An Evaluation of Persons Per Household (PPH) Data Generated By the American Community Survey: A Demographic Perspective*

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Abstract

The American Community Survey (ACS) is a US Census Bureau product designed to provide accurate and timely demographic and economic indicators on an annual basis for both large and small geographic areas within the United States. Operational plans call for ACS to serve not only as a substitute for the decennial census long-form, but as a means of providing annual data at the national, state, county, and subcounty levels . In addition to being highly ambitious, this approach represents a major change in how data are collected and interpreted. Two of the major questions facing the ACS are its functionality and usability. This paper explores the latter of these two questions by examining "Persons Per Household (PPH)," a variable of high interest to demographers and others preparing regular post-censal population estimates. The data used in this exploration are taken from 18 of the counties that formed the set of 1999 ACS test sites. The examination proceeds by comparing ACS PPH values to PPH values generated using a geometric model based on PPH change between the 1990 and 2000 census counts. The ACS PPH values represent what could be called the "statistical perspective" because variations in the values of specific variables over time and space are viewed largely by statisticians with an eye toward sample (and non-sample) error. The model-based PPH values represent a "demographic perspective" because PPH values are largely viewed by demographers as varying systematically, an orientation stemming from theory and empirical evidence that PPH values respond to demographic and related determinants. The comparisons suggest that the ACS PPH values exhibit too much "noisy" variation for a given area over time to be usable by demographers and others preparing post-censal population estimates. These findings should be confirmed through further analysis and suggestions are provided for the directions this research could take.

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Introduction

The American Community Survey (ACS) is a US Census Bureau product designed to provide accurate and timely demographic and economic indicators on an annual basis for both large and small geographic areas within the United States (Citro and Kalton, 2007; US Census Bureau, 2004). Operational plans call for ACS to serve not only as a substitute for the decennial census long-form, but as a means of providing annual data at the national, state, county, and subcounty levels (Cork, Cohen, and King, 2004; US Census Bureau, 2001a, 2001b, 2003, 2004a). In addition to being highly ambitious, this approach represents a major change in how data are collected and interpreted (Citro and Kalton, 2007; Hough and Swanson, 1998, 2006). Two of the major questions facing the ACS are its functionality and usability (Citro and Kalton, 2007). This paper explores the latter of these two questions by examining “Persons Per Household” (PPH), a variable of high interest to demographers and others preparing regular post-censal population estimates (Bryan, 2004; Devine and Coleman, 2003; Kimpel and Lowe, 2007; Lowe, Pittenger, and Walker, 1977; Roe, Carlson, and Swanson, 1992; Smith, 1986; Smith and Cody, 1994; Smith and Lewis, 1980; Smith and Mandell, 1984; Smith, Nogle, and Cody, 2002; Swanson, 2004; Swanson, Baker, and Van Patten, 1983).

The data used in this exploration are taken from 18 counties that were in the 1999 ACS test sites (See Exhibit 1). The examination proceeds by comparing ACS PPH values for these 18 counties to PPH values generated using a geometric model based on

PPH change from Census 1990 to Census 2000. The ACS PPH values represent what could be called the "statistical perspective" because variations in the values of specific variables over time and space are viewed largely by statisticians with an eye toward sample (and non-sample) error (Citro and Kalton, 2007; Fay, 2005; Kish, 1998; Purcell and Kish, 1979; US Census Bureau, 2001a, 2001b, 2003, 2004). The model-based PPH values represent a "demographic perspective" because PPH values are largely viewed by demographers as varying systematically, an orientation stemming from theory and empirical evidence that PPH values respond to demographic and related determinants (Burch, 1967, 1970; Burch et al., Coale, 1965; 1987; Goldsmith, Jackson, and Shambaugh, 1982; Kimpel and Lowe, 2007; Korbin, 1976; Myers and Doyle, 1990; Smith, Nogle, and Cody, 2002).

Before proceeding, it is worthwhile to review the Housing Unit Method (HUM). The HUM formula used to generate the population of an area at a given point in time is:

$$P = GQ + (PPH)(H)(OR)$$

where

P = Total Population

GQ = Population in Groups Quarters

PPH = Persons Per Household

H = Total Number of Housing Units

OR = Occupancy Rate

Note that (H)(OR) = Total Number of Households

The HUM is based on the assumption that virtually everyone lives in some type of housing structure. It is generally accepted that the HUM is the most commonly used method for making small area population estimates in the United States (Byerly, 1990; Smith, Nogle, and Cody, 2002). One of the reasons for this is that current data for two of its elements are generally available, the number of households and the group quarters population (Smith, Nogle, and Cody, 2002). The other remaining element needed to get the household population is PPH. Until the full implementation of the ACS, current PPH values were obtained by using the value from the most recent census or extrapolating trends found from the two most recent decennial censuses (Bryan, 2004; Smith, Nogle, and Cody, 2004; Swanson, Baker, and Van Patten, 1983). With the expansion of the ACS to its full design in 2005 (Griffin and Waite, 2006), it is not surprising that among the large number of HUM users, more than a few are interested in seeing if the ACS can provide usable PPH values. This paper represents an attempt to answer this question.

Data

The US Census Bureau established the operational structure for the ACS in 1994 when it put in place the "Continuous Measurement Office," which implemented the first operational test of the ACS in four test sites in 1995 (Griffin and Waite, 2006). These test sites were subsequently expanded, and by 1999, operational tests took place in 36 counties spread across 26 states (Griffin and Waite, 2006). Three year ACS averages centered on 2000 were set up for these counties to support comparisons with Census 2000. Relevant among the many findings of these tests was that the arithmetic mean (2.63) of the PPH values found in the ACS for these 36 counties was the same as that found in Census 2000 and that there were no statistically significant differences for PPH (US Census Bureau, 2004b: 17). It was also noted that this result was not unexpected because the total household population and the total number of housing units found in

Census 2000 are used as control variables in ACS weighting (US Census Bureau 2004b: 17).

Among the 36 ACS test counties, annual PPH values estimated from single-year ACS collections are available online for 21 of them for the period 2001 to 2006; annual PPH values estimated from three-year ACS collections are available online for 18 of these same 21 counties for the period 1999-2001 to 2003-2005. (See Exhibit 1). It is for these 18 counties that both single-year and three-year ACS PPH values are used in our comparison with model-based PPH values.

The analytical method for generating the model-based PPH values is one method commonly used by applied demographers for this purpose, namely, the geometric rate of change (Lowe, Pittenger, and Walker, 1977; Smith, Nogle, and Cody, 2002; Smith, Tayman, and Swanson, 2001; Swanson, Baker, and Van Patten, 1983). In this approach, the rate of change is benchmarked to two most recent successive census counts and then applied to the PPH value found in the most recent census count, which is then extrapolated beyond the most recent census by applying the rate of change to it.

The process takes place in two steps. The first is the calculation of the rate of change in PPH:

$$r = (PPH_l/PPH_b)^{(1/y)} - 1$$

where

r = rate of change
PPH = Persons Per Household
l = Launch Year (most recent census)
b = Base Year (Census preceding launch Year
y = Number of years between l and b (10 years)

The second step is applying the rate to the launch year to find PPH values:

$$PPH_t = (PPH_l) [(1 + r)^{(y)}]$$

where

r = rate of change (from step 1)

PPH = Persons Per Household

t = Target Year

l = Launch Year (most recent census)

y = number of years between t and l

The preceding process is used with 1990 and 2000 census PPH values to generate annual PPH values for the period 2001 to 2006 for each of the 18 ACS test counties from which the corresponding single-year and three-year data are available.

Results

The data for the 18 counties are shown in exhibits 2 through 19. Each of these exhibits is divided into two parts. The first part shows the single-year ACS PPH values for each year from 2001 to 2006 while the second part shows the three-year ACS PPH values for each year from 2001 to 2005, the latter corresponding to the ACS collections from 1999-2001 to 2003-2005. Both parts of each of the exhibits also show the annual ACS values generated using the geometric model. The ACS PPH values are labeled as "ACSPPH" in each of the two parts and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived).

Before discussing the results, it is important to note that the PPH values generated by geometric trend extrapolation are used as benchmarks not because they are inherently more accurate than those derived from other models or from samples such as the ACS, but, rather, because they represent the type of systematic change demographers expect to see in PPH values. However, in order to provide evidence that county level PPH values generated by the geometric trend extrapolation method are reasonably accurate, Table 1 shows the result of a test using the 39 counties in the state of Washington.

In this test, Census 1980 and 1990 PPH values are used as input to the geometric model, which is applied to the Census 1990 PPH values to generate PPH values for 2000. These estimated PPH values are then compared to Census 2000 PPH values. The results support the argument that the geometric method is capable of generating PPH values sufficiently accurate for use in post-censal HUM estimates: (1) The mean error is 0.068; (2) the mean absolute percent error is 2.97; (3) the mean algebraic percent error is -2.60; and (4) the number of absolute percent errors that are 5.0 or greater is six.

In comparing the single-year ACS PPH values to the model-based PPH values, we find that the ACS PPH values are above the model-based PPH values in seven counties for the entire period, 2001-2006, that they are below the model-based values in two counties for the entire period and cross over the model-based values in nine counties (three of which (Bronx, Multnomah, and Schuykill) have two crossovers each and one of which (Jefferson) has three crossovers). In terms of directional changes, the single-year ACS PPH values change direction three or more times in three counties, twice in nine counties, and once in six counties.

The three-year ACS PPH values remain above the model-based values for the entire period, 1999-2001 to 20003-2005 in nine counties, while in only one county (Yakima) they remain below the model-based values, and cross over the model based values nine times. The three-year ACS PPH values change direction twice in two counties and once in seven counties. In the remaining nine counties no directional changes are observed, although there are some in which trends become flattened for some of the time. The model-based PPH values show a secular decline in 11 counties and an increase in seven.

In some of the counties with declining model-based PPH values, the trends are very slight (e.g., Pima County, Arizona) and in others, more distinct (Schuylkill County, Pennsylvania). Similarly, some of the counties with increasing model-based PPH values have a very slight upward trend (e.g., San Francisco County, California), in others they are much more pronounced (e.g., Tulare County, California).

