Food and Beverage Manufacturing Subsectors in Lane County, Oregon: Candidates for Economic Growth and Development?

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Executive Summary

We investigate the qualitative and quantitative evidence underlying the economic and employment growth of the food and beverage manufacturing subsectors in Lane County, Oregon. And use the empirical findings to answer the following question: What qualifies the food and beverage manufacturing subsectors as candidates for economic growth and development in Lane County, Oregon? We calculate output and employment multipliers that indicate that the brewing, flour milling, and a few other select food and beverage manufacturing subsectors possess potential for contributing substantial effects in both economic growth and employment growth, but we temper these potential effects with discussions of long run dynamics and cautionary findings in limits to scaling select subsectors. We identify that during 2002-2011, food and beverage manufacturing subsectors in Lane County enjoyed a combined average employment growth rate that exceeded both state and national employment growth rates by an average of 6.5 percentage points. And we identified that during 2002-2011, food and beverage manufacturing subsectors in Lane County enjoyed a combined average economic growth rate that exceeded both state and national economic growth rates by an average of 2 percentage points.

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Introduction

During 2007 to 2009, Lane County's manufacturing sector lost 7,345 jobs or 36.9%, while the food and beverage manufacturing subsectors added a combined 189 jobs, or 11%.[1] This growth in the food and beverage subsectors caught the attention of our clients, the Eugene Area Chamber of Commerce and the Lane County Department of Community and Economic Development, and inspired the question this paper investigates. What qualifies the food and beverage subsectors as candidates for economic growth and development in Lane County, Oregon? This question interests our clients given they operate with unique, yet parallel missions, both focused on promoting a healthy economy and ultimately a healthy community.

For clarity these definitions help:

- **Food manufacturing** is the transformation of livestock and agricultural products into products for intermediate or final consumption. Distinguished by raw materials processed into food products.[2]
- **Beverage manufacturing** is the production of nonalcoholic beverages, alcoholic beverages through the fermentation process, and distilled alcoholic beverages.[3]
- **Economic growth** is the increase in a region's average wage or per-capita income.[4]
- **Employment growth** is the increase in a region's total workforce.[5]
- **Economic development** is the qualitative change and restructuring in a region's economy in connection with technological and social progress.[6]
- **Local** is the administrative region of Lane County.

Knowing the context in which our research question is asked helps us focus our analysis and interpret our results. The context is Lane County. The March 2012 estimated 8.8 percent unemployment rate translates to roughly 15.8 thousand workers

[1] (Rooney, 2010)
[2] (Oregon Employment Department, 2011)
[3] (Oregon Employment Department, 2011)
[4] (O'Sullivan, 2009)
[5] (O'Sullivan, 2009)
[6] (Soubbotina, Beyond Economic Growth, 2004)

seeking employment.[1] In 2011 the average annual wage, considering all private industry sectors, was $35,335.[2] For the same year the food manufacturing subsector enjoyed an average annual wage of $37,358.[3] In 2011 manufacturing accounted for 11% (12,000 jobs) of total private industry employment and the food and beverage manufacturing subsectors account for 15.6% (1,867 jobs).[4]

These contextual, economic facts are useless to our investigation without linking them to systematic, structured reasoning. Our approach is to go back to the basics. In a recent op-ed commenting on Lane County's economy now and the potential for healthy growth, Bryce Ward, Philip Taylor, and Ed Whitelaw state that economies are built on four forms of capital: human capital (workers and their education and skills), physical capital (private and public machines, buildings, roads, water and sewer systems), natural capital (mountains, valleys, rivers, coasts, grasslands, and forests), and social capital (social networks and norms, laws and political systems).[5] If these are the building blocks for an economy, then a descriptive analysis of a subsector of that economy should seek to gauge the quantity, quality, and reproducibility of the forms of capital as indicators of potential growth. We intend to identify and describe each of these four forms of capital as they exist in Lane County and as they relate to the food and beverage manufacturing subsectors. And because rigorous economic analysis demands both qualitative and quantitative components we will describe and analyze quantitative economic data characteristic of food and beverage manufacturing in Lane County, Oregon, and the United States.

[1] (Bureau of Labor Statistics, 2012)
[2] (Oregon Employment Department, 2011)
[3] (Oregon Employment Department, 2011)
[4] (Oregon Employment Department, 2011)
[5] (Ward, Taylor, & Whitelaw, 2012)

CHAPTER 1 - Literature Review

Our research question involves estimating the economic impact of industry subsectors on the economy of Lane County. One of the most common methods for doing this is to use input-output models and regional multipliers. We used "A Consumer's Guide to Regional Economic Multipliers"[1], by Coughlin and Mandelbaum to guide our use and discussion of regional economic multipliers.

Multipliers are most commonly derived using an input-output model. An input-output model is a mathematical representation of the economic connections between defined sectors in the region at the time the data is gathered; for example, a model representing the beverage manufacturing subsector would show that sales of printed packaging materials in the region is dependent on beverage manufacturing sales, but this relationship is fixed in the model. These relationships help to provide understanding of the multiplier. The multiplier is primarily used to estimate total effect, or impact, on the local economy associated with a given change. Coughlin and Mandelbaum state, "an output multiplier of 1.66 indicates that if a firm's sales in one region to buyers in another region increase by $100 million, total sales throughout the region are expected ultimately to increase by $166 million."[2] It is important to note that a multiplier describes the relationships between industry sectors, but these are not necessarily causal relationships. Therefore any estimated impact should be interpreted with skepticism. This being said multipliers are valuable tools for estimating the economic effects of some change in a region. They allow rather complex web of economic linkages to be synthesized into a reasonably accurate description.

[1] (Coughlin & Mandelbaum, 1991)
[2] (Coughlin & Mandelbaum, 1991)

CHAPTER 2 - The Four Types of Capital

We analyze and describe select examples of the four types of capital as they exist in Lane County and relate to the food and beverage manufacturing subsectors.

