

## **Potato Demand in an Increasingly Organic Marketplace**

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For at-home potato consumption, fresh potatoes are the largest single category, dominated by russet potatoes, then red, white, and other colored potatoes (Figure 1). Though organic potatoes averaged only 0.2% of at-home fresh potato consumption during 2000-2005, they are the fastest growing potato consumption category. Organic food sales grew at nearly 20% annually over the past decade in the U.S., reaching \$13.8 billion in 2005 or 2.5% of total U.S. food sales (Figure 2). Conventional food retailers have continued to capture a growing share of organic food sales, and this shift is expected to continue, as Wal-Mart and Target recently announced a major move into marketing organic foods. These and other retailers will put downward pressure on retail prices for organic foods, making them accessible and affordable to tens of millions of Americans who are currently not part of this market. Among all the trends affecting potato demand, what is the effect of the growing organic sector?

Another important issue for potato growers and the industry is the source of the price premium for organic potatoes. From 2000-2005, retail prices for organic potatoes were 115% above retail prices for russet and white potatoes, 30% above prices for red potatoes, and 17% above minor colored potatoes (gold/Yukon, yellow, purple, fingerlings). These organic price premiums are noticeably higher than for other types of fresh vegetables. What determines this price premium? Are organic potato prices high because the supply is short or do demand factors determine the price premium? This is an important question for those considering investing in organic potato production or processing. If supply factors dominate, price premiums will begin evaporating once production "catches up," but the price premium should have staying power if demand factors dominate.

Here we will summarize on-going research meant to answer these and related questions. This work is sponsored by the UW Food Systems Research Group in the Department of Agricultural and Applied Economics (<http://www.aae.wisc.edu/fsrg/>). The research is led by Ming-Feng Hsieh (an AAE Ph.D. student) under the direction of Paul D. Mitchell and Kyle W. Stiegert, Associate Professor and Director of the Food Systems Research Group in AAE. This research is not yet completed; a preliminary fact sheet is available on the FSRG web page, but we are in the process of updating that fact sheet with our new results summarized here. When we publish a peer-reviewed version of our results, we will finalize the fact sheet.

### **Potato Demand Data**

The few existing economic analyses of potato demand focus on potatoes as a single good and examined its demand relations with the broad complex of carbohydrate foods (bread, rice, pasta) and/or other vegetables (fresh and processed). This study is unique in that it focuses on the demand relations among varieties of fresh potatoes (russet, white, red, minor colored, organic) as well as processed potato categories (frozen/refrigerated, dehydrated), while also examining relations with carbohydrate food categories and vegetables and incorporating supply side effects.

For this demand analysis, AC Neilson supermarket sales data for at-home consumption of fresh potatoes and processed potato products were used, as provided by Mac Johnson at the U.S. Potato Board. Quarterly data were available at an aggregate level for four U.S. regions from 2000 to 2005 for each potato category (fresh russet, white, red, minor colored and organic potatoes, plus frozen/refrigerated and dehydrated potato products). These data only capture at-home consumption of potatoes purchased at larger supermarkets, representing about 45% of the U.S. potato consumption (Figure 2), which accounts for about 55% of U.S. annual potato production. Besides potatoes consumed as food away-from-home, potato chips consumed at-home are the most significant potato category excluded from this study. We justify this exclusion on the grounds that potato chips belong more appropriately to a snack food group rather than a close substitute for other potato products.

Besides these quantity and price data, the analysis included several other variables. The analysis controlled for seasonal and regional effects, plus added demand shifters such as demographic and income variables and price indexes for related commodities (e.g., rice, pasta, bread, fresh vegetables, processed vegetables). Supply side variables were also included, such as average U.S. potato yield, plus several producer price indexes to proxy production costs. Finally, the organic market penetration rate (organic food sales as a percentage of total food sales) was used to capture the effect of organic agriculture on potato demand.

