Two Examples of ProFamy Application

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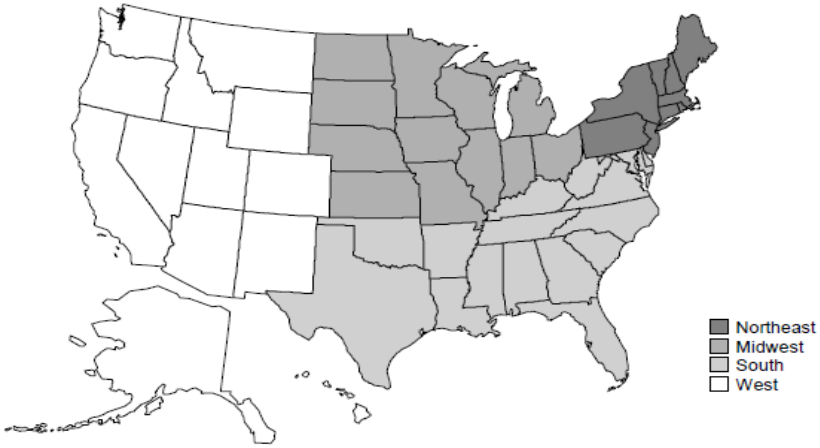
Forecast Household Vehicle Consumption in the USA

Vehicle consumption at the household level is inherently **associated with household** demographic and socioeconomic status. However, few studies have attempted to forecast vehicle consumption by these household characteristics, and most researchers use aggregated population and economic data to forecast in use of either regression or other modelling approaches.

American automakers have been experiencing **a continuous downturn**: the output of passenger cars has decreased steadily from 5.6 million in 1999 to 2.2 million in 2009; the annual growth rate of the average number of vehicles per household was 2.53 per cent in the period 1970-1980, but decreased to 0.48 per cent in the period 1990-2000.

Summary of household forecasts from 2000 to 2025

Region	Population Size	Number of Households	Average Household Size	Married-couple households (%)	One-person-only households (%)	Single-parent households (%)	Cohabiting-couple households (%)
Northeast							
2000	53,594,380	20,285,610	2.55	50.18	27.21	13.59	5.09
2009	54,736,112	21,141,810	2.50	48.73	28.11	12.44	5.74
2010	54,741,484	21,163,530	2.50	48.69	28.09	12.39	5.77
2015	54,745,540	21,268,024	2.49	48.48	28.26	12.28	5.81
2020	54,751,312	21,241,202	2.49	48.33	28.29	12.35	5.79
2025	54,774,228	21,161,876	2.50	48.09	28.37	12.46	5.77
Midwest							
2000	64,392,772	24,734,530	2.52	53.02	26.86	12.09	4.80
2009	67,050,356	26,354,170	2.47	51.71	28.41	10.46	5.49
2010	67,293,184	26,515,424	2.47	51.66	28.46	10.39	5.51
2015	68,470,448	27,280,866	2.44	51.40	28.78	10.19	5.56
2020	69,544,488	27,890,148	2.42	51.13	29.00	10.17	5.56
2025	70,519,144	28,403,604	2.41	50.71	29.26	10.25	5.54
South							
2000	100,236,816	38,015,212	2.56	51.65	25.33	14.79	4.40
2009	112,461,816	43,114,632	2.53	49.62	26.77	12.72	5.56
2010	113,848,880	43,663,700	2.53	49.51	26.75	12.67	5.60
2015	120,802,040	46,537,776	2.52	49.02	27.06	12.56	5.72
2020	127,728,984	48,775,108	2.55	48.78	27.05	12.76	5.75
2025	134,841,200	50,318,712	2.60	48.41	27.03	13.22	5.71
West							
2000	63,197,932	22,444,732	2.73	51.80	24.22	13.23	5.72
2009	71,314,272	25,846,178	2.70	51.51	25.43	11.22	6.36
2010	72,110,904	26,184,768	2.69	51.48	25.51	11.15	6.37
2015	76,046,448	27,817,182	2.67	51.39	25.71	10.94	6.36
2020	79,913,616	29,257,780	2.67	51.23	25.81	10.98	6.31
2025	83,746,896	30,558,684	2.68	51.02	25.85	11.14	6.25
Total							
2000	281,421,900	105,480,084	2.59	51.72	25.82	13.59	4.91
2009	305,562,556	116,456,790	2.55	50.35	27.09	11.82	5.75
2010	307,994,452	117,527,422	2.55	50.29	27.10	11.76	5.78
2015	320,064,476	122,903,848	2.53	49.99	27.34	11.62	5.85
2020	331,938,400	127,164,238	2.54	49.78	27.40	11.72	5.85
2025	343,881,468	130,442,876	2.56	49.47	27.46	11.96	5.81



