ABSTRACT

We are comparing the Price-Rent ratio of farmland in California with the Price-Earning ratio of Standard & Poor's 500 Index between 2009 and 2016. Using the ratios on average, we find walnut land, citrus land, and wine grape land had been a better investment opportunity than the stock market. In addition, we investigated the factors that influence the farmland values. Our estimation results are consistent with prior research. The farmland price is positively impacted by the production and price of the commodity on the land. The value and the investment prospect of farmland vary across commodities and regions.

Assessing the Investment Prospect of Farmland: Evidence from California

By Xiaowei Cai, Austin Cosgrove, and Jacob Paul

Introduction

Farmland prices in California have seen a steady increase between 2000 and 2016. Much of the increase during this time is stimulated by the ever growing global demand for tree nuts and certain fruits, low interest rates, and infrequent farmland sales. Farmland in California is becoming increasingly attractive to investors since it has generated returns higher than the S&P 500 index (Ifft & Kuethe, 2011). In addition, farmland was not affected by the residential and commercial real estate market (Ifft & Kuethe, 2011).



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Research has been done to compare the farmland investment with the stock market. Zhang and Duffy (2016) compared the returns to farmland in Iowa and the returns to the stock market. They found that farmland in Iowa has shown higher returns than the stock market in the past 50 years. Sahs and Doye (2012) repeated Duffy's method using Oklahoma data. They showed that the returns to the cropland and pastureland in Oklahoma during 1970 and 2012 were significantly less than the stock market. Baker, Boehlje, and Langemeier (2015) examined the two investments in Western Indiana between 1960 and 2015. They found that returns on the farmland are high compared to the stock market. Although these studies were all focused on the farmland in areas where the field crop variety is limited, their conclusions suggest that return to farmland varies by regions.

Different from the states in the middle part of the country, agriculture in California is very diverse. More than 400 different varieties of farm products are grown in this state, ranging from field crops, vegetables, fruits, tree nuts to dairy. An interesting question arises, does farmland in California have better growth opportunities comparing to investment in the stock market? Additionally, because investment prospect on farmland can vary significantly across crops and regions, then what might be the contributing factors on farmland in California?

In the literature, many studies have looked at farmland value to identify determinants for returns to farmland. The hedonic studies used individual land parcel data to explain returns to farmland by parcel characteristics such as land size, location, neighborhood and soil erosion rates, and seller and buyer characteristics (Huang, Miller, Sherrick, and Gomez, 2006; Tsoodle, Golden, and Featherstone, 2006; Mathews & Rex, 2012). Other studies use data in the Midwest or national aggregate data of agricultural land values to measure the effects of climate change and socio-demographic variables on average farmland values (Blank, Erickson, and Hallahan 2012; Weerahewa et. al, 2008; Gloy et al., 2011; Kuethe 2011; Ma & Swinton, 2012; Stephens & Schurle, 2013; Kuethe, Walsh, and Ifft, 2013). However, as far as we know, very few studies have assessed the farmland values in California.

In the present paper, we are addressing two research objectives. First, we compare the investment growth opportunities between the stock market and farmland of five selected commodities in California. These commodities are rice in the northern counties, walnut and citrus in the central valley, wine grape on the central coast, and avocado in the southern counties. Second, we use a linear regression model to identify the main factors contributing to the farmland value of those five selected commodities. We are interested in understanding the effects of commodity production, price, and input cost on the value of farmland.

The five commodities of various regions were selected because they account for a vast majority of the gross value of crop productions in California. In 2015, the dollar value of rice production in Colusa, Butte, Sutter, Glenn and Yuba counties in the northern region is 88.3 percent of the state total (USDA NASS, 2015). San Joaquin, Tulare, Fresno, Stanislaus, and a few other counties in the central valley account for about 70 percent of the total walnut production value in the state (USDA NASS, 2015). Similarly, Tulare, Kern, Fresno, and Madera counties in the central valley take up over 90 percent of the citrus production value in California (USDA, NASS

2015). With regard to the wine grapes, counties on the central coast including Sonoma, Napa, Monterey, San Luis Obispo, Lake, and San Benito account for nearly 60 percent of the state total (CDFA 2016). Lastly in the southern region, Ventura, San Diego, Santa Barbara, and Riverside counties have more than 92 percent of the total avocado production value in California (USDA NASS 2015).

