# BSE and the US Economy:
# Adjustments in a Specific Factors Model

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**Abstract**

The potential impact of a BSE outbreak on the US economy is gauged in a general equilibrium specific factors model including related agricultural production and processing. Output and factor price adjustments are simulated for various vectors of BSE induced price changes and degrees of substitution. Outputs, revenues, and capital returns in beef production and meat processing are projected to closely mirror the percentage drop in the price of beef, while pork and poultry production and poultry processing follow increases in those prices. Wages and energy prices fall slightly across the economy while capital returns in the rest of the economy rise negligibly.

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For nearly two decades US beef demand has been affected by bovine spongiform encephalopathy (BSE) after its potential danger to human health was exposed by Holt and Phillips (1988), Dealler (1993), Sawcer (1993), and Lacey (1993). The BSE outbreak in the UK during the mid 1990s and its possible link to cases of human Creutzfeldt-Jakob disease led various agencies of the US government to implement control measures. The spread of BSE to Japan and Canada during 2003 led to increased surveillance and research funding by the USDA. When BSE was reported in Washington the same year, stronger regulatory efforts increased cost by $0.45 per head and proposed BSE measures would cost 5 times that for fed cattle (15 times that for non-fed cattle) according to Coffey, Mintert, Fox, Schroeder, and Valentin (2005).

The present general equilibrium specific factors model gauges the effects of a BSE outbreak on beef production as well as poultry and pork production, related food processing, and the rest of the economy. Demand falls worldwide, leading to the lower exogenous international price in the model. Exports would fall if the price decrease outweighs the fall in US demand. Outputs and factor prices adjust in the general equilibrium production model to the lower beef price. Various vectors of BSE-induced price changes and a range of constant elasticity substitution are simulated. The contribution of the general equilibrium model is that it provides perspective on BSE in the context of the aggregate economy.

Output and capital (including land) in beef production would suffer the brunt of a BSE outbreak absorbing almost all of the effect of the lower price. Increased demand for poultry and pork raise those prices, outputs, and capital returns. There would be negligible decreases in the wages and energy prices in the economy, and returns to capital in the rest of the economy rise very slightly.

**A Review of BSE Industrial Impacts**

In the week following the Washington BSE case in December 2003 cattle prices fell 16% and cattle future prices 20% but they rose back during the first quarter of 2004. Had the low prices held, the cattle industry would have lost $2 billion during the first quarter of 2004.

The consumer survey of Henderson (2003) suggests US beef demand could fall as much as 15% with a BSE outbreak. Coffey, Mintert, Fox, Schroeder, and Valentin (2005) use a regionally targeted consumer survey and find over three quarters of consumers did not change habits because of the BSE case but that subsequent cases, particularly multiple ones, could have a significant impact. Jin, Skripnitchenko, and Koo (2004) estimate there would be a 20% domestic decline of beef consumption with additional BSE outbreaks in the United States.

Within days of the Washington case 53 countries including major importers such as Japan, Mexico, South Korea, and Canada banned imports of US beef. Exports of $4 billion accounted for 10% of US beef production during 2003 and the bans reduced exports by 82%. If all exported beef were consumed domestically, the increased quantity would have lowered domestic beef prices 16% as developed by Henderson (2003).

During the second half of 2004 cattle future prices remained perhaps 10% lower than had been expected. Francl (2003) points out that based on the expected sale of over 25 billion pounds in 2004 every $10 per hundredweight drop in price results in a $2.5 billion drop in revenue. Lost exports would then account for a loss of $1 billion revenue with total lost revenue of about $3.5 billion.

From 1998 to 2002, the US exported a yearly average of $1.4 billion of beef products and Feuz (2005) estimates exports during the period increased the price of cattle about $40 per head. Gross receipts from sales of cattle and calves in 2000 totaled $41 million accounting for 21% of all agricultural receipts. BSE would impact other agriculture and the present general equilibrium model offers perspective on its impact on the aggregate economy as well.

**The Applied Specific Factors Model of Production**

The comparative static specific factors general equilibrium model assumes constant returns to scale, full employment, competitive pricing, cost minimization, sector specific capital inputs, and mobility of labor and energy across the economy. The competitive model of production and trade is developed by Jones and Scheinkman (1977), Chang (1979) and Thompson (1995). Competitive pricing of output and full employment of labor, energy, and industrial capital and are the main behavioral assumptions. The comparative static model solves for adjustments in factor prices and outputs to changes in exogenous world prices of outputs, holding total factor supplies constant but allowing mobility of labor and energy.