Table 2 provides mean PPH values across the 18 counties (and their standard deviations) by year. Not surprisingly, the single-year ACS PPH values exhibit the least systematic change over time and the most variation each year. In two of the six years, these values are less than the model-based PPH values while in the remaining four years they exceed the model-based values. The means of the three-year ACS PPH values show a systematic decline over time with annual variations comparable to the model-based PPH values.

Discussion

As noted earlier, the US Census Bureau found encouraging results for the three-year ACS PPH values among the set of 1999 test counties when it compared the 1999-2001 numbers to the PPH values of the 2000 Census (US Census Bureau 2004b). As also was noted earlier, this finding was no surprise because the total household population and the total number of housing units found in Census 2000 are used as control variables in ACS weighting. Given this, the results found here are a bit discouraging, given that these same variables are also used as control variables in ACS weighting – with one major change – once beyond the 2000 census, the total household populations and housing units are not enumerated directly, but, instead, estimated.

Not surprisingly, it is the single-year ACS PPH estimates that are the most discouraging. They jump around a great deal from year to year in many of the counties, a characteristic that is not desirable for both demographers who use the HUM and the stakeholders for whom HUM estimates are done. This is because there is an expectation on the part of both these demographers and the stakeholders that PPH values should exhibit systematic changes unless there is compelling substantive evidence (e.g., the PPH values jumped because of a surge of in-migrants with high fertility and large family sizes) to the contrary. If such PPH values are used in the absence of compelling substantive evidence justifying their temporal instability then it appears to me that the risk of challenges and related administrative and legal actions increases (See, e.g., Walashek and Swanson, 2006), especially when these estimates are used to allocate resources, which is often the case (National Research Council, 1980, 2003; Scire, 2007).

In considering the three-year ACS PPH values, the results are not as discouraging, as those for the single-year values, but neither are they strongly encouraging. These values change more systematically than do the single-year ACS PPH values, but they still exhibit temporal instability.

In addition to the temporal instability issue, one must ask what causes some of the substantial differences observed between the mean ACS PPH values and the mean model-based PPH values. For example, in 2001, the mean ACS PPH is 2.503 while the model-based mean is 2.627. This is a substantial difference, one likely beyond the scope of simple sampling error. Is this difference partly due to the ACS residency rule? After all, it is not the same as the Decennial Census residency rule, the one that is inherent in the model-based ACS PPH values. With a two-month rule, the ACS clearly will tend to have higher PPH values in areas in which seasonal migrants are currently residing than would be the case with the "majority of your time" rule used by the Decennial Census. This might explain in part the higher ACS PPH values found in Pima County, Arizona, However, if this were the case, we would expect that the ACS PPH values would consistently be higher than the model-based PPH values in Tulare County, California, but they are not.

Conclusions and Suggestions for Future Research

As described at the start of this paper, the ACS provides annual PPH estimates that are subject to sample (and non-sample) error. This means that they can fluctuate from year to year in a given population, which reflects a "Statistical Perspective." Demographers, however, tend to view PPH as a population attribute that has demographic determinants. This implies that demographers view PPH as an attribute that changes systematically over time - the "Demographic Perspective." The comparisons suggest that the ACS PPH values exhibit too little systematic change over time for a given area to be usable by demographers and others preparing post-censal population estimates.

Our finding that the ACS PPH values are not particularly usable for purposes of making HUM-based population estimates is preliminary in nature. More work needs to be done not only to confirm this finding, but also to figure out if the ACS PPH values can be modified so that they could be used if the finding is confirmed. With this in mind, our suggestions for further analysis include: (1) conducting a broader scale comparison, taking into account the full range of counties; (2) examining ACS PPH values that are not controlled; (3) consideration of a way to utilize sample error (i.e., confidence intervals) in determining ACS PPH changes over time; (4) an examination of 5-year ACS PPH values when at least five years of data become available; and (5) making adjustments to ACS PPH values (deriving model-based PPH values from the ACS) that may provide more temporal stability.

The ACS is a resource of high potential value to all stakeholders and ACS PPH values represent the same type of resource to demographers making population estimates and their stakeholders. The goal of our suggestions for further research is to see if the ACS PPH values can become "usable" in terms of the demographic perspective, especially as implemented in HUM-based estimates.

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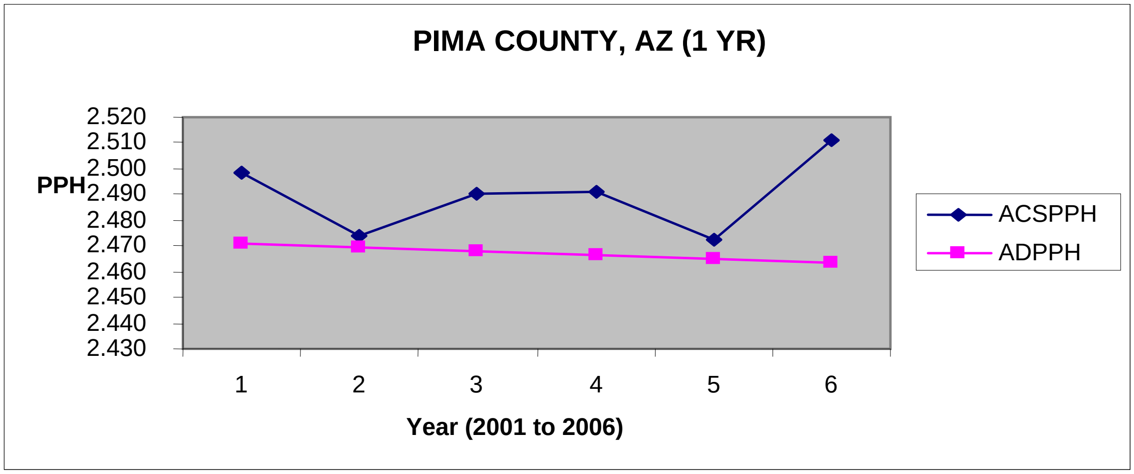
EXHIBIT 1. The 18 COUNTIES USED IN THE ANALYSIS

Pima County, AZ	Madison County, MS
Jefferson County, AR	Douglas County, NE
San Francisco County, CA	Bronx County, NY
Tulare County, CA	Rockland County, NY
Broward County, FL	Franklin County, OH
Lake County, IL	Multnomah County, OR
Black Hawk County, IA	Schuylkill County, PA
Calvert County, MD	Sevier County, TN
Hampden County, MA	Yakima County, WA

EXHIBIT 2.1*



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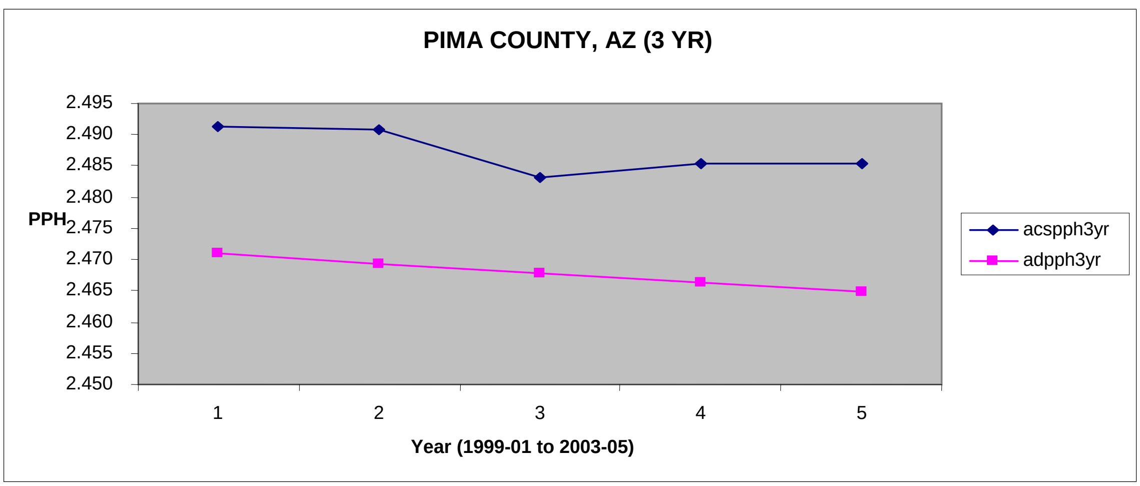
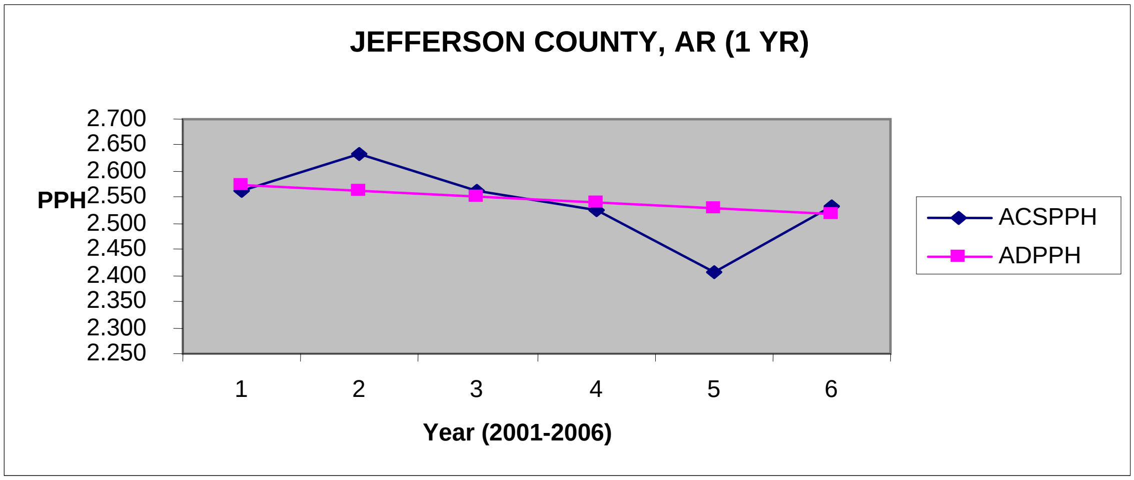