For clarity these definitions help:

- **Human capital** is people's innate abilities and talents plus their knowledge, skills, and experience that make them economically productive.[1]
- **Social capital** is the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. And increasing evidence shows that social cohesion is critical for societies to prosper economically and for development to be sustainable. Social capital is not just the sum of the institutions which underpin a society; it is the glue that holds them together.[2]
- **Physical capital** the buildings (public and private), roads, bridges, water systems, energy grids, machines, and technical equipment used in production, plus it is the inventories of raw materials, half-finished goods, and finished goods.[3]
- **Natural capital** is the stock of natural resources, such as land, water, and minerals, used for production. These can be either renewable or nonrenewable.[4]

Human Capital

There are 1,867 food and beverage manufacturing workers and 15,800 unemployed workers in Lane County. These employed and unemployed workers represent human capital. Therefore a logical question is as follows: How talented, skilled, and knowledgeable are these employed and unemployed workers? This is difficult to answer. A rigorous assessment of the talents, skills, and knowledge of these workers would require a comprehensive and expensive survey be conducted. Because we have neither the time nor money for this comprehensive analysis, we have chosen to use a proxy statistic.

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[1] (Soubbotina, 2004)
[2] (World Bank , 1998)
[3] (Soubbotina, 2004)
[4] (Soubbotina, 2004)

The most common proxy used for assessing a region's human capital is to determine the educational attainment of the workforce. Table 1.1 indicates that Lane County trends above state and national percentages for high school graduation or higher, but trends lower than state and national percentages for bachelor's degree or higher. A quick survey of educational requirements for food and beverage manufacturing occupations reveals that on average, the educational requirements are medium to long term on the job training and some post-secondary technical training.[1] Because of these average educational requirements, it is safe to assume that high school graduation rates and Lane Community College are two key contributors to the quality and quantity of the region's stock of human capital as it relates to food and beverage manufacturing jobs. Because high school graduation rates trend higher than state and national rates we assume this aspect of human capital is satisfactory in Lane County. Lane Community College provides specialized technical training in mechanics, welding, and manufacturing, training in culinary arts and hospitality, and foundational courses in math, science, and writing. These educational opportunities are more affordable than comparable opportunities at the University of Oregon and provide technical skills and knowledge that are applicable to many job descriptions in the food and beverage manufacturing subsectors.

But it is important to recognize that because of the smaller average size of the local food and beverage manufacturing establishments, the range of educational attainment and skills required is probably broader and more equally distributed. And the number of positions within each establishment and the required skills for these positions are not as heavily weighted in the lower skill categories as would be expected in larger manufacturing firms. This need for more skilled labor is easily met by the University of Oregon, which provides workers that have skills and knowledge in finance, management, and science.

The take away from this brief description of human capital in Lane County is that the quality and quantity of the stock of human capital is healthy. And the reproducibility of this stock is strengthened by the region's universities, community colleges, and high schools.

[1] (Oregon Employment Department, 2012)

Table 2.1: Educational Attainment	Lane County	Oregon	United States
Percent high school graduate or higher	89.9%	88.6%	85.0%
Percent bachelor's degree or higher	27.7%	28.6%	27.9%

Source: U.S. Census Bureau[1]

Social Capital

It is widely accepted that social connections are correlated with economic growth and development. And this acceptance is due to ease of observing that people connect, share ideas, provide services, and are better off. This is an enduring phenomenon and it is crucial to the growth of local food and beverage manufacturers.

The foodie[2] culture in Lane County is an example of social capital. This culture inspires a plethora of food manufacturing startups, often street food cart vendors, and the local, final demand necessary to sustain these infant companies. Foodies, quite literally, feed the food and beverage manufacturing subsectors new ideas and opportunities. Another example of social capital, the entrepreneurship program at the University of Oregon, has helped numerous food and beverage startups to make critical connections with investors and other resources. A recent example is Simon Blatz and the startup distillery Blue Dog Mead. Simon Blatz, along with Chase Drum and Simon Spencer, founded Blue Dog Mead in November 2011. The fledgling company is projecting revenues of $14 million in five years. [3] A third example of social capital is the Business Development Center at Lane Community College. This center helped frame the success story of Coconut Bliss, a local non-dairy frozen dessert company. Coconut Bliss was sold to Lochmead Dairy in 2009 and has become a multi-million dollar company.[4]

Another social capital indicator is clustering, which is often described in terms of agglomerative economies. Clustering is the buzz in Lane County due to recent

[1] (U.S. Census Bureau, 2010)
[2] (Wikipedia, 2012). "… foodies are amateurs who simply love food for consumption, study, preparation, and news." "…foodies want to learn everything about food, both the best and the ordinary, and about the science, industry, and personalities surrounding food."
[3] (Diatz, 2012)
[4] (Aleshire, 2012)

expansion and location decisions of three large local breweries: Ninkasi, Oakshire, and Hop Valley.[1] It is often true that creativity thrives on proximity and proximity enables knowledge spill overs and efficiency gains through shared inputs. But ascribing agglomeration as the cause of clustering should be done reluctantly. The local brewing industry purchases a large portion of their intermediate inputs outside of the region so efficiency gains through sharing providers of intermediate inputs would most likely be realized in the transportation of those inputs. And this efficiency gain would most likely be small enough to not directly cause clustering. If the culture of local breweries is collaborative, and there does seem to be willingness among local breweries to collaborate and share knowledge, then there could be knowledge spillovers. But there is no obvious or conclusive evidence to suggest this is occurring to any degree of significance. Although there is limited evidence to suspect efficiency gains through shared intermediate inputs and no obvious evidence of knowledge spillovers, there could be gains to local brewery clustering through the facilitation of beer tourism. Breweries that locate near each other could facilitate tourists visiting multiple breweries within a convenient distance of each other. The important thing to consider is that clustering does not always occur purposefully and it does not always provide significant benefits to the clustering businesses. But in the case of local breweries in Lane County there could be some advantages in developing proximity and encouraging tourism of craft breweries.