The rest of the paper is organized as follows. After methodology and data, the next section contains results and discussions. The last section concludes.

Methodology and Data

We follow Baker, Boehlje, and Langemeier (2015) and use the Price-to-Cash Rent ratio (P/Rent) to measure the investment growth opportunities for the farmland. P/Rent ratio indicates the farmland price relative its cash rent earnings. Specifically, it shows how much an investor would like to pay for each dollar of earnings generated by the land. It is an equivalent indicator to the Price-to-Earning ratio (P/E) used in the stock market. A high P/E ratio usually suggests that the investors are willing to pay a higher price for one dollar of earnings. We calculated the P/Rent ratios between 2009 and 2016 using the yearly farmland price and cash rent data collected from the *Trends in Agricultural Land and Lease Values* publications by the California Chapter of ASFMRA. Additional county level cash rent data are collected from the National Agricultural Statistics Service (NASS USDA). The P/E ratio values of the Standard & Poor's 500 Index are collected from Shiller's website. We used his cyclically adjusted P/E ratio (CAPE) which is 10-year moving average for earnings in the P/E ratio. In order to smooth out the volatilities in the P/Rent and P/E ratios, we compared the three-year moving averages to show which investment appears to have a better growth opportunity.

Knowing which investment is better is not sufficient, we are also interested in identifying the important factors that contribute to the farmland's value, the model we used is shown in equation (1).

$$(1) \quad \text{Land Price}_{it} = \beta_1 + \beta_2 \text{Production}_{it-1} + \beta_3 \text{Commodity Price}_{it-1} + \beta_4 \text{Labor Cost}_{it} + \beta_5 \text{Fuel Cost}_{it} + \beta_6 \text{Walnut}_t + \beta_7 \text{Citrus}_t + \beta_8 \text{Wine Grape}_t + \beta_9 \text{Avocado}_t + \mu_{it},$$

where the farmland price for commodity *i* at year *t* is a function of total commodity production quantity in the previous year *t-1*, price of the commodity in the prior year *t-1*, labor cost at time *t*, fuel-diesel cost at time *t*, and a group of dummy variables that identify the commodity. Five commodities are analyzed. They are rice, walnut, citrus, wine grape, and avocado. Take Walnut_t as an example, if the farmland examined at time *t* is Walnut, then this dummy variable is 1, otherwise, it is zero. The reference commodity in this equation is rice. The commodity production and price data are collected from NASS USDA. The cost data are collected from the cost studies done over the years by UC-Davis Extension. We use Ordinary Least Squares (OLS) to estimate the model in equation (1). Table 1 presents the summary statistics of all the variables. The labor cost during 2009 and 2016 is about $12 per hour. The average price of farmland across the five commodities and across regions is $20,694 per acre. The average land prices per acre, from highest to the lowest, are $34,875 for wine grapes on the central coast, $23,594 for walnut in the central

valley, $20,781 for avocado in the southern counties, $16,438 for citrus in the central valley, and $7,781 for rice in the northern counties.

Results and Discussions

Figure 1 shows that the three-year moving P/Rent average of rice farmland in the northern counties declined from 24.33 to 19.11 in 2012. Since 2012, the P/Rent has been steadily rising. Meanwhile, the three-year moving P/E average ratio of S&P 500 Index started at 19.47 in 2009, lower than the P/Rent ratio of rice land. However, it has been increasing since then and surpassed P/Rent ratio of rice land in 2011.

Figure 2 shows that the three-year moving P/Rent average of walnut farmland in the central valley increased from 61.12 in 2009 to 94.17 in 2014. In 2016, the P/Rent ratio dropped to 90.17. With the decreased global demand for walnut and declining price in 2017, it is likely that the P/Rent ratio will continue to decrease. Over the 7 years, it is obvious that the P/Rent ratios of walnut land are much higher than the P/E ratio of S&P 500 Index. It appears that the investment in walnut land in the central valley is a better investment than the stock market between 2009 and 2016.

The comparison results between the three-year moving P/Rent average of citrus land and the three-year moving P/E average of S&P 500 Index are presented in Figure 3. Between 2009 and 2016, the P/Rent ratio of citrus land increased from 53.46 in 2009 to 84.99 in 2012. After 2012, the ratio decreased till 2015. Last year saw a little rise again in the P/Rent ratio for citrus land. Compared to the P/E ratio of S&P 500 Index, the P/Rent numbers are significantly larger. Again, it suggests that the citrus land in the central valley has a better investment opportunity than the stock market during the study years.

