across supplying countries, we disaggregate imports by the following sources: Chile, Mexico, other South America, and the Rest of World. As mentioned, other South America is an aggregation of South American countries other than Chile. Peru is now the leading supplier of fresh blueberries to the United States, accounting for almost all imports from South American countries other than Chile, which first occurred in 2019 (U.S. Department of Agriculture 2021). The remaining suppliers are aggregated into the Rest of World, which is mostly imports from Canada. Neither Peru nor Canada are specified individually due to periodic zero trade, despite both at times accounting for a significant share of U.S. imports.

We estimate the inverse demand model represented by equation (2) using the generalized Gauss-Newton method in TSP (version 5.0), which is a maximum likelihood procedure for equation systems (Hall and Cummins 2009). We test and correct for autoregressive disturbances using a procedure for singular equation systems developed by Beach and MacKinnon (1979). Homogeneity and symmetry are imposed on the model.

While equations (3) - (5) measure how import prices respond to imports, important to this study is how U.S. blueberry prices respond to imports. The import price flexibilities are the first stage of this relationship. That is, import quantities affect import prices, and then import prices affect U.S. prices. To derive the relationship between import prices and U.S. prices, we estimate
a straightforward first order VAR model over the same time period (first quarter of 2012 to the fourth quarter of 2020):

\[
p_t = A_1 p_{t-1} + \epsilon_t. \tag{6}
\]

The vector \( p \) includes import prices and a representative domestic price (all are in logs), \( A_1 \) are square coefficient matrices, and \( \epsilon \) is a vector of random disturbances. The advantage of using levels, as opposed to differences, is that the estimates remain consistent regardless of prices being integrated or not. Furthermore, standard inference on impulse responses in levels will remain asymptotically valid, and the inference is asymptotically the same even in the presence of cointegrated prices (Lütkepohl and Reimers 1992; Sims, Stock, and Watson 1990). Using this procedure, we derive impulse response functions to assess how domestic prices respond to import price shocks.

The inverse demand model estimates are reported in Table 2. Note that these estimates are best understood as price flexibilities, which are reported in Table 3. The scale flexibilities are all significant, negative, and indicate that for every percentage increase in total imports, the price of fresh blueberries from Chile, Mexico and Rest of World decrease by 1.27% 1.06%, and 1.12%, respectively, whereas imports from other South America decrease by only 0.46%. According to Eales and Unnevehr (1994), scale flexibilities are less than -1.0 for necessities and greater than -1.0 for luxuries. This suggests that imports from other South American countries like Peru are relatively more valued by consumers, as reflected by total imports having a smaller effect on prices.

The own flexibilities are highly significant and show a similar pattern, with Chilean prices being the most sensitive to “own” imports (-1.03). That is, for every one-percent increase in fresh blueberry imports from Chile, Chilean fresh blueberry prices decrease by 1.03%. The
own flexibilities for Mexico (-0.86) and Rest of World (-0.92) are somewhat smaller by comparison. Import prices are the least responsive to imports from other South America (-0.73) (Table 3).

The flexibility estimates indicate that import volumes – total and source-specific – have a significant and negative impact on source-specific import prices. But what is the impact of import prices on U.S. prices? We estimate this relationship using the VAR procedure previously discussed. Unfortunately, due to the seasonal nature of U.S. blueberry production, data on fresh blueberry prices at the producer level are incomplete. Thus, we use average U.S. blueberry prices instead. Since average U.S. prices are clearly dependent on imports prices, which could bias results, we estimate a similar VAR model using the consumer price index for other fresh fruits (excludes apples, bananas, and citrus) as a proxy for U.S. blueberry prices. Before estimating the VAR models, we examined the stationarity properties of each price series. Results are reported in Table 4. Both the Augment Dickey Fuller (ADF) and Phillipps-Perron (PP) tests indicate that we can reject the null hypothesis that each prices series is nonstationary; the PP test for Mexico is the sole exception.

The VAR estimates are reported in Table 5. Given that the variables are in logs, the estimates can be interpreted as elasticities. Note the significant relationships between the U.S. average price and import prices for Chile (0.23) and Mexico (0.37), suggesting an initial impact on U.S. prices of about 0.23% and 0.37% for every one-percent increase in Chilean and Mexican blueberry prices, respectively. The estimates for the U.S. average price are clearly driven by the fact that average U.S. prices and import prices are highly correlated, particularly during off-season periods when the United States relies mostly on imports. However, when using the U.S.

