Modeling the Impact of Summer Squash Imports on U.S. Producers

Seasonal Effects Model Release

> **Read Me :**
> This model accompanies the USITC report, *Squash: Effect of Imports on U.S. Seasonal Markets, with a Focus on the U.S. Southeast*, Inv. 332-584. The report includes a quantitative analysis of the economic impact of fresh summer squash imports on U.S. domestic prices, production, revenue, operating income, and employment. Economic effects are modeled to reflect seasonal implications, where harvesting periods are split into June-October and November-May. The model inputs (BLUE-shaded cells) include elasticities that describe responsiveness to price changes, and domestic production and imports data for each growing season from 2015 to 2020. Data sources are listed in the cell above the data input. The model then lowers imports to a counterfactual level where the historical above-average growth rates are removed. Outputs are in the GREEN-shaded cells. The white cells are intermediate calculations.
>
> This PDF is a printout of the Mathematica file "Seasonal summer squash model - model release.nb".

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Nov 2019 - Oct 2020

In[●]:= `ClearAll[f];`

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1. Model Parameters

1.1 Elasticity of Substitution

Source: USITC's econometric estimation using the trade cost method in Riker (2020).

Riker, David. "A Trade Cost Approach to Estimating the Elasticity of Substitution." Economics Working Paper Series 2020-07-D, U.S. International Trade Commission, July 2020. https://www.usitc.gov/publications/332/working_papers/ecwp_2017-07-d.pdf.

In[●]:= `sigma = 3.0880;`

1.2 Industry Price Elasticity of Demand

Source: USITC staff estimate.

In[●]:= `eta = -1;`

1.3 Domestic Supply Elasticities

Source: USITC staff estimate and interviews with industry participants.

June-October domestic supply elasticity

In[●]:= `en = 6;`

November-May domestic supply elasticity

In[●]:= `ef = 6;`

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2. Data Inputs

2.1 U.S. Production Values and Quantities

Source: USITC estimates. Annual state level data obtained from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). State level data was split into June-October and November-May production using information about state-level harvesting months.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October domestic production quantity (mt) and value ($)

In[ ]:= `qdn0 = 131 127;`

In[ ]:= `vdn0 = 81 471 003;`

In[ ]:= `pdn0 = vdn0 / qdn0;`

November-May domestic production quantity (mt) and value ($)

In[ ]:= `qdf0 = 49 404;`

In[ ]:= `vdf0 = 35 050 502;`

In[ ]:= `pdf0 = vdf0 / qdf0;`

2.2 Import Values and Quantities

Source: USITC estimates. Monthly import data was obtained from USITC DataWeb/Census for HTS product code 0709.93.20. Import data was split into summer and winter varieties using production estimates by major trading partner. The import counterfactuals were calculated by removing the above-average increases in imports from 2009 to 2019, reducing the high-growth years growth rates in imports to follow average growth rates.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October import quantity (mt) and value ($)

In[ ]:= `qfn0 = 77 747;`

In[ ]:= `vfn0 = 65 812 842;`

In[ ]:= `pfn0 = vfn0 / qfn0;`

November-May import quantity (mt) and value ($)

In[ ]:= `qff0 = 307 771;`

In[ ]:= `vff0 = 318 736 628;`

In[ ]:= `pff0 = vff0 / qff0;`

June-October counterfactual import quantity (mt)

In[ ]:= `qcn0 = 47 024;`

November-May counterfactual import quantity (mt)

In[ ]:= `qcf0 = 205 314;`

2.3 Domestic Export Quantity

Source: USITC estimates. Monthly exports data were obtained from USITC DataWeb/Census for HTS product code 0709.93.20.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October exports quantity (mt)

In[ ]:= `qdne0 = 1714;`

In[ ]:= `vdn0 = (qdn0 – qdne0) * pdn0;`

November-May exports quantity (mt)

In[ ]:= `qdfe0 = 2058;`

In[ ]:= `vdf0 = (qdf0 – qdfe0) * pdf0;`

2.4 Domestic Employment

Source: USITC estimates. The number of full-time equivalent (FTE) workers was estimated using information about per-acre labor hours and acreage data from USDA NASS.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October number of FTEs

In[ ]:= `qempn0 = 1807;`

November-May number of FTEs

In[ ]:= `qempf0 = 681;`

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3. Calibration

3.1 Supply Parameters

In[ ]:= `adn = qdn0 pdn0`$^{-en}$`;`

In[ ]:= `adf = qdf0 pdf0`$^{-ef}$`;`

3.2 Demand Parameters

$In[\bullet]:=$ $\mathbf{bfn} = \dfrac{\mathbf{vfn0}}{\mathbf{vdn0}} \left(\dfrac{\mathbf{pfn0}}{\mathbf{pdn0}}\right)^{\mathbf{sigma-1}};$

$In[\bullet]:=$ $\mathbf{pin0} = \left(\mathbf{pdn0}^{1-sigma} + \mathbf{bfn}\,\mathbf{pfn0}^{1-sigma}\right)^{\frac{1}{1-sigma}};$

$In[\bullet]:=$ $\mathbf{kn} = \left(\mathbf{qdn0} - \mathbf{qdne0}\right)\mathbf{pin0}^{-sigma-eta}\,\mathbf{pdn0}^{sigma};$

$In[\bullet]:=$ $\mathbf{bff} = \dfrac{\mathbf{vff0}}{\mathbf{vdf0}} \left(\dfrac{\mathbf{pff0}}{\mathbf{pdf0}}\right)^{\mathbf{sigma-1}};$

$In[\bullet]:=$ $\mathbf{pif0} = \left(\mathbf{pdf0}^{1-sigma} + \mathbf{bff}\,\mathbf{pff0}^{1-sigma}\right)^{\frac{1}{1-sigma}};$

$In[\bullet]:=$ $\mathbf{kf} = \left(\mathbf{qdf0} - \mathbf{qdfe0}\right)\mathbf{pif0}^{-sigma-eta}\,\mathbf{pdf0}^{sigma};$

4. New Equilibrium Calculation

June-October Equilibrium Calculation

$In[\bullet]:=$ $\mathbf{pin} = \left(\mathbf{pd1}^{1-sigma} + \mathbf{bfn}\,\mathbf{pf1}^{1-sigma}\right)^{\frac{1}{1-sigma}};$

$In[\bullet]:=$ $\mathbf{Eqn11} = \mathbf{adn}\,\mathbf{pd1}^{en} == \mathbf{qdne0} + \mathbf{kn}\,\mathbf{pin}^{sigma+eta}\,\mathbf{pd1}^{-sigma};$

$In[\bullet]:=$ $\mathbf{Eqn12} = \mathbf{qcn0} == \mathbf{kn}\,\mathbf{bfn}\,\mathbf{pin}^{sigma+eta}\,\mathbf{pf1}^{-sigma};$

$In[\bullet]:=$ $\mathbf{FindRoot[\{Eqn11, Eqn12\}, \{pd1, pdn0\}, \{pf1, pfn0\}]}$

