

STUDY SERIES  
(*Statistics #2020-01*)

**A Deterministic Retabulation of Pennsylvania  
Congressional District Profiles from 115<sup>th</sup> Congress to 116<sup>th</sup> Congress**

Tommy Wright,  
Martin Klein<sup>1</sup>,  
Eric Slud

<sup>1</sup>U.S. Food and Drug Administration, Silver Spring, Maryland

Center for Statistical Research & Methodology  
Research and Methodology Directorate  
U.S. Census Bureau  
Washington, D.C. 20233

Report Issued: March 30, 2020

*Disclaimer:* This report is released to inform interested parties of research and to encourage discussion. The views expressed are those of the authors and not necessarily those of the U.S. Census Bureau.

**A Deterministic Retabulation of Pennsylvania  
Congressional District Profiles from 115<sup>th</sup> Congress to 116<sup>th</sup> Congress\***

Tommy Wright, Martin Klein<sup>1</sup>, and Eric Slud  
U.S. Bureau of the Census

**Abstract**

This study documents a methodology and results for retabulating 116<sup>th</sup> Congress (2019-2021) *Congressional District Profiles* for the newly drawn eighteen (18) districts of Pennsylvania. This is to be done without the usual estimation methodology using American Community Survey sample microdata. This is to be done only using data that are already available to the public. Inspection of empirical results from the proposed methodology are not too different from those results obtained using the usual methodology.

\*In a few cases where tabulated numbers are added or multiplied, the shown result (sum or product) may differ from the actual result due to rounding.

<sup>1</sup>Now with the U.S. Food and Drug Administration, Silver Spring, Maryland.

# 1. Introduction

## 1.1. Overview

This study documents a methodology and results for retabulating 116<sup>th</sup> Congress (2019-2021) *Congressional District Profiles* for the newly drawn eighteen (18) districts of Pennsylvania. Based on 2015 American Community Survey (ACS) 1-Year sample data, the 115<sup>th</sup> Congress (2017-2019) *Congressional District Profiles* for Pennsylvania are given in Tables PA.1 - PA.18. It is required that the retabulations for Pennsylvania for the 116<sup>th</sup> Congress *Congressional Districts Profiles* be produced with data that are available to the public. While the current 2015 ACS 1-Year based congressional district profiles can be used, the underlying 2015 ACS 1-year sample data can not.

The proposed method is deterministic in the sense that given the 2010 Census Summary File 1 (SF1) data and the 2015 ACS 1-Year Estimates in the profiles, our methodology is not based on any sort of additional randomization. The proposed method is deeply rooted in the block counts reported in the 2010 Census SF1 data, and we make an adjustment using 2015 ACS 1-Year data to account for “growth” (or change) from 2010 to 2015 for population counts and for housing unit counts.

Counts of blocks and associated housing units and population that move from old (115<sup>th</sup> Congress) congressional districts to new (116<sup>th</sup> Congress) congressional districts are given in Tables 1 and 2 for Pennsylvania.

The straightforward methodology is deterministic and seeks to account for “movement” of population and housing units (and their data vintage of the 2015 ACS 1-Year data grounded in 2010 Census/SF1 data) from old districts to the newly drawn districts in Pennsylvania. The methodology (Sections 3.1.2 and 3.1.3) “adjusts” 2010 Census SF1 population and housing unit counts at the block level of old districts to reflect growth from 2010 to 2015 using 2015 ACS 1-Year profiles, moves these blocks to the new districts, and retabulates distributions in profiles for new districts with these adjusted numbers of housing units and persons.

Profiles for Pennsylvania’s new congressional districts are given in Tables PA.1\* - PA.18\* of Section 4. In Section 5, we visually check our results with those from the usual ACS estimation methodology based on underlying 2015 ACS 1-Year sample data. The checks provide some empirical evidence that results are “not too different” and support further investigation of the deterministic method.

## 1.2. Background

During the period of the 115<sup>th</sup> Congress the lines for the eighteen congressional districts of Pennsylvania were redrawn *deterministically* based on geography and population data. There are 421,545 2010 Census blocks in Pennsylvania. Details of numbers of affected blocks, housing units, and people based on 2010 Census counts for Pennsylvania are given in Table 1.

From Table 1, we see the following movement from Congressional District CD-07 for the 115<sup>th</sup> Congress to various new congressional districts for the 116<sup>th</sup> Congress: 40 blocks (1294 housing units, 4078 people) to CD-01, 2206 blocks (52945 housing units, 132742 people) to CD-04, 6265 blocks (151427 housing units, 380572 people) to CD-05, 3499 blocks (50753 housing units, 136193 people) to CD-06, 654 blocks (7354 housing units, 19398 people) to CD-09, and 1151 blocks (10100 housing units, 32705 people) to CD-11. The numbering for the Pennsylvania congressional districts was changed significantly from the 115<sup>th</sup> to the 116<sup>th</sup> Congress. For example, over half of the people in the new Congressional District CD-05 (380572) were in the old congressional district CD-07.

Table 1. Number of Pennsylvania Blocks (B), Housing Units (HU), and People (P) that Moved from 115<sup>th</sup> Congress Districts to 116<sup>th</sup> Congress Districts (Census 2010 Data)

	CD116																			
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	Total	
01 B	0	3862	1815	0	4961	0	0	0	0	0	0	0	0	0	0	0	0	0	10638	
01 HU	0	109951	70562	0	117462	0	0	0	0	0	0	0	0	0	0	0	0	0	297975	
01 P	0	281133	138528	0	286027	0	0	0	0	0	0	0	0	0	0	0	0	0	705688	
02 B	0	864	6972	537	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8954	
02 HU	0	27238	273241	12452	16593	0	0	0	0	0	0	0	0	0	0	0	0	0	329524	
02 P	0	69412	567160	30027	39089	0	0	0	0	0	0	0	0	0	0	0	0	0	705688	
03 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29048	
03 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21526	226	0	29048	
03 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54366	7067	0	315622	
04 B	0	0	0	0	0	0	0	0	0	11616	6000	0	4429	0	0	568823	17489	0	705688	
04 HU	0	0	0	0	0	0	0	0	0	178398	76368	0	40820	0	0	0	0	0	295586	
04 P	0	0	0	0	0	0	0	0	0	418037	186243	0	101407	0	0	0	0	0	705687	
05 B	0	0	0	0	0	0	0	0	0	0	0	7936	2115	0	29295	3808	0	0	43154	
05 HU	0	0	0	0	0	0	0	0	0	67511	15418	0	67511	0	207729	49870	0	0	340528	
05 P	0	0	0	0	0	0	0	0	0	147955	33893	0	147955	0	403925	119915	0	0	705688	
06 B	0	0	0	3512	0	7517	0	0	5573	0	0	0	0	0	0	0	0	0	16602	
06 HU	0	0	0	74323	0	145016	0	0	64866	0	0	0	0	0	0	0	0	0	284205	
06 P	0	0	0	188295	0	356104	0	0	161289	0	0	0	0	0	0	0	0	0	705688	
07 B	40	0	0	2206	6265	3499	0	0	654	0	1151	0	0	0	0	0	0	0	13815	
07 HU	1294	0	0	52945	151427	50753	0	0	7354	0	10100	0	0	0	0	0	0	0	273873	
07 P	4078	0	0	132742	380572	136193	0	0	19398	0	32705	0	0	0	0	0	0	0	705688	
08 B	12856	0	0	879	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13735	
08 HU	259242	0	0	18206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	277448	
08 P	657726	0	0	47962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	705688	
09 B	0	0	0	0	0	0	0	0	0	0	0	0	22855	11441	6607	0	0	0	40903	
09 HU	0	0	0	0	0	0	0	0	0	0	0	0	168612	98023	50928	0	0	0	317563	
09 P	0	0	0	0	0	0	0	0	0	0	0	0	374836	210184	120668	0	0	0	705688	
10 B	0	0	0	0	0	0	535	12022	0	0	0	32770	0	0	0	0	0	0	45327	
10 HU	0	0	0	0	0	0	10079	111296	0	0	221974	0	0	0	0	0	0	0	343349	
10 P	0	0	0	0	0	0	25517	200685	0	0	479485	0	0	0	0	0	0	0	705687	
11 B	0	0	0	0	0	0	0	5885	11586	7897	0	5478	2597	0	0	0	0	0	33443	
11 HU	0	0	0	0	0	0	0	77713	91581	97389	0	35545	18371	0	0	0	0	0	320599	
11 P	0	0	0	0	0	0	0	169605	190474	220814	0	78248	46547	0	0	0	0	0	705688	
12 B	0	0	0	0	0	0	0	0	0	0	0	0	7173	2142	2623	895	10458	376	23667	
12 HU	0	0	0	0	0	0	0	0	0	1789	33344	0	63771	33344	27004	7789	173845	13075	318828	
12 P	0	0	0	0	0	0	0	0	0	0	0	0	129753	74201	61719	16949	392471	30595	705688	
13 B	707	3556	0	5458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9721	
13 HU	17785	140222	0	129757	0	0	0	0	0	0	0	0	0	0	0	0	0	0	287764	
13 P	43883	355143	0	306661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	705687	
14 B	0	0	0	0	0	0	0	0	0	0	0	0	0	647	0	0	0	0	20322	
14 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	9711	0	4011	15664	0	362556	
14 P	0	0	0	0	0	0	0	0	0	0	0	0	0	18273	0	151963	535452	0	705688	
15 B	0	0	0	0	0	0	16573	0	5845	1954	0	0	0	0	0	0	0	0	24372	
15 HU	0	0	0	0	0	0	205873	0	53411	28539	0	0	0	0	0	0	0	0	287823	
15 P	0	0	0	0	0	0	505216	0	133634	66837	0	0	0	0	0	0	0	0	705687	
16 B	0	0	0	0	0	0	0	0	241	0	12127	0	0	0	0	0	0	0	17784	
16 HU	0	0	0	0	0	0	81197	0	2348	0	192852	0	0	0	0	0	0	0	276397	
16 P	0	0	0	0	0	0	213391	0	5557	0	486740	0	0	0	0	0	0	0	705688	
17 B	0	0	0	0	0	0	5815	11623	8823	0	0	0	0	0	0	0	0	0	26261	
17 HU	0	0	0	0	0	0	71019	159489	90987	0	0	0	0	0	0	0	0	0	321495	
17 P	0	0	0	0	0	0	174955	335397	195335	0	0	0	0	0	0	0	0	0	705687	
18 B	0	0	0	0	0	0	0	0	0	0	0	0	1012	14962	0	0	3130	2650	21754	
18 HU	0	0	0	0	0	0	0	0	0	0	0	0	9881	178652	0	0	66272	61375	316180	
18 P	0	0	0	0	0	0	0	0	0	0	0	0	19252	403030	0	0	143765	139641	705688	
Total B	13603	8282	8787	12592	11807	16432	22923	29330	32722	21467	19278	46184	40181	29192	45821	26229	17825	18690	421545	
Total HU	278321	277411	343803	287683	285482	276966	286971	348498	310547	304326	279320	325030	316873	319730	340027	311848	324700	349779	5567315	
Total P	705687	705688	705688	705688	705688	705688	705687	705687	705688	705688	705688	705688	705688	705688	705688	705687	705688	705688	705688	12702379

Source: Summary File 1, 2010 Census, U. S. Bureau of the Census, Washington, D.C.

### 1.3. 115<sup>th</sup> Congress Congressional District Profiles

The following profiles based on 2015 ACS 1-Year Estimates were provided at the beginning of the 115<sup>th</sup> Congress for each congressional district in Pennsylvania.

Table PA.1. Pennsylvania Congressional District 1 Profile (115<sup>th</sup> Congress)

Total Population	<b>720611</b>		
Age-Under 5:	7.1%		
Age-5 to 19:	19.0%		
Age-20 to 24:	7.0%		
Age-25 to 34:	18.8%		
Age-35 to 44:	13.6%		
Age-45 to 54:	12.6%		
Age-55 to 64:	11.1%		
Age-65+ :	10.8%		
Median Age:	33.8		
Percent Male:	47.9%		
Percent Female:	52.1%		
Veterans 18 yrs and older:	25,454		
		Total Housing Units:	<b>300762</b>
		Percent Occupied:	<b>87.3%</b>
		- Owner Occupied:	55.8%
		- Renter Occupied:	44.2%
		Percent Vacant:	<b>12.7%</b>
		One Race	
		- White:	48.4%
		- Black...:	34.9%
		- Am Ind & Alaska Nat:	0.3%
		- Asian:	7.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	5.6%
		Two or More Races:	3.1%
		Hispanic/Latino:	17.2%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.2. Pennsylvania Congressional District 02 Profile (115<sup>th</sup> Congress)

Total Population	<b>725418</b>		
Age-Under 5:	6.1%		
Age-5 to 19:	17.7%		
Age-20 to 24:	9.2%		
Age-25 to 34:	18.0%		
Age-35 to 44:	10.8%		
Age-45 to 54:	11.6%		
Age-55 to 64:	12.2%		
Age-65+ :	14.5%		
Median Age:	34.3		
Percent Male:	46.1%		
Percent Female:	53.9%		
Veterans 18 yrs and older:	32,762		
		Total Housing Units:	<b>333211</b>
		Percent Occupied:	<b>84.1%</b>
		- Owner Occupied:	49.7%
		- Renter Occupied:	50.3%
		Percent Vacant:	<b>15.9%</b>
		One Race	
		- White:	32.0%
		- Black...:	57.6%
		- Am Ind & Alaska Nat:	0.5%
		- Asian:	5.0%
		- Nat Haw & Other:	0.1%
		- Some Other Race:	2.2%
		Two or More Races:	2.5%
		Hispanic/Latino:	6.2%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.3. Pennsylvania Congressional District 03 Profile (115<sup>th</sup> Congress)