Race/ethnic groups： White non-Hispanic, Black non-Hispanic, Hispanic, Asian and other non-Hispanic.

Vehicles types: car (passenger car, station wagon, SUV, and others cars), van (minivan, cargo-van, and passenger van), and truck (pickup and other trucks).

Household income categories: high income, middle income I, middle income II, and low income) are defined based on the income quartiles.

Household Vehicle Ownership Rates

In order to estimate the household vehicle ownership rate of cars, vans, trucks and all vehicles, we used various sources including the micro dataset of 2000 census, American Community Survey (ACS) 2000-2002, American Housing Survey (AHS) 2001 and 2003, and National Household Travel Survey (NHTS) 2001.

Age Differentials of Vehicle Ownership Rate

Racial Differentials of Vehicle Ownership Rate

Household Type/Size Differentials of Vehicle Ownership Rates

Household Income Differentials of Vehicle Ownership Rate

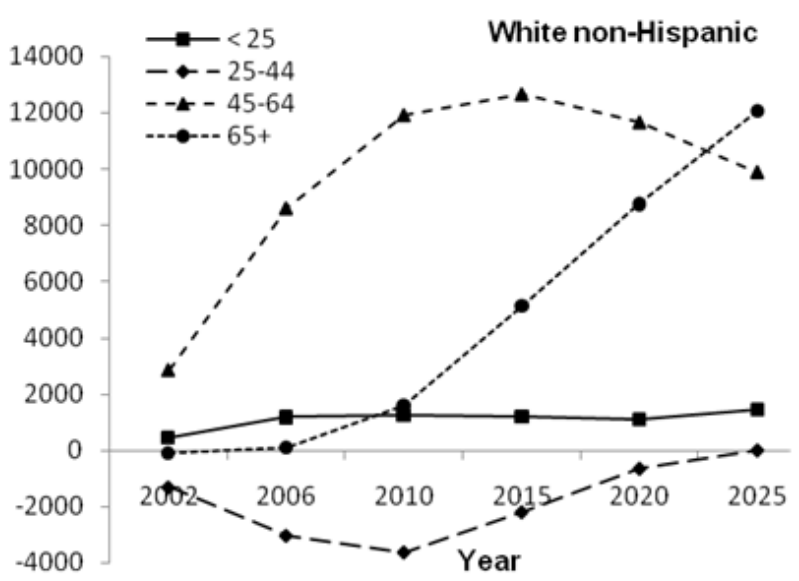
Regional Differentials of Vehicle Ownership Rates