### **Potato Demand**

Estimation and interpretation of results from a demand analysis such as this can be fairly technical. We focus on what economists call elasticities—measures of the responsiveness of the quantity demanded to changes in another variable. The elasticities emerging from the complicated econometrics were reasonable and generally consistent with findings in similar studies of other supermarket categories. For example, we found that all potato quantities had negative elasticities with respect to their own price—in other words, when the price of each potato product increased, demand decreased. The analysis also estimated cross-price elasticities between potatoes and other foods. The results imply that fresh russet, red, and white potatoes are strong substitutes for bread products and processed (frozen/canned) vegetables and strong complements with rice/pasta products. Frozen/refrigerated potatoes weakly follow these same trends, while dehydrated potato products strongly show the opposite trends. Interestingly, fresh potato demand is not really affected by prices for other fresh vegetables, as though consumers do not consider potatoes a fresh vegetable. Income effects show that as consumer income and expenditures rise, fresh potato demand increases strongly while demand for dehydrated potato products falls off sharply. Finally, almost all elasticity estimates for organic potatoes and their effects on other potato categories were not significant. This outcome is not surprising, since organic demand is so small relative to the other categories that it is difficult to estimate its effects amidst all the “noise” in the marketplace.

Among all the potato products examined, the results imply that demand for fresh minor colored potatoes is the most price responsive, followed by russet potatoes. Demand for these varieties drops the fastest when prices increase. Demand for white potatoes was least responsive to changes in its own price. The demand responsiveness of organic potatoes was similar to that for russet potatoes, but was not statistically significant. Own price elasticity estimates for both processed potatoes categories were also statistically insignificant. In other words, the model

could not explain demand changes for these potato products relative to all the “noise” in the marketplace.

None of these findings are surprising, which is good news, since it means the complicated econometrics used for the analysis imply results that make sense. These are the general results. Not presented here are the actual numerical results, which would allow specific estimates of how demand for each potato product would respond to specific changes. For example, how much would demand for fresh russet potatoes change if the price of fresh white potatoes increased 5%? Also, these substitution/complementarity relationships do not imply that people make these changes on their plates. Rather, these are the substitution/complementarity changes people make over the course of their weekly and monthly food purchases for at home use.

Moving forward with a fair amount of confidence about the data analysis, we look more closely at the two critical features of the organic potato market we discussed at the beginning.

### **Effects of an Increasingly Organic Marketplace**

The analysis also allowed calculation of elasticities for the effect of the organic market penetration rate on the demand for each type of fresh potato. First, the demand for organic potatoes was very strongly responsive to the organic market penetration rate, which is not at all surprising. For each 1% proportional increase in the penetration rate, the estimated demand for fresh organic potatoes increases around 8%. Interestingly, the demand for minor colored potatoes was also strongly responsive to the organic market penetration, though the magnitude of the response was slightly smaller. The increasingly organic marketplace is good news for these minor potato varieties (gold/Yukon, yellow, purple, fingerlings). Apparently, the increasing consumer demand for specialty/premium foods benefits not only demand for organic potatoes, but also these minor colored varieties.

The story is not so rosy for fresh red potatoes. The demand for red potatoes is fairly responsive to the organic market penetration rate, but negatively so. For each 1% proportional increase in the penetration rate, the estimated demand for fresh red potatoes decreases almost 2%. Thus, as the marketplace becomes increasingly organic, demand for fresh red potatoes will suffer. The estimated effect of the organic market penetration rate on white and russet potato demand was smaller and generally not statistically significant. These more traditional varieties were somewhat insulated from the increasing organic trend from 2000 to 2005, but this may change as the organic market share increases. Figure 2 shows the rapid increase in organic sales. As this trend continues to grow, eventually it is likely to cause statistically significant downward pressure on demand for these varieties as well. Increased consumer expenditures on organic foods imply some decrease in expenditure on non-organic foods, and these potato varieties will likely not continue to be immune to this shift in consumer preferences.