Total Population	<b>701892</b>		
Age-Under 5:	5.4%		
Age-5 to 19:	18.6%		
Age-20 to 24:	6.2%		
Age-25 to 34:	11.3%		
Age-35 to 44:	11.4%		
Age-45 to 54:	14.1%		
Age-55 to 64:	14.8%		
Age-65+ :	18.1%		
Median Age:	42.8		
Percent Male:	49.3%		
Percent Female:	50.7%		
Veterans 18 yrs and older:	53,199		
		Total Housing Units:	<b>317890</b>
		Percent Occupied:	<b>88.4%</b>
		- Owner Occupied:	71.4%
		- Renter Occupied:	28.6%
		Percent Vacant:	<b>11.6%</b>
		One Race	
		- White:	91.6%
		- Black...:	4.5%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	0.9%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.3%
		Two or More Races:	2.5%
		Hispanic/Latino:	2.3%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.4. Pennsylvania Congressional District 04 Profile (115<sup>th</sup> Congress)

Total Population	<b>724891</b>		
Age-Under 5:	5.4%		
Age-5 to 19:	19.1%		
Age-20 to 24:	6.4%		
Age-25 to 34:	12.2%		
Age-35 to 44:	11.9%		
Age-45 to 54:	14.7%		
Age-55 to 64:	13.6%		
Age-65+ :	16.7%		
Median Age:	41.0		
Percent Male:	49.3%		
Percent Female:	50.7%		
Veterans 18 yrs and older:	52,189		
		Total Housing Units:	<b>302564</b>
		Percent Occupied:	<b>91.3%</b>
		- Owner Occupied:	71.3%
		- Renter Occupied:	28.7%
		Percent Vacant:	<b>8.7%</b>
		One Race	
		- White:	85.3%
		- Black...:	7.8%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	2.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.7%
		Two or More Races:	2.4%
		Hispanic/Latino:	7.2%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.5. Pennsylvania Congressional District 05 Profile (115<sup>th</sup> Congress)

Total Population	<b>699108</b>		
Age-Under 5:	4.8%		
Age-5 to 19:	17.6%		
Age-20 to 24:	9.3%		
Age-25 to 34:	12.1%		
Age-35 to 44:	10.9%		
Age-45 to 54:	13.1%		
Age-55 to 64:	14.3%		
Age-65+ :	17.8%		
Median Age:	40.7		
Percent Male:	51.1%		
Percent Female:	48.9%		
Veterans 18 yrs and older:	53,575		
		Total Housing Units:	<b>342111</b>
		Percent Occupied:	<b>79.0%</b>
		- Owner Occupied:	70.1%
		- Renter Occupied:	29.9%
		Percent Vacant:	<b>21.0%</b>
		One Race	
		- White:	93.3%
		- Black...:	2.7%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	1.8%
		- Nat Haw & Other:	0.1%
		- Some Other Race:	0.4%
		Two or More Races:	1.5%
		Hispanic/Latino:	1.9%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.6. Pennsylvania Congressional District 06 Profile (115<sup>th</sup> Congress)

Total Population	<b>720652</b>		
Age-Under 5:	5.4%		
Age-5 to 19:	18.9%		
Age-20 to 24:	6.3%		
Age-25 to 34:	11.5%		
Age-35 to 44:	12.4%		
Age-45 to 54:	15.6%		
Age-55 to 64:	13.9%		
Age-65+ :	16.0%		
Median Age:	41.7		
Percent Male:	49.1%		
Percent Female:	50.9%		
Veterans 18 yrs and older:	38,140		
		Total Housing Units:	<b>286021</b>
		Percent Occupied:	<b>95.2%</b>
		- Owner Occupied:	75.6%
		- Renter Occupied:	24.4%
		Percent Vacant:	<b>4.8%</b>
		One Race	
		- White:	86.1%
		- Black...:	4.5%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	5.2%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	2.2%
		Two or More Races:	1.8%
		Hispanic/Latino:	6.0%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.7. Pennsylvania Congressional District 07 Profile (115<sup>th</sup> Congress)

Total Population	<b>709623</b>		
Age-Under 5:	5.4%		
Age-5 to 19:	18.9%		
Age-20 to 24:	6.0%		
Age-25 to 34:	11.1%		
Age-35 to 44:	11.6%		
Age-45 to 54:	14.6%		
Age-55 to 64:	14.8%		
Age-65+ :	17.7%		
Median Age:	42.8		
Percent Male:	48.9%		
Percent Female:	51.1%		
Veterans 18 yrs and older:	37,592		
		Total Housing Units:	<b>272204</b>
		Percent Occupied:	<b>94.6%</b>
		- Owner Occupied:	78.7%
		- Renter Occupied:	21.3%
		Percent Vacant:	<b>5.4%</b>
		One Race	
		- White:	86.5%
		- Black...:	5.3%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	5.1%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.0%
		Two or More Races:	2.0%
		Hispanic/Latino:	3.9%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.8. Pennsylvania Congressional District 08 Profile (115<sup>th</sup> Congress)

Total Population	<b>707083</b>		
Age-Under 5:	5.0%		
Age-5 to 19:	18.7%		
Age-20 to 24:	5.6%		
Age-25 to 34:	10.7%		
Age-35 to 44:	12.0%		
Age-45 to 54:	15.8%		
Age-55 to 64:	15.2%		
Age-65+ :	17.1%		
Median Age:	43.7		
Percent Male:	49.1%		
Percent Female:	50.9%		
Veterans 18 yrs and older:	41,533		
		Total Housing Units:	<b>279444</b>
		Percent Occupied:	<b>94.9%</b>
		- Owner Occupied:	75.1%
		- Renter Occupied:	24.9%
		Percent Vacant:	<b>5.1%</b>
		One Race	
		- White:	88.0%
		- Black...:	3.9%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	4.8%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.4%
		Two or More Races:	1.7%
		Hispanic/Latino:	5.0%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.9. Pennsylvania Congressional District 09 Profile (115<sup>th</sup> Congress)

Total Population	<b>696545</b>		
Age-Under 5:	5.1%		
Age-5 to 19:	18.1%		
Age-20 to 24:	6.4%		
Age-25 to 34:	11.2%		
Age-35 to 44:	11.3%		
Age-45 to 54:	13.7%		
Age-55 to 64:	14.7%		
Age-65+ :	19.4%		
Median Age:	43.4		
Percent Male:	49.4%		
Percent Female:	50.6%		
Veterans 18 yrs and older:	51,947		
		Total Housing Units:	<b>318557</b>
		Percent Occupied:	<b>87.5%</b>
		- Owner Occupied:	73.3%
		- Renter Occupied:	26.7%
		Percent Vacant:	<b>12.5%</b>
		One Race	
		- White:	94.2%
		- Black...:	2.8%
		- Am Ind & Alaska Nat:	0.0%
		- Asian:	0.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.4%
		Two or More Races:	1.9%
		Hispanic/Latino:	2.2%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.10. Pennsylvania Congressional District 10 Profile (115<sup>th</sup> Congress)

Total Population	<b>705602</b>		
Age-Under 5:	5.2%		
Age-5 to 19:	18.0%		
Age-20 to 24:	6.4%		
Age-25 to 34:	11.2%		
Age-35 to 44:	10.8%		
Age-45 to 54:	14.6%		
Age-55 to 64:	14.9%		
Age-65+ :	18.8%		
Median Age:	43.7		
Percent Male:	50.2%		
Percent Female:	49.8%		
Veterans 18 yrs and older:	53,089		
		Total Housing Units:	<b>346991</b>
		Percent Occupied:	<b>77.4%</b>
		- Owner Occupied:	74.4%
		- Renter Occupied:	25.6%
		Percent Vacant:	<b>22.6%</b>
		One Race	
		- White:	92.8%
		- Black...:	3.7%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	0.9%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.8%
		Two or More Races:	1.6%
		Hispanic/Latino:	4.0%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.11. Pennsylvania Congressional District 11 Profile (115<sup>th</sup> Congress)

Total Population	<b>704916</b>		
Age-Under 5:	5.5%		
Age-5 to 19:	17.6%		
Age-20 to 24:	6.5%		
Age-25 to 34:	11.7%		
Age-35 to 44:	12.0%		
Age-45 to 54:	14.0%		
Age-55 to 64:	14.4%		
Age-65+ :	18.3%		
Median Age:	42.3		
Percent Male:	49.3%		
Percent Female:	50.7%		
Veterans 18 yrs and older:	50,629		
		Total Housing Units:	<b>322010</b>
		Percent Occupied:	<b>87.7%</b>
		- Owner Occupied:	70.5%
		- Renter Occupied:	29.5%
		Percent Vacant:	<b>12.3%</b>
		One Race	
		- White:	88.7%
		- Black...:	5.5%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	1.3%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	2.0%
		Two or More Races:	2.3%
		Hispanic/Latino:	6.2%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.12. Pennsylvania Congressional District 12 Profile (115<sup>th</sup> Congress)

Total Population	<b>700339</b>		
Age-Under 5:	5.3%		
Age-5 to 19:	16.9%		
Age-20 to 24:	4.9%		
Age-25 to 34:	11.5%		
Age-35 to 44:	11.2%		
Age-45 to 54:	14.5%		
Age-55 to 64:	15.9%		
Age-65+ :	19.8%		
Median Age:	45.1		
Percent Male:	48.9%		
Percent Female:	51.1%		
Veterans 18 yrs and older:	50701		
		Total Housing Units:	<b>319833</b>
		Percent Occupied:	<b>89.8%</b>
		- Owner Occupied:	76.7%
		- Renter Occupied:	23.3%
		Percent Vacant:	<b>10.2%</b>
		One Race	
		- White:	93.1%
		- Black...:	3.2%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	1.7%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.2%
		Two or More Races:	1.7%
		Hispanic/Latino:	1.7%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC



Table PA.13. Pennsylvania Congressional District 13 Profile (115<sup>th</sup> Congress)

Total Population	<b>729101</b>		
Age-Under 5:	7.1%		
Age-5 to 19:	18.4%		
Age-20 to 24:	6.5%		
Age-25 to 34:	14.8%		
Age-35 to 44:	12.6%		
Age-45 to 54:	12.7%		
Age-55 to 64:	12.8%		
Age-65+ :	15.1%		
Median Age:	37.3		
Percent Male:	48.1%		
Percent Female:	51.9%		
Veterans 18 yrs and older:	32,250		
		Total Housing Units:	<b>288581</b>
		Percent Occupied:	<b>92.6%</b>
		- Owner Occupied:	63.3%
		- Renter Occupied:	36.7%
		Percent Vacant:	<b>7.4%</b>
		One Race	
		- White:	63.2%
		- Black...:	19.1%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	9.3%
		- Nat Haw & Other:	0.1%
		- Some Other Race:	5.5%
		Two or More Races:	2.7%
		Hispanic/Latino:	11.5%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.14. Pennsylvania Congressional District 14 Profile (115<sup>th</sup> Congress)

Total Population	<b>699463</b>		
Age-Under 5:	5.4%		
Age-5 to 19:	15.0%		
Age-20 to 24:	8.2%		
Age-25 to 34:	17.3%		
Age-35 to 44:	10.6%		
Age-45 to 54:	11.6%		
Age-55 to 64:	14.5%		
Age-65+ :	17.5%		
Median Age:	38.6		
Percent Male:	48.4%		
Percent Female:	51.6%		
Veterans 18 yrs and older:	48,489		
		Total Housing Units:	<b>363522</b>
		Percent Occupied:	<b>86.2%</b>
		- Owner Occupied:	54.4%
		- Renter Occupied:	45.6%
		Percent Vacant:	<b>13.8%</b>
		One Race	
		- White:	71.2%
		- Black...:	21.1%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	3.4%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.6%
		Two or More Races:	3.7%
		Hispanic/Latino:	2.2%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.15. Pennsylvania Congressional District 15 Profile (115<sup>th</sup> Congress)

Total Population	<b>728044</b>		
Age-Under 5:	5.6%		
Age-5 to 19:	19.7%		
Age-20 to 24:	6.6%		
Age-25 to 34:	12.0%		
Age-35 to 44:	12.0%		
Age-45 to 54:	14.0%		
Age-55 to 64:	13.5%		
Age-65+ :	16.5%		
Median Age:	40.3		
Percent Male:	49.3%		
Percent Female:	50.7%		
Veterans 18 yrs and older:	45,269		
		Total Housing Units:	<b>291253</b>
		Percent Occupied:	<b>94.0%</b>
		- Owner Occupied:	68.6%
		- Renter Occupied:	31.4%
		Percent Vacant:	<b>6.0%</b>
		One Race	
		- White:	84.4%
		- Black...:	4.7%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	2.9%
		- Nat Haw & Other:	0.1%
		- Some Other Race:	4.8%
		Two or More Races:	2.9%
		Hispanic/Latino:	15.7%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.16. Pennsylvania Congressional District 16 Profile (115<sup>th</sup> Congress)

Total Population	<b>732595</b>		
Age-Under 5:	6.9%		
Age-5 to 19:	21.2%		
Age-20 to 24:	6.7%		
Age-25 to 34:	12.9%		
Age-35 to 44:	11.8%		
Age-45 to 54:	13.1%		
Age-55 to 64:	11.9%		
Age-65+ :	15.6%		
Median Age:	37.0		
Percent Male:	49.0%		
Percent Female:	51.0%		
Veterans 18 yrs and older:	39,158		
		Total Housing Units:	<b>281829</b>
		Percent Occupied:	<b>93.8%</b>
		- Owner Occupied:	64.5%
		- Renter Occupied:	35.5%
		Percent Vacant:	<b>6.2%</b>
		One Race	
		- White:	83.0%
		- Black...:	6.7%
		- Am Ind & Alaska Nat:	0.7%
		- Asian:	1.7%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	3.5%
		Two or More Races:	4.3%
		Hispanic/Latino:	18.3%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.17. Pennsylvania Congressional District 17 Profile (115<sup>th</sup> Congress)

