TREND YIELDS AND THE CROP INSURANCE PROGRAM

by

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ABSTRACT

Multiple Peril Crop Insurance (MPCI) is a federally subsidized crop insurance program designed to mitigate risk for farmers across the United States. Many changes in technology and weather have increased yields in recent years. This has caused some to argue for the crop insurance program to consider yield trends when setting yields for the producer. This thesis evaluates alternative Actual Production History (APH) methods for corn to determine differences in the methods and the resulting APH.

The key issue to be evaluated is that a producer's APH may not be reflective of their "yield goal." The thesis examined how the APH can differ under alternative methods of calculating an APH. Some methods examined are currently used by the Risk Management Agency (RMA). Other methods are hypothetical alternatives. This study examines alternative methods on a national, county, and a farm level.

This thesis demonstrates that adjusting APHs for yield trends provides a higher APH than an un-trended APH. The 7 Year Olympic Trended APH provides the highest APH in most cases for all the methods examined. The RMA Un-trended APH proved to provide the least yield on average for all methods examined. This demonstrates the importance of adjusting for yield trends to factor in agricultural technology advancements over time.

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CHAPTER I: INTRODUCTION TO CROP INSURANCE

1.1 History of Crop Insurance

Crop insurance was initiated in the 1930s due to the nation-wide drought and depression. The Federal Crop Insurance Corporation (FCIC) was created by the United States Congress to administer the program. The program was limited to only major crops grown at that time and was experimental. That experiment remained in place until the Federal Crop Insurance Act of 1980 was passed. In 1980, the Federal Crop Insurance Act began subsidizing the crop insurance program (Risk Management Agency 2011).

After several years of Ad Hoc Disaster Payments authorized by the Federal Government, the Federal Crop Insurance Reform Act of 1994 was enacted. This reform required a producer to purchase crop insurance for that crop year to be eligible to receive deficiency payments under the price support program among other benefits. In 1996, changes were made to require crop insurance to be eligible to receive disaster payments. In 1996, the Risk Management Agency (RMA) was also created. RMA's goal was to oversee the FCIC programs. In 1998, approximately 180 million acres were insured, which was more than three times the acres that were insured in the 1988 crop year (Risk Management Agency 2011).

By the end of the 2010 crop year, the RMA oversaw $78 billion of liability for the crop insurance program. A total of 256 million acres were insured in 2010 with a total premium due of $7.6 billion. The corn liability in 2010 was $31.7 billion accounting for approximately 40.6% of the total liability insured (Murphy 2011).

1.2 Problems Producers Face

Under Multiple Peril Crop Insurance (MPCI), a producer's Actual Production History (APH) for a particular section of land may be below the farmer's "yield goal" or "expected yield." This is a common issue producer's face when signing contracts for crop insurance every year. Farmers that have 10 years of history may have an APH much below their "expected yield." This leads to problems when farmers try to mitigate risk when purchasing crop insurance because bushels are left "un-insured." It may be "too expensive" to buy higher levels of coverage to cover a larger amount of bushels.

There are many factors that contribute to low APHs, but one factor is the use of historical yields. If a producer has one field in a section and plants that whole field to the same crop in a given year but rotates two different crops (corn/soybeans), that producer could have a 20 year old yield in the database. Those yields are not representative of current production practices such as: seed genetics, precision farming practices, and variable rate fertilizer application. Since 1996, biotechnology has had an impact on increasing yields in the United States. Historical yields may not represent a producer's ability to produce a crop using the technology of today. Other factors that can negatively affect one's APH are: drought, excessive precipitation, or even hail. These reduce a producer's APH and contribute to a producer's inability to insure "expected yield." Because producers APH's are lower when using their most recent 10 years of actual production history, it is similar to having a double deductible crop insurance policy. One deductible is from the APH being lower than their "expected yield." The other deductible is the one the producer selects with the insurance policy that is purchased.

Many producers express frustration with the current method of calculating an APH. Most producers may create "yield goals" from what they have produced over the past three to five years, or what the technology is capable of, not the last 10 to 20 years. For producers to properly cover their risk, they need to have APHs reflective of what they are able to produce. Therefore, adjusting APHs for trends may help to increase their APH and provide them with more coverage. Adjusting for trends may account for the advancements in seed technology, precision farming practices of today, and the advancements in variable rate fertilizer application. Adjusting the yields for each year of history may make old yields more relevant to today's technology, creating a more accurate APH of what the producer expects to produce.

1.3 Objective of this Study

Most producers may not have APHs reflective of their "yield goals." The objective of this study is to analyze current APH models and alternative APH models to examine the resulting APH. Many producers have concerns about mitigating risk when purchasing crop insurance because their APHs are low.

This study analyzes different APH models at the national level, the county level, and the farm level for corn. NASS data are used to gather yield information at the national and county level. Data were gathered from three different producers in three different states to examine APHs at the farm level. The thesis also discusses the rating process under trend adjustment and the resulting crop insurance premium paid by the producer.

CHAPTER II: LITERATURE REVIEW

Yield trends and attributes that affect yield over time have been extensively researched. The review will examine information pertaining to weather impacting yields, as well as how biotechnology has increased yields over time. Yields in the United States have increased since the 1950s. Factors that have led to increased yields are: weather pattern changes, the use of nitrogen fertilizer, and biotechnology.

Egli (2008) examined corn and soybean yields in the United States from the time yield information became available for each crop in the following states: Illinois, Indiana, Iowa, Kentucky, Missouri, and Tennessee. He found no statistically significant change in corn yield from 1866 to 1930. There was a transition period from 1930 to 1950 where the use of open pollinated corn lines was discontinued and hybrids were transitioned in. These hybrids increased yield over this time period. Nitrogen fertilizer use began in about 1945 and an increased use of herbicides around 1960. These advances increased yields along with increased planting populations and mechanization. Nitrogen fertilizer was not a major part of yield increase in soybeans. Corn yields increased at a faster rate compared to soybeans. Egli found corn and soybean yields trending steadily upward for the past 75 years with no indication of a declining rate of production increases. Egli suggested that an increase in management has less of an impact on increasing yields in the future than what it has over the past 75 years.

Irwin (2008) discussed the changes in weather patterns from 1960 to 2007 and their affect on yield. He finds that weather has a greater impact on yields than technology. During the month of July, a corn crop receiving two inches higher than average precipitation had increases in corn yield by six bushels per acre. However, when there was two inches below average precipitation in July, corn yield fell by 16 bushels per acre. Therefore weather has a large impact on corn yield. Yet, the variation in corn yields due to changes in weather patterns from year to year has decreased, demonstrating that technology may be buffering yield variability. Irwin does not rule out improvements of yield due to technology advances, but merely demonstrates the effects weather has on yield.

Brookes (2009) discusses gains in farm income from increased yields of corn, soybeans, and cotton due to changing seed technology from 1996 to 2007. He found the largest gains in farm income came from soybeans due to increased yields and decreased costs. This is mostly due to the Genetically Modified Herbicide Tolerant technology of the seed. Genetically Modified Insect Resistant and Herbicide Tolerant technology is now available for corn. From 1996 to 2007, the average yield increase for corn has been 6.1% (calculations included only acres planted with seed with this technology). Genetically Modified Cotton has a yield increase of 13.4% (Brookes 2009).

Brookes (2009) found the increase in farm income is due to the results of: increased weed control, decreased costs, and no-till farming practices being adopted. The decreased costs are attributed to decreased herbicide costs and savings on labor and machinery. The use of Biotech Herbicide Tolerant soybeans has allowed double cropping in some parts of the world such as South America. According to Brookes, if biotechnology traits were not used in 2007, it would have taken another 5.89 million hectares of soybeans, 3 million hectares of corn, and 2.54 million hectares of cotton to make up the difference in yield produced that year.