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1 Average U.S. price data are from Agronometrics, available at: https://www.agronometrics.com/.
other fresh fruit CPI as a proxy for U.S. prices, the estimates are not as large (Table 5). The only significant causal relationship is between the U.S. CPI and the import price for Chile (0.09), albeit the estimate for Mexico (0.07) is not highly insignificant (P-value = 0.51). This estimate suggests that the initial impact on U.S. prices is only 0.09% for every one-percent increase in Chilean blueberry prices (0.07% for Mexico), which is considerably smaller by comparison.

Impulse response functions (IRFs) based on the estimates in Table 5 for Chile and Mexico are shown in Figure 3. We do not report the IRFs for the other sources, which are overwhelmingly insignificant. The IRFs show the impact of an import price shock on either the U.S. average blueberry price or other fresh fruit CPI. After the initial price response to an import price shock for Chile or Mexico, the confidence bands for the responsiveness of U.S. prices include the zero axis after the 2\textsuperscript{nd} quarter, which is indication that the U.S. price response to import prices are not long-lasting. Note that this is the case regardless of how U.S. prices are measured (U.S. average price versus the CPI).

5. Global Safeguard Implications

The recent global safeguard investigation for blueberries was based on the notion that blueberry imports increased significantly within recent years causing “substantial and serious injury” to the domestic blueberry sector (Office of the U.S. Trade Representative 2020b; U.S. International Trade Commission 2021). Given the counter seasonal nature of blueberry imports, the claim was that imports off-season depressed seasonal U.S. prices. What do the results of this study imply about this claim? Overall, the results show that increased imports result in lower import prices. However, it is not clear if lower import prices necessarily depress U.S. prices. For instance, based on the own flexibility results, a 20% increase in fresh blueberry imports from Mexico
would cause the price of fresh Mexican blueberries to fall by 17.2%. Using the VAR results based on average U.S. prices, this decrease would cause U.S. prices to fall by 5.5%. Using the VAR results based on the other fresh fruit CPI, U.S. prices would only fall by 1.2%. In both instances, the decline in U.S. prices is small when compared to the level of import growth. The IRFs suggest that this impact would not be long lasting. That is, U.S. prices would likely recover in the following quarter.

The U.S. Bureau of Labor Statistics tracks U.S. blueberry prices at the producer level (blueberry producer price index), but these data are only reported for the second and third quarter due to the periodic nature of U.S. blueberry production. Consequently, we could not use this price series in our econometric analysis. However, we do compare this price series to out-of-season import changes. In Figure 4, we report deseasonalized quarterly import growth for Chile, other South America, and Mexico from 2012 (first quarter) to 2020 (fourth quarter) and deseasonalized quarterly percentage changes in blueberry prices paid to U.S. producers. Note that deseasonalized growth or percentage changes are based on the following formula.

$$\% \Delta x_t = 100 \times \frac{(x_t - x_{t-4})}{x_{t-4}}$$

According to Figure 4, there is no obvious relationship between imports and U.S. producer prices. In 2013, for instance, imports from Chile and other South American countries grew by about 20%; U.S. producer prices fell around 8% the following season. Imports grew by an even larger percentage in late 2014 and early 2015, but U.S. prices only decreased around 3% thereafter. What is particularly interesting is that quarterly import growth for Chile and other South American countries peaked at over 50% in late 2016 and early 2017. U.S. producer prices did not fall as a result. In fact, this was followed by the largest U.S. price increase since 2012. In recent years, however, there appears to be an inverse relationship between import growth and
U.S. prices, particularly for imports from other South American countries. Imports in 2018 and 2019 increased by about 20% and 30%, respectively when compared to the previous season, and U.S. prices experienced their largest decline, down by about 36% over the two-year period.

Imports from Mexico persistently grew since 2012, exceeding 100% in some quarters. However, there is no clear pattern to suggest that U.S. producer prices have been negatively impacted by this growth. Similar to Chile and other South American countries, however, we observe the same pattern for Mexico in 2018 and 2019 – higher imports and lower U.S. prices. Given what occurred in 2018 and 2019, it is understandable why U.S. producers would assert that increased imports of fresh blueberries affected their prices and profitability.