Total Population	<b>686892</b>		
Age-Under 5:	4.9%		
Age-5 to 19:	18.0%		
Age-20 to 24:	6.1%		
Age-25 to 34:	11.9%		
Age-35 to 44:	11.9%		
Age-45 to 54:	14.4%		
Age-55 to 64:	14.4%		
Age-65+ :	18.4%		
Median Age:	43.0		
Percent Male:	48.8%		
Percent Female:	51.2%		
Veterans 18 yrs and older:	47,647		
		Total Housing Units:	<b>319469</b>
		Percent Occupied:	<b>82.8%</b>
		- Owner Occupied:	70.0%
		- Renter Occupied:	30.0%
		Percent Vacant:	<b>17.2%</b>
		One Race	
		- White:	87.4%
		- Black...:	6.2%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	1.9%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.7%
		Two or More Races:	2.6%
		Hispanic/Latino:	8.5%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.18. Pennsylvania Congressional District 18 Profile (115<sup>th</sup> Congress)

Total Population	<b>709728</b>		
Age-Under 5:	4.9%		
Age-5 to 19:	17.6%		
Age-20 to 24:	5.1%		
Age-25 to 34:	11.4%		
Age-35 to 44:	12.3%		
Age-45 to 54:	14.8%		
Age-55 to 64:	14.9%		
Age-65+ :	18.9%		
Median Age:	44.1		
Percent Male:	48.5%		
Percent Female:	51.5%		
Veterans 18 yrs and older:	48,963		
		Total Housing Units:	<b>316799</b>
		Percent Occupied:	<b>91.8%</b>
		- Owner Occupied:	75.3%
		- Renter Occupied:	24.7%
		Percent Vacant:	<b>8.2%</b>
		One Race	
		- White:	93.6%
		- Black...:	2.1%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	1.9%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.2%
		Two or More Races:	2.1%
		Hispanic/Latino:	1.4%

Source: 2015 American Community Survey 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

## 2. Statement of Objective

The objective is to retabulate the Congressional District Profiles for the new congressional districts in Pennsylvania in the “data vintage of the 2015 ACS 1-Year Estimates” using only data available to the public. That is, we want to update Tables PA.1. - PA.18 using the new boundaries for the congressional districts while making use of data already released to the public.

## 3. A Deterministic Method

The proposed method is deterministic in the sense that given the 2010 Census SF1 data and the 2015 ACS 1-Year Estimates in the profiles, our methodology is not based in any sort of additional randomization. The proposed method is deeply rooted in the block counts reported in the 2010 Census SF1 data, and we make an adjustment using 2015 ACS 1-Year data to account for “growth” (or change) from 2010 to 2015 for population counts and for housing unit counts.

### 3.1. Pennsylvania

There were substantial changes in all congressional districts from the 115<sup>th</sup> Congress to the 116<sup>th</sup> Congress for Pennsylvania. Profiles need to be retabulated for all new congressional districts in Pennsylvania.

#### 3.1.1. Data for Pennsylvania

To retabulate the profiles for the redrawn congressional districts in Pennsylvania, we use block level counts from the *2010 Census Summary File 1* and the *115<sup>th</sup> Congressional District Profiles* based on the *2015 American Community Survey (ACS) 1-Year Data*.

To approximate change (growth) in the number of housing units and the number of associated people that moved from CD-x in the 115<sup>th</sup> Congress to CD-y in the 116<sup>th</sup> Congress, we also produce and use the adjusted counts for housing units and associated number of people given in Table 2. Block counts for the collections of blocks corresponding to entries in Tables 1 and 2 are the same.

The adjusted number of housing units that move from old CD-x to new CD-y as presented in Table 2 is obtained by

$$HU_{a(x,y)} = \left( \begin{array}{c} \text{Number of} \\ \text{Housing Units} \\ \text{Moving from} \\ \text{CD-x 115}^{\text{th}} \\ \text{to CD-y 116}^{\text{th}} \\ \text{(2010 Census, SF1)} \end{array} \right) \times \frac{\left( \begin{array}{c} \text{Total Number of Housing Units} \\ \text{in CD-x (2015 ACS 1-Year)} \end{array} \right)}{\left( \begin{array}{c} \text{Total Number of Housing Units} \\ \text{in CD-x (2010 Census, SF1)} \end{array} \right)}. \quad (i)$$

Similarly, the adjusted number of people that move from old CD-x to new CD-y as presented in Table 2 is obtained by

$$P_{a(x,y)} = \left( \begin{array}{c} \text{Population} \\ \text{Moving from} \\ \text{CD-x 115}^{\text{th}} \\ \text{to CD-y 116}^{\text{th}} \\ \text{(2010 Census, SF1)} \end{array} \right) \times \frac{\left( \begin{array}{c} \text{Total Population} \\ \text{in CD-x (2015 ACS 1-Year)} \end{array} \right)}{\left( \begin{array}{c} \text{Total Population} \\ \text{in CD-x (2010 Census, SF1)} \end{array} \right)}. \quad (ii)$$

It is important to note that the 2010 Census represents the April 1, 2010 count whereas the 2015 ACS is controlled to the July 1, 2015 population estimates at the county level.

The adjusted counts are given in Table 2 for Pennsylvania. Note that the number of blocks are not adjusted; they remain the same as in Table 1.

Table 2. Adjusted Number of Pennsylvania Blocks (B), Housing Units (HU), and People (P) that Moved from 115<sup>th</sup> Congress Districts to 116<sup>th</sup> Congress Districts

	CD116																		
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	Total
01 B	0	3862	1815	0	4961	0	0	0	0	0	0	0	0	0	0	0	0	0	10638
01 HU	0	110979	71222	0	118561	0	0	0	0	0	0	0	0	0	0	0	0	0	300762
01 P	0	287078	141457	0	292076	0	0	0	0	0	0	0	0	0	0	0	0	0	720611
02 B	0	864	6972	537	581	0	0	0	0	0	0	0	0	0	0	0	0	0	8954
02 HU	0	27543	276298	12591	16779	0	0	0	0	0	0	0	0	0	0	0	0	0	333211
02 P	0	71353	583017	30867	40182	0	0	0	0	0	0	0	0	0	0	0	0	0	725418
03 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29048
03 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	317890
03 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	725418
04 B	0	0	0	0	0	0	0	0	11616	6000	0	4429	0	0	0	0	0	0	22045
04 HU	0	0	0	0	0	0	0	0	182610	78171	0	41784	0	0	0	0	0	0	302564
04 P	0	0	0	0	0	0	0	0	429413	191311	0	104167	0	0	0	0	0	0	724891
05 B	0	0	0	0	0	0	0	0	0	0	7936	2115	0	0	0	0	0	0	43154
05 HU	0	0	0	0	0	0	0	0	0	0	67825	15490	0	0	0	0	0	0	342111
05 P	0	0	0	0	0	0	0	0	0	0	146575	33577	0	0	0	0	0	0	699108
06 B	0	0	0	0	0	0	0	0	5573	0	0	0	0	0	0	0	0	0	16602
06 HU	0	0	0	0	0	0	0	0	65280	0	0	0	0	0	0	0	0	0	286021
06 P	0	0	0	0	0	0	0	0	164709	0	0	0	0	0	0	0	0	0	720652
07 B	40	0	0	2206	6265	3499	0	0	654	0	1151	0	0	0	0	0	0	0	13815
07 HU	1286	0	0	52622	150504	50444	0	0	7309	0	10038	0	0	0	0	0	0	0	272204
07 P	4101	0	0	133482	382694	136952	0	0	19506	0	32887	0	0	0	0	0	0	0	709623
08 B	12856	0	0	879	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13735
08 HU	261107	0	0	18337	0	0	0	0	0	0	0	0	0	0	0	0	0	0	279444
08 P	659026	0	0	48057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	707083
09 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40903
09 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	318557
09 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	696545
10 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45327
10 HU	0	0	0	0	0	0	535	12022	0	0	32770	0	0	0	0	0	0	0	346991
10 P	0	0	0	0	0	0	25514	206661	0	0	479427	0	0	0	0	0	0	0	705602
11 B	0	0	0	0	0	0	0	0	5885	11586	7897	5478	2597	0	0	0	0	0	33443
11 HU	0	0	0	0	0	0	0	0	78055	91984	97818	35701	18452	0	0	0	0	0	322010
11 P	0	0	0	0	0	0	0	0	169419	190266	220572	78162	46496	0	0	0	0	0	704916
12 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23667
12 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	319833
12 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700339
13 B	707	3556	0	5458	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9721
13 HU	17835	140620	0	130125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	288581
13 P	45339	366926	0	316836	0	0	0	0	0	0	0	0	0	0	0	0	0	0	729101
14 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30322
14 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	279101
14 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	704916
15 B	0	0	0	0	0	0	0	0	16573	0	5845	1954	0	0	0	0	0	0	24372
15 HU	0	0	0	0	0	0	0	0	208326	0	54048	28879	0	0	0	0	0	0	291253
15 P	0	0	0	0	0	0	0	0	521222	0	137868	68954	0	0	0	0	0	0	728044
16 B	0	0	0	0	0	0	0	0	0	0	241	0	0	0	0	0	0	0	17784
16 HU	0	0	0	0	0	0	0	0	0	0	12127	0	0	0	0	0	0	0	281829
16 P	0	0	0	0	0	0	0	0	0	0	196642	0	0	0	0	0	0	0	732595
17 B	0	0	0	0	0	0	0	0	5815	11623	8823	0	0	0	0	0	0	0	26261
17 HU	0	0	0	0	0	0	0	0	70571	158484	90414	0	0	0	0	0	0	0	319469
17 P	0	0	0	0	0	0	0	0	170295	326464	190133	0	0	0	0	0	0	0	686892
18 B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21754
18 HU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	316799
18 P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	709728
Total B	13603	8282	8787	12592	11807	16432	22923	29530	32722	21467	19278	46184	40181	29192	45821	26229	17825	18690	421545
Total HU	280229	279142	347520	288474	285843	279179	289084	349016	311429	309306	284851	327855	318737	320518	341628	313931	325635	350674	5603051
Total P	708466	725357	724474	721529	714952	722135	717031	696544	708250	718940	729497	704165	702351	704549	699248	701381	702102	701532	12802503

Source: Summary File 1, 2010 Census and 2015 ACS 1-Year Data, U. S. Bureau of the Census, Washington, D.C.

Observations of the Distributions for 115<sup>th</sup> Congress Districts from 2010 and 2015

It is worth noting how little the distributions for the eighteen (18) congressional districts in Pennsylvania appear to change from 2010 Census (SF1) to 2015 ACS 1-Year Estimates in the profiles. These Observations are given in Tables 3a, 3b, and 3c. The distributions seem very stable over time although they might not always be so if there were important demographic changes within localities.

Table 3a. 115<sup>th</sup> Congress Pennsylvania Profile Observations Based on 2010 SF1 Block Data vs Tables PA.1 - PA.6

	115 <sup>th</sup> CD-1		115 <sup>th</sup> CD-2		115 <sup>th</sup> CD-3		115 <sup>th</sup> CD-4		115 <sup>th</sup> CD-5		115 <sup>th</sup> CD-6	
	2010 SF1 Data	Table PA.1	2010 SF1 Data	Table PA.2	2010 SF1 Data	Table PA.3	2010 SF1 Data	Table PA.4	2010 SF1 Data	Table PA.5	2010 SF1 Data	Table PA.6
Age-Under 5:	7.1%	7.1%	6.1%	6.1%	5.6%	5.4%	6.0%	5.4%	5.0%	4.8%	6.0%	5.4%
Age-5 to 19:	20.2%	19.0%	19.6%	17.7%	19.6%	18.6%	19.5%	19.1%	18.9%	17.6%	20.3%	18.9%
Age-20 to 24:	8.7%	7.0%	11.0%	9.2%	6.4%	6.2%	6.0%	6.4%	9.8%	9.3%	5.7%	6.3%
Age-25 to 34:	16.7%	18.8%	15.3%	18.0%	10.8%	11.3%	11.9%	12.2%	10.9%	12.1%	11.4%	11.5%
Age-35 to 44:	13.2%	13.6%	11.1%	10.8%	12.5%	11.4%	13.7%	11.9%	12.0%	10.9%	13.9%	12.4%
Age-45 to 54:	13.3%	12.6%	12.8%	11.6%	15.5%	14.1%	15.6%	14.7%	14.7%	13.1%	16.2%	15.6%
Age-55 to 64:	10.0%	11.1%	11.2%	12.2%	13.3%	14.8%	12.9%	13.6%	12.8%	14.3%	12.3%	13.9%
Age-65+ :	10.8%	10.8%	12.9%	14.5%	16.4%	18.1%	14.3%	16.7%	15.8%	17.8%	14.1%	16.0%
Percent Male:	48.3%	47.9%	45.7%	46.1%	49.0%	49.3%	49.2%	49.3%	50.6%	51.1%	48.9%	49.1%
Percent Female:	51.7%	52.1%	54.3%	53.9%	51.0%	50.7%	50.8%	50.7%	49.4%	48.9%	51.1%	50.9%
Percent Occupied:	90.2%	87.3%	87.4%	84.1%	89.4%	88.4%	93.4%	91.3%	81.5%	79.0%	95.0%	95.2%
- Owner Occupied:	57.0%	55.8%	50.2%	49.7%	71.9%	71.4%	72.7%	71.3%	71.1%	70.1%	75.9%	75.6%
- Renter Occupied:	43.0%	44.2%	49.8%	50.3%	28.1%	28.6%	27.3%	28.7%	28.9%	29.9%	24.1%	24.4%
Percent Vacant:	9.8%	12.7%	12.6%	15.9%	10.6%	11.6%	6.6%	8.7%	18.5%	21.0%	5.0%	4.8%
One Race												
- White:	46.9%	48.4%	30.3%	32.0%	92.2%	91.6%	85.4%	85.3%	94.7%	93.3%	88.5%	86.1%
- Black...:	35.5%	34.9%	59.8%	57.6%	4.7%	4.5%	7.8%	7.8%	2.1%	2.7%	4.3%	4.5%
- Am Ind & Alaska Nat:	0.5%	0.3%	0.3%	0.5%	0.1%	0.1%	0.2%	0.2%	0.1%	0.1%	0.1%	0.2%
- Asian:	6.4%	7.6%	4.7%	5.0%	0.8%	0.9%	1.9%	2.6%	1.5%	1.8%	3.8%	5.2%
- Nat Haw & Other:	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
- Some Other Race:	7.5%	5.6%	2.3%	2.2%	0.6%	0.3%	2.5%	1.7%	0.5%	0.4%	1.6%	2.2%
Two or More Races:	3.1%	3.1%	2.5%	2.5%	1.6%	2.5%	2.1%	2.4%	1.1%	1.5%	1.7%	1.8%
Hispanic/Latino:	15.4%	17.2%	5.4%	6.2%	1.9%	2.3%	6.0%	7.2%	1.6%	1.9%	4.8%	6.0%