Aggregate economy substitution elasticities $\sigma$ summarize how cost minimizing firms alter inputs in the face of changing factor prices. Industry shares $\lambda$ describe the share of each input in each industry, and factor shares $\theta$ the portion of industry revenue paid each factor. The model is stated in elasticity form as

$$\begin{bmatrix} \sigma & \lambda \\ \theta' & 0 \end{bmatrix} \begin{bmatrix} \hat{w} \\ \hat{x} \end{bmatrix} = \begin{bmatrix} \hat{v} \\ \hat{p} \end{bmatrix} \qquad (1)$$

where ^ represents percentage changes, $\sigma$ is the matrix of substitution elasticities based on constant elasticity substitution (CES) in the present application, $\lambda$ is the matrix of industry shares, $\theta'$ the transposed matrix of factor shares, and *0* a null matrix. The vector *w* represents endogenous factor prices, *x* endogenous outputs, *v* exogenous factor endowments, and *p* exogenous world prices of products. The first equation in (1) is derived from full employment conditions and the second from competitive pricing.

**Factor and Industry Shares in the BSE Specific Factors Model**

The first step in building the applied model is to derive factor shares $\theta$ and industry shares $\lambda$ from factor payments as in Thompson (1996). Data includes value added and the labor bill in meat and poultry processing, other manufacturing, and services from the 2002 *Economic Census*. Energy spending for manufacturing and services is from US Department of Energy (2001). Total receipts, labor inputs, and energy data for cattle, poultry, pork, and other agriculture are from the 2002 Census of Agriculture *Summary by North American Industry Classification System (NAICS).* Capital inputs are residuals of value added after labor and energy bills.

Factor shares $\theta$ are the portions productive factors receive from industry revenue, and industry shares $\lambda$ portions of factors employed in each industry. Factor shares are derived directly from payment data, while derivation of industry shares assumes prices of mobile labor and energy are identical across industries. Table 1 is the total payment matrix used to derive factor and industry shares.

* Table 1 *

Table 2 presents the factor share matrix $\theta$. Summing down a column in Table 1 gives total sector revenue. For instance, total revenue of the beef industry is $27.1 billion and the capital share is $22.3/27.1 = 82%. Capital implicitly includes land and has the largest factor share in each industry. The service sector has the largest labor share 34% followed by other manufacturing and poultry processing with labor shares about half that. The labor share in cattle is 4.4% and in meat processing twice that.

* Table 2 *

Industry shares $\lambda$ are in Table 3. Summing across rows in Table 1 gives total factor income and assuming equal factor prices across industries leads to the industry shares. For instance, total labor income in beef production is $1.9 billion implying employment of $1.9/$3,164 = .06% of all labor. Poultry and pork use half that much labor while meat and poultry processing use .2% each. The industry share of each specific capital equals 1.

* Table 3 *

**Derived CES Substitution Elasticities**

Substitution elasticities summarize adjustment in cost minimizing inputs when factor prices change as developed by Jones (1965) and Takayama (1982). Following Allen (1938) the cross price elasticity between the input of factor *i* and the payment to factor *k* in sector *j* is $E_{ij}^{k} = \hat{a}_{ij} / \hat{w}_{k} = \theta_{kj} S_{ij}^{k}$ (2)

where $S_{ij}^{k}$ is the Allen partial elasticity of substitution. With Cobb-Douglas production $S_{ij}^{k} = 1$ and constant elasticity of substitution (CES) production implies a positive value for the Allen elasticity. In the present simulations any degree of CES substitution can be considered. Given linear homogeneity, $\Sigma_k E_{ij}^{k} = 0$ and own price elasticities $E_{ij}^{i}$ are derived as the negative of the sum of cross price elasticities.

Aggregate substitution elasticities are the weighted average of cross price elasticities for each industry,

$$\sigma_{ik} \equiv \hat{a} / \hat{w}_{k} = \sum_{j} \lambda_{ij} E_{ij}^{k} = \sum_{j} \lambda_{ij} \theta_{kj} S_{ij}^{k} . \qquad (3)$$

Derived Cobb-Douglas substitution elasticities are in Table 4 and CES scales elasticities accordingly. All factors are substitutes. Table 4 includes the own capital substitution elasticities. Note there is no substitution between specific capital inputs across industries.