Edgerton (2009) examined the impact new technology may have on corn yields in the future. Marker assisted breeding and technology traits should improve future yields.

New research demonstrates that marker technology in corn can improve yields and reduce stalk lodging. Drought tolerance is a new technology that should allow corn to be produced in drier climates and improve corn yields from corn currently grown in drier climates. Another biotechnology trait expected to have a positive impact on corn yield is having the plant use nitrogen more efficiently. In the next couple of decades, with advancements in biotechnology, Edgerton suggests that corn yields in the United States have the potential to double.

The International Service for the Acquisition of Agri-biotech Applications (2010) (ISAAA) states that since biotech traits were introduced in 1996, many hectares have been planted to a crop with a biotech trait. From 1996 to 2005 approximately 500 million hectares were planted to crops with biotechnology traits. From 2006 to 2010, approximately another 500 million hectares were grown with crops having biotechnology traits globally. The ISAAA also states that this is the fastest crop technology adoption in history. In 1996, 1.7 million hectares were grown to crops with biotechnology traits. In 2010, 148 million hectares world-wide were grown to biotech crops. Biotechnology crops from 1996 to 2009 have provided an economic gain in United States dollars of approximately $65 billion, mainly due to decreases in production costs and increases in productivity or yield gains.

These previous articles demonstrate that increasing yields have occurred. The impacts of weather, technology, and changes in practice over time have continued to increase yields and will likely continue to increase yields in the future.   These works demonstrate the possible importance of considering increasing yields over time which has not been accounted for in crop insurance.

CHAPTER III: THEORY

3.1 How the Crop Insurance Program Works

Crop insurance is sold on a contract basis that can be renewed annually. Each crop year by sales closing date, producers choose the crops to cover, coverage levels, percent of price to insure, and additional options for the policy. The crop contracts are provided on a crop per county basis.

After planting, acres are reported by acreage reporting deadline. Any losses from prevented planting need to be accounted for after harvest when production is reported to the RMA and any indemnities are processed. Unlike many other types of insurance, interaction occurs between the crop insurance agent and the producer throughout the year.

3.2 Concept of Insurance

Crop insurance designed to transfer risk from the grain producer to the insurance company. This creates a “safety net” for producers. In many cases when producers borrow money to operate their business, they often are subject to stipulations in the loan that require the producer to buy crop insurance at a certain level. Purchasing crop insurance allows producers to more safely market grain ahead of harvest by guaranteeing a bushel or revenue floor for the producer to manage their risk for the year (Collins and Bulut 2012).

However, when an insurance company takes on risk by selling insurance policies, they expose themselves to “adverse selection.” Adverse selection occurs when the insurance company has asymmetric information from the producer (Baye 2007). This is more common with new producers than those that have been farming and using crop insurance for a long period of time.

Over time, crop insurance companies are able to reduce the incidence of adverse selection. Every year, producers report their production records to RMA. Any losses are determined at that time. A producer's crop insurance premium is rated each year. The RMA uses a rating system that factors historical loss experience for a crop in a county to create a county base rate. The RMA then adjusts the county base rates for the coverage level, unit type, crop type, and crop practice (Coble, et al. 2011). Over time, crop insurance companies are able to reduce the incidence of adverse selection on a farmer basis because they have individual yield information to base their premium charges on.

3.3 Subsidization of Crop Insurance

Unlike most other types of insurance, crop insurance is sold to producers at a subsidized rate by the government. This subsidy encourages participation in the crop insurance program and is the first "safety net" for the producer.

Crop insurance has different subsidy levels for different coverage levels and plans (Table 3.1). Subsidy levels are higher when the producer assumes more risk. For example, a producer that selects a 70% coverage level for the optional unit has 59% of the premium paid by the subsidy, whereas a producer that selects a 70% coverage level for an enterprise unit has 80% of the premium paid for by the subsidy (Table 3.1). An optional unit is coverage by crop per section per county. An enterprise unit is coverage by crop per county. The subsidy levels are higher for the enterprise unit rather than the optional unit because it is less likely the producer will suffer a loss. Therefore the government is willing to increase the subsidy percentage if the producer is willing to assume more risk.

Revenue Protection is available for all coverage levels and units (Table 3.1) except Catastrophic Coverage (CAT). Yield Protection is available for all coverage levels and all units except the Whole Farm Unit.

Table 3.1: Subsidy Levels for Yield and Revenue Plans of Insurance Crop Year 2012

Coverage Level:	CAT	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85

Subsidy Factor by Unit:									
Basic Unit:	1.0	0.67	0.64	0.64	0.59	0.59	0.55	0.48	0.38
Optional Unit:		0.67	0.64	0.64	0.59	0.59	0.55	0.48	0.38
Enterprise Unit:		0.80	0.80	0.80	0.80	0.80	0.77	0.68	0.53
Whole Farm Unit:		0.80	0.80	0.80	0.80	0.80	0.80	0.71	0.56

(Risk Management Agency 2012)

Crop insurance subsidizes premiums for group plans of crop insurance (Table 3.2). The higher the coverage level the lower the subsidy. Group plans often have cheaper premiums because losses are determined at the county level and there is no prevented planting coverage. For example: a producer with a group plan of insurance can only collect an indemnity if the county has a loss. An individual producer may not have a loss, but if the county yield or the calculated county revenue comes in below the county guarantee, the producer is paid for the difference based on the county estimates of yield or revenue.

Table 3.2: Subsidy Levels for Group Plans of Insurance for Crop Year 2012

Coverage Level:	**CAT**	**0.70**	**0.75**	**0.80**	**0.85**	**0.90**
Subsidy Factor:	1.0	0.59	0.55	0.55	0.49	0.44

(Risk Management Agency 2012)

CHAPTER IV: METHODS

Data were collected from the National Agriculture Statistics Service (NASS) for corn on a national level and also from 24 counties across the United States. Those counties qualify for the RMA Trend Adjustment that is available for the 2012 crop year. Additionally, data were gathered for corn from three producers from three different states. The goal is to compare trended methods to non-trended methods to determine the differences in alternative APH methods and the resulting APH.

An analysis of estimated trend factors was completed. The RMA assigned trend factors for the 24 counties were compared to the estimated trend factors calculated using the slope from the 30 Year Sloped Trend APH using both a linear and a non-linear method.

The trend factor used for the national analysis of corn APHs was determined using the 30 year slope calculated from a non-linear regression and multiplying that by the trend APH for 2011, resulting in a trend factor of 2.57 (Table 4.1). This factor is a result of the calculations in the 30 Year Sloped Trend APH (Non-linear). RMA caps the trend factors assigned to each county at 2.5. The factor of 2.57 was used for the National analysis because RMA does not assign a trend factor for the United States and it demonstrates what the actual factor is. The un-capped trend factor in Table 4.1 was also used as the trend factor in the National analysis for the RMA 10 Year Trended APH (Non-linear) and the 7 Year Olympic Trended APH (Non-linear) methods.

Table 4.1: National Trend Factor (Non-linear)

30 Year Slope		2011 Trend APH		Trend Factor
0.01606	*	160	=	2.57

The linear trend factor derived from using the linear regression was calculated from a 30 year slope from the crop year 2011. That trend factor is 2.01, less than the cap on the trend factor of 2.5. The trend factor of 2.01 is also used as the trend factor for the calculations in the RMA 10 Year Trended APH (Linear) and the 7 Year Olympic Trended APH (Linear).

Eight different APH methods are examined at the national level. Regression analysis is used for both a linear method and a non-linear method. The equation for the non-linear regression is:

$(\ln \text{yield})_i = a + b(\text{year})_i + e_i$.

The equation for the linear regression is:

$\text{Yield}_i = a + b(\text{year})_i + e_i$.

The slope is used to create a trend yield for each year. The previous 10 years of trend yields are then averaged to create an APH for both the linear and non-linear equations.