Source: 2010 SF1 Census Blocks and Tables PA.1 - PA.6, U. S. Bureau of the Census, Washington, DC

Table 3b. 115<sup>th</sup> Congress Pennsylvania Profile Observations Based on 2010 SF1 Block Data vs Tables PA.7 - PA.12

	115 <sup>th</sup> CD-7		115 <sup>th</sup> CD-8		115 <sup>th</sup> CD-9		115 <sup>th</sup> CD-10		115 <sup>th</sup> CD-11		115 <sup>th</sup> CD-12	
	2010 SF1 Data	Table PA.7	2010 SF1 Data	Table PA.8	2010 SF1 Data	Table PA.9	2010 SF1 Data	Table PA.10	2010 SF1 Data	Table PA.11	2010 SF1 Data	Table PA.12
Age-Under 5:	5.8%	5.4%	5.5%	5.0%	5.5%	5.1%	5.4%	5.2%	5.4%	5.5%	5.1%	5.3%
Age-5 to 19:	20.4%	18.9%	19.8%	18.7%	18.9%	18.1%	19.3%	18.0%	18.6%	17.6%	18.0%	16.9%
Age-20 to 24:	5.7%	6.0%	5.2%	5.6%	6.5%	6.4%	6.3%	6.4%	6.7%	6.5%	4.9%	4.9%
Age-25 to 34:	10.5%	11.1%	10.7%	10.7%	10.9%	11.2%	10.2%	11.2%	11.1%	11.7%	10.3%	11.5%
Age-35 to 44:	12.9%	11.6%	13.5%	12.0%	12.5%	11.3%	12.6%	10.8%	12.8%	12.0%	12.4%	11.2%
Age-45 to 54:	16.2%	14.6%	17.4%	15.8%	14.9%	13.7%	15.9%	14.6%	15.5%	14.0%	16.6%	14.5%
Age-55 to 64:	13.0%	14.8%	13.3%	15.2%	13.5%	14.7%	13.7%	14.9%	13.7%	14.4%	14.4%	15.9%
Age-65+ :	15.5%	17.7%	14.6%	17.1%	17.3%	19.4%	16.8%	18.8%	16.3%	18.3%	18.4%	19.8%
Percent Male:	48.9%	48.9%	49.1%	49.1%	49.2%	49.4%	49.9%	50.2%	49.0%	49.3%	48.7%	48.9%
Percent Female:	51.1%	51.1%	50.9%	50.9%	50.8%	50.6%	50.1%	49.8%	51.0%	50.7%	51.3%	51.1%
Percent Occupied:	95.2%	94.6%	95.5%	94.9%	89.3%	87.5%	80.1%	77.4%	88.8%	87.7%	91.7%	89.8%
- Owner Occupied:	78.9%	78.7%	76.9%	75.1%	72.7%	73.3%	75.1%	74.4%	71.8%	70.5%	77.0%	76.7%
- Renter Occupied:	21.1%	21.3%	23.1%	24.9%	27.3%	26.7%	24.9%	25.6%	28.2%	29.5%	23.0%	23.3%
Percent Vacant:	4.8%	5.4%	4.5%	5.1%	10.7%	12.5%	19.9%	22.6%	11.2%	12.3%	8.3%	10.2%
One Race												
- White:	88.7%	86.5%	89.0%	88.0%	94.4%	94.2%	93.3%	92.8%	90.1%	88.7%	93.8%	93.1%
- Black...:	4.9%	5.3%	3.5%	3.9%	2.9%	2.8%	3.3%	3.7%	4.8%	5.5%	3.1%	3.2%
- Am Ind & Alaska Nat:	0.1%	0.1%	0.2%	0.2%	0.1%	0.0%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%
- Asian:	4.0%	5.1%	4.2%	4.8%	0.5%	0.6%	0.8%	0.9%	1.3%	1.3%	1.5%	1.7%
- Nat Haw & Other:	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
- Some Other Race:	0.9%	1.0%	1.5%	1.4%	0.7%	0.4%	1.0%	0.8%	1.9%	2.0%	0.3%	0.2%
Two or More Races:	1.4%	2.0%	1.6%	1.7%	1.3%	1.9%	1.4%	1.6%	1.7%	2.3%	1.2%	1.7%
Hispanic/Latino:	2.8%	3.9%	4.2%	5.0%	1.7%	2.2%	3.4%	4.0%	4.5%	6.2%	1.1%	1.7%

Source: 2010 SF1 Census Blocks and Tables PA.7 - PA.12, U. S. Bureau of the Census, Washington, DC

Table 3c. 115<sup>th</sup> Congress Pennsylvania Profile Observations Based on 2010 SF1 Block Data vs Tables PA.13 - PA.18

	115 <sup>th</sup> CD-13		115 <sup>th</sup> CD-14		115 <sup>th</sup> CD-15		115 <sup>th</sup> CD-16		115 <sup>th</sup> CD-17		115 <sup>th</sup> CD-18	
	2010 SF1 Data	2010 Table PA.13	2010 SF1 Data	2010 Table PA.14	2010 SF1 Data	2010 Table PA.15	2010 SF1 Data	2010 Table PA.16	2010 SF1 Data	2010 Table PA.17	2010 SF1 Data	2010 Table PA.18
Age-Under 5:	6.4%	7.1%	5.3%	5.4%	5.7%	5.6%	7.1%	6.9%	5.4%	4.9%	5.0%	4.9%
Age-5 to 19:	19.2%	18.4%	16.5%	15.0%	20.1%	19.7%	21.5%	21.2%	18.8%	18.0%	18.0%	17.6%
Age-20 to 24:	6.6%	6.5%	9.3%	8.2%	6.6%	6.6%	6.9%	6.7%	6.3%	6.1%	5.1%	5.1%
Age-25 to 34:	13.7%	14.8%	14.5%	17.3%	11.3%	12.0%	12.2%	12.9%	11.2%	11.9%	10.5%	11.4%
Age-35 to 44:	13.1%	12.6%	11.2%	10.6%	12.9%	12.0%	12.7%	11.8%	13.2%	11.9%	13.0%	12.3%
Age-45 to 54:	14.7%	12.7%	14.2%	11.6%	15.4%	14.0%	14.4%	13.1%	15.5%	14.4%	16.4%	14.8%
Age-55 to 64:	11.8%	12.8%	12.8%	14.5%	12.7%	13.5%	11.4%	11.9%	12.9%	14.4%	14.3%	14.9%
Age-65+ :	14.5%	15.1%	16.2%	17.5%	15.2%	16.5%	13.9%	15.6%	16.6%	18.4%	17.8%	18.9%
Percent Male:	47.8%	48.1%	47.6%	48.4%	48.7%	49.3%	48.9%	49.0%	49.0%	48.8%	48.7%	48.5%
Percent Female:	52.2%	51.9%	52.4%	51.6%	51.3%	50.7%	51.1%	51.0%	51.0%	51.2%	51.3%	51.5%
Percent Occupied:	94.0%	92.6%	88.1%	86.2%	94.2%	94.0%	94.2%	93.8%	87.1%	82.8%	92.8%	91.8%
- Owner Occupied:	65.2%	63.3%	55.6%	54.4%	70.7%	68.6%	65.7%	64.5%	70.1%	70.0%	75.9%	75.3%
- Renter Occupied:	34.8%	36.7%	44.4%	45.6%	29.3%	31.4%	34.3%	35.5%	29.9%	30.0%	24.1%	24.7%
Percent Vacant:	6.0%	7.4%	11.9%	13.8%	5.8%	6.0%	5.8%	6.2%	12.9%	17.2%	7.2%	8.2%
One Race												
- White:	66.2%	63.2%	72.5%	71.2%	84.8%	84.4%	81.1%	83.0%	88.3%	87.4%	94.4%	93.6%
- Black...:	17.8%	19.1%	21.7%	21.1%	4.5%	4.7%	6.6%	6.7%	5.5%	6.2%	2.4%	2.1%
- Am Ind & Alaska Nat:	0.3%	0.2%	0.2%	0.1%	0.3%	0.2%	0.3%	0.7%	0.2%	0.1%	0.1%	0.1%
- Asian:	8.2%	9.3%	2.5%	3.4%	2.5%	2.9%	1.8%	1.7%	1.5%	1.9%	1.7%	1.9%
- Nat Haw & Other:	0.1%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
- Some Other Race:	4.9%	5.5%	0.6%	0.6%	5.6%	4.8%	7.5%	3.5%	2.6%	1.7%	0.3%	0.2%
Two or More Races:	2.6%	2.7%	2.5%	3.7%	2.3%	2.9%	2.7%	4.3%	1.8%	2.6%	1.2%	2.1%
Hispanic/Latino:	10.2%	11.5%	1.8%	2.2%	13.0%	15.7%	16.2%	18.3%	6.9%	8.5%	1.1%	1.4%

Source: 2010 SF1 Census Blocks and Tables PA.13 - PA.18, U. S. Bureau of the Census, Washington, DC

It is also worth noting in Tables 3a, 3b, and 3c that in the Hispanic/Latino category the 2015 ACS 1-Year share of population is always larger (by up to 2.7 percentage points of the district distribution) than the 2010 SF1 Hispanic/Latino share. This is likely a real phenomenon. This phenomenon is not being modeled in this write-up, but could be. As suggested by a reviewer, this phenomenon could be investigated in future work by investigating the POP Estimates trend for Pennsylvania. For details on how ACS estimates are controlled by POP Estimates, see the *ACS Design and Methodology Report*, Chapter 11.

### 3.1.2. Method for Pennsylvania

For the most part, each profile consists of distributions of a count or number (actually proportions derived from counts) over  $K$  categories of a particular variable (e.g., age, gender, race, ethnicity, housing status,...) for a given congressional district. The variables of interest fall into two categories: people or housing units. The rest of our discussion in this section focuses on people variables. (The presentation for housing unit variables is similar.)

In general, to determine the distribution of the count over  $K$  categories of a people variable for the 116<sup>th</sup> Congress congressional district CD-y, we proceed as follows:

**Step 1:** For each 2010 Census person in congressional district CD-x of the 115<sup>th</sup> Congress, represent that “1 person” as “adjusted  $P_{a(x)}$  person(s)” where

$$P_{a(x)} = \frac{\left( \begin{array}{c} \text{Total Population} \\ \text{in CD-x (2015 ACS 1-Year)} \end{array} \right)}{\left( \begin{array}{c} \text{Total Population} \\ \text{in CD-x (2010 Census, SF1)} \end{array} \right)}. \quad (iii)$$

That is, relative to the 2015 ACS 1-Year based profiles, each single person in CD-x (115<sup>th</sup> Congress) using 2010 Census (SF1) data is now considered to be  $P_{a(x)}$  persons. (A similar factor  $HU_{a(x)}$  is computed for each housing unit). These (growth) factors for population and housing units are given in Table 4.

Table 4. Pennsylvania Growth Factors from 2010 Census to 2015 1-year Profile Estimates  
Pennsylvania

CD-x	Population	Housing Unit
	Growth Factors	Growth Factors
	$P_{a(x)}$	$HU_{a(x)}$
01	1.021147	1.009353
02	1.027959	1.011189
03	0.994621	1.007186
04	1.027213	1.023607
05	0.990676	1.004649
06	1.021205	1.006390
07	1.005576	0.993906
08	1.001977	1.007194
09	0.987044	1.003130
10	0.999880	1.010607
11	0.998906	1.004401
12	0.992420	1.003152
13	1.033179	1.002839
14	0.991179	1.002664
15	1.031681	1.011917
16	1.038129	1.019653
17	0.973366	0.993698
18	1.005725	1.001958

*Source:* Tables PA.1 - PA.18; and 2

**Step 2:** “Move” each of the  $P_{a(x)}$  person(s) in the old district CD-x to his/her new congressional district CD-y for all people in CD-x. Repeat in a similar way for housing units.