Physical Capital

Lane County has advantages in physical capital in its bi-section by Interstate 5 (I5), water systems, and electrical grids, but some potential disadvantages in climate controlled storage and food grade dry storage. Most, if not all, of the food and beverage manufacturing businesses in Lane County rely on highway transport to move their inputs and outputs. Thus, ready access to I5 (The main transportation route along the west coast of the United States) is a locational advantage. EWEB, the electric and water provider for Eugene supplies millions of gallons of water to the region's brewing industry and millions of kilo-watts of reliable electric power to beverage and food

[1] (McDonald, 2012)

manufacturers. The reliable and consistent flow of clean water and energy is an advantage for local food and beverage manufacturers. There is a single large cold storage provider in Lane County. And this provider has supplied reliable cold storage for intermediate inputs and finished goods over the last half century, but it is important to note the differences between cold storage and climate control storage and that there currently exists no climate control storage in Lane County. Cold storage controls only temperature while climate control storage controls both temperature and humidity. Climate control allows for lengthy storage of perishable raw inputs such as apples, berries, and tomatoes. This lack of climate control storage is significant because some food and beverage manufacturers require consistent flows of high quality raw inputs, such as raw tomatoes, apples, blackberries, carrots, etc., and startups and small manufacturers (the average demographic of Lane County food and beverage manufacturers) could find the costs associated with purchasing their own climate control storage, prohibitive. If the supply of cost competitive and affordable climate control storage remains limited, the region's capacity to attract, sustain, and retain scalable food and beverage manufacturers could be restricted. The flour milling subsector is experiencing resurgence in Lane County, but is facing a similar barrier to the climate controlled storage issue, a limited supply of cost competitive and affordable, food grade-dry storage for grains. It is important to note that based on business responses to the Lane County Food Cluster Survey, these storage issues are perceived to be some of the more critical choke points for scaling existing and prospective food manufacturing businesses.

Natural Capital

Lane County has abundant natural capital. The Willamette and McKenzie Rivers and 71,951 acres of farmed land[1] are several of the most applicable and notable examples. The McKenzie Watershed is the lifeblood of the craft brewing industry. It is that simple, good water equals good beer which equals more final demand. Craft brews flowing out of the region are recognized for their uniqueness and quality.[2] Also given the volume of farmable acres and the climate there is great potential for growing local

[1] (Rooney, Agriculture in Lane County, 2012)
[2] (DeBenedetti & Fletcher, 2010)

raw inputs for food and beverage manufacturing. These inputs could be fresh, cost competitive (fewer transport miles), and provide a consistent supply. The obvious caveat to this advantage is that in order for these crops to be produced there has to be the benefits accrued by local farmers must outweigh the costs. And farmers will be reluctant to produce crops for which there is limited demand. Local food and beverage manufacturers could be a solution to minimizing these constraints.

The takeaway is that Lane County has large stock of high quality natural capital. And because quality of life is inextricably linked to the quality of a region's natural capital, these amazing stocks of natural capital may be the strongest draw for attracting and retaining skilled labor and entrepreneurs alike.

CHAPTER 3 - Quantitative Analysis

We analyze and describe the quantitative characteristics of the food and beverage manufacturing subsectors in Lane County by gathering survey data from a sample of local food and beverage manufacturers and analyzing regional economic and

employment growth data for the food and beverage manufacturing subsectors in Lane County, Oregon and the United States. We use this data to inform our investigative question: What qualifies the food and beverage manufacturing subsectors in Lane County as candidates for economic growth and development?

See these definitions for clarity:

- The **short run** is the amount of time during which at least one production input is fixed.
- The **long run** is the amount of time during which all production inputs are variable.
- The **traded sector** is business activity resulting in non-local sales; where non-local are sales outside of Lane County.
- A **multiplier** is a number that estimates the re-spending of revenue in the local economy; it is a ratio of total change to initial change where total change includes direct, indirect and induced effects of a given change and initial change is that given change.
- A **direct effect** is an initial change in the study area such as an increase of one thousand dollars in traded sector sales or one hundred new jobs in traded sector employment.
- An **indirect effect** is a result of business purchases within the study area.
- An **induced effect** is a result of household purchases within the study area.
- An **output multiplier** estimates the total change in local sales resulting from a measurable change in traded sector sales.
- An **employment multiplier** estimates the total change in local employment resulting from a measurable change in traded sector employment.

Our study focuses on food and beverage manufacturing businesses that sell a percentage of goods and services outside of the local region. We refer to these as traded sector businesses. This focus is logical for several reasons. First, traded sector businesses have usually demonstrated scalable operations which often correlate with increased rates of economic and employment growth. Second, traded sector businesses often experience higher accounting profits which could translate into more

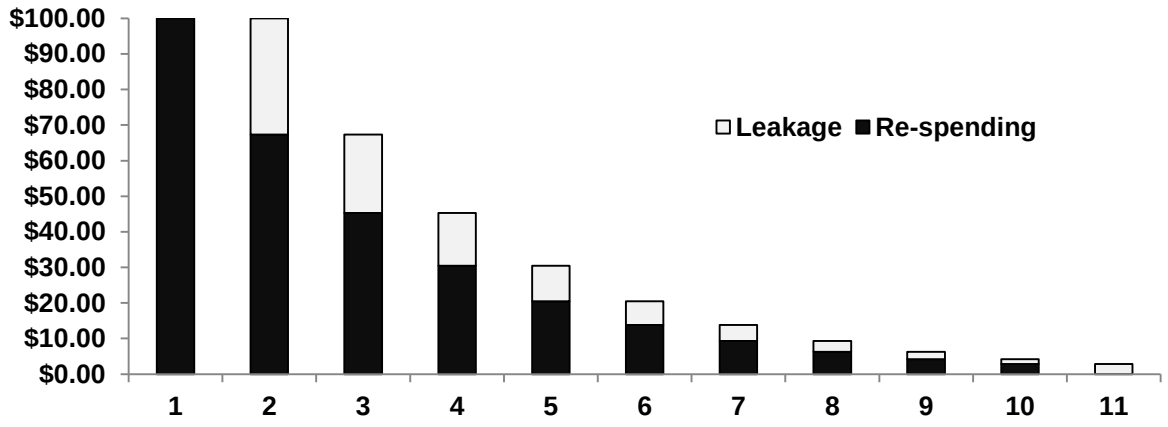
retained earnings. And if retained earnings are re-invested locally this adds to the economic impact of the subsector this business is categorized under.

We analyze economic growth and employment data at local, state and national levels to help indicate the long run viability of these local subsectors. First we analyze the food and beverage manufacturing subsectors from a short run perspective and describe the economic impacts as they exist now by estimating output and employment multipliers. Second, we analyze the food and beverage manufacturing subsectors from a long run perspective and describe the inter-temporal economic and employment growth trends and some potential constraints to future growth.

Short Run - The Economy Now

The effects of a change in traded sector output can be synthesized into a multiplier that describes the estimated re-spending of net export sales revenue. Figure 3.1 shows the re-spending and leakage used in calculating multipliers. The sum of the re-spending divided by

Figure 3.1: Effects of a $100 Change with 3.0 Multiplier



the initial change provides the multiplier; the leakage at each level is the amount that leaves the region. There are four types of multipliers: Output, Employment, Income, and Added Value Multipliers. We focus on the output and employment multipliers. The output multiplier estimates the total change in local sales resulting from a measurable change in traded sector sales; the employment multiplier estimates the total change in local employment resulting in a measurable change in traded sector employment.