The next method is the RMA Un-trended APH and follows the RMAs traditional method for creating an APH. The 10 most recent yields are averaged to create an APH (Table 4.2). For example: the APH for 2011 averages the yields from 2001 to 2010.

Table 4.2: RMA Un-trended APH for 2011 Crop Year for U.S. Yields

Crop Year	Yield
2001	138
2002	129
2003	142
2004	160
2005	148
2006	149
2007	151
2008	154
2009	165
2010	153
APH	149

The next method is the 7 Year Un-trended Olympic APH that calculates an APH using a 7 Year Olympic method (Table 4.3). The yields from the most recent seven years are used. The high and low yields are deleted. The remaining five years are averaged to create an APH. For example: the APH for 2011 would delete the highest and lowest yields from 2004 to 2010 and average the remaining five yields.

Table 4.3: 7 Year Un-trended Olympic APH for 2011 Crop Year for U.S. Yields

Crop Year	Yield
2004	160
2005	~~148~~
2006	149
2007	151
2008	154
2009	~~165~~
2010	153
APH	153

The next method is the RMA 10 Year Trended APH (Table 4.4). This calculates an APH using RMAs current trended APH yield system. Each qualifying county is assigned a trend yield factor by the RMA. The yield is re-calculated using this trend factor. The current crop year minus the crop year with an actual yield in the database is taken and multiplied by the trend factor. That amount is added to the yield for that year in the database. This is done for each of the previous 10 years. For example: the current crop year (2011) minus the first year in the database (2010), is 1. Multiply 1 times the trend factor assigned by the RMA for that county and add it to the yield already in the database. Then continue back through the other years in the database 2009, 2008, 2007, etc. Finally, average all 10 trend adjusted yields in the database.

For the National analysis, this method was conducted twice. Once using the trend factor of 2.57 from the 30 Year Sloped Trend APH (Non-linear) regression. The RMA 10 Year Trended APH (Non-linear) will use the 2.57 trend factor in its adjustment. The second time it was calculated using the trend factor of 2.01 from the 30 Year Sloped Trend APH (Linear) regression. The RMA 10 Year Trended APH (Linear) uses the 2.01 trend factor in its adjustment. This was done because RMA does not assign a trend yield for the National level, only at the county level.

Table 4.4: RMA 10 Year Trended APH for 2011 Crop Year for U.S. Yields

Trend Factor	2.57		
Crop Year	2011		
Crop Year	**Yield**	**Adjusted Yield**	
2001	138	2011 - 2001 = 10 * 2.57 = 25.7 + 138 =	164
2002	129	2011 - 2002 = 9 * 2.57 = 23.13 + 129 =	152
2003	142	2011 - 2003 = 8 * 2.57 = 20.56 + 142 =	163
2004	160	2011 - 2004 = 7 * 2.57 = 17.99 + 160 =	178
2005	148	2011 - 2005 = 6 * 2.57 = 15.42 + 148 =	163
2006	149	2011 - 2006 = 5 * 2.57 = 12.85 + 149 =	162
2007	151	2011 - 2007 = 4 * 2.57 = 10.28 + 151 =	161
2008	154	2011 - 2008 = 3 * 2.57 = 7.71 + 154 =	162
2009	165	2011 - 2009 = 2 * 2.57 = 5.14 + 165 =	170
2010	153	2011 - 2010 = 1 * 2.57 = 2.57 + 153 =	155
APH	149	**Trended APH**	163

The next method is the 7 Year Olympic Trended APH (Table 4.5). This uses the same method as the RMA 10 Year Trended APH above. However, the difference is the most recent seven years of yields are used. The high and low are deleted and the remaining five are averaged to create a new APH.

For the National analysis, this method was conducted twice. Once using the trend factor of 2.57 from the 30 Year Sloped Trend APH (Non-linear) regression, and next using the trend factor of 2.01 from the 30 Year Sloped Trend APH (Linear) regression. The 7 Year Olympic Trended APH (Linear) will uses the 2.01 trend factor for its adjustment.

Table 4.5: 7 Year Olympic Trended APH for 2011 Crop Year for U.S. Yields

Trend Factor	2.57		
Crop Year	2011		
Crop Year	**Yield**	**Adjusted Yield**	
2004	160	2011 - 2004 = 7 * 2.57 = 17.99 + 160 =	~~178~~
2005	~~148~~	2011 - 2005 = 6 * 2.57 = 15.42 + 148 =	163
2006	149	2011 - 2006 = 5 * 2.57 = 12.85 + 149 =	162
2007	151	2011 - 2007 = 4 * 2.57 = 10.28 + 151 =	161
2008	154	2011 - 2008 = 3 * 2.57 = 7.71 + 154 =	162
2009	~~165~~	2011 - 2009 = 2 * 2.57 = 5.14 + 165 =	170
2010	153	2011 - 2010 = 1 * 2.57 = 2.57 + 153 =	~~155~~
APH	153	**Trended APH**	164

At the county level, the counties were analyzed using the 30 Year Sloped Trend APH (Non-linear), RMA Un-trended APH, 7 Year Un-trended Olympic APH, the RMA 10 Year Trended APH, the 7 Year Olympic Trended APH methods, and the 30 Year Sloped Trend APH (Linear) methods. Both the RMA 10 Year Trended APH and the 7 Year Olympic Trended APH used the trend factors assigned by the RMA for each of the 24 counties. Therefore, only six methods were used when examining the counties.

An analysis was completed by comparing and contrasting actual data at the farm level from three different producers in three different states. For the crop year 2011, APHs were gathered from three different producers and their APH history was examined using all of the previous methods used in the county analysis. The method for the 30 Year Sloped Trend APH (Non-linear) and the 30 Year Sloped Trend APH (Linear) used the producer's actual yields from 2001 to 2010. The years from 1981 to 2000 used the NASS yields instead of actual yields because actual yields were not available from the producers. This \

provided 30 years of yields to estimate both the 30 Year Sloped Trend APH (Non-linear) and the 30 Year Sloped Trend APH (Linear) for that individual producer. The RMA 10 Year Trended APH and the 7 Year Olympic Trended APH methods used the trend factors assigned by RMA which is the same way as in the county analysis.

An analysis was completed at the farm level observing the differences in APHs, dollars of guaranteed coverage, farmer paid premium, and the affects of subsidy on farmer paid premium. Two methods were used and compared. The RMA Un-trended APH and the RMA 10 Year Trended APH were used because the other methods are hypothetical and therefore not rated by RMA. Therefore no premiums could be calculated for the hypothetical methods. The APHs are actual 2011 crop year APHs and used in a premium calculation derived from the 2012 crop year. The figures are derived from the calculations for a producer purchasing a Revenue Protection contract.

CHAPTER V: ANALYSIS

Chapter 5 evaluates the results of the analysis and data from the project. A comparison of trend factors was done. The sections will also cover analysis from the national level, the county level, and the actual farm level.

5.1 Analysis of Trend Factors

Most of the trend factors assigned by RMA (Table 5.1) are lower than the calculated trend factors using the 30 Year Non-linear Slope multiplied by the 10 year trend APH from the 30 Year Sloped Trend APH (Non-linear) calculation. Only three counties had a trend factor assigned by RMA that was higher than the calculated trend factor using the 30 Year Non-linear Slope. The trend factors are the same for Clark County, Wisconsin and Hendricks County, Indiana. There were 19 of the 24 counties (79.2%) that had trend factors using the 30 Year Non-linear Slope that were higher than the trend factor assigned by RMA. Barnes County, North Dakota had the largest difference in trend factors of 2.7 bushels different. Stafford County, Kansas had a negative trend of -0.02. There is no trend factor assigned to the United States yield by the RMA.