**Step 3:** Now that new congressional district CD-y has received all of its “adjusted” persons from the old congressional districts, we simply retabulate the new various people distributions for CD-y. Repeat in a similar way for housing units.

Note that the method just described does not immediately yield the “median age” nor the “count of Veterans 18 years and older” for each of the new districts. The methodology we use to produce these two estimates is illustrated in Section 3.1.3.

### 3.1.3. Example: Pennsylvania

We illustrate the method described in Section 3.1.2 by providing the steps leading to an update of Table PA.1 for the “new” Pennsylvania Congressional District CD-01 for the 116<sup>th</sup> Congress using “2010 Census SF1 Data” and “2015 American Community Survey 1-Year Estimates Data”. Because of renumbering of districts in Pennsylvania, the districts with the same numbers from the 115<sup>th</sup> Congress to the 116<sup>th</sup> Congress should not be compared.

Before specifics, from Tables 1 and 2, notice that the “new” CD-01 for the 116<sup>th</sup> Congress is composed of blocks from the old CD-07, CD-08, and CD-13. In Table 2 and using 2010 Census data and 2015 ACS data, we estimate that the 40 blocks from the old CD-07 for the 115<sup>th</sup> Congress contain an adjusted 1286 housing units (HU) with adjusted 4101 people (P); the 12856 blocks from the old CD-08 for the 115<sup>th</sup> Congress contain an adjusted 261107 housing units (HU) with adjusted 659026 people (P); and the 707 blocks from the old CD-13 for the 115<sup>th</sup> Congress contain an adjusted 17835 housing units (HU) with adjusted 45339 people (P).

We continue with our example.

### *Total Population and Total Housing Units for New PA CD-01*

Note that the *Total Population* = 708466 comes from the last row and CD-01 column of Table 2. Directly above this number is the *Total Housing Units* = 280229.

### *The Profile Distributions for New CD-01*

Table 5 illustrates computation for most of the profile distribution for the new PA CD-01. The adjusted counts in the first three columns of Table 5 are 2010 Census SF1 counts that have been adjusted by the appropriate growth factor shown in Table 4. Compare the last column of Table 5 with the content of Table PA.1\*

Table 5. Retabulation Details for 116<sup>th</sup> Pennsylvania Congressional District CD-01

	Adjusted Counts from Old PA CD-07 to New PA CD-01	Adjusted Counts from Old PA CD-08 to New PA CD-01	Adjusted Counts from Old PA CD-13 to New PA CD-01	Totals for New PA CD-01	Distributions for New PA CD-01
Age-Under 5:	180	36210	2760	39150	5.5%
Age-5 to 19:	1219	129746	8892	139856	19.7%
Age-20 to 24:	149	34954	2314	37417	5.3%
Age-25 to 34:	147	70829	5543	76519	10.8%
Age-35 to 44:	649	88339	6627	95615	13.5%
Age-45 to 54:	898	114440	7567	122905	17.3%
Age-55 to 64:	458	87892	5328	93678	13.2%
Age 65+:	402	96616	6307	103324	14.6%
Percent Male:	2027	323284	21877	347188	49.0%
Percent Female:	2073	335742	23462	361278	51.0%
Percent Occupied:	1262	249092	16919	267273	95.4%
- Owner Occupied:	1222	190554	12573	204348	76.5%
- Renter Occupied:	41	58538	4346	62925	23.5%
Percent Vacant:	24	12015	917	12955	4.6%
One Race					
-White	3614	584505	34693	622812	87.9%
-Black...	111	23625	2330	26065	3.7%
-Am Ind & Alaska Nat:	4	1332	60	1396	0.2%
-Asian:	316	28170	6888	35374	5.0%
Nat Haw & Other:	0.0	196	23	219	0.0%
-Some Other Race:	20	10119	451	10591	1.5%
Two or More Races:	36	11109	894	12039	1.7%
Hispanic/Latino:	68	28756	1480	30304	4.3%

Note that the 2010 Census SF1 counts (unadjusted counts) are not given in this report, but they can be obtained easily from the adjusted counts in Table 5 (also Tables PA.1\* - PA.18\*) by dividing the adjusted count by the appropriate population growth factor. For example, Table 5 reveals that the adjusted count of Asians “moving” from the old PA CD-08 to the new PA CD-01 is 28,170. The corresponding 2010 Census SF1 count (unadjusted count) of Asians is  $(28,170)/(1.001977) = 28,114$ .

### *Median Age for New PA CD-01*

We use the age distribution (last column) for the “new” CD-01 in Table 5 to estimate median age via a linear interpolation of the cumulative age distribution of the population. Recall that the



*median age* is the age at which 50% of the ages are below it and 50% of the ages are above it. Because 41.3% (= 5.5% + 19.7% + 5.3% + 10.8%) of the ages are below 35 and 54.8% (= 41.3% + 13.5%) of the ages are below 45, the median age is in the interval 35 to 44. We take the *median age* for the new congressional district CD-01 for the 116<sup>th</sup> Congress to be

$$\text{median age} = 35 + \frac{50\% - 41.3\%}{13.5\%}(44 - 35) = 40.8 \quad (1)$$

#### *Veterans 18 Years and Older for New PA CD-01*

Because the 2010 Census SF1 does not provide block level Veterans counts, the method used for the other tabulations can not be used to update Veterans Counts. So we proceed as follows by a pro-rata synthetic allocation method.

The Veterans count in Table PA.7 is 37,592 or  $\frac{37592}{709623} \times 100\% = 5.30\%$ , leading to the estimated count for veterans contributed from adjusted 4101 people to be

$$(5.30\%) \times (4101) = 217.25. \quad (2)$$

The Veterans count in Table PA.8 is 41,533 or  $\frac{41533}{707083} \times 100\% = 5.87\%$ , leading to the estimated count for veterans contributed from adjusted 659026 people to be

$$(5.87\%) \times (659026) = 38710.20. \quad (3)$$

The Veterans count in Table PA.13 is 32250 or  $\frac{32250}{729101} \times 100\% = 4.42\%$ , leading to the estimated count for veterans contributed from adjusted 45339 people to be

$$(4.42\%) \times (45339) = 2005.46. \quad (4)$$

Adding the counts in (2), (3), and (4) gives a count for the “new” congressional district CD-01 of 40,933 *Veterans 18 Years and Older*.

In arriving at the estimated count of 40,933 Veterans, we are assuming that each collection of blocks that moves from the old (115<sup>th</sup> Congress) Congressional District CD-x to a new (116<sup>th</sup> Congress) Congressional District CD-y has 2015 proportion of Veterans that is similar to the 2015 proportion of Veterans of the entire Congressional District CD-x.

As an alternative for estimating Veterans 18 Years and Older, one reviewer noted, “As a thought, I wonder to what degree using the percentage of 18<sup>+</sup> population or even the 20<sup>+</sup> population might be more accurate and potentially a more stable assumption”. We agree with this thought and will pursue it in future work.

#### 4. 116<sup>th</sup> Congress Congressional District Profiles for Pennsylvania

Table PA.1\*. Pennsylvania Congressional District 1 Profile (116<sup>th</sup> Congress)

Total Population	<b>708466</b>		
Age-Under 5:	5.5%		
Age-5 to 19:	19.7%		
Age-20 to 24:	5.3%		
Age-25 to 34:	10.8%		
Age-35 to 44:	13.5%		
Age-45 to 54:	17.3%		
Age-55 to 64:	13.2%		
Age-65+ :	14.6%		
Median Age:	40.8		
Percent Male:	49.0%		
Percent Female:	51.0%		
Veterans 18 yrs and older:	40,933		
		Total Housing Units:	<b>280229</b>
		Percent Occupied:	<b>95.4%</b>
		- Owner Occupied:	76.5%
		- Renter Occupied:	23.5%
		Percent Vacant:	<b>4.6%</b>
		One Race	
		- White:	87.9%
		- Black...:	3.7%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	5.0%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.5%
		Two or More Races:	1.7%
		Hispanic/Latino:	4.3%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.2\*. Pennsylvania Congressional District 02 Profile (116<sup>th</sup> Congress)

Total Population	<b>725357</b>		
Age-Under 5:	7.3%		
Age-5 to 19:	21.5%		
Age-20 to 24:	8.1%		
Age-25 to 34:	14.9%		
Age-35 to 44:	13.0%		
Age-45 to 54:	13.4%		
Age-55 to 64:	10.3%		
Age-65+ :	11.6%		
Median Age:	33.8		
Percent Male:	48.2%		
Percent Female:	51.8%		
Veterans 18 yrs and older:	29,593		
		Total Housing Units:	<b>279142</b>
		Percent Occupied:	<b>91.9%</b>
		- Owner Occupied:	59.4%
		- Renter Occupied:	40.6%
		Percent Vacant:	<b>8.1%</b>
		One Race	
		- White:	51.5%
		- Black...:	26.8%
		- Am Ind & Alaska Nat:	0.6%
		- Asian:	6.6%
		- Nat Haw & Other:	0.1%
		- Some Other Race:	11.1%
		Two or More Races:	3.3%
		Hispanic/Latino:	21.8%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.3\*. Pennsylvania Congressional District 03 Profile (116<sup>th</sup> Congress)

Total Population	<b>724474</b>		
Age-Under 5:	5.9%		
Age-5 to 19:	17.7%		
Age-20 to 24:	11.4%		
Age-25 to 34:	17.5%		
Age-35 to 44:	11.5%		
Age-45 to 54:	12.5%		
Age-55 to 64:	10.8%		
Age-65+ :	12.6%		
Median Age:	32.7		
Percent Male:	46.2%		
Percent Female:	53.8%		
Veterans 18 yrs and older:	31,327		
		Total Housing Units:	<b>347520</b>
		Percent Occupied:	<b>87.4%</b>
		- Owner Occupied:	48.4%
		- Renter Occupied:	51.6%
		Percent Vacant:	<b>12.6%</b>
		One Race	
		- White:	30.3%
		- Black...:	60.1%
		- Am Ind & Alaska Nat:	0.3%
		- Asian:	5.4%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.3%
		Two or More Races:	2.4%
		Hispanic/Latino:	3.9%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.4\*. Pennsylvania Congressional District 04 Profile (116<sup>th</sup> Congress)

Total Population	<b>721529</b>		
Age-Under 5:	5.9%		
Age-5 to 19:	19.2%		
Age-20 to 24:	5.3%		
Age-25 to 34:	12.1%		
Age-35 to 44:	13.6%		
Age-45 to 54:	16.1%		
Age-55 to 64:	12.6%		
Age-65+ :	15.1%		
Median Age:	39.9		
Percent Male:	48.7%		
Percent Female:	51.3%		
Veterans 18 yrs and older:	35,479		
		Total Housing Units:	<b>288474</b>
		Percent Occupied:	<b>94.5%</b>
		- Owner Occupied:	73.5%
		- Renter Occupied:	26.5%
		Percent Vacant:	<b>5.5%</b>
		One Race	
		- White:	81.8%
		- Black...:	9.0%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	5.4%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.7%
		Two or More Races:	1.9%
		Hispanic/Latino:	4.3%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.5\*. Pennsylvania Congressional District 05 Profile (116<sup>th</sup> Congress)

Total Population	<b>714952</b>		
Age-Under 5:	6.2%		
Age-5 to 19:	20.5%		
Age-20 to 24:	7.2%		
Age-25 to 34:	12.4%		
Age-35 to 44:	12.6%		
Age-45 to 54:	15.0%		
Age-55 to 64:	11.9%		
Age-65+ :	14.2%		
Median Age:	37.6		
Percent Male:	47.6%		
Percent Female:	52.4%		
Veterans 18 yrs and older:	32,405		
		Total Housing Units:	<b>285843</b>
		Percent Occupied:	<b>93.0%</b>
		- Owner Occupied:	69.1%
		- Renter Occupied:	30.9%
		Percent Vacant:	<b>7.0%</b>
		One Race	
		- White:	67.8%
		- Black...:	23.1%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	5.7%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.2%
		Two or More Races:	2.0%
		Hispanic/Latino:	3.4%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.6\*. Pennsylvania Congressional District 06 Profile (116<sup>th</sup> Congress)

Total Population	<b>722135</b>		
Age-Under 5:	6.5%		
Age-5 to 19:	21.6%		
Age-20 to 24:	6.3%		
Age-25 to 34:	11.4%		
Age-35 to 44:	13.5%		
Age-45 to 54:	15.6%		
Age-55 to 64:	12.0%		
Age-65+ :	13.0%		
Median Age:	37.8		
Percent Male:	49.0%		
Percent Female:	51.0%		
Veterans 18 yrs and older:	38,342		
		Total Housing Units:	<b>279179</b>
		Percent Occupied:	<b>94.1%</b>
		- Owner Occupied:	72.1%
		- Renter Occupied:	27.9%
		Percent Vacant:	<b>5.9%</b>
		One Race	
		- White:	81.7%
		- Black...:	6.6%
		- Am Ind & Alaska Nat:	0.3%
		- Asian:	3.2%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	5.9%
		Two or More Races:	2.4%
		Hispanic/Latino:	13.0%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.7\*. Pennsylvania Congressional District 07 Profile (116<sup>th</sup> Congress)