* Table 4 *

The largest own substitution occurs for energy and the smallest for capital in the poultry industry. Every 1% increase in energy prices causes .61% decline in energy input while every 1% increase in the return to poultry capital lowers that capital input by .069%. The own labor substitution elasticity is larger than own capital elasticities.

Capital is more of a substitute for labor than energy, and energy is more of a substitute for labor than vice versa. Inputs are weak substitutes with any reasonable degree of CES production.

**Comparative Static Elasticities of Falling Beef Prices**

Table 5 presents elasticities of factor prices with respect to product prices derived by inverting the comparative static system (1). Every 10% decrease in the price of beef would lower the return to capital (including land) in the cattle industry by 12.2%. The largest other effect would be on the price of energy, a decrease of only .03%. The returns to all other industry capitals rise slightly with labor and energy released from beef production. The spillover effects of the price decrease are small because the output adjustment is a strong buffer and the beef industry is small relative to the economy.

* Table 5 *

The largest price effects are for the largest sectors, services and other manufacturing. Every 1% increase in the price of other agricultural products raises that return to capital 1.34% and the price of energy .04% with very small losses spread across labor and other capital returns. Wages depend heavily on the price of services.

Thompson and Toledo (2000) show the comparative static elasticities of factor prices with respect to product prices are identical for all CES production functions in the specific factors model. The surprise is that the degree of substitution has no effect on these general equilibrium price elasticities. The comparative static factor price elasticities in Table 5 extend to all CES production functions.

Table 6 reports the price elasticities of outputs along the production frontier. A higher price raises that output and draws labor and energy away from other industries. The largest own output effect occurs in other agriculture where every 1% price increase raises output .34%. Every 10% increase in the price of beef raises output 2.2% with trivial decreases across other industries and sectors. The smallest own effect is in the large service sector which has more difficulty attracting labor and energy from the rest of the economy relative to what it employs.

* Table 6 *

**Simulated Factor Price and Output Adjustments**

Jin, Skripnitchenko and Koo (2004) and Otto and Lawrence (2001) predict a drop of up to 20% in US beef prices with a BSE outbreak. Demand for poultry and pork would increase, and those prices are assumed to rise by 5% in the present simulations. The price of meat processing is assumed to fall 15% with increased pork processing partly offsetting the lost beef processing. The price of poultry processing is assumed to rise 5%.

Other agriculture could suffer due to decreased demand for cattle feed while the decreased income might have spillover effects on demand for manufacturing and services. To capture these changes, the first scenario imposes price changes of -2% for other agriculture, -1% for other manufacturing, and -1% for the service sector.

Multiply the vector of predicted price changes by the matrix of factor price elasticities in Table 5 to find the predicted factor price adjustments in Table 7. Capital returns in beef production and meat processing fall by 24% and 17%, larger than the underlying price changes due to the magnification effect of Jones (1965). The return to capital in other agriculture decreases over 2%. Returns to capital in the poultry and pork industries rise by about 6%. Wages and energy prices each fall just over 1% suggesting industries with falling prices are labor and energy intensive.

* Table 7 *

Output effects in Table 7 are derived by multiplying the output elasticities in Table 6 by the projected vector of price changes. Output increases by about 1% in poultry processing and pork production, and by about half that much in poultry production. Beef production declines just over 4%, other agriculture .33%, and other manufacturing slightly. Beef revenue falls by the sum of the price and output declines, 24%. Factor price and output adjustments are proportional to the vector of price changes.

Regarding sensitivity to substitution, factor price adjustments are identical for any degree of CES production while outputs effects are scaled according to the degree of CES substitution. If CES = ½ output adjustments are half as large, beef output falling 2% and beef revenue 22%. Estimates of substitution in the applied production literature are typically between ½ and 1.

In the long run the lower capital returns will diminish investment and the stock of productive capital, leading to larger output adjustments. Suppose capital inputs ultimately change in proportion to their returns with every 1% change in return leading to a 1% adjustment in that capital stock. Capital stocks would then adjust according to the vector of capital return adjustments. With constant return to scale subsequent output changes would closely mirror adjustments in industrial capital stocks. The approximate long run output changes then equal the vector of capital return changes, much larger than the short run adjustments. Revenue changes would be the sum of these output changes and the underlying price change, with beef revenue falling 44%.