In Figure 4, the P/E average ratio of wine grapes on the central coast has been slightly declining from 2009 to 2010. Then it has been slightly increasing from 2010 to 2016. The three-year moving P/E average of S&P 500 Index in the meantime has been slightly increasing. Although the P/Rent average ratio is larger than the P/E average ratio, the gap is becoming smaller.

As shown in Figure 5, the P/Rent average ratio of avocado land in the southern counties started high at 31.61 which is larger than the P/E ratio of S&P 500 Index. It dropped significantly to 21.30 in 2010 and went below the P/E ratio of S&P 500 Index. It continued to decrease to 17.37 in 2011 and since then, it has been steady at around 19.

The average comparisons show that walnut, citrus, and wine grape lands have a significantly higher P/Rent ratio than the P/E ratio of S&P 500 Index. It suggests that these farmlands have shown a better investment growth opportunity than the stock market. Rice and avocado have experienced lower investment growth than the stock market since 2010. To further assess the factors that contribute to the price of different farmlands over the years, we estimated equation (1) with OLS. The regression results are reported in Table 2. The adjusted R^2 is 91.65 percent which means around 92 percent of the land price variations can be explained by the explanatory variables selected in our model. Not surprisingly, the farmland price is positively impacted by the one-year lag production and price of the commodity grown on the land. As the one-year lag production increases by one

million tons, the land price increases by $440 per acre. When the one-year lag price goes up by $1 per ton, the price of land rises by $3.59/acre. In terms of production costs, the labor cost has a significantly positive impact on the land price. If labor cost increases by $1 per hour, the land price would go up by $3,653.94 per acre. Based on this marginal effect and the average values of farmland price and labor cost, we calculated the elasticity impact and found that a one percent increase in labor cost would lead to 2.12 percent increase in land price in California. The fuel cost does not affect the farmland price.

Additionally, all the coefficients of commodity dummy variables are significant. Since the reference commodity is rice in the northern counties, the results suggest that if other things held constant, the price of walnut land in the central valley exceeds the rice land price by $26,231.95 per acre. The land prices of citrus in the central valley, wine grapes on the coast, and avocado in the southern counties are $25,044.25, $42,472.97, and $24,421.95 higher than the price of rice land per acre, respectively. These commodities, wine grapes and walnut in particular, are more profitable than rice.

Conclusions

The present research compares the P/Rent ratios of farmland in California with the P/E ratios of S&P 500 Index during 2009 and 2016. The comparison results show that walnut, citrus and wine grape land appeared to have a better investment prospect compared to the stock market over the study years. The results coincide with the fact that the most sought after land in California is for permanent crops such as walnuts, mandarins, and grapes, as they have seen strong productions and prices in the recent years. Therefore, we empirically test how the one-year lag commodity production, one year lag commodity price, labor cost, and fuel cost affect the farmland value of different commodities in various regions in California using an OLS regression model. Not surprisingly, the results show that commodity production, commodity price, and labor cost had a significantly positive impact on the value of farmland, which are consistent with many studies in the literature. Specifically, one million tons of additional production in the prior year can increase the price of farmland by $440/acre. If labor cost in California increases by $1 per hour, the farmland price would increase by an impressive $3,654 per acre. Moreover, comparing with the rice land, the values of walnut, citrus, wine grapes avocado lands tend to be substantially higher.

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Figure 1. Comparisons of S&P 500 Index P/E and P/Rent of rice land in Northern Counties