Total Population	<b>717031</b>		
Age-Under 5:	5.7%		
Age-5 to 19:	20.1%		
Age-20 to 24:	6.6%		
Age-25 to 34:	11.4%		
Age-35 to 44:	13.1%		
Age-45 to 54:	15.5%		
Age-55 to 64:	12.5%		
Age-65+ :	15.0%		
Median Age:	39.2		
Percent Male:	48.6%		
Percent Female:	51.4%		
Veterans 18 yrs and older:	46,141		
		Total Housing Units:	<b>289084</b>
		Percent Occupied:	<b>93.6%</b>
		- Owner Occupied:	70.1%
		- Renter Occupied:	29.9%
		Percent Vacant:	<b>6.4%</b>
		One Race	
		- White:	82.2%
		- Black...:	6.0%
		- Am Ind & Alaska Nat:	0.3%
		- Asian:	2.7%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	6.2%
		Two or More Races:	2.6%
		Hispanic/Latino:	14.7%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.8\*. Pennsylvania Congressional District 08 Profile (116<sup>th</sup> Congress)

Total Population	<b>696544</b>		
Age-Under 5:	5.2%		
Age-5 to 19:	18.9%		
Age-20 to 24:	6.2%		
Age-25 to 34:	10.6%		
Age-35 to 44:	12.9%		
Age-45 to 54:	15.8%		
Age-55 to 64:	13.5%		
Age-65+ :	17.0%		
Median Age:	41.4		
Percent Male:	49.0%		
Percent Female:	51.0%		
Veterans 18 yrs and older:	49,911		
		Total Housing Units:	<b>349016</b>
		Percent Occupied:	<b>80.8%</b>
		- Owner Occupied:	70.8%
		- Renter Occupied:	29.2%
		Percent Vacant:	<b>19.2%</b>
		One Race	
		- White:	88.4%
		- Black...:	5.1%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	1.3%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	3.0%
		Two or More Races:	1.8%
		Hispanic/Latino:	7.7%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.9\*. Pennsylvania Congressional District 09 Profile (116<sup>th</sup> Congress)

Total Population	<b>708250</b>		
Age-Under 5:	5.3%		
Age-5 to 19:	18.7%		
Age-20 to 24:	6.3%		
Age-25 to 34:	10.6%		
Age-35 to 44:	13.1%		
Age-45 to 54:	15.6%		
Age-55 to 64:	13.4%		
Age-65+ :	16.9%		
Median Age:	41.2		
Percent Male:	49.6%		
Percent Female:	50.4%		
Veterans 18 yrs and older:	45,485		
		Total Housing Units:	<b>311429</b>
		Percent Occupied:	<b>89.2%</b>
		- Owner Occupied:	76.2%
		- Renter Occupied:	23.8%
		Percent Vacant:	<b>10.8%</b>
		One Race	
		- White:	93.9%
		- Black...:	2.2%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	0.8%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.7%
		Two or More Races:	1.2%
		Hispanic/Latino:	4.4%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.10\*. Pennsylvania Congressional District 10 Profile (116<sup>th</sup> Congress)

Total Population	<b>718940</b>		
Age-Under 5:	6.1%		
Age-5 to 19:	19.3%		
Age-20 to 24:	6.1%		
Age-25 to 34:	12.5%		
Age-35 to 44:	13.3%		
Age-45 to 54:	15.4%		
Age-55 to 64:	12.9%		
Age-65+ :	14.4%		
Median Age:	39.1		
Percent Male:	48.8%		
Percent Female:	51.2%		
Veterans 18 yrs and older:	51,046		
		Total Housing Units:	<b>309306</b>
		Percent Occupied:	<b>93.2%</b>
		- Owner Occupied:	69.2%
		- Renter Occupied:	30.8%
		Percent Vacant:	<b>6.8%</b>
		One Race	
		- White:	81.2%
		- Black...:	10.7%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	2.7%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	2.6%
		Two or More Races:	2.6%
		Hispanic/Latino:	6.3%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.11\*. Pennsylvania Congressional District 11 Profile (116<sup>th</sup> Congress)

Total Population	<b>729497</b>		
Age-Under 5:	6.6%		
Age-5 to 19:	20.6%		
Age-20 to 24:	6.4%		
Age-25 to 34:	11.5%		
Age-35 to 44:	12.7%		
Age-45 to 54:	15.1%		
Age-55 to 64:	12.3%		
Age-65+ :	14.8%		
Median Age:	38.5		
Percent Male:	49.1%		
Percent Female:	50.9%		
Veterans 18 yrs and older:	42,525		
		Total Housing Units:	<b>284851</b>
		Percent Occupied:	<b>95.1%</b>
		- Owner Occupied:	71.5%
		- Renter Occupied:	28.5%
		Percent Vacant:	<b>4.9%</b>
		One Race	
		- White:	90.2%
		- Black...:	3.3%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	1.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	2.9%
		Two or More Races:	1.8%
		Hispanic/Latino:	7.0%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.12\*. Pennsylvania Congressional District 12 Profile (116<sup>th</sup> Congress)

Total Population	<b>704165</b>		
Age-Under 5:	5.4%		
Age-5 to 19:	19.4%		
Age-20 to 24:	9.3%		
Age-25 to 34:	10.6%		
Age-35 to 44:	11.8%		
Age-45 to 54:	14.6%		
Age-55 to 64:	12.8%		
Age-65+ :	16.0%		
Median Age:	39.0		
Percent Male:	50.0%		
Percent Female:	50.0%		
Veterans 18 yrs and older:	52,918		
		Total Housing Units:	<b>327855</b>
		Percent Occupied:	<b>84.4%</b>
		- Owner Occupied:	70.7%
		- Renter Occupied:	29.3%
		Percent Vacant:	<b>15.6%</b>
		One Race	
		- White:	94.5%
		- Black...:	2.1%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	1.4%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.6%
		Two or More Races:	1.2%
		Hispanic/Latino:	1.9%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.13\*. Pennsylvania Congressional District 13 Profile (116<sup>th</sup> Congress)

Total Population	<b>702351</b>		
Age-Under 5:	5.6%		
Age-5 to 19:	18.9%		
Age-20 to 24:	6.0%		
Age-25 to 34:	10.8%		
Age-35 to 44:	12.8%		
Age-45 to 54:	15.2%		
Age-55 to 64:	13.5%		
Age-65+ :	17.3%		
Median Age:	41.2		
Percent Male:	49.5%		
Percent Female:	50.5%		
Veterans 18 yrs and older:	51,663		
		Total Housing Units:	<b>318737</b>
		Percent Occupied:	<b>88.7%</b>
		- Owner Occupied:	74.2%
		- Renter Occupied:	25.8%
		Percent Vacant:	<b>11.3%</b>
		One Race	
		- White:	94.4%
		- Black...:	2.5%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	0.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	1.0%
		Two or More Races:	1.3%
		Hispanic/Latino:	2.6%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.14\*. Pennsylvania Congressional District 14 Profile (116<sup>th</sup> Congress)

Total Population	<b>704549</b>		
Age-Under 5:	5.0%		
Age-5 to 19:	17.8%		
Age-20 to 24:	5.5%		
Age-25 to 34:	10.5%		
Age-35 to 44:	12.8%		
Age-45 to 54:	16.1%		
Age-55 to 64:	14.5%		
Age-65+ :	18.0%		
Median Age:	43.1		
Percent Male:	48.8%		
Percent Female:	51.2%		
Veterans 18 yrs and older:	50,022		
		Total Housing Units:	<b>320518</b>
		Percent Occupied:	<b>91.1%</b>
		- Owner Occupied:	75.1%
		- Renter Occupied:	24.9%
		Percent Vacant:	<b>8.9%</b>
		One Race	
		- White:	94.4%
		- Black...:	3.2%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	0.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.3%
		Two or More Races:	1.4%
		Hispanic/Latino:	1.0%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.15\*. Pennsylvania Congressional District 15 Profile (116<sup>th</sup> Congress)

Total Population	<b>699248</b>		
Age-Under 5:	5.1%		
Age-5 to 19:	18.2%		
Age-20 to 24:	7.0%		
Age-25 to 34:	10.8%		
Age-35 to 44:	12.5%		
Age-45 to 54:	15.6%		
Age-55 to 64:	13.6%		
Age-65+ :	17.2%		
Median Age:	41.4		
Percent Male:	50.3%		
Percent Female:	49.7%		
Veterans 18 yrs and older:	52,982		
		Total Housing Units:	<b>341628</b>
		Percent Occupied:	<b>83.6%</b>
		- Owner Occupied:	74.5%
		- Renter Occupied:	25.5%
		Percent Vacant:	<b>16.4%</b>
		One Race	
		- White:	96.2%
		- Black...:	1.8%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	0.6%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.4%
		Two or More Races:	0.8%
		Hispanic/Latino:	1.2%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.16\*. Pennsylvania Congressional District 16 Profile (116<sup>th</sup> Congress)

Total Population	<b>701381</b>		
Age-Under 5:	5.6%		
Age-5 to 19:	19.9%		
Age-20 to 24:	6.9%		
Age-25 to 34:	10.7%		
Age-35 to 44:	12.3%		
Age-45 to 54:	15.2%		
Age-55 to 64:	13.2%		
Age-65+ :	16.1%		
Median Age:	40.0		
Percent Male:	48.9%		
Percent Female:	51.1%		
Veterans 18 yrs and older:	53,203		
		Total Housing Units:	<b>313931</b>
		Percent Occupied:	<b>89.9%</b>
		- Owner Occupied:	71.1%
		- Renter Occupied:	28.9%
		Percent Vacant:	<b>10.1%</b>
		One Race	
		- White:	92.0%
		- Black...:	4.7%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	0.8%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.6%
		Two or More Races:	1.6%
		Hispanic/Latino:	2.0%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.17\*. Pennsylvania Congressional District 17 Profile (116<sup>th</sup> Congress)

Total Population	<b>702102</b>		
Age-Under 5:	5.3%		
Age-5 to 19:	17.9%		
Age-20 to 24:	5.0%		
Age-25 to 34:	11.5%		
Age-35 to 44:	12.7%		
Age-45 to 54:	16.5%		
Age-55 to 64:	13.8%		
Age-65+ :	17.2%		
Median Age:	42.3		
Percent Male:	48.1%		
Percent Female:	51.9%		
Veterans 18 yrs and older:	49,933		
		Total Housing Units:	<b>325635</b>
		Percent Occupied:	<b>92.5%</b>
		- Owner Occupied:	72.6%
		- Renter Occupied:	27.4%
		Percent Vacant:	<b>7.5%</b>
		One Race	
		- White:	90.5%
		- Black...:	5.5%
		- Am Ind & Alaska Nat:	0.1%
		- Asian:	2.1%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.3%
		Two or More Races:	1.5%
		Hispanic/Latino:	1.3%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

Table PA.18\*. Pennsylvania Congressional District 18 Profile (116<sup>th</sup> Congress)

Total Population	<b>701532</b>		
Age-Under 5:	5.1%		
Age-5 to 19:	17.0%		
Age-20 to 24:	8.9%		
Age-25 to 34:	13.8%		
Age-35 to 44:	11.3%		
Age-45 to 54:	14.3%		
Age-55 to 64:	12.9%		
Age-65+ :	16.6%		
Median Age:	39.1		
Percent Male:	47.8%		
Percent Female:	52.2%		
Veterans 18 yrs and older:	48,679		
		Total Housing Units:	<b>350674</b>
		Percent Occupied:	<b>89.1%</b>
		- Owner Occupied:	59.3%
		- Renter Occupied:	40.7%
		Percent Vacant:	<b>10.9%</b>
		One Race	
		- White:	75.3%
		- Black...:	19.0%
		- Am Ind & Alaska Nat:	0.2%
		- Asian:	2.9%
		- Nat Haw & Other:	0.0%
		- Some Other Race:	0.5%
		Two or More Races:	2.1%
		Hispanic/Latino:	1.7%

Source: 2010 Census SF1 & 2015 ACS 1-Year Estimates, U. S. Bureau of the Census, Washington, DC

## 5. Discussion

### *Two Basic Assumptions*

The method of this paper, described in Section 3.1.2 and illustrated in Section 3.1.3 is based on the following primary assumption

**Assumption 1:** *There is uniform “growth” (or rate of change) for population and for housing units across categories within each of the old congressional districts in Pennsylvania from 2010 to 2015. We believe that this permits the use of the growth factors  $P_{a(x)}$  and  $HU_{a(x)}$ .*

We believe that Tables 3a, 3b, and 3c provide some empirical support for this assumption.

We examined each of the sixty-four (64) collections of blocks (Tables 1 or 2) that moved from an old congressional district to a new congressional district and found that *the distributions of the collections of blocks that carry large populations have a large influence on the profile distributions of congressional districts (old and new).*

As mentioned in Section 3.1.3 because the 2010 Census SF1 data do not provide block level Veterans counts, we must use an alternative method to retabulate Veterans counts. The method used for Veterans counts is based on the following assumption:

**Assumption 2:** *Each collection of blocks that moves from the old (115<sup>th</sup> Congress) Congressional District CD- $x$  to a new (116<sup>th</sup> Congress) Congressional District has 2015 proportion of Veterans that is similar to the 2015 proportion of Veterans of the entire Congressional District CD- $x$ .*

### *Two Assessments*

In the first assessment, we check empirically our results with results produced by the usual ACS methodology for producing the new profiles for 2015. In the second assessment, we are able to easily compute margins of error for the new estimates for “Total Population” and “Total Housing Units”.

#### *Assessment 1: Empirical Check of the Method of This Report (Sections 3.1.2 and 3.1.3) with the Usual ACS Estimation Method*

The method introduced and used in this report to produce the eighteen 116<sup>th</sup> Congress Congressional District Profiles for Pennsylvania were based on aggregated data available to the public (2012 Census SF1 and 115<sup>th</sup> Congress CD Profiles for Pennsylvania based on 2015 ACS 1-Year data). The eighteen profiles that we produced are given in Section 4.