6. Conclusion

The global safeguard investigation for blueberries raises questions about the relationship between U.S. blueberry imports, prices, and the wellbeing of U.S. producers. Although the USITC ruled that imports have not caused serious injury to domestic producers, it was important to further examine this issue to understand the factors driving the USITC decision. Fresh blueberry imports have, in fact, more than doubled since 2011, with significant increases in more recent years (U.S. Department of Agriculture 2021). As Kramer, Simnitt, and Calvin (2020) note, the recent growth in fresh blueberry imports from countries like Mexico is “…likely to continue to put downward pressure on [in-season] blueberry prices.” However, they also highlight expanding domestic production as also contributing to lower prices. The IRF results in this study suggest that the impact of import price shocks on U.S. prices would not be long lasting and that U.S. prices would likely recover in the following quarter. This suggests that negative shocks to import prices should not be a concern for U.S. producers.
The results of this study should be taken with some caution, primarily due to the limited number of observations. While this limitation does not negate the validity of the inverse demand estimates since the number of observations (36 observations) far exceed the number of products in the system (4 products), it does raise concerns about the reliability of the VAR estimates and IRF results. Unfortunately, we are limited by the data in this regard.

We do not address quantity endogeneity in this study. While issues of demand endogeneity have mainly focused on ordinary demand and endogenous prices, there have been some studies of inverse demand and endogenous quantities. However, these studies have focused on products with much shorter production horizons such as live seafood capture (Huang 2015). Given the perishable and non-storable nature of fresh produce and the relatively long production season, quantity endogeneity should not be an issue. Note that quantity endogeneity is based on the notion that higher price expectations could result in greater output or quantity supply resulting in small, insignificant, or even positive own-price flexibilities. This is clearly not the case in this study.

The results of this study do not necessarily refute the claim that imports depressed U.S. blueberry prices. Note that the IRFs are based on one-time price shocks, and it could be argued that repeated shocks from persistent import growth could lead to a sustained decrease in U.S. prices. It could also be the case that the most recent price declines experienced in 2018 and 2019 is indicative of a new normal. However, despite fourth quarter imports reaching record level in 2020, 2021 prices could actually exceed the previous two year. For instance, Florida blueberry spot prices (as of March 30th) at the beginning of the 2021 harvest, are higher than prices in 2019 and 2020 (Fain 2021). Time will tell if the recently observed negative relationship between
blueberry imports and U.S. prices will persist or if 2021 prices will remain higher in spite of higher imports.

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### Table 1. U.S. fresh blueberry imports and market share by source: 2011–2020

| Year | Quantity (1,000 MT) | Value ($ million) | Chile | Mexico | Other S. America | Rest of World | Market Share (%) |
|------|---------------------|------------------|-------|--------|------------------|---------------|------------------|
| 2011 | 82.39               | $429.36          | 59.4  | 2.4    | 21.0             | 17.1          |
| 2012 | 88.22               | 475.82           | 39.4  | 23.1   | 13.1             | 32.6          |
| 2013 | 94.29               | 508.86           | 41.9  | 21.7   | 11.6             | 24.8          |
| 2014 | 94.40               | 596.71           | 35.0  | 28.5   | 13.9             | 22.6          |
| 2015 | 105.40              | 702.35           | 30.4  | 28.2   | 17.3             | 24.1          |
| 2016 | 130.30              | 873.74           | 28.3  | 26.8   | 24.6             | 20.4          |
| 2017 | 130.13              | 869.29           | 23.6  | 35.9   | 20.5             | 20.0          |
| 2018 | 157.52              | 1,055.16         | 22.3  | 35.1   | 24.9             | 17.7          |
| 2019 | 181.84              | 1,113.68         | 16.8  | 33.7   | 36.4             | 13.1          |
| 2020 | 181.56              | 1,056.06         | 15.9  | 37.0   | 38.2             | 8.9           |
| Average | 124.61         | 768.10           | 31.3  | 27.2   | 22.2             | 20.1          |

Note: Fresh blueberry imports are defined according to HS Code: 0810.40.0029 blueberries, cultivated (including highbush), fresh, other than certified organic.
Source: U.S. Department of Agriculture, 2021.
Table 2. IAID estimates for U.S. fresh blueberry imports

| Parameter | Estimate | SE  | P-value |
|-----------|----------|-----|---------|
| $\beta_1$ | -0.08    | 0.04| [.030]  |
| $\beta_2$ | -0.02    | 0.04| [.623]  |
| $\beta_3$ | 0.12     | 0.05| [.008]  |
| $\beta_4$ | -0.02    | 0.06| [.664]  |
| $\gamma_{11}$ | 0.01 | 0.01| [.048]  |
| $\gamma_{12}$ | -0.02   | 0.01| [.006]  |
| $\gamma_{13}$ | -0.01   | 0.01| [.398]  |
| $\gamma_{14}$ | 0.01    | 0.00| [.194]  |
| $\gamma_{22}$ | 0.05    | 0.01| [.000]  |
| $\gamma_{23}$ | -0.01   | 0.01| [.122]  |
| $\gamma_{24}$ | -0.02   | 0.01| [.001]  |
| $\gamma_{33}$ | 0.03    | 0.01| [.000]  |
| $\gamma_{34}$ | -0.01   | 0.01| [.038]  |
| $\gamma_{44}$ | 0.03    | 0.01| [.002]  |

