Updating the Department of Environmental Protection's Affordability Index, 2011

Final Report for Contract SP697

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I. Introduction

In 2002 to 2003 a three-person team, Dr. William Serow, Dr. David Macpherson and Dr. Stefan Norrbin, were contracted by Department of Environmental Protection (DEP) to deliver a model that could compare how much different areas in Florida could afford to pay for utility improvements.¹ This comparison of ability to pay is called the Affordability Index.

The original Affordability Index needs to be updated to reflect changing conditions in different parts of Florida. This study provides such an update to the original index. The update is done in a manner consistent with the original approach to encourage continuity in the use of the index. This report compares the results in the original index and the updated index to determine the extent of the changes of the updated index in comparison to the original index. The report highlights the fact that most of the results are consistent across the two reports. Comparing the top ten and bottom ten counties in the original index and the updated index, one can see that 70-80% of the counties are the same. Thus, a few counties have moved up and down the rankings, but most counties remain close to their original ranking.

This final report includes a CD with four Excel spreadsheets that can be used to compare the ability to pay for census tracts in Florida. The data used in these spreadsheets have been updated to the most recently available data, and updated indices have been computed for all the census tracts and counties in Florida. A User Manual is also provided on the CD to facilitate the use of the indices.

II. Methodology

The model used in the final report has three stages. The first stage compares the counties of Florida and creates an affordability index for each county, whereas the second stage creates a within county comparison for each census tract within the county. The final stage aggregates the census tracts, within a county, by the population to create an aggregate index for each subsector in Florida.

A large number of variables were examined in the original project in 2002-2003, and four variables were selected as the preferred candidates for the computation of the index. The selected four variables were: Median household income, poverty rates, unemployment, and sales. The sales variable appeared more sensitive than the other variables, resulting in the creation of two separate affordability indices in 2002-2003; one with sales as the fourth variable and one without sales. In the updated project we have followed that approach and provide affordability indices with and without the sales variable.

¹ Dr. William Serow passed away shortly after the study was completed.

In 2002-2003 we discussed the fact that theory does not tell us exactly which weighting scheme to use for the selected variables. Therefore the report had two different types of weighting schemes for the computation of the county level index. The first two weighting schemes are based on theory, whereas the second two are based on a principal component analysis²:

- 1. 60% on median household income, 20% on the poverty rate, 20% on unemployment
- 2. 60% on median household income, 20% on sales, 10% on poverty, 10% on the unemployment rate
- 3. 31.7% on median household income, 8.9% on sales, 25.6% on unemployment and 33.6% on poverty
- 4. 34.5% on median household income, 28.6% on unemployment and 36.9% on poverty ³

In the current report we follow the original study in using the theoretical weights in the first two cases, and update the principal component analysis to provide two additional weightings. Thus the updated study uses four different weighting schemes where the county index has been computed using the following:

- 1. 60% on median household income, 20% on the poverty rate, 20% on unemployment
- 2. 60% on median household income, 20% on sales, 10% on poverty, 10% on the unemployment rate
- 3. 45.8% on median household income, -8.9% on sales, 21.4% on unemployment and 41.7% on poverty ⁴
- 4. 42.1% on median household income, 20.5% on unemployment and 37.4% on poverty

The county index is computed using the above weighting schemes as a 100 average index for all counties combined. This facilitates comparison between counties as an average county would have a score of 100 and an index score above 100 would indicate above average affordability.

In a similar way to the county index, an index for census tract affordability within the county is computed. The average for all census tracts within a county is set to 100 so that an index score above 100 would indicate that a census tract has above average

 $^{^{2}}$ A principal component analysis is a statistical way to summarize several variables into one or more summary variables. The statistical weights are set to maximize the information from a set of variables. In our case that means that the weights are set so that the index has as much information as possible from the variables used.

³ Note that technically poverty is defined as the lack of poverty, i.e. (1-poverty), and unemployment is defined as (1-unemployment). Both of these transformations are made to make all components contribute to the index in the same positive way. These technical modifications were also made in the current update of the index.