*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 3.1*



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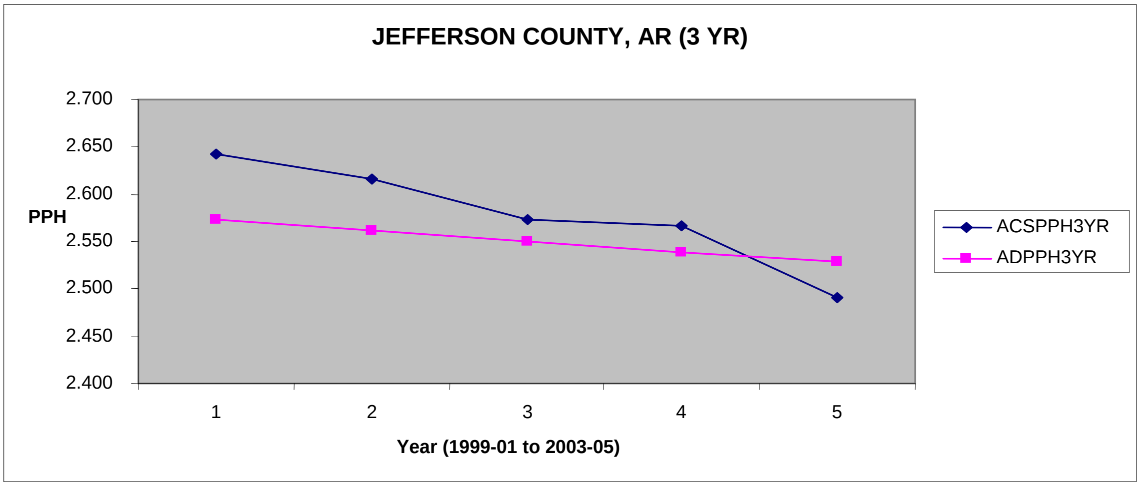

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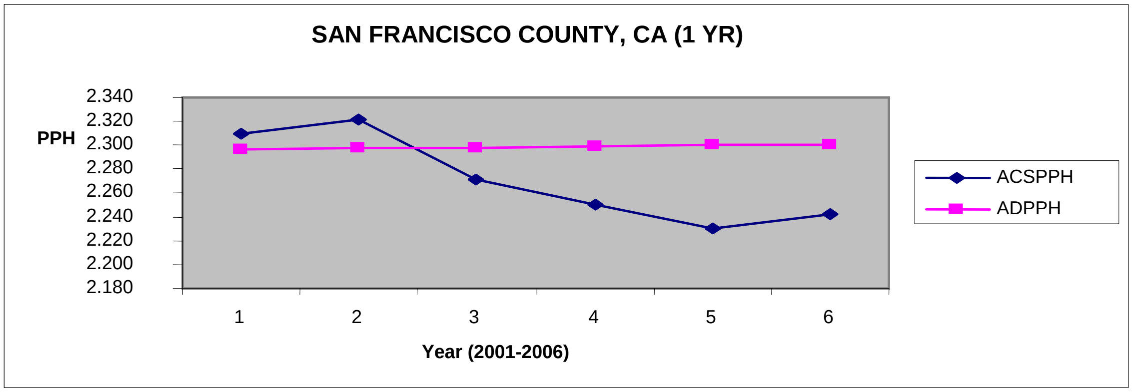

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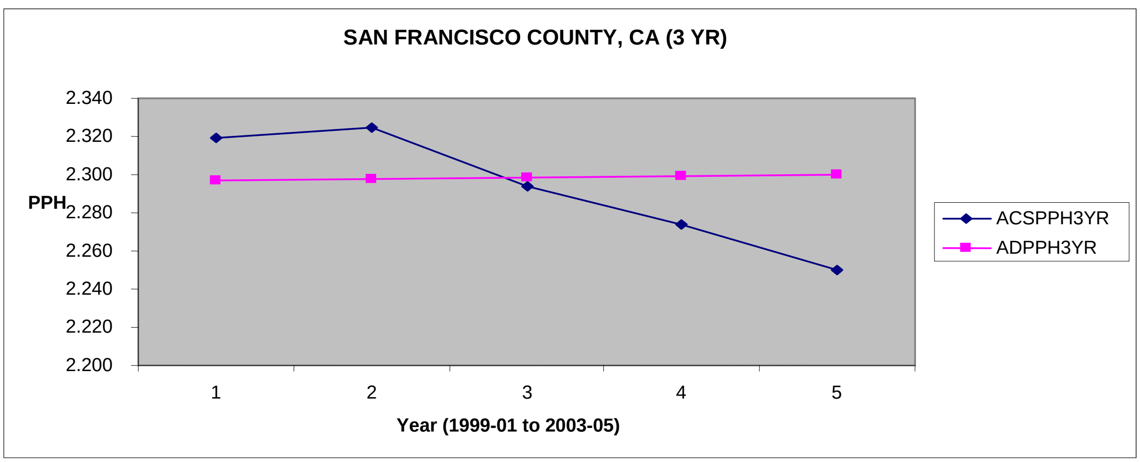

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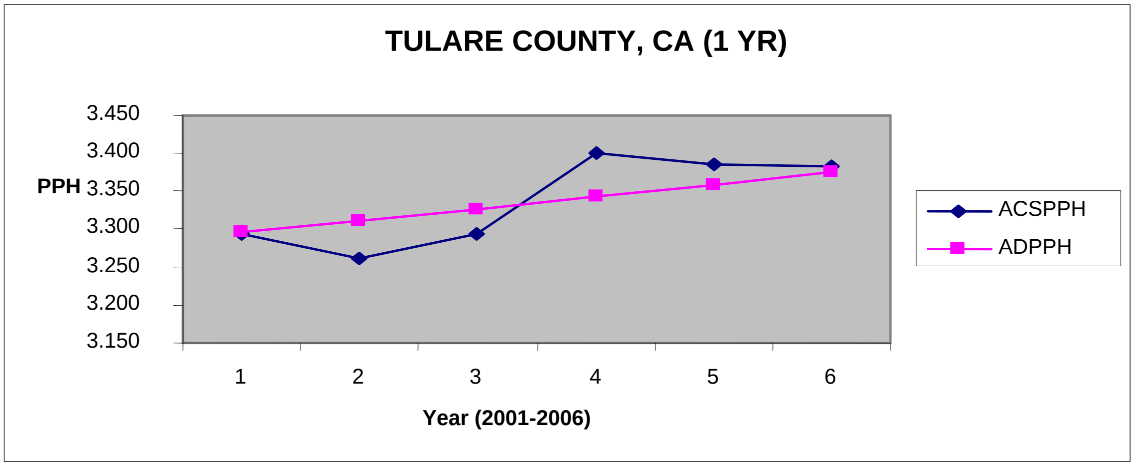
EXHIBIT 5.1*



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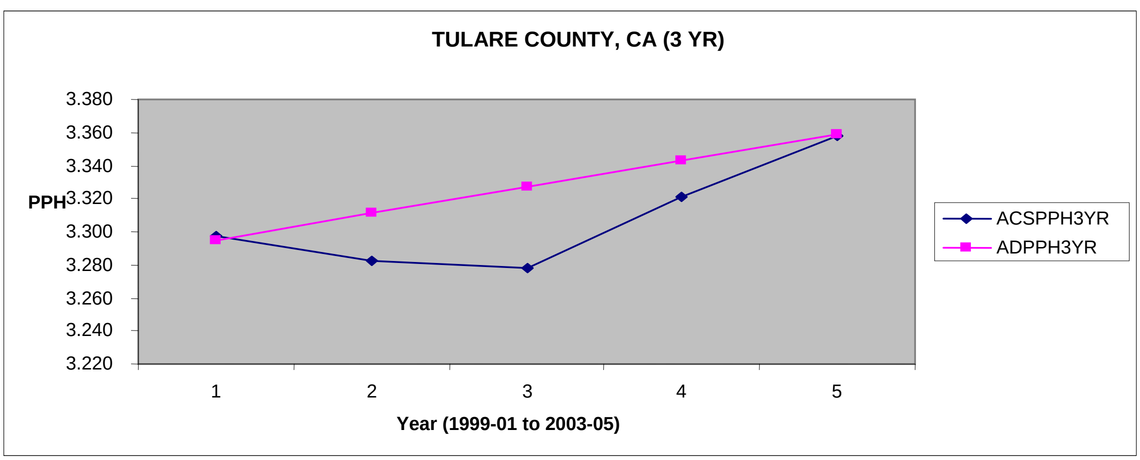

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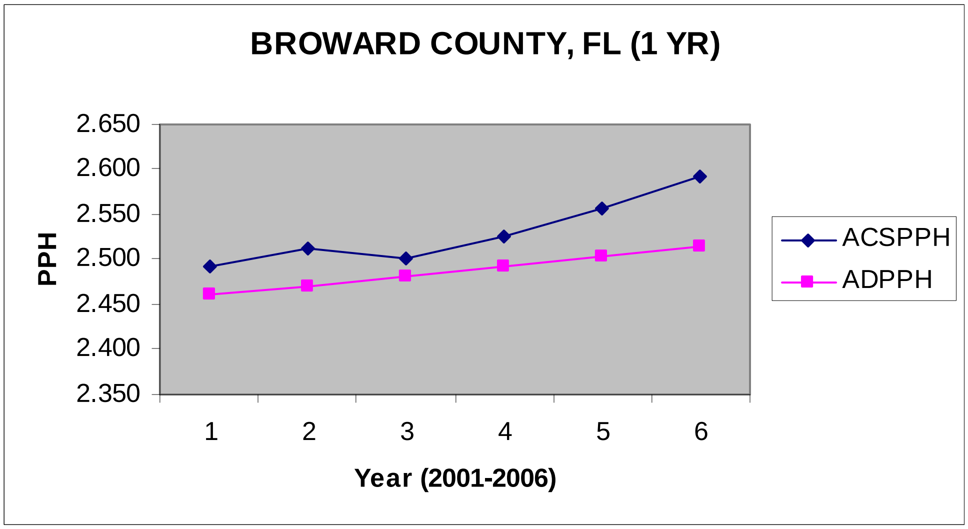
EXHIBIT 6.1*