Multipliers are frequently used, but there are limitations to their usefulness. First, the effects multipliers measure describe the economy now, yet multipliers are popular methods for forecasting the cumulative economic effects over time of some project or change in policy. This is ironic because the effects of a policy or project occur over time in a dynamic, not static, economy. For example, if output were to decrease in a traded sector, an employment multiplier would predict a decrease in employment across all other sectors, but some of this reduction will be temporary as workers whose jobs were eliminated find new jobs in the region.[1] For this reason alone, multipliers should only be used to describe the economy for a snap-shot in time. Second, multipliers do not consider supply constraints, but assume that as output increases or decreases, the supply of all inputs will adjust proportionately. But this is rarely the case. For example, if the food and beverage manufacturing subsectors were to grow at a rapid pace, it is likely that manufacturers would be forced to source more inputs from outside of the region due to limited local supply. The same is true for other inputs including skilled labor. Third, multipliers can be distorted by interregional feedback.[2] This is a problem when multipliers are applied to smaller regions, such as Lane County. Suppose a Lane County beverage manufacturer purchases raw input from a farmer in neighboring Linn County, but the farmer purchases his raw inputs from Lane County suppliers. If there were an increase in beverage manufacturing output, there would be an associated increase in demand for the farmer's inputs as well, but the multiplier would not account for this effect and would underestimate the total effects. This is more noticeable in smaller regions because they are more interdependent on the regions around them. Fourth, multipliers fail to account for certain cost structures. Business services such as accounting are calculated as locally purchased inputs, but an increase in a firm's output by 2 percent will not likely impact the level of accounting services purchased by the firm. But the multiplier will not consider this and predict a proportionate increase in accounting. Considering these four problems multipliers should not be relied upon to forecast economic impacts and can merely provide a descriptive analysis of short run economic effects as they occur now.

[1] (Coughlin & Mandelbaum, 1991)
[2] (Coughlin & Mandelbaum, 1991)

Long Run - The Economy Later

Over time, the economic structure of regional industries and linkages change. And this change, if positive, is the goal of economic development. Because our clients are most interested in long run economic growth and development we use basic methods of comparative analysis to describe the food and beverage manufacturing subsectors. These methods are consistent with the dynamics of an economy over time. And this analysis reflects and expands on the sufficiency and in-sufficiency of the existing stocks of human, social, physical, and natural capital to support long run growth and development.

The potential for size and scale of the food and beverage manufacturing subsectors depends on their ability to access necessary capital. Because we received our single completed and useable survey from a local brewery, we focus our case study analysis on issues to scaling and increasing the economic impact of the local brewing subsector. We have found two limiting factors faced by the brewing subsector.

First, breweries produce large volumes of waste water that have a high PH and contain large concentrations of organic matter. This waste water must be treated before it re-enters the region's waterways or soil. Typically startup breweries rely on city treatment infrastructure (physical capital) because this requires little to no initial investment other than the water treatment fees that the city charges. But city waste water treatment infrastructures are finite and as a local brewing industry grows the excess capacity of the city's treatment infrastructure may be depleted. In Bend, Oregon the city's waste water treatment infrastructure is approaching an upper limit in the volume of brewery waste water it can process.[1] And city engineers and planners have indicated that in the foreseeable future it would be difficult to approve any additional breweries that would rely on city waste water treatment. But it is important to note that Bend has roughly 3 times the concentration of breweries with 30% of the wastewater treatment capacity. And another thing to consider is this upper limit could be pushed out further if breweries begin to invest in private onsite waste water treatment infrastructure. A recent study suggests that substantial cost savings as well as

[1] (Novet, 2011)

increased production capacity could cause the benefits of installing an onsite waste water treatment facility to outweigh the costs.[1]

The second limiting factor is the large minimum efficient scale[2] for many of the industries providing intermediate inputs for the brewing subsector. For example, Great Western Malting, which supplies much of the malted barley to brewers in Lane County, has only two malting facilities in the United States. These facilities have a combined capacity of 13.8 million bushels.[3] Breweries prefer to use malt stocks that are consistent in quality because this allows production of a beer that has consistent attributes from barrel to barrel. Also commercial breweries prefer pelletized hops over whole hops for improved freshness, and shipping and storage space efficiency. Pelletized hops are vacuum sealed in bags and are half the volume of an equivalent quantity of whole hops. There is only one high tech hop pelletizing facility in Oregon, Indie Hops.[4] Bottling and cardboard packaging are also large expenditures for commercial breweries and these intermediate inputs are subject to production under very large economies of scale. The profit margin on glass bottles for a glass manufacturer is very low for each bottle which makes large, highly efficient production volumes necessary.

These examples of economies of scale in production of intermediate inputs are important to note because the economic impact of the brewing subsector expands or contracts with the quantity of expenditures that are spent locally. And though it is unlikely that Lane County would ever have a large enough brewing subsector to attract a glass manufacturer, the development of such large intermediate input manufacturers could increase the economic impact of the brewing subsector. It should be noted that this discussion can also be applied to other food and beverage manufacturing subsectors.

Data

We issued six surveys to a mix of food and beverage manufacturers and we collected two completed surveys and used one of these surveys to inform our output

[1] (Shah-Ganai, 2011)
[2] Minimum Efficient Scale is defined as the minimum scale at which returns to scale are fully realized.
[3] (Great Western Malting, 2012)
[4] (Indie Hops, 2010)

multiplier calculation. An example of the survey can be viewed in Appendix A. We collected wage and employment data for local, state, and national food and beverage manufacturing industries from two sources: The Oregon Labor Market Information System (OLMIS) through the Oregon Employment Department and the Bureau of Labor Statistics (BLS) through the United States Department of Labor. Supporting data can be found in Appendix B.