⁴ The sales variable has a negative sign in the principal component. This can happen as the principal component tries to find the highest difference between counties.

affordability within the census tract. For the census tracts a single weighting scheme of 0.6 for median household income, 0.2 for poverty rates and 0.2 for the unemployment rate, was used.⁵

Once the individual county and census tract indices have been computed, one can compute any geographical area in the State of Florida by selecting the appropriate census tracts or components of census tracts. An index is then computed as a population weighted average of the index in the county and the census tracts according to the following formula:

Index = Σ_i^{I} [(Population_i)/Population₁) * Index_{county J} * Index_{tract i}]

where Σ_i^{I} is the summation over all census tract i up to the total of I of the population weighted census tract indices. The final index is a combined index for the selected census tracts. The aggregated index from the above equation is then used by Florida DEP to determine the affordability for a selected geographic area in FL.⁶

III. Data

The original 2002-2003 study used Census Bureau data from 2000 for the census tract data. The new Census data will not contain the data needed to update the original study. Instead the American Community Survey (ACS) (also published by the U.S. Census Bureau) provides census tract level detail for the necessary economic variables for the 2005-2009 period. The ACS data is averaged within a census tract for the 2005-2009 period to obtain a sufficient sample for accurate reporting of the variables. The most recent data available for this dataset is the 2005-2009 averaged data published 2010. Annual updates will be available for county level, but for census tracts the five-year average is necessary to obtain a large enough sample.⁷

In addition to the Census Bureau data we also updated the other variables in the formula. The unemployment variable was updated using data from the Florida Agency for Workforce Innovation and Bureau of Labor Statistics. The price level was updated using data from the University of Florida Bureau of Economic and Business Research. County level poverty levels and median household income were updated using the *Florida Statistical Abstract, 2010.*

⁵ The variables were normalized, and in the census tract computation the result was normalized to have a variance similar to the census tracts.

⁶ See the sample aggregation page from one of the spreadsheets in Appendix A.

⁷ See more details of the data in Appendix B: The User Manual.

IV. Discussion of the Results

Table 1 through 4 ranks the top ten and bottom ten counties for each of the four weighting schemes for both the original study and for the updated study.⁸ Recall that the four weighting schemes are:

- 1. 60% on median household income, 20% on the poverty rate, 20% on unemployment
- 2. 60% on median household income, 20% on sales, 10% on poverty, 10% on the unemployment rate
- 3. 45.8% on median household income, -8.9% on sales, 21.4% on unemployment and 41.7% on poverty ⁹
- 4. 42.1% on median household income, 20.5% on unemployment and 37.4% on poverty

In Table 1 the results for the first weighting scheme is analyzed. The fixed weighting scheme without sales, results in very similar rankings in the two studies. In the top ten St. Johns moves up to the top, with the previous number one becoming the runner up in the 2011 study. Most of the top ten stays the same with 80% of the counties being the same as in the 2002-2003 study. In the bottom ten, Hamilton maintains its lowest position. However, the index is closer to the second to lowest ranking county. Of the bottom ten, six are the same in the update as compared to the original study.

Table 1.A Fixed Weights without Sales; Ten Counties with HighestAffordability

	2011 Update			2002 Original	
	-	Affordal	oility		Affordability
Ranking	County	Index		County	Index
1	St. Johns		147	Clay	133
2	Clay		134	Seminole	132
3	Nassau		130	St. Johns	13 1
4	Okaloosa		129	Nassau	125
5	Seminole		127	Sarasota	122
6	Santa Rosa		127	Okaloosa	122
7	Collier		126	Collier	122
8	Monroe		122	Santa Rosa	118
9	Wakulla		120	Lee	118
10	Martin		116	Martin	116

⁸ See Appendix A for complete rankings of all the counties for each of the weighting schemes.

⁹ The sales variable has a negative sign in the principal component. This can happen as the principal component tries to find the highest difference between counties.