$Out[\bullet]=$ $\{pd1 \to 636.894,\ pf1 \to 1072.14\}$

$In[\bullet]:=$ $\mathbf{pdn1} = \mathbf{pd1}\ /.\ \%;$

$In[\bullet]:=$ $\mathbf{pfn1} = \mathbf{pf1}\ /.\ \%\%;$

$In[\bullet]:=$ $\mathbf{qdn1} = \mathbf{adn}\,\mathbf{pdn1}^{en};$

$In[\bullet]:=$ $\mathbf{qfn1} = \mathbf{qcn0};$

$In[\bullet]:=$ $\mathbf{pin1} = \left(\mathbf{pdn1}^{1-sigma} + \mathbf{bfn}\,\mathbf{pfn1}^{1-sigma}\right)^{\frac{1}{1-sigma}};$

November-May Equilibrium Calculation

$In[\bullet]:=$ $\mathbf{pif} = \left(\mathbf{pd2}^{1-sigma} + \mathbf{bff}\,\mathbf{pf2}^{1-sigma}\right)^{\frac{1}{1-sigma}};$

$In[\bullet]:=$ $\mathbf{Eqn21} = \mathbf{adf}\,\mathbf{pd2}^{ef} == \mathbf{qdfe0} + \mathbf{kf}\,\mathbf{pif}^{sigma+eta}\,\mathbf{pd2}^{-sigma};$

$In[\bullet]:=$ $\mathbf{Eqn22} = \mathbf{qcf0} == \mathbf{kf}\,\mathbf{bff}\,\mathbf{pif}^{sigma+eta}\,\mathbf{pf2}^{-sigma};$

$In[\bullet]:=$ $\mathbf{FindRoot[\{Eqn21, Eqn22\}, \{pd2, pdf0\}, \{pf2, pff0\}]}$

$Out[\bullet]=$ $\{pd2 \to 759.366,\ pf2 \to 1448.92\}$

$In[\bullet]:=$ $\mathbf{pdf1} = \mathbf{pd2}\ /.\ \%;$

$In[\bullet]:=$ $\mathbf{pff1} = \mathbf{pf2}\ /.\ \%\%;$

In[•]:= **qdf1 = adf pdf1$^{\text{ef}}$;**

In[•]:= **qff1 = qcf0;**

In[•]:= **pif1 = $\left(\text{pdf1}^{1-\text{sigma}} + \text{bff pff1}^{1-\text{sigma}}\right)^{\frac{1}{1-\text{sigma}}}$;**

---

5. Results

Percent change in prices of domestic product, {June-October, November-May}

In[•]:= **PriceChange = $\left\{ \dfrac{100\,(\text{pdn1} - \text{pdn0})}{\text{pdn0}},\ \dfrac{100\,(\text{pdf1} - \text{pdf0})}{\text{pdf0}} \right\}$**

Out[•]= {2.50765, 7.03332}

Percent change in quantities of domestic product, {June-October, November-May}

In[•]:= **QuantityChange = $\left\{ \dfrac{100\,(\text{qdn1} - \text{qdn0})}{\text{qdn0}},\ \dfrac{100\,(\text{qdf1} - \text{qdf0})}{\text{qdf0}} \right\}$**

Out[•]= {16.0213, 50.3537}

Percent change in price of imported product, {June-October, November-May}

In[•]:= **ImportPChange = $\left\{ \dfrac{100\,(\text{pfn1} - \text{pfn0})}{\text{pfn0}},\ \dfrac{100\,(\text{pff1} - \text{pff0})}{\text{pff0}} \right\}$**

Out[•]= {26.6562, 39.9072}

Percent change in quantities of imported product, {June-October, November-May}

In[•]:= **ImportQChange = $\left\{ \text{N}\left[\dfrac{100\,(\text{qfn1} - \text{qfn0})}{\text{qfn0}} \right],\ \text{N}\left[\dfrac{100\,(\text{qff1} - \text{qff0})}{\text{qff0}} \right] \right\}$**

Out[•]= {-39.5166, -33.29}

Change in revenue of domestic producers ($), {June-October, November-May}

In[•]:= **Revenues = {IntegerPart[pdn1 qdn1 – pdn0 qdn0], IntegerPart[pdf1 qdf1 – pdf0 qdf0]}**

Out[•]= {15 423 004, 21 355 750}

Change in operating income of domestic producers ($), {June-October, November-May}

In[•]:= **OP = IntegerPart$\left[\left\{ \left(\dfrac{1}{\text{sigma}}\right)(\text{pdn1 qdn1} - \text{pdn0 qdn0}),\ \left(\dfrac{1}{\text{sigma}}\right)(\text{pdf1 qdf1} - \text{pdf0 qdf0}) \right\} \right]$**

Out[•]= {4 994 496, 6 915 722}

Change in employment (# of FTEs), {June-October, November-May}

In[ ]:= **Employment = $\{$qempn0 $\dfrac{(qdn1 - qdn0)}{qdn0}$, qempf0 $\dfrac{(qdf1 - qdf0)}{qdf0}\}$**

Out[ ]= $\{289.504, 342.908\}$

Nov 2018 - Oct 2019

In[ ]:= **ClearAll[f];**

1. Model Parameters

1.1 Elasticity of Substitution

Source: USITC's econometric estimation using the trade cost method in Riker (2020).

Riker, David. "A Trade Cost Approach to Estimating the Elasticity of Substitution." Economics Working Paper Series 2020-07-D, U.S. International Trade Commission, July 2020. https://www.usitc.gov/publications/332/working_papers/ecwp_2017-07-d.pdf.

In[ ]:= **sigma = 3.0880;**

1.2 Industry Price Elasticity of Demand

Source: USITC staff estimate.

In[ ]:= **eta = -1;**

1.3 Domestic Supply Elasticities

Source: USITC staff estimate and interviews with industry participants..

June-October domestic supply elasticity

In[ ]:= **en = 6;**

November-May domestic supply elasticity

In[ ]:= **ef = 6;**

2. Data Inputs

2.1 U.S. Production Values and Quantities

Source: USITC estimates. Annual state level data obtained from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). State level data was split into June-October and November-May production using information about state-

level harvesting months.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Squash Greenhouse production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October domestic production quantity (mt) and value ($)

In[ ]:= `qdn0 = 129 863;`

In[ ]:= `vdn0 = 89 191 443;`

In[ ]:= `pdn0 = vdn0 / qdn0;`

November-May domestic production quantity (mt) and value ($)

In[ ]:= `qdf0 = 73 432;`

In[ ]:= `vdf0 = 36 189 018;`

In[ ]:= `pdf0 = vdf0 / qdf0;`

2.2 Import Values and Quantities

Source: USITC estimates. Monthly import data was obtained from USITC DataWeb/Census for HTS product code 0709.93.20. Import data was split into summer and winter varieties using production estimates by major trading partner. The import counterfactuals were calculated by removing the above-average increases in imports from 2009 to 2019, reducing the high-growth years growth rates in imports to follow average growth rates.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October import quantity (mt) and value ($)

In[ ]:= `qfn0 = 75 485;`

In[ ]:= `vfn0 = 59 815 767;`

In[ ]:= `pfn0 = vfn0 / qfn0;`

November-May import quantity (mt) and value ($)