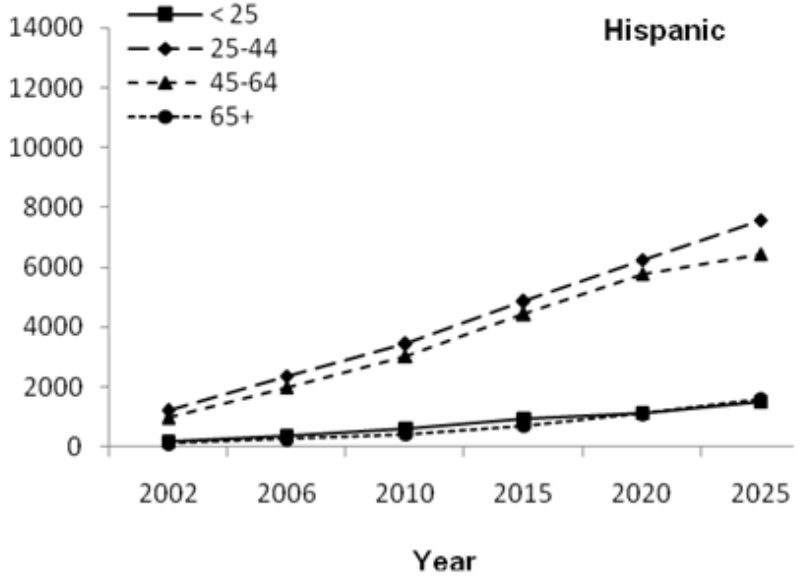
Forecast Household Vehicle Consumption in the USA

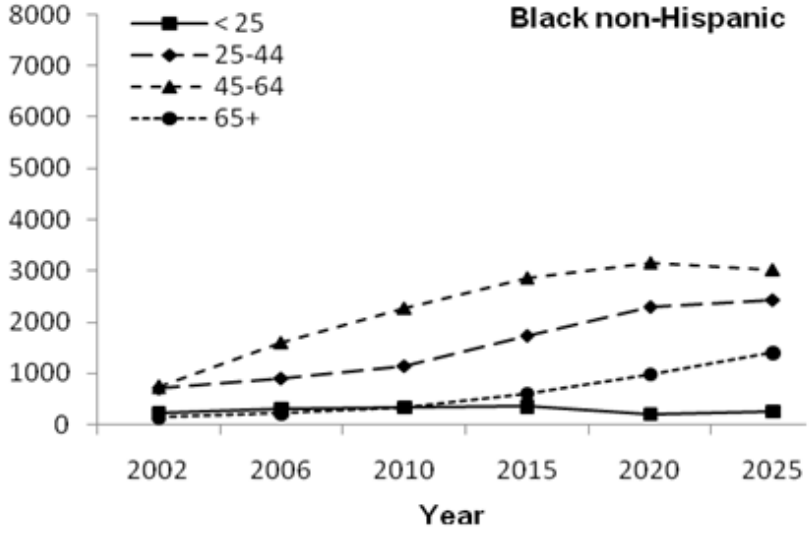
A comparison between our projected home-use passenger cars and the official statistics of U.S. Department of Transportation, 2000 to 2009

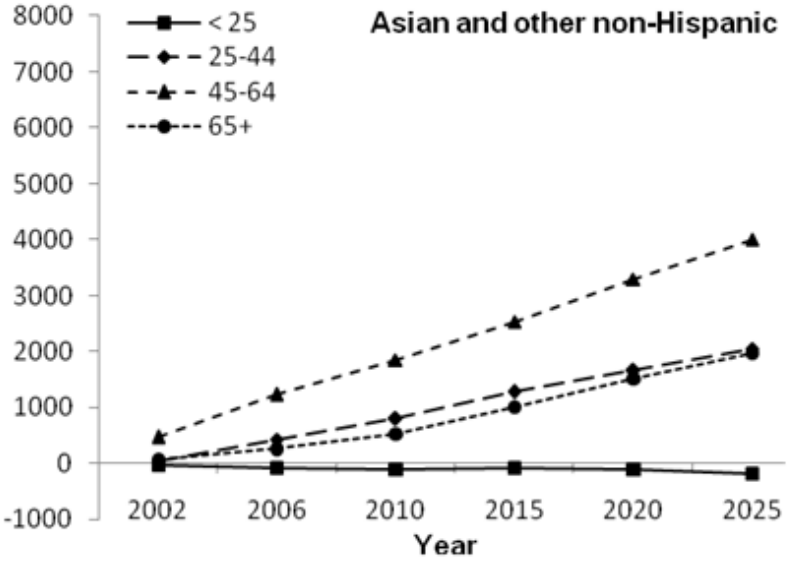
Year	ProFamy projections	Official statistics	Forecast Percent Error
2000	128,043,495	132,247,286	-4.4%
2001	133,836,606	136,340,945	-2.8%
2002	132,001,744	134,604,524	-3.0%
2003	133,732,685	134,336,851	-1.4%
2004	135,398,896	135,007,031	-0.8%
2005	136,997,767	135,192,288	0.3%
2006	138,523,397	134,012,369	2.3%
2007	139,995,950	134,510,252	2.9%
2008	141,409,761	135,637,845	3.1%
2009	142,928,590	133,437,105	7.1%
Mean Algebraic Percent error			0.3%
Mean Absolute Percent Error			2.8%