Note: SE denotes the standard error. 1=Chile, 2=Mexico, 3=Other South America, and 4=Rest of World. Homogeneity and symmetry are imposed on the model. The equation $R^2$ and Durbin–Watson statistics are, respectively, 0.25 and 2.10 (Chile); 0.45 and 1.94 (Mexico); and 0.20 and 2.08 (other South America).

Source: Authors’ estimation.
Table 3. Scale and uncompensated own flexibilities

| Country          | Scale flexibility | Own flexibility |
|------------------|-------------------|-----------------|
|                  | Estimate  SE   | P-value | Estimate  SE   | P-value |
| Chile            | -1.27  0.13 | [.000] | -1.03  0.05 | [.000] |
| Mexico           | -1.06  0.13 | [.000] | -0.86  0.06 | [.000] |
| Other South America | -0.46  0.20 | [.024] | -0.73  0.06 | [.000] |
| Rest of World    | -1.12  0.28 | [.000] | -0.92  0.06 | [.000] |

Note: SE denotes the asymptotic standard error.
Source: Authors’ estimation.
Table 4. Augmented Dickey Fuller (ADF) and Phillips–Perron (PP) tests statistics

| Price Variable            | Test Statistic |          |          |
|---------------------------|----------------|----------|----------|
|                           | ADF            | PP       |          |
| US Average Price          | -4.59 [0.00]   | -39.85 [0.00] |          |
| CPI                       | -7.49 [0.00]   | -29.54 [0.01] |          |
| Chile                     | -8.65 [0.00]   | -31.70 [0.01] |          |
| Mexico                    | -3.65 [0.03]   | -13.86 [0.23] |          |
| Other South America       | -7.34 [0.00]   | -24.09 [0.03] |          |
| Rest of World             | -5.06 [0.00]   | -25.24 [0.04] |          |

Note: The p-values for the ADF and PP tests are in brackets.
Table 5. VAR model estimates

| Variable          | Estimate | SE  | P-value | Estimate | SE  | P-value |
|-------------------|----------|-----|---------|----------|-----|---------|
| U.S. Price (-1)   | -0.54    | 0.17| [0.003] | 0.26     | 0.23| [0.269] |
| Chile Price (-1)  | 0.23     | 0.10| [0.022] | 0.09     | 0.03| [0.007] |
| Mexico Price (-1) | 0.37     | 0.15| [0.021] | 0.07     | 0.04| [0.051] |
| Other SA (-1)     | 0.15     | 0.11| [0.181] | -0.04    | 0.03| [0.166] |
| ROW (-1)          | 0.09     | 0.06| [0.145] | 0.01     | 0.01| [0.390] |
| Constant          | 6.43     | 1.29| [0.000] | 2.36     | 1.20| [0.061] |

Dependent variable = U.S. Average Price  
Dependent variable = U.S. CPI
Figure 1. U.S. fresh blueberry imports by source: 2011 Q1–2020 Q4

Note: Fresh blueberry imports are defined according to HS Code: 0810.40.0029 blueberries, cultivated (including highbush), fresh, other than certified organic.
Source: U.S. Department of Agriculture, 2021.
Figure 2. Import prices by source ($/metric ton): 2011–2020

Note: Fresh blueberry imports are defined according to HS Code: 0810.40.0029 blueberries, cultivated (including highbush), fresh, other than certified organic.
Source: U.S. Department of Agriculture, 2021.
Figure 3. Impulse response functions: U.S. prices w.r.t select import prices

Note: The y-axis measures the mean response in units (percent changes) and the x-axis measures time in quarters. The solid line is the mean response and the dotted lines are 95% confidence intervals. Source: Authors’ estimation.
Figure 4. Deseasonalized quarterly growth in import volume and U.S. blueberry producer price index (PPI): 2012 Q1–2020 Q4

Note: Data points are based on differences to control for seasonality: \( \%\Delta x_t = 100 \times (x_t - x_{t-4})/x_{t-4} \). 
Source: U.S. Department of Agriculture and U.S. Bureau of Labor Statistics, 2021.