Table 1.B:Fixed Weights without Sales; Ten Counties with Lowest						
Affordability						
	2011 Update			2002 Origir	nal	
	•	Affordabilit	у	_	Affordability	
Ranking	County	Index		County	Index	
58	Highlands		83	Glades	80	
59	Washington		82	Putnam	80	
60	Okeechobee		80	Holmes	79	
61	Gadsden		79	Madison	79	
62	Hardee		79	De Soto	78	
63	Putnam		78	Dixie	78	
64	Madison		78	Taylor	75	
65	Hendry		76	Hardee	66	
66	Dixie		74	Hendry	61	
67	Hamilton		72	Hamilton	57	

In table 2 we report the rankings of the top ten and bottom ten counties with the fixed weights, but this time including sales in the variables of interest. The top ten are also here very similar to the ones in the original study. 70% of the counties are the same in top ten of the 2011 ranking as compared to the 2002-2003 ranking. For the bottom ten counties, 70% of the counties have the same ranking in the two studies.

Table 2.A: Fixed Weights with Sales; Ten Counties with the Highest Affordability

	2011 Upda	te		2002 Origir	nal	
		Affordabi	lity		Affordability	/
Ranking	County	Index	-	County	Index	
1	St. Johns		142	Seminole	1	.38
2	Clay		128	St. Johns	1	.34
3	Okaloosa		128	Clay	1	.33
4	Seminole		126	Nassau	1	.31
5	Collier		126	Collier	1	.29
6	Nassau		125	Orange	1	.27
7	Monroe		122	Okaloosa	1	21
8	Santa Rosa		121	Martin	1	21
9	Baker		120	Hillsborough	1	.19
10	Martin		117	Duval	1	.19

Table 2.B: Fixed Weights with Sales; Ten Counties with Lowest Affordability

	2011	Update Affordability	2002	Original Affordability
Ranking	County	Index	County	Index
58	Washington	82	Washington	80
59	Highlands	82	Franklin	80
60	Gadsden	82	Levy	80
61	Calhoun	82	Glades	79
62	Holmes	82	Hardee	78
63	Putnam	79	Holmes	77
64	Hardee	79	Calhoun	77
65	Madison	77	Dixie	74
66	Dixie	73	Madison	74
67	Hamilton	73	Hamilton	67

In table 3 the rankings of the top ten and bottom ten counties with statistical weights instead of fixed weights are shown. In this ranking the sales variable is included so this table corresponds to the third weighting scheme. The top ten are similar to the ones in the original study, but the percentage that appear in both tables falls to 60% of the counties are the same in top ten of the 2011 ranking as compared to the 2002-2003 ranking. For the bottom ten counties, the percentage of counties appearing in both rankings is also 60% of the counties have the same ranking in the two studies. The reason for the decrease in the number of counties appearing in both tables is because of the statistical weight on the sales variable. The negative weight causes some changes in the 2011 ranking relative to the 2002-2003 ranking where the sales variable has a positive weight.

Table 3.A: Statistical Model with Sales; Ten Counties with Highest Affordability

	2011 Update Affordability		2002 Original Affordability	
Ranking	County	Index	County	Index
1	St. Johns	146	Seminole	131
2	Clav	135	Clay	129
3	Nassau	131	St. Johns	129
4	Okaloosa	129	Nassau	125
5	Santa Rosa	128	Collier	122
6	Seminole	127	Sarasota	122
0 7	Collier	125	Okaloosa	121
, 8	Wakulla	122	Orange	118
e q	Monroe	122	Lee	117
10	Martin	116	Martin	116

Table 3.B: Statistical Model with Sales; Ten Counties with lowestAffordability

	2011 Upda	2011 Update		ginal
		Affordability		Affordability
Ranking	County	Index	County	Index
58	Washington	80	Calhoun	81
59	Okeechobee	79	Glades	79
60	De Soto	78	Holmes	79
61	Hardee	78	De Soto	78
62	Madison	77	Madison	78
63	Putnam	77	Dixie	78
64	Dixie	74	Taylor	77
65	Gadsden	74	Hardee	67
66	Hendry	69	Hendry	67
67	Hamilton	67	Hamilton	58

The final weighting scheme is the fourth case where the weights are statistically based, but without a sales variable. Table 4 shows the results for the two studies for the fourth weighting scheme. This weighting scheme shows the strongest similarity between the two studies with 80% of the top counties appearing in both rankings and 70% of the bottom 10 counties.