To gauge sensitivity to price changes, consider a series of other scenarios. A second scenario increases demand in other agriculture due to substitution in demand increasing that price by 2%. Other price changes in this scenario are the same as those in Table 8. Output and the return to capital follow price in other agriculture while the other changes are nearly identical to the first scenario. With ample labor and energy for agriculture to draw upon from the rest of the economy, capital return and output adjustments closely follow price changes.

* Table 8 *

Table 9 reports a third scenario with no price spillover effects on the rest of the economy not directly related to beef production and consumption. With no price changes in other agriculture, other manufacturing, and services, their capital returns are not affected to any extent. The impacts on capital returns in the affected industries are nearly identical to the previous scenarios. Adjustments in factor prices are similar but smaller with trivial decreases in wages and energy prices, reflecting the small size of the BSE affected industries relative to the economy. These other outputs are hardly affected in the short or long run, suggesting the effects of BSE would be nearly industry specific and local.

* Table 9 *

## Conclusion

An outbreak of BSE would hurt the US beef industry and meat processing with falling outputs and capital returns while pork and poultry production and poultry processing would benefit.  Output adjustments are smaller than price changes while industry capital returns are magnified effects.  Short run output adjustments would be negligible beyond these directly affected industries and there would be slight decreases in wages and energy prices across the economy.

Decreased capital returns would lower industrial investment leading to larger long run output adjustments.  The decline in beef production would ultimately mirror a persistent lower price of beef in the general equilibrium but it is not apparent that an outbreak of BSE would permanently lower beef prices.

The present model provides perspective on the potential of BSE to affect the economy.  Generally, the rest of the economy would not be much affected although substantial industrial and local effects would closely follow any permanent decrease in the price of beef.

The model predicts a 24% reduction in beef revenue, amounting to $3 billion using figures for 2003.  Coffey, Mintert, Fox, Schroeder, and Valentin (2005) predict a 16% reduction in price would lead to lost revenue of $2.5 billion.  Francl (2003) predicts $2.6 billion lost revenue with a 4% reduction in output.  The advantage of the present general equilibrium model is that it gauges the positive effect on pork and poultry industries as well as effects on other agriculture and the rest of the economy with all markets clearing in the adjustment.

The projected $3 billion lost revenue provides a gauge of the benefits of increased BSE surveillance. With increased cost of $3 per head the total cost would be $1.2 billion using the 2003 calf crop of about 40 million. The projected loss of $3 billion revenue would have to be discounted less than 40% to make the surveillance worthwhile for the industry. The probability of an outbreak in the long run seems near one, with or without surveillance. The potential health danger to humans is a separate issue but the potential impact on the beef industry is certain.

The present general equilibrium model can be extended. Various vectors of price changes with beef price changes of 10% or 30%, for instance, can be simulated. Various degrees of substitution for pork and poultry in consumption can be simulated with various vectors of price changes. Specific links between beef and other industries in both supply and demand can be included to derive price change vectors. Export demand can be explicitly modeled and the change in exports included in simulations.

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**Table 1. Factor Payments, $ billion**

| | Meat Proc | Poultry Proc | Other Mfg | Service | Beef | Poultry | Pork | Other Agr |
|---|---|---|---|---|---|---|---|---|
| **Labor** | 7.5 | 5.2 | 538.4 | 2,592 | 1.9 | .9 | .8 | 18.0 |
| **Capital** | 74.6 | 31.1 | 3,037 | 4,662 | 22.3 | 19.7 | 8.3 | 119.7 |
| **Energy** | 3.0 | 1.3 | 133.4 | 387.2 | 2.9 | .5 | .5 | 24.0 |
| **Total** | 85.2 | 37.6 | 3,708 | 7,641 | 27.1 | 21.2 | 9.6 | 161.8 |

**Table 2. Factor Shares, $\theta_{ij}$**

| | Meat Proc | Poultry Proc | Other Mfg | Service | Beef | Poultry | Pork | Other Agr |
|---|---|---|---|---|---|---|---|---|
| **Labor** | .088 | .136 | .145 | .339 | .072 | .044 | .083 | .111 |
| **Capital** | .876 | .828 | .819 | .610 | .821 | .931 | .867 | .740 |
| **Energy** | .036 | .036 | .036 | .051 | .107 | .025 | .051 | .149 |