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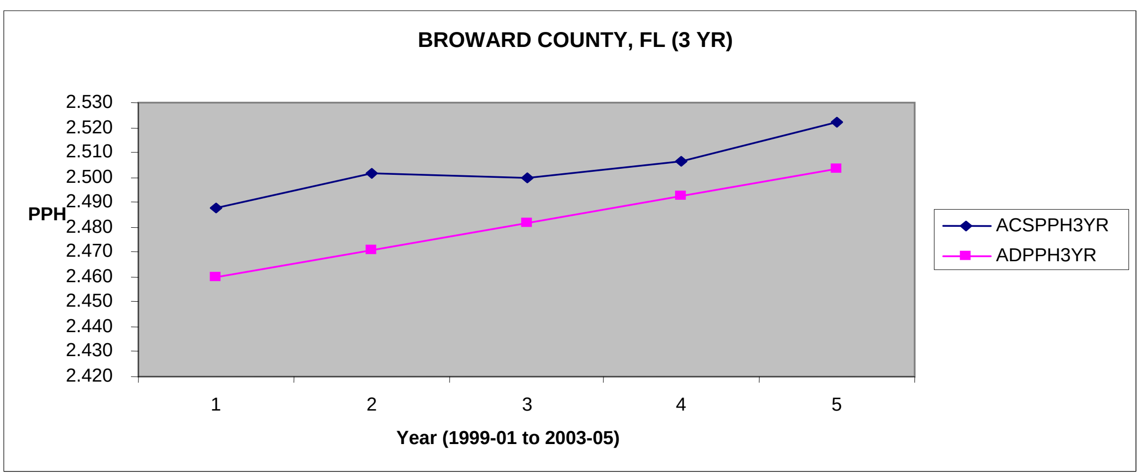

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EXHIBIT 7.1*

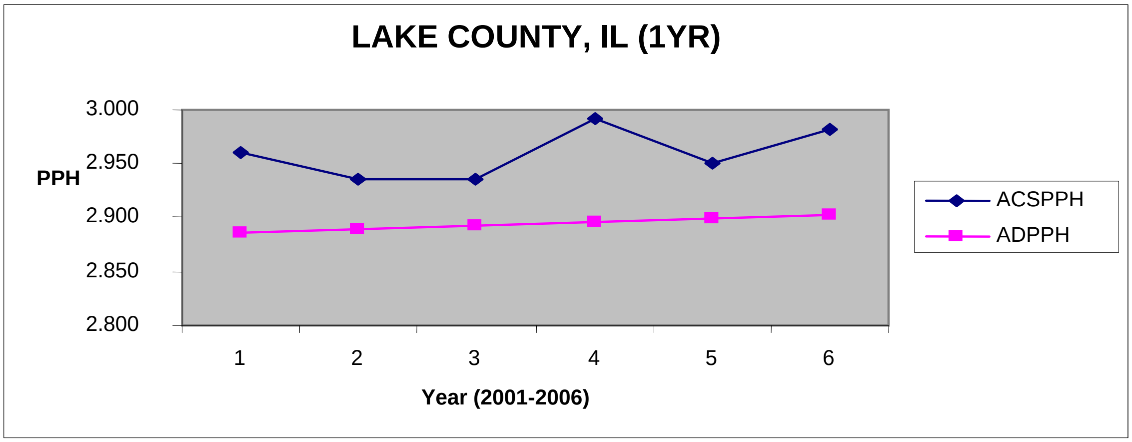

EXHIBIT 7.2*

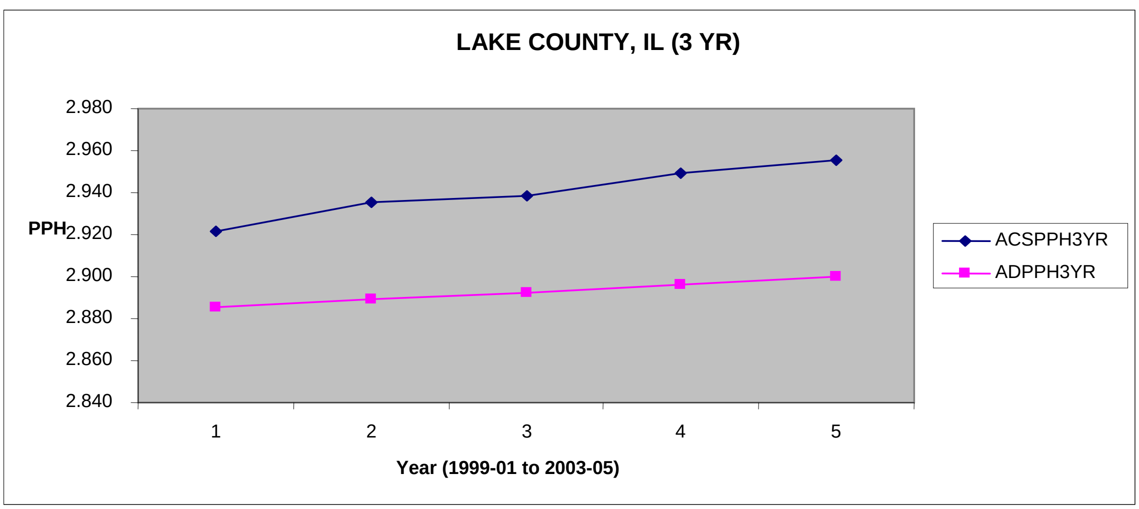

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EXHIBIT 8.1*

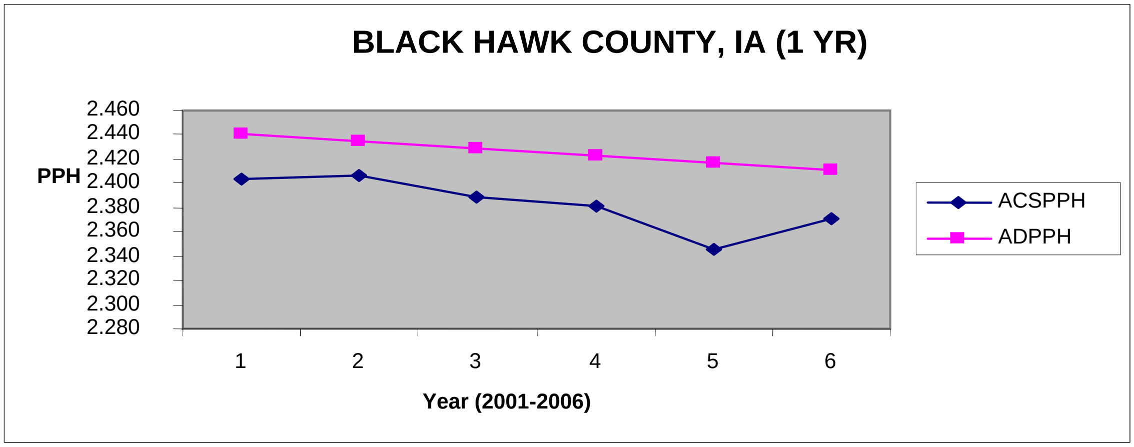
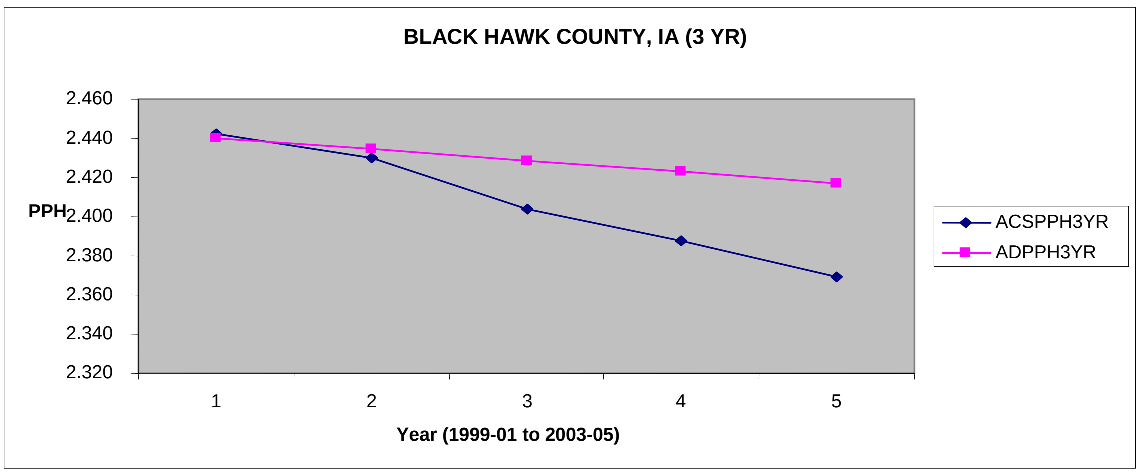


EXHIBIT 8.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 9.1*

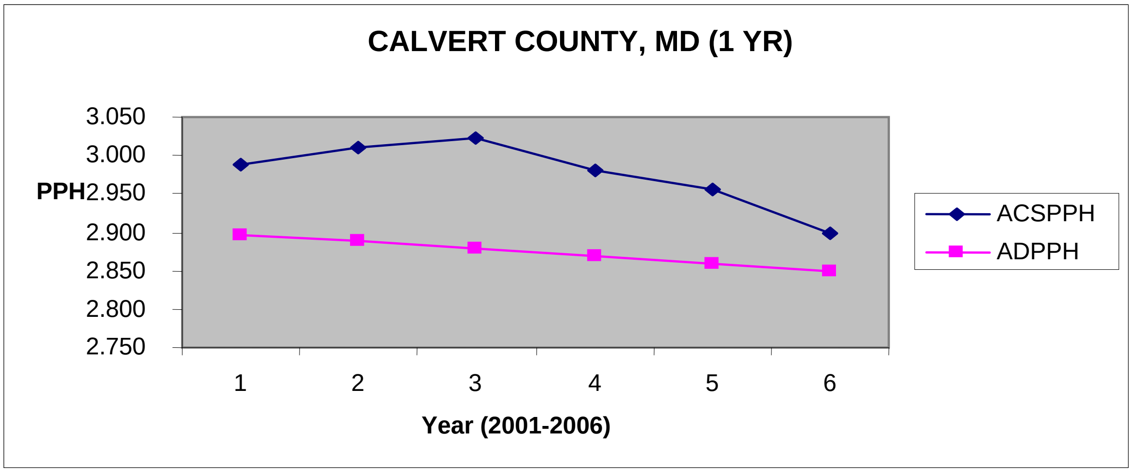
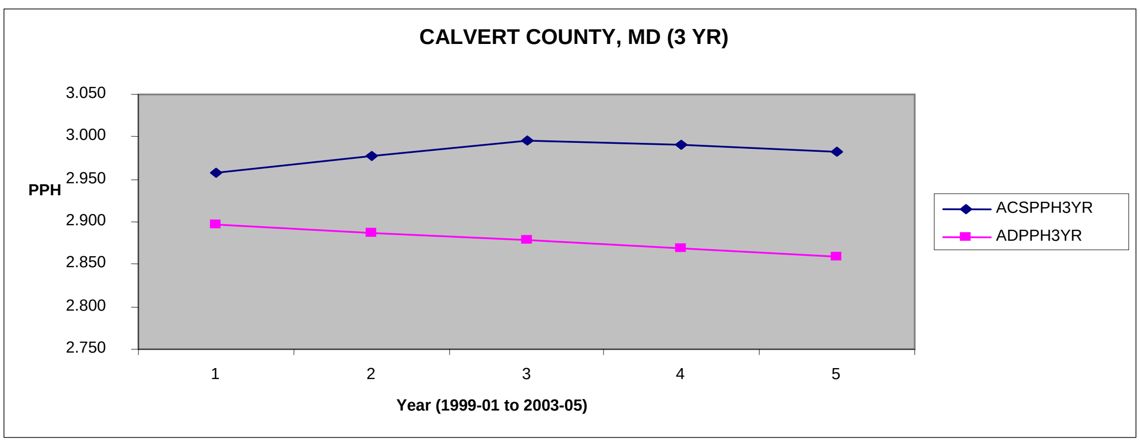