Most trend factors assigned by the RMA are smaller than those calculated from the 30 Year Linear Slope (Table 5.1). Fourteen of the 24 counties (58.3%) evaluated had a trend factor calculated from the 30 Year Linear Slope that was higher than the trend factor assigned by the RMA. The remaining 10 counties had a trend factor assigned by RMA that was higher than the trend factor calculated from the 30 Year Linear Slope. Stafford County, Kansas again had a negative trend factor when calculated from the 30 Year Linear Slope. Stafford County, Kansas also had the largest difference at 1.62 bushels.

This demonstrates that RMA may need to document how it calculates the trend factors. While RMA caps yield increase at 2.5 bushels, many more counties than those that are capped are different using both slope calculations making it un-clear how RMA determines a trend factor for each county.

Table 5.1: Analysis of Trend Factors

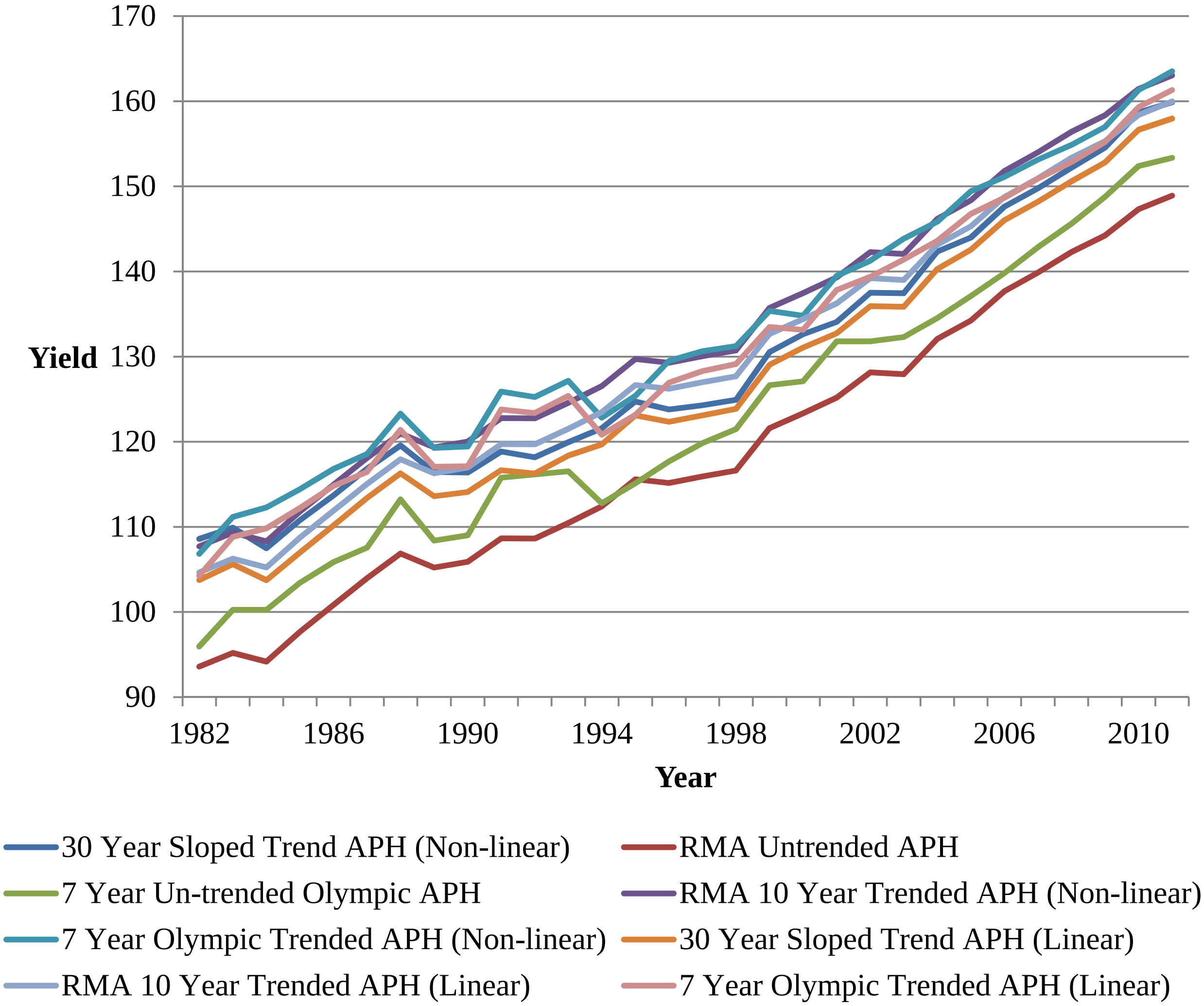
	RMA Assigned Trend Factor	Trend Factor Using 30 Year Non-linear Slope	Difference	Trend Factor Using 30 Year Linear Slope	Difference
United States		2.57		2.01	
Barnes, ND	2.50	5.20	-2.70	3.01	-0.51
Grand Forks, ND	2.35	2.79	-0.44	2.00	0.35
Clark, WI	2.08	2.08	0.00	1.65	0.43
Dane, WI	2.20	2.82	-0.62	2.18	0.02
Kent, MI	1.64	2.39	-0.75	1.84	-0.20
Lenawee, MI	1.72	2.39	-0.67	1.88	-0.16
Marion, OH	1.79	2.81	-1.02	2.19	-0.40
Warren, OH	1.77	2.40	-0.63	1.90	-0.13
Chariton, MO	1.89	2.39	-0.50	1.76	0.13
Stoddard, MO	2.07	1.86	0.21	1.56	0.51
Spink, SD	2.50	4.96	-2.46	3.11	-0.61
Yankton, SD	2.50	4.07	-1.57	2.78	-0.28
Hendricks, IN	2.42	2.42	0.00	1.85	0.57
Huntington, IN	1.71	2.42	-0.71	1.93	-0.22
Sioux, IA	2.50	4.28	-1.78	3.13	-0.63
Johnson, IA	2.27	3.69	-1.42	2.55	-0.28
Jefferson, IL	1.66	2.31	-0.65	1.72	-0.06
Knox, IL	2.29	3.70	-1.41	2.68	-0.39
Otter Tail, MN	2.50	3.78	-1.28	2.62	-0.12
Blue Earth, MN	2.38	3.39	-1.01	2.53	-0.15
Washington, NE	2.34	2.83	-0.49	2.21	0.13
Lincoln, NE	2.14	2.00	0.14	1.67	0.47
Nemaha, KS	1.86	2.13	-0.27	1.68	0.18
Stafford, KS	1.61	-0.02	1.63	-0.01	1.62

(Risk Management Agency 2012)

5.2 Analysis on a National Level

Analysis was conducted using eight different APH methods. When evaluating the different APHs, the RMA Un-trended APH results in the lowest yield on a national basis for almost all years from 1982 to 2011 (Figure 5.1). The 7 Year Un-trended Olympic APH provides the second lowest APH throughout most of the 30 year period. The 7 Year Olympic Trended APH (Non-linear) and the RMA 10 Year Trended APH (Non-linear) provide the highest APHs throughout the time period, giving producers the highest APHs of 164 and 163 bushels respectively for 2011. The 7 Year Olympic Trended APH (Linear) has the next highest APH for 2011 at 161 bushels. The 2011 APHs for the 30 Year Sloped Trend APH (Non-linear) and the RMA 10 Year Trended APH (Linear) are the same at 160 bushels. The 30 Year Sloped Trend APH (Linear) has a 2011 APH of 158 bushels.

Figure 5.1: National Analysis of Corn APH's from 1982 to 2011



All APH methods are highly correlated (Table 5.2). The RMA Un-trended APH, the RMA 10 Year Trended APH (Non-linear), and the RMA 10 Year Trended APH (Linear) are perfectly correlated with each other. The other methods are correlated at the 98% level or higher. The correlation was calculated over a 30 year period from 1982 to 2011.