Following the production of the Profiles for Pennsylvania’s 116<sup>th</sup> CDs, we received 2015 ACS 1-Year estimates from the American Community Survey Office from which we extracted the estimates for the Profiles of Pennsylvania’s 116<sup>th</sup> CDs using the usual ACS methodology which is based on microdata. (For more, see *ACS Design and Methodology Report*.) The two sets of new profiles for the eighteen CDs are presented in Tables 5a, 5b, 5c, and 5d. The profiles produced by both methods for each of the CDs are visually “not too different”, though there are still some “sensitive” categories where the differences between estimated proportions are noteworthy, e.g., vacant, Hispanic/Latino, Black... (We do not perform formal tests of hypotheses and therefore do not make claims of statistical significance. We leave this for future work.)



Table 5a. 116<sup>th</sup> Congress Pennsylvania Profile Comparisons Based on *Method This Paper* vs *Usual ACS Method*

	116 <sup>th</sup> CD-1		116 <sup>th</sup> CD-2		116 <sup>th</sup> CD-3		116 <sup>th</sup> CD-4		116 <sup>th</sup> CD-5	
	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method
	<b>Total Population:</b>	708466	713860	725357	725235	724474	728060	721529	718875	714952
Age-Under 5:	5.5%	5.3%	7.3%	8.1%	5.9%	5.8%	5.9%	5.3%	6.2%	6.1%
Age-5 to 19:	19.7%	18.7%	21.5%	19.8%	17.7%	16.2%	19.2%	18.5%	20.5%	19.3%
Age-20 to 24:	5.3%	5.6%	8.1%	7.2%	11.4%	9.1%	5.3%	5.8%	7.2%	6.8%
Age-25 to 34:	10.8%	11.2%	14.9%	16.1%	17.5%	21.0%	12.1%	12.2%	12.4%	13.4%
Age-35 to 44:	13.5%	12.3%	13.0%	12.9%	11.5%	11.4%	13.6%	12.3%	12.6%	12.2%
Age-45 to 54:	17.3%	15.2%	13.4%	12.7%	12.5%	11.4%	16.1%	15.0%	15.0%	13.5%
Age-55 to 64:	13.2%	15.0%	10.3%	11.1%	10.8%	11.6%	12.6%	14.0%	11.9%	13.6%
Age-65+ :	14.6%	16.8%	11.6%	12.0%	12.6%	13.6%	15.1%	16.9%	14.2%	15.1%
Median Age:	40.8	42.9	33.8	34.2	32.7	33.8	39.9	41.7	37.6	38.8
Percent Male:	49.0%	49.1%	48.2%	47.9%	46.2%	46.5%	48.7%	48.7%	47.6%	47.8%
Percent Female:	51.0%	50.9%	51.8%	52.1%	53.8%	53.5%	51.3%	51.3%	52.4%	52.2%
Veterans 18 yrs and older:	40,933	41,485	29,593	26,215	31,327	32,425	35,479	37,170	32,405	33,005
One Race										
-White:	87.9%	86.4%	51.5%	52.3%	30.3%	32.2%	81.8%	80.1%	67.8%	65.1%
-Black...:	3.7%	4.2%	26.8%	26.7%	60.1%	57.6%	9.0%	9.2%	23.1%	24.1%
-Am Ind & Alaska Nat:	0.2%	0.2%	0.6%	0.4%	0.3%	0.4%	0.1%	0.1%	0.2%	0.1%
-Asian:	5.0%	5.8%	6.6%	7.6%	5.4%	6.1%	5.4%	6.8%	5.7%	6.4%
-Nat Haw & Other:	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
-Some Other Race:	1.5%	1.4%	11.1%	9.8%	1.3%	1.2%	1.7%	1.7%	1.2%	1.6%
Two or More Races:	1.7%	2.0%	3.3%	3.1%	2.4%	2.4%	1.9%	2.1%	2.0%	2.7%
Hispanic/Latino:	4.3%	5.3%	21.8%	24.8%	3.9%	4.3%	4.3%	4.6%	3.4%	4.1%
<b>Total Housing Units:</b>	280229	280015	279142	282870	347520	341385	288474	289875	285843	284520
Percent Occupied:	95.4%	94.8%	91.9%	89.3%	87.4%	83.8%	94.5%	94.3%	93.0%	91.3%
-Owner Occupied:	76.5%	74.4%	59.4%	56.5%	48.4%	48.1%	73.5%	73.4%	69.1%	68.3%
-Renter Occupied:	23.5%	25.6%	40.6%	43.5%	51.6%	51.9%	26.5%	26.6%	30.9%	31.7%
Percent Vacant:	4.6%	5.2%	8.1%	10.7%	12.6%	16.2%	5.5%	5.7%	7.0%	8.7%

Table 5b. 116<sup>th</sup> Congress Pennsylvania Profile Comparisons Based on *Method This Paper* vs *Usual ACS Method*

	116 <sup>th</sup> CD-6		116 <sup>th</sup> CD-7		116 <sup>th</sup> CD-8		116 <sup>th</sup> CD-9		116 <sup>th</sup> CD-10	
	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method
	<b>Total Population:</b>	722135	722920	717031	724240	696544	693610	708250	703810	718940
Age-Under 5:	6.5%	6.0%	5.7%	5.4%	5.2%	5.0%	5.3%	5.0%	6.1%	5.8%
Age-5 to 19:	21.6%	20.8%	20.1%	19.3%	18.9%	17.9%	18.7%	17.7%	19.3%	18.7%
Age-20 to 24:	6.3%	6.4%	6.6%	6.8%	6.2%	6.4%	6.3%	6.4%	6.1%	6.6%
Age-25 to 34:	11.4%	11.9%	11.4%	11.9%	10.6%	11.5%	10.6%	11.1%	12.5%	12.4%
Age-35 to 44:	13.5%	12.3%	13.1%	11.7%	12.9%	11.6%	13.1%	11.7%	13.3%	12.3%
Age-45 to 54:	15.6%	14.7%	15.5%	14.3%	15.8%	14.5%	15.6%	14.3%	15.4%	14.5%
Age-55 to 64:	12.0%	13.0%	12.5%	13.7%	13.5%	14.6%	13.4%	15.0%	12.9%	13.5%
Age-65+ :	13.0%	14.8%	15.0%	16.9%	17.0%	18.6%	16.9%	18.6%	14.4%	16.2%
Median Age:	37.8	39.1	39.2	40.8	41.4	43.2	41.2	43.5	39.1	40.5
Percent Male:	49.0%	49.3%	48.6%	48.8%	49.0%	49.5%	49.6%	49.8%	48.8%	48.9%
Percent Female:	51.0%	50.7%	51.4%	51.2%	51.0%	50.5%	50.4%	50.2%	51.2%	51.1%
Veterans 18 yrs and older:	38,342	34,390	46,141	45,195	49,911	47,845	45,485	49,245	51,046	49,900
One Race										
-White:	81.7%	83.1%	82.2%	82.2%	88.4%	87.2%	93.9%	92.0%	81.2%	80.6%
-Black...:	6.6%	6.0%	6.0%	6.0%	5.1%	6.1%	2.2%	2.9%	10.7%	10.8%
-Am Ind & Alaska Nat:	0.3%	0.8%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
-Asian:	3.2%	4.0%	2.7%	3.3%	1.3%	1.6%	0.8%	1.2%	2.7%	3.2%
-Nat Haw & Other:	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
-Some Other Race:	5.9%	2.2%	6.2%	4.8%	3.0%	2.5%	1.7%	2.3%	2.6%	1.8%
Two or More Races:	2.4%	3.9%	2.6%	3.4%	1.8%	2.4%	1.2%	1.3%	2.6%	3.4%
Hispanic/Latino:	13.0%	14.6%	14.7%	17.2%	7.7%	10.2%	4.4%	5.9%	6.3%	7.9%
<b>Total Housing Units:</b>	279179	281230	289084	290120	349016	349050	311429	311995	309306	310400
Percent Occupied:	94.1%	93.7%	93.6%	92.4%	80.8%	76.5%	89.2%	87.4%	93.2%	92.0%
-Owner Occupied:	72.1%	71.3%	70.1%	68.1%	70.8%	70.2%	76.2%	76.1%	69.2%	66.9%
-Renter Occupied:	27.9%	28.7%	29.9%	31.9%	29.2%	29.8%	23.8%	23.9%	30.8%	33.1%
Percent Vacant:	5.9%	6.3%	6.4%	7.6%	19.2%	23.5%	10.8%	12.6%	6.8%	8.0%

Table 5c. 116<sup>th</sup> Congress Pennsylvania Profile Comparisons Based on *Method This Paper* vs *Usual ACS Method*

	116 <sup>th</sup> CD-11		116 <sup>th</sup> CD-12		116 <sup>th</sup> CD-13		116 <sup>th</sup> CD-14		116 <sup>th</sup> CD-15	
	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method
	<b>Total Population:</b>	729497	724650	704165	700975	702351	702560	704549	694785	699248
Age-Under 5:	6.6%	6.3%	5.4%	5.2%	5.6%	5.1%	5.0%	4.9%	5.1%	5.1%
Age-5 to 19:	20.6%	19.7%	19.4%	18.7%	18.9%	18.1%	17.8%	16.8%	18.2%	17.0%
Age-20 to 24:	6.4%	6.2%	9.3%	8.7%	6.0%	5.9%	5.5%	5.9%	7.0%	6.7%
Age-25 to 34:	11.5%	12.5%	10.6%	11.4%	10.8%	11.2%	10.5%	10.9%	10.8%	11.6%
Age-35 to 44:	12.7%	11.6%	11.8%	10.7%	12.8%	11.5%	12.8%	11.3%	12.5%	11.5%
Age-45 to 54:	15.1%	13.3%	14.6%	13.6%	15.2%	14.1%	16.1%	14.3%	15.6%	14.0%
Age-55 to 64:	12.3%	13.3%	12.8%	13.6%	13.5%	14.5%	14.5%	15.8%	13.6%	15.2%
Age-65+ :	14.8%	17.2%	16.0%	18.0%	17.3%	19.6%	18.0%	20.0%	17.2%	19.0%
Median Age:	38.5	39.6	39.0	40.6	41.2	43.7	43.1	45.1	41.4	43.6
Percent Male:	49.1%	49.1%	50.0%	50.1%	49.5%	49.8%	48.8%	48.8%	50.3%	50.7%
Percent Female:	50.9%	50.9%	50.0%	49.9%	50.5%	50.2%	51.2%	51.2%	49.7%	49.3%
Veterans 18 yrs and older:	42,525	44,575	52,918	50,330	51,663	55,975	50,022	52,100	52,982	54890
One Race										
-White:	90.2%	90.3%	94.5%	93.9%	94.4%	93.7%	94.4%	93.9%	96.2%	95.3%
-Black...:	3.3%	3.9%	2.1%	2.5%	2.5%	2.5%	3.2%	2.8%	1.8%	2.3%
-Am Ind Alaska Nat:	0.2%	0.2%	0.2%	0.2%	0.2%	0.0%	0.1%	0.1%	0.1%	0.1%
-Asian:	1.6%	1.7%	1.4%	1.5%	0.6%	0.8%	0.6%	0.6%	0.6%	0.7%
-Nat Haw & Other:	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
-Some Other Race:	2.9%	2.1%	0.6%	0.5%	1.0%	1.0%	0.3%	0.3%	0.4%	0.2%
Two or More Races:	1.8%	1.8%	1.2%	1.3%	1.3%	1.9%	1.4%	2.3%	0.8%	1.3%
Hispanic/Latino:	7.0%	8.2%	1.9%	2.1%	2.6%	3.0%	1.0%	1.4%	1.2%	1.4%
<b>Total Housing Units:</b>	284851	284680	327855	326335	318737	318040	320518	320785	341628	341510
Percent Occupied:	95.1%	94.5%	84.4%	82.1%	88.7%	87.2%	91.1%	88.8%	83.6%	80.9%
-Owner Occupied:	71.5%	70.5%	70.7%	70.3%	74.2%	74.1%	75.1%	75.5%	74.5%	74.2%
-Renter Occupied:	28.5%	29.5%	29.3%	29.7%	25.8%	25.9%	24.9%	24.5%	25.5%	25.8%
Percent Vacant:	4.9%	5.5%	15.6%	17.9%	11.3%	12.8%	8.9%	11.2%	16.4%	19.1%

Table 5d. 116<sup>th</sup> Congress Pennsylvania Profile Comparisons Based on *Method This Paper* vs *Usual ACS Method*