EXHIBIT 9.2*



*The ACS PPH values are labeled as “ACSPPH” and the model-generated PPH values are labeled as “ADPPH” (where “AD” stands for Analytically Derived). “(1 YR)” stands for single year ACS data and “(3 YR)” stands for 3 year ACS data.

EXHIBIT 10.1*

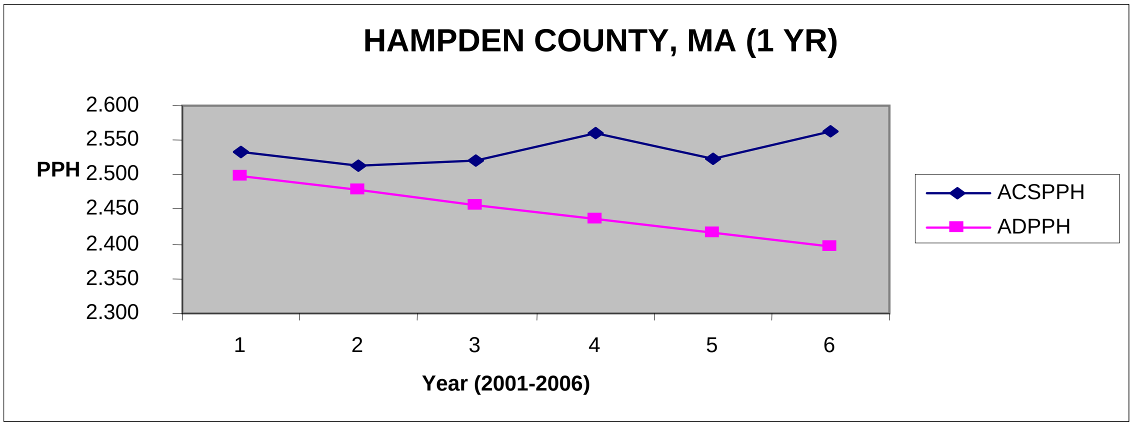
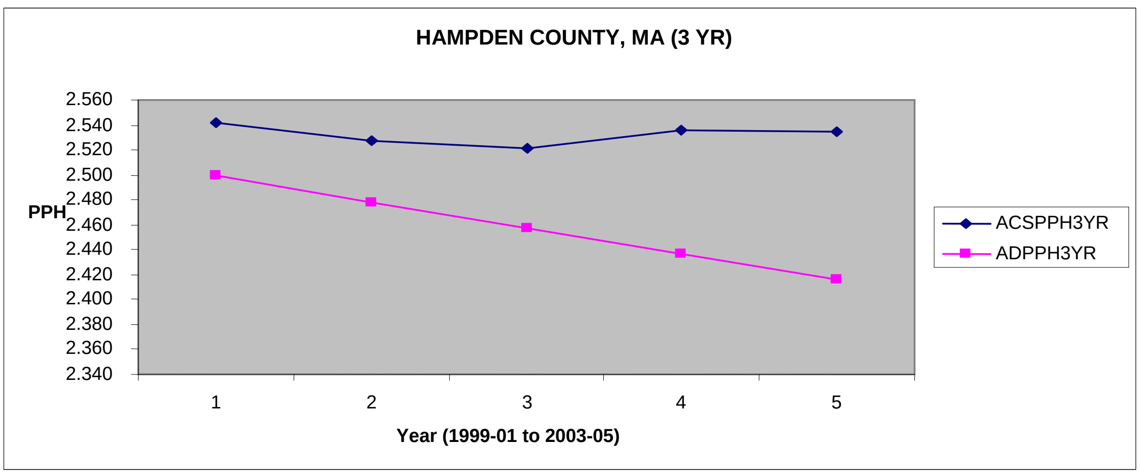


EXHIBIT 10.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 11.1*

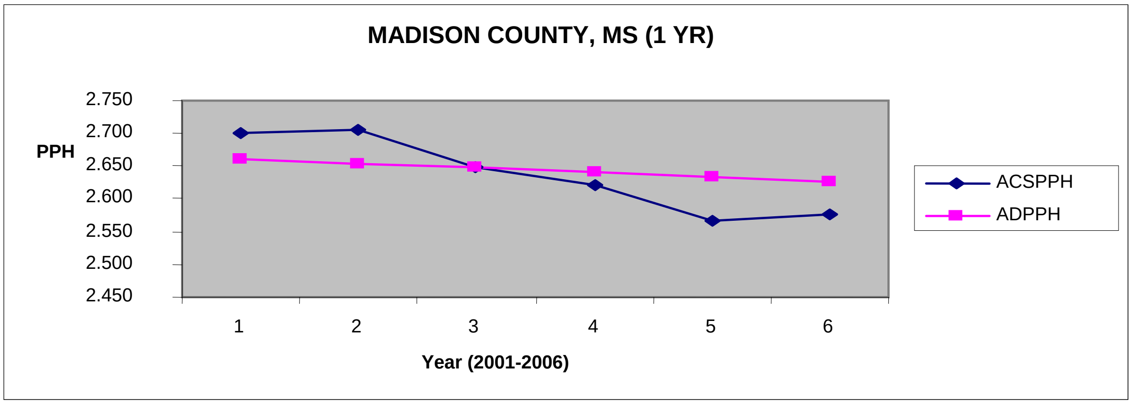
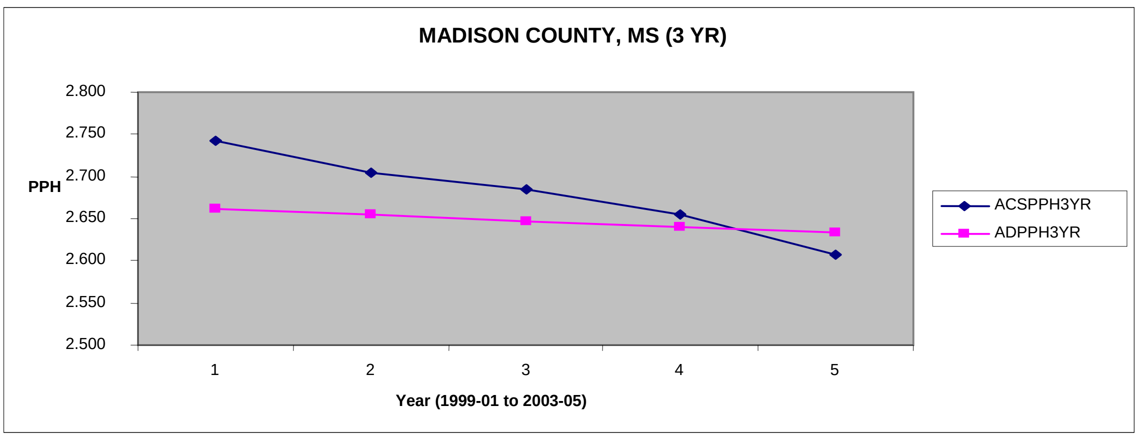


EXHIBIT 11.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 12.1*

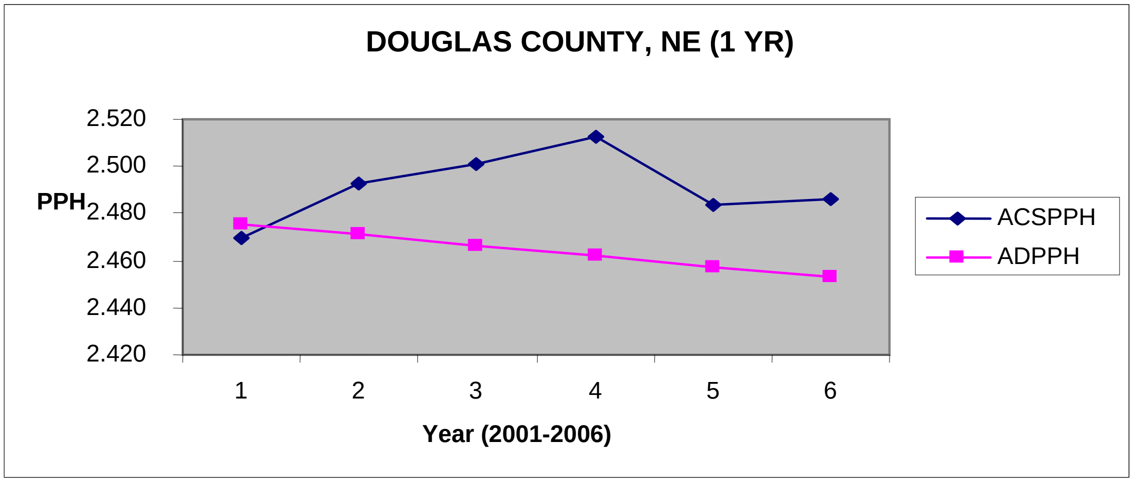
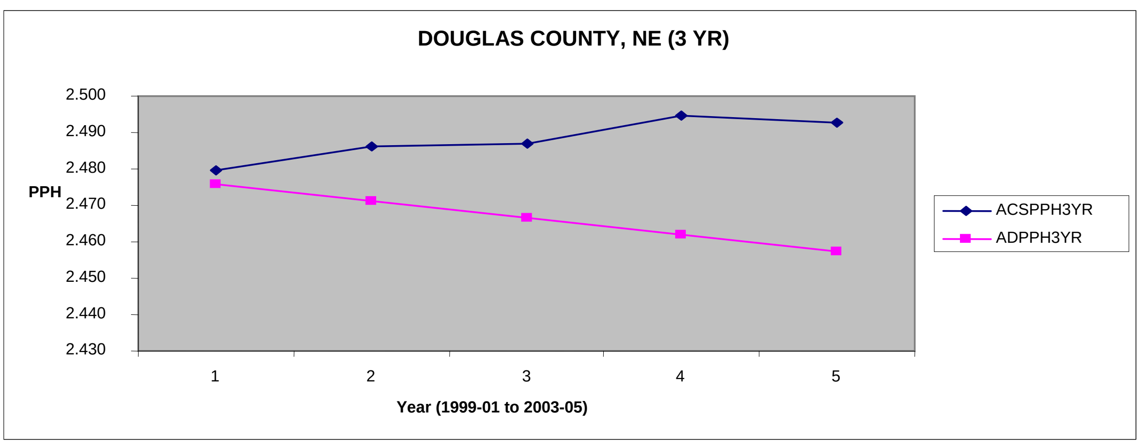