Table 5.2: Correlation of National Yields

APH Model	A	B	C	D	E	F	G	H
A	1.0	0.9949	0.9898	0.9949	0.9911	0.9988	0.9949	0.9909
B	0.9949	1.0	0.9937	1.0	0.9937	0.9986	1.0	0.9938
C	0.9898	0.9937	1.0	0.9937	0.9976	0.9933	0.9937	0.9984
D	0.9949	1.0	0.9937	1.0	0.9937	0.9986	1.0	0.9938
E	0.9911	0.9937	0.9976	0.9937	1.0	0.9940	0.9937	0.9999
F	0.9988	0.9986	0.9933	0.9986	0.9940	1.0	0.9986	0.9939
G	0.9949	1.0	0.9937	1.0	0.9937	0.9986	1.0	0.9938
H	0.9909	0.9938	0.9984	0.9938	0.9999	0.9939	0.9938	1.0

30 Year Sloped Trend APH (Non-linear) = A
RMA Un-trended APH = B
7 Year Un-trended Olympic APH = C
RMA 10 Year Trended APH (Non-linear) = D
7 Year Olympic Trended APH (Non-linear) = E
30 Year Sloped Trend APH (Linear) = F
RMA 10 Year Trended APH (Linear) = G
7 Year Olympic Trended APH (Linear) = H

When comparing the average APHs over the 30 year period from 1982 to 2011 of the 7 Year Olympic Trended APH (Non-linear) and the RMA 10 Year Trended APH (Non-linear) (Table 5.3), they are very close at 133 and 132.8 bushels respectively. When comparing the 7 Year Olympic Trended APH (Linear) to the RMA 10 Year Trended APH (Linear), they are similar at 130.9 and 129.7 bushels respectively. The RMA Un-trended

APH and the 7 Year Un-trended Olympic APH have the lowest average APHs of 118.7 and 122.8 bushels respectively.

The 30 Year Sloped Trend APH (Non-linear) has the least variability with a standard deviation of 15.8 while the 30 Year Slope Trend APH (Linear) is tied for having the second highest variability with a standard deviation of 16.4. The 7 Year Olympic Trended APH (Non-linear) and the 7 Year Olympic Trended APH (Linear) have the second lowest variability with a standard deviation of 16. The RMA Un-trended APH, the RMA 10 Year Trended APH (Non-linear), and the RMA 10 Year Trended APH (Linear) all have the same variability of 16.6.

Table 5.3: APH Statistical Analysis for U.S. Corn Yields from 1982 to 2011

	Average	Minimum	Maximum	St. Dev.
30 Year Sloped Trend APH (Non-linear)	129.2	107.5	159.9	15.8
RMA Un-trended APH	118.7	93.6	148.9	16.6
7 Year Un-trended Olympic APH	122.8	95.9	153.4	16.4
RMA 10 Year Trended APH (Non-linear)	132.8	107.7	163.0	16.6
7 Year Olympic Trended APH (Non-linear)	133.0	106.8	163.5	16.0
30 Year Sloped Trend APH (Linear)	127.0	103.7	158.0	16.4
RMA 10 Year Trended APH (Linear)	129.7	104.6	160.0	16.6
7 Year Olympic Trended APH (Linear)	130.9	104.3	161.3	16.0

5.3 Analysis on a County Level

On a county level, the average APHs were evaluated to determine the robustness of the national results. The 7 Year Olympic Trended APH has the highest average APH of 124.8 bushels (Table 5.4) over a 30 year period from 1982 to 2011. The RMA 10 Year Trended APH provides the second highest average yield with an APH of 123.4 bushels.

The 7 Year Olympic Trended APH is the highest APH in 19 of the 24 counties evaluated (79.2%). In the five counties where the 7 Year Olympic Trended APH did not provide the highest APH, it provided the second highest APH for four of the five counties.

This demonstrates that the 7 Year Olympic Trended APH tended to have a high yield on a consistent basis across the country.

The RMA Un-trended APH provided the lowest APH for every county evaluated and also at the national level. The RMA Un-trended APH provides the lowest yield with an average APH of 112.1 bushels across all the counties evaluated.

Table 5.4: Average APH at the County Level for Corn Yield, 1982-2011

	A	B	C	D	E	F
United States	129.2	118.7	122.8	132.8	133.0	127.0
Barnes, ND	86.6	75.8	79.4	89.5	89.6	83.5
Grand Forks, ND	88.6	80.5	83.5	93.4	93.2	86.9
Clark, WI	108.6	101.0	105.2	109.6	111.4	107.5
Dane, WI	132.0	123.6	129.1	135.7	137.4	130.7
Kent, MI	111.9	102.8	106.8	111.8	112.9	110.1
Lenawee, MI	124.2	116.6	122.2	126.1	129.1	123.2
Marion, OH	128.9	120.0	124.9	129.8	132.2	127.5
Warren, OH	130.3	120.1	124.0	129.8	131.5	128.3
Chariton, MO	114.9	106.0	109.7	116.3	116.9	113.2
Stoddard, MO	142.4	129.2	133.6	140.5	142.1	138.9
Spink, SD	95.7	81.0	86.0	94.8	96.2	90.3
Yankton, SD	98.4	88.3	91.9	102.0	101.4	95.9
Hendricks, IN	140.2	130.1	134.2	140.0	141.6	138.3
Huntington, IN	131.9	123.0	128.6	132.4	135.5	130.4
Sioux, IA	146.7	132.6	138.4	146.4	148.7	143.4
Johnson, IA	132.1	124.3	129.8	136.8	138.5	130.9
Jefferson, IL	98.6	91.1	94.7	100.3	101.3	97.1
Knox, IL	144.6	135.1	140.7	147.7	150.2	143.0
Otter Tail, MN	106.6	94.5	99.0	108.2	109.7	103.4
Blue Earth, MN	143.4	132.3	138.9	145.4	148.3	141.4
Washington, NE	122.4	112.0	116.3	124.8	125.4	120.1
Lincoln, NE	152.2	135.8	139.5	147.5	148.1	147.0
***Nemaha, KS**	98.2	89.6	93.3	99.8	101.0	96.4
***Stafford, KS**	168.4	145.0	146.7	153.9	153.1	156.9
Average of Counties	122.8	112.1	116.5	123.4	124.8	120.2

* Denotes: Only a 24 Year slope could be used for 30 Year Sloped Trend APH Calculations

30 Year Sloped Trend APH (Non-linear) =	**A**
RMA Un-trended APH =	**B**
7 Year Un-trended Olympic APH =	**C**
RMA 10 Year Trended APH =	**D**
7 Year Olympic Trended APH =	**E**
30 Year Sloped Trend APH (Linear) =	**F**

When evaluating the 24 counties that were studied in this model, the RMA Un-trended APH and the RMA 10 Year Trended APH both have the least variation with an average standard deviation of 17.3 (Table 5.5). The 7 Year Olympic Trended APH has slightly more variation with a standard deviation on average of 17.5 over the 30 year period. At the national level, the 30 Year Slope Trend APH (Non-linear) provided the least variation with a standard deviation of 15.8, but, at the county level, it is the highest at 18.9. The 30 Year Slope Trend APH (Non-linear) has the highest standard deviation in 14 of the 24 counties evaluated (58.3%).

The RMA Un-trended APH and the RMA 10 Year Trended APH have the same standard deviation both at the national level and all the county levels. At the county level, the RMA Un-trended APH and the RMA 10 Year Trended APH have the lowest standard deviation in 12 of the 24 counties evaluated (50%). They also have the lowest average standard deviation of 17.3. When evaluating the standard deviation at the national level, the RMA Un-trended APH and the RMA 10 Year Trended APH have the highest variation.

When evaluating the variability across the country, the northern most states tend to have the most variability; North Dakota, South Dakota, and Minnesota have high standard deviations.