Forecasts of cumulative increase in household vehicle consumption by race and age of householder (Unit: 1,000)









Forecast Household Vehicle Consumption in the USA

- More than a half of the cumulative increase of household vehicle consumption is due to the increased consumption in cars.
- The consumption of vans will increase very quickly, which is mainly driven by householders aged 25-64, White non-Hispanic households and Hispanic households, and households with more than five members.
- The age group of 45-64 will make the largest contribution to the vehicle consumption increase. And vehicle owners aged 65+ will increase rapidly after 2010.
- Hispanic households will play a significant role in the vehicle consumption increase of the next decade, in particular, those with householder aged 25-44.

Forecast at the Sub-national Level

Since the late 1990s, researchers and policymakers have demanded household projections **at sub-national levels** such as provinces (or states), counties and cities, and other small areas.

Household and living arrangement projections at sub-national levels are useful for distributing government funds, allocating various types of resources, planning development of infrastructure and public facilities, market research, production planning for household-related goods and services, and decisions on expansion or reduction of local businesses.

Subnational data tend to be **limited**, especially for the city/county levels. Thus we may need some methods to address this data limitation.

Forecast at the Sub-national Level

Southern California Association of Governments (SCAG) is the officially certified regional planning agency for these six counties (Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura), and it is currently the largest metropolitan planning organization of the United States with an area of more than 38,000 square miles. This makes up a good case to apply and validate the method of ProFamy at the county level.

Forecast at the Sub-national Level

Percentage Difference between the ProFamy Projection in 2010 and the 2010 Census Observation for each of the six counties of Southern California*

County	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura
Population size	0.30	-0.31	-0.26	0.33	-0.25	0.18
Number of households	-0.08	-0.73	-0.45	2.24	0.45	2.02
Average household size	-1.80	0.06	0.28	-1.90	-0.43	-1.60
% of 1 person households	2.93	-2.46	-0.96	0.22	0.20	-2.63
% of 2-3 person households	3.85	4.37	2.04	1.61	-0.01	3.97
% of 4+ person households	-4.77	-3.81	-2.22	-2.00	-0.08	-3.86
% of married-couple households	-2.23	1.94	-2.57	-0.77	2.27	1.73

*Percentage difference = [(ProFamy projection-Census observation) / Census observation] × 100

Forecast at the Sub-national Level

Year	2010	2015	2020	2025	2030	2035	2040	Percentage Change* (2040 vs 2010)
Population size								
Imperial	174264	160289	179125	194238	255827	269169	281390	+61.47
Los Angeles	9807740	10198087	10632509	10886785	11093004	11295045	11522711	+17.49
Orange	3006924	3155432	3234793	3301064	3359940	3424794	3472837	+15.49
Riverside	2187056	2320025	2483936	2653814	2820783	2961440	3067769	+40.27
San Bemardino	2033093	2150382	2236982	2332689	2448539	2566198	2682770	+31.96
Ventura	822277	857619	876408	894671	914846	935871	958911	+16.62
Southern California	18031354	18841834	19643753	20263261	20892939	21452517	21986388	+21.93
Number of Household								
Imperial	49126	53435	69269	74705	79685	83802	88150	+79.44
Los Angeles	3241204	3285550	3503898	3626939	3727679	3826371	3938056	+21.50
Orange	992781	1060027	1114139	1154986	1192753	1210528	1223612	+23.25
Riverside	686260	730744	806556	891623	959872	1018921	1067608	+55.57
San Bemardino	611618	647424	689363	742032	787689	824655	861750	+40.90
Ventura	266920	268901	283876	294814	304166	309348	312918	+17.23
Southern California	5847909	6046081	6467101	6785099	7051844	7273625	7492094	+28.12