EXHIBIT 12.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 13.1*

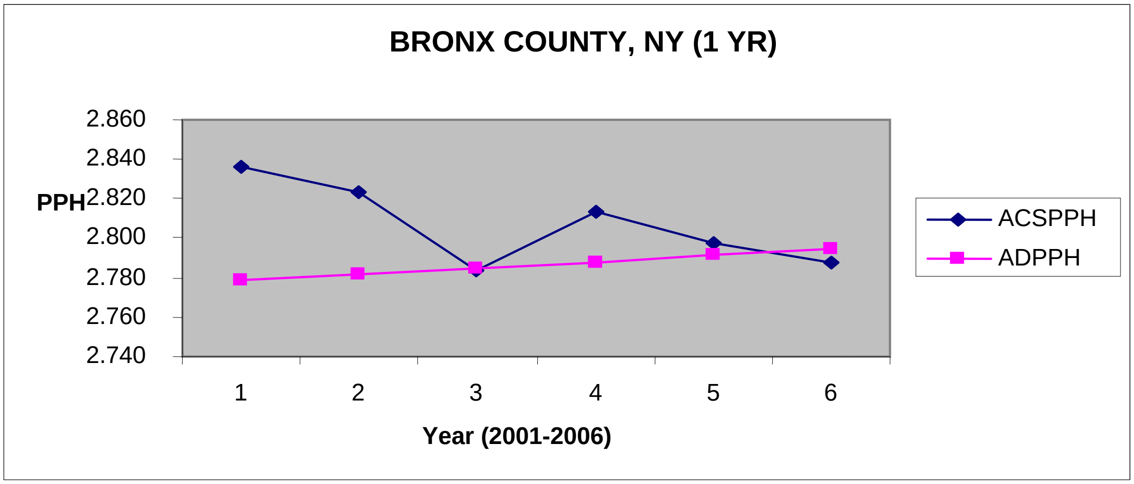
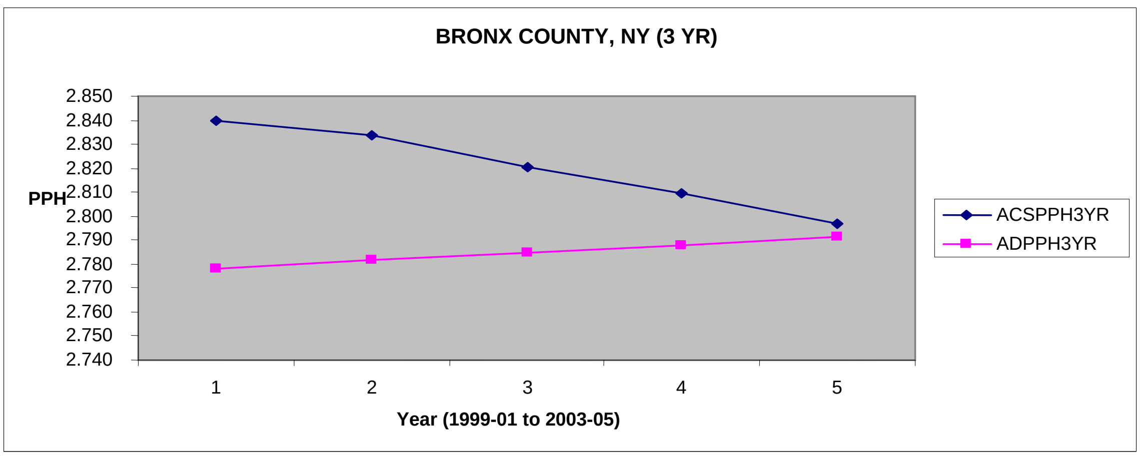


EXHIBIT 13.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 14.1*

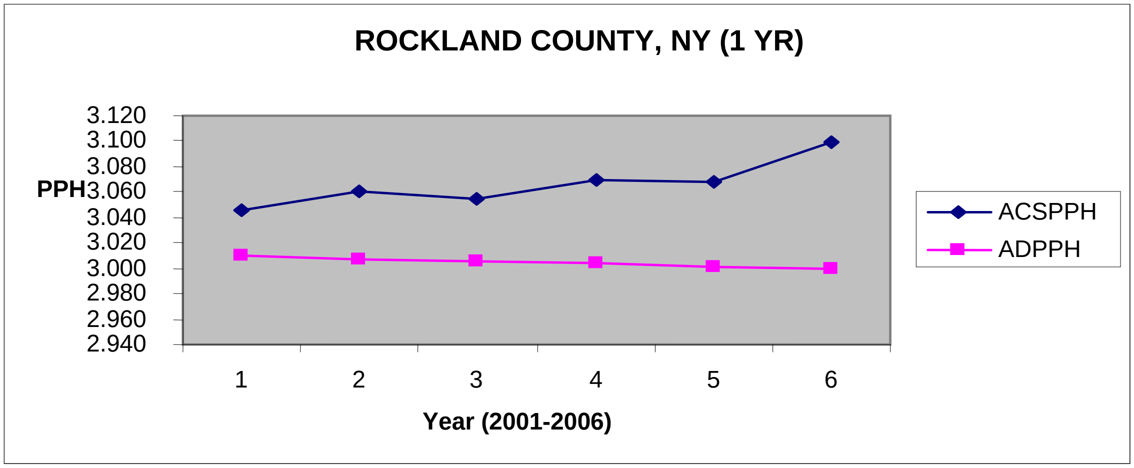
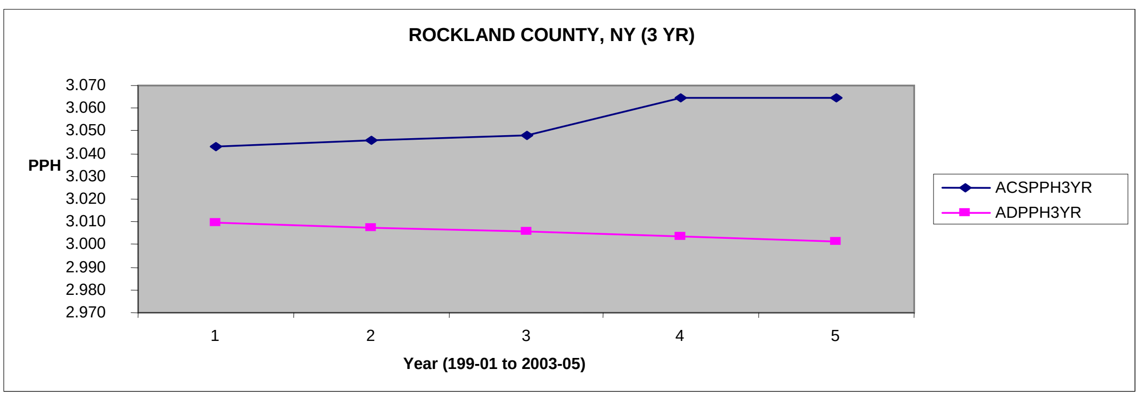


EXHIBIT 14.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 15.1*

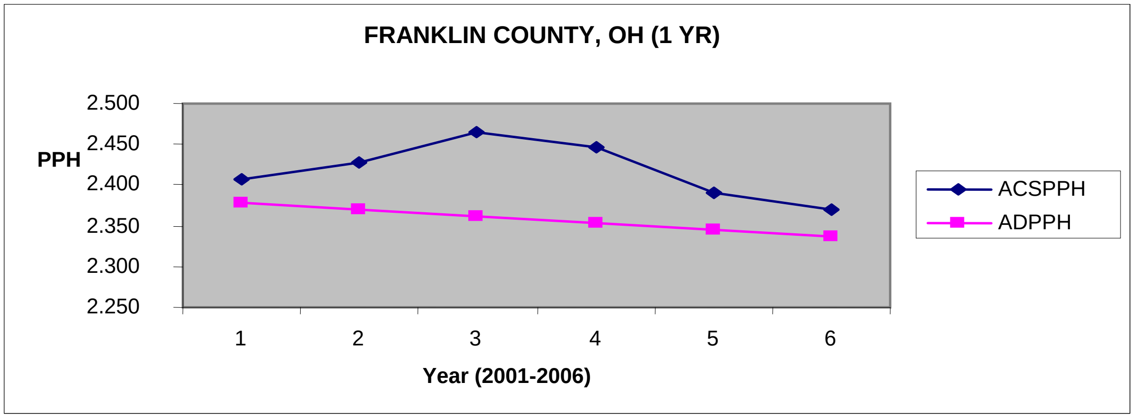
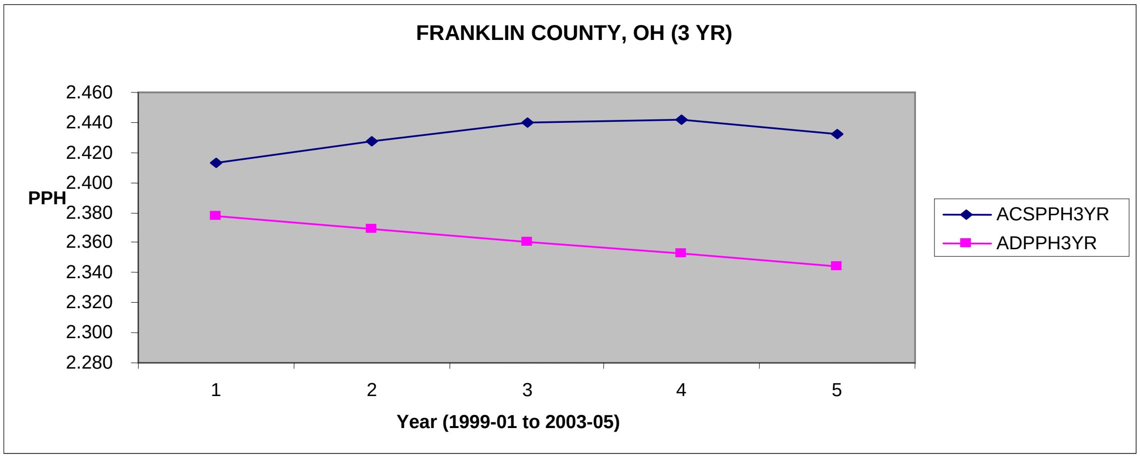


EXHIBIT 15.2*



*The ACS PPH values are labeled as “ACSPPH” and the model-generated PPH values are labeled as “ADPPH” (where “AD” stands for Analytically Derived). “(1 YR)” stands for single year ACS data and “(3 YR)” stands for 3 year ACS data.