Table 5.5: Standard Deviation at the County Level for Corn Yield, 1982-2011

	A	B	C	D	E	F
United States	15.8	16.6	16.4	16.6	16.0	16.4
Barnes, ND	28.7	24.1	25.9	24.1	25.7	26.8
Grand Forks, ND	15.5	14.7	16.4	14.7	16.3	15.4
Clark, WI	16.1	15.1	15.1	15.1	15.0	15.7
Dane, WI	19.4	17.6	17.2	17.6	16.5	18.8
Kent, MI	14.1	14.5	15.0	14.5	14.7	14.4
Lenawee, MI	16.2	15.2	15.8	15.2	15.8	15.9
Marion, OH	15.4	15.3	16.2	15.3	16.2	15.5
Warren, OH	13.5	14.3	14.1	14.3	14.0	13.9
Chariton, MO	20.2	17.7	17.0	17.7	16.9	19.1
Stoddard, MO	12.9	16.2	15.4	16.2	15.5	14.8
Spink, SD	31.6	25.8	26.9	25.8	27.5	28.9
Yankton, SD	25.2	21.2	21.6	21.2	21.4	23.7
Hendricks, IN	14.6	15.2	13.9	15.2	13.6	14.8
Huntington, IN	13.3	14.1	14.9	14.1	14.8	13.7
Sioux, IA	27.0	25.2	25.0	25.2	25.1	26.7
Johnson, IA	22.8	19.9	21.1	19.9	21.0	21.8
Jefferson, IL	13.2	13.0	13.4	13.0	13.2	13.3
Knox, IL	23.1	20.9	22.5	20.9	22.6	22.5
Otter Tail, MN	26.3	23.1	23.2	23.1	23.2	25.1
Blue Earth, MN	21.4	20.4	21.1	20.4	21.2	21.2
Washington, NE	19.7	18.5	18.2	18.5	18.3	19.4
Lincoln, NE	10.5	16.6	16.2	16.6	16.2	14.0
***Nemaha, KS**	12.3	11.0	13.0	11.0	12.8	11.7
***Stafford, KS**	21.4	4.4	3.5	4.4	3.5	9.6
Average of Counties	18.9	17.3	17.6	17.3	17.5	18.2

* Denotes: Only a 24 Year slope could be used for 30 Year Sloped Trend APH Calculations

30 Year Sloped Trend APH (Non-linear) =	**A**
RMA Un-trended APH =	**B**
7 Year Un-trended Olympic APH =	**C**
RMA 10 Year Trended APH =	**D**
7 Year Olympic Trended APH =	**E**
30 Year Sloped Trend APH (Linear) =	**F**

5.3 Analysis of Farm Level Data from Actual Producers

Figure 5.2 calculates a 2011 APH using all the APH models consisting of actual production history from a producer in Spink County, South Dakota. The 7 Year Olympic Trended APH provides the most coverage with an APH of 129.0 bushels. The 30 Year Sloped Trend APH (Non-linear), the 7 Year Un-trended Olympic APH, the RMA 10 Year Trended APH and the 30 Year Sloped Trend APH (Linear) are very close together at 119, 118, 116, and 117 bushels respectively. The RMA Un-trended APH provides the least coverage for this producer with an APH of 103.0 bushels and the 7 Year Olympic Trended APH provides the producer with the most coverage.

Figure 5.2: Spink County, SD Actual Producer Data

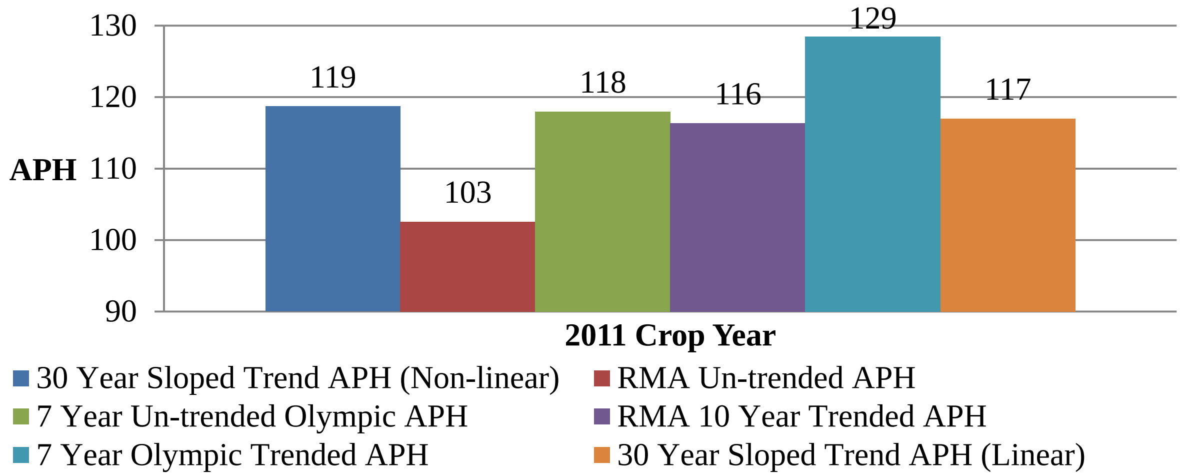


Figure 5.3 calculates an APH using actual producer history from a producer in Sioux County, Iowa. The 30 Year Sloped Trend APH (Non-linear) provides the highest APH of 214 bushels. The RMA 10 Year Trended APH is tied for having the second highest APH with the 30 Year Sloped Trend APH (Linear) at 208 bushels. The 7 Year Olympic Trended APH is one bushel less at 207 bushels. The 7 Year Un-trended Olympic APH provides the lowest APH at 193 bushels while the RMA Un-trended APH is at 194

bushels. For this producer, the 30 Year Sloped Trend APH (Non-linear) would provide the most coverage while the 7 Year Olympic Trended APH would provide the least coverage.

Figure 5.3: Sioux County, IA Actual Producer Data

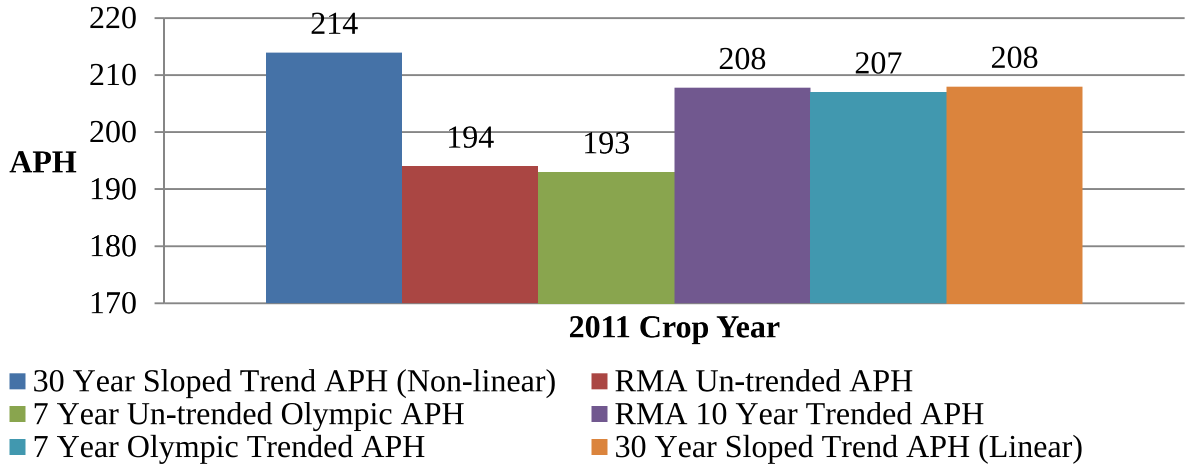
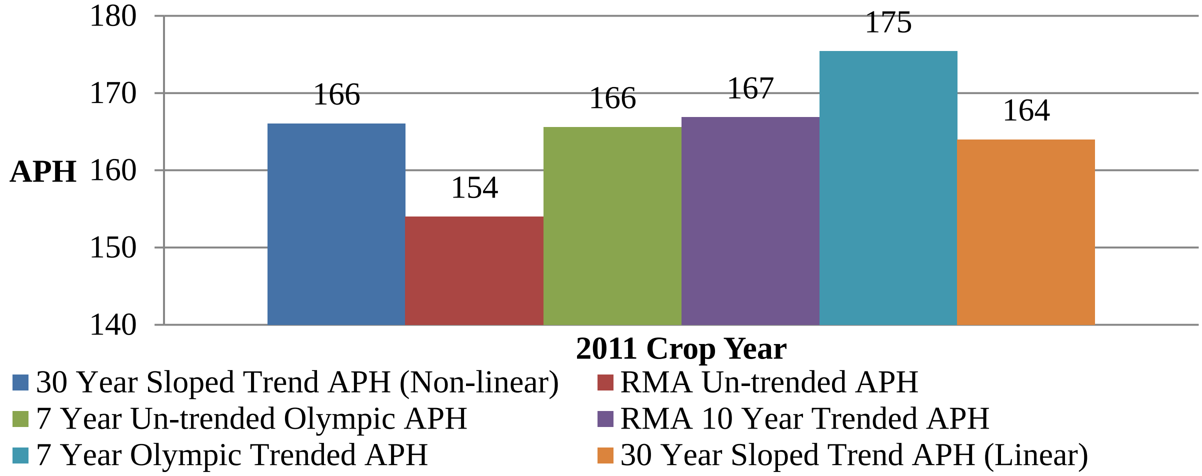