Calculated Output Multipliers

We conducted a survey to collect data from local food and beverage manufacturing businesses and use this data to compute an output multiplier for these manufacturing subsectors. But many businesses were unable to gather and provide data because of time constraints. We received survey results from two beverage manufacturing businesses. One is a startup and did not begin production until the fourth quarter of 2011. Because of this their cost structure is unrepresentative of the beverage manufacturing subsector as a whole because the majority of their expenses were startup costs that most companies only incur once. For this reason, we decided to not use the data. The other survey provided excellent data and we estimated a multiplier using the following equation:

$$\frac{\text{Traded Sector Sales} + \text{Traded Sector Local Expenditures} + \text{Traded Sector Payroll Spent Locally}}{\text{Traded Sector Sales}}$$

To calculate and apply this multiplier we make some assumptions:

- All traded sector items (payroll, expenses, etc.) are proportionate to their totals as traded sector sales are to total sales.
- Households spend 60% of payroll locally.[1]
- The leakage for all subsequent levels (See Figure 3.1) is proportionally equivalent.
- The cost structure, and therefore the multiplier, is a fair representation of the local beverage manufacturing industry as a whole.

[1] (Felsenstein, 1995)

- As the industry grows, the cost structures and input sources will grow proportionally.

We apply this multiplier to sales data for the industry to find the impact of the industry's traded sector sales on the local economy with the following equation:

$$\text{Impact} = \text{Traded Sector Sales} * \text{Output Multiplier}$$

The output multiplier calculation yielded a multiplier of 1.57. This means that for every one thousand additional dollars of traded sector sales, there is $1,570 of impact on Lane County. Applying this multiplier to sales data for the company, we find an impact of more than $24 million dollars on Lane County for traded sector sales. When we apply this multiplier to the total sales for Lane County's current beverage manufacturing subsector, we find more than $430 million dollars of impact on Lane County.[1]

The research question for this paper focuses on economic growth and economic development. Applications of the output multiplier can be successfully used to describe short run economic growth from changes in output for the beverage manufacturing subsector, but the same multiplier would probably not be accurate to forecast any long run economic changes because it would not fully consider the dynamic variables of the region's economy over time. We can apply the output multiplier to a given change in traded sector sales to estimate the impact that change would have on the local economy with the following equation:

$$\text{Impact} = \text{Change in Traded Sector Sales} * \text{Output Multiplier}$$

We demonstrate the usefulness of this multiplier by computing the impact of two different initial output changes for the beverage manufacturing subsector in Lane County. A 10% increase in sales would be approximately a $27.7 million increase in sales[2]. Given our assumptions, we find there would be a $43.5 million impact on the

[1] (Oregon Labor Department, 2012)
[2] (Oregon Labor Department, 2012)

local economy. Given a $10 million increase in traded sector sales in the beverage manufacturing industry in Lane County, we find there would be a $15.7 million impact on the local economy. In practice, this calculation may be used for cost-benefit analysis for policy options. For example, our estimates suggest that a policy costing the region $1 million that would increase beverage manufacturing output by $900 thousand would be beneficial because the net impact on the region would be:

$$\text{Net Impact} = (900{,}000 * 1.57) - 1{,}000{,}000 = \$413{,}000 \text{ gain}$$

If the same policy would increase beverage manufacturing output by only $500 thousand, it would not be beneficial because the net impact on the region would be:

$$\text{Net Impact} = (500{,}000 * 1.57) - 1{,}000{,}000 = \$215{,}000 \text{ loss}$$

IMPLAN Employment Multipliers

We obtained a list of IMPLAN[1] employment multipliers for select food and beverage manufacturing subsectors in Lane County (Table 3.1).

Table 3.1

Industry Sector Title	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Flour milling and malt manufacturing	1.0	4.5	1.9	7.4
Cheese manufacturing	1.0	3.5	0.8	5.3
Fluid milk and butter manufacturing	1.0	2.9	0.8	4.7
Animal (except poultry) slaughtering, rendering, and processing	1.0	2.5	0.6	4.1
Snack food manufacturing	1.0	2.3	0.8	4.1
Coffee and tea manufacturing	1.0	1.9	0.7	3.6
Seasoning and dressing manufacturing	1.0	1.8	0.7	3.5
Breakfast cereal manufacturing	1.0	1.3	0.9	3.2
Seafood product preparation and packaging	1.0	1.4	0.6	3.0
Ice cream and frozen dessert manufacturing	1.0	1.2	0.7	2.9
Breweries	1.0	1.0	0.6	2.6
Fruit and vegetable canning, pickling, and drying	1.0	1.0	0.5	2.5
All other food manufacturing	1.0	1.0	0.5	2.5
Wineries	1.0	0.9	0.6	2.5
Cookie, cracker, and pasta manufacturing	1.0	1.0	0.4	2.4
Soft drink and ice manufacturing	1.0	0.9	0.5	2.4

[1] IMPLAN is a cost effective input-output model that mathematically represents how different parts of the economy are linked together. Some advantages of IMPLAN are that it uses a double entry accounting framework and it uses secondary source data that has been vetted by government agencies.

Confectionery manufacturing from purchased chocolate	**1.0**	**0.7**	**0.4**	**2.1**
Non-chocolate confectionery manufacturing	**1.0**	**0.7**	**0.4**	**2.1**
Bread and bakery product manufacturing	**1.0**	**0.5**	**0.5**	**2.0**
Average Effect	**1.0**	**1.6**	**0.7**	**3.3**
Total Effect	**19.0**	**31.0**	**12.9**	**62.9**

Source: IMPLAN – Courtesy of Charlie Johnson. Senior Economic Analyst. Oregon Employment Department.

The following assumptions help to interpret these employment multipliers:

- Analysis uses 2010 IMPLAN model of Lane County, Oregon.
- Analysis assumes direct impact is the addition of exactly one job in each industry.
- Analysis assumes direct impact occurs in 2012.
- Analysis assumes direct impact occurs in Lane County, OR.
- Analysis assumes 100% of new jobs added are within the study area.
- Indirect effects are a result of business purchases within the study area.
- Induced effects are a result of household purchases within the study area.
- Total effects are the sum of direct, indirect, and induced effects.