EXHIBIT 16.1*

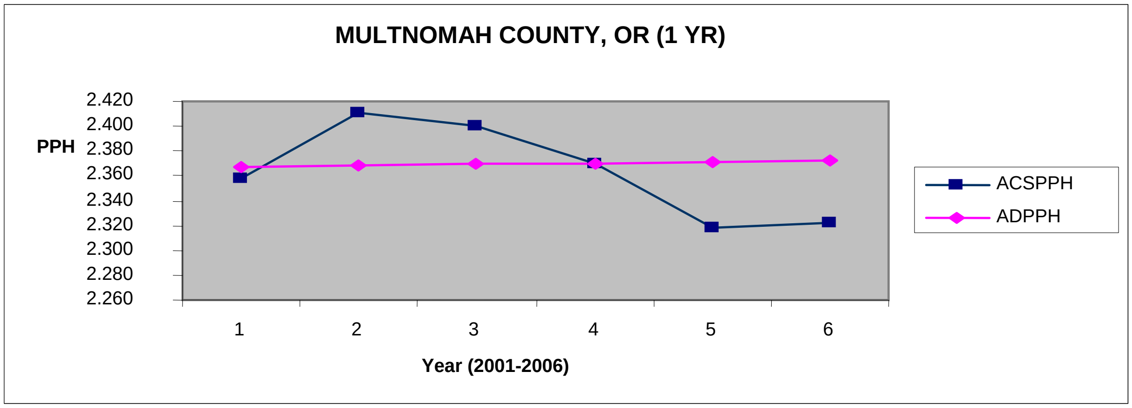
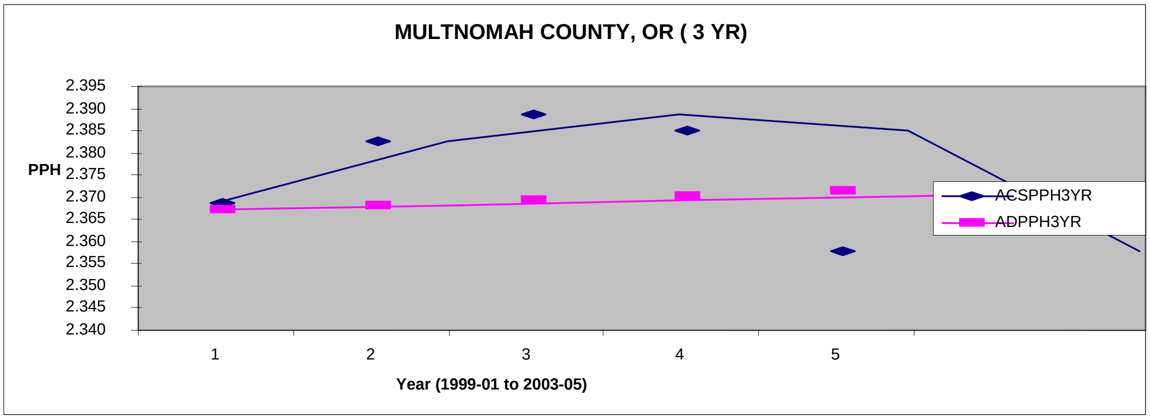


EXHIBIT 16.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 17.1*

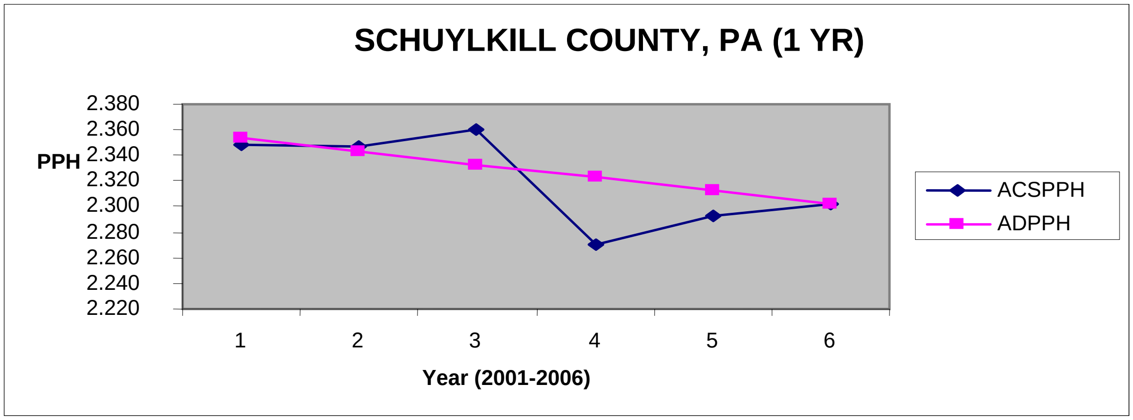
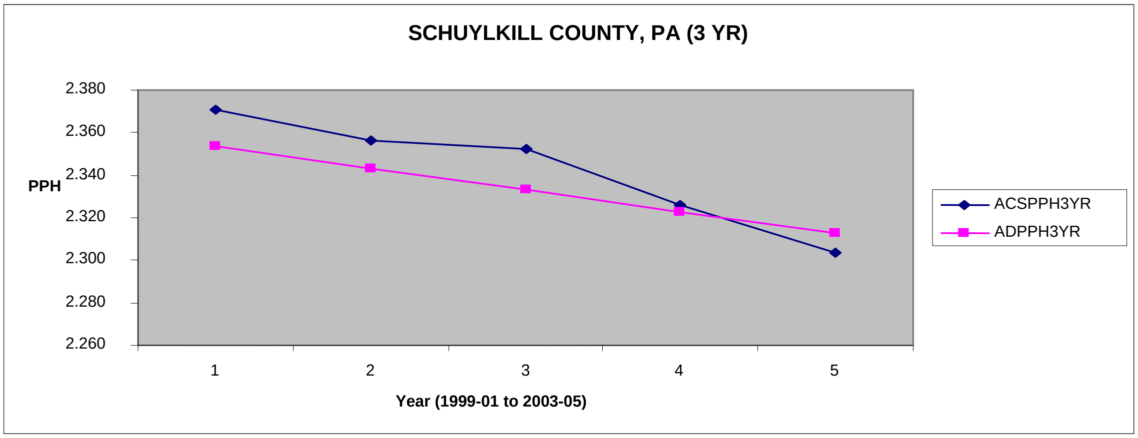


EXHIBIT 17.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 18.1*

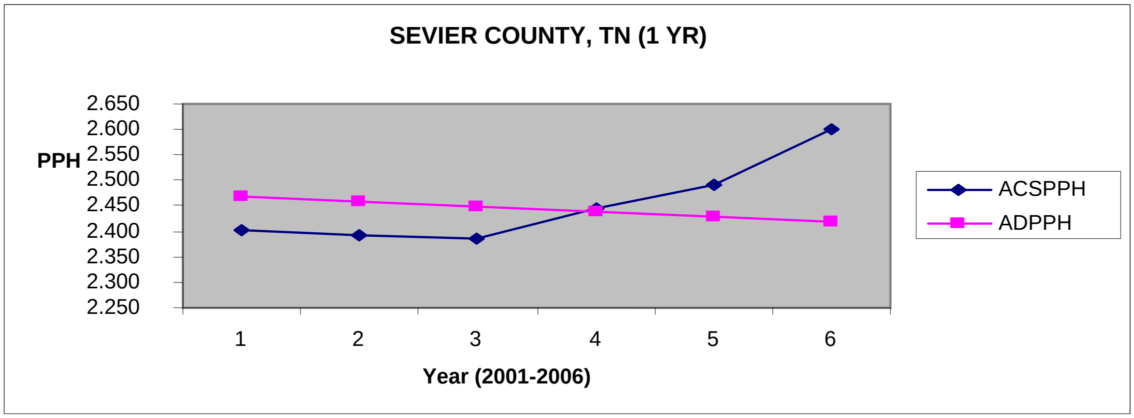
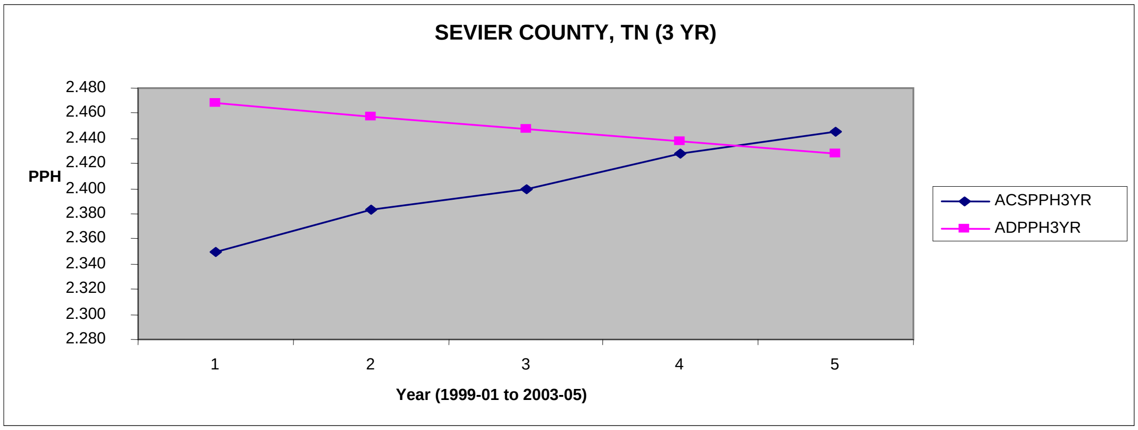