Figure 5.4 calculates APHs using actual production history from a producer in Washington County, Nebraska. The 7 Year Olympic Trended APH provides the highest APH of 175 bushels. The RMA Un-trended APH provides the lowest APH for the producer at 154 bushels. The 30 Year Sloped Trend APH (Non-linear) and the 7 Year Un-trended Olympic APH are the same at 166 bushels. The RMA 10 Year Trended APH is one bushel higher at 167 bushels. The 30 Year Sloped Trend APH (Linear) is three bushels less at 164 bushels. The 7 Year Olympic Trended APH provides the producer the most coverage while the RMA Un-trended APH provides this producer with the least coverage.

Figure 5.4: Washington County, NE Actual Producer Data



When comparing the actual producer yield data in the previous three figures, the 7 Year Olympic Trended APH provides the highest APH for the producers in two of the three counties. The 30 Year Sloped Trend APH (Non-linear) provides the highest APH of 214 bushels for the producer in Sioux County, Iowa. The RMA Un-trended APH has the lowest APH in two of the three counties. Just like in the national and county simulations, the RMA Un-trended APH provides a low APH for the producer. The 30 Year Sloped Trend APH (Non-linear) provides the highest APH for the producer from Sioux County, IA, but it is in the middle for the other two producers. The RMA 10 Year Trended APH and the 7 Year Un-trended Olympic APH have very similar results for the producers in Spink County, South Dakota and Washington County, Nebraska. The 30 Year Sloped Trend APH (Linear) produces APHs which are toward the middle for all three producers.

5.4 Premium and Coverage Analysis at the Farm Level

Table 5.5 demonstrates the premium and dollars of coverage for the producer from Spink County, South Dakota. This producer receives a 13 bushel increase in APH when the APH is adjusted for the trend. The 85% coverage level with no trend adjustment and the 75% coverage level adjusted for the trend provide nearly the same dollars of coverage per acre at $497.57 and $494.16 respectively. The Unsubsidized Rate Per $100 is nearly the same for both coverage levels at $24.68 for the 85% coverage level with no trend adjustment and $24.26 for the 75% coverage level adjusted for the trend. The major difference is the Farmer Paid Premium which is much lower at the 75% coverage level adjusted for the trend. The Farm Paid Rate per $100 is $4.38 lower at the 75% coverage level adjusted for the trend than the 85% coverage level with no trend adjustment. This is due to the subsidy percentage being higher at the 75% coverage level than at the 85% coverage level. The subsidy level at the 75% coverage level is 55%, while the subsidy level at the 85% coverage level is 38%. This producer can buy nearly the same dollars of coverage per acre at the 75% coverage level adjusted for the trend as at the 85% coverage level not adjusted for the trend and pay much less in premium.

Table 5.5: Premium and Coverage Analysis for Spink County, SD Producer

Spink County, South Dakota Corn

APH	103 bu			
Trend APH	116 bu			
Price Election	$5.68	Price Election for 2012		
Volatility	0.22	Volatility for 2012		
Revenue Protection Optional Unit Rates for 2012				
	No Trend	**Trend**	**No Trend**	**Trend**
Coverage	85%	80%	**80%**	75%
$ Coverage	$497.57		$468.03	
Coverage Trend		$527.10		$494.16
Unsubsidized Premium per Acre	$122.80		$105.78	
Unsubsidized Premium per Acre		$136.55		$119.88
Added Coverage	$29.54		$28.97	
Added Coverage Trend		$59.07		$55.10
Added Subsidy for Trend		$18.88		$15.16
Unsubsidized Rate Per $100	**$24.68**		**$22.60**	
Unsubsidized Rate Per $100		**$25.91**		**$24.26**
Farm Paid Rate Per $100	$15.30		$11.75	
Farm Paid Rate Per $100		$13.47		$10.92

(Barnaby 2012)

Table 5.5 demonstrates the premium and dollars of coverage for the producer from Sioux County, Iowa. This producer receives a 14 bushel increase in APH when the APH is adjusted for the trend. The 75% coverage level with the trend adjustment provides $4.54 more coverage per acre than the 80% coverage level with no trend adjustment. The Unsubsidized Rate Per $100 is the same at $6.41 for both the 75% coverage level with the trend adjustment and the 80% coverage level with no trend adjustment. The major difference is farmer paid premium. The Farm Paid Rate per $100 is $0.45 cheaper for the 75% coverage level with the trend adjustment than the 80% coverage level with no trend adjustment. The 75% coverage level with the trend adjustment provides the Sioux County, Iowa producer more dollars of coverage per acre for less premium cost. This is due to the different subsidy levels. The subsidy level at the 75% coverage level is 55% while the subsidy level at the 80% coverage level is 48%.

Table 5.6: Premium and Coverage Analysis for Sioux County, IA Producer

Sioux County, Iowa Corn

APH	194 bu	
Trend APH	208 bu	
Price Election	$5.68	Price Election for 2012
Volatility	0.22	Volatility for 2012

Revenue Protection Optional Unit Rates for 2012

	No Trend	Trend	No Trend	Trend
Coverage	85%	80%	**80%**	75%
$ Coverage	$936.63		$881.54	
Coverage Trend		$945.15		$886.08
Unsubsidized Premium per Acre	$74.39		$56.54	
Unsubsidized Premium per Acre		$77.57		$56.83
Added Coverage	$55.09		$55.10	
Added Coverage Trend		$63.61		$59.64
Added Subsidy for Trend		$8.96		$4.12
Unsubsidized Rate Per $100	**$7.94**		**$6.41**	
Unsubsidized Rate Per $100		**$8.21**		**$6.41**
Farm Paid Rate Per $100	$4.92		$3.34	
Farm Paid Rate Per $100		$4.27		$2.89

(Barnaby 2012)

Table 5.7 demonstrates the premium and dollars of coverage for the producer from Washington County, Nebraska. This producer receives a 13 bushel increase in APH when his APH is adjusted for the trend. The 75% coverage level with the trend adjustment provides $11.92 more coverage per acre than the 80% coverage level with no trend adjustment. The Unsubsidized Rate Per $100 are within $0.36. The farmer paid premium is cheaper at the 75% coverage level with the trend adjustment than the 80% coverage level with no trend adjustment. The Farm Paid Rate per $100 is $0.51 cheaper. The 75%

coverage level adjusted for the trend provides more guaranteed dollars of coverage per acre for less premium cost. Again, this is due to the difference in subsidy levels.