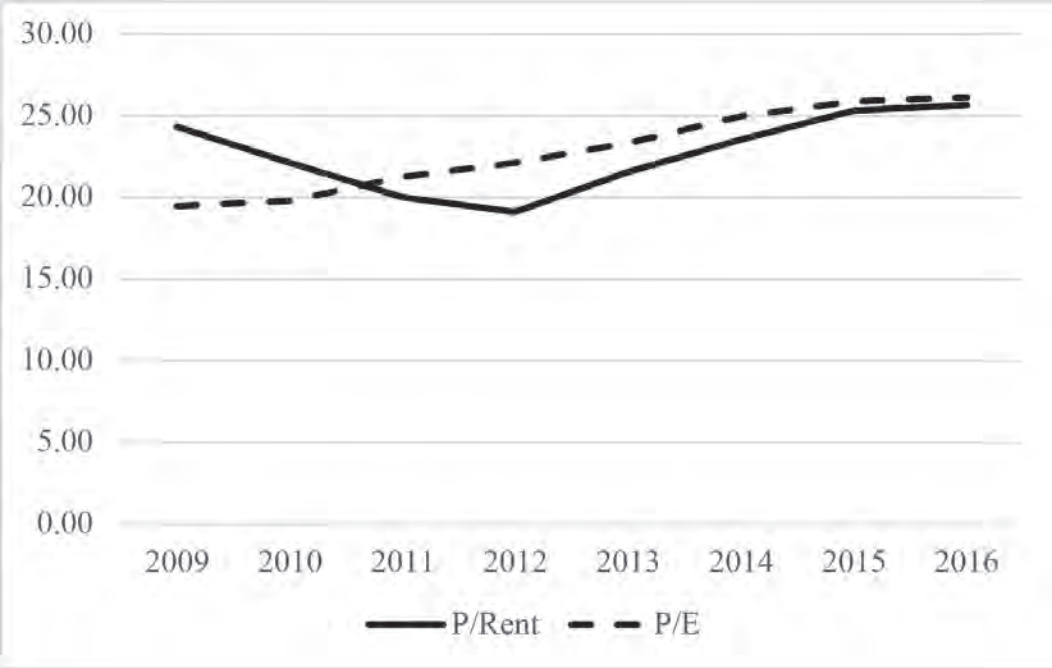

Figure 2. Comparisons of S&P 500 Index P/E and P/Rent of walnut land in Central Valley

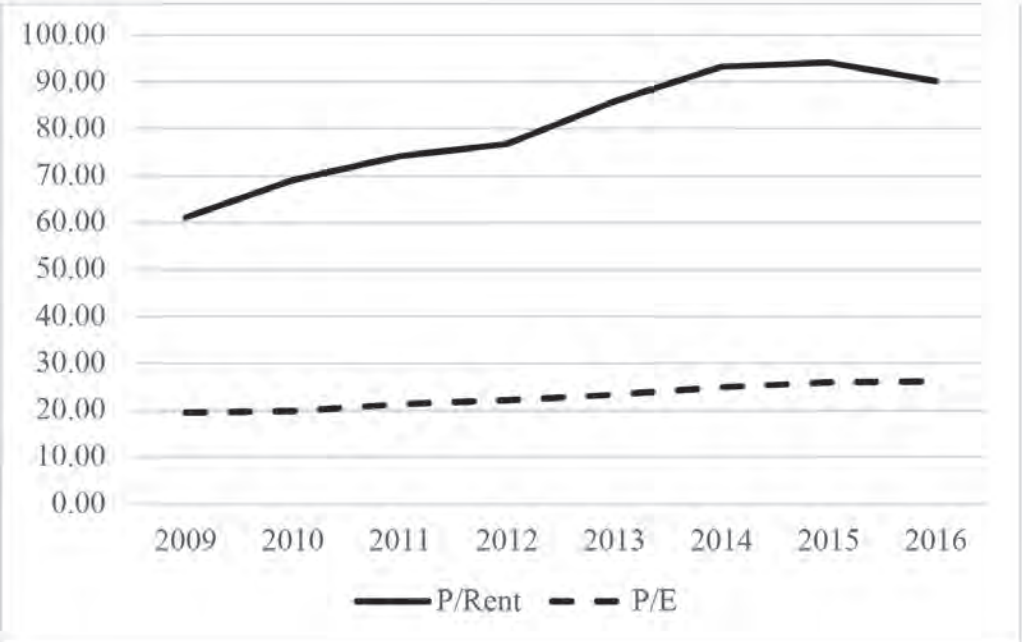

Figure 3. Comparisons of S&P 500 Index P/E and P/Rent of citrus land in Central Valley

