# Price Behavior of Jalapenos in the U.S. and Mexico

by

Luis Roberto Palafox Osuna

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This Thesis has been approved on the dates shown below

Russell Tronstad — 8-11-2010

Dr. Russell Tronstad
Department of Agricultural and Resource
Economics, University of Arizona

Date

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**Abstract**

This paper studies the behavior of Jalapeno prices in the U.S. and Mexico. In particular, it explores the influence of seasonal and non-seasonal factors on prices of Jalapeno peppers. Also, it measures the influence of cyclical events such as weather and other periodical seasonal events by estimating seasonality in the conditional means. This allows for a more precise observation and analysis of other non seasonal events such as the influence of substitutes, transportation costs and a shock, in the form of food safety regulations. Results have implications for accurate risk and market assessment in producing, storing, and sourcing Jalapeno peppers. Seemingly Unrelated Regression Estimation is used to obtain more efficient standard errors by considering cross-city error correlations. We selected prices from the terminal markets of Chicago, San Francisco and Mexico City to conduct this study. The use of these locations allows for a comparison of markets across countries as well as different regions in the U.S. Specifically, we use lag Jalapeno prices from the three locations to measure the significance of geographically separated markets in the weekly prices of Jalapenos. Findings suggest Mexico City's prices play an important and positive role in determining Jalapeno prices in the U.S. markets. Results also have implications for the use transportation costs when modeling Jalapeno weekly prices; they suggest shocks to transportation costs don't transfer to Jalapeno prices. Estimated results also show strong seasonality patterns that reflect numerous cyclical supply and demand factors.

# Chapter 1: Introduction

## 1.1 Research Motivation

Traditional market theory suggests prices of agricultural commodities should follow a seasonal pattern related to the interaction of the production season and the level of market supply; prices being the lowest during harvest months when the market supply level is at its highest, and then prices having an upward spike as the market supply reaches its lowest levels. Hence, the understanding of these seasonal price patterns can be very relevant as they present an outlook of the market, which in turn can serve as a very important tool to producers and traders in their market and business strategies.

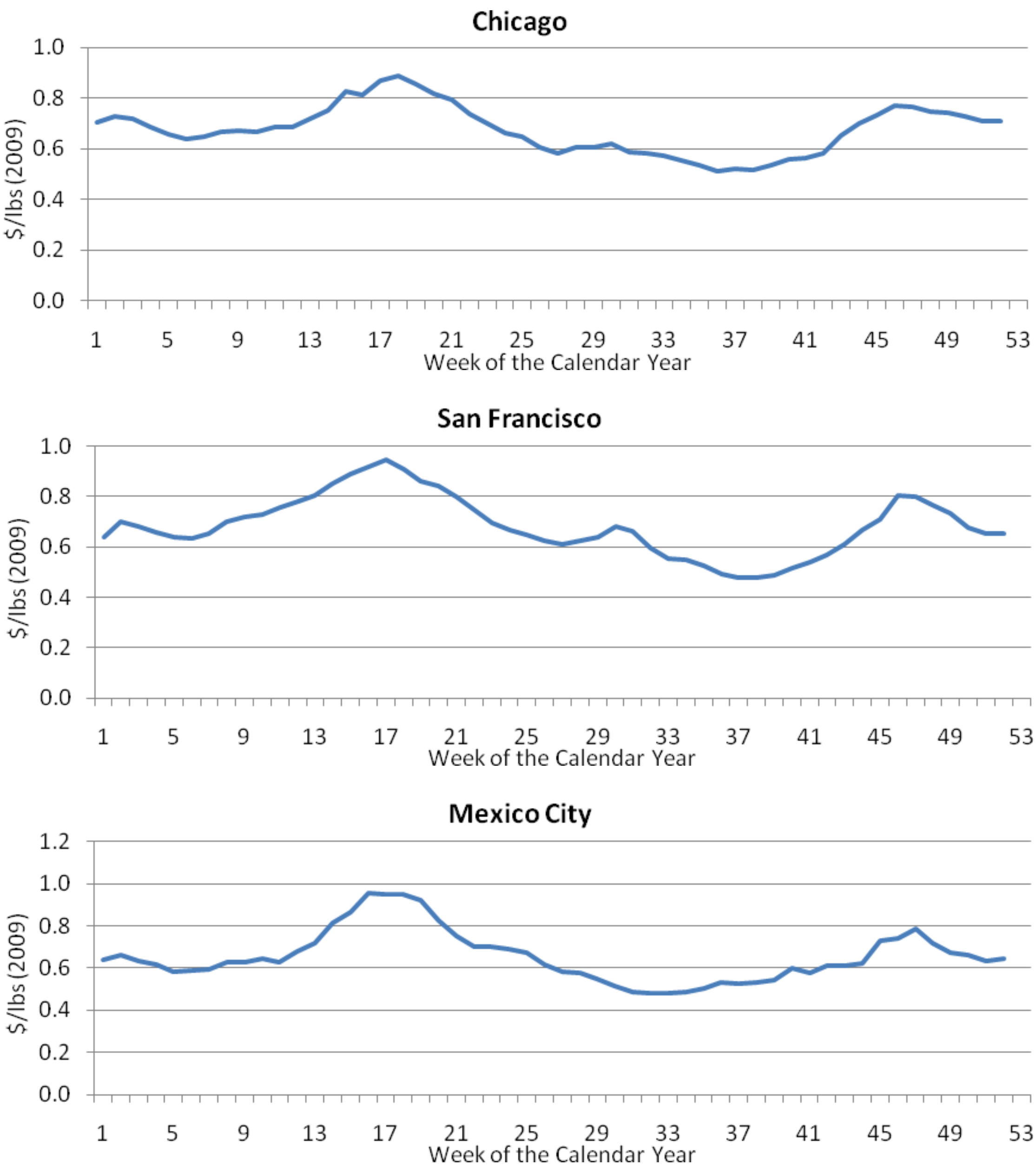
Most economic time series exhibit seasonal variation or seasonal patterns, and Jalapeno prices are no exception. The nature of seasonality in Jalapeno peppers can be explained by how spatially separated growing areas have to supply the market demand for these short shelf life commodities at different periods throughout the year. For example, the U.S. has to import Jalapeno peppers from Mexico during the winter months because of cool weather conditions in the domestic Jalapeno producer regions. Due to this occurrence, one would expect Jalapeno prices to fluctuate more from months in which there is domestic production relative to the months in which Jalapenos have to be imported.

For Jalapenos in particular, decisions such as planting and harvest dates and inventory control become very important because of seasonal price movements. The time lag between planting and harvest Jalapeno peppers is about 100 days and market prices can change by a 2 or 3 fold in this time span. For example, California growers planting in early January occasionally see Jalapeno prices double by the time they start harvest in mid April (see Table 1.1 for U.S. chili pepper harvest dates). Also, Jalapenos have a short shelf-life of about 2 to 3 weeks (Smith et al., 1998) and they start losing value very fast after harvest; hence, the understanding of seasonality can be very relevant in decision making when managing fresh Jalapenos.

Ferrier and Zhen (2010) looked at this issue from the perspective of asparagus; like Jalapenos, this is a fresh perishable product that is available throughout the year in the U.S., even during the months outside the domestic growing season. They calculated that the out-of-season price of asparagus is roughly three times higher than its in-season price. One of the arguments for this behavior is how the availability of fresh fruits and vegetables year round seemed to be increasing the demand for fresh commodities; also creating a decline in the per capita consumption of frozen and canned vegetables since 1991. As a result, the higher demand for fresh fruits and vegetables cannot be met by U.S. production alone due to seasonality in production, so one would expect prices to behave according to these periodical changes in the supply chain.

To illustrate that Jalapeno pepper prices experience seasonality, Figure 1.1 displays the average price of Jalapeno for three different markets. The time period we show in these graphs extends from January 1998 to December 2009. We break it down to weekly average prices to provide a more detailed illustration of how this commodity presents similar patterns throughout the year regardless of the location of the market. For the three locations illustrated, we see that the highest average price occurs between weeks 16 and 19 (from mid April to beginning of May approximately) after which there is a long period of price decline until we see another price increase around October, which peaks around the beginning of December.

Figure 1.1: Average weekly price of Jalapeno peppers




Source: U.S. Department of Agriculture, Agricultural Marketing Service.

This drop in the price of Jalapeno peppers is most likely reflecting the locations Jalapeno peppers are sourced from. When Jalapenos start their price decline around the end of April, several locations across the U.S. start their Jalapeno harvest, and continue through the summer. Table 1.1 shows the usual planting and harvest dates for Jalapeno growing regions in the U.S. Information regarding U.S. Jalapeno pepper production is not available since dissagregated data for Jalapenos is not reported in a consistant manner. However, production data is reported for "green peppers" as a whole which serves as a good proxy for information regarding Jalapeno peppers. In this case, the term green peppers refers to all green pungent peppers grown in the U.S.

Table 1.2 reports total annual pepper production per state. Again, these values are no dissagregated to Jalapenos only, as the values represent the sum of all varieties of green pungent peppers. We see that New Mexico and Texas harvest most of their pepper production (more than half of total U.S. production) in a two month gap, which happen to be the lowest months in terms of average Jalapeno prices.

Table 1.1: U.S. Chili Pepper Planting and Harvest Dates

| | | Usual Planting Dates | | Usual Harvesting Dates | | |
|---|---|---|---|---|---|---|
| **Season** | **State** | **Begins** | **Ends** | **Begins** | **Most Active** | **Ends** |
| Spring | CA | Jan 1 | Mar 1 | Apr 20 | May 1 - June 5 | June 30 |
| Summer | CA | Jan 1 | May 31 | May 1 | June 1 - Aug 31 | Sep 30 |
| Summer | NM | Mar 1 | Apr 30 | July 20 | Aug 1 - Sep 30 | Oct 15 |
| Summer | TX | Mar 30 | June 15 | Aug 1 | Aug 1 - Sep 15 | Sep 30 |
| Fall | CA | Feb 1 | June 30 | Aug 1 | Sep 1 - Oct 31 | Nov 30 |

Source: U.S. Department of Agriculture, National Agricultural Statistical Services.

Table 2.2: U.S. Chili Pepper Production (Tons - 2240 lbs)

| | | CA | | NM | | TX | |
|---|---|---|---|---|---|---|---|
| Year | ALL | Tons | % | Tons | % | Tons | % |
| 2000 | 149,955 | 49,286 | 33% | 88,393 | 59% | 12,277 | 8% |
| 2001 | 133,929 | 44,196 | 33% | 72,321 | 54% | 17,411 | 13% |
| 2002 | 146,607 | 48,259 | 33% | 86,071 | 59% | 12,277 | 8% |
| 2003 | 177,813 | 49,286 | 28% | 118,482 | 67% | 10,045 | 6% |
| 2004 | 208,973 | 57,991 | 28% | 143,616 | 69% | 7,366 | 4% |
| 2005 | 203,036 | 62,813 | 31% | 129,732 | 64% | 10,491 | 5% |
| 2006 | 192,813 | 81,027 | 42% | 105,536 | 55% | 6,250 | 3% |
| 2007 | 174,286 | 80,268 | 46% | 86,384 | 50% | 7,634 | 4% |

Source: U.S. Department of Agriculture, National Agricultural Statistical Services.

Additionally, if we look at Mexico's Jalapeno production we find the summer season to be the one with the largest volume. Table 1.3 shows annual Jalapeno production in Mexico from 2000 to 2007.

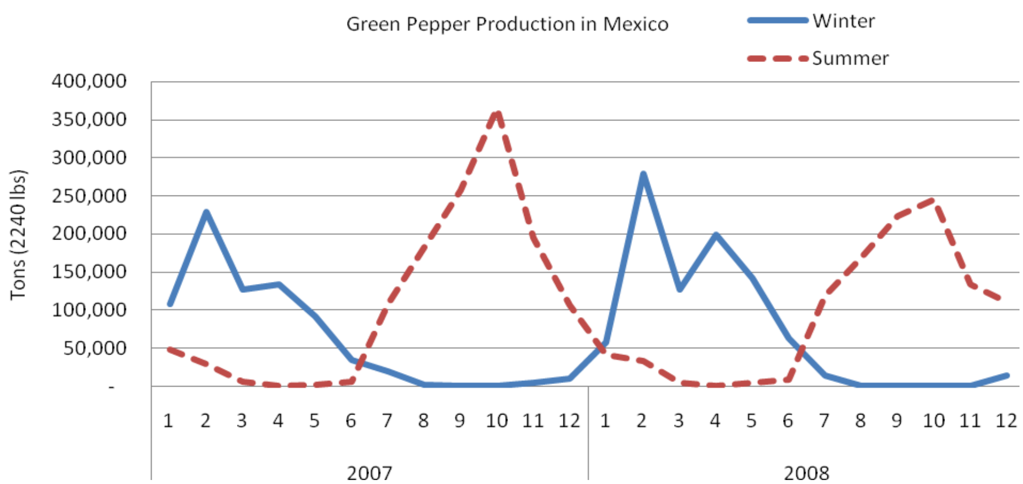
Table 3.3: Mexico's Jalapeno Production (Tons - 2240 lbs)

| | | Winter | | Summer | |
|---|---|---|---|---|---|
| Year | ALL | Tons | % | Tons | % |
| 2000 | 157,856 | 72,822 | 46% | 85,034 | 54% |
| 2001 | 158,884 | 42,680 | 27% | 116,204 | 73% |
| 2002 | 173,101 | 50,998 | 29% | 122,103 | 71% |
| 2003 | 229,509 | 72,899 | 32% | 156,610 | 68% |
| 2004 | 503,246 | 142,271 | 28% | 360,975 | 72% |
| 2005 | 580,559 | 194,400 | 33% | 386,159 | 67% |
| 2006 | 652,767 | 218,884 | 34% | 433,883 | 66% |
| 2007 | 712,700 | 236,578 | 33% | 476,122 | 67% |
| 2008 | 649,161 | 236,220 | 36% | 412,942 | 64% |

Source: Sistema de Información Agroalimentaria de Consulta.

We can use the tables above to understand the supply side of the Jalapeno market, which will help explain the seasonal effects of Jalapeno pepper prices. . If we divide the calendar year into two periods of (1) winter and (2) summer production seasons we find that there is a big difference in production volumes. During the winter season only one country supplies Jalapenos for two countries whereas during the summer season both countries produce Jalapeno peppers. The fact that summer Jalapeno supply is much higher than winter supply explains the lower prices during the summer months and the higher prices in April and December are explained by the interaction of the two production seasons. Figure 1.2 is an illustration of green pepper production in Mexico, we use monthly green pepper production as a proxy for Jalapeno monthly production since the latter is not reported in a monthly basis in Mexico. Similarly to the U.S. data (Tables 1.1 and 1.2), the term “green pepper” refers to the sum of all types of green peppers produced, not just Jalapenos. We see that the higher prices (April) match in date with the decline of the winter season production. As the volume from the summer season raises the prices drop, until the volume from the summer season starts to drop at the end of the year, which is when the second peak in average prices occurr.

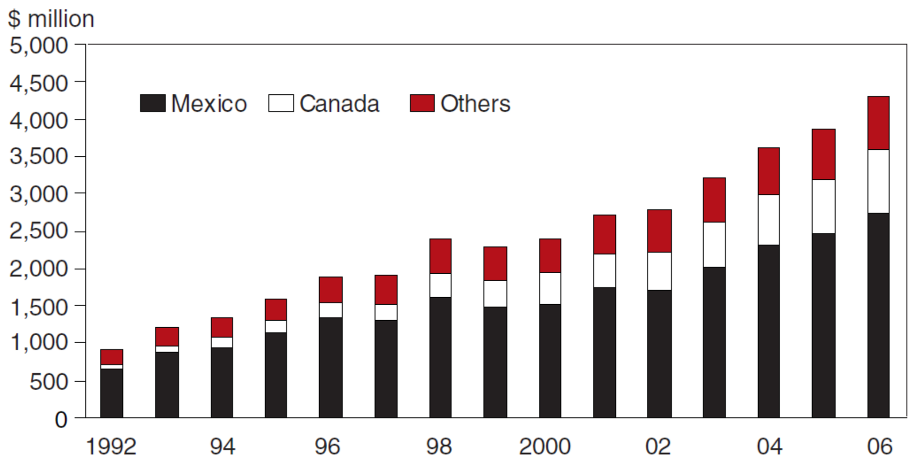
Figure 2.2: Green Pepper Production in Mexico 2007-08




Source: Sistema de Información Agroalimentaria de Consulta.

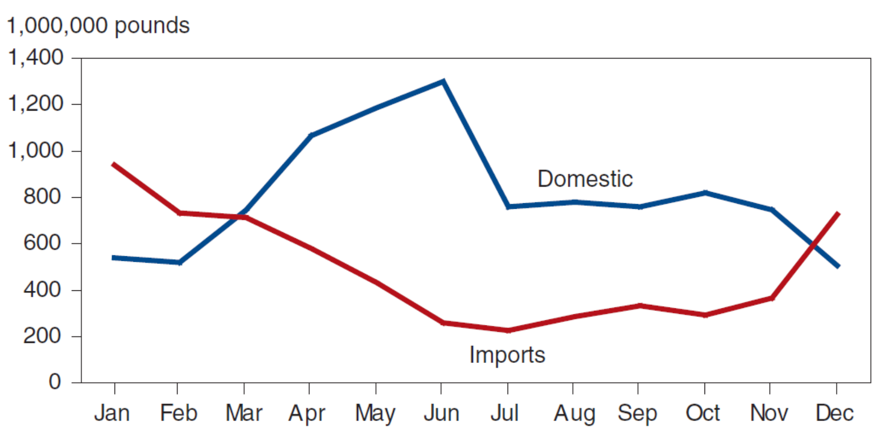
As shown in the previous figures, seasonality appears to be a factor in Jalapeno prices for the United States and Mexico, and Jalapeno growers are contributing to this cyclical behavior by following price signals. Since NAFTA was implemented in 1994, the expansion of the cross national relations between the United States and Mexico has eased the supply of Jalapenos from different regions across different seasons (Figure 1.3 gives a general idea how vegetable imports from Mexico to the U.S. have been impacted by NAFTA). Huang and Huang (2007) illustrate U.S. trade data for bell peppers and show how imports and domestic shipments play a complementary role in the U.S.; imports showing a decline around the summer months while domestic production rises over the same period (see Figure 1.4).

Figure 3.3: U.S. fresh vegetables imports




Source: Prepared by USDA, ERS, using data from USDA, Foreign Agricultural Service.

Figure 4.4: Average of import and domestic bell pepper shipments




Source: Prepared by USDA, ERS, using data from USDA, AMS.

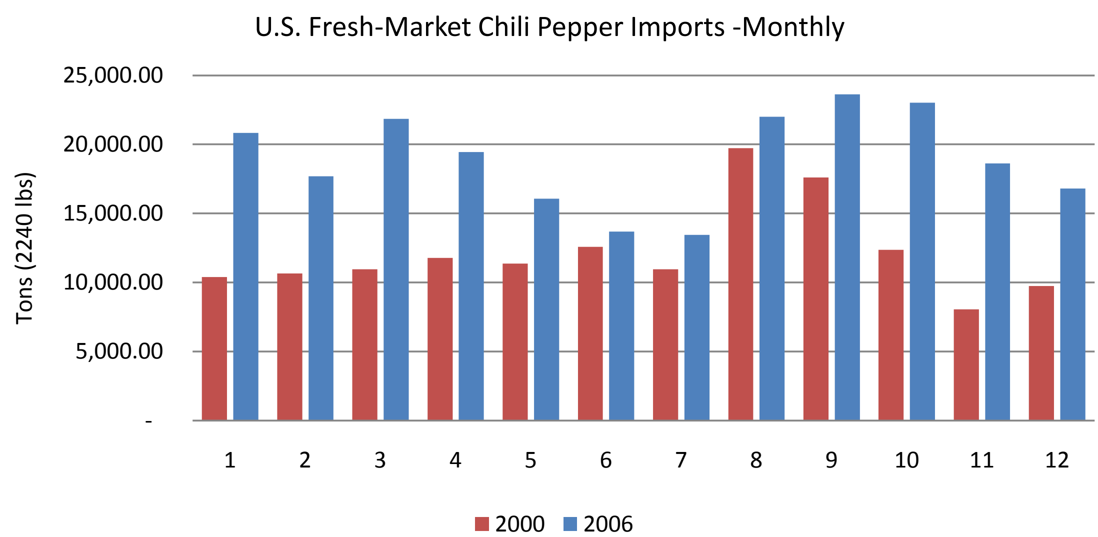
It’s not possible to look at Jalapeno monthly trade data with Mexico because of the lack of information specific for this commodity. However, we can use trade data of green peppers as a whole to proxy for information about Jalapeno imports from Mexico to the U.S. Table 1.4 shows total U.S. chili (pungent) pepper imports and Figure 1.5 shows monthly imports of chili peppers for two time periods, 2000 and 2006. We see that U.S. imports from Mexico in 2006 follow the production patterns from Mexico (Figure 1.2), with lower imports in the periods between harvests, i.e. lowest harvest. Most importantly, when we compare both periods we see how Mexican growers from the periods with higher (average) Jalapeno price have doubled the volume of their exports from 2000 to 2006. In contrast, summer growers have not increased their export volumes at the same rate. As already explained, during the winter months there is basically only one country supplying the demand of Jalapenos for both countries; during this period Jalapeno growers can choose the location (country) to send their product based on the criteria of profit of maximization (i.e. expected price less transportation costs). During the summer months, exports from Mexico to the U.S. have not increased at the same rate because the higher costs associated with exporting and shipping to the U.S. are not offset by higher prices. This corresponds with the literature; Nzaku and Houston (2009) found that own commodity prices are very important in deciding fresh fruit and vegetable imports.