Table 5.7: Premium and Coverage Analysis for Washington County, NE Producer

Washington County, Nebraska Corn

APH	154 bu			
Trend APH	167 bu			
Price Election	$5.68	Price Election for 2012		
Volatility	0.22	Volatility for 2012		
Revenue Protection Optional Unit Rates for 2012				
	No Trend	**Trend**	**No Trend**	**Trend**
Coverage	85%	80%	**80%**	75%
$ Coverage	$743.51		$699.78	
Coverage Trend		$758.85		$711.70
Unsubsidized Premium per Acre	$84.98		$67.18	
Unsubsidized Premium per Acre		$91.43		$70.88
Added Coverage	$43.73		$43.74	
Added Coverage Trend		$59.07		$55.66
Added Subsidy for Trend		$11.60		$6.73
Unsubsidized Rate Per $100	**$11.43**		**$9.60**	
Unsubsidized Rate Per $100		**$12.05**		**$9.96**
Farm Paid Rate Per $100	$7.09		$4.99	
Farm Paid Rate Per $100		$6.26		$4.48

(Barnaby 2012)

The previous three tables indicate that a producer may receive similar dollars of coverage per acre or more dollars of coverage per acre by purchasing down one coverage level by applying the trend adjustment to that coverage level. This occurs in some instances because the different coverage levels have different subsidy levels. This is not the case in all instances, however. It will also depend on how much the trend adjustment increases the APH, therefore these results will not happen occur for all producers. For all three of the producers studied, it was cheaper to purchase coverage at the 75% coverage level adjusted for the trend.

5.5 Analysis of Slopes over a 30 Year Period

Table 5.8 demonstrates the slopes derived from the regression analysis from both the 30 Year Sloped Trend APH (Linear) and the 30 Year Sloped Trend APH (Non-linear) methods from the National level for each year from 1982 to 2011. This table provides the bushel increase for the linear model and percentage increase for the non-linear model. This table demonstrates the bushel increases per year and the percentage increases per year were higher in the early 1980s than currently. This table also demonstrates yields nationally are increasing over time.

Table 5.8: United States Trend Increases 1982 – 2011

Year	30 Year Slope (Linear) (Bushels)	30 Year Slope (Non-linear) (Percentage)
1982	2.26	3.33%
1983	2.32	3.30%
1984	2.12	3.00%
1985	2.07	2.81%
1986	2.08	2.70%
1987	2.10	2.62%
1988	2.09	2.52%
1989	1.86	2.22%
1990	1.82	2.11%
1991	1.78	1.99%
1992	1.70	1.87%
1993	1.76	1.88%
1994	1.62	1.72%
1995	1.67	1.69%
1996	1.60	1.61%
1997	1.60	1.58%
1998	1.61	1.58%
1999	1.66	1.60%
2000	1.71	1.64%
2001	1.68	1.56%
2002	1.73	1.59%
2003	1.76	1.63%
2004	1.83	1.67%
2005	1.85	1.61%
2006	1.85	1.58%
2007	1.85	1.55%
2008	1.85	1.52%
2009	1.91	1.56%
2010	2.07	1.68%
2011	2.01	1.61%

CHAPTER VI: CONCLUSIONS

6.1 Results

Many producers believe they have APHs that are not reflective of their "expected yield." Therefore, they argue that there are bushels left un-insured. Several different APH methods were examined to see differences in the APHs and whether that difference was consistent. These methods were examined on a national, county, and farm level. It is important for a producer's APH is reflective of his yield goal or it may become similar to buying a "double deductible" insurance policy and bushels are left un-covered. One deductible is the coverage level purchased, and the other is that the APH is lower than the "expected yield."

Eight different APH methods were examined at the national level. The first was a 30 Year Sloped Trend APH. This method used both a linear regression and a non-linear regression trend. The 30 year slope is estimated using regression analysis and that slope is used to create a trend yield. The previous ten years of yields are averaged to create an APH for that year. Two un-trended APH methods were used. The RMA Un-trended APH is the current un-trended APH method the RMA uses and averages the previous 10 years of yields. The 7 Year Un-trended Olympic APH uses the 7 most recent yields deleting the high and low yields and averaging the remaining five. The final two trended methods are the RMA 10 Year Trended APH and the 7 Year Olympic Trended APH. The RMA 10 Year Trended APH adjusts the most recent 10 yields by a trend factor and creates a new APH. The 7 Year Olympic Trended APH is very similar except the most recent 7 yields are used, the high and low are deleted and the remaining are averaged. At the national level, the RMA 10 Year Trended APH and the 7 Year Olympic Trended APH were each conducted twice. Once using the non-linear trend factor and once using a linear trend factor.

Nationally, the 7 Year Olympic Trended APH (Non-linear) provides the highest APH on average. It also has the second lowest variability of the five methods examined. The second highest APH method on average is the RMA 10 Year Trended APH (Non-linear). Both the un-trended APH methods provide the lowest APHs on a national level. Also, the RMA Un-trended APH is tied for having the highest variability. This combination for the RMA Un-trended APH of having the lowest APH and the highest variability is an undesirable combination for a producer wanting to choose an APH method to mitigate risk for his farming operation. The 30 Year Sloped Trend APH (Non-linear) has the least variability of the methods studied.

At a county level, the 7 Year Olympic Trended APH provides the highest APH in 19 of the 24 counties observed (79.2%). The RMA 10 Year Trended APH is a close second on average for having the highest APH (1.4 bushels less than the 7 Year Olympic Trended APH model). Both, the un-trended APH methods provide the lowest APH for every county observed. This demonstrates that an un-trended APH method provides the lowest APH for the producer and the least amount of coverage.

At the farm level, the 7 Year Olympic Trended APH provides the highest APH for two of the three farmers. The 30 Year Sloped Trend APH (Non-linear) provides the highest APH for one producer. The RMA Un-trended APH has the lowest APH for two of the three producers.

The RMA does not document how they calculate their trend factors. Many of the RMA trend factors assigned to each county are lower than those calculated from the 30 Year Non-linear Slope and those calculated from the 30 Year Linear Slope.

Producers may want to consider purchasing the trend adjustment. Often times, they can purchase down a coverage level, provide similar dollars of coverage, and possibly obtain a higher subsidy.

When developing APHs, an APH needs to be representative of a producer's "expected yield." The un-trended APHs may not provide a good estimate of expected yield. Un-trended APHs do not adjust for the advancements taking place in agriculture that improve yields over time. The 7 Year Olympic Trended APH provides the highest average APH for all methods while the RMA Un-trended APH provides the lowest average APH.

6.2 Criticism of this Study

More research needs to be conducted at the producer level. More APHs need to be examined to further examine the effects of crop rotation and how older yields impact an APH model. This is especially the case when using a trended APH.

More producer data needs to be used for researching models. NASS data removes variability and more relevant information would be available if actual producer information was used and not NASS data. Producer data from the RMA needs to be obtained and examined to determine the effects of the models at the farmland.

This study only examines the impacts of these APH models on corn. Other commodities should be examined to see how the APH models affect those.

6.3 Suggestions to be Further Researched

This study demonstrated the impact trended APH models can have on a producer's APH. The evaluation of the impacts of various models of APHs needs to be extended to other crops. This study demonstrated that shortening the time to calculate an APH does not change the APHs much. For example: the 7 Year Un-trended Olympic APH provided the second lowest APH of the models examined most of the time. However, when that model was trended, it provided the highest APH on the average at the national, county, and producer levels.

More research needs to be conducted on APHs using a shorter time period than 10 years. More five and seven year trended APH models need to be evaluated to analyze the impact they have on increasing a producers APH.

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