Table 4.A: Statistical Model without Sales; Ten Counties with Highest Affordability

	2011 Update			2002 Original	
	-	Affordability		Affordability	
Ranking	County	Index	County	Index	
1	St. Johns	141	Clay	133	
2	Clay	131	Seminole	132	
3	Okaloosa	129	St. Johns	131	
4	Nassau	128	Nassau	125	
5	Seminole	125	Sarasota	122	
6	Santa Rosa	125	Okaloosa	122	
7	Collier	123	Collier	122	
8	Monroe	123	Santa Rosa	118	
9	Wakulla	118	Lee	118	
10	Martin	115	Martin	116	

 Table 4.B: Statistical Model without Sales; Ten Counties with Lowest

 Affordability

2011 Updat		te 2002 Orig		ginal
		Affordability		Affordability
Ranking	County	Index	County	Index
58	Taylor	83	Glades	80
59	Washington	81	Putnam	80
60	Okeechobee	81	Holmes	79
61	Hardee	79	Madison	79
62	Putnam	77	De Soto	78
63	Madison	77	Dixie	78
64	Gadsden	76	Taylor	75
65	Dixie	75	Hardee	66
66	Hendry	74	Hendry	61
67	Hamilton	68	Hamilton	57

V. Summary

This study updates the data for the variables used in the Affordability Index. The update is done in a manner consistent with the original approach to encourage continuity in the use of the index. An index for each census tract and each county was computed using four different weighting schemes. Using these indices DEP can select any particular geographic section of Florida and use the supplied spreadsheets to compute an affordability index for the selected geographic section.

The rankings of the present study are similar to the 2002-2003 rankings. Although some counties move up and down in the rankings, most counties are close to their position in the original study. In fact most of the weighting schemes result in around 70% of the counties staying in the top ten or bottom ten depending on where they were in 2002-2003. By maintaining the same methodology as the original study, while updating the data, we have supplied an index that is close to the original index, but updates some counties that have had major adjustments in their household incomes, sales, poverty, or unemployment data.

This final report includes a CD with four Excel spreadsheets that can be used to compare the ability to pay for census tracts in Florida. The data used in these spreadsheets have been updated to the most recently available data, and updated indices have been computed for all the census tracts and counties in Florida. A User Manual is also provided on the CD to facilitate the use of the indices. This manual is also supplied in Appendix B of this report.

Appendix A: Sample User Interface

USER INTERFACE

weights: income -- .60; poverty rate -- 0.20; unemployment rate -- 0.20

Number	County	Census tract	Index	Population
1	99	3.02	157 49	3 614
2	1	2.00	56.99	5,884
3	95	141.00	124.23	6,100
4	0	0.00	0.00	0
5	0	0.00	0.00	0
6	0	0.00	0.00	0
7	0	0.00	0.00	0
8	0	0.00	0.00	0
9	0	0.00	0.00	0
10	0	0.00	0.00	0
11	0	0.00	0.00	0
12	0	0.00	0.00	0
13	0	0.00	0.00	0
14	0	0.00	0.00	0
15	0	0.00	0.00	0
16	0	0.00	0.00	0
<u>17</u>	0	0.00	0.00	0
18	0	0.00	0.00	0
19	0	0.00	0.00	0
20	0	0.00	0.00	0
21	0	0.00	0.00	0
22	0	0.00	0.00	0
23	0	0.00	0.00	0
24	0	0.00	0.00	0
25	0	0.00	0.00	0
Summary			106.57	15,598

USER MANUAL: AFFORDABILITY INDEX

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I. PROGRAM OVERVIEW

All four versions of the Affordability Index program [*AffordabilityIndex.6.2.2; AffordabilityIndex.6, .2, .1, .1; AffordabilityIndex-pca* and *AffordabilityIndex-pca-no sales*] have been designed with the user in mind. By entering a county number and a census tract number, each program generates the census tract population and also the affordability index number associated with the program type.