The employment multipliers in Table 3.1 are sorted in increasing order of magnitude of total effect. The flour milling total effect of 7.4 is eye catching and we focus on this estimate for several reasons. Flour milling is a re-emerging sector in Lane County with unknown impact and growth potential. And because the large stocks of farmable grass seed acres and grass seed farm machinery (natural and physical capital) in Lane County could be more easily re-tooled and transitioned into grain production than any other locally produced agricultural commodity. We analyze the flour milling multiplier by looking at the indirect and induced effects individually and deriving some assumptions about each. First, the high indirect effect (4.5) leads us to assume that labor productivity is very high in flour milling. And this assumption holds true because flour milling is a capital intensive industry.[1] The notably smaller induced effect (1.9) further re-enforces our assumption of high labor productivity because in a

[1] Characterized by the substitution of machinery for labor; usually resulting in large gains in worker productivity.

capital intensive industry it would be consistent that household expenditures (induced effects) would be smaller than intermediate and raw input (indirect effects) expenditures. These assumptions can be demonstrated by the following scenario. Suppose a flour mill worker produces $10 million of flour per year. Assume that at the current production volume the flour mill incurs $5 million in intermediate and raw input expenditures. These expenditures are local. Further assume the one worker is already producing at maximum capacity, but the mill's physical capital is sufficient to increase production. Also assume the mill's physical capital is fixed (They cannot purchase another milling machine). Then assume the mill experiences an increase in final demand requiring them to double production and this causes them to add a new worker. Now assume that all factors of production adjust perfectly to the increase in production. All else being held constant this additional worker will result in a huge increase in local expenditures ($5 million) which could result in significant indirect effects (New jobs in other sectors). Conversely this additional worker and the new workers resulting from the indirect effects will purchase goods and services in the local region. But when these expenditures are compared to the much larger initial expenditures by the flour mill ($5 million), they will more than likely be smaller and therefore result in fewer new jobs. If we expand our analytical window to look at cheese manufacturing and fluid milk and butter manufacturing the same assumptions of capital intensity and worker productivity hold true. The production processes in these food manufacturing subsectors utilize large machinery to process large volumes of raw inputs into final goods.

There are several key assumptions to keep in mind to more accurately draw useful conclusions from this list of employment multipliers.

- All aspects of production must be the same in 2012 as they were in 2010.
- All production factor inputs must adjust perfectly and match 2010 proportions.
- There are no supply constraints.

If each of these assumptions holds true then the employment effect of one new job in each of the sectors listed in Table 3.1 will be accurate. But this is more than likely not the case. In fact there are known barriers to increasing production in flour milling in

Lane County. The first is access to sufficient volumes of food grade, dry storage for grains. The second is necessary and sufficient volumes of locally grown grains to support perfect matching of 2010 factor input proportions. If the barriers to increasing flour milling production were overcome and the industry subsector did scale up production there could be some significant employment growth. But it is very important to recognize that the effects of adding one new job for flour milling or any of the other 18 subsectors in Table 3.1 could be very different from the estimated effect for myriads of reasons. The economy is dynamic and does not always change in predictable ways.

Employment Growth

Lane County has seen continuous employment growth in both the food and beverage manufacturing subsectors. As seen in table 3.1, this growth has been significantly larger than that for the state or the nation over a nine year period from 2002 to 2011; growth rates are average annual growth.

Table 3.2: Employment Growth	Food Manufacturing	Beverage Manufacturing
Lane County	5.4%	4.6%
Oregon	-1.1%	-4.9%
United States	-0.5%	-1.0%

Source: Source: Oregon Employment Department[1] and Bureau of Labor Statistics[2]

Economic Growth

Economic growth in the Lane County food manufacturing subsector has outpaced the state growth rate over the same nine year period and the national growth rate for a comparable six year period from 2006 to 2011; and the beverage manufacturing industry has performed very well relative to state and national rates (See Table 3.3).

Table 3.3: Economic Growth	Food Manufacturing	Beverage Manufacturing
Lane County	3.6%	3.9%
Oregon	2.1%	1.4%
United States	2.7%	0.2%

[1] (Oregon Employment Department, 2011)
[2] (Bureau of Labor Statistics, 2011)

Source: Oregon Employment Department[1] and Bureau of Labor Statistics[2]

Average annual wage by sector for 2011 seems to tell a different story than the relationships in Table 3.3; Lane County outperforms in food manufacturing but underperforms in beverage manufacturing (See Table 3.4).

Table 3.4: Average Annual Wage	Food Manufacturing	Beverage Manufacturing
Lane County	$37,358.00	$28,218.00
Oregon	$34,241.16	$33,118.56
United States	$34,661.38	$40,705.13

Source: Oregon Employment Department[3] and Bureau of Labor Statistics[4]

We have no easy or definite way to explain the notably high employment growth but low average annual wage of the Lane County beverage manufacturing subsector. But we propose and explain logical reasons for this by describing the industry demographics. First both breweries and wineries have added jobs but we expect that breweries have added them at a higher rate in the last few years. Second, of the total beverage manufacturing establishments (17 establishments) in Lane County, wineries (11 establishments) are approximately 3 times the number of breweries (4 establishments).[5] And of total employment for beverage manufacturing (335 workers), wineries (224 workers) account for more than twice total employment for breweries (97 workers).[6] We assume breweries employ workers at full time employment with little to no seasonal fluctuations. This assumption is based on the fact that breweries manufacture beer continually throughout the year. Next we assume that on average wineries do not employ their workers at full time employment and they experience seasonal fluctuations in labor demand. This assumption is based on the fact that most wineries do not engage in year round wine manufacturing and that they demand large volumes of agricultural labor during certain months of the year, but do not retain these workers through the entire year. If we assume wineries employ their workers at less than full time employment this difference in hours worked could explain the lower annual average wage. We realize there are more variables to consider but given what we

[1] (Oregon Employment Department, 2011)
[2] (Bureau of Labor Statistics, 2011)
[3] (Oregon Employment Department, 2011)
[4] (Bureau of Labor Statistics, 2011)
[5] (Bureau of Labor Statistics, 2010)
[6] (Bureau of Labor Statistics, 2010)

know now we feel this is a logical explanation of the lower beverage manufacturing average annual wage.

CHAPTER 4 – Reflections and Conclusions

We began with the intention of answering the following investigative question: What qualifies the food and beverage subsectors as candidates for economic growth and development in Lane County, Oregon? Answers to this question are complex and dynamic, much like the economic subsectors at which the question is directed. We see weaknesses and strengths in our work. Several weaknesses are the limited data and the broad scope of the investigative question. One strength is the development of a framework for analyzing and describing the economic and employment growth of Lane County's food and beverage manufacturing subsectors; this framework has also inspired several, more focused questions.