Table 4.4: U.S. Fresh-Market Imports from Mexico and the World

| | Tons (2240 lbs) | | |
|---|---|---|---|
| Year | Total | Mexico | % Mexico |
| 1989 | 29,205.7 | 28,696.3 | 98% |
| 1990 | 35,514.6 | 34,880.2 | 98% |
| 1991 | 35,755.5 | 34,533.4 | 97% |
| 1992 | 37,392.8 | 36,310.7 | 97% |
| 1993 | 34,966.0 | 33,541.1 | 96% |
| 1994 | 47,729.3 | 47,392.6 | 99% |
| 1995 | 87,243.9 | 86,410.2 | 99% |
| 1996 | 104,511.5 | 104,002.9 | 100% |
| 1997 | 109,579.6 | 108,541.5 | 99% |
| 1998 | 128,191.7 | 126,883.5 | 99% |
| 1999 | 133,460.0 | 133,322.1 | 100% |
| 2000 | 146,122.3 | 145,898.3 | 100% |
| 2001 | 148,532.1 | 147,904.7 | 100% |
| 2002 | 156,013.5 | 155,593.4 | 100% |
| 2003 | 177,628.7 | 173,190.9 | 98% |
| 2004 | 184,943.1 | 179,925.8 | 97% |
| 2005 | 189,901.9 | 188,957.5 | 100% |
| 2006 | 227,060.2 | 225,301.5 | 99% |
| 2007 | 251,536.5 | 249,170.5 | 99% |

Source: U.S. Department of Agriculture, National Agricultural Statistical Services.

Figure 5.5: U.S. Fresh-Market Chili (Pungent) Pepper Imports - Monthly




Source: U.S. Department of Agriculture, National Agricultural Statistical Services.

The fact that seasonality has such a big impact in Jalapeno supply is understandable since prices determine the profitability of a business; thus, growers will send their produce to their best option in terms of profit. Hence, Jalapeno price seasonality can be an important guide to growers; an incomplete analysis of seasonal patterns can turn into inaccurate production, management and marketing decisions.

A better understanding of seasonality also allows us to focus on how prices are affected by non-seasonal factors, exogenous to Jalapeno prices. Outside cyclical factors that affect prices include items such as weather and production. Other components directly related to Jalapeno prices also need to be analyzed. Specifically, we will be closely analyzing the role of a Serrano peppers as a substitute good in the weekly prices of Jalapenos. Additionally, we will use data related to the cost of transportation to measure the effects of fuel price shocks in the price of this commodity. Lastly, we take a look at how a food safety shock impacted Jalapeno pepper prices.

## 1.2 Research Question

The understanding of market price seasonality for a perishable product such as Jalapeno peppers can have significant implications due to the short shelf-life of these fresh products. Yet relatively little market research has been conducted to estimate the effects of seasonality on the prices of these commodities. In agricultural markets, seasonality is the result of various supply and demand factors that occur in a cyclical manner every year. The supply of agricultural commodities can be the result of planting and harvest dates, weather patterns and transportation logistics. The demand for these commodities can be caused by events such as the change in consumption trends or seasonal consumption. By measuring the effects of seasonally in the time series, systematic events that are hard to measure such as weather and other recurring seasonal events can be considered in the model, allowing also for a more precise observation and analysis of other non-seasonal events. So, the general research question comes to what are the impacts of seasonal and non-seasonal factors in the market price of Jalapeno peppers?

### 1.3 Literature Review

In this section we briefly discuss the existing literature of seasonality. We connect our issue of price behavior of Jalapenos in the US and Mexico to the economic literature, which in turn suggests an appropriate statistical approach to build upon.

#### 1.3.1 Seasonality Estimation

Researchers long have been aware of recurrent fluctuations in the prices of commodities. We can detect these systematic patterns in a time series by simply observing its daily, weekly, and annual cycles. Previous literature refers to this behavior as seasonality (Stark et al., 2010). A widely accepted definition of seasonality has been proposed by Sven Hylleberg (1992):

> *"Seasonality is the systematic, although not necessarily regular, intra-year movement caused by the changes of the weather, the calendar, and timing decisions made by the agents of the economy. These decisions are influenced by endowments, the expectations and preferences of the agents and the production techniques available in the economy." (p.4)*

Seasonality then, can serve as a measure to proxy the combined effects of several factors that occur throughout the year. We can extend this concept to our research; we find an interesting characteristic of our data (weekly prices of Jalapenos) when we visually inspect the mean prices of the three locations we're studying. One can observe the presence of the same shifts in the curves for all three markets. That is, in each market the mean price of Jalapeno prices increase and decrease around the same time periods.

It's worth mentioning that in order to deal with seasonality, some studies have used methods of seasonal adjustment to filter the data. The motive for this has to do with the idea of removing irrelevant noise prior to estimation. In this respect, several researchers have established profound arguments against this approach and believe seasonality must be taken into consideration; mainly because the elimination of this component can result in detrimental information loss, since seasonality in many cases is an important component of the unobserved part of the time series (Ghysels and Perron 1993).

An article by Roberts (1978) observes that "surely the route to better scientific understanding is to incorporate the seasonality directly into the multivariate models that are formulated in terms of unadjusted data so the source, transmission, and effects of seasonal variations can be better understood". In a more recent work Sims (1992) supports this idea and adds that in other fields, such as meteorology, researchers directly model phenomena with high degree of seasonality without undertaking adjustment as a separate step. Accordingly, we feel that forcing seasonal adjustments could lead to inaccurate results. Mainly because it's not clear how these adjustments will alter the properties of the data or even introduce additional noise to the series. Hence, we will model for seasonality without seasonally adjusting the data.

Recent literature argues that perhaps the use of dummy variables would be a good way to account for seasonality in models involving specific periods, such as weekly or monthly data (Davidson and McKinnon 1993). The problem with this approach is that the results may not be an accurate representation of the behavior of the market. Mainly because the transition from one period to the next is not known in advance and varies from year to year. Furthermore, the use of dummies could result in sudden changes in random periods, even though the transition from period to period is expected to be continuous and smooth, similar to what we see in Figure 1.1.

Since the use of dummies seems like a very rudimentary way to handle seasonality we will shift our attention to the approach developed by Aradhyula and Tronstad (2006). They estimated seasonality using a high order polynomial. The advantage of this method is that is very flexible and is able to adjust itself to highly nonlinear patterns while maintaining a relatively small number of parameters for statistical estimation. In the context of weekly price analysis there might be as many as 52 or 53 different values of a price throughout the year and conceptually, there always exists a continuous curve through all the respective points. The efficiency of a polynomial is best represented by how these 52 or 53 parameters values can be closely represented by a polynomial of sufficient order. The order of the polynomial needs to be high enough to allow flexibility to the seasonal fit. However, it is important to note that the order of the polynomial needs to stay rather low in order to preserve the degrees of freedom. In practice, the desired order of the polynomial is not know a prior and must be quantitatively determined, so it is desirable to use a statistical procedure/test statistic(s) in order to find the degree of the polynomial that best fits the continuous price curve.

**1.4 Structure of Research**

The outline of this research paper is as follows. The research is structured in five chapters; the first chapter gives an introduction to the topic of the research as well as the previous work done in the area. It also explains the focus that the research takes and the motivation for it. The following chapter talks about the methodology; it describes the model used in the analysis to estimate seasonality. The third chapter discusses in detailed the data used in the research as well as its descriptive statistics. The forth chapter presents the estimation results, and the last chapter provides a conclusion as well as suggestions for future research in this topic.

## Chapter 2: Model Specification

While ordinary least squares (OLS) does not provide efficient estimates when the error structure is correlated across equations, OLS does provide a useful starting point for determining model specifications. In order to determine the appropriate polynomial order for seasonality in each market, Schwarz's Bayesian Information Criteria (BIC) is used from single OLS equations to determine the best polynomial order for each market. Figure 1.1 identifies important features from the data. To be precise, we can see how Jalapeno prices have on average a very systematic seasonal pattern; each market showing a peak in Jalapeno prices around spring and another peak at the end of the year. We can also notice how the three markets in our data tend to move in tandem. For these reasons we cannot rule out the possibility that the error terms in the three different equations are mutually correlated.

Instead of estimating equations separately for each market, we propose a way to combine the impacts of seasonality and other explanatory variables into a single model that will jointly consider all three cities. Also, we want to be able to run each equation with its own fixed set of parameters. To perform these procedures, we will use the Seemingly Unrelated Regression Equations (SURE) model. We build upon the work of Aradhyula and Tronstad (2006) who, as mentioned in the previous chapter, developed a general approach for modeling seasonality using a high order polynomial.

Therefore, we will estimate Jalapeno prices jointly for the three different locations as:

$$P_{i,t} = \alpha_0 + \alpha_1 Serr_{i,t-1} + \alpha_2 Diesel_{i,t-1} + \alpha_3 DSalm08_{i,t} + S_{i,t} + \sum_{i=1}^{k}\sum_{j=1}^{L}\gamma_{ij}P_{i,t-j} + e_{i,t},\ (k = L = 3), \quad (2.1)$$

where $P_{it}$ is the price of Jalapenos for the *i*th city in week *t*, k is one of the three locations/markets of Chicago, San Francisco and Mexico City, and L is the backshift or lag operator. $Serri_{i,t-1}$ is the price of Serrano peppers for market *i* in period t-1. $Diesel_{t-1}$ is the price of diesel for market *i* in period t-1. $DSalm08_{i,t}$ is dummy binary variable identifying the period during the Salmonella outbreak in 2008. $S_{i,t}$ is the seasonality of the mean price associated with city *i* in period *t*. $\gamma_{ij}$ are the coefficients associated with lagged Jalapeno prices and $e_{i,t}$ is the error term. In the next chapter we discuss in detail the characteristics of the data as well as the sources.

In equation (2.1), seasonality or $S_{i,t}$ was modeled as a polynomial function of

$$S_{it} = a_{i1}w_t + a_{i2}w_t^2 + a_{i3}w_t^3 + ... + a_{ij}w_t^q, \quad (2.2)$$

where $w_t$ is a time index cycling between 0 and 1, defined as the calendar week of the year divided by the total number of weeks in the year, $a_{ij}$ are unknown parameters, and *q* is the order of the polynomial.

In order to make the seasonality function so that the beginning and end of the year are the same, the restriction of

$$S\,|_{s=0} = S\,|_{s=1} \quad \text{or} \quad \sum_{j=1}^{q} a_{ij} = 0$$

is imposed. Additionally, to ensure that seasonality is smooth between the end and beginning year, we impose the condition that the slope of $S_i\,(0)$ equals the slope at $S_i\,(1)$.

So, our second restriction for smoothness is:

$$S_i\,'(0) = S_i\,'(1) \quad \text{or} \quad \sum_{j=2}^{q} j a_{ij} = 0$$

We assume the error term of the k regression equations (i.e. $e_{k,t}$) is normally distributed with mean:

$$E(\,e_{k,t}\,) = 0 \qquad\qquad (t = 1,2,\ldots,T)$$

and variance-covariance matrix given by:

$$E(e_k e_k') = \sigma_{kk} \mathrm{I}_{\mathrm{T}}$$

where $\mathrm{I}_{\mathrm{T}}$ is an identity matrix of order (*T x T*).

Each equation is expected to satisfy the conditions of the classical normal linear regression model. But we are not going to rule out the possibility that the regression disturbances in different equations are mutually correlated.

In this case we have:

$$E(e_k e'_p) = \sigma_{kp} \mathrm{I}_{\mathrm{T}} \qquad \text{(k, p = 1, 2,…,K)}$$

Hence, the assumptions for our three equation system of seemingly unrelated regression equations are:

$$e = \begin{bmatrix} e_1 \\ e_2 \\ e_3 \end{bmatrix} \sim N(0,\Omega), \quad \text{where} \quad \Omega = \begin{bmatrix} \sigma_{11}\mathrm{I} & \sigma_{12}\mathrm{I} & \sigma_{13}\mathrm{I} \\ \sigma_{21}\mathrm{I} & \sigma_{22}\mathrm{I} & \sigma_{23}\mathrm{I} \\ \sigma_{31}\mathrm{I} & \sigma_{32}\mathrm{I} & \sigma_{33}\mathrm{I} \end{bmatrix}$$

where $\sigma_{kp}$ measures the correlation between the disturbances of the *k*th and *p*th equations.

## Chapter 3: Data and Descriptive Statistics

As discussed above, our model is applied to weekly wholesale prices of fresh Jalapeno peppers. For the most part, this variety of green peppers is considered hot when eaten and it's a very popular variety of pepper for a number of dishes; traditionally, the Jalapeno pepper has had an important association to Mexican cuisine, and as such it has continued to be consumed by Mexican immigrants in the United States to the point of adapting it to emerging cuisines, such as the Tex-Mex cuisine. Also, the introduction and adoption of products like salsa to the non-Hispanic U.S. markets suggests will be a higher demand for Jalapeno peppers in the years to come.

Typically Jalapenos are harvested by hand when they're still green; once picked, peppers ripen and turn a red color. The time that it takes to turn red varies individually from pepper to pepper but temperature conditions and the variety of the seed tend to play important roles in this process. Although it is quite common for these peppers to be eaten red, the majority of Jalapeno peppers are traded while they are still green. For this reason, we decided to use only price quotes for green Jalapeno peppers.

This chapter provides a detailed description of the data. Specifically, this section discusses how variables were collected and the criteria for choosing the variables. The chapter also describes the variables and explains how the data were modified and structured for the analysis. Furthermore, to provide an overview of the data, we present relevant descriptive statistics that serve as a quantitative summary of our data set, that show important features and characteristics of our data such as the type, tendencies and dispersion.

### 3.1 Commodity Data

As discussed above in Chapter 1, we used terminal prices for two different commodities; Jalapeno peppers, our commodity analyzed, and the price of Serrano peppers, a substitute good. The terminal markets considered are San Francisco, Chicago, and Mexico City. The U.S. terminal markets were selected based on the criteria of their geographic location, and as such they represent different regions of the United States. As for Mexico City, it is very relevant to include since it is the largest and most densely populated city from Mexico, a country that is both a major consumer and producer of Jalapeno peppers.

Commodity prices were collected from the U.S. Department of Agriculture's Agricultural Marketing Service (AMS). These data are comprised of weekly price quotes for the terminal markets considered (i.e. prices quoted in wholesale markets) and they are reported with a minimum and maximum price. For the purpose of this study we used the mean of the minimum and maximum. Sometimes the units of sale vary for U.S. terminals, it usually has to do with the location of the market; to solve this issue all prices were transformed to represent weekly prices in dollars per pound. To convert units of sale into pounds we used the "Container Approximate Net Weights" table from the 2009 Fruit and Vegetable Market News User Guide.

Market prices from Mexican terminals were not available through AMS for the period analyzed; thus, we used price data gathered from Mexico's National System of Information and Integration of Markets, which is managed by Mexico's Ministry of Economy (SE). Since these prices are reported in kilograms, prices were converted from kilograms and Mexican pesos into U.S. dollars per pound. We used historic exchange rate data (OANDA) to transform Mexican pesos into U.S. dollars.

### 3.1.1 Price Relationship between Jalapeno and Serrano peppers

As explained before, we use Serrano peppers in our model under the assumption that Serrano peppers can serve as a substitute for Jalapeno peppers. Ideally we would like to have demand data for Jalapenos and Serranos to measure their cross-price elasticity. Unfortunately, as explained in Chapter 1 such detailed information is not reported by either country and so, we have hypothesize that Serranos and Jalapenos are substitutes of each other based on the criteria of their consumption uses, i.e. both commodities share characteristics that makes it easy to switch from one to the other when consumed.

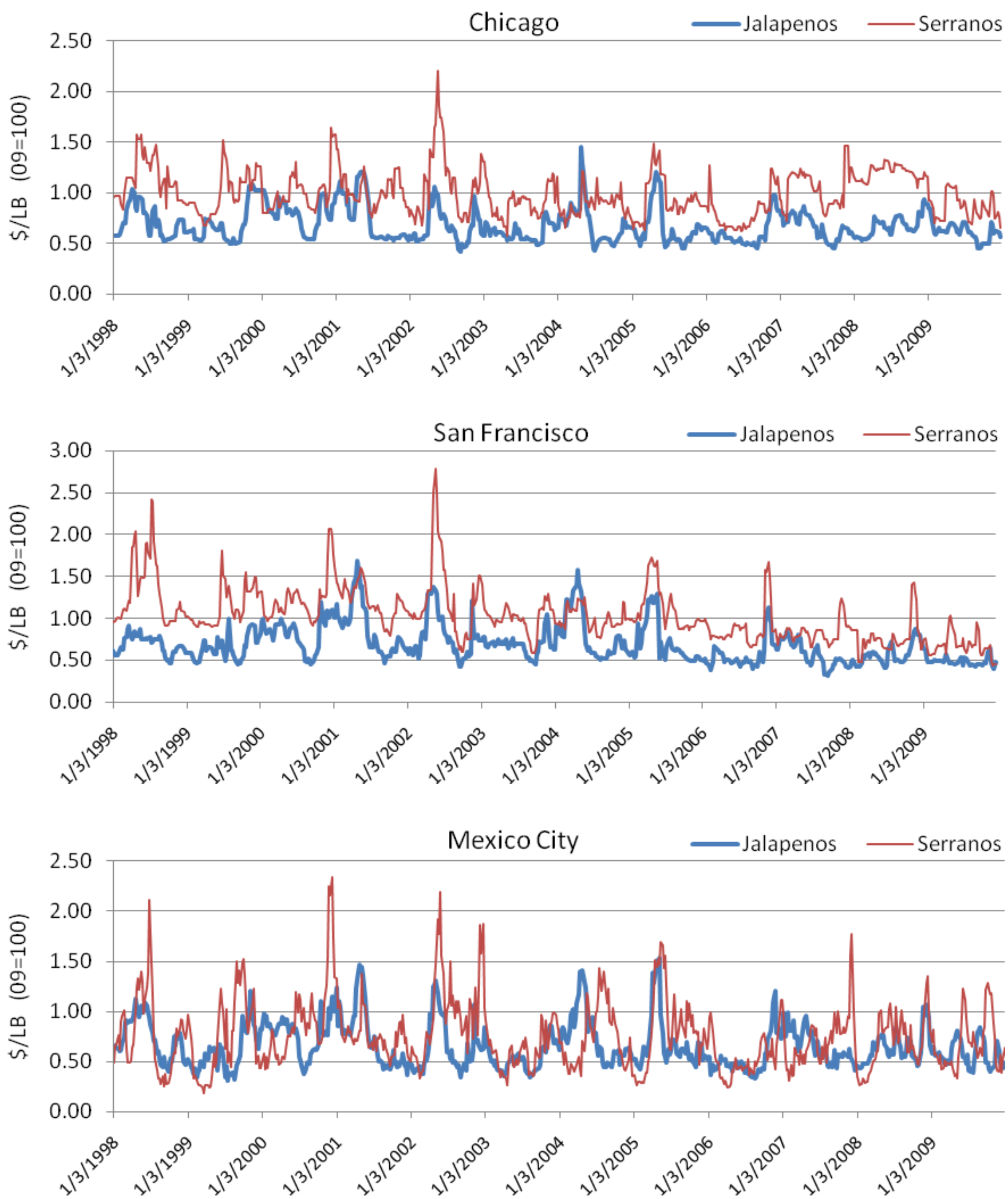
Under the assumption that they are substitutes (i.e. the demand of one of the goods will increase when the price of the other good increases) we expect an increase in the price of Serrano peppers to positively contribute to the price of Jalapeno peppers. Table 3.1 presents basic statistics about the price of both commodities in the three cities considered. From this table we can presume that Serrano peppers tend to have a higher price compared to Jalapeno peppers. We can also detect that the Serrano prices in Mexico City behaves differently than in the other two cities; to be specific, this commodity seems to be more volatile in Mexico City.

Table 5.1: Price Description of Jalapeno and Serrano peppers

| | | | Price ($/lb) | | | |
|---|---|---|---|---|---|---|
| **City** | **Commodity** | **No. of Weeks** | **Mean** | **SD** | **Min** | **Max** |
| Chicago | Jalapeno | 626 | 0.68 | 0.17 | 0.42 | 1.45 |
| | Serrano | 626 | 0.99 | 0.22 | 0.57 | 2.21 |
| San Francisco | Jalapeno | 626 | 0.68 | 0.23 | 0.32 | 1.69 |
| | Serrano | 626 | 1.03 | 0.32 | 0.44 | 2.79 |
| Mexico city | Jalapeno | 626 | 0.66 | 0.23 | 0.31 | 1.53 |
| | Serrano | 626 | 0.75 | 0.34 | 0.18 | 2.34 |

Although Table 3.1 provides us with very relevant information regarding Serrano prices, it does not show any detail on the movement of the time series; we need to know if the prices of Jalapeno and Serrano peppers do indeed move up and down in a similar fashion; the way substitute goods are supposed to behave. Figure 3.1 graphically portrays real (inflation adjusted) weekly prices for both commodities in each of the cities. For the two U.S. cities, Chicago and San Francisco, we can see that even though both prices don’t exactly move uniformly, they do follow a similar pattern of price increases and decreases. On the other hand, the prices from Mexico City seem to follow a more erratic pattern, coinciding with our findings in Table 3.1.

Figure 6.1: Weekly Real prices of Jalapeno and Serrano peppers




Source: U.S. Department of Agriculture, Agricultural Marketing Service.

Additionally, it can be seen in Table 3.2 that indeed Jalapeno and Serrano prices are positively correlated in all our markets. A distinction between the US cities and Mexico City markets is the level of correlation. Mexico City has somewhat less correlation between Jalapeno and Serrano prices compared to the other cities, supporting the findings in Figure 3.1.

Table 6.2: Correlation for Jalapeno and Serrano Prices

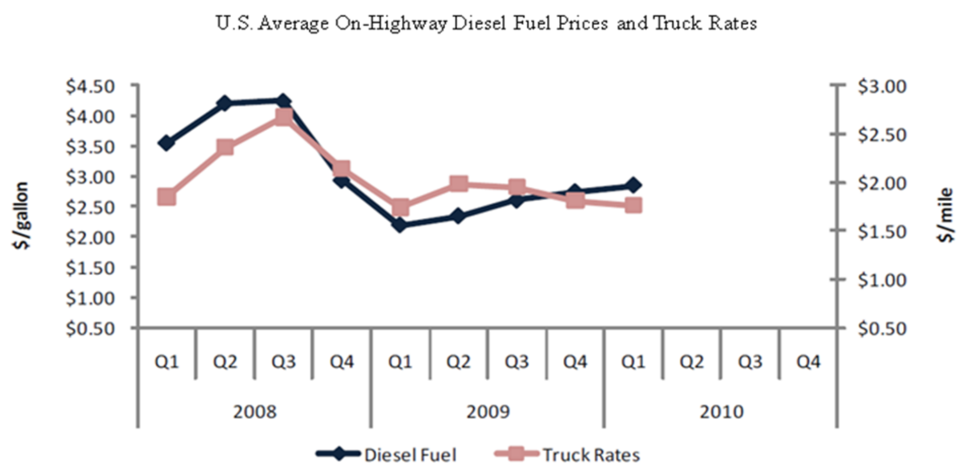
| | **Ch Jal** | **Ch Serr** | **Sf Jal** | **Sf Serr** | **Mex Jal** | **Mex Serr** |
|---|---|---|---|---|---|---|
| **Ch Jal** | 1.00 | | | | | |
| **Ch Serr** | 0.44 | 1.00 | | | | |
| **Sf Jal** | 0.77 | 0.34 | 1.00 | | | |
| **Sf Serr** | 0.52 | 0.55 | 0.67 | 1.00 | | |
| **Mex Jal** | 0.79 | 0.42 | 0.76 | 0.52 | 1.00 | |
| **Mex Serr** | 0.24 | 0.49 | 0.27 | 0.47 | 0.35 | 1.00 |

### 3.2 Fuel Data

Diesel prices are used as a proxy for transportation costs because diesel prices are a major input into the cost of fresh produce at different terminal markets. Due to the short self-life for produce commodities, trucks are the most common method for moving produce from the point of production to final consumer. A caveat for using diesel prices as a proxy for transportation costs is how in many cases, trucking companies (and independent drivers) are not able to immediately pass on increases in fuel prices to shippers due to existing contracts, competition, and the desire to haul some revenue producing cargo rather than an empty trailer.