- *AffordabilityIndex.6.2.2*: calculates an affordability index number with the following weighting scheme—60% on median household income, 20% on the poverty rate, and 20% on the unemployment rate.
- *AffordabilityIndex.6, .2, .1, .1*: calculates an affordability index number with the following weighting scheme—60% on median household income, 20% on sales, 10% on the poverty rate, and 10% on the unemployment rate.
- *AffordabilityIndex-pca*: calculates an affordability index number that relies on a weighting scheme derived from principal component analysis (pca). This analysis generated weights of 45.8% on median household income, -8.9% on sales, 21.4% on unemployment, and 41.7% on poverty. These percentages are population weighted.
- *Affordability Index-pca-no sales*: calculates an affordability index number that relies on a weighting scheme derived from principal component analysis (pca). This analysis generated weights of 42.1% on median household income, 20.5% on unemployment, and 37.4% on poverty. These percentages are population weighted.
 - All four of the programs utilize standardized numbers. Standardizing the numbers allows for accurate construction of the affordability index. Standardizing the variables ensures that the different variable types are comparable (i.e., this allows comparison between median household income and poverty etc.)
 - Also, these programs calculate the index number in adjusted or "real" terms. Therefore, the sales figures and the median household income have been adjusted in order to take into account the price level.
 - The index numbers are centered on a mean of 100. This implies that numbers above 100 are of above average affordability and that numbers below 100 are below average affordability. The use of mean=100, allows for ease in comprehension.

II. STEP-BY-STEP GUIDE TO USE

There are four sheets contained in each of the four *AffordabilityIndex* programs: Interface, County Data, County Index, and Tract Data. WHEN USING THE PROGRAM, ONLY USE THE INTERFACE WORKSHEET.

A. Interface Worksheet

The Interface sheet is the only one that is to be used in order to obtain the index numbers and population information. NOTE: altering any other aspect of the program will lead to malfunction. This means that you may not insert or delete columns or sheets etc. To use the Interface worksheet you simply enter the county FIPS number (**SEE APPENDIX A**) and the number of the census tract that you are interested in. By entering these two numbers, the program will automatically generate an affordability index number and the census tract population. Also, note that at the bottom of the user interface box, there is a bolded index number.

When using the interface, it is imperative that you only enter census tract numbers that exist for the county that you specify. Specifying a nonexistent census tract number will result in an incorrect index number and an incorrect population number. Therefore, caution in entering these numbers is strongly advised.

• **11 census tracts have been deleted, the following numbers must not be entered.** These 11 tracts have been deleted due to restrictions on population/households or insufficient number of households.

County	Tract	Population
Hernando	9401.00	24
Hillsborough	109.00	4812
Leon	13.00	5095
Miami-Dade	0.00	0
Miami-Dade	75.02	3728
Miami-Dade	101.25	0
Monroe	9701.00	0
Palm Beach	71.00	285
Palm Beach	81.02	833
Sumter	9909.00	5291
Taylor	9902.00	0

* **To repeat:** DO NOT enter these particular county/tract combinations into the interface worksheet -- they have been deleted from the dataset.

B. County Data Worksheet

This sheet should only be used to update the numbers. DO NOT DELETE ANY COLUMNS OR ROWS and DO NOT ADD ANY COLUMNS OR ROWS TO THIS SHEET.

When updating the data it is imperative that you enter the new numbers right on top of the old ones. Therefore, it is recommended that you resave the excel spreadsheet under a new name each time that you update the numbers. Again, be sure not to add or delete rows or columns in this worksheet. In order to update you must write over the old numbers.

ALSO, IT IS IMPERATIVE THAT YOU ENTER THE DATA IN THE CORRECT UNITS. Therefore, gross population must be entered in thousands (i.e., if Alachua's population consists of 247,336 people, it must be entered as 247.336). Unemployment must be entered as a rate (i.e., Alachua's unemployment rate is 8.2). The price level index should be entered as a number that probably falls somewhere around 100, i.e., Alachua's price level index number is 97.33). Median household income must be entered in dollars, i.e., Alachua's median household income is 42,980. Poverty must be entered as a rate (i.e., Baker's poverty rate is 15.3). And, Gross Sales must be entered in thousands (i.e., if Calhoun has gross sales of \$145,265,391.50 it should be entered as 145265.3915).