### **Determinants of Organic Potato Price Premiums**

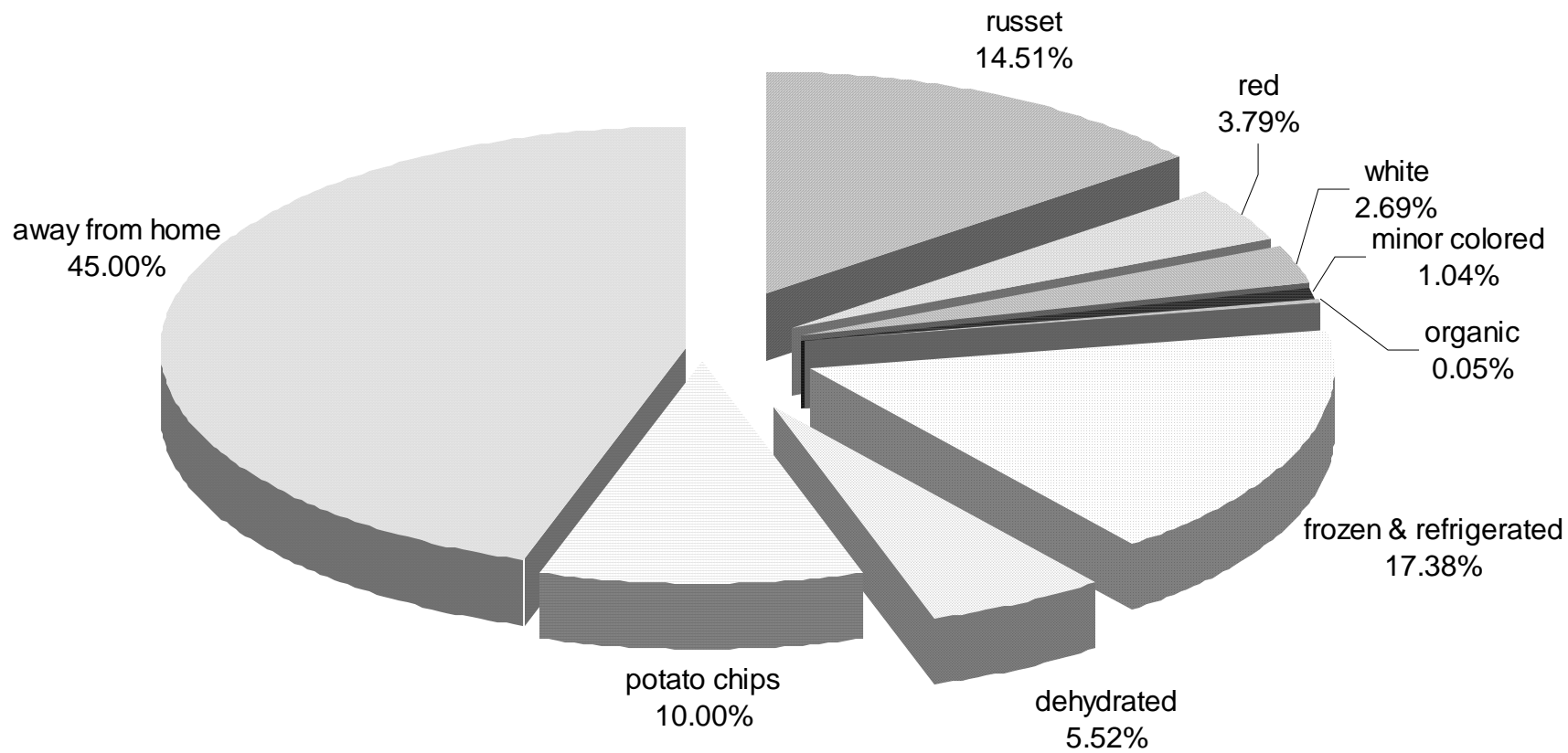
Our analysis also examines the determinants of the variance in the organic potato price premium. For this analysis, we calculated the importance of variability derived from regional and seasonal effects, from demand factors, and from supply factors. The results imply that regional effects and demand factors are important determinants of the variability of organic potato price premiums. Thus, variations in the premium could be explained by the U.S. region (four regions

were analyzed) and by factors such as the price of competing products like rice and pasta. Seasonality and variability in the factors determining supply did not explain much of the variation in the organic premium. For farmers considering converting to organic potato production, the implication is that price premiums are not influenced much by variability in production costs, or seasonal supply/demand forces. Food retailers are apparently able to clear the volumes of potatoes they sell by paying more attention to their consumer base and how they respond to changing prices of competing products. To be clear, we are not claiming the premium is somehow shielded from increases in the supply of organic potatoes. Indeed, the volume of research about price premiums in many other food markets would argue for a great deal of sensitivity between the premium and overall supply of each type of commodity present. What has kept the premium strong over time has been a continually growing demand for organic potatoes. If farmers undersupply organic potatoes, the premium is likely to widen and vice versa.