Figure 3.2 was prepared by the AMS' Transportation Services Division for its quarterly report on agricultural refrigerated trucks. In this graph we can see that indeed diesel fuel prices provide a good proxy for longer-term trends in U.S. trucking rates.

Figure 7.2: U.S. Average On-Highway Diesel Fuel Prices and Truck Rates



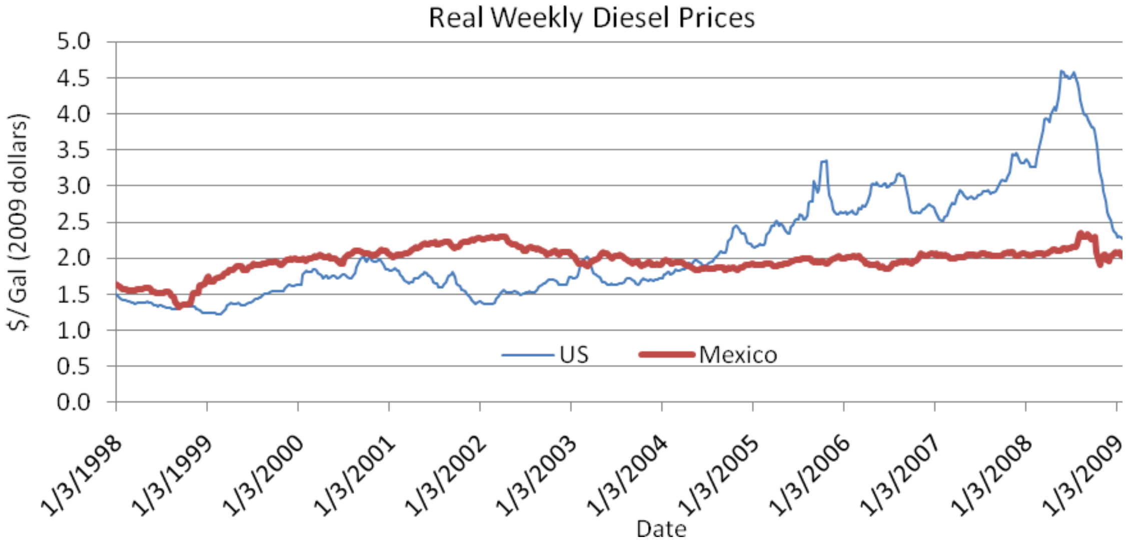

Sources:
Diesel Fuel: Energy Information Administration / U.S. Department of Energy.
Truck Rate: Agricultural Marketing Service, Fruit and Vegetable Program.

US diesel prices were collected from the U.S. Energy Information Administration (EIA), a statistical and analytical agency within the U.S. Department of Energy. They provide detailed information on weekly diesel prices by quality and geographical region; for this study we used their national weekly average for all types (of diesel), which basically compiles the prices of diesel for all qualities as well as for all regions of the country. These prices include taxes and are in dollars per gallon.

Since we are studying two US cities that are spatially apart from each other we decided not to use the more detailed regional data available; it would have been very difficult to speculate which geographical regions were being used to charge the produce haulers with diesel, especially with all the possible shipping points each location can have.

Diesel prices from Mexico were available from Mexico's state-own oil company Petroleos Mexicanos (PEMEX) which is the sole provider of all commercial gas stations in Mexico. These data were collected through PEMEX's "Price of Fuel Products to the Public" report. Unlike EIA's data on diesel, PEMEX reports fuel prices in Mexican pesos per liter. For the purpose of this study, we decided to keep the units consistent for both countries and so, these prices were transformed to represent weekly diesel prices in dollars per gallon. A potential problem with using diesel prices from Mexico as a proxy for transportation cost is how diesel prices in Mexico don't fluctuate freely as they do in the United States. This is due to the fact that the Mexican government subsidies the price of gasoline and fuel. Figure 3.3 precisely portrays this by comparing the real weekly price of Diesel for both countries. Diesel prices in Mexico do not show any peaks or drops that would suggest sudden changes, like which occurs in the weekly U.S. diesel price series.

Figure 8.3: Weekly Real prices of Diesel fuel in Mexico and the US




Source: U.S. Department of Agriculture, Agricultural Marketing Service.

### 3.3 Salmonella Outbreak Data

A number of food contamination incidents in recent years have led to food safety control initiatives by both the private and public sectors (Palma et al., 2009). Such was the case in the summer of 2008 when Jalapeno and Serrano peppers were linked to Salmonella, one of the most common food-borne illnesses; the string of the disease was the Saint Paul serotype. Immediately after the first cases were detected, the Food and Drug Administration (FDA) put in place an advice to consumers to avoid eating fresh Jalapeno and Serrano peppers grown, harvested or packed in Mexico, since salsa containing Mexican produce was thought to be the responsible of the outbreak. Consequently, most produce importers stopped importing Mexican Jalapenos because their main buyers, large supermarkets and restaurant chains, stopped purchasing these peppers. The outbreak lasted from June 2008 through August of 2008; more than 1400 people in 43 states were infected due to this strain of salmonella. In August $28^{th}$ of that same year the FDA lifted the warning to consumers about the consumption of fresh Jalapeno and Serrano peppers coming from Mexico.

To help us identify the effect of the 2008 Salmonella Saintpaul outbreak in the price of Jalapeno peppers we defined a dummy variable to account for the period of time in which FDA had the warning about consuming fresh Mexican peppers. A value of 1 was assigned for the 13 weeks in which the FDA warning took place and a value of 0 otherwise.

**3.4 Data Structure**

To recap this chapter, we use the weekly prices of Jalapenos of the terminal markets in San Francisco, Chicago and Mexico City as dependent variables.

In addition to the seasonality polynomial and the lag values of the dependent variable explained in the previous chapter, explanatory variables of Serrano peppers, our substitute for Jalapeno peppers, and diesel prices which serve as a good proxy for transportation costs are analyzed. For the US markets, EIA's fuel data is utilized while for Mexico City we use PEMEX's diesel prices. Also, we use a dummy variable to see if the 2008 salmonella outbreak had any effect on the price of Jalapenos. Table 3.3 presents a summary of our non-seasonality variables.

Table 7.3: Summary Statistics for the Dependent and Explanatory Variables

| | Variable | Type | No. of Weeks | Mean | SD | Min | Max |
|---|---|---|---|---|---|---|---|
| Dependent (Jalapeno) | Chicago | Price | 626 | 0.68 | 0.17 | 0.42 | 1.45 |
| | SF | Price | 626 | 0.68 | 0.23 | 0.32 | 1.69 |
| | Mexico | Price | 626 | 0.66 | 0.23 | 0.31 | 1.53 |
| Substitute (Serrano) | ChicagoS | Price | 626 | 0.99 | 0.22 | 0.57 | 2.21 |
| | SfS | Price | 626 | 1.03 | 0.32 | 0.44 | 2.79 |
| | MexicoS | Price | 626 | 0.75 | 0.34 | 0.18 | 2.34 |
| Cost (Diesel) | DieselUS | Price | 626 | 2.17 | 0.74 | 1.22 | 4.60 |
| | DieselMX | Price | 626 | 1.99 | 0.19 | 1.32 | 2.35 |
| Shock | DSalm08 | Dummy | 626 | 0.03 | 0.18 | 0.00 | 1.00 |

# Chapter 4: Empirical Results

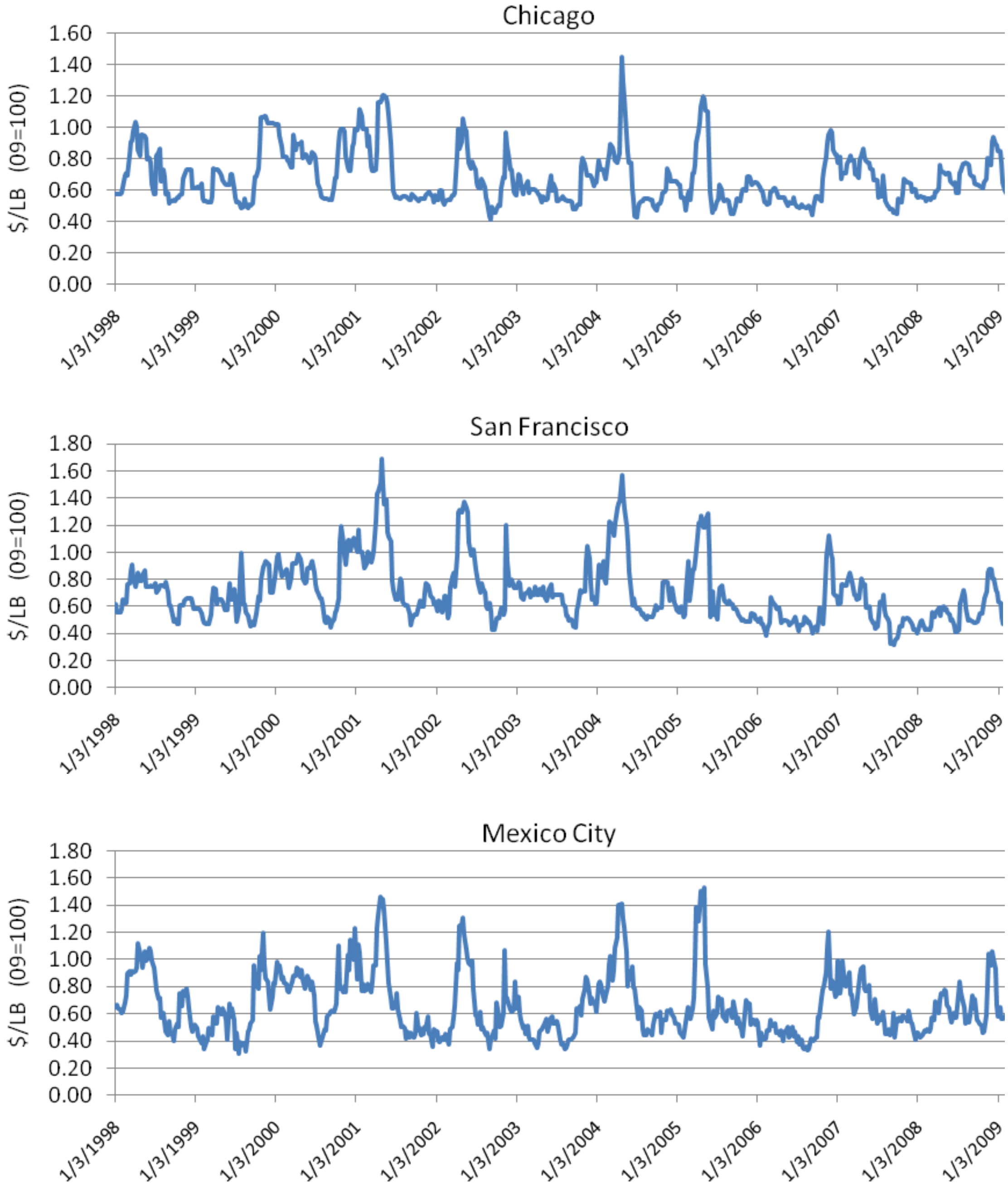
## 4.1 Stationarity

When estimating a time series it's important to ensure that the variable to be modeled is stationary; namely that it's stochastic properties are invariant with respect to time. If a time series shows a trending behavior (i.e. the mean changes over time) then it clearly cannot be stationary. It is imperative to check for this behavior since the model could lead to incorrect conclusions about how meaningful is the relationship among the variables in the regression.

Before pursuing any formal tests for non-stationarity, we plotted all our Jalapeno time series to get initial clues about the markets, to see if any of them showed signs of trending behavior. Figure 4.1 illustrates that over the 11-year period being analyzed, none of the cities show any trends that would suggest that the mean price of Jalapenos have been changing. This intuitive exercise is the starting point of a more formal test of stationarity.

Stationarity of a time series can be tested directly with a unit root test. Granger and Newbold (1974) and Phillips (1986) show that critical t-values are more significant than they should be  (Greene, 2003). Dickey and Fuller (1979) for a series simulating critical values for random walk, random walk with a drift, and a single trend. To test our data for a unit root we used the augmented version of the Dickey Fuller equation (ADF) which removes structural effect before testing. The ADF tests for the null hypothesis of a unit root against the alternative of stationarity. Because of the nature in the data (i.e. Jalapeno being a short shelf item) we performed tests out to four weeks, or approximately one month.

Figure 9.1: Weekly Real prices of Jalapeno peppers




Source: U.S. Department of Agriculture, Agricultural Marketing Service.

The ADF tests results are presented in Table 4.1; in all cases the null hypothesis of non-stationarity can be rejected and thus, it can be concluded that the data does not need to be differenced to satisfy stationary conditions. This is rather satisfactory since valuable information from economic theory concerning the long-run equilibrium properties of the data could be lost when using only differenced variables.

Table 8.1: Augmented Dickey-Fuller Unit Root Tests - Single Mean Type

| CITY | Lags | Rho | Pr < Rho | Tau | Pr < Tau | F | Pr > F |
|---|---|---|---|---|---|---|---|
| Mexico City | 1 | -54.75 | 0.0018 | -5.20 | <.0001 | 13.54 | 0.001 |
| | 2 | -81.36 | 0.0018 | -6.14 | <.0001 | 18.87 | 0.001 |
| | 3 | -101.14 | 0.0001 | -6.55 | <.0001 | 21.46 | 0.001 |
| | 4 | -105.91 | 0.0001 | -6.45 | <.0001 | 20.78 | 0.001 |
| Chicago | 1 | -73.30 | 0.0018 | -6.04 | <.0001 | 18.22 | 0.001 |
| | 2 | -92.56 | 0.0018 | -6.54 | <.0001 | 21.38 | 0.001 |
| | 3 | -105.01 | 0.0001 | -6.67 | <.0001 | 22.26 | 0.001 |
| | 4 | -110.14 | 0.0001 | -6.56 | <.0001 | 21.52 | 0.001 |
| San Francisco | 1 | -59.79 | 0.0018 | -5.44 | <.0001 | 14.81 | 0.001 |
| | 2 | -51.82 | 0.0018 | -4.95 | <.0001 | 12.27 | 0.001 |
| | 3 | -60.07 | 0.0018 | -5.19 | <.0001 | 13.49 | 0.001 |
| | 4 | -73.66 | 0.0018 | -5.54 | <.0001 | 15.36 | 0.001 |

### 4.2 Order of Polynomial and Number of Lag Weeks

While economic theory provides a basis for variables to include in our model, statistical methods are needed to aid in selecting the order associated with polynomial seasonality terms and lagged price variables. We utilize the Schwarz's information criterion (SIC) as the basis for determining the appropriate seasonality and lag orders.

The SIC is a model selection criteria among a set of models with different nested parameters. It was developed by Gideon E. Schwarz, it is closely related to Akaike

Information criterion (AIC) but the difference is that the penalty for adding additional parameters in SIC is stronger than in AIC. When estimating a model using Maximum Likelihood, it's possible to increase the likelihood by adding parameters; the problem is that if we have too many degrees of freedom compared to the observations, the model will have poor performance for forecasting as it can exaggerate small changes in the data. SIC solves this issue by introducing a stronger penalty for each additional parameter. The SIC statistic is as follows:

$$-2 \cdot \ln p(x \mid k) \approx \mathrm{SIC} = -2 \cdot \ln L + k \ln(n) \qquad (4.1)$$

where $x$ is the observed data, $n$ is the number of observations, $k$ is the number of parameters to be estimated, $p(x|k)$ is the likelihood of the parameters given the observed data, and $L$ is the maximized value of the likelihood for the estimated model.

Under the assumption that the error terms are independent and normally distributed, SIC becomes

$$\mathrm{SIC} = n \cdot \ln(\sigma_e^2) + k \cdot \ln(n)\,, \qquad (4.2)$$

where $\sigma_e^2$ is the error term which is defined as

$$\sigma_e^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2\,. \qquad (4.3)$$

Since SIC is an increasing function of $\sigma_e^2$ and $k$, a model with the lowest SIC value is preferred because unexplained variation in the dependent variable and the number of explanatory variables increase the value of the SIC.

Appendix A shows the results of models with different combinations of lag prices and seasonality polynomial orders. Appendix A provides the SIC values for each city. In terms of lagged prices, results for each market varied. For Mexico City the model using weekly Jalapeno price lags for t-1, t-2, and t-3 weeks is the best performing model, even under different polynomial orders for seasonality. For Chicago, the model using Jalapeno price lags for t-1 and t-2 periods is the best performing model, again even under different polynomial orders. For San Francisco, models using the own price lag of t-1 consistently performed better than other combinations of lagged prices, regardless of the polynomial order selected for seasonality. In terms of the order of the polynomial for seasonality, models using a 6$^{th}$ order polynomial had the lowest SIC values for all cities. Consistent with being the best performing models on the basis of the SIC, the 6th order polynomial models are also the ones with the most significant parameters. Hence, for the rest of estimations results presented we use the following 6$^{th}$ order polynomial function to estimate seasonal effects for each market:

$$S_{it} = a_{i1}w_t + a_{i2}w_t^2 + a_{i3}w_t^3 + a_{i4}w_t^4 + a_{i5}w_t^5 + a_{i6}w_t^6 \quad (4.4)$$

Subject to:

$S|_{s=0} = S|_{s=1} \ldots$ Function continuity – no jump in seasonality

and

$S_i\ '(0) = S_i\ '(1) \ldots$ Smoothness – beginning and end of year.

The following are best performing models for each of the three markets in terms of SIC:

$$P_{i,t} = \alpha_0 + \alpha_1 Serr_{i,t} + \alpha_2 Diesel_{i,t-1} + \alpha_3 DSalm08_{i,t} + S_{i,t} + \sum_{j=1}^{2} P_{i,t-j} + e_{i,t} \qquad (4.5)$$

when $i$ = Chicago

$$P_{i,t} = \alpha_0 + \alpha_1 Serr_{i,t} + \alpha_2 Diesel_{i,t-1} + \alpha_3 DSalm08_{i,t} + S_{i,t} + \sum_{j=1}^{3} P_{i,t-j} + e_{i,t} \qquad (4.6)$$

when $i$ = Mexico City

$$P_{i,t} = \alpha_0 + \alpha_1 Serr_{i,t} + \alpha_2 Diesel_{i,t-1} + \alpha_3 DSalm08_{i,t} + S_{i,t} + P_{i,t-1} + e_{i,t} \qquad (4.7)$$

when $i$ = San Francisco

**4.3 Estimates**

As discussed in Chapter 2 this research uses the SURE model to estimate the weekly price of Jalapeno peppers in three different markets. To be able to compare performance we ran two different specifications of the model: in the first specification we only use own-city lags for Jalapeno prices, specifically we use models 4.5, 4.6 and 4.7. In the second specification we added Jalapeno lag prices from the two other markets. Estimated coefficients and their standard errors are presented in Table 4.2; it shows the estimates from the two different models in all three cities.

Seasonality seems to be an important factor in determining Jalapeno prices since seasonality variables show robustness in both model specifications. The estimated polynomials for seasonality are graphed for all three markets in Figures 4.2 and 4.3. In Figure 4.2 prices for all markets begin the year at 8 cents and rapidly increase to a peak around the 15$^{th}$ week. Then prices decline quite sharply to reach the lowest level around the 31st week. Prices then increase again (not as sharply as the beginning of the year) to reach another peak around the 46th week. In this figure, the price shifts from the three locations are very similar as their prices go up and down around the same periods, the difference lies in the “height” of their seasonality curves. In the first price peak, the price of Mexico City goes up at a faster rate and reaches 16, San Francisco reaches 14 cents, and Chicago only goes up to 11 cents. Their price difference is smaller at the lowest point (week 31st); Mexico City goes down to 7 cents and the other two markets reach a low of 5 cents. On the following weeks Mexico City’s price again increases at a faster rate and reaches a peak close to 13 cents at the end of the year. San Francisco increases up to 12 cents and Chicago reaches 10 cents. In Figure 4.3, the Jalapeno price patterns for Mexico City show a very similar behavior than those in Figure 4.2. Increasing and decreasing throughout the year at faster rate than the other two markets. The difference is that in this model the price in Mexico City starts at a lower level of 6 cents, it goes up to 14 cents in the first price peak, reaches a low price of 5 cents around the 30th week, and then increases again to reach 12 cents at the end of the year. The other two markets show a different behavior, to be precise their prices don’t fluctuate at the same rate of Mexico City. This suggests the interaction of the other cities lag prices decreases the effect of the seasonality polynomial. Chicago has the smaller estimated price spread between its peaks and trough; its price starts at around 9 cents and goes up to 11 cents, at the lowest point it reaches 6 cents, and then reaches 11 cents again at the end of the year. San Francisco’s spread is not as small as Chicago’s; starting at 8 cents and increasing to about 13 cents in its first height. It reaches down 6 cents at its lowest point and then increases to about 11 cents at the end of the year.

Based on historic price behavior of Jalapenos and based on previous literature this is exactly how we expected the seasonality polynomial to behave. If we compare these graphs versus the average weekly price of Jalapenos (Figure 1.1) we see that the estimations of seasonality follow a very similar pattern to the real price average; just as in Figure 1.1 with find two peak prices in the seasonality estimations, approximately at the end of the summer and winter harvests, and a lower price level around the summer months.