In[ ]:= `qff0 = 311 228;`

In[ ]:= `vff0 = 240 669 897;`

In[ ]:= `pff0 = vff0 / qff0;`

June-October counterfactual import quantity (mt)

In[ ]:=   `qcn0 = 45,656;`

November-May counterfactual import quantity (mt)

In[ ]:=   `qcf0 = 207,621;`

2.3 Domestic Export Quantity

Source: USITC estimates. Monthly exports data were obtained from USITC DataWeb/Census for HTS product code 0709.93.20.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October exports quantity (mt)

In[ ]:=   `qdne0 = 1789;`

In[ ]:= `vdn0 = (qdn0 - qdne0) * pdn0;`

November-May exports quantity (mt)

In[ ]:=   `qdfe0 = 3140;`

In[ ]:= `vdf0 = (qdf0 - qdfe0) * pdf0;`

2.4 Domestic Employment

Source: USITC estimates. The number of full-time equivalent (FTE) workers was estimated using information about per-acre labor hours and acreage data from USDA NASS.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October number of FTEs

In[ ]:=   `qempn0 = 1557;`

November-May number of FTEs

In[ ]:=   `qempf0 = 881;`

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3. Calibration

3.1 Supply Parameters

In[ ]:= `adn = qdn0 pdn0^{-en};`

In[ ]:= `adf = qdf0 pdf0^{-ef};`

3.2 Demand Parameters

$In[\bullet]:=$ $\quad \mathbf{bfn} \ = \ \dfrac{\mathbf{vfn0}}{\mathbf{vdn0}} \ \left(\dfrac{\mathbf{pfn0}}{\mathbf{pdn0}}\right)^{\mathbf{sigma-1}} ;$

$In[\bullet]:=$ $\quad \mathbf{pin0} \ = \ \left(\mathbf{pdn0}^{1-\mathbf{sigma}} + \mathbf{bfn} \ \mathbf{pfn0}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}} ;$

$In[\bullet]:=$ $\quad \mathbf{kn} \ = \ \left(\mathbf{qdn0} - \mathbf{qdne0}\right) \mathbf{pin0}^{-\mathbf{sigma}-\mathbf{eta}} \ \mathbf{pdn0}^{\mathbf{sigma}} ;$

$In[\bullet]:=$ $\quad \mathbf{bff} \ = \ \dfrac{\mathbf{vff0}}{\mathbf{vdf0}} \ \left(\dfrac{\mathbf{pff0}}{\mathbf{pdf0}}\right)^{\mathbf{sigma-1}} ;$

$In[\bullet]:=$ $\quad \mathbf{pif0} \ = \ \left(\mathbf{pdf0}^{1-\mathbf{sigma}} + \mathbf{bff} \ \mathbf{pff0}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}} ;$

$In[\bullet]:=$ $\quad \mathbf{kf} \ = \ \left(\mathbf{qdf0} - \mathbf{qdfe0}\right) \mathbf{pif0}^{-\mathbf{sigma}-\mathbf{eta}} \ \mathbf{pdf0}^{\mathbf{sigma}} ;$

---

4. New Equilibrium Calculation

June-October Equilibrium Calculation

$In[\bullet]:=$ $\quad \mathbf{pin} \ = \ \left(\mathbf{pd1}^{1-\mathbf{sigma}} + \mathbf{bfn} \ \mathbf{pf1}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}} ;$

$In[\bullet]:=$ $\quad \mathbf{Eqn11} \ = \ \mathbf{adn} \ \mathbf{pd1}^{\mathbf{en}} \ == \ \mathbf{qdne0} + \mathbf{kn} \ \mathbf{pin}^{\mathbf{sigma+eta}} \ \mathbf{pd1}^{-\mathbf{sigma}} ;$

$In[\bullet]:=$ $\quad \mathbf{Eqn12} \ = \ \mathbf{qcn0} \ == \ \mathbf{kn} \ \mathbf{bfn} \ \mathbf{pin}^{\mathbf{sigma+eta}} \ \mathbf{pf1}^{-\mathbf{sigma}} ;$

$In[\bullet]:=$ $\quad \mathbf{FindRoot}[\{\mathbf{Eqn11}, \ \mathbf{Eqn12}\}, \ \{\mathbf{pd1}, \ \mathbf{pdn0}\}, \ \{\mathbf{pf1}, \ \mathbf{pfn0}\}]$

$Out[\bullet]=$ $\{\mathrm{pd1} \to 701.717, \ \mathrm{pf1} \to 993.911\}$

$In[\bullet]:=$ $\quad \mathbf{pdn1} \ = \ \mathbf{pd1} \ /. \ \% ;$

$In[\bullet]:=$ $\quad \mathbf{pfn1} \ = \ \mathbf{pf1} \ /. \ \%\% ;$

$In[\bullet]:=$ $\quad \mathbf{qdn1} \ = \ \mathbf{adn} \ \mathbf{pdn1}^{\mathbf{en}} ;$

$In[\bullet]:=$ $\quad \mathbf{qfn1} \ = \ \mathbf{qcn0} ;$

$In[\bullet]:=$ $\quad \mathbf{pin1} \ = \ \left(\mathbf{pdn1}^{1-\mathbf{sigma}} + \mathbf{bfn} \ \mathbf{pfn1}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}} ;$

November-May Equilibrium Calculation

$In[\bullet]:=$ $\quad \mathbf{pif} \ = \ \left(\mathbf{pd2}^{1-\mathbf{sigma}} + \mathbf{bff} \ \mathbf{pf2}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}} ;$

$In[\bullet]:=$ $\quad \mathbf{Eqn21} \ = \ \mathbf{adf} \ \mathbf{pd2}^{\mathbf{ef}} \ == \ \mathbf{qdfe0} + \mathbf{kf} \ \mathbf{pif}^{\mathbf{sigma+eta}} \ \mathbf{pd2}^{-\mathbf{sigma}} ;$

$In[\bullet]:=$ $\quad \mathbf{Eqn22} \ = \ \mathbf{qcf0} \ == \ \mathbf{kf} \ \mathbf{bff} \ \mathbf{pif}^{\mathbf{sigma+eta}} \ \mathbf{pf2}^{-\mathbf{sigma}} ;$

$In[\bullet]:=$ $\quad \mathbf{FindRoot}[\{\mathbf{Eqn21}, \ \mathbf{Eqn22}\}, \ \{\mathbf{pd2}, \ \mathbf{pdf0}\}, \ \{\mathbf{pf2}, \ \mathbf{pff0}\}]$

$Out[\bullet]=$ $\{\mathrm{pd2} \to 524.565, \ \mathrm{pf2} \to 1064.15\}$

$In[\bullet]:=$ $\quad \mathbf{pdf1} \ = \ \mathbf{pd2} \ /. \ \% ;$

$In[\bullet]:=$ $\quad \mathbf{pff1} \ = \ \mathbf{pf2} \ /. \ \%\% ;$

$In[\bullet]:=$ `qdf1 = adf pdf1`^{ef}`;`

$In[\bullet]:=$ `qff1 = qcf0;`

$In[\bullet]:=$ `pif1 = ( pdf1`$^{1-sigma}$` + bff pff1`$^{1-sigma}$`)`$^{\frac{1}{1-sigma}}$`;`