NOTE: Many of these variables will already be listed in the correct units when you go to update the numbers. However, it is imperative that you check and make sure that they are being entered/expressed in the correct terms.

C. County Index Worksheet

UNDER NO CIRCUMSTANCES SHOULD ANYTHING ON THIS SHEET BE CHANGED. Do not change ANYTHING on this worksheet. This is where the calculations are done, altering even the tiniest detail or moving a column etc., will surely lead to results that are incorrect.

D. Tract Data Worksheet

As is the case for the County Index worksheet, NOTHING IN THIS WORKSHEET SHOULD BE CHANGED. Do not change ANYTHING on this worksheet. This is where the calculations are done, altering even the tiniest detail or moving a column etc., will surely lead to results that are incorrect.

** The affordability index program relies specifically on the County Index and Tract Data worksheets. Therefore, NOTHING SHOULD EVER BE ALTERED ON EITHER OF THESE

TWO SHEETS. And, in fact, aside from updating the numbers, nothing should be altered in the entire program.

SO to summarize, updating the data will only done on the "County Data" worksheet. By updating on this worksheet, the program will automatically adjust so that all calculations rely on those numbers. Remember that when you update the data, you must enter the new numbers directly on top of the old ones—NEVER ADD OR DELETE COLUMNS OR ROWS FROM ANY OF THE WORKSHEETS.

III. DATA SOURCES—HOW TO UPDATE

NOTE: This page describes explicitly the data sources and how to find new numbers. IN ORDER TO ACTUALLY UPDATE THE PROGRAM YOU MUST READ section II of this manual, the "Step-by-Step Guide to Use." Section II

• the *Florida Statistical Abstract*, published annually by BEBR, provides a hard copy version of all these variables.

2010 unemp from <u>http://lmi.floridajobs.org/laus/LAUS.HTM</u> source: Florida Agency for workforce innovation, labor market stats with BLS

> <u>To update</u>: go to http://www.labormarketinfo.com/Library/LAUS.htm "Local Area Unemployment Averages" Use the scroll down menu entitled "Annual Averages" Found under the heading "Statewide and All Areas" Then, select the year and format that you are interested in

2010 price level index-- http://www.bebr.ufl.edu/files/FPLI_SP%202010.pdf Found on website for University of Florida Bureau of Economic and Business Research

> to update: go to http://www.bebr.ufl.edu/free/data Then scroll down and there will be a link to the "current year Florida price level index"

2008 median household income and poverty:

poverty refers to % of population for whom poverty status is determined *Florida Statistical Abstract*, 2010

APPENDIX A

FLORIDA FIPS CODES

CODE NAME	CODE NAME	CODE NAME
001 Alachua	051 Hendry	101 Pasco
003 Baker	053 Hernando	103 Pinellas
005 Bay	055 Highlands	105 Polk
007 Bradford	057 Hillsborough	107 Putnam
009 Brevard	059 Holmes	109 St. Johns
011 Proward	061 Indian Divar	111 St Lucio
011 Diowalu 012 Calhaun	062 Jackson	111 St. Lucie
015 Camoun	065 Jackson	115 Santa Rosa
015 Charlotte	065 Jefferson	115 Sarasola
017 Citrus	067 Lafayette	117 Seminole
019 Clay	069 Lake	119 Sumter
021 Collier	071 Lee	121 Suwannee
023 Columbia	073 Leon	123 Taylor
	075 Levy	125 Union
027 DeSoto	077 Liberty	127 Volusia
029 Dixie	079 Madison	129 Wakulla
021 D1		101 W-14-
031 Duval	081 Manatee	131 Walton
033 Escambia	083 Marion	133 Washington
035 Flagler	085 Martin	
037 Franklin	086 Miami-Dade	
	087 Monroe	
039 Gadsden	089 Nassau	
041 Gilchrist	091 Okaloosa	
043 Glades	093 Okeechobee	
045 Gulf	095 Orange	
047 Hamilton	097 Osceola	
049 Hardee	099 Palm Beach	
		-