**Table 3. Industry Shares, $\lambda_{ij}$**

| | Meat Proc | Poultry Proc | Other Mfg | Service | Beef | Poultry | Pork | Other Agr |
|---|---|---|---|---|---|---|---|---|
| **Labor** | .002 | .002 | .170 | .819 | .001 | .000 | .000 | .006 |
| **Capital** | .009 | .004 | .381 | .585 | .003 | .003 | .001 | .015 |
| **Energy** | .006 | .003 | .241 | .700 | .005 | .001 | .001 | .044 |

**Table 4. Cobb-Douglas Substitution Elasticities, $\sigma_{ik}$**

| | $w_L$ | $w_E$ | $w_K$ |
|---|---|---|---|
| $a_{Labor}$ | -.401 | .049 | .000 |
| $a_{Energy}$ | .279 | -.609 | .001 |
| $a_{Meat\ Proc}$ | .088 | .036 | -.124 |
| $a_{Poultry\ Proc}$ | .136 | .036 | -.172 |
| $a_{Other\ Mfg}$ | .145 | .036 | -.181 |
| $a_{Service}$ | .339 | .051 | -.390 |
| $a_{Beef}$ | .072 | .107 | -.179 |
| $a_{Poultry}$ | .044 | .025 | -.069 |
| $a_{Pork}$ | .083 | .051 | -.133 |
| $a_{Other\ Agr}$ | .111 | .149 | -.260 |

**Table 5. Elasticities of Factor Prices with Respect to Output Prices**

| | $p_{Meat\ Proc}$ | $p_{Poultry\ Proc}$ | $p_{Other\ Mfg}$ | $p_{Service}$ | $p_{Beef}$ | $p_{Poultry}$ | $p_{Pork}$ | $p_{Other\ Agr}$ |
|---|---|---|---|---|---|---|---|---|
| $w_{Labor}$ | .001 | .001 | .064 | .933 | .0001 | .00003 | .0001 | .002 |
| $w_{Energy}$ | .002 | .001 | .121 | .830 | .0032 | .0002 | .0004 | .042 |
| $r_{Meat\ Proc}$ | 1.142 | -.0001 | -.011 | -.128 | -.0001 | -.00001 | -.00002 | -.002 |
| $r_{Poultry\ Proc}$ | -.000 | 1.208 | -.016 | -.189 | -.0002 | -.00001 | -.00003 | -.002 |
| $r_{Other\ Mfg}$ | -.0002 | -.0002 | 1.205 | -.202 | -.0002 | -.00001 | -.0001 | -.002 |
| $r_{Service}$ | -.0005 | -.0004 | -.046 | 1.051 | -.0003 | -.00003 | -.0001 | -.004 |
| $r_{Beef}$ | -.0003 | -.0002 | -.021 | -.190 | 1.217 | -.00003 | -.00001 | -.006 |
| $r_{Poultry}$ | -.0001 | -.0001 | -.007 | -.067 | -.0001 | 1.074 | -.00001 | -.001 |
| $r_{Pork}$ | -.0002 | -.0001 | -.013 | -.138 | -.0002 | -.00001 | 1.154 | -.003 |
| $r_{Other\ Agr}$ | -.0005 | -.0003 | -.034 | -.308 | -.001 | -.00004 | -.0001 | 1.343 |

**Table 6. Elasticities of Output with Respect to Output Prices**

| | $p_{Meat\ Proc}$ | $p_{Poultry\ Proc}$ | $p_{Other\ Mfg}$ | $p_{Service}$ | $p_{Beef}$ | $p_{Poultry}$ | $p_{Pork}$ | $p_{Other\ Agr}$ |
|---|---|---|---|---|---|---|---|---|
| $x_{Meat\ Proc}$ | .142 | -.0001 | -.011 | -.128 | -.0001 | -.00001 | -.00002 | -.002 |
| $x_{Poultry\ Proc}$ | -.002 | .208 | -.016 | -.189 | -.0001 | -.00001 | -.00002 | -.002 |
| $x_{Other\ Mfg}$ | -.0002 | -.0001 | .205 | -.202 | -.0001 | -.00001 | -.00003 | -.002 |
| $x_{Service}$ | -.0005 | -.0004 | -.046 | .051 | -.0003 | -.00003 | -.0001 | -.004 |
| $x_{Cattle}$ | -.0003 | -.0002 | -.021 | -.190 | .217 | -.00003 | -.0001 | -.006 |
| $x_{Poultry}$ | -.0001 | -.0001 | -.006 | -.067 | -.0001 | .074 | -.00001 | -.001 |
| $x_{Pork}$ | -.0002 | -.0001 | -.013 | -.138 | -.0002 | -.00001 | .154 | -.003 |
| $x_{Other\ Agr}$ | -.0005 | -.0003 | -.034 | -.308 | -.001 | -.00004 | -.0001 | .343 |