Besides the polynomial for seasonality showing robustness in both specifications, lag prices of Jalapenos prove to be highly significant in explaining the price of Jalapenos in week *t*. The way in which these variables are used constitutes the main difference between the two model specifications. In the first specification we do not include cross-city price lags for Jalapenos; we find lagged Jalapeno price variables to be highly significant in the SURE model, behaving in a similar way as they do in the individual models ran in the previous section (Appendix A). In the second specification we introduced lagged Jalapeno prices from the other two markets; however we find mixed results from the addition of these price variables. The use of Mexico City's Jalapeno prices in the other two markets is highly significant for both Chicago and San Francisco, suggesting that Mexico City, being a major player in the demand of Jalapenos, serves as a good point of reference in explaining the price of Jalapenos in US cities. Mexico City's lagged Jalapeno prices positively influence both US markets. However, lagged Jalapeno prices from Chicago and San Francisco did not have an effect on other markets. The Chicago market has a negative effect on the price of San Francisco Jalapenos but not vice versa; suggesting that an increase in Jalapeno prices in Chicago (week *t*-1) results in an increase in the supply of Jalapenos in the terminal market of San Francisco (in week *t*). A possible explanation for this is that Jalapeno distributors in the Bay Area pay close attention to price patterns of Jalapenos in the Chicago market; in view that Chicago is one of the biggest Hispanic markets in the U.S. If they see an increase in the Chicago prices, they stack up their warehouses with more volume, anticipating higher prices. Lagged San Francisco Jalapeno prices are not significant for Chicago, but in they are for Mexico City, suggesting that Jalapeno growers from Mexico respond to price shocks in San Francisco by exporting more, thus shifting down Jalapeno supply in Mexico. If we look at the main winter producers in Mexico (Sinaloa and Nayarit – Table A1.1) we notice that in terms of accessibility, California is more appealing for exports since their closest port of entry is Nogales, AZ. Therefore it makes sense that winter producers from Mexico, responsible for the winter pepper supply for both countries, pay more attention to prices from this U.S. region instead of Chicago.

It is important to point out that the use of cross-city price lags should be treated with care. From these results it’s obvious that the use of Mexico City does provide important information to the U.S. markets, but when we introduce the “smaller” U.S. markets into the equation for Mexico City, inconsistent results occur. It may be that the best approach is to use other cities (besides Mexico City) to explain Jalapeno prices in US cities by taking into account the distance between the cities. Markets that are closer geographically should behave in a similar manner, whereas in our case the distance seems to render diverse results.

In the first specification the use of Serrano lagged prices as a substitute for Jalapeno peppers turned out to be significant for Chicago and San Francisco and not Mexico City. As expected, an increase in the price of Serranos in week *t*-1 results in an increase in the price of Jalapenos in week *t*. The fact that Serrano prices are not significant for Mexico City is not real surprising, as explained in section 3.1.1, the relationship between the prices of Jalapeno and Serrano peppers in Mexico City is very different than the behavior they show in the US cities. However, the results from this variable in model (2) were unexpected. The introduction of other cities' Jalapeno lagged prices seems to diminish the effect of Serrano prices for the US cities. On the other hand, the use of Serrano prices in Mexico City becomes significant at a 10 percent level.

The use of the price of diesel in the model for Mexico City did not show any significance in any of the two specifications; again these results are not surprising given the information provided in chapter 3 about how diesel prices in Mexico do not fluctuate much due to the fact that diesel is subsidized by the Mexican government. In fact, the only city showing significance in the diesel variable is San Francisco, but contrary to what we were expecting it shows a negative sign. This negative effect could be driven by less disposable income after driving costs, since higher diesel prices indicate higher gas prices and less money for fresh produce. However the negative effect from diesel prices for San Francisco washes away when we introduce the other cities' Jalapeno prices, just like the case of Serrano peppers. As mentioned Chapter 3, in many cases trucking companies and independent drivers are not able to pass on higher fuel prices to customers right away due to factors such as existing contracts and competition. Also, fuel prices are usually higher during the summer months so the results suggest that higher fuel prices during the summer period do not impact the low Jalapeno prices caused by higher Jalapeno volume during this period.

Finally, the dummy variable to quantify the impact of the salmonella outbreak in 2008 was significant for both US cities in both specifications, and as expected it contributed positively to the price of Jalapeno peppers. Jalapeno peppers from Mexico were essentially removed from the market during this period, resulting in higher Jalapeno prices for those sourced from other areas. The same results were not present for Mexico City. This probably has to do with the time of the year in which the shock occurred and the total consumption of Jalapenos from each of the markets. The FDA warning occurred during the summer, a period in which the U.S. Jalapeno supply doesn't depend solely on imports from Mexico, but still the shock was big enough to offset the U.S. market. On the other hand, the increase of Jalapeno supply in Mexico wasn't big enough to offset the prices, mainly because consumption per capita is much higher in Mexico than in the U.S. Had this shock occurred during the winter harvest, this variable would probably show a negative (and significant) effect on Mexico City's Jalapeno prices.

Table 9.2: SURE Estimation Results

| City | Variable | Own Price Lags Only Estimate | Own Price Lags Only Std Err | | Cross-City Price Lags Estimate | Cross-City Price Lags Std Err | |
|---|---|---|---|---|---|---|---|
| Mexico City | Intercept | 0.0819* | (0.0457) | | 0.0640 | (0.0474) | |
| | w1 | -0.5307** | (0.2077) | | -0.4125** | (0.2077) | |
| | w2 | 12.3655*** | (2.2825) | | 10.8322*** | (2.2748) | |
| | w3 | -57.7636*** | (9.5672) | | -52.5156*** | (9.5371) | |
| | w4 | 107.8392*** | (18.1619) | | 100.7444*** | (18.1167) | |
| | w5 | -88.6650*** | (15.9142) | | -84.7956*** | (15.8949) | |
| | w6 | 26.7546*** | (5.2339) | **R-sq** | 26.1471*** | (5.2361) | **R-sq** |
| | mexico1 | 0.7261*** | (0.0393) | **0.8237** | 0.7519*** | (0.0404) | **0.8267** |
| | mexico2 | 0.221261*** | (0.0496) | | 0.1845*** | (0.0500) | |
| | mexico3 | -0.1102*** | (0.0398) | | -0.1405*** | (0.0411) | |
| | mexicos1 | 0.0198 | (0.0136) | | 0.0237* | (0.0137) | |
| | dieselus1 | -0.0096 | (0.0207) | | -0.0181 | (0.0206) | |
| | Dsalm08 | 0.0321 | (0.0280) | | 0.0410 | (0.0284) | |
| | chicago1 | | | | 0.0099 | (0.0481) | |
| | sf1 | | | | 0.0774** | (0.0302) | |
| Chicago | Intercept | 0.0773*** | (0.0190) | | 0.0929*** | (0.0182) | |
| | w1 | -0.4970*** | (0.1332) | | -0.2619** | (0.1239) | |
| | w2 | 8.1227*** | (1.4381) | | 4.5809*** | (1.3558) | |
| | w3 | -34.8452*** | (5.9635) | | -21.3316*** | (5.6046) | |
| | w4 | 61.3459*** | (11.3097) | | 39.6248*** | (10.5690) | |
| | w5 | -47.6647*** | (9.9448) | | -32.0067*** | (9.2491) | |
| | w6 | 13.5383*** | (3.2868) | **R-sq** | 9.3946*** | (3.0462) | **R-sq** |
| | chicago1 | 0.9673*** | (0.0376) | **0.8635** | 0.7996*** | (0.0401) | **0.8855** |
| | chicago2 | -0.1183*** | (0.0371) | | -0.1309*** | (0.0347) | |
| | chicagos1 | 0.0306** | (0.0125) | | 0.0117 | (0.0118) | |
| | dieselus1 | -0.0061 | (0.0038) | | -0.0040 | (0.0037) | |
| | Dsalm08 | 0.0377* | (0.0201) | | 0.0486*** | (0.0185) | |
| | mexico1 | | | | 0.1690*** | (0.0182) | |
| | sf1 | | | | 0.0300 | (0.0189) | |
| San Francisco | Intercept | 0.0773*** | (0.0241) | | 0.0837*** | (0.0257) | |
| | w1 | -0.3979** | (0.1755) | | -0.1097 | (0.1707) | |
| | w2 | 9.8898*** | (1.9262) | | 6.3748*** | (1.8706) | |
| | w3 | -47.3348*** | (8.0298) | | -35.0110*** | (7.7777) | |
| | w4 | 89.5409*** | (15.2095) | | 71.3946*** | (14.7212) | |
| | w5 | -74.2493*** | (13.3260) | | -62.5976*** | (12.9106) | |
| | w6 | 22.5512*** | (4.3864) | **R-sq** | 19.9487*** | (4.2575) | **R-sq** |
| | sf1 | 0.8444*** | (0.0208) | **0.8693** | 0.7798*** | (0.0279) | **0.8819** |
| | sfs1 | 0.0326** | (0.0148) | | 0.0179 | (0.0144) | |
| | dieselus1 | -0.0113** | (0.0056) | | -0.0176*** | (0.0054) | |
| | Dsalm09 | 0.0466* | (0.0265) | | 0.0489* | (0.0254) | |
| | chicago1 | | | | -0.0854** | (0.0360) | |
| | mexico1 | | | | 0.1987*** | (0.0251) | |
| **System R-sq** | | **0.8196** | | | **0.8367** | | |

Significance Levels: *.05 **.01 ***.001

Figure 10.2: Estimation of Seasonality using Own Price Lags

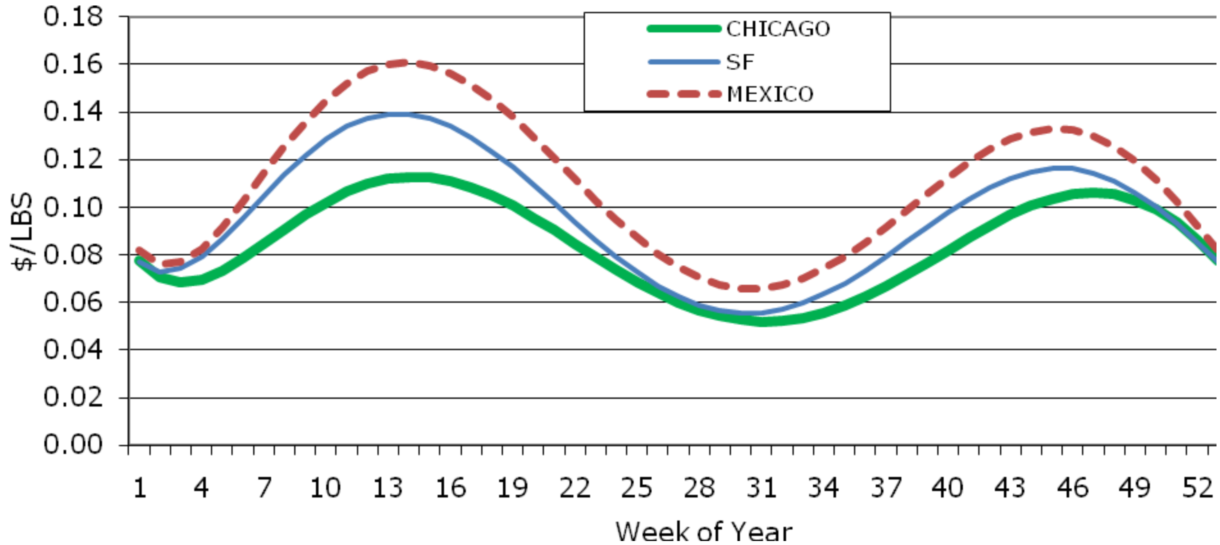
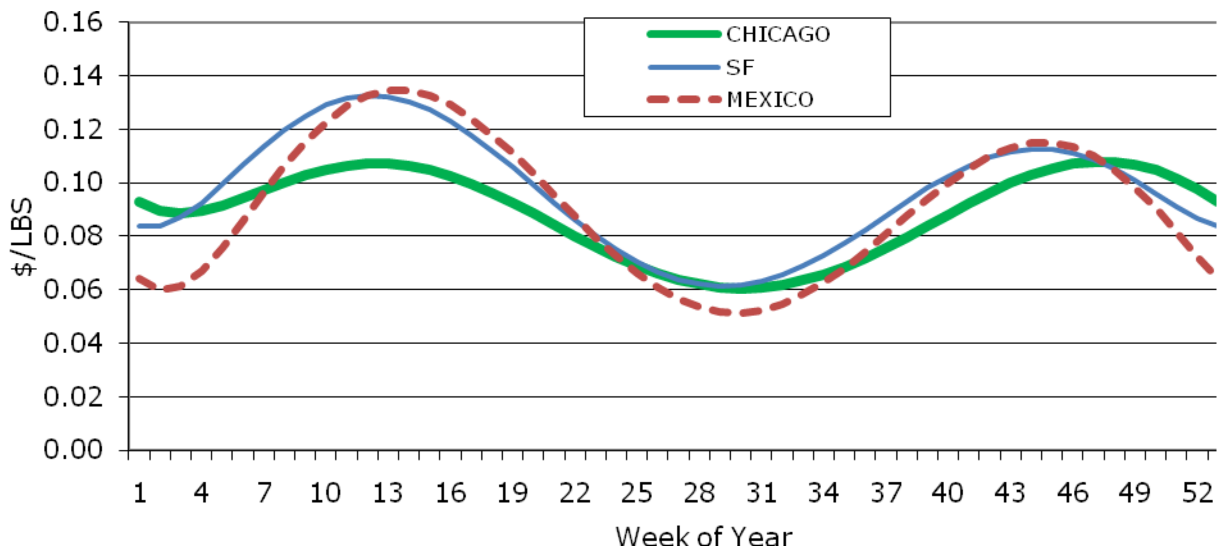



Figure 11.3: Estimation of Seasonality using Own and Cross-City Price Lags



## 4.4 Correlation of Markets

As discussed above the main reason for using SURE as the statistical tool to conduct this analysis was the possibility of correlation between the disturbance terms in the three markets. In table … own_price

Table 4.3: Correlation of Residuals – Own Price Lags

| | Mexico | Chicago | San Francisco |
|---|---|---|---|
| **Mexico** | 1.0000 | | |
| **Chicago** | 0.2033 | 1.0000 | |
| **San Francisco** | 0.1973 | 0.3605 | 1.0000 |

Table 4.4: Covariance of Residuals Matrix – Own Price Lags

| | Mexico | Chicago | San Francisco |
|---|---|---|---|
| **Mexico** | 0.009160 | 0.001083 | 0.001419 |
| **Chicago** | 0.001083 | 0.003227 | 0.001254 |
| **San Francisco** | 0.001419 | 0.001254 | 0.006200 |

Table 4.5: Correlation of Residuals – Cross-City Price Lags

| | Mexico | Chicago | San Francisco |
|---|---|---|---|
| **Mexico** | 1.0000 | | |
| **Chicago** | 0.2032 | 1.0000 | |
| **San Francisco** | 0.1991 | 0.2846 | 1.0000 |

Table 4.6: Covariance of Residuals Matrix – Cross-City Price Lags

| | Mexico | Chicago | San Francisco |
|---|---|---|---|
| **Mexico** | 0.009160 | 0.001083 | 0.001419 |
| **Chicago** | 0.001083 | 0.003227 | 0.001254 |
| **San Francisco** | 0.001419 | 0.001254 | 0.006200 |

## Chapter 5: Conclusion

Crop prices are a matter of concern for agricultural growers, in particular for produce growers, because of the high costs associated with their production. To help Jalapeno growers and sellers understand the behavior of Jalapeno prices, this study formally quantifies seasonality, lagged price effects for own prices, other cities, and a substitute good. Models estimated yield promising results, demonstrating that seasonal patterns do play a significant role in the price of Jalapenos. To be precise, the results clearly illustrate how prices tend to be highest during the weeks prior to the summer and winter harvests.

The statistical significance of seasonality answers part of the research question addressed in this analysis; as far the effects of non-seasonal events we observe that own Jalapenos prices play a very important role in explaining the prices of Jalapenos, showing robustness throughout different model specifications. Another contribution of this analysis was finding significance in the salmonella outbreak from 2008. This is very revealing since this event occurred during a period in which Jalapeno imports from Mexico are not the only source of Jalapenos to the US. The fact that this variable was significant provides insight into what may happen if an outbreak of this magnitude occurs during the winter harvest, a period in which Mexico is the major supplier of Jalapenos to the US. Additional to these results, we did not find consistency in the use of a substitute good and the use of a proxy for transportation costs, in particular for the Mexico City market, suggesting that the size of the market makes Jalapeno prices more stable against exogenous factors.

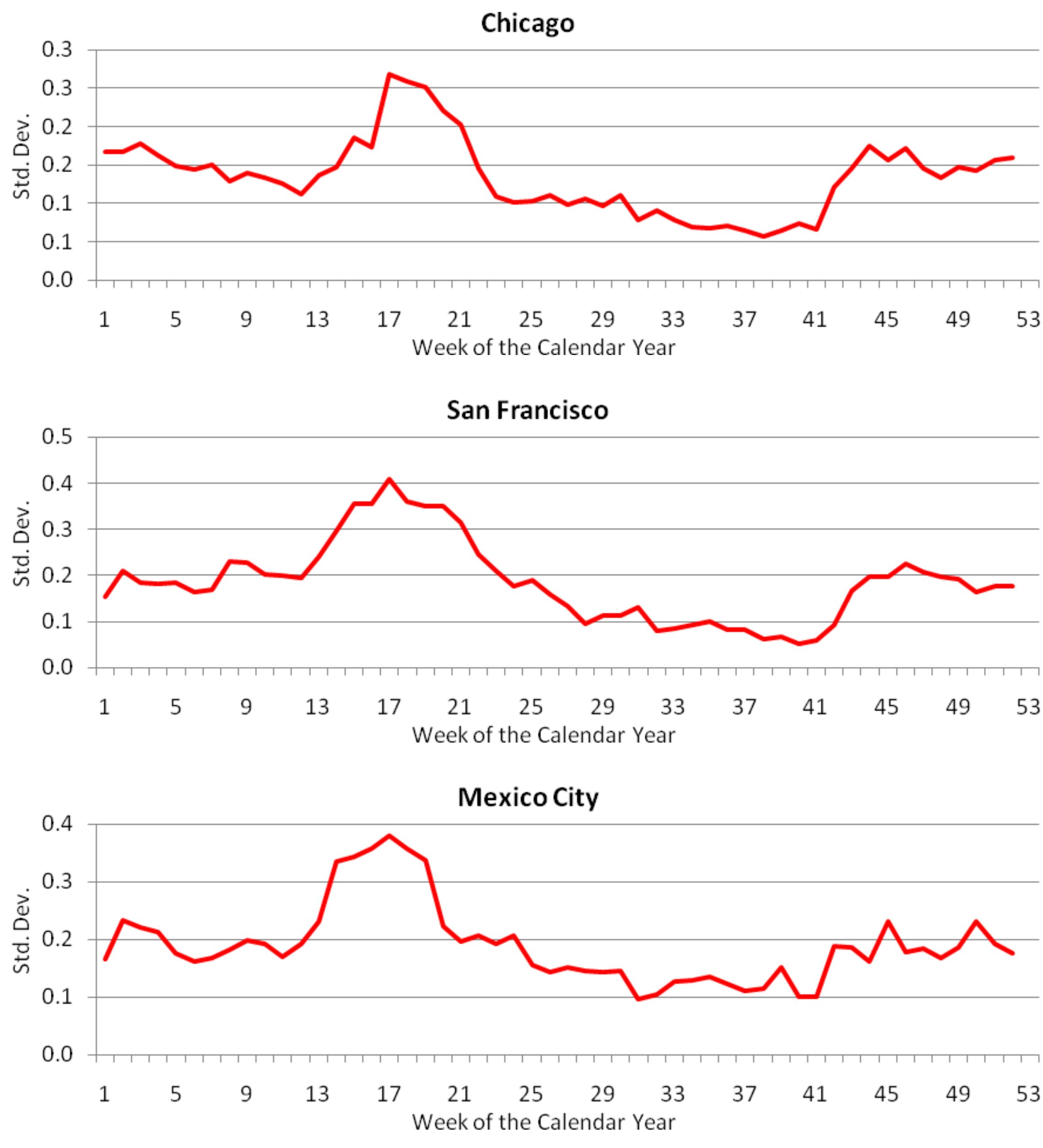
The results from this analysis have important implications for individuals who produce and trade Jalapenos. Growers may use these results to invest more in their Jalapeno crops, through better crop management or better quality of pesticides, to extend the productive life of the plants and have good production volumes at the end of the Jalapeno production seasons, which is when the prices are highest. Similarly, this analysis should prove useful to buyers and sellers as the results should help in the development of price expectations and may have implications for offers and counter-offers.

## 5.1 Future Research

Price volatility in agricultural commodities has always presented challenges to agricultural growers. Even though agricultural production risks are a major issue for producers, market risks present a whole different set of challenges and adversities to overcome. For agricultural growers, a good price is a very important element of profit maximization; if prices are high enough, production costs can be covered and profitability achieved. The opposite is true with low prices. More often than not, we find that prices from agricultural products are uncertain throughout the year, especially for perishable goods such as Jalapeno peppers. So the understanding of seasonal price variation can be very relevant in decision making when managing fresh Jalapenos.

As an initial effort in a largely unexplored crop, our hope is that future studies will continue to research issues not explored in this analysis. Even though we were successful in showing that seasonality in the mean can be very similar for Jalapenos in three different locations, further research could estimate the seasonality of the variance. Given that the mean in the price exhibits seasonality it is very likely that the price variances of Jalapenos will also demonstrate some form of seasonality. Figure 5.1 illustrates how much price fluctuation can exist during the weeks of the year in which the estimated mean seasonality is the highest. So, limiting our attention to just the mean can confine our understanding of price relationships across regions and lead to poor marketing decisions.

Figure 12.1: Standard Deviation of Jalapeno weekly prices




Source: U.S. Department of Agriculture, Agricultural Marketing Service.