---

5. Results

Percent change in prices of domestic product, {June-October, November-May}

$In[\bullet]:=$ `PriceChange = {`$\dfrac{100 \, (pdn1 - pdn0)}{pdn0}$`,` $\dfrac{100 \, (pdf1 - pdf0)}{pdf0}$`}`

$Out[\bullet]=$ {2.17024, 6.44074}

Percent change in quantities of domestic product, {June-October, November-May}

$In[\bullet]:=$ `QuantityChange = {`$\dfrac{100 \, (qdn1 - qdn0)}{qdn0}$`,` $\dfrac{100 \, (qdf1 - qdf0)}{qdf0}$`}`

$Out[\bullet]=$ {13.7487, 45.4278}

Percent change in price of imported product, {June-October, November-May}

$In[\bullet]:=$ `ImportPChange = {`$\dfrac{100 \, (pfn1 - pfn0)}{pfn0}$`,` $\dfrac{100 \, (pff1 - pff0)}{pff0}$`}`

$Out[\bullet]=$ {25.4274, 37.6132}

Percent change in quantities of imported product, {June-October, November-May}

$In[\bullet]:=$ `ImportQChange = {N[`$\dfrac{100 \, (qfn1 - qfn0)}{qfn0}$`], N[`$\dfrac{100 \, (qff1 - qff0)}{qff0}$`]}`

$Out[\bullet]=$ {-39.5165, -33.2897}

Change in revenue of domestic producers ($), {June-October, November-May}

$In[\bullet]:=$ `Revenues = {IntegerPart[pdn1 qdn1 - pdn0 qdn0], IntegerPart[pdf1 qdf1 - pdf0 qdf0]}`

$Out[\bullet]=$ {14 464 446, 19 829 547}

Change in operating income of domestic producers ($), {June-October, November-May}

$In[\bullet]:=$ `OP = IntegerPart[{(`$\dfrac{1}{sigma}$`) (pdn1 qdn1 - pdn0 qdn0), (`$\dfrac{1}{sigma}$`) (pdf1 qdf1 - pdf0 qdf0)}]`

$Out[\bullet]=$ {4 684 082, 6 421 485}

Change in employment (# of FTEs), {June-October, November-May}

In[●]:= `Employment = {qempn0` $\frac{(qdn1 - qdn0)}{qdn0}$ `, qempf0` $\frac{(qdf1 - qdf0)}{qdf0}$ `}`

Out[●]= {214.067, 400.219}

Nov 2017 - Oct 2018

In[●]:= `ClearAll[f];`

1. Model Parameters

1.1 Elasticity of Substitution

Source: USITC's econometric estimation using the trade cost method in Riker (2020).

Riker, David. "A Trade Cost Approach to Estimating the Elasticity of Substitution." Economics Working Paper Series 2020-07-D, U.S. International Trade Commission, July 2020. https://www.usitc.gov/publications/332/working_papers/ecwp_2017-07-d.pdf.

In[●]:= `sigma = 3.0880;`

1.2 Industry Price Elasticity of Demand

Source: USITC staff estimate.

In[●]:= `eta = -1;`

1.3 Domestic Supply Elasticities

Source: USITC staff estimate and interviews with industry participants..

June-October domestic supply elasticity

In[●]:= `en = 6;`

November-May domestic supply elasticity

In[●]:= `ef = 6;`

2. Data Inputs

2.1 U.S. Production Values and Quantities

Source: USITC estimates. Annual state level data obtained from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). State level data was split into June-October and November-May production using information about state-

level harvesting months.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October domestic production quantity (mt) and value ($)

In[ ]:= **qdn0 = 160 147;**

In[ ]:= **vdn0 = 76 813 733;**

In[ ]:= **pdn0 = vdn0 / qdn0;**

November-May domestic production quantity (mt) and value ($)

In[ ]:= **qdf0 = 59 733;**

In[ ]:= **vdf0 = 34 879 820;**

In[ ]:= **pdf0 = vdf0 / qdf0;**

2.2 Import Values and Quantities

Source: USITC estimates. Monthly import data was obtained from USITC DataWeb/Census for HTS product code 0709.93.20. Import data was split into summer and winter varieties using production estimates by major trading partner. The import counterfactuals were calculated by removing the above-average increases in imports from 2009 to 2019, reducing the high-growth years growth rates in imports to follow average growth rates.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October import quantity (mt) and value ($)

In[ ]:= **qfn0 = 64 317;**

In[ ]:= **vfn0 = 47 474 240;**

In[ ]:= **pfn0 = vfn0 / qfn0;**

November-May import quantity (mt) and value ($)

In[ ]:= **qff0 = 295 183;**

In[ ]:= **vff0 = 234 380 300;**

In[ ]:= **pff0 = vff0 / qff0;**

June-October counterfactual import quantity (mt)

In[ ]:= `qcn0 = 41 773;`

November-May counterfactual import quantity (mt)

In[ ]:= `qcf0 = 211 641;`

2.3 Domestic Export Quantity

Source: USITC estimates. Monthly exports data were obtained from USITC DataWeb/Census for HTS product code 0709.93.20.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October exports quantity (mt)

In[ ]:= `qdne0 = 1704;`

In[ ]:= `vdn0 = (qdn0 - qdne0) * pdn0;`

November-May exports quantity (mt)

In[ ]:= `qdfe0 = 4428;`

In[ ]:= `vdf0 = (qdf0 - qdfe0) * pdf0;`

2.4 Domestic Employment

Source: USITC estimates. The number of full-time equivalent (FTE) workers was estimated using information about per-acre labor hours and acreage data from USDA NASS.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October number of FTEs

In[ ]:= `qempn0 = 1829;`

November-May number of FTEs

In[ ]:= `qempf0 = 682;`

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3. Calibration

3.1 Supply Parameters

In[ ]:= `adn = qdn0 pdn0^{-en};`

In[ ]:= `adf = qdf0 pdf0^{-ef};`

3.2 Demand Parameters

$In[\bullet]:=$ $\mathbf{bfn = \dfrac{vfn0}{vdn0} \left(\dfrac{pfn0}{pdn0}\right)^{sigma-1}};$

$In[\bullet]:=$ $\mathbf{pin0 = \left(pdn0^{1-sigma} + bfn\, pfn0^{1-sigma}\right)^{\frac{1}{1-sigma}}};$

$In[\bullet]:=$ $\mathbf{kn = \left(qdn0 - qdne0\right) pin0^{-sigma-eta}\, pdn0^{sigma}};$

$In[\bullet]:=$ $\mathbf{bff = \dfrac{vff0}{vdf0} \left(\dfrac{pff0}{pdf0}\right)^{sigma-1}};$

$In[\bullet]:=$ $\mathbf{pif0 = \left(pdf0^{1-sigma} + bff\, pff0^{1-sigma}\right)^{\frac{1}{1-sigma}}};$

$In[\bullet]:=$ $\mathbf{kf = \left(qdf0 - qdfe0\right) pif0^{-sigma-eta}\, pdf0^{sigma}};$