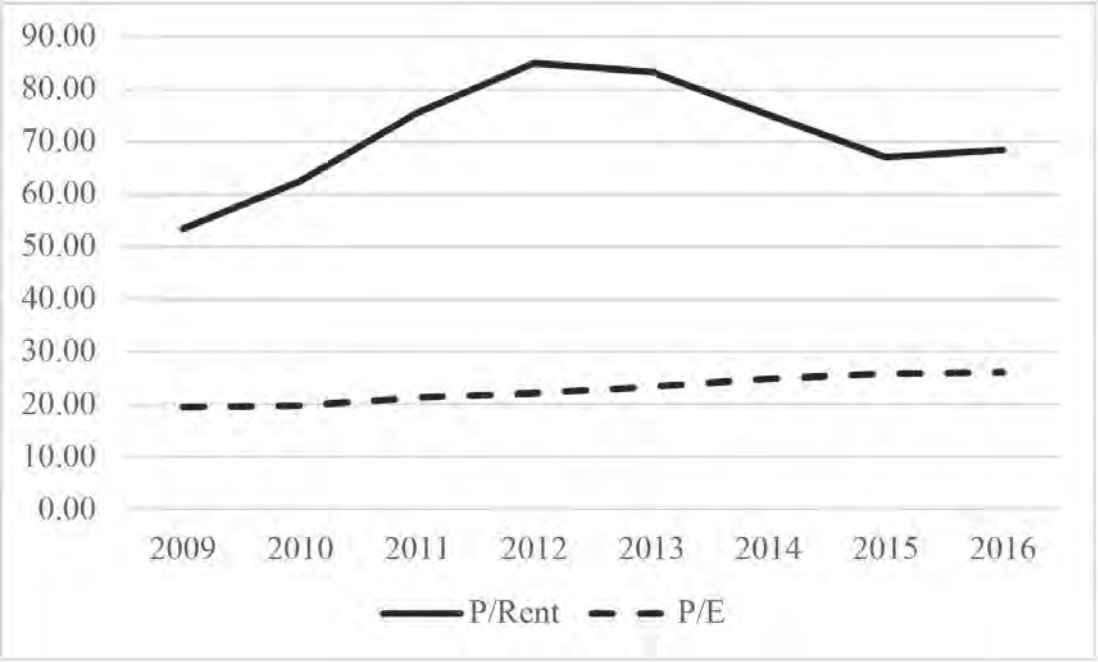

Figure 4. Comparisons of S&P 500 Index P/E and P/Rent of wine grape land on Central Coast

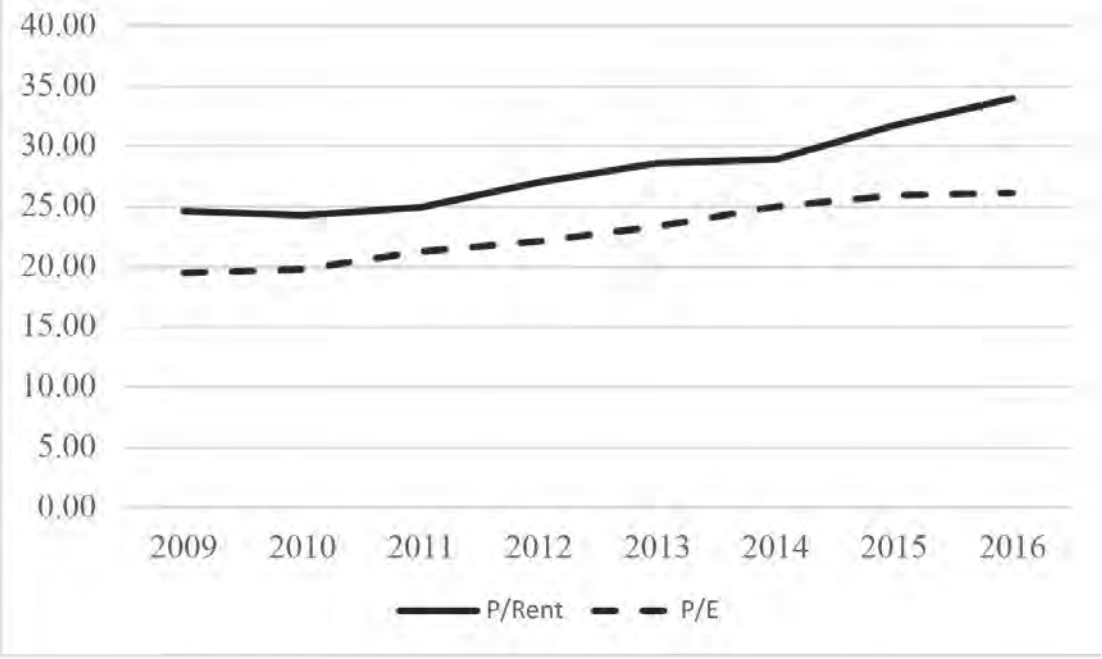

Figure 5. Comparisons of S&P 500 Index P/E and P/Rent of avocado land in Southern Counties