We faced a scarcity of time in fully addressing the many aspects of Lane County's food and beverage manufacturing subsectors that characterize the answers to our investigative question. And we faced a scarcity of data in our choice to attempt calculating output and employment multipliers using primary source data. The output multiplier we calculated for Lane County breweries would be more representative of the region's brewery subsector if we had primary source data from each, or at least many, establishments. Given more time, we could have done this. Additionally it is important to recognize that our investigative question asks about the collective industries of food and beverage manufacturing, but we only developed an output multiplier for brewing and employment multipliers for a select number of the food and beverage manufacturing subsectors. A more comprehensive project using our framework would be beneficial; hopefully, our framework will provide a starting point to allow this comprehensive project to be completed in the time frame.

Despite the breadth of our investigative question we have created a functional framework for describing and analyzing the food and beverage subsectors in Lane County. And this framework has yielded several useful empirical findings as well as revealed several more focused areas to analyze and describe.

First, we have calculated output and employment multipliers that indicate that the brewing and flour milling subsectors possess potential for contributing substantial effects in both economic growth and employment growth, but we have tempered these potential effects with discussions of long run dynamics and cautionary findings in limits to scaling these select subsectors. Second, we identified that during 2002-2011, food

and beverage manufacturing subsectors in Lane County enjoyed a combined average employment growth rate that exceeded both state and national employment growth rates by an average of 6.5 percentage points. And we identified that during 2002-2011, food and beverage manufacturing subsectors in Lane County enjoyed a combined average economic growth rate that exceeded both state and national economic growth rates by an average of 2 percentage points. Considering the time period 2002-2011 includes the most recent and one of the most severe economic recessions in the history of Lane County and the United States, these employment and economic growth numbers are noteworthy.

We have also identified more specific areas for further analysis of Lane County's food and beverage manufacturing subsectors. We have uncovered some areas for further analysis:

- Conduct a cost - benefit analysis of implementing several technical programs at Lane Community College. Lane County possesses healthy and sizeable stocks of human and social capital in the form of the "foodie" culture, experienced and skilled food business owners, and experienced and skilled food science innovators. Our suggestion would be to capitalize on these capital stocks by becoming a training center for food innovators and entrepreneurs.
- Conduct a cost - benefit analysis of implementing an information agent to find and troubleshoot information problems that may be causing market failures. This agent would function to bridge information gaps and improve supply and demand chain efficiencies to increase backward linkages and increase multiplier effects.
- Perform statistical analysis of differences in impact of local vs. traded sector output. In our multiplier analysis, questions arise because we assume no difference in cost structure for traded sector vs. local output.
- Further regional food and beverage multiplier investigation. Specifically, collect more primary source data. In building on the work we have done, future research may experience more success in data collection and calculating multipliers for more than one firm. Along with this, future projects could attempt to capture effects further down the supply chain.

Appendices

Appendix A

Instructions: Please fill out answers to the questions below and email the completed form back to thacker@uoregon.edu or Janai@uoregon.edu.

Where not specified, please use data from the most recent fiscal year; however, data from multiple separate years would be helpful if you are able to provide it for us.

Thank you for taking time to help us with this project. We hope that the benefits from this project will help your business, the local industry and the entire community in the future.

Questions:

Please list your name and the name of your company:

What is (are) your primary product line(s)?

What is your total annual payroll? And total annual compensation?

In both quantity and dollars, what were your total sales for the most recent fiscal year?

Of total annual sales, how much was sold outside of Lane County?

In both quantity and dollars, what were your total annual variable costs, excluding payroll, of goods sold for the most recent fiscal year?

Of that total annual variable cost, how much was spent on goods and services in Lane County?

In both quantity and dollars, what were your 5 largest inputs for the most recent fiscal year, excluding payroll?

Of those, which were sourced within Lane County?

For each sourced within Lane County, who are the [largest] suppliers?

Appendix B

Lane County Food Manufacturing: NAICS 311				
Year	**Average Employment**	**Total Payroll**	**Avg. Pay per Worker**	**Business Estab.**

2001	1,283	$33,878,708	$26,406	51
2002	1,221	$33,407,772	$27,361	55
2003	1,214	$34,378,103	$28,318	53
2004	1,201	$35,864,258	$29,862	54
2005	1,242	$37,448,968	$30,152	58
2006	1,302	$42,526,428	$32,662	57
2007	1,408	$48,134,425	$34,186	54
2008	1,479	$56,386,302	$38,125	52
2009	1,497	$56,518,326	$37,754	55
2010	1,521	$57,863,696	$38,043	59
2011	1,500	$56,037,322	$37,358	57

Year	Average Annual Wage	Change	Percent Change	
2001	$26,406			
2002	$27,361	$955.00	0.04	
2003	$28,318	$957.00	0.03	
2004	$29,862	$1,544.00	0.05	
2005	$30,152	$290.00	0.01	
2006	$32,662	$2,510.00	0.08	
2007	$34,186	$1,524.00	0.05	
2008	$38,125	$3,939.00	0.12	
2009	$37,754	-$371.00	-0.01	
2010	$38,043	$289.00	0.01	
2011	$37,358	-$685.00	-0.02	
			0.04	Average

Year	Average Employment	Change	Percent Change	
2001	1283			
2002	1221	-62	-0.048	
2003	1214	-7	-0.006	
2004	1201	-13	-0.011	
2005	1242	41	0.034	
2006	1302	60	0.048	
2007	1408	106	0.081	
2008	1479	71	0.050	
2009	1497	18	0.012	
2010	1521	24	0.016	
2011	1500	-21	-0.014	
			0.024	Average

Lane County Beverage and Tobacco Manufacturing: NAICS 312

Year	Average Employment	Total Payroll	Avg. Pay per Worker	Business Estabs.
2001	271	$7,503,641	$27,689	8
2002	264	$7,306,295	$27,675	12
2003	267	$7,335,675	$27,474	10
2004	172	$3,870,059	$22,500	9
2005	205	$4,619,985	$22,537	10
2006	239	$5,703,839	$23,865	13
2007	261	$6,227,315	$23,859	13
2008	327	$8,307,966	$25,407	16
2009	360	$9,539,127	$26,498	17
2010	335	$8,550,868	$25,525	17
2011	367	$10,355,922	$28,218	20

Year	Average Annual Wage	Change	Percent Change	
2001	$27,689			
2002	$27,675	-$14.00	-0.001	
2003	$27,474	-$201.00	-0.007	
2004	$22,500	-$4,974.00	-0.181	
2005	$22,537	$37.00	0.002	
2006	$23,865	$1,328.00	0.059	
2007	$23,859	-$6.00	0.000	
2008	$25,407	$1,548.00	0.065	
2009	$26,498	$1,091.00	0.043	
2010	$25,525	-$973.00	-0.037	
2011	$28,218	$2,693.00	0.106	
			0.039	Average