	116 <sup>th</sup> CD-16		116 <sup>th</sup> CD-17		116 <sup>th</sup> CD-18	
	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method	Method This Paper	Usual ACS Method
	<b>Total Population:</b>	701381	696970	702102	711520	701532
Age-Under 5:	5.6%	5.4%	5.3%	5.4%	5.1%	5.2%
Age-5 to 19:	19.9%	18.9%	17.9%	16.6%	17.0%	16.2%
Age-20 to 24:	6.9%	6.6%	5.0%	4.7%	8.9%	7.8%
Age-25 to 34:	10.7%	11.5%	11.5%	12.9%	13.8%	16.7%
Age-35 to 44:	12.3%	11.2%	12.7%	11.9%	11.3%	10.9%
Age-45 to 54:	15.2%	13.7%	16.5%	14.4%	14.3%	12.1%
Age-55 to 64:	13.2%	14.8%	13.8%	15.6%	12.9%	14.0%
Age-65+ :	16.1%	18.0%	17.2%	18.6%	16.6%	17.2%
Median Age:	40.0	42.2	42.3	43.8	39.1	38.7
Percent Male:	48.9%	49.2%	48.1%	48.6%	47.8%	48.1%
Percent Female:	51.1%	50.8%	51.9%	51.4%	52.2%	51.9%
Veterans:	53,203	53,580	49,933	47,365	48,679	46,900
One Race						
-White:	92.0%	91.3%	90.5%	89.6%	75.3%	74.1%
-Black...:	4.7%	4.5%	5.5%	5.6%	19.0%	18.1%
-Am Ind Alaska Nat:	0.2%	0.1%	0.1%	0.1%	0.2%	0.1%
-Asian:	0.8%	1.0%	2.1%	2.4%	2.9%	4.0%
-Nat Haw & Other:	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
-Some Other Race:	0.6%	0.4%	0.3%	0.3%	0.5%	0.4%
Two or More Races:	1.6%	2.6%	1.5%	2.0%	2.1%	3.4%
Hispanic/Latino:	2.0%	2.4%	1.3%	1.7%	1.7%	2.2%
<b>Total Housing Units:</b>	313931	312425	325635	328400	350674	349410
Percent Occupied:	89.9%	89.0%	92.5%	91.9%	89.1%	87.7%
-Owner Occupied:	71.1%	70.2%	72.6%	72.2%	59.3%	57.7%
-Renter Occupied:	28.9%	29.8%	27.4%	27.8%	40.7%	42.3%
Percent Vacant:	10.1%	11.0%	7.5%	8.1%	10.9%	12.3%

*Assessment 2: Margin of Error (MOE) for the “Total Population” and Margin of Error (MOE) for the “Total Housing Units” Estimates for each 116<sup>th</sup> Congress CD Presented in Section 4*

Because the 2010 Census “Total Population” counts and “Total Housing Unit” counts are constants, the denominators of the Population Growth Factors ( $P_{a(x)}$ ) and the Housing Unit Growth Factors ( $HU_{a(x)}$ ) are constants, and the numerators of  $P_{a(x)}$  and  $HU_{a(x)}$  are random variables, we are able to compute a margin of error (MOE) for the “Total Population” and for the “Total Housing Units” estimates of Section 4 for each Pennsylvania CD in the 116<sup>th</sup> Congress as described below.

First, we obtained the MOEs for these estimates (denoted by  $\widehat{POP}_{115(CD-x)}$  and  $\widehat{HU}_{115(CD-x)}$ ) that were produced using the usual ACS estimation methodology for each of Pennsylvania’s CDs in the 115<sup>th</sup> Congress. These estimates, available to the public, are given in Table 6a.

Table 6a. Estimates and 90% MOEs for Pennsylvania’s 115<sup>th</sup> Congress Congressional Districts

115 <sup>th</sup> Congress CD	Total Population Estimate		Total Housing Units Estimate	
	$\widehat{POP}_{115(CD-x)}$	$MOE(\widehat{POP}_{115(CD-x)})$	$\widehat{HU}_{115(CD-x)}$	$MOE(\widehat{HU}_{115(CD-x)})$
01	720,611	± 16,105	300,762	± 6,410
02	725,418	± 15,604	333,211	± 5,029
03	701,892	± 4,751	317,890	± 2,200
04	724,891	± 4,502	302,564	± 2,539
05	699,108	± 4,413	342,111	± 2,084
06	720,652	± 10,911	286,021	± 4,234
07	709,623	± 11,117	272,204	± 3,631
08	707,083	± 5,374	279,444	± 1,676
09	696,545	± 5,125	318,557	± 2,035
10	705,602	± 8,095	346,991	± 3,139
11	704,916	± 7,383	322,010	± 3,933
12	700,339	± 7,926	319,833	± 3,751
13	729,101	± 13,355	288,581	± 3,920
14	699,463	± 7,573	373,522	± 3,133
15	728,044	± 9,101	291,253	± 3,027
16	732,595	± 8,758	281,829	± 2,941
17	686,892	± 10,106	319,469	± 3,370
18	709,728	± 8,861	316,799	± 4,289

Source: 2015 1-Year American Community Survey, U. S. Bureau of the Census

Using counts from Table 1, adjusted counts from Table 2, and estimates and associated MOEs from Table 6a, we can compute estimates and associated 90% MOE for each of Pennsylvania’s 116<sup>th</sup> Congress CDs for Total Population and Total Housing Units as follows by giving the details for Pennsylvania’s 116<sup>th</sup> Congress CD-01. The estimates and associated MOEs for all eighteen CDs for the 116<sup>th</sup> Congress are given in Table 6b.

Recall that CD-01 in the 116<sup>th</sup> Congress is made from collections of blocks from CD-07, CD-08, and CD-13 in the 115<sup>th</sup> Congress.

## TOTAL POPULATION ESTIMATION

An (approximate) equivalent production of the **Total Population** estimate for CD-01 in the 116<sup>th</sup> Congress:

$$\begin{aligned}
 & \widehat{POP}_{116(CD-01)} \\
 &= \frac{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-07 POP} \\ \text{to 116 CD-01} \end{pmatrix}}{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-07} \\ \text{Total POP} \end{pmatrix}} (\widehat{POP}_{115(CD-07)}) + \frac{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-08 POP} \\ \text{to 116 CD-01} \end{pmatrix}}{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-08} \\ \text{Total POP} \end{pmatrix}} (\widehat{POP}_{115(CD-08)}) + \frac{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-13 POP} \\ \text{to 116 CD-01} \end{pmatrix}}{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-13} \\ \text{Total POP} \end{pmatrix}} (\widehat{POP}_{115(CD-13)}) \\
 &= \frac{(4,078)}{(705,688)}(709,623) + \frac{(657,726)}{(705,688)}(707,083) + \frac{(43,883)}{(705,687)}(729,101) = 708,466
 \end{aligned}$$

with associated *MOE*:

$$\begin{aligned}
 & MOE(\widehat{POP}_{116(CD-01)}) \\
 &= \sqrt{\left(\frac{4,078}{705,688}\right)^2 [MOE(\widehat{POP}_{115(CD-07)})]^2 + \left(\frac{657,726}{705,688}\right)^2 [MOE(\widehat{POP}_{115(CD-08)})]^2 + \left(\frac{43,883}{705,687}\right)^2 [MOE(\widehat{POP}_{115(CD-13)})]^2} \\
 &= \sqrt{\left(\frac{4,078}{705,688}\right)^2 [11,117]^2 + \left(\frac{657,726}{705,688}\right)^2 [5,374]^2 + \left(\frac{43,883}{705,687}\right)^2 [13,355]^2} = 5,078.
 \end{aligned}$$

## TOTAL HOUSING UNITS ESTIMATION

An (approximate) equivalent production of the **Total Housing Units** estimate for CD-01 in the 116<sup>th</sup> Congress:

$$\begin{aligned}
 & \widehat{HU}_{116(CD-01)} \\
 &= \frac{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-07 HU} \\ \text{to 116 CD-01} \end{pmatrix}}{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-07} \\ \text{Total HU} \end{pmatrix}} (\widehat{HU}_{115(CD-07)}) + \frac{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-08 HU} \\ \text{to 116 CD-01} \end{pmatrix}}{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-08} \\ \text{Total HU} \end{pmatrix}} (\widehat{HU}_{115(CD-08)}) + \frac{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-13 HU} \\ \text{to 116 CD-01} \end{pmatrix}}{\begin{pmatrix} 2010 \text{ Census} \\ 115 \text{ CD-13} \\ \text{Total HU} \end{pmatrix}} (\widehat{HU}_{115(CD-13)}) \\
 &= \frac{(1,294)}{(273,873)}(272,204) + \frac{(259,242)}{(277,448)}(279,444) + \frac{(17,785)}{(287,764)}(288,581) = 280,229
 \end{aligned}$$

with associated *MOE*:

$$\begin{aligned}
 & MOE(\widehat{HU}_{116(CD-01)}) \\
 &= \sqrt{\left(\frac{1,294}{273,873}\right)^2 [MOE(\widehat{HU}_{115(CD-07)})]^2 + \left(\frac{259,242}{277,448}\right)^2 [MOE(\widehat{HU}_{115(CD-08)})]^2 + \left(\frac{17,785}{287,764}\right)^2 [MOE(\widehat{HU}_{115(CD-13)})]^2} \\
 &= \sqrt{\left(\frac{1,294}{273,873}\right)^2 [3,631]^2 + \left(\frac{259,242}{277,448}\right)^2 [1,676]^2 + \left(\frac{17,785}{287,764}\right)^2 [3,920]^2} = 1,585.
 \end{aligned}$$

Table 6b. Estimates and 90% MOEs for Pennsylvania’s 116<sup>th</sup> Congress Congressional Districts

116 <sup>th</sup> Congress CD	Total Population		Total Housing Units	
	Estimate	MOE	Estimate	MOE
01	708,466	± 5,078	280,229	± 1,585
02	725,357	± 9,418	279,142	± 2,794
03	724,474	± 12,933	347,520	± 4,362
04	721,529	± 6,863	288,474	± 2,212
05	714,952	± 8,905	285,843	± 2,940
06	722,135	± 6,475	279,179	± 2,422
07	717,031	± 6,987	289,084	± 2,291
08	696,544	± 5,614	349,016	± 2,177
09	708,250	± 4,592	311,429	± 1,852
10	718,940	± 3,632	309,306	± 1,966
11	729,497	± 6,178	284,851	± 2,159
12	704,165	± 5,637	327,855	± 2,116
13	702,351	± 3,208	318,737	± 1,390
14	704,549	± 5,355	320,518	± 2,535
15	699,248	± 2,877	341,628	± 1,403
16	701,381	± 3,907	313,931	± 1,800
17	702,102	± 5,036	325,635	± 2,333
18	701,532	± 6,018	350,674	± 2,525

*Early Alternative Approach Considered, But Assumption Failed to Hold*

In earlier stages of development of the methodology described in this report, we considered an approach based on pro-rata allocation of the ACS-estimated population in each congressional district for the 115<sup>th</sup> Congress to redrawn congressional districts for the 116<sup>th</sup> Congress. In each district, publicly available data include the census blocks and population counts in each 115<sup>th</sup> Congress district that form part of each 116<sup>th</sup> Congress district (e.g., Table 1), as well as the proportion of each 115<sup>th</sup> Congress population in the demographic categories summarized in the profiles of Section 1.2. Say that 115<sup>th</sup> Congress CD- $x$  has proportion  $p_A$  of its total population  $T$  falling in category  $A$ . If a proportion  $p_{xy}$  of CD- $x$  moves to 116<sup>th</sup> Congress CD- $y$ , then the number of CD- $x$  category  $A$  persons estimated (imputed) to fall in 116<sup>th</sup> CD- $y$  according to the pro-rata method is  $p_A \times p_{xy} \times T$  (see Section 3.1.3 for computation of estimate of “Veterans 18 Years and Older for New PA CD-01”). The underlying assumption of this method is that the category proportions in the segments of districts transferred under revised redistricting plans are the same as in the originating district as a whole (e.g., Assumption 2). When the demographic categories  $A$  are sensitive with respect to voting patterns, such a “Black...” and “Hispanic/Latino”, this assumption frequently does not hold. While the pro-rata method seems to produce reasonably accurate population shares in redrawn congressional districts for categories  $A$  thought not to be sensitive in the same way, we believe the method often produces errors (as measured with respect to non-public ACS population data and Census data). Nevertheless, in the profile category – Veteran Status – for which Census 2010 cross-classifications are not available at the census-block level, the pro-rata method is the one that continues to be used in this report, as noted. We also use this method for computing the Median Age estimate.

*Further Development*

Because the proposed method is deterministic (except for the estimates in Table 6b), the results lack statements of uncertainty based in probability. Additional work would permit the investigation of other methods including some based in probability. We also need to investigate what is possible in cases where Assumption 1 fails to hold.

Another topic for future work was mentioned by a reviewer who mentioned that age-cohort

effects as well as age-specific migration effects could both be affecting the slight differences in age proportions in the 2010 Census (SF1) and 2015 ACS 1-Year Tables 3a-c by CD. The same could be said for racial categories. One could do a finer adjustment of growth-factor weights based on raking both of these sets of marginal proportions (age and racial groups, and could also use Hispanic and/or Sex as other marginal variables for raking). The effect of raking would be to make proportions within marginal categories (Age, Race, and possibly Hispanic) in the old CD's propagated forward to 2015 ACS exact; in doing raking, there is an implicit assumption that cross-tabulated proportions (within Age  $\times$  Race or Age  $\times$  Race  $\times$  Hisp) follow a loglinear model without interactions. People would receive individual weights that are constant within cross-tabulated cells. But this kind of deterministic adjustment is likely to be seen (by demographers) as a more accurate way to do the forward-time adjustment of persons from 2010 to 2015. Then the weighted people would again be moved block-wise to the new CDs as we did in this report. Even if we ratio-adjusted (in place of raking) by Age  $\times$  Sex alone, and then used national VA tables for the Age  $\times$  Sex distribution of veterans, we would be able to get a more refined (and likely more accurate) adjustment for Veteran proportions in the pre-and post- redistricting CDs.

*Disclaimer:* Any views expressed in this paper are those of the authors and not of the U.S. Bureau of the Census.

**Acknowledgments:** The authors are grateful to Nicholas Spanos and Xiang (Shelly) Li of the American Community Survey Office for carrying out the usual ACS estimation methodology using the 2015 ACS 1-Year sample data and making those results available to us. They also checked our results against those produced by the usual ACS estimation methodology. Details of these checks are shown in Tables 5a, 5b, 5c, and 5d of Section 5. They also provided the publicly available estimates and *MOEs* in