4. New Equilibrium Calculation

June-October Equilibrium Calculation

$In[\bullet]:=$ $\mathbf{pin = \left(pd1^{1-sigma} + bfn\, pf1^{1-sigma}\right)^{\frac{1}{1-sigma}}};$

$In[\bullet]:=$ $\mathbf{Eqn11 = adn\, pd1^{en} == qdne0 + kn\, pin^{sigma+eta}\, pd1^{-sigma}};$

$In[\bullet]:=$ $\mathbf{Eqn12 = qcn0 == kn\, bfn\, pin^{sigma+eta}\, pf1^{-sigma}};$

$In[\bullet]:=$ $\mathbf{FindRoot[\{Eqn11, Eqn12\}, \{pd1, pdn0\}, \{pf1, pfn0\}]}$

$Out[\bullet]=$ $\{pd1 \rightarrow 488.203,\ pf1 \rightarrow 894.507\}$

$In[\bullet]:=$ $\mathbf{pdn1 = pd1\, /.\, \%;}$

$In[\bullet]:=$ $\mathbf{pfn1 = pf1\, /.\, \%\%;}$

$In[\bullet]:=$ $\mathbf{qdn1 = adn\, pdn1^{en}};$

$In[\bullet]:=$ $\mathbf{qfn1 = qcn0};$

$In[\bullet]:=$ $\mathbf{pin1 = \left(pdn1^{1-sigma} + bfn\, pfn1^{1-sigma}\right)^{\frac{1}{1-sigma}}};$

November-May Equilibrium Calculation

$In[\bullet]:=$ $\mathbf{pif = \left(pd2^{1-sigma} + bff\, pf2^{1-sigma}\right)^{\frac{1}{1-sigma}}};$

$In[\bullet]:=$ $\mathbf{Eqn21 = adf\, pd2^{ef} == qdfe0 + kf\, pif^{sigma+eta}\, pd2^{-sigma}};$

$In[\bullet]:=$ $\mathbf{Eqn22 = qcf0 == kf\, bff\, pif^{sigma+eta}\, pf2^{-sigma}};$

$In[\bullet]:=$ $\mathbf{FindRoot[\{Eqn21, Eqn22\}, \{pd2, pdf0\}, \{pf2, pff0\}]}$

$Out[\bullet]=$ $\{pd2 \rightarrow 614.846,\ pf2 \rightarrow 1036.4\}$

$In[\bullet]:=$ $\mathbf{pdf1 = pd2\, /.\, \%;}$

$In[\bullet]:=$ $\mathbf{pff1 = pf2\, /.\, \%\%;}$

In[ ]:= `qdf1 = adf pdf1`$^{\text{ef}}$`;`

In[ ]:= `qff1 = qcf0;`

In[ ]:= `pif1 = ( pdf1`$^{1-\text{sigma}}$` + bff pff1`$^{1-\text{sigma}}$`)`$^{\frac{1}{1-\text{sigma}}}$`;`

---

5. Results

Percent change in prices of domestic product, {June-October, November-May}

In[ ]:= `PriceChange = {`$\dfrac{100\,(\text{pdn1} - \text{pdn0})}{\text{pdn0}}$`,` $\dfrac{100\,(\text{pdf1} - \text{pdf0})}{\text{pdf0}}$`}`

Out[ ]= {1.78419, 5.29462}

Percent change in quantities of domestic product, {June-October, November-May}

In[ ]:= `QuantityChange = {`$\dfrac{100\,(\text{qdn1} - \text{qdn0})}{\text{qdn0}}$`,` $\dfrac{100\,(\text{qdf1} - \text{qdf0})}{\text{qdf0}}$`}`

Out[ ]= {11.1942, 36.2816}

Percent change in price of imported product, {June-October, November-May}

In[ ]:= `ImportPChange = {`$\dfrac{100\,(\text{pfn1} - \text{pfn0})}{\text{pfn0}}$`,` $\dfrac{100\,(\text{pff1} - \text{pff0})}{\text{pff0}}$`}`

Out[ ]= {21.1858, 30.5266}

Percent change in quantities of imported product, {June-October, November-May}

In[ ]:= `ImportQChange = {N[`$\dfrac{100\,(\text{qfn1} - \text{qfn0})}{\text{qfn0}}$`], N[`$\dfrac{100\,(\text{qff1} - \text{qff0})}{\text{qff0}}$`]}`

Out[ ]= {-35.0514, -28.3018}

Change in revenue of domestic producers ($), {June-October, November-May}

In[ ]:= `Revenues = {IntegerPart[pdn1 qdn1 - pdn0 qdn0], IntegerPart[pdf1 qdf1 - pdf0 qdf0]}`

Out[ ]= {10 122 564, 15 171 731}

Change in operating income of domestic producers ($), {June-October, November-May}

In[ ]:= `OP = IntegerPart[{(`$\dfrac{1}{\text{sigma}}$`) (pdn1 qdn1 - pdn0 qdn0), (`$\dfrac{1}{\text{sigma}}$`) (pdf1 qdf1 - pdf0 qdf0)}]`

Out[ ]= {3 278 032, 4 913 125}

Change in employment (# of FTEs), {June-October, November-May}

$In[\bullet]:=$ `Employment = {qempn0` $\dfrac{(qdn1 - qdn0)}{qdn0}$ `, qempf0` $\dfrac{(qdf1 - qdf0)}{qdf0}$ `}`

$Out[\bullet]=$ {204.741, 247.44}

Nov 2016 - Oct 2017

$In[\bullet]:=$ `ClearAll[f];`

1. Model Parameters

1.1 Elasticity of Substitution

Source: USITC's econometric estimation using the trade cost method in Riker (2020).

Riker, David. "A Trade Cost Approach to Estimating the Elasticity of Substitution." Economics Working Paper Series 2020-07-D, U.S. International Trade Commission, July 2020. https://www.usitc.gov/publications/332/working_papers/ecwp_2017-07-d.pdf.

$In[\bullet]:=$ `sigma = 3.0880;`

1.2 Industry Price Elasticity of Demand

Source: USITC staff estimate.

$In[\bullet]:=$ `eta = -1;`

1.3 Domestic Supply Elasticities

Source: USITC staff estimate and interviews with industry participants..