# APPENDIX A

## Appendix A1 – Pepper Production in Mexico

Table A1.1: Mexico Jalapeno Production – Dates and Locations

| Winter Season | | Summer Season | |
|---|---|---|---|
| Usual Harvest Dates: | | Usual Harvest Dates: | |
| | December - August | | June – March |
| **2008 Jalapeno Harvest** | | **2008 Jalapeno Harvest** | |
| **States** | | **States** | |
| BAJA CALIFORNIA SUR | 0.08% | BAJA CALIFORNIA | 3.79% |
| CAMPECHE | 0.12% | CAMPECHE | 6.19% |
| CHIAPAS | 5.77% | CHIHUAHUA | 57.49% |
| COLIMA | 6.02% | COAHUILA | 1.75% |
| GUANAJUATO | 0.14% | COLIMA | 0.01% |
| HIDALGO | 1.10% | DURANGO | 1.80% |
| JALISCO | 9.77% | GUANAJUATO | 0.06% |
| MEXICO | 0.04% | JALISCO | 4.21% |
| MICHOACAN | 6.61% | MEXICO | 0.03% |
| MORELOS | 0.01% | MICHOACAN | 10.79% |
| NAYARIT | 12.26% | NUEVO LEON | 2.02% |
| NUEVO LEON | 4.61% | QUERETARO | 0.21% |
| QUERETARO | 0.07% | QUINTANA ROO | 1.65% |
| QUINTANA ROO | 0.12% | SAN LUIS POTOSI | 2.14% |
| SAN LUIS POTOSI | 0.21% | SONORA | 1.90% |
| SINALOA | 48.05% | TAMAULIPAS | 5.03% |
| TABASCO | 0.51% | VERACRUZ | 0.94% |
| TAMAULIPAS | 4.30% | | |
| VERACRUZ | 0.20% | | |
| **Total Production (tons 2240 lbs):** | **236,220** | **Total Production (tons 2240 lbs):** | **412,942** |

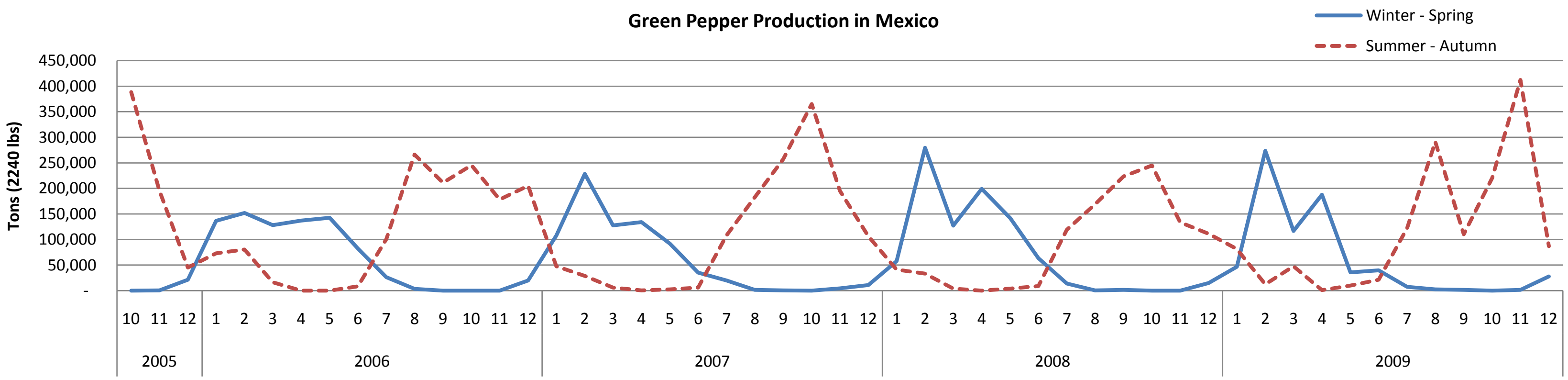
Source: SIACON.

Table A1.2: Annual Production of Peppers in Mexico (Tons – 2240 lbs)

| Year | Green Peppers | Jalapenos | % of Jal |
|---|---|---|---|
| 2000 | 1,741,680 | 157,856 | 9% |
| 2001 | 1,897,257 | 158,884 | 8% |
| 2002 | 1,784,517 | 173,101 | 10% |
| 2003 | 1,778,357 | 229,509 | 13% |
| 2004 | 1,867,148 | 503,246 | 27% |
| 2005 | 2,023,442 | 580,559 | 29% |
| 2006 | 2,078,477 | 652,767 | 31% |
| 2007 | 2,259,562 | 712,700 | 32% |
| 2008 | 1,913,431 | 649,161 | 34% |
| 2009 | 2,000,998 | 618,684 | 31% |

Source: SIACON.

Figure A1.1: Monthly Green Pepper Production in Mexico – by Season




Source: SIACON.

## Appendix A2 – U.S. Data on Green Peppers

Table A2.1: U.S. Chile Pepper Principal Counties and Varieties Grown 2004-05

| Season | State | Principal Producing Counties | Principal Varieties Grown |
|---|---|---|---|
| Spring | CA | Imperial and Riverside | Jalapeno and Paprika |
| Summer | CA | San Diego, Orange, and Ventura | Jalapeno and Paprika |
| Summer | NM | Luna, Dona Ana, Chaves, and Hidalgo | Cayene, Green Hot, Green Mild, Jalapeno and Paprika |
| Summer | TX | El Paso and Hudspeth | Habanero and Jalapeno |
| Fall | CA | San Luis Obispo, Monterrey, San Benito, Santa Clara, Tulare, Fresno, and San Joaquin | Jalapeno and Paprika |

Source: NASS.

Table A2.2: U.S. Fresh-Market Imports by Country (excluding Mexico) - 2007

| Country | Tons |
|---|---|
| Dominican Republic | 824.9 |
| Canada | 411.8 |
| China | 237.9 |
| Trinidad and Tobago | 160.3 |
| Netherlands | 61.1 |
| Peru | 31.1 |
| Jamaica | 20.7 |
| Other | 31.6 |

Source: NASS.

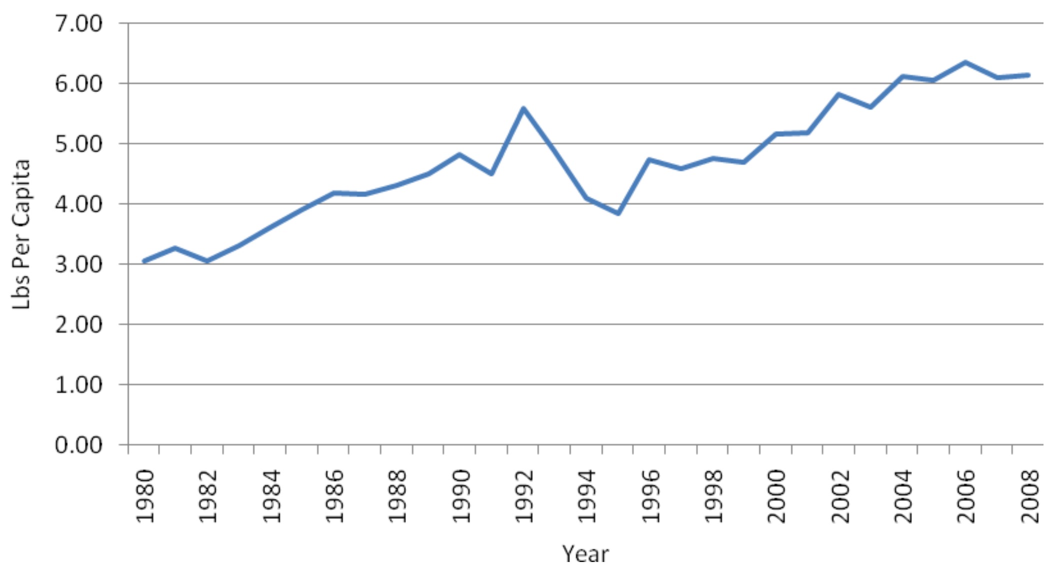
**Appendix A3 – Green Pepper Consumption in Mexico and the U.S.**

Table A3.1: U.S. Per Capita Chili Pepper Availability (excluding Bell Peppers)

| Year | Lbs | Year | Lbs | Year | Lbs |
|---|---|---|---|---|---|
| 1980 | 3.05 | 1990 | 4.83 | 2000 | 5.15 |
| 1981 | 3.27 | 1991 | 4.51 | 2001 | 5.18 |
| 1982 | 3.06 | 1992 | 5.58 | 2002 | 5.83 |
| 1983 | 3.31 | 1993 | 4.90 | 2003 | 5.61 |
| 1984 | 3.61 | 1994 | 4.10 | 2004 | 6.13 |
| 1985 | 3.91 | 1995 | 3.83 | 2005 | 6.06 |
| 1986 | 4.18 | 1996 | 4.73 | 2006 | 6.36 |
| 1987 | 4.17 | 1997 | 4.59 | 2007 | 6.09 |
| 1988 | 4.32 | 1998 | 4.76 | 2008 | 6.15 |
| 1989 | 4.50 | 1999 | 4.71 | | |

Source: ERS.

Figure A3.1: U.S. Per Capita Chili Pepper Availability (excluding Bell Peppers)



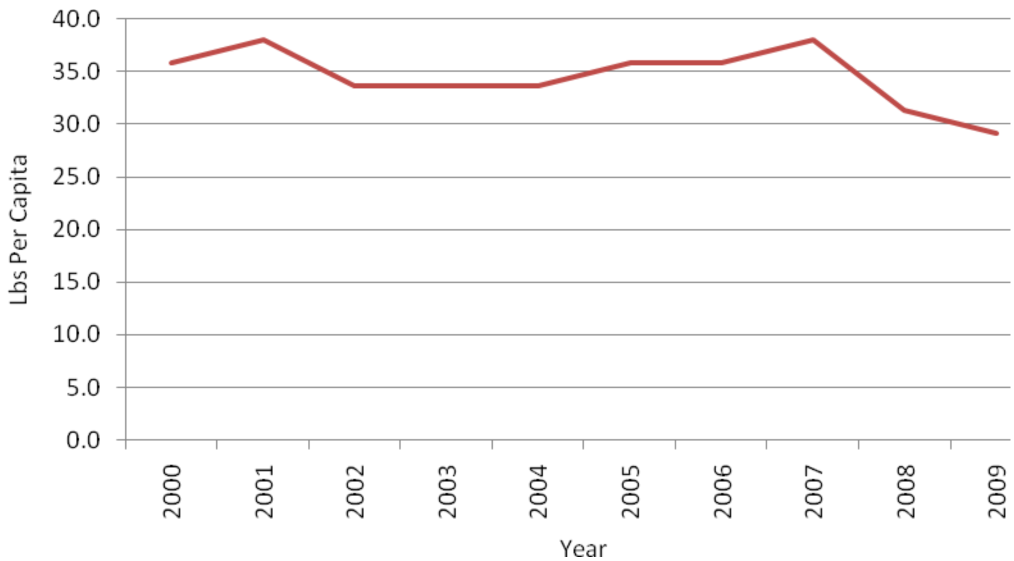

Source: ERS.

Table A3.2: Mexico Per Capita Chili Pepper Availability (All Green Peppers)

| Year | Lbs |
|---|---|
| 2000 | 35.8 |
| 2001 | 38.1 |
| 2002 | 33.6 |
| 2003 | 33.6 |
| 2004 | 33.6 |
| 2005 | 35.8 |
| 2006 | 35.8 |
| 2007 | 38.1 |
| 2008 | 31.4 |
| 2009 | 29.1 |

Source: SIAP.

Figure A3.2: Mexico Per Capita Chili Pepper Availability (All Green Peppers)




Source: SIAP.

## APPENDIX B

Estimates calculated to determine the order of the seasonality polynomial and the number of lag weeks.

**Variable Description:**

W*q* – W is a Time index variable cycling between 0 and 1.
*q* is the order of the polynomial

chicago*t* – Weekly prices of Jalapenos for Chicago.
*t* is the number of the time lag (in weeks)

chicagos*t* – Weekly prices of Serranos for Chicago.
*t* is the number of the time lag (in weeks)

mexico*t* – Weekly prices of Jalapenos for Mexico.
*t* is the number of the time lag (in weeks)

mexicos*t* – Weekly prices of Serranos for Mexico.
*t* is the number of the time lag (in weeks)

sf*t* – Weekly prices of Jalapenos for San Francisco.
*t* is the number of the time lag (in weeks)

sfs*t* – Weekly prices of Serranos for San Francisco.
*t* is the number of the time lag (in weeks)

dieselus*t* – Weekly prices of diesel in the U.S.
*t* is the number of the time lag (in weeks)

dieselmx*t* – Weekly prices of diesel in the Mexico.
*t* is the number of the time lag (in weeks)

SALM08 – Dummy binary variable for the time period with the FDA Salmonella warning

# B.1 Estimates for Chicago

**Order of the Seasonality Polynomial = 8**

| R-sqr 0.87 | | SIC -1619.96 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.09 *** | 0.02 |
| W1 | -0.09 | 0.31 |
| W2 | -1.62 | 6.07 |
| W3 | 36.27 | 46.42 |
| W4 | -185.10 | 175.75 |
| W5 | 413.83 | 364.59 |
| W6 | -465.34 | 422.01 |
| W7 | 258.66 | 255.69 |
| W8 | -56.62 | 63.17 |
| chicago1 | 1.00 *** | 0.04 |
| chicago2 | -0.08 | 0.06 |
| chicago3 | -0.06 | 0.06 |
| chicago4 | -0.02 | 0.04 |
| chicagos1 | 0.03 ** | 0.01 |
| dieselus1 | -0.01 * | 0.00 |
| SALM08 | 0.04 * | 0.02 |

| R-sqr 0.87 | | SIC -1629.76 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.09 *** | 0.02 |
| W1 | -0.11 | 0.30 |
| W2 | -1.38 | 6.05 |
| W3 | 35.39 | 46.32 |
| W4 | -184.26 | 175.48 |
| W5 | 415.62 | 364.06 |
| W6 | -470.10 | 421.36 |
| W7 | 262.61 | 255.26 |
| W8 | -57.77 | 63.06 |
| chicago1 | 1.00 *** | 0.04 |
| chicago2 | -0.08 | 0.06 |
| chicago3 | -0.08 ** | 0.04 |
| chicagos1 | 0.03 ** | 0.01 |
| dieselus1 | -0.01 * | 0.00 |
| SALM08 | 0.04 * | 0.02 |

| R-sqr 0.87 | | SIC -1635.93 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.08 *** | 0.02 |
| W1 | -0.13 | 0.30 |
| W2 | -0.94 | 6.03 |
| W3 | 33.70 | 46.26 |
| W4 | -182.92 | 175.46 |
| W5 | 419.56 | 364.28 |
| W6 | -478.95 | 421.77 |
| W7 | 269.12 | 255.58 |
| W8 | -59.44 | 63.15 |
| chicago1 | 1.02 *** | 0.04 |
| chicago2 | -0.16 *** | 0.04 |
| chicagos1 | 0.03 ** | 0.01 |
| dieselus1 | -0.01 * | 0.00 |
| SALM08 | 0.04 ** | 0.02 |

| R-sqr 0.86 | | SIC -1629.69 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.07 *** | 0.02 |
| W1 | -0.19 | 0.30 |
| W2 | 0.07 | 6.05 |
| W3 | 29.57 | 46.53 |
| W4 | -179.15 | 176.77 |
| W5 | 428.58 | 367.38 |
| W6 | -501.01 | 425.68 |
| W7 | 286.09 | 258.09 |
| W8 | -63.96 | 63.80 |
| chicago1 | 0.88 *** | 0.02 |
| chicagos1 | 0.02 * | 0.01 |
| dieselus1 | -0.01 * | 0.00 |
| SALM08 | 0.04 ** | 0.02 |

| R-sqr = 0.73 | | SIC -1194.90 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.14 *** | 0.03 |
| W1 | -0.40 | 0.43 |
| W2 | -1.04 | 8.62 |
| W3 | 66.86 | 66.12 |
| W4 | -373.61 | 250.70 |
| W5 | 863.83 * | 520.34 |
| W6 | -990.68 | 602.48 |
| W7 | 559.43 | 365.13 |
| W8 | -124.40 | 90.23 |
| chicago2 | 0.72 *** | 0.03 |
| chicagos1 | 0.07 *** | 0.02 |
| dieselus1 | -0.01 ** | 0.01 |
| SALM08 | 0.08 *** | 0.03 |

| R-sqr = 0.72 | | SIC -1186.41 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.16 *** | 0.03 |
| W1 | -0.46 | 0.44 |
| W2 | -0.93 | 8.69 |
| W3 | 69.48 | 66.60 |
| W4 | -388.02 | 252.38 |
| W5 | 895.55 * | 523.76 |
| W6 | -1026.00 * | 606.43 |
| W7 | 579.35 | 367.54 |
| W8 | -128.94 | 90.83 |
| chicago2 | 0.73 *** | 0.03 |
| chicagos2 | 0.05 ** | 0.02 |
| dieselus2 | -0.01 ** | 0.01 |
| SALM08 | 0.09 *** | 0.03 |

| R-sqr = 0.86 | | SIC -1624.31 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.07 *** | 0.02 |
| W1 | -0.21 | 0.31 |
| W2 | 0.07 | 6.11 |
| W3 | 30.60 | 46.91 |
| W4 | -184.12 | 177.88 |
| W5 | 439.05 | 369.22 |
| W6 | -512.42 | 427.45 |
| W7 | 292.43 | 259.01 |
| W8 | -65.40 | 64.00 |
| chicago1 | 0.88 *** | 0.02 |
| chicagos2 | 0.02 | 0.01 |
| dieselus2 | -0.01 * | 0.00 |
| SALM08 | 0.05 ** | 0.02 |

| R-sqr = 0.87 | | SIC -1634.74 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| Intercept | 0.08 *** | 0.02 |
| W1 | -0.16 | 0.30 |
| W2 | -0.77 | 6.04 |
| W3 | 33.63 | 46.32 |
| W4 | -184.84 | 175.63 |
| W5 | 425.66 | 364.58 |
| W6 | -487.06 | 422.10 |
| W7 | 274.28 | 255.78 |
| W8 | -60.73 | 63.20 |
| chicago1 | 1.02 *** | 0.04 |
| chicago2 | -0.16 *** | 0.04 |
| chicagos2 | 0.02 * | 0.01 |
| dieselus2 | -0.01 * | 0.00 |
| SALM08 | 0.04 ** | 0.02 |

*** Significant at 1%   ** Significant at 5%   * Significant at 10%

**Order of the Seasonality Polynomial = 7**

| R-sqr = 0.87 | | SIC -1625.57 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 *** | 0.02 |
| **W1** | -0.10 | 0.31 |
| **W2** | 1.27 | 5.15 |
| **W3** | 5.20 | 30.86 |
| **W4** | -48.54 | 87.57 |
| **W5** | 107.77 | 127.65 |
| **W6** | -96.31 | 92.39 |
| **W7** | 30.72 | 26.30 |
| **chicago1** | 1.00 *** | 0.04 |
| **chicago2** | -0.08 | 0.06 |
| **chicago3** | -0.06 | 0.06 |
| **chicago4** | -0.02 | 0.04 |
| **chicagos1** | 0.03 ** | 0.01 |
| **dieselus1** | -0.01 * | 0.00 |
| **SALM08** | 0.04 * | 0.02 |

| R-sqr = 0.87 | | SIC -1635.34 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 *** | 0.02 |
| **W1** | -0.12 | 0.30 |
| **W2** | 1.58 | 5.11 |
| **W3** | 3.60 | 30.68 |
| **W4** | -44.73 | 87.13 |
| **W5** | 103.08 | 127.09 |
| **W6** | -93.41 | 92.02 |
| **W7** | 30.00 | 26.20 |
| **chicago1** | 1.01 *** | 0.04 |
| **chicago2** | -0.08 | 0.06 |
| **chicago3** | -0.08 ** | 0.04 |
| **chicagos1** | 0.03 ** | 0.01 |
| **dieselus1** | -0.01 * | 0.00 |
| **SALM08** | 0.04 * | 0.02 |

| R-sqr = 0.87 | | SIC -1641.47 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 *** | 0.02 |
| **W1** | -0.15 | 0.30 |
| **W2** | 2.10 | 5.08 |
| **W3** | 1.02 | 30.56 |
| **W4** | -39.43 | 86.86 |
| **W5** | 98.11 | 126.76 |
| **W6** | -91.47 | 91.81 |
| **W7** | 29.82 | 26.15 |
| **chicago1** | 1.02 *** | 0.04 |
| **chicago2** | -0.16 *** | 0.04 |
| **chicagos1** | 0.03 ** | 0.01 |
| **dieselus1** | -0.01 * | 0.00 |
| **SALM08** | 0.04 * | 0.02 |

| R-sqr = 0.86 | | SIC -1635.10 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.06 *** | 0.02 |
| **W1** | -0.21 | 0.30 |
| **W2** | 3.33 | 5.10 |
| **W3** | -5.48 | 30.70 |
| **W4** | -25.07 | 87.36 |
| **W5** | 83.15 | 127.58 |
| **W6** | -84.39 | 92.45 |
| **W7** | 28.66 | 26.34 |
| **chicago1** | 0.88 *** | 0.02 |
| **chicagos1** | 0.02 * | 0.01 |
| **dieselus1** | -0.01 | 0.00 |
| **SALM08** | 0.04 ** | 0.02 |

| R-sqr = 0.73 | | SIC -1199.40 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.13 *** | 0.03 |
| **W1** | -0.43 | 0.43 |
| **W2** | 5.34 | 7.27 |
| **W3** | -1.56 | 43.73 |
| **W4** | -73.39 | 124.31 |
| **W5** | 191.35 | 181.35 |
| **W6** | -179.99 | 131.31 |
| **W7** | 58.68 | 37.39 |
| **chicago2** | 0.72 *** | 0.03 |
| **chicagos1** | 0.07 *** | 0.02 |
| **dieselus1** | -0.01 ** | 0.01 |
| **SALM08** | 0.08 *** | 0.03 |

| R-sqr = 0.72 | | SIC -1190.80 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.15 *** | 0.03 |
| **W1** | -0.50 | 0.44 |
| **W2** | 5.68 | 7.34 |
| **W3** | -1.40 | 44.11 |
| **W4** | -76.96 | 125.34 |
| **W5** | 198.69 | 182.78 |
| **W6** | -185.86 | 132.32 |
| **W7** | 60.34 | 37.67 |
| **chicago2** | 0.74 *** | 0.03 |
| **chicagos2** | 0.05 ** | 0.02 |
| **dieselus2** | -0.01 ** | 0.01 |
| **SALM08** | 0.08 *** | 0.03 |

| R-sqr = 0.86 | | SIC -1629.68 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 *** | 0.02 |
| **W1** | -0.22 | 0.31 |
| **W2** | 3.42 | 5.16 |
| **W3** | -5.37 | 31.00 |
| **W4** | -26.23 | 88.14 |
| **W5** | 85.38 | 128.62 |
| **W6** | -86.11 | 93.15 |
| **W7** | 29.14 | 26.53 |
| **chicago1** | 0.88 *** | 0.02 |
| **chicagos2** | 0.02 | 0.01 |
| **dieselus2** | -0.01 * | 0.00 |
| **SALM08** | 0.05 ** | 0.02 |

| R-sqr = 0.87 | | SIC -1640.23 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 *** | 0.02 |
| **W1** | -0.17 | 0.30 |
| **W2** | 2.34 | 5.10 |
| **W3** | 0.24 | 30.64 |
| **W4** | -38.26 | 87.07 |
| **W5** | 97.25 | 127.02 |
| **W6** | -91.16 | 91.98 |
| **W7** | 29.76 | 26.19 |
| **chicago1** | 1.03 *** | 0.04 |
| **chicago2** | -0.16 *** | 0.04 |
| **chicagos2** | 0.02 * | 0.01 |
| **dieselus2** | -0.01 * | 0.00 |
| **SALM08** | 0.04 ** | 0.02 |