* Percentage change = [(Number in 2040-Number in 2010) / Number in 2010] × 100

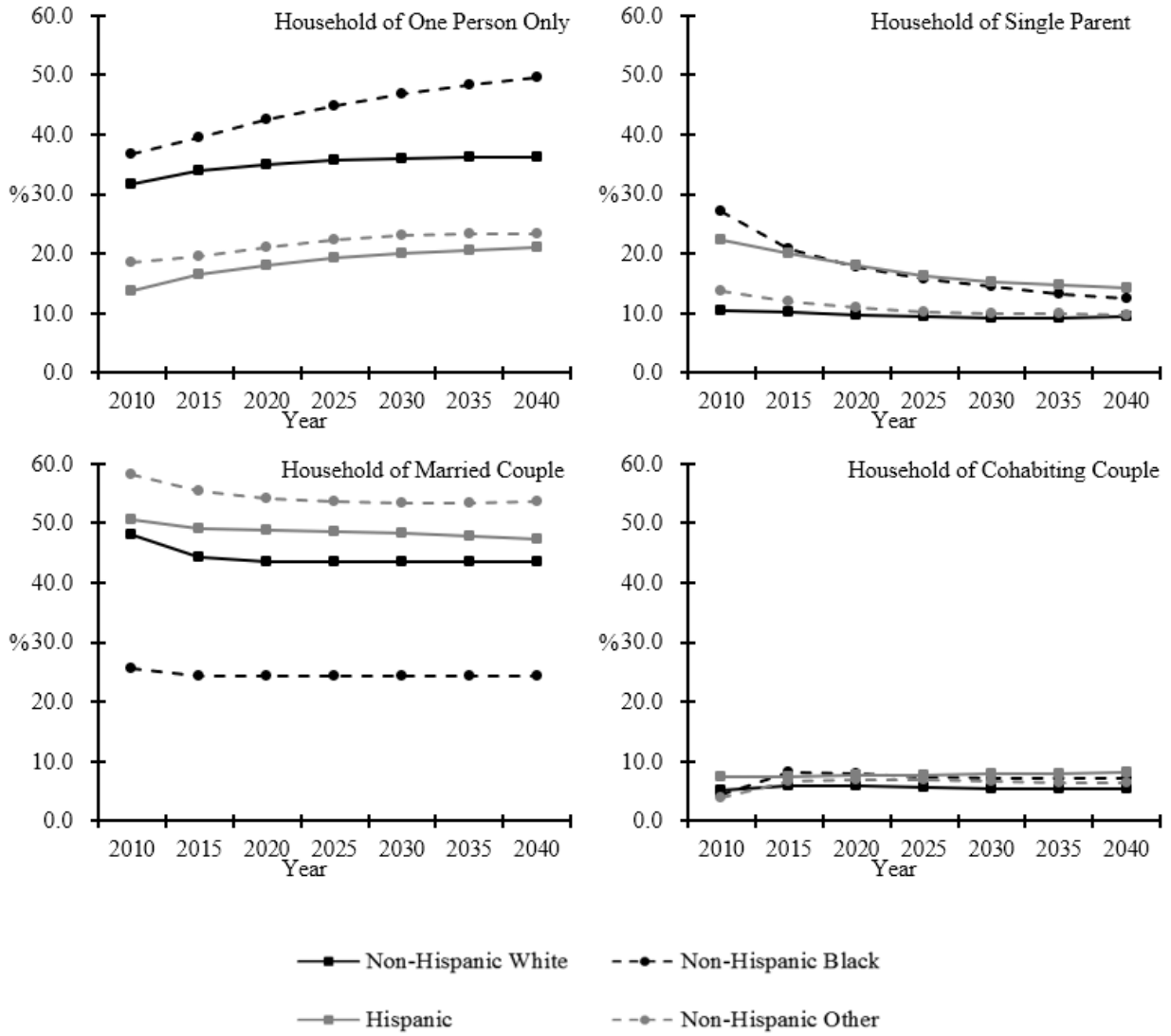
Forecast at the Sub-national Level

Year	2010	2015	2020	2025	2030	2035	2040
Percentages of Households by Size							
1 person	22.14	22.70	23.00	23.27	23.60	23.70	23.99
2 person	27.09	25.32	26.92	27.72	27.39	27.18	27.53
3 person	16.31	16.27	16.51	16.56	16.92	17.30	17.97
4 person	15.59	15.00	14.00	13.54	13.49	13.49	13.47
5 person	9.16	9.45	8.82	8.50	8.42	8.38	8.18
6 person	4.64	5.26	4.97	4.78	4.76	4.75	4.40
7 person	2.38	2.81	2.70	2.60	2.63	2.64	2.34
8 person	1.42	1.67	1.61	1.57	1.48	1.39	1.15
9+ person	1.28	1.51	1.47	1.45	1.32	1.18	0.96
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Average Household Size	3.01	3.08	3.01	2.98	2.96	2.95	2.88
Percentages of Households by							
One person only	22.14	22.70	23.00	23.27	23.60	23.70	23.99
One person and other	8.26	7.86	8.07	8.29	8.02	7.76	7.17
Married couple, no co-residing	16.94	16.65	17.51	17.26	16.61	16.33	16.19
Cohabiting couple, no co-residing	2.65	4.17	4.46	4.32	4.21	4.19	4.18
Married couple, with co-residing	30.04	29.55	28.75	28.19	27.74	27.44	27.41
Cohabiting couple, with co-residing	2.65	3.42	3.22	3.18	3.39	3.58	3.66
Lone mother, with co-residing	11.71	11.07	10.53	10.94	11.77	12.33	12.72
Lone father, with co-residing	5.62	4.58	4.46	4.55	4.67	4.68	4.68
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