June-October domestic supply elasticity

$In[\bullet]:=$ `en = 6;`

November-May domestic supply elasticity

$In[\bullet]:=$ `ef = 6;`

2. Data Inputs

2.1 U.S. Production Values and Quantities

Source: USITC estimates. Annual state level data obtained from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). State level data was split into June-October and November-May production using information about state-

level harvesting months.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October domestic production quantity (mt) and value ($)

In[ ]:= `qdn0 = 155 457;`

In[ ]:= `vdn0 = 93 929 665;`

In[ ]:= `pdn0 = vdn0 / qdn0;`

November-May domestic production quantity (mt) and value ($)

In[ ]:= `qdf0 = 45 894;`

In[ ]:= `vdf0 = 40 249 165;`

In[ ]:= `pdf0 = vdf0 / qdf0;`

2.2 Import Values and Quantities

Source: USITC estimates. Monthly import data was obtained from USITC DataWeb/Census for HTS product code 0709.93.20. Import data was split into summer and winter varieties using production estimates by major trading partner. The import counterfactuals were calculated by removing the above-average increases in imports from 2009 to 2019, reducing the high-growth years growth rates in imports to follow average growth rates.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October import quantity (mt) and value ($)

In[ ]:= `qfn0 = 70 443;`

In[ ]:= `vfn0 = 56 504 219;`

In[ ]:= `pfn0 = vfn0 / qfn0;`

November-May import quantity (mt) and value ($)

In[ ]:= `qff0 = 271 773;`

In[ ]:= `vff0 = 216 026 784;`

In[ ]:= `pff0 = vff0 / qff0;`

June-October counterfactual import quantity (mt)

In[ ]:= **qcn0 = 45 751;**

November-May counterfactual import quantity (mt)

In[ ]:= **qcf0 = 208 969;**

2.3 Domestic Export Quantity

Source: USITC estimates. Monthly exports data were obtained from USITC DataWeb/Census for HTS product code 0709.93.20.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October exports quantity (mt)

In[ ]:= **qdne0 = 2006;**

In[ ]:= **vdn0 = (qdn0 − qdne0) * pdn0;**

November-May exports quantity (mt)

In[ ]:= **qdfe0 = 4990;**

In[ ]:= **vdf0 = (qdf0 − qdfe0) * pdf0;**

2.4 Domestic Employment

Source: USITC estimates. The number of full-time equivalent (FTE) workers was estimated using information about per-acre labor hours and acreage data from USDA NASS.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October number of FTEs

In[ ]:= **qempn0 = 1987;**

November-May number of FTEs

In[ ]:= **qempf0 = 586;**

---

3. Calibration

3.1 Supply Parameters

In[ ]:= **adn = qdn0 pdn0^{-en};**

In[ ]:= **adf = qdf0 pdf0^{-ef};**

3.2 Demand Parameters

$In[\circ]:=$ $\mathbf{bfn} = \dfrac{\mathbf{vfn0}}{\mathbf{vdn0}} \left(\dfrac{\mathbf{pfn0}}{\mathbf{pdn0}}\right)^{\mathbf{sigma-1}};$

$In[\circ]:=$ $\mathbf{pin0} = \left(\mathbf{pdn0}^{1-\mathbf{sigma}} + \mathbf{bfn}\,\mathbf{pfn0}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\circ]:=$ $\mathbf{kn} = \left(\mathbf{qdn0} - \mathbf{qdne0}\right) \mathbf{pin0}^{-\mathbf{sigma-eta}}\,\mathbf{pdn0}^{\mathbf{sigma}};$

$In[\circ]:=$ $\mathbf{bff} = \dfrac{\mathbf{vff0}}{\mathbf{vdf0}} \left(\dfrac{\mathbf{pff0}}{\mathbf{pdf0}}\right)^{\mathbf{sigma-1}};$

$In[\circ]:=$ $\mathbf{pif0} = \left(\mathbf{pdf0}^{1-\mathbf{sigma}} + \mathbf{bff}\,\mathbf{pff0}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\circ]:=$ $\mathbf{kf} = \left(\mathbf{qdf0} - \mathbf{qdfe0}\right) \mathbf{pif0}^{-\mathbf{sigma-eta}}\,\mathbf{pdf0}^{\mathbf{sigma}};$

---

4. New Equilibrium Calculation

June-October Equilibrium Calculation

$In[\circ]:=$ $\mathbf{pin} = \left(\mathbf{pd1}^{1-\mathbf{sigma}} + \mathbf{bfn}\,\mathbf{pf1}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\circ]:=$ $\mathbf{Eqn11} = \mathbf{adn}\,\mathbf{pd1}^{\mathbf{en}} == \mathbf{qdne0} + \mathbf{kn}\,\mathbf{pin}^{\mathbf{sigma+eta}}\,\mathbf{pd1}^{-\mathbf{sigma}};$

$In[\circ]:=$ $\mathbf{Eqn12} = \mathbf{qcn0} == \mathbf{kn}\,\mathbf{bfn}\,\mathbf{pin}^{\mathbf{sigma+eta}}\,\mathbf{pf1}^{-\mathbf{sigma}};$

$In[\circ]:=$ $\mathbf{FindRoot}[\{\mathbf{Eqn11},\ \mathbf{Eqn12}\},\ \{\mathbf{pd1},\ \mathbf{pdn0}\},\ \{\mathbf{pf1},\ \mathbf{pfn0}\}]$

$Out[\circ]=$ $\{\mathbf{pd1} \to 614.765,\ \mathbf{pf1} \to 971.058\}$

$In[\circ]:=$ $\mathbf{pdn1} = \mathbf{pd1}\ /.\ \%;$

$In[\circ]:=$ $\mathbf{pfn1} = \mathbf{pf1}\ /.\ \%\%;$

$In[\circ]:=$ $\mathbf{qdn1} = \mathbf{adn}\,\mathbf{pdn1}^{\mathbf{en}};$

$In[\circ]:=$ $\mathbf{qfn1} = \mathbf{qcn0};$

$In[\circ]:=$ $\mathbf{pin1} = \left(\mathbf{pdn1}^{1-\mathbf{sigma}} + \mathbf{bfn}\,\mathbf{pfn1}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}};$

November-May Equilibrium Calculation

$In[\circ]:=$ $\mathbf{pif} = \left(\mathbf{pd2}^{1-\mathbf{sigma}} + \mathbf{bff}\,\mathbf{pf2}^{1-\mathbf{sigma}}\right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\circ]:=$ $\mathbf{Eqn21} = \mathbf{adf}\,\mathbf{pd2}^{\mathbf{ef}} == \mathbf{qdfe0} + \mathbf{kf}\,\mathbf{pif}^{\mathbf{sigma+eta}}\,\mathbf{pd2}^{-\mathbf{sigma}};$

$In[\circ]:=$ $\mathbf{Eqn22} = \mathbf{qcf0} == \mathbf{kf}\,\mathbf{bff}\,\mathbf{pif}^{\mathbf{sigma+eta}}\,\mathbf{pf2}^{-\mathbf{sigma}};$

$In[\circ]:=$ $\mathbf{FindRoot}[\{\mathbf{Eqn21},\ \mathbf{Eqn22}\},\ \{\mathbf{pd2},\ \mathbf{pdf0}\},\ \{\mathbf{pf2},\ \mathbf{pff0}\}]$

$Out[\circ]=$ $\{\mathbf{pd2} \to 911.021,\ \mathbf{pf2} \to 975.794\}$

$In[\circ]:=$ $\mathbf{pdf1} = \mathbf{pd2}\ /.\ \%;$

$In[\circ]:=$ $\mathbf{pff1} = \mathbf{pf2}\ /.\ \%\%;$

In[●]:= `qdf1 = adf pdf1^ef;`

In[●]:= `qff1 = qcf0;`

In[●]:= `pif1 = ( pdf1^{1-sigma} + bff pff1^{1-sigma} )^{\frac{1}{1-sigma}};`

---

5. Results

Percent change in prices of domestic product, {June-October, November-May}

In[●]:= `PriceChange = {` $\frac{100\ (pdn1 - pdn0)}{pdn0}$ `,` $\frac{100\ (pdf1 - pdf0)}{pdf0}$ `}`