**Table 7. Factor Price and Output Adjustments – Scenario 1**

| | Price Changes | | Factor Price Adjustments | | Output Adjustments |
|---|---|---|---|---|---|
| | | $w_{Labor}$ | -1.01 | | |
| | | $w_{Energy}$ | -1.12 | | |
| Meat Proc | -15% | $r_{Meat\ Proc}$ | -17.0 | $x_{Meat\ Proc}$ | -1.98 |
| Poultry Proc | 5% | $r_{Poultry\ Proc}$ | 6.25 | $x_{Poultry\ Proc}$ | 1.25 |
| Other Mfg | -1% | $r_{Other\ Mfg}$ | -0.99 | $x_{Other\ Mfg}$ | 0.01 |
| Service | -1% | $r_{Service}$ | -0.99 | $x_{Service}$ | 0.01 |
| Beef | -20% | $r_{Beef}$ | -24.1 | $x_{Beef}$ | -4.12 |
| Poultry | 5% | $r_{Poultry}$ | 5.45 | $x_{Poultry}$ | 0.45 |
| Pork | 5% | $r_{Pork}$ | 5.93 | $x_{Pork}$ | 0.93 |
| Other Agr | -2% | $r_{Other\ Agr}$ | -2.33 | $x_{Other\ Agr}$ | -0.33 |

**Table 8. Factor Price and Output Adjustments – Scenario 2**

| | Price Changes | | Factor Price Adjustments | | Output Adjustments |
|---|---|---|---|---|---|
| | | $w_{Labor}$ | -1.00 | | |
| | | $w_{Energy}$ | -0.95 | | |
| Meat Proc | -15% | $r_{Meat\ Proc}$ | -17.0 | $x_{Meat\ Proc}$ | -1.99 |
| Poultry Proc | 5% | $r_{Poultry\ Proc}$ | 6.24 | $x_{Poultry\ Proc}$ | 1.24 |
| Other Mfg | -1% | $r_{Other\ Mfg}$ | -1.00 | $x_{Other\ Mfg}$ | -0.002 |
| Service | -1% | $r_{Service}$ | -1.00 | $x_{Service}$ | -0.004 |
| Beef | -20% | $r_{Beef}$ | -24.2 | $x_{Beef}$ | -4.15 |
| Poultry | 5% | $r_{Poultry}$ | 5.44 | $x_{Poultry}$ | 0.44 |
| Pork | 5% | $r_{Pork}$ | 5.92 | $x_{Pork}$ | 0.92 |
| Other Agr | 2% | $r_{Other\ Agr}$ | 3.05 | $x_{Other\ Agr}$ | 1.05 |

**Table 9. Factor Price and Output Adjustments - Scenario 3**

| | Price Changes | | Factor Price Adjustments | | Output Adjustments |
|---|---|---|---|---|---|
| | | $w_{Labor}$ | -0.01 | | |
| | | $e_{Energy}$ | -0.08 | | |
| Meat Proc | -15% | $r_{Meat\ Proc}$ | -17.1 | $x_{Meat\ Proc}$ | -2.12 |
| Poultry Proc | 5% | $r_{Poultry\ Proc}$ | 6.04 | $x_{Poultry\ Proc}$ | 1.04 |
| Other Mfg | 0% | $r_{Other\ Mfg}$ | 0.01 | $x_{Other\ Mfg}$ | 0.01 |
| Service | 0% | $r_{Service}$ | 0.01 | $x_{Service}$ | 0.01 |
| Beef | -20% | $r_{Beef}$ | -24.4 | $x_{Beef}$ | -4.35 |
| Poultry | 5% | $r_{Poultry}$ | 5.37 | $x_{Poultry}$ | 0.37 |
| Pork | 5% | $r_{Pork}$ | 5.78 | $x_{Pork}$ | 0.78 |
| Other Agr | 0% | $r_{Other\ Agr}$ | 0.02 | $x_{Other\ Agr}$ | 0.02 |