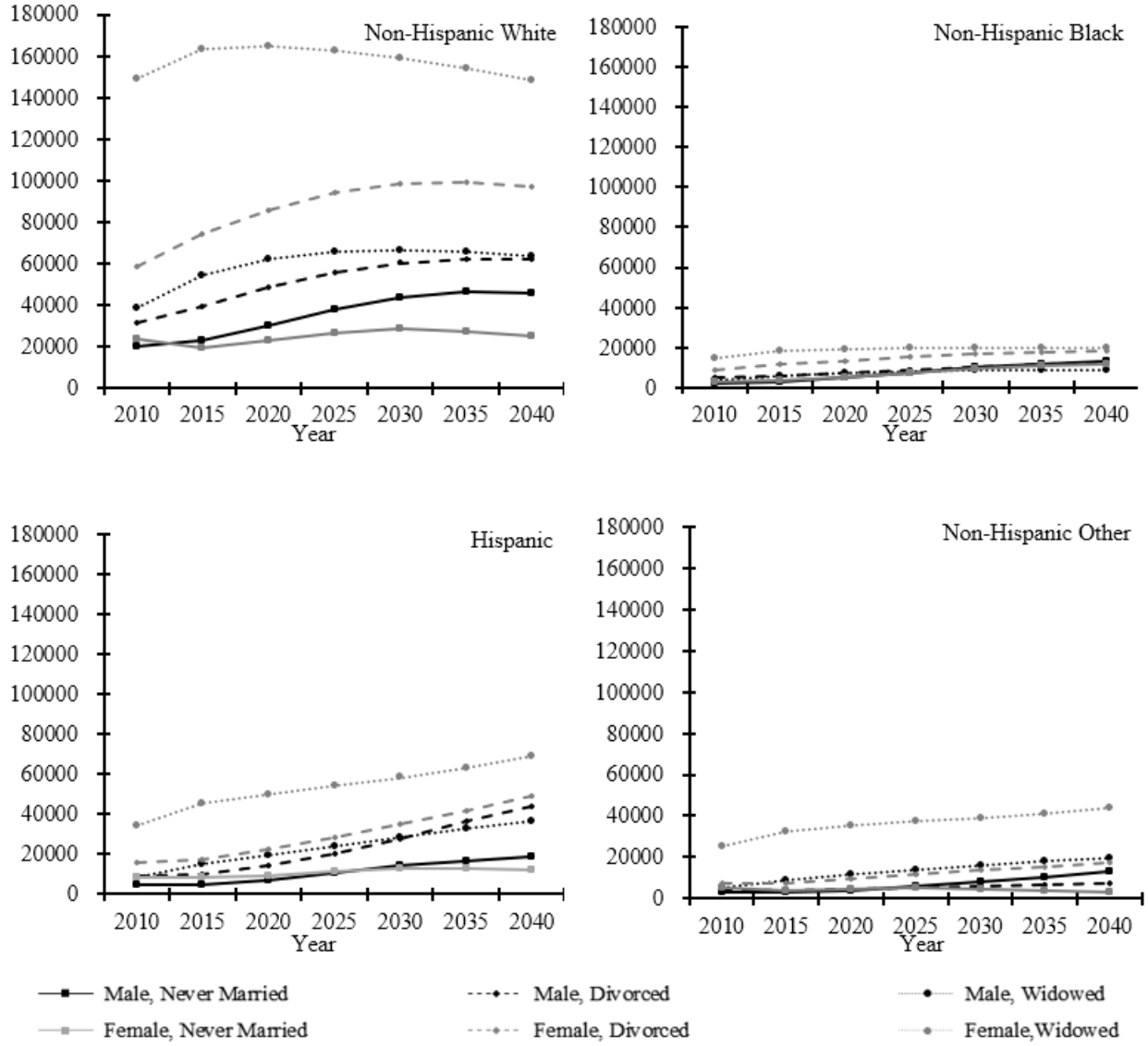
Forecast at the Sub-national Level

Year	2010	2015	2020	2025	2030	2035	2040
Single, alone	3.66	3.06	3.49	3.97	4.24	4.33	4.31
Divorced, alone	8.06	7.42	7.47	7.66	7.89	8.17	8.46
Widowed, alone	14.62	13.54	12.57	11.60	10.81	10.38	10.07
Subtotal of living alone	26.34	24.02	23.53	23.23	22.94	22.88	22.84
Married, not with children	38.43	33.82	32.56	31.43	30.25	29.51	29.06
Cohabiting, not with children	1.20	2.74	3.71	4.08	4.15	4.24	4.35
Subtotal of only living with spouse/partner	39.63	36.56	36.27	35.51	34.4	33.75	33.41
Married, with children	14.48	17.75	18.45	19.09	19.72	19.98	20.15
Cohabiting, with children	0.19	0.80	1.11	1.25	1.33	1.35	1.37
Single, with children	0.79	2.12	2.40	2.73	2.96	2.93	2.78
Divorced, with children	2.80	3.90	4.10	4.48	5.02	5.45	5.82
Widowed, with children	9.52	9.06	8.31	7.80	7.60	7.35	7.05
Subtotal of living with children	27.78	33.63	34.37	35.36	36.63	37.06	37.17
Institutionalized	2.92	3.14	3.12	3.10	3.16	3.27	3.39
With others, not with spouse/child	3.33	2.65	2.71	2.80	2.89	3.05	3.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Percentage Distributions of Living Arrangements of **the Elderly aged 65+** in Southern California, 2010 to 2040



Percentage of Household Types by Race in South California, 2010 to 2040



Number of **Solo-living 65+ Elderly** in South California by Sex, Race and Marital Status, 2010 to 2040

Congratulations to Professor Zeng Yi!

Oct 16, 2006, USA