Out[●]= {1.7459, 3.8789}

Percent change in quantities of domestic product, {June-October, November-May}

In[●]:= `QuantityChange = {` $\frac{100\ (qdn1 - qdn0)}{qdn0}$ `,` $\frac{100\ (qdf1 - qdf0)}{qdf0}$ `}`

Out[●]= {10.9434, 25.6504}

Percent change in price of imported product, {June-October, November-May}

In[●]:= `ImportPChange = {` $\frac{100\ (pfn1 - pfn0)}{pfn0}$ `,` $\frac{100\ (pff1 - pff0)}{pff0}$ `}`

Out[●]= {21.0604, 22.76}

Percent change in quantities of imported product, {June-October, November-May}

In[●]:= `ImportQChange = {N[` $\frac{100\ (qfn1 - qfn0)}{qfn0}$ `], N[` $\frac{100\ (qff1 - qff0)}{qff0}$ `]}`

Out[●]= {-35.0525, -23.109}

Change in revenue of domestic producers ($), {June-October, November-May}

In[●]:= `Revenues = {IntegerPart[pdn1 qdn1 - pdn0 qdn0], IntegerPart[pdf1 qdf1 - pdf0 qdf0]}`

Out[●]= {12 098 501, 12 285 773}

Change in operating income of domestic producers ($), {June-October, November-May}

In[●]:= `OP = IntegerPart[{` $\left(\frac{1}{sigma}\right)$ `(pdn1 qdn1 - pdn0 qdn0),` $\left(\frac{1}{sigma}\right)$ `(pdf1 qdf1 - pdf0 qdf0)}]`

Out[●]= {3 917 908, 3 978 553}

Change in employment (# of FTEs), {June-October, November-May}

In[ ]:= **Employment = {qempn0** $\frac{(qdn1 - qdn0)}{qdn0}$ **, qempf0** $\frac{(qdf1 - qdf0)}{qdf0}$**}**

Out[ ]= {217.446, 150.312}

Nov 2015 - Oct 2016

In[ ]:= **ClearAll[f];**

1. Model Parameters

1.1 Elasticity of Substitution

Source: USITC's econometric estimation using the trade cost method in Riker (2020).

Riker, David. "A Trade Cost Approach to Estimating the Elasticity of Substitution." Economics Working Paper Series 2020-07-D, U.S. International Trade Commission, July 2020. https://www.usitc.gov/publications/332/working_papers/ecwp_2017-07-d.pdf.

In[ ]:= **sigma = 3.0880;**

1.2 Industry Price Elasticity of Demand

Source: USITC staff estimate.

In[ ]:= **eta = -1;**

1.3 Domestic Supply Elasticities

Source: USITC staff estimate and interviews with industry participants..

June-October domestic supply elasticity

In[ ]:= **en = 6;**

November-May domestic supply elasticity

In[ ]:= **ef = 6;**

2. Data Inputs

2.1 U.S. Production Values and Quantities

Source: USITC estimates. Annual state level data obtained from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS). State level data was split into June-October and November-May production using information about state-

level harvesting months.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October domestic production quantity (mt) and value ($)

In[ ]:=   **qdn0 = 154 942;**

In[ ]:=   **vdn0 = 76 710 960;**

In[ ]:= **pdn0 = vdn0 / qdn0;**

November-May domestic production quantity (mt) and value ($)

In[ ]:=   **qdf0 = 43 548;**

In[ ]:=   **vdf0 = 38 093 320;**

In[ ]:= **pdf0 = vdf0 / qdf0;**

2.2 Import Values and Quantities

Source: USITC estimates. Monthly import data was obtained from USITC DataWeb/Census for HTS product code 0709.93.20. Import data was split into summer and winter varieties using production estimates by major trading partner. The import counterfactuals were calculated by removing the above-average increases in imports from 2009 to 2019, reducing the high-growth years growth rates in imports to follow average growth rates.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October import quantity (mt) and value ($)

In[ ]:=   **qfn0 = 60 354;**

In[ ]:=   **vfn0 = 40 209 248;**

In[ ]:= **pfn0 = vfn0 / qfn0;**

November-May import quantity (mt) and value ($)

In[ ]:=   **qff0 = 276 670;**

In[ ]:=   **vff0 = 262 906 245;**

In[ ]:= **pff0 = vff0 / qff0;**

June-October counterfactual import quantity (mt)

In[ ]:=
```
qcn0 = 42 110;
```

November-May counterfactual import quantity (mt)

In[ ]:=
```
qcf0 = 212 734;
```

2.3 Domestic Export Quantity

Source: USITC estimates. Monthly exports data were obtained from USITC DataWeb/Census for HTS product code 0709.93.20.

U.S. International Trade Commission Interactive Tariff and Trade DataWeb (USITC DataWeb)/U.S. Census Bureau (Census). Accessed various dates. http://dataweb.usitc.gov.

June-October exports quantity (mt)

In[ ]:=
```
qdne0 = 1484;
```

In[ ]:=
```
vdn0 = (qdn0 – qdne0) * pdn0;
```

November-May exports quantity (mt)

In[ ]:=
```
qdfe0 = 3974;
```

In[ ]:=
```
vdf0 = (qdf0 – qdfe0) * pdf0;
```

2.4 Domestic Employment

Source: USITC estimates. The number of full-time equivalent (FTE) workers was estimated using information about per-acre labor hours and acreage data from USDA NASS.

U.S. Department of Agriculture (USDA). National Agricultural Statistics Service (NASS). "Squash Production, Area harvested, and Yield," Quick Stats database. Accessed various dates. https://quickstats.nass.usda.gov/.

June-October number of FTEs

In[ ]:=
```
qempn0 = 2017;
```

November-May number of FTEs

In[ ]:=
```
qempf0 = 567;
```

3. Calibration

3.1 Supply Parameters

In[ ]:=
```
adn = qdn0 pdn0^-en;
```

In[ ]:=
```
adf = qdf0 pdf0^-ef;
```

3.2 Demand Parameters

$In[\bullet]:=$ $\mathbf{bfn} = \dfrac{\mathbf{vfn0}}{\mathbf{vdn0}} \left(\dfrac{\mathbf{pfn0}}{\mathbf{pdn0}} \right)^{\mathbf{sigma-1}};$

$In[\bullet]:=$ $\mathbf{pin0} = \left(\mathbf{pdn0}^{1-\mathbf{sigma}} + \mathbf{bfn}\,\mathbf{pfn0}^{1-\mathbf{sigma}} \right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\bullet]:=$ $\mathbf{kn} = \left(\mathbf{qdn0} - \mathbf{qdne0} \right) \mathbf{pin0}^{-\mathbf{sigma-eta}}\,\mathbf{pdn0}^{\mathbf{sigma}};$

$In[\bullet]:=$ $\mathbf{bff} = \dfrac{\mathbf{vff0}}{\mathbf{vdf0}} \left(\dfrac{\mathbf{pff0}}{\mathbf{pdf0}} \right)^{\mathbf{sigma-1}};$