*** Significant at 1%   ** Significant at 5%   * Significant at 10%

**Order of the Seasonality Polynomial = 6**

**R-sqr = 0.87 SIC -1630.62**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.08 | *** | 0.02 |
| W1 | -0.42 | *** | 0.14 |
| W2 | 7.02 | *** | 1.49 |
| W3 | -30.12 | *** | 6.21 |
| W4 | 52.83 | *** | 11.80 |
| W5 | -40.85 | *** | 10.36 |
| W6 | 11.54 | *** | 3.41 |
| chicago1 | 1.01 | *** | 0.04 |
| chicago2 | -0.08 | | 0.06 |
| chicago3 | -0.06 | | 0.06 |
| chicago4 | -0.02 | | 0.04 |
| chicagos1 | 0.03 | ** | 0.01 |
| dieselus1 | -0.01 | * | 0.00 |
| SALM08 | 0.04 | * | 0.02 |

**R-sqr = 0.87 SIC -1640.44**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.08 | *** | 0.02 |
| W1 | -0.44 | *** | 0.13 |
| W2 | 7.19 | *** | 1.46 |
| W3 | -30.82 | *** | 6.08 |
| W4 | 54.14 | *** | 11.56 |
| W5 | -41.94 | *** | 10.17 |
| W6 | 11.87 | *** | 3.36 |
| chicago1 | 1.01 | *** | 0.04 |
| chicago2 | -0.08 | | 0.06 |
| chicago3 | -0.08 | ** | 0.04 |
| chicagos1 | 0.03 | ** | 0.01 |
| dieselus1 | -0.01 | * | 0.00 |
| SALM08 | 0.04 | * | 0.02 |

**R-sqr = 0.87 SIC -1646.58**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.07 | *** | 0.02 |
| W1 | -0.46 | *** | 0.13 |
| W2 | 7.66 | *** | 1.44 |
| W3 | -33.16 | *** | 5.97 |
| W4 | 58.79 | *** | 11.32 |
| W5 | -46.01 | *** | 9.97 |
| W6 | 13.17 | *** | 3.30 |
| chicago1 | 1.02 | *** | 0.04 |
| chicago2 | -0.16 | *** | 0.04 |
| chicagos1 | 0.03 | ** | 0.01 |
| dieselus1 | -0.01 | * | 0.00 |
| SALM08 | 0.04 | * | 0.02 |

**R-sqr = 0.86 SIC -1640.34**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.06 | *** | 0.02 |
| W1 | -0.50 | *** | 0.13 |
| W2 | 8.67 | *** | 1.43 |
| W3 | -38.28 | *** | 5.88 |
| W4 | 69.24 | *** | 11.12 |
| W5 | -55.29 | *** | 9.79 |
| W6 | 16.17 | *** | 3.24 |
| chicago1 | 0.88 | *** | 0.02 |
| chicagos1 | 0.03 | * | 0.01 |
| dieselus1 | -0.01 | | 0.00 |
| SALM08 | 0.04 | * | 0.02 |

**R-sqr = 0.72 SIC -1203.34**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.12 | *** | 0.03 |
| W1 | -1.04 | *** | 0.19 |
| W2 | 16.32 | *** | 2.00 |
| W3 | -68.95 | *** | 8.31 |
| W4 | 120.11 | *** | 15.85 |
| W5 | -92.41 | *** | 14.04 |
| W6 | 25.97 | *** | 4.67 |
| chicago2 | 0.73 | *** | 0.03 |
| chicagos1 | 0.07 | *** | 0.02 |
| dieselus1 | -0.01 | ** | 0.01 |
| SALM08 | 0.07 | ** | 0.03 |

**R-sqr = 0.72 SIC -1194.63**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.14 | *** | 0.03 |
| W1 | -1.12 | *** | 0.19 |
| W2 | 16.99 | *** | 2.02 |
| W3 | -70.77 | *** | 8.41 |
| W4 | 122.16 | *** | 16.09 |
| W5 | -93.22 | *** | 14.25 |
| W6 | 25.96 | *** | 4.73 |
| chicago2 | 0.74 | *** | 0.03 |
| chicagos2 | 0.05 | *** | 0.02 |
| dieselus2 | -0.01 | ** | 0.01 |
| SALM08 | 0.08 | *** | 0.03 |

**R-sqr = 0.86 SIC -1634.89**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.06 | *** | 0.02 |
| W1 | -0.53 | *** | 0.13 |
| W2 | 8.86 | *** | 1.44 |
| W3 | -38.80 | *** | 5.97 |
| W4 | 69.80 | *** | 11.31 |
| W5 | -55.49 | *** | 9.94 |
| W6 | 16.16 | *** | 3.29 |
| chicago1 | 0.88 | *** | 0.02 |
| chicagos2 | 0.02 | | 0.01 |
| dieselus2 | -0.01 | | 0.00 |
| SALM08 | 0.04 | ** | 0.02 |

**R-sqr = 0.87 SIC -1645.36**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.07 | *** | 0.02 |
| W1 | -0.48 | *** | 0.13 |
| W2 | 7.89 | *** | 1.44 |
| W3 | -33.90 | *** | 6.01 |
| W4 | 59.83 | *** | 11.42 |
| W5 | -46.64 | *** | 10.05 |
| W6 | 13.30 | *** | 3.32 |
| chicago1 | 1.03 | *** | 0.04 |
| chicago2 | -0.16 | *** | 0.04 |
| chicagos2 | 0.02 | * | 0.01 |
| dieselus2 | -0.01 | * | 0.00 |
| SALM08 | 0.04 | * | 0.02 |

*** Significant at 1%  ** Significant at 5%  * Significant at 10%

**Order of the Seasonality Polynomial = 5**

| R-sqr = 0.86 | SIC -1625.49 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.41 *** | 0.14 |
| **W2** | 4.03 *** | 1.21 |
| **W3** | -12.64 *** | 3.49 |
| **W4** | 15.25 *** | 4.03 |
| **W5** | -6.23 *** | 1.61 |
| **chicago1** | 1.02 *** | 0.04 |
| **chicago2** | -0.08 | 0.06 |
| **chicago3** | -0.06 | 0.06 |
| **chicago4** | -0.04 | 0.04 |
| **chicagos1** | 0.03 * | 0.01 |
| **dieselus1** | -0.01 * | 0.00 |
| **SALM08** | 0.03 | 0.02 |

| R-sqr = 0.86 | SIC -1634.28 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.43 *** | 0.14 |
| **W2** | 4.18 *** | 1.20 |
| **W3** | -13.06 *** | 3.46 |
| **W4** | 15.73 *** | 4.00 |
| **W5** | -6.42 *** | 1.60 |
| **chicago1** | 1.02 *** | 0.04 |
| **chicago2** | -0.08 | 0.06 |
| **chicago3** | -0.11 *** | 0.04 |
| **chicagos1** | 0.03 * | 0.01 |
| **dieselus1** | -0.01 * | 0.00 |
| **SALM08** | 0.03 | 0.02 |

| R-sqr = 0.86 | SIC -1637.01 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.10 *** | 0.02 |
| **W1** | -0.47 *** | 0.14 |
| **W2** | 4.41 *** | 1.20 |
| **W3** | -13.65 *** | 3.47 |
| **W4** | 16.41 *** | 4.00 |
| **W5** | -6.70 *** | 1.60 |
| **chicago1** | 1.05 *** | 0.04 |
| **chicago2** | -0.20 *** | 0.04 |
| **chicagos1** | 0.02 * | 0.01 |
| **dieselus1** | -0.01 | 0.00 |
| **SALM08** | 0.03 | 0.02 |

| R-sqr = 0.86 | SIC -1622.05 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.10 *** | 0.02 |
| **W1** | -0.52 *** | 0.14 |
| **W2** | 4.76 *** | 1.22 |
| **W3** | -14.57 *** | 3.52 |
| **W4** | 17.49 *** | 4.07 |
| **W5** | -7.15 *** | 1.63 |
| **chicago1** | 0.87 *** | 0.02 |
| **chicagos1** | 0.02 | 0.01 |
| **dieselus1** | -0.01 | 0.00 |
| **SALM08** | 0.03 | 0.02 |

| R-sqr = 0.71 | SIC -1179.14 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.21 *** | 0.03 |
| **W1** | -1.16 *** | 0.19 |
| **W2** | 10.78 *** | 1.71 |
| **W3** | -32.94 *** | 4.93 |
| **W4** | 39.36 *** | 5.69 |
| **W5** | -16.03 *** | 2.28 |
| **chicago2** | 0.71 *** | 0.03 |
| **chicagos1** | 0.03 *** | 0.02 |
| **dieselus1** | -0.01 ** | 0.01 |
| **SALM08** | 0.07 ** | 0.03 |

| R-sqr = 0.71 | SIC -1171.28 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.19 *** | 0.03 |
| **W1** | -1.09 *** | 0.19 |
| **W2** | 10.16 *** | 1.71 |
| **W3** | -31.29 *** | 4.93 |
| **W4** | 37.52 *** | 5.68 |
| **W5** | -15.31 *** | 2.27 |
| **chicago2** | 0.70 *** | 0.03 |
| **chicagos2** | 0.06 * | 0.02 |
| **dieselus2** | -0.01 ** | 0.01 |
| **SALM08** | 0.06 ** | 0.03 |

| R-sqr = 0.86 | SIC -1617.33 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.10 *** | 0.02 |
| **W1** | -0.54 *** | 0.14 |
| **W2** | 4.90 *** | 1.22 |
| **W3** | -14.91 *** | 3.52 |
| **W4** | 17.86 *** | 4.07 |
| **W5** | -7.30 *** | 1.63 |
| **chicago1** | 0.88 *** | 0.02 |
| **chicagos2** | 0.00 | 0.01 |
| **dieselus2** | -0.01 | 0.00 |
| **SALM08** | 0.04 * | 0.02 |

| R-sqr = 0.86 | SIC -1635.72 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.49 *** | 0.13 |
| **W2** | 4.57 *** | 1.19 |
| **W3** | -14.11 *** | 3.46 |
| **W4** | 16.92 *** | 4.00 |
| **W5** | -6.90 *** | 1.60 |
| **chicago1** | 1.05 *** | 0.04 |
| **chicago2** | -0.20 *** | 0.04 |
| **chicagos2** | 0.02 | 0.01 |
| **dieselus2** | -0.01 | 0.00 |
| **SALM08** | 0.03 | 0.02 |

*** Significant at 1%   ** Significant at 5%   * Significant at 10%

**Order of the Seasonality Polynomial = 4**

| R-sqr = 0.86 | | SIC -1616.89 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 *** | 0.02 |
| **W1** | 0.09 ** | 0.04 |
| **W2** | -0.59 *** | 0.17 |
| **W3** | 0.79 *** | 0.26 |
| **W4** | -0.30 ** | 0.12 |
| **chicago1** | 1.05 *** | 0.04 |
| **chicago2** | -0.08 | 0.06 |
| **chicago3** | -0.05 | 0.06 |
| **chicago4** | -0.06 | 0.04 |
| **chicagos1** | 0.03 ** | 0.01 |
| **dieselus1** | 0.00 | 0.00 |
| **SALM08** | 0.02 | 0.02 |

| R-sqr = 0.86 | | SIC -1624.55 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 *** | 0.02 |
| **W1** | 0.09 ** | 0.04 |
| **W2** | -0.57 *** | 0.17 |
| **W3** | 0.80 *** | 0.26 |
| **W4** | -0.31 *** | 0.12 |
| **chicago1** | 1.06 *** | 0.04 |
| **chicago2** | -0.08 | 0.06 |
| **chicago3** | -0.12 *** | 0.04 |
| **chicagos1** | 0.03 ** | 0.01 |
| **dieselus1** | 0.00 | 0.00 |
| **SALM08** | 0.02 | 0.02 |

| R-sqr = 0.86 | | SIC -1625.93 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 *** | 0.02 |
| **W1** | 0.07 * | 0.04 |
| **W2** | -0.56 *** | 0.17 |
| **W3** | 0.82 *** | 0.26 |
| **W4** | -0.33 *** | 0.12 |
| **chicago1** | 1.08 *** | 0.04 |
| **chicago2** | -0.21 *** | 0.04 |
| **chicagos1** | 0.03 ** | 0.01 |
| **dieselus1** | 0.00 | 0.00 |
| **SALM08** | 0.02 | 0.02 |

| R-sqr = 0.85 | | SIC -1609.24 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 *** | 0.02 |
| **W1** | 0.05 | 0.04 |
| **W2** | -0.53 *** | 0.18 |
| **W3** | 0.86 *** | 0.26 |
| **W4** | -0.38 *** | 0.12 |
| **chicago1** | 0.90 *** | 0.02 |
| **chicagos1** | 0.02 | 0.01 |
| **dieselus1** | 0.00 | 0.00 |
| **SALM08** | 0.02 | 0.02 |

| R-sqr = 0.69 | | SIC -1141.23 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.14 *** | 0.03 |
| **W1** | 0.15 *** | 0.06 |
| **W2** | -1.22 *** | 0.26 |
| **W3** | 1.81 *** | 0.38 |
| **W4** | -0.75 *** | 0.18 |
| **chicago2** | 0.75 *** | 0.03 |
| **chicagos1** | 0.08 *** | 0.02 |
| **dieselus1** | -0.01 | 0.01 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr = 0.68 | | SIC -1129.34 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.16 *** | 0.03 |
| **W1** | 0.13 ** | 0.06 |
| **W2** | -1.12 *** | 0.26 |
| **W3** | 1.71 *** | 0.38 |
| **W4** | -0.72 *** | 0.18 |
| **chicago2** | 0.77 *** | 0.03 |
| **chicagos2** | 0.04 * | 0.02 |
| **dieselus2** | -0.01 | 0.01 |
| **SALM08** | 0.04 | 0.03 |

| R-sqr = 0.85 | | SIC -1603.76 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 *** | 0.02 |
| **W1** | 0.04 | 0.04 |
| **W2** | -0.49 *** | 0.18 |
| **W3** | 0.82 *** | 0.26 |
| **W4** | -0.37 *** | 0.12 |
| **chicago1** | 0.91 *** | 0.02 |
| **chicagos2** | 0.00 | 0.01 |
| **dieselus2** | 0.00 | 0.00 |
| **SALM08** | 0.02 | 0.02 |

| R-sqr = 0.86 | | SIC -1623.53 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 *** | 0.02 |
| **W1** | 0.07 * | 0.04 |
| **W2** | -0.53 *** | 0.17 |
| **W3** | 0.78 *** | 0.26 |
| **W4** | -0.32 *** | 0.12 |
| **chicago1** | 1.09 *** | 0.04 |
| **chicago2** | -0.21 *** | 0.04 |
| **chicagos2** | 0.02 | 0.01 |
| **dieselus2** | 0.00 | 0.00 |
| **SALM08** | 0.02 | 0.02 |

*** Significant at 1%  ** Significant at 5%  * Significant at 10%

## B.2 Estimates for Mexico City

**Order of the Seasonality Polynomial = 8**

**R-sqr 0.83 SIC -1072.22**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.09 * | 0.05 |
| W1 | -0.03 | 0.48 |
| W2 | -3.62 | 9.43 |
| W3 | 73.01 | 72.14 |
| W4 | -388.36 | 273.58 |
| W5 | 920.63 | 568.27 |
| W6 | -1106.00 * | 658.37 |
| W7 | 661.05 * | 399.15 |
| W8 | -156.37 | 98.65 |
| mexico1 | 0.78 *** | 0.04 |
| mexico2 | 0.23 *** | 0.05 |
| mexico3 | -0.09 * | 0.05 |
| mexico4 | -0.06 | 0.04 |
| mexicos1 | 0.02 | 0.01 |
| dieselmx1 | -0.01 | 0.02 |
| SALM08 | 0.03 | 0.03 |

**R-sqr 0.83 SIC -1079.29**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.08 * | 0.05 |
| W1 | -0.06 | 0.47 |
| W2 | -3.28 | 9.41 |
| W3 | 73.43 | 72.11 |
| W4 | -398.19 | 273.48 |
| W5 | 952.42 * | 567.92 |
| W6 | -1151.00 * | 657.74 |
| W7 | 690.99 * | 398.66 |
| W8 | -164.09 * | 98.51 |
| mexico1 | 0.79 *** | 0.04 |
| mexico2 | 0.21 *** | 0.05 |
| mexico3 | -0.14 *** | 0.04 |
| mexicos1 | 0.01 | 0.01 |
| dieselmx1 | -0.01 | 0.02 |
| SALM08 | 0.03 | 0.03 |

**R-sqr 0.83 SIC -1076.34**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.06 | 0.05 |
| W1 | -0.14 | 0.48 |
| W2 | -2.41 | 9.44 |
| W3 | 73.67 | 72.51 |
| W4 | -419.82 | 275.23 |
| W5 | 1027.00 * | 571.65 |
| W6 | -1260.00 * | 662.06 |
| W7 | 764.89 * | 401.25 |
| W8 | -183.38 * | 99.15 |
| mexico1 | 0.78 *** | 0.04 |
| mexico2 | 0.11 *** | 0.04 |
| mexicos1 | 0.01 | 0.01 |
| dieselmx1 | 0.00 | 0.02 |
| SALM08 | 0.04 | 0.03 |

**R-sqr 0.82 SIC -1078.46**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.08 * | 0.05 |
| W1 | -0.07 | 0.47 |
| W2 | -3.78 | 9.41 |
| W3 | 80.03 | 72.42 |
| W4 | -428.69 | 275.28 |
| W5 | 1020.00 * | 572.27 |
| W6 | -1229.00 * | 663.11 |
| W7 | 736.40 * | 402.02 |
| W8 | -174.63 * | 99.36 |
| mexico1 | 0.87 *** | 0.02 |
| mexicos1 | 0.01 | 0.01 |
| dieselmx1 | -0.01 | 0.02 |
| SALM08 | 0.04 | 0.03 |

**R-sqr 0.72 SIC -787.78**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.12 ** | 0.06 |
| W1 | -0.30 | 0.60 |
| W2 | -4.79 | 11.95 |
| W3 | 135.10 | 91.68 |
| W4 | -749.04 ** | 347.66 |
| W5 | 1800.00 ** | 721.70 |
| W6 | -2178.00 *** | 835.73 |
| W7 | 1308.00 *** | 506.57 |
| W8 | -310.88 ** | 125.21 |
| mexico2 | 0.77 *** | 0.03 |
| mexicos1 | 0.03 * | 0.02 |
| dieselmx1 | -0.01 | 0.03 |
| SALM08 | 0.06 | 0.04 |

**R-sqr 0.72 SIC -785.75**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.13 ** | 0.06 |
| W1 | -0.36 | 0.60 |
| W2 | -4.60 | 11.98 |
| W3 | 135.29 | 91.91 |
| W4 | -750.94 ** | 348.39 |
| W5 | 1805.00 ** | 723.06 |
| W6 | -2185.00 *** | 837.20 |
| W7 | 1313.00 *** | 507.42 |
| W8 | -312.43 ** | 125.40 |
| mexico2 | 0.78 *** | 0.03 |
| mexicos2 | 0.02 | 0.02 |
| dieselmx2 | -0.01 | 0.03 |
| SALM08 | 0.06 | 0.04 |

**R-sqr 0.82 SIC -1075.93**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.07 | 0.05 |
| W1 | -0.10 | 0.48 |
| W2 | -3.05 | 9.49 |
| W3 | 75.54 | 72.91 |
| W4 | -415.34 | 276.65 |
| W5 | 997.95 * | 574.41 |
| W6 | -1209.00 * | 665.01 |
| W7 | 726.23 * | 402.91 |
| W8 | -172.57 * | 99.53 |
| mexico1 | 0.87 *** | 0.02 |
| mexicos2 | 0.01 | 0.01 |
| dieselmx2 | 0.00 | 0.02 |
| SALM08 | 0.03 | 0.03 |

**R-sqr 0.83 SIC -1076.35**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.06 | 0.05 |
| W1 | -0.15 | 0.47 |
| W2 | -2.26 | 9.45 |
| W3 | 72.81 | 72.58 |
| W4 | -417.46 | 275.36 |
| W5 | 1024.00 * | 571.81 |
| W6 | -1257.00 * | 662.16 |
| W7 | 763.27 * | 401.28 |
| W8 | -183.05 * | 99.15 |
| mexico1 | 0.78 *** | 0.04 |
| mexico2 | 0.11 *** | 0.04 |
| mexicos2 | 0.01 | 0.01 |
| dieselmx2 | 0.00 | 0.02 |
| SALM08 | 0.04 | 0.03 |