Year	Average Employment	Change	Percent Change	
2001	271			
2002	264	-7	-0.026	
2003	267	3	0.011	
2004	172	-95	-0.356	
2005	205	33	0.192	
2006	239	34	0.166	
2007	261	22	0.092	
2008	327	66	0.253	
2009	360	33	0.101	
2010	335	-25	-0.069	
2011	367	32	0.096	
			0.054	Average

Oregon Beverage and Tobacco Manufacturing: NAICS 312						
Year	Annual Avg. Emp.	Change	Percent Change			
2001	2,339					
2002	2,269	70	0.030			
2003	2,421	-152	-0.067			
2004	2,536	-115	-0.048			
2005	2,603	-67	-0.026			
2006	2,841	-238	-0.091			
2007	3,161	-320	-0.113			
2008	3,247	-86	-0.027			
2009	3,311	-64	-0.020			
2010	3,306	5	0.002			
2011	3,480	-174	-0.053			
			-0.049	Average		
Year	Annual Total	Annual Avg. Emp.	Annual Avg. Payroll	Change	Percent Change	
2001	$69,734,717	2,339	$29,813.90			
2002	$67,097,784	2,269	$29,571.52	-$242.38	-0.008	
2003	$69,608,396	2,421	$28,751.92	-$819.60	-0.028	
2004	$79,604,218	2,536	$31,389.68	$2,637.76	0.092	
2005	$81,175,249	2,603	$31,185.27	-$204.41	-0.007	
2006	$89,363,182	2,841	$31,454.83	$269.57	0.009	
2007	$101,389,381	3,161	$32,075.10	$620.26	0.020	
2008	$108,055,334	3,247	$33,278.51	$1,203.42	0.038	
2009	$117,729,389	3,311	$35,557.05	$2,278.54	0.068	
2010	$109,431,536	3,306	$33,100.89	-$2,456.16	-0.069	
2011	$115,252,606	3,480	$33,118.56	$17.68	0.001	
			$31,754.29	$330.47	0.014	Average

Oregon Food Manufacturing: NAICS 311			
Year	Annual Avg. Emp.	Change	Percent Change
2001	22,141		
2002	21,992	149	0.007
2003	21,882	110	0.005
2004	22,048	-166	-0.008
2005	21,611	437	0.020
2006	22,136	-525	-0.024
2007	22,865	-729	-0.033

2008	23,412	-547	-0.024	
2009	23,261	151	0.006	
2010	23,755	-494	-0.021	
2011	24,199	-444	-0.019	
			-0.011	Average

Year	Annual Total	Annual Avg. Emp.	Annual Avg. Payroll	Change	Percent Change
2001	$614,238,881	22,141	$27,742.15		
2002	$623,609,182	21,992	$28,356.18	$614.04	0.022
2003	$644,536,712	21,882	$29,455.11	$1,098.93	0.039
2004	$663,711,973	22,048	$30,103.05	$647.94	0.022
2005	$661,915,457	21,611	$30,628.64	$525.59	0.017
2006	$699,190,932	22,136	$31,586.15	$957.51	0.031
2007	$736,896,461	22,865	$32,228.14	$642.00	0.020
2008	$773,567,323	23,412	$33,041.49	$813.35	0.025
2009	$780,331,281	23,261	$33,546.76	$505.28	0.015
2010	$804,678,379	23,755	$33,874.06	$327.30	0.010
2011	$828,601,943	24,199	$34,241.16	$367.10	0.011
			$31,345.72	$649.90	0.021

U.S. Beverage and Tobacco Manufacturing: NAICS 312

Year	Total Avg. Annual Hrs.	Avg. Hourly Earnings	Total Avg. Annual Earnings	Change	Percent Change
2006	1941.50	$20.82	$40,414.26		
2007	1991.67	$21.41	$42,644.90	$2,230.64	0.055
2008	1915.00	$22.09	$42,308.73	-$336.17	-0.008
2009	1852.50	$22.41	$41,508.35	-$800.38	-0.019
2010	1877.50	$23.24	$43,634.66	$2,126.31	0.051
2011	1836.67	$22.16	$40,705.13	-$2,929.54	-0.067
2012	1800.00	$22.42	$40,360.50	-$344.62	-0.008
	1887.83	$22.08	$41,653.79	-$8.96	0.002

Year	Annual Avg. Employment	Change	Percent Change
2002	207.30		
2003	199.48	-7.82	-0.04
2004	194.67	-4.82	-0.02
2005	191.93	-2.73	-0.01
2006	194.27	2.33	0.01
2007	198.12	3.85	0.02
2008	198.02	-0.10	0.00
2009	187.31	-10.71	-0.05
2010	183.56	-3.75	-0.02

2011	188.31	4.75	0.03	
2012	195.58	7.27	0.04	
			-0.01	Average

U.S. Food Manufacturing: NAICS 311						
Year	Annual Average	Total Annual Average	Avg. Earnings per Hr.	Total Annual Earnings	Change	Percent Change
2006	38.99	1949.50	$15.54	$30,287.43		
2007	39.44	1972.08	$15.92	$31,387.35	$1,099.92	0.036
2008	39.59	1979.58	$16.39	$32,453.62	$1,066.27	0.034
2009	38.86	1942.92	$17.08	$33,180.16	$726.54	0.022
2010	39.61	1980.42	$17.29	$34,239.75	$1,059.59	0.032
2011	39.39	1969.58	$17.60	$34,661.38	$421.63	0.012
2012	39.75	1987.50	$17.87	$35,511.66	$850.27	0.025
	39.38	1968.80	$16.81	$33,103.05	$870.70	0.027

Year	Annual Avg. Employment	Change	Percent Change	
2002	1524.93			
2003	1517.41	-7.53	-0.005	
2004	1494.05	-23.36	-0.015	
2005	1477.61	-16.44	-0.011	
2006	1479.43	1.83	0.001	
2007	1483.73	4.30	0.003	
2008	1480.40	-3.33	-0.002	
2009	1456.61	-23.79	-0.016	
2010	1450.95	-5.66	-0.004	
2011	1456.63	5.68	0.004	
2012	1451.30	-5.33	-0.004	
			-0.005	Average

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