$In[\bullet]:=$ $\mathbf{pif0} = \left(\mathbf{pdf0}^{1-\mathbf{sigma}} + \mathbf{bff}\,\mathbf{pff0}^{1-\mathbf{sigma}} \right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\bullet]:=$ $\mathbf{kf} = \left(\mathbf{qdf0} - \mathbf{qdfe0} \right) \mathbf{pif0}^{-\mathbf{sigma-eta}}\,\mathbf{pdf0}^{\mathbf{sigma}};$

4. New Equilibrium Calculation

June-October Equilibrium Calculation

$In[\bullet]:=$ $\mathbf{pin} = \left(\mathbf{pd1}^{1-\mathbf{sigma}} + \mathbf{bfn}\,\mathbf{pf1}^{1-\mathbf{sigma}} \right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\bullet]:=$ $\mathbf{Eqn11} = \mathbf{adn}\,\mathbf{pd1}^{\mathbf{en}} == \mathbf{qdne0} + \mathbf{kn}\,\mathbf{pin}^{\mathbf{sigma+eta}}\,\mathbf{pd1}^{-\mathbf{sigma}};$

$In[\bullet]:=$ $\mathbf{Eqn12} = \mathbf{qcn0} == \mathbf{kn}\,\mathbf{bfn}\,\mathbf{pin}^{\mathbf{sigma+eta}}\,\mathbf{pf1}^{-\mathbf{sigma}};$

$In[\bullet]:=$ $\mathbf{FindRoot}[\{\mathbf{Eqn11}, \mathbf{Eqn12}\}, \{\mathbf{pd1}, \mathbf{pdn0}\}, \{\mathbf{pf1}, \mathbf{pfn0}\}]$

$Out[\bullet]=$ $\{\mathbf{pd1} \to 501.683,\ \mathbf{pf1} \to 778.471\}$

$In[\bullet]:=$ $\mathbf{pdn1} = \mathbf{pd1}\ /.\ \%;$

$In[\bullet]:=$ $\mathbf{pfn1} = \mathbf{pf1}\ /.\ \%\%;$

$In[\bullet]:=$ $\mathbf{qdn1} = \mathbf{adn}\,\mathbf{pdn1}^{\mathbf{en}};$

$In[\bullet]:=$ $\mathbf{qfn1} = \mathbf{qcn0};$

$In[\bullet]:=$ $\mathbf{pin1} = \left(\mathbf{pdn1}^{1-\mathbf{sigma}} + \mathbf{bfn}\,\mathbf{pfn1}^{1-\mathbf{sigma}} \right)^{\frac{1}{1-\mathbf{sigma}}};$

November-May Equilibrium Calculation

$In[\bullet]:=$ $\mathbf{pif} = \left(\mathbf{pd2}^{1-\mathbf{sigma}} + \mathbf{bff}\,\mathbf{pf2}^{1-\mathbf{sigma}} \right)^{\frac{1}{1-\mathbf{sigma}}};$

$In[\bullet]:=$ $\mathbf{Eqn21} = \mathbf{adf}\,\mathbf{pd2}^{\mathbf{ef}} == \mathbf{qdfe0} + \mathbf{kf}\,\mathbf{pif}^{\mathbf{sigma+eta}}\,\mathbf{pd2}^{-\mathbf{sigma}};$

$In[\bullet]:=$ $\mathbf{Eqn22} = \mathbf{qcf0} == \mathbf{kf}\,\mathbf{bff}\,\mathbf{pif}^{\mathbf{sigma+eta}}\,\mathbf{pf2}^{-\mathbf{sigma}};$

$In[\bullet]:=$ $\mathbf{FindRoot}[\{\mathbf{Eqn21}, \mathbf{Eqn22}\}, \{\mathbf{pd2}, \mathbf{pdf0}\}, \{\mathbf{pf2}, \mathbf{pff0}\}]$

$Out[\bullet]=$ $\{\mathbf{pd2} \to 911.601,\ \mathbf{pf2} \to 1176.55\}$

$In[\bullet]:=$ $\mathbf{pdf1} = \mathbf{pd2}\ /.\ \%;$

$In[\bullet]:=$ $\mathbf{pff1} = \mathbf{pf2}\ /.\ \%\%;$

In[ ]:= `qdf1 = adf pdf1`$^{\text{ef}}$`;`

In[ ]:= `qff1 = qcf0;`

In[ ]:= `pif1 = ( pdf1`$^{1-\text{sigma}}$` + bff pff1`$^{1-\text{sigma}}$`)`$^{\frac{1}{1-\text{sigma}}}$`;`

---

5. Results

Percent change in prices of domestic product, {June-October, November-May}

In[ ]:= $\textbf{PriceChange} = \{ \dfrac{100\ (\text{pdn1} - \text{pdn0})}{\text{pdn0}}, \dfrac{100\ (\text{pdf1} - \text{pdf0})}{\text{pdf0}} \}$

Out[ ]= {1.33077, 4.21354}

Percent change in quantities of domestic product, {June-October, November-May}

In[ ]:= $\textbf{QuantityChange} = \{ \dfrac{100\ (\text{qdn1} - \text{qdn0})}{\text{qdn0}}, \dfrac{100\ (\text{qdf1} - \text{qdf0})}{\text{qdf0}} \}$

Out[ ]= {8.25501, 28.0988}

Percent change in price of imported product, {June-October, November-May}

In[ ]:= $\textbf{ImportPChange} = \{ \dfrac{100\ (\text{pfn1} - \text{pfn0})}{\text{pfn0}}, \dfrac{100\ (\text{pff1} - \text{pff0})}{\text{pff0}} \}$

Out[ ]= {16.8483, 23.8149}

Percent change in quantities of imported product, {June-October, November-May}

In[ ]:= $\textbf{ImportQChange} = \{ N \big[\dfrac{100\ (\text{qfn1} - \text{qfn0})}{\text{qfn0}} \big], N \big[\dfrac{100\ (\text{qff1} - \text{qff0})}{\text{qff0}} \big] \}$

Out[ ]= {- 30.2283, - 23.1091}

Change in revenue of domestic producers ($), {June-October, November-May}

In[ ]:= `Revenues = {IntegerPart[pdn1 qdn1 - pdn0 qdn0], IntegerPart[pdf1 qdf1 - pdf0 qdf0]}`

Out[ ]= {7,437,616, 12,759,831}

Change in operating income of domestic producers ($), {June-October, November-May}

In[ ]:= $\textbf{OP} = \textbf{IntegerPart}\big[\{ \big(\dfrac{1}{\text{sigma}}\big)\ (\text{pdn1 qdn1} - \text{pdn0 qdn0}), \big(\dfrac{1}{\text{sigma}}\big)\ (\text{pdf1 qdf1} - \text{pdf0 qdf0}) \}\big]$

Out[ ]= {2,408,554, 4,132,069}

Change in employment (# of FTEs), {June-October, November-May}

In[ ]:= **Employment** = $\left\{ \texttt{qempn0} \ \frac{(\texttt{qdn1} - \texttt{qdn0})}{\texttt{qdn0}}, \ \texttt{qempf0} \ \frac{(\texttt{qdf1} - \texttt{qdf0})}{\texttt{qdf0}} \right\}$

Out[ ]= $\{166.504, 159.32\}$