EXHIBIT 18.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

EXHIBIT 19.1*

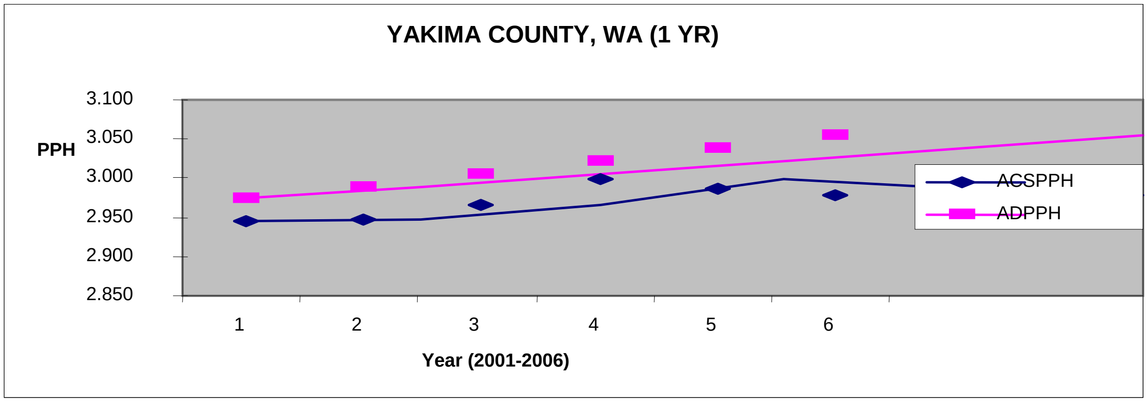
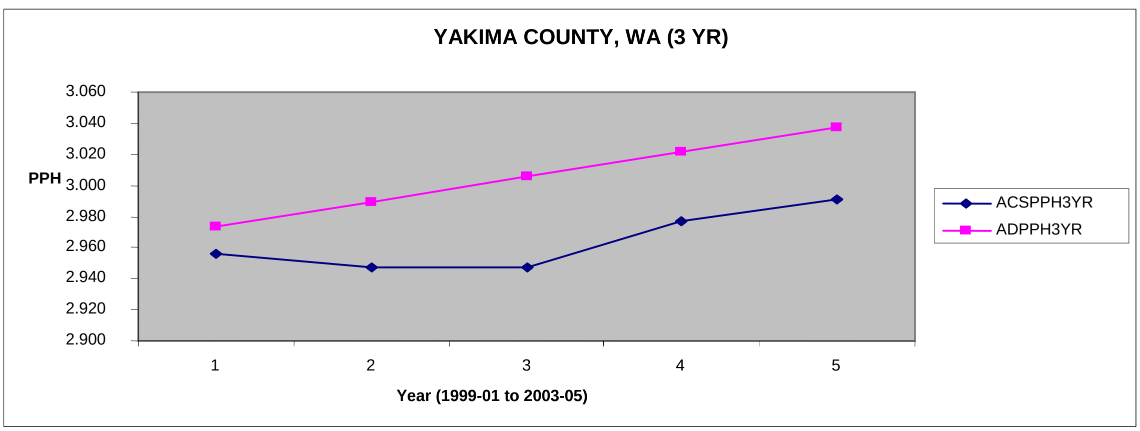


EXHIBIT 19.2*



*The ACS PPH values are labeled as "ACSPPH" and the model-generated PPH values are labeled as "ADPPH" (where "AD" stands for Analytically Derived). "(1 YR)" stands for single year ACS data and "(3 YR)" stands for 3 year ACS data.

Table 1. Accuracy Test of the Geometric Method of Estimating PPH Values for Counties: Washington State 2000

Washington State PPH Values By County, 1980, 1990, and 2000								
	1980 Persons Per Household	1990 Persons Per Household	2000 Persons per Household	1980-1990 Geometric Rate of Change	Estimated 2000 Persons Per Household	Absolute Error	Percent Error	MAPE
STATE	2.6086	2.5348	2.5349	-0.0029	2.4631	-0.0718	-2.83%	2.83%
Adams	2.9113	2.9405	3.0949	0.0010	2.9700	-0.1249	-4.03%	4.03%
Asotin	2.5662	2.4727	2.4162	-0.0037	2.3826	-0.0336	-1.39%	1.39%
Benton	2.7971	2.6516	2.6795	-0.0053	2.5137	-0.1658	-6.19%	6.19%
Chelan	2.4827	2.4863	2.6192	0.0001	2.4899	-0.1293	-4.93%	4.93%
Clallam	2.5374	2.4007	2.3066	-0.0055	2.2714	-0.0353	-1.53%	1.53%
Clark	2.7625	2.6625	2.6900	-0.0037	2.5661	-0.1239	-4.61%	4.61%
Columbia	2.5254	2.4368	2.3628	-0.0036	2.3513	-0.0115	-0.49%	0.49%
Cowlitz	2.6619	2.5588	2.5531	-0.0039	2.4597	-0.0934	-3.66%	3.66%
Douglas	2.7591	2.6769	2.7554	-0.0030	2.5971	-0.1583	-5.74%	5.74%
Ferry	2.8567	2.6978	2.4938	-0.0057	2.5477	0.0539	2.16%	2.16%
Franklin	2.8817	3.034	3.2637	0.0052	3.1943	-0.0693	-2.12%	2.12%
Garfield	2.5955	2.3948	2.3911	-0.0080	2.2096	-0.1815	-7.59%	7.59%
Grant	2.7986	2.7407	2.9204	-0.0021	2.6840	-0.2364	-8.09%	8.09%
Grays Harbor	2.5966	2.4813	2.4826	-0.0045	2.3711	-0.1115	-4.49%	4.49%
Island	2.6706	2.6149	2.5223	-0.0021	2.5604	0.0381	1.51%	1.51%
Jefferson	2.4537	2.3089	2.2122	-0.0061	2.1726	-0.0395	-1.79%	1.79%
King	2.4868	2.3982	2.3905	-0.0036	2.3128	-0.0777	-3.25%	3.25%
Kitsap	2.682	2.6469	2.6007	-0.0013	2.6123	0.0115	0.44%	0.44%
Kittitas	2.3976	2.3251	2.3314	-0.0031	2.2548	-0.0766	-3.29%	3.29%
Klickitat	2.7211	2.6409	2.5361	-0.0030	2.5631	0.0270	1.06%	1.06%
Lewis	2.6732	2.5997	2.5690	-0.0028	2.5282	-0.0408	-1.59%	1.59%
Lincoln	2.5726	2.4308	2.4233	-0.0057	2.2968	-0.1265	-5.22%	5.22%
Mason	2.5458	2.5162	2.4891	-0.0012	2.4869	-0.0022	-0.09%	0.09%
Okanogan	2.6674	2.5877	2.5762	-0.0030	2.5104	-0.0658	-2.56%	2.56%
Pacific	2.4465	2.3499	2.2711	-0.0040	2.2571	-0.0140	-0.62%	0.62%
Pend Oreille	2.8088	2.6029	2.5074	-0.0076	2.4121	-0.0953	-3.80%	3.80%
Pierce	2.6586	2.6231	2.6047	-0.0013	2.5881	-0.0166	-0.64%	0.64%
San Juan	2.2946	2.2489	2.1587	-0.0020	2.2041	0.0454	2.10%	2.10%
Skagit	2.5656	2.5495	2.6032	-0.0006	2.5335	-0.0697	-2.68%	2.68%
Skamania	2.7896	2.6921	2.6120	-0.0036	2.5980	-0.0140	-0.54%	0.54%
Snohomish	2.7606	2.67935	2.6547	-0.0030	2.6005	-0.0542	-2.04%	2.04%
Spokane	2.5789	2.4747	2.4646	-0.0041	2.3747	-0.0899	-3.65%	3.65%
Stevens	2.907	2.7318	2.6439	-0.0062	2.5672	-0.0768	-2.90%	2.90%
Thurston	2.6441	2.553	2.4987	-0.0035	2.4650	-0.0337	-1.35%	1.35%
Wahkiakum	2.7724	2.4762	2.4243	-0.0112	2.2116	-0.2127	-8.77%	8.77%
Walla Walla	2.5411	2.4955	2.5388	-0.0018	2.4507	-0.0880	-3.47%	3.47%
Whatcom	2.5902	2.5324	2.5113	-0.0023	2.4759	-0.0354	-1.41%	1.41%
Whitman	2.4668	2.3868	2.3115	-0.0033	2.3094	-0.0021	-0.09%	0.09%
Yakima	2.7711	2.8039	2.9576	0.0012	2.8371	-0.1205	-4.08%	4.08%

COUNTY LEVEL SUMMARY STATISTICS	
Mean Error	**-0.0680**
MAPE	**2.97%**
MALPE	**-2.60%**
N ABS % ERROR >5	**6**

Table 2. Mean ACS Values by Year and Their Standard Deviations

Year	Mean 1-Year ACS PPH Values*	Mean Model-Based PPH Values*	Mean 3-Year ACS PPH Values*	Year
2001	2.503 (0.295)	2.627 (0.281)	2.648 (0.290)	1999-2001
2002	2.509 (0.287)	2.625 (0.286)	2.647 (0.286)	2000-2002
2003	2.642 (0.294)	2.622 (0.289)	2.642 (0.289)	2001-2003
2004	2.647 (0.319)	2.620 (0.300)	2.644 (0.300)	2002-2004
2005	2.623 (0.323)	2.618 (0.303)	2.635 (0.312)	2003-2005
2006	2.717 (0.312)	2.625 (0.309)	N/A	N/A
*The value shown in parentheses is the standard deviation (N=18)				