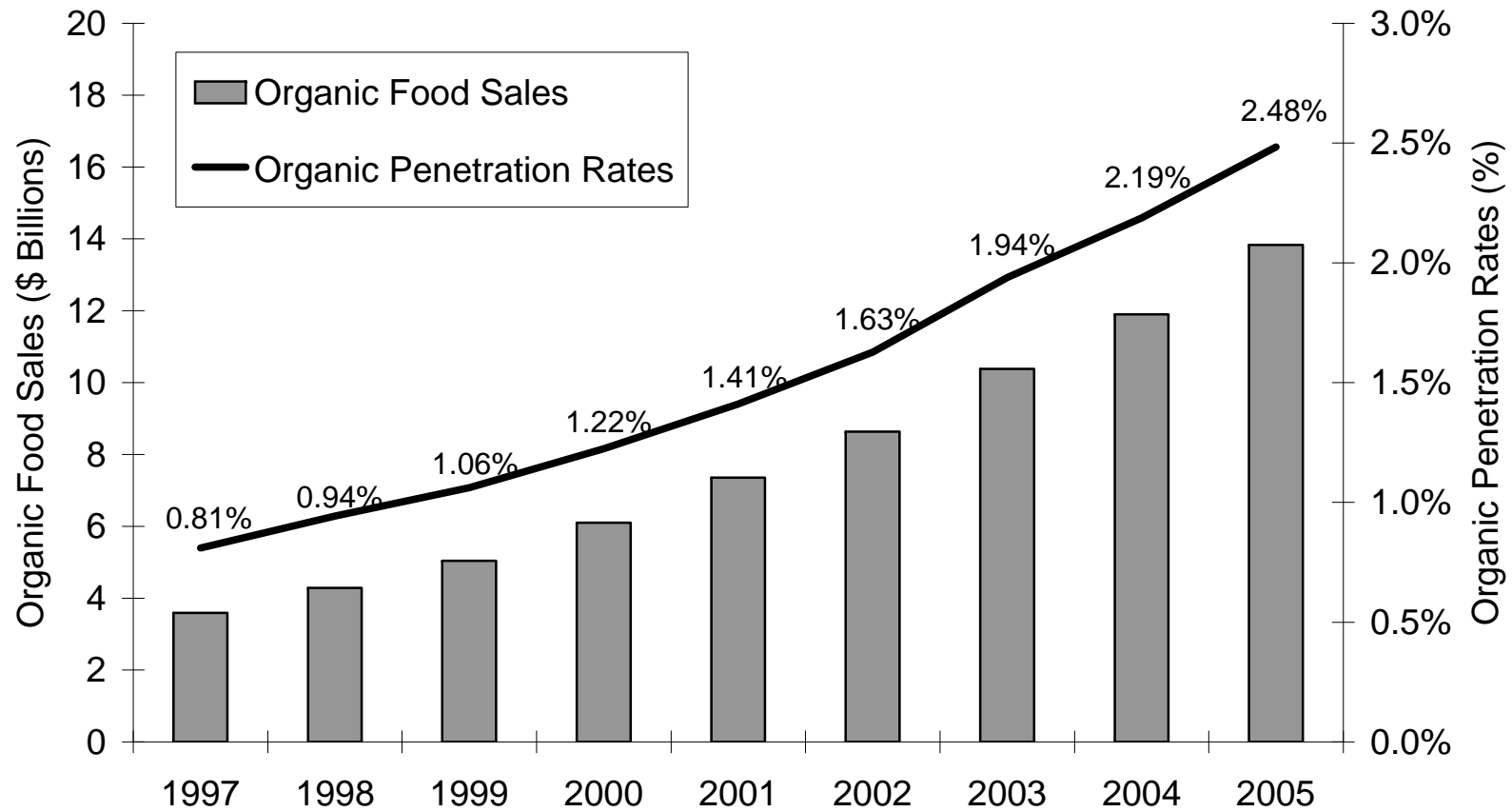
### **Conclusion**

Thus in summary, potato demand in an increasingly organic world obviously looks good for organic potatoes. However, this growing trend also implies increased demand for varieties that consumers typically recognize as specialty or premium potatoes, here combined into the single category called minor colored potatoes (gold/Yukon, yellow, purple, fingerlings). As for the other varieties of fresh potatoes, we were already able to identify a statistically significant decrease in the demand for fresh red potatoes. Results for russet and white potatoes also showed a negative effect, but it was smaller and not significant, but given time it may become so. Finally, regional effects and demand factors were the primary determinants of movements in organic potato price premiums, rather than seasonality or supply effects such as production costs. The organic price premium has remained strong over time due to the continually growing demand for organic potatoes and the attention of food retailers to their customers.

**Figure 1. Average U.S. Potato Consumption by Category, 2000-2005**



**Figure 2. Organic Food Sales and Penetration Rates\* in the U.S., 1997-2005**



\*Penetration rates are organic food sales as a percentage of total food sales.