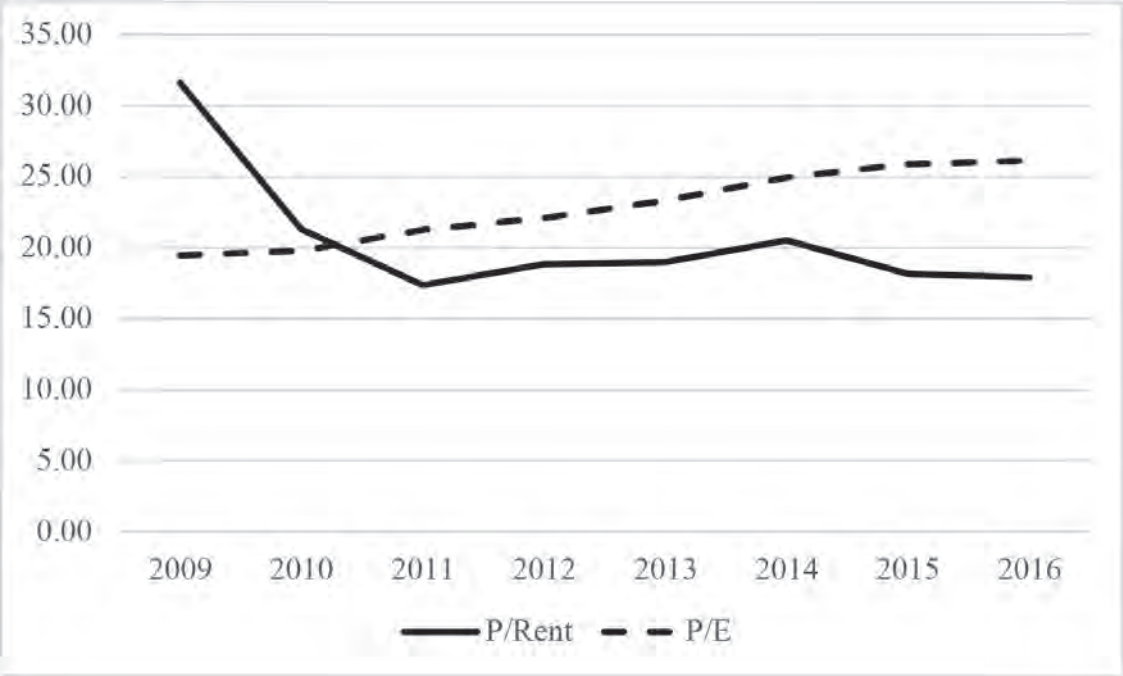

Table 1. Summary statistics for the variables used in equation (1), number of observation = 40

Variable	Description	Mean	St. Dev.
Farmland Price	The average price of the farmland, in $/acre	20,693.75	10,282.78
Production one year lag	The commodity production quantity in the prior year, in million tons	10.39	17.21
Price one year lag	The commodity price in the prior year, in $/ton	1,162.73	1,127.48
Labor cost	Labor cost, in $/hour	12.02	0.94
Fuel cost	Fuel diesel cost, in $/gallon	3.28	0.66
Walnut	Dummy = 1 if the commodity is walnut, 0 otherwise	0.2	0.41
Citrus	Dummy = 1 if the commodity is citrus, 0 otherwise	0.2	0.41
Wine Grape	Dummy = 1 if the commodity is wine grape, 0 otherwise	0.2	0.41
Avocado	Dummy = 1 if the commodity is avocado, 0 otherwise	0.2	0.41

Source: Trends Publications, NASS USDA, and UC-Davis Cost Studies, 2009-2016.

Table 2. OLS results for estimating equation (1)

	Coefficient	Robust Std. Err.
Production one year lag	440.32**	182.95
Price one year lag	3.59**	1.48
Labor cost	3653.94***	997.17
Fuel cost	191.12	893.78
Walnut	26231.95***	9230.42
Citrus	25044.25***	7549.05
Wine Grape	42472.97***	8171.28
Avocado	24421.95**	9525.24
Intercept	-56224.53***	17272.03
Adjusted R^2	91.65%	
F-statistic	73.19***	

*** Denotes that the coefficient estimate is significant at the 0.01 level. **: At the 0.05 level. *: At the 0.10 level.