*** Significant at 1%    ** Significant at 5%    * Significant at 10%

**Order of the Seasonality Polynomial = 7**

| R-sqr 0.83 | | SIC -1076.08 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 | 0.05 |
| **W1** | -0.07 | 0.48 |
| **W2** | 4.28 | 8.01 |
| **W3** | -12.31 | 48.09 |
| **W4** | -12.44 | 136.53 |
| **W5** | 76.85 | 199.11 |
| **W6** | -88.04 | 144.17 |
| **W7** | 31.74 | 41.05 |
| **mexico1** | 0.78 *** | 0.04 |
| **mexico2** | 0.23 *** | 0.05 |
| **mexico3** | -0.10 * | 0.05 |
| **mexico4** | -0.06 | 0.04 |
| **mexicos1** | 0.02 | 0.01 |
| **dieselmx1** | -0.01 | 0.02 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.83 | | SIC -1082.90 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.06 | 0.05 |
| **W1** | -0.11 | 0.47 |
| **W2** | 5.06 | 7.97 |
| **W3** | -16.44 | 47.91 |
| **W4** | -2.93 | 136.15 |
| **W5** | 66.01 | 198.67 |
| **W6** | -82.04 | 143.90 |
| **W7** | 30.44 | 40.99 |
| **mexico1** | 0.79 *** | 0.04 |
| **mexico2** | 0.21 *** | 0.05 |
| **mexico3** | -0.14 *** | 0.04 |
| **mexicos1** | 0.01 | 0.01 |
| **dieselmx1** | 0.00 | 0.02 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.82 | | SIC -1079.30 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.04 | 0.05 |
| **W1** | -0.19 | 0.48 |
| **W2** | 6.95 | 7.99 |
| **W3** | -26.96 | 48.02 |
| **W4** | 22.36 | 136.63 |
| **W5** | 36.19 | 199.52 |
| **W6** | -65.01 | 144.60 |
| **W7** | 26.66 | 41.20 |
| **mexico1** | 0.78 *** | 0.04 |
| **mexico2** | 0.10 ** | 0.04 |
| **mexicos1** | 0.01 | 0.01 |
| **dieselmx1** | 0.00 | 0.02 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.82 | | SIC -1081.76 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.06 | 0.05 |
| **W1** | -0.12 | 0.47 |
| **W2** | 5.11 | 7.95 |
| **W3** | -15.65 | 47.83 |
| **W4** | -8.02 | 136.20 |
| **W5** | 76.81 | 199.07 |
| **W6** | -91.69 | 144.38 |
| **W7** | 33.56 | 41.16 |
| **mexico1** | 0.87 *** | 0.02 |
| **mexicos1** | 0.01 | 0.01 |
| **dieselmx1** | 0.00 | 0.02 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.72 | | SIC -787.98 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 | 0.06 |
| **W1** | -0.39 | 0.60 |
| **W2** | 11.13 | 10.12 |
| **W3** | -35.58 | 60.91 |
| **W4** | 0.30 | 173.30 |
| **W5** | 121.05 | 253.02 |
| **W6** | -153.57 | 183.33 |
| **W7** | 57.06 | 52.22 |
| **mexico2** | 0.77 *** | 0.03 |
| **mexicos1** | 0.03 * | 0.02 |
| **dieselmx1** | 0.00 | 0.03 |
| **SALM08** | 0.05 | 0.04 |

| R-sqr 0.72 | | SIC -785.90 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 | 0.06 |
| **W1** | -0.45 | 0.60 |
| **W2** | 11.42 | 10.16 |
| **W3** | -36.37 | 61.09 |
| **W4** | 2.49 | 173.71 |
| **W5** | 116.86 | 253.52 |
| **W6** | -149.65 | 183.65 |
| **W7** | 55.70 | 52.30 |
| **mexico2** | 0.78 *** | 0.03 |
| **mexicos2** | 0.02 | 0.02 |
| **dieselmx2** | 0.00 | 0.03 |
| **SALM08** | 0.05 | 0.04 |

| R-sqr 0.82 | | SIC -1079.31 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.05 | 0.05 |
| **W1** | -0.15 | 0.48 |
| **W2** | 5.81 | 8.01 |
| **W3** | -19.46 | 48.18 |
| **W4** | 1.58 | 137.03 |
| **W5** | 64.19 | 200.09 |
| **W6** | -83.30 | 145.03 |
| **W7** | 31.32 | 41.32 |
| **mexico1** | 0.87 *** | 0.02 |
| **mexicos2** | 0.01 | 0.01 |
| **dieselmx2** | 0.00 | 0.02 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.82 | | SIC -1079.32 |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.04 | 0.05 |
| **W1** | -0.20 | 0.47 |
| **W2** | 7.10 | 8.00 |
| **W3** | -27.71 | 48.08 |
| **W4** | 24.11 | 136.72 |
| **W5** | 34.04 | 199.58 |
| **W6** | -63.65 | 144.61 |
| **W7** | 26.31 | 41.19 |
| **mexico1** | 0.78 *** | 0.04 |
| **mexico2** | 0.10 ** | 0.04 |
| **mexicos2** | 0.01 | 0.01 |
| **dieselmx2** | 0.00 | 0.02 |
| **SALM08** | 0.03 | 0.03 |

*** Significant at 1%  ** Significant at 5%  * Significant at 10%

**Order of the Seasonality Polynomial = 6**

| R-sqr 0.83 | SIC -1081.91 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.07 | 0.05 |
| W1 | -0.40 * | 0.21 |
| W2 | 10.21 *** | 2.32 |
| W3 | -48.72 *** | 9.75 |
| W4 | 92.14 *** | 18.53 |
| W5 | -76.57 *** | 16.23 |
| W6 | 23.34 *** | 5.33 |
| mexico1 | 0.79 *** | 0.04 |
| mexico2 | 0.23 *** | 0.05 |
| mexico3 | -0.10 * | 0.05 |
| mexico4 | -0.06 | 0.04 |
| mexicos1 | 0.02 | 0.01 |
| dieselmx1 | -0.01 | 0.02 |
| SALM08 | 0.03 | 0.03 |

| R-sqr 0.83 | SIC -1088.77 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.06 | 0.05 |
| W1 | -0.43 ** | 0.21 |
| W2 | 10.74 *** | 2.29 |
| W3 | -51.31 *** | 9.59 |
| W4 | 97.29 *** | 18.21 |
| W5 | -81.08 *** | 15.95 |
| W6 | 24.77 *** | 5.25 |
| mexico1 | 0.80 *** | 0.04 |
| mexico2 | 0.21 *** | 0.05 |
| mexico3 | -0.14 *** | 0.04 |
| mexicos1 | 0.01 | 0.01 |
| dieselmx1 | 0.00 | 0.02 |
| SALM08 | 0.03 | 0.03 |

| R-sqr 0.82 | SIC -1085.31 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.04 | 0.05 |
| W1 | -0.47 ** | 0.21 |
| W2 | 11.90 *** | 2.27 |
| W3 | -57.43 *** | 9.48 |
| W4 | 110.02 *** | 17.96 |
| W5 | -92.54 *** | 15.73 |
| W6 | 28.52 *** | 5.18 |
| mexico1 | 0.78 *** | 0.04 |
| mexico2 | 0.11 *** | 0.04 |
| mexicos1 | 0.01 | 0.01 |
| dieselmx1 | 0.00 | 0.02 |
| SALM08 | 0.03 | 0.03 |

| R-sqr 0.82 | SIC -1087.52 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.06 | 0.05 |
| W1 | -0.46 ** | 0.21 |
| W2 | 11.32 *** | 2.27 |
| W3 | -53.89 *** | 9.41 |
| W4 | 102.09 *** | 17.75 |
| W5 | -85.02 *** | 15.52 |
| W6 | 25.96 *** | 5.10 |
| mexico1 | 0.87 *** | 0.02 |
| mexicos1 | 0.01 | 0.01 |
| dieselmx1 | 0.00 | 0.02 |
| SALM08 | 0.03 | 0.03 |

| R-sqr 0.72 | SIC -793.20 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.08 | 0.06 |
| W1 | -0.99 *** | 0.26 |
| W2 | 21.76 *** | 2.81 |
| W3 | -100.90 *** | 11.70 |
| W4 | 188.11 *** | 22.22 |
| W5 | -154.62 *** | 19.55 |
| W6 | 46.64 *** | 6.46 |
| mexico2 | 0.78 *** | 0.03 |
| mexicos1 | 0.03 * | 0.02 |
| dieselmx1 | 0.00 | 0.03 |
| SALM08 | 0.05 | 0.04 |

| R-sqr 0.72 | SIC -791.18 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.08 | 0.06 |
| W1 | -1.03 *** | 0.26 |
| W2 | 21.80 *** | 2.85 |
| W3 | -100.18 *** | 11.93 |
| W4 | 185.90 *** | 22.65 |
| W5 | -152.28 *** | 19.87 |
| W6 | 45.79 *** | 6.55 |
| mexico2 | 0.79 *** | 0.03 |
| mexicos2 | 0.02 | 0.02 |
| dieselmx2 | 0.00 | 0.03 |
| SALM08 | 0.05 | 0.04 |

| R-sqr 0.82 | SIC -1085.16 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.05 | 0.05 |
| W1 | -0.48 ** | 0.21 |
| W2 | 11.63 *** | 2.30 |
| W3 | -55.24 *** | 9.62 |
| W4 | 104.52 *** | 18.15 |
| W5 | -86.98 *** | 15.82 |
| W6 | 26.55 *** | 5.19 |
| mexico1 | 0.87 *** | 0.02 |
| mexicos2 | 0.01 | 0.01 |
| dieselmx2 | 0.00 | 0.02 |
| SALM08 | 0.03 | 0.03 |

| R-sqr 0.82 | SIC -1085.34 | |
|---|---|---|
| Variable | Estimate | Std Error |
| Intercept | 0.04 | 0.05 |
| W1 | -0.48 ** | 0.21 |
| W2 | 11.99 *** | 2.30 |
| W3 | -57.81 *** | 9.63 |
| W4 | 110.67 *** | 18.23 |
| W5 | -93.05 *** | 15.93 |
| W6 | 28.67 *** | 5.23 |
| mexico1 | 0.78 *** | 0.04 |
| mexico2 | 0.10 ** | 0.04 |
| mexicos2 | 0.01 | 0.01 |
| dieselmx2 | 0.00 | 0.02 |
| SALM08 | 0.03 | 0.03 |

*** Significant at 1%  ** Significant at 5%  * Significant at 10%

**Order of the Seasonality Polynomial = 5**

| R-sqr 0.82 | SIC -1069.09 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.12 | *** | 0.05 |
| **W1** | -0.38 | * | 0.21 |
| **W2** | 4.10 | ** | 1.88 |
| **W3** | -12.99 | ** | 5.42 |
| **W4** | 15.60 | ** | 6.25 |
| **W5** | -6.33 | ** | 2.50 |
| **mexico1** | 0.82 | *** | 0.04 |
| **mexico2** | 0.23 | *** | 0.05 |
| **mexico3** | -0.11 | ** | 0.05 |
| **mexico4** | -0.09 | ** | 0.04 |
| **mexicos1** | 0.01 | | 0.01 |
| **dieselmx1** | -0.01 | | 0.02 |
| **SALM08** | 0.02 | | 0.03 |

| R-sqr 0.82 | SIC -1072.92 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.12 | ** | 0.05 |
| **W1** | -0.43 | ** | 0.21 |
| **W2** | 4.36 | ** | 1.88 |
| **W3** | -13.65 | ** | 5.42 |
| **W4** | 16.36 | *** | 6.24 |
| **W5** | -6.64 | *** | 2.49 |
| **mexico1** | 0.83 | *** | 0.04 |
| **mexico2** | 0.21 | *** | 0.05 |
| **mexico3** | -0.18 | *** | 0.04 |
| **mexicos1** | 0.00 | | 0.01 |
| **dieselmx1** | -0.01 | | 0.02 |
| **SALM08** | 0.02 | | 0.03 |

| R-sqr 0.82 | SIC -1061.65 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.10 | ** | 0.05 |
| **W1** | -0.49 | ** | 0.21 |
| **W2** | 4.66 | ** | 1.90 |
| **W3** | -14.33 | *** | 5.48 |
| **W4** | 17.12 | *** | 6.32 |
| **W5** | -6.97 | *** | 2.53 |
| **mexico1** | 0.82 | *** | 0.04 |
| **mexico2** | 0.07 | | 0.04 |
| **mexicos1** | -0.01 | | 0.01 |
| **dieselmx1** | -0.01 | | 0.02 |
| **SALM08** | 0.02 | | 0.03 |

| R-sqr 0.81 | SIC -1068.24 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.11 | ** | 0.05 |
| **W1** | -0.49 | ** | 0.21 |
| **W2** | 4.72 | ** | 1.90 |
| **W3** | -14.59 | *** | 5.47 |
| **W4** | 17.44 | *** | 6.31 |
| **W5** | -7.09 | *** | 2.52 |
| **mexico1** | 0.88 | *** | 0.02 |
| **mexicos1** | -0.01 | | 0.01 |
| **dieselmx1** | -0.01 | | 0.02 |
| **SALM08** | 0.02 | | 0.03 |

| R-sqr 0.69 | SIC -748.92 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.19 | *** | 0.06 |
| **W1** | -1.06 | *** | 0.27 |
| **W2** | 10.37 | *** | 2.42 |
| **W3** | -31.80 | *** | 6.99 |
| **W4** | 37.83 | *** | 8.05 |
| **W5** | -15.33 | *** | 3.22 |
| **mexico2** | 0.77 | *** | 0.03 |
| **mexicos1** | 0.00 | | 0.02 |
| **dieselmx1** | -0.01 | | 0.03 |
| **SALM08** | 0.02 | | 0.04 |

| R-sqr 0.69 | SIC -749.92 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.19 | *** | 0.06 |
| **W1** | -1.08 | *** | 0.27 |
| **W2** | 10.29 | *** | 2.42 |
| **W3** | -31.34 | *** | 6.99 |
| **W4** | 37.20 | *** | 8.06 |
| **W5** | -15.07 | *** | 3.22 |
| **mexico2** | 0.78 | *** | 0.03 |
| **mexicos2** | -0.02 | | 0.02 |
| **dieselmx2** | -0.01 | | 0.03 |
| **SALM08** | 0.02 | | 0.04 |

| R-sqr 0.81 | SIC -1065.55 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.10 | ** | 0.05 |
| **W1** | -0.48 | ** | 0.21 |
| **W2** | 4.66 | ** | 1.90 |
| **W3** | -14.38 | *** | 5.49 |
| **W4** | 17.20 | *** | 6.33 |
| **W5** | -6.99 | *** | 2.53 |
| **mexico1** | 0.88 | *** | 0.02 |
| **mexicos2** | -0.01 | | 0.01 |
| **dieselmx2** | 0.00 | | 0.02 |
| **SALM08** | 0.02 | | 0.03 |

| R-sqr 0.82 | SIC -1061.94 | | |
|---|---|---|---|
| **Variable** | **Estimate** | | **Std Error** |
| **Intercept** | 0.10 | ** | 0.05 |
| **W1** | -0.48 | ** | 0.21 |
| **W2** | 4.53 | ** | 1.90 |
| **W3** | -13.93 | ** | 5.49 |
| **W4** | 16.66 | *** | 6.33 |
| **W5** | -6.78 | *** | 2.53 |
| **mexico1** | 0.82 | *** | 0.04 |
| **mexico2** | 0.07 | * | 0.04 |
| **mexicos2** | -0.01 | | 0.01 |
| **dieselmx2** | 0.00 | | 0.02 |
| **SALM08** | 0.02 | | 0.03 |

*** Significant at 1%   ** Significant at 5%   * Significant at 10%

**Order of the Seasonality Polynomial = 4**

| R-sqr 0.82 | SIC -1069.03 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 ** | 0.05 |
| **W1** | 0.13 ** | 0.07 |
| **W2** | -0.62 ** | 0.27 |
| **W3** | 0.71 ** | 0.40 |
| **W4** | -0.23 | 0.19 |
| **mexico1** | 0.83 *** | 0.04 |
| **mexico2** | 0.24 *** | 0.05 |
| **mexico3** | -0.10 ** | 0.05 |
| **mexico4** | -0.10 ** | 0.04 |
| **mexicos1** | 0.01 | 0.01 |
| **dieselmx1** | -0.01 | 0.02 |
| **SALM08** | 0.01 | 0.03 |

| R-sqr 0.82 | SIC -1072.19 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.10 ** | 0.05 |
| **W1** | 0.11 * | 0.07 |
| **W2** | -0.58 ** | 0.27 |
| **W3** | 0.73 * | 0.40 |
| **W4** | -0.26 | 0.19 |
| **mexico1** | 0.85 *** | 0.04 |
| **mexico2** | 0.22 *** | 0.05 |
| **mexico3** | -0.19 *** | 0.04 |
| **mexicos1** | 0.00 | 0.01 |
| **dieselmx1** | -0.01 | 0.02 |
| **SALM08** | 0.01 | 0.03 |

| R-sqr 0.81 | SIC -1060.41 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 * | 0.05 |
| **W1** | 0.07 | 0.07 |
| **W2** | -0.52 * | 0.28 |
| **W3** | 0.76 * | 0.40 |
| **W4** | -0.31 * | 0.19 |
| **mexico1** | 0.84 *** | 0.04 |
| **mexico2** | 0.07 * | 0.04 |
| **mexicos1** | -0.01 | 0.01 |
| **dieselmx1** | 0.00 | 0.02 |
| **SALM08** | 0.01 | 0.03 |

| R-sqr 0.81 | SIC -1066.73 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 ** | 0.05 |
| **W1** | 0.09 | 0.07 |
| **W2** | -0.55 ** | 0.28 |
| **W3** | 0.75 * | 0.40 |
| **W4** | -0.29 | 0.19 |
| **mexico1** | 0.90 *** | 0.02 |
| **mexicos1** | -0.01 | 0.01 |
| **dieselmx1** | 0.00 | 0.02 |
| **SALM08** | 0.01 | 0.03 |

| R-sqr = 0.68 | SIC -732.75 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.15 ** | 0.06 |
| **W1** | 0.18 ** | 0.09 |
| **W2** | -1.06 *** | 0.36 |
| **W3** | 1.42 *** | 0.52 |
| **W4** | -0.53 ** | 0.24 |
| **mexico2** | 0.81 *** | 0.03 |
| **mexicos1** | 0.00 | 0.02 |
| **dieselmx1** | -0.01 | 0.03 |
| **SALM08** | 0.01 | 0.04 |

| R-sqr = 0.68 | SIC -734.54 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.16 *** | 0.06 |
| **W1** | 0.13 | 0.08 |
| **W2** | -0.91 ** | 0.36 |
| **W3** | 1.30 ** | 0.52 |
| **W4** | -0.52 ** | 0.24 |
| **mexico2** | 0.83 *** | 0.03 |
| **mexicos2** | -0.02 | 0.02 |
| **dieselmx2** | -0.01 | 0.03 |
| **SALM08** | 0.01 | 0.04 |

| R-sqr = 0.81 | SIC -1064.30 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.09 * | 0.05 |
| **W1** | 0.08 | 0.06 |
| **W2** | -0.53 * | 0.27 |
| **W3** | 0.74 * | 0.40 |
| **W4** | -0.29 | 0.19 |
| **mexico1** | 0.90 *** | 0.02 |
| **mexicos2** | -0.01 | 0.01 |
| **dieselmx2** | 0.00 | 0.02 |
| **SALM08** | 0.01 | 0.03 |

| R-sqr = 0.81 | SIC -1061.12 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.08 * | 0.05 |
| **W1** | 0.06 | 0.07 |
| **W2** | -0.50 * | 0.27 |
| **W3** | 0.75 * | 0.40 |
| **W4** | -0.31 * | 0.19 |
| **mexico1** | 0.84 *** | 0.04 |
| **mexico2** | 0.07 * | 0.04 |
| **mexicos2** | -0.02 | 0.01 |
| **dieselmx2** | 0.00 | 0.02 |
| **SALM08** | 0.01 | 0.03 |

*** Significant at 1% ** Significant at 5% * Significant at 10%

## B.3 Estimates for San Francisco

**Order of the Seasonality Polynomial = 8**

R-sqr 0.88 SIC -1273.06

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.05 | * | 0.03 |
| W1 | 0.08 | | 0.41 |
| W2 | 6.72 | | 8.11 |
| W3 | -56.23 | | 61.95 |
| W4 | 211.50 | | 234.74 |
| W5 | -461.45 | | 487.51 |
| W6 | 588.30 | | 564.79 |
| W7 | -398.06 | | 342.39 |
| W8 | 109.13 | | 84.61 |
| sf1 | 0.99 | *** | 0.04 |
| sf2 | -0.22 | *** | 0.06 |
| sf3 | 0.13 | ** | 0.06 |
| sf4 | -0.03 | | 0.04 |
| sfs1 | 0.03 | * | 0.02 |
| dieselus1 | -0.01 | * | 0.01 |
| SALM08 | 0.04 | * | 0.03 |

R-sqr 0.88 SIC -1282.12

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.05 | * | 0.03 |
| W1 | 0.04 | | 0.41 |
| W2 | 7.62 | | 8.01 |
| W3 | -62.12 | | 61.32 |
| W4 | 230.27 | | 232.88 |
| W5 | -494.44 | | 484.39 |
| W6 | 621.07 | | 561.73 |
| W7 | -415.27 | | 340.75 |
| W8 | 112.84 | | 84.24 |
| sf1 | 0.99 | *** | 0.04 |
| sf2 | -0.22 | *** | 0.06 |
| sf3 | 0.10 | ** | 0.04 |
| sfs1 | 0.03 | * | 0.02 |
| dieselus1 | -0.01 | | 0.01 |
| SALM08 | 0.04 | * | 0.03 |

R-sqr 0.87 SIC -1285.08

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.06 | ** | 0.03 |
| W1 | 0.09 | | 0.40 |
| W2 | 5.57 | | 7.96 |
| W3 | -45.30 | | 61.03 |
| W4 | 167.56 | | 232.07 |
| W5 | -368.28 | | 483.22 |
| W6 | 479.09 | | 560.77 |
| W7 | -331.20 | | 340.33 |
| W8 | 92.47 | | 84.17 |
| sf1 | 0.98 | *** | 0.04 |
| sf2 | -0.12 | *** | 0.04 |
| sfs1 | 0.03 | ** | 0.02 |
| dieselus1 | -0.01 | * | 0.01 |
| SALM08 | 0.04 | | 0.03 |

R-sqr 0.87 SIC -1285.88

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.05 | * | 0.03 |
| W1 | 0.06 | | 0.40 |
| W2 | 7.73 | | 7.93 |
| W3 | -64.69 | | 60.82 |
| W4 | 243.20 | | 231.46 |
| W5 | -525.43 | | 482.30 |
| W6 | 660.47 | | 560.01 |
| W7 | -440.89 | | 340.00 |
| W8 | 119.54 | | 84.10 |
| sf1 | 0.88 | *** | 0.02 |
| sfs1 | 0.03 | * | 0.02 |
| dieselus1 | -0.01 | * | 0.01 |
| SALM08 | 0.04 | * | 0.03 |

R-sqr 0.76 SIC -881.96

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.06 | * | 0.04 |
| W1 | -0.22 | | 0.56 |
| W2 | 18.19 | * | 11.02 |
| W3 | -131.25 | | 84.51 |
| W4 | 447.74 | | 321.54 |
| W5 | -903.30 | | 669.64 |
| W6 | 1090.00 | | 777.14 |
| W7 | -711.23 | | 471.63 |
| W8 | 190.53 | | 116.63 |
| sf2 | 0.70 | *** | 0.03 |
| sfs1 | 0.11 | *** | 0.02 |
| dieselus1 | -0.01 | | 0.01 |
| SALM08 | 0.08 | ** | 0.04 |

R-sqr 0.75 SIC -858.79

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.11 | *** | 0.04 |
| W1 | -0.38 | | 0.57 |
| W2 | 20.55 | * | 11.22 |
| W3 | -151.62 | * | 85.99 |
| W4 | 539.06 | * | 327.00 |
| W5 | -1117.00 | | 680.71 |
| W6 | 1356.00 | * | 789.74 |
| W7 | -878.13 | * | 479.18 |
| W8 | 232.07 | * | 118.49 |
| sf2 | 0.75 | *** | 0.03 |
| sfs2 | 0.05 | ** | 0.02 |
| dieselus2 | -0.02 | *** | 0.01 |
| SALM08 | 0.09 | ** | 0.04 |

R-sqr 0.87 SIC -1280.89

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.06 | ** | 0.03 |
| W1 | 0.05 | | 0.41 |
| W2 | 7.50 | | 8.00 |
| W3 | -64.06 | | 61.24 |
| W4 | 246.97 | | 232.59 |
| W5 | -543.86 | | 483.94 |
| W6 | 690.63 | | 561.34 |
| W7 | -462.68 | | 340.58 |
| W8 | 125.45 | | 84.22 |
| sf1 | 0.89 | *** | 0.02 |
| sfs2 | 0.01 | | 0.02 |
| dieselus2 | -0.01 | ** | 0.01 |
| SALM08 | 0.05 | * | 0.03 |

R-sqr 0.87 SIC -1283.22

| Variable | Estimate | | Std Error |
|---|---|---|---|
| Intercept | 0.07 | ** | 0.03 |
| W1 | 0.06 | | 0.40 |
| W2 | 6.00 | | 7.97 |
| W3 | -48.78 | | 61.08 |
| W4 | 183.22 | | 232.17 |
| W5 | -405.71 | | 483.23 |
| W6 | 526.74 | | 560.64 |
| W7 | -361.74 | | 340.21 |
| W8 | 100.22 | | 84.13 |
| sf1 | 0.99 | *** | 0.04 |
| sf2 | -0.12 | *** | 0.04 |
| sfs2 | 0.02 | | 0.02 |
| dieselus2 | -0.01 | ** | 0.01 |
| SALM08 | 0.05 | * | 0.03 |

*** Significant at 1% ** Significant at 5% * Significant at 10%

**Order of the Seasonality Polynomial = 7**

**R-sqr 0.88 SIC -1277.79**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.06 ** | 0.03 |
| W1 | 0.12 | 0.41 |
| W2 | 1.05 | 6.82 |
| W3 | 4.11 | 40.64 |
| W4 | -52.56 | 114.93 |
| W5 | 129.22 | 167.32 |
| W6 | -123.26 | 121.12 |
| W7 | 41.33 | 34.51 |
| sf1 | 1.00 *** | 0.04 |
| sf2 | -0.22 *** | 0.06 |
| sf3 | 0.13 ** | 0.06 |
| sf4 | -0.03 | 0.04 |
| sfs1 | 0.03 ** | 0.02 |
| dieselus1 | -0.01 * | 0.01 |
| SALM08 | 0.05 * | 0.03 |

**R-sqr 0.87 SIC -1286.73**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.06 ** | 0.03 |
| W1 | 0.07 | 0.40 |
| W2 | 1.82 | 6.74 |
| W3 | -0.13 | 40.24 |
| W4 | -41.79 | 114.00 |
| W5 | 115.07 | 166.16 |
| W6 | -113.89 | 120.38 |
| W7 | 38.84 | 34.32 |
| sf1 | 0.99 *** | 0.04 |
| sf2 | -0.22 *** | 0.06 |
| sf3 | 0.10 ** | 0.04 |
| sfs1 | 0.03 ** | 0.02 |
| dieselus1 | -0.01 * | 0.01 |
| SALM08 | 0.05 * | 0.03 |

**R-sqr 0.87 SIC -1290.29**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.07 *** | 0.02 |
| W1 | 0.12 | 0.40 |
| W2 | 0.87 | 6.72 |
| W3 | 5.22 | 40.13 |
| W4 | -54.69 | 113.76 |
| W5 | 130.35 | 165.93 |
| W6 | -122.69 | 120.28 |
| W7 | 40.82 | 34.30 |
| sf1 | 0.98 *** | 0.04 |
| sf2 | -0.12 *** | 0.04 |
| sfs1 | 0.03 ** | 0.02 |
| dieselus1 | -0.01 * | 0.01 |
| SALM08 | 0.05 * | 0.03 |

**R-sqr 0.87 SIC -1290.27**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.06 ** | 0.02 |
| W1 | 0.09 | 0.40 |
| W2 | 1.72 | 6.72 |
| W3 | 0.28 | 40.16 |
| W4 | -43.27 | 113.92 |
| W5 | 118.17 | 166.24 |
| W6 | -116.89 | 120.53 |
| W7 | 39.90 | 34.38 |
| sf1 | 0.88 *** | 0.02 |
| sfs1 | 0.03 * | 0.02 |
| dieselus1 | -0.01 * | 0.01 |
| SALM08 | 0.05 * | 0.03 |

**R-sqr 0.76 SIC -885.68**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.08 ** | 0.03 |
| W1 | -0.17 | 0.56 |
| W2 | 8.55 | 9.32 |
| W3 | -27.31 | 55.70 |
| W4 | -9.97 | 157.99 |
| W5 | 124.04 | 230.47 |
| W6 | -150.47 | 167.05 |
| W7 | 55.33 | 47.63 |
| sf2 | 0.70 *** | 0.03 |
| sfs1 | 0.12 *** | 0.02 |
| dieselus1 | -0.01 | 0.01 |
| SALM08 | 0.09 ** | 0.04 |

**R-sqr 0.75 SIC -861.34**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.13 *** | 0.04 |
| W1 | -0.32 | 0.57 |
| W2 | 8.82 | 9.51 |
| W3 | -24.96 | 56.81 |
| W4 | -18.66 | 161.11 |
| W5 | 134.41 | 235.03 |
| W6 | -154.85 | 170.39 |
| W7 | 55.56 | 48.59 |
| sf2 | 0.75 *** | 0.03 |
| sfs2 | 0.05 ** | 0.02 |
| dieselus2 | -0.02 *** | 0.01 |
| SALM08 | 0.09 ** | 0.04 |

**R-sqr 0.87 SIC -1285.07**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.07 *** | 0.03 |
| W1 | 0.09 | 0.41 |
| W2 | 1.14 | 6.78 |
| W3 | 4.45 | 40.47 |
| W4 | -54.51 | 114.73 |
| W5 | 132.63 | 167.37 |
| W6 | -125.82 | 121.34 |
| W7 | 42.03 | 34.61 |
| sf1 | 0.89 *** | 0.02 |
| sfs2 | 0.01 | 0.02 |
| dieselus2 | -0.01 ** | 0.01 |
| SALM08 | 0.05 * | 0.03 |

**R-sqr 0.87 SIC -1288.21**

| Variable | Estimate | Std Error |
|---|---|---|
| Intercept | 0.07 *** | 0.03 |
| W1 | 0.08 | 0.40 |
| W2 | 0.91 | 6.73 |
| W3 | 6.01 | 40.20 |
| W4 | -57.77 | 113.95 |
| W5 | 134.82 | 166.23 |
| W6 | -125.51 | 120.51 |
| W7 | 41.46 | 34.37 |
| sf1 | 1.00 *** | 0.04 |
| sf2 | -0.13 *** | 0.04 |
| sfs2 | 0.02 | 0.02 |
| dieselus2 | -0.01 ** | 0.01 |
| SALM08 | 0.05 * | 0.03 |

*** Significant at 1% ** Significant at 5% * Significant at 10%

**Order of the Seasonality Polynomial = 6**

| R-sqr 0.87 | SIC -1282.76 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.06 ** | 0.03 |
| **W1** | -0.33 * | 0.18 |
| **W2** | 8.87 *** | 1.97 |
| **W3** | -43.52 *** | 8.34 |
| **W4** | 83.75 *** | 15.89 |
| **W5** | -70.45 *** | 13.94 |
| **W6** | 21.68 *** | 4.58 |
| **sf1** | 1.00 *** | 0.04 |
| **sf2** | -0.23 *** | 0.06 |
| **sf3** | 0.13 ** | 0.06 |
| **sf4** | -0.03 | 0.04 |
| **sfs1** | 0.03 ** | 0.02 |
| **dieselus1** | -0.01 * | 0.01 |
| **SALM08** | 0.04 * | 0.03 |

| R-sqr 0.87 | SIC -1291.86 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.06 ** | 0.03 |
| **W1** | -0.34 * | 0.17 |
| **W2** | 9.13 *** | 1.94 |
| **W3** | -44.72 *** | 8.16 |
| **W4** | 86.01 *** | 15.55 |
| **W5** | -72.32 *** | 13.66 |
| **W6** | 22.25 *** | 4.50 |
| **sf1** | 0.99 *** | 0.04 |
| **sf2** | -0.22 *** | 0.06 |
| **sf3** | 0.10 ** | 0.04 |
| **sfs1** | 0.03 ** | 0.02 |
| **dieselus1** | -0.01 * | 0.01 |
| **SALM08** | 0.04 * | 0.03 |

| R-sqr 0.87 | SIC -1295.29 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 *** | 0.02 |
| **W1** | -0.32 * | 0.17 |
| **W2** | 8.53 *** | 1.92 |
| **W3** | -41.56 *** | 8.06 |
| **W4** | 79.45 *** | 15.34 |
| **W5** | -66.45 *** | 13.48 |
| **W6** | 20.35 *** | 4.44 |
| **sf1** | 0.98 *** | 0.04 |
| **sf2** | -0.12 *** | 0.04 |
| **sfs1** | 0.03 ** | 0.02 |
| **dieselus1** | -0.01 * | 0.01 |
| **SALM08** | 0.04 | 0.03 |

| R-sqr 0.87 | SIC -1295.34 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.05 ** | 0.02 |
| **W1** | -0.33 * | 0.18 |
| **W2** | 9.20 *** | 1.92 |
| **W3** | -45.40 *** | 8.01 |
| **W4** | 87.78 *** | 15.18 |
| **W5** | -74.15 *** | 13.32 |
| **W6** | 22.91 *** | 4.39 |
| **sf1** | 0.88 *** | 0.02 |
| **sfs1** | 0.03 * | 0.02 |
| **dieselus1** | -0.01 * | 0.01 |
| **SALM08** | 0.04 * | 0.03 |

| R-sqr 0.76 | SIC -890.75 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 ** | 0.03 |
| **W1** | -0.76 *** | 0.24 |
| **W2** | 18.95 *** | 2.60 |
| **W3** | -90.78 *** | 10.83 |
| **W4** | 171.99 *** | 20.62 |
| **W5** | -142.85 *** | 18.19 |
| **W6** | 43.46 *** | 6.02 |
| **sf2** | 0.70 *** | 0.03 |
| **sfs1** | 0.12 *** | 0.02 |
| **dieselus1** | -0.01 | 0.01 |
| **SALM08** | 0.08 ** | 0.04 |

| R-sqr 0.75 | SIC -866.44 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.13 *** | 0.04 |
| **W1** | -0.91 *** | 0.24 |
| **W2** | 19.24 *** | 2.70 |
| **W3** | -88.61 *** | 11.34 |
| **W4** | 163.88 *** | 21.61 |
| **W5** | -133.44 *** | 19.01 |
| **W6** | 39.84 *** | 6.27 |
| **sf2** | 0.75 *** | 0.03 |
| **sfs2** | 0.05 ** | 0.02 |
| **dieselus2** | -0.02 *** | 0.01 |
| **SALM08** | 0.09 ** | 0.04 |

| R-sqr 0.87 | SIC -1290.01 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 *** | 0.03 |
| **W1** | -0.36 ** | 0.18 |
| **W2** | 9.02 *** | 1.97 |
| **W3** | -43.67 *** | 8.27 |
| **W4** | 83.51 *** | 15.69 |
| **W5** | -69.93 *** | 13.73 |
| **W6** | 21.43 *** | 4.51 |
| **sf1** | 0.89 *** | 0.02 |
| **sfs2** | 0.01 | 0.02 |
| **dieselus2** | -0.01 ** | 0.01 |
| **SALM08** | 0.05 * | 0.03 |

| R-sqr 0.87 | SIC -1293.17 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.07 *** | 0.03 |
| **W1** | -0.35 ** | 0.17 |
| **W2** | 8.67 *** | 1.95 |
| **W3** | -41.44 *** | 8.24 |
| **W4** | 78.36 *** | 15.67 |
| **W5** | -64.98 *** | 13.73 |
| **W6** | 19.73 *** | 4.51 |
| **sf1** | 1.00 *** | 0.04 |
| **sf2** | -0.13 *** | 0.04 |
| **sfs2** | 0.02 | 0.02 |
| **dieselus2** | -0.01 ** | 0.01 |
| **SALM08** | 0.04 * | 0.03 |

*** Significant at 1%   ** Significant at 5%   * Significant at 10%

**Order of the Seasonality Polynomial = 5**

| R-sqr 0.87 | SIC -1266.74 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.30 * | 0.18 |
| **W2** | 3.18 ** | 1.59 |
| **W3** | -10.33 ** | 4.60 |
| **W4** | 12.65 ** | 5.31 |
| **W5** | -5.19 ** | 2.12 |
| **sf1** | 1.04 *** | 0.04 |
| **sf2** | -0.23 *** | 0.06 |
| **sf3** | 0.13 ** | 0.06 |
| **sf4** | -0.06 | 0.04 |
| **sfs1** | 0.01 | 0.02 |
| **dieselus1** | -0.01 ** | 0.01 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.87 | SIC -1273.87 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.34 * | 0.18 |
| **W2** | 3.43 ** | 1.58 |
| **W3** | -11.06 ** | 4.58 |
| **W4** | 13.51 ** | 5.28 |
| **W5** | -5.54 *** | 2.11 |
| **sf1** | 1.03 *** | 0.04 |
| **sf2** | -0.22 *** | 0.06 |
| **sf3** | 0.07 | 0.04 |
| **sfs1** | 0.01 | 0.02 |
| **dieselus1** | -0.01 ** | 0.01 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.87 | SIC -1280.76 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.32 * | 0.18 |
| **W2** | 3.37 ** | 1.58 |
| **W3** | -10.91 ** | 4.57 |
| **W4** | 13.31 ** | 5.27 |
| **W5** | -5.45 *** | 2.11 |
| **sf1** | 1.02 *** | 0.04 |
| **sf2** | -0.15 *** | 0.04 |
| **sfs1** | 0.01 | 0.02 |
| **dieselus1** | -0.01 ** | 0.01 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.87 | SIC -1274.72 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.11 *** | 0.02 |
| **W1** | -0.34 * | 0.18 |
| **W2** | 3.40 ** | 1.60 |
| **W3** | -10.92 ** | 4.62 |
| **W4** | 13.35 ** | 5.32 |
| **W5** | -5.49 ** | 2.13 |
| **sf1** | 0.89 *** | 0.02 |
| **sfs1** | 0.00 | 0.02 |
| **dieselus1** | -0.01 ** | 0.01 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.73 | SIC -846.45 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.18 *** | 0.03 |
| **W1** | -0.81 *** | 0.25 |
| **W2** | 8.34 *** | 2.23 |
| **W3** | -26.67 *** | 6.44 |
| **W4** | 32.33 *** | 7.42 |
| **W5** | -13.20 *** | 2.96 |
| **sf2** | 0.70 *** | 0.03 |
| **sfs1** | 0.08 *** | 0.02 |
| **dieselus1** | -0.02 ** | 0.01 |
| **SALM08** | 0.06 | 0.04 |

| R-sqr 0.73 | SIC -833.22 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.23 *** | 0.03 |
| **W1** | -0.92 *** | 0.25 |
| **W2** | 9.16 *** | 2.25 |
| **W3** | -28.72 *** | 6.50 |
| **W4** | 34.55 *** | 7.49 |
| **W5** | -14.07 *** | 2.99 |
| **sf2** | 0.76 *** | 0.03 |
| **sfs2** | 0.01 | 0.02 |
| **dieselus2** | -0.03 *** | 0.01 |
| **SALM08** | 0.06 | 0.04 |

| R-sqr 0.87 | SIC -1273.92 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.12 *** | 0.02 |
| **W1** | -0.35 * | 0.18 |
| **W2** | 3.39 ** | 1.60 |
| **W3** | -10.80 ** | 4.62 |
| **W4** | 13.16 ** | 5.32 |
| **W5** | -5.41 ** | 2.13 |
| **sf1** | 0.91 *** | 0.02 |
| **sfs2** | -0.02 | 0.01 |
| **dieselus2** | -0.01 ** | 0.01 |
| **SALM08** | 0.03 | 0.03 |

| R-sqr 0.87 | SIC -1280.44 | |
|---|---|---|
| **Variable** | **Estimate** | **Std Error** |
| **Intercept** | 0.12 *** | 0.02 |
| **W1** | -0.34 * | 0.18 |
| **W2** | 3.51 ** | 1.58 |
| **W3** | -11.23 ** | 4.57 |
| **W4** | 13.66 *** | 5.27 |
| **W5** | -5.59 *** | 2.11 |
| **sf1** | 1.03 *** | 0.04 |
| **sf2** | -0.15 *** | 0.04 |
| **sfs2** | 0.00 | 0.02 |
| **dieselus2** | -0.01 ** | 0.01 |
| **SALM08** | 0.03 | 0.03 |

*** Significant at 1% ** Significant at 5% * Significant at 10%

**Order of the Seasonality Polynomial = 4**

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.87 | | SIC -1267.11 | |
| Intercept | 0.10 | *** | 0.02 |
| W1 | 0.12 | ** | 0.05 |
| W2 | -0.69 | *** | 0.23 |
| W3 | 0.90 | *** | 0.34 |
| W4 | -0.33 | ** | 0.16 |
| sf1 | 1.05 | *** | 0.04 |
| sf2 | -0.23 | *** | 0.06 |
| sf3 | 0.14 | ** | 0.06 |
| sf4 | -0.07 | * | 0.04 |
| sfs1 | 0.01 | | 0.02 |
| dieselus1 | -0.01 | * | 0.01 |
| SALM08 | 0.02 | | 0.03 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.87 | | SIC -1273.33 | |
| Intercept | 0.09 | *** | 0.02 |
| W1 | 0.11 | ** | 0.05 |
| W2 | -0.69 | *** | 0.22 |
| W3 | 0.94 | *** | 0.34 |
| W4 | -0.36 | ** | 0.16 |
| sf1 | 1.05 | *** | 0.04 |
| sf2 | -0.22 | *** | 0.06 |
| sf3 | 0.06 | | 0.04 |
| sfs1 | 0.01 | | 0.02 |
| dieselus1 | -0.01 | | 0.01 |
| SALM08 | 0.02 | | 0.03 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.87 | | SIC -1280.43 | |
| Intercept | 0.09 | *** | 0.02 |
| W1 | 0.12 | ** | 0.05 |
| W2 | -0.69 | *** | 0.22 |
| W3 | 0.90 | *** | 0.33 |
| W4 | -0.33 | ** | 0.16 |
| sf1 | 1.04 | *** | 0.04 |
| sf2 | -0.15 | *** | 0.04 |
| sfs1 | 0.01 | | 0.02 |
| dieselus1 | -0.01 | | 0.01 |
| SALM08 | 0.02 | | 0.03 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.86 | | SIC -1274.45 | |
| Intercept | 0.09 | *** | 0.02 |
| W1 | 0.10 | * | 0.05 |
| W2 | -0.68 | *** | 0.23 |
| W3 | 0.96 | *** | 0.34 |
| W4 | -0.38 | ** | 0.16 |
| sf1 | 0.91 | *** | 0.02 |
| sfs1 | 0.01 | | 0.02 |
| dieselus1 | -0.01 | | 0.01 |
| SALM08 | 0.02 | | 0.03 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.73 | | SIC -833.08 | |
| Intercept | 0.14 | *** | 0.03 |
| W1 | 0.26 | *** | 0.07 |
| W2 | -1.51 | *** | 0.32 |
| W3 | 1.98 | *** | 0.48 |
| W4 | -0.73 | *** | 0.23 |
| sf2 | 0.73 | *** | 0.03 |
| sfs1 | 0.08 | *** | 0.02 |
| dieselus1 | -0.01 | | 0.01 |
| SALM08 | 0.04 | | 0.04 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.72 | | SIC -817.63 | |
| Intercept | 0.20 | *** | 0.03 |
| W1 | 0.21 | *** | 0.08 |
| W2 | -1.32 | *** | 0.32 |
| W3 | 1.78 | *** | 0.48 |
| W4 | -0.67 | *** | 0.23 |
| sf2 | 0.80 | *** | 0.03 |
| sfs2 | 0.00 | | 0.02 |
| dieselus2 | -0.02 | ** | 0.01 |
| SALM08 | 0.04 | | 0.04 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.87 | | SIC -1273.84 | |
| Intercept | 0.11 | *** | 0.02 |
| W1 | 0.09 | * | 0.05 |
| W2 | -0.63 | *** | 0.23 |
| W3 | 0.91 | *** | 0.34 |
| W4 | -0.37 | ** | 0.16 |
| sf1 | 0.92 | *** | 0.02 |
| sfs2 | -0.02 | | 0.01 |
| dieselus2 | -0.01 | ** | 0.01 |
| SALM08 | 0.02 | | 0.03 |

| Variable | Estimate | | Std Error |
|---|---|---|---|
| R-sqr 0.87 | | SIC -1279.78 | |
| Intercept | 0.11 | *** | 0.02 |
| W1 | 0.11 | ** | 0.05 |
| W2 | -0.64 | *** | 0.22 |
| W3 | 0.86 | ** | 0.33 |
| W4 | -0.32 | ** | 0.16 |
| sf1 | 1.05 | *** | 0.04 |
| sf2 | -0.15 | *** | 0.04 |
| sfs2 | 0.00 | | 0.02 |
| dieselus2 | -0.01 | ** | 0.01 |
| SALM08 | 0.02 | | 0.03 |

*** Significant at 1%    ** Significant at 5%    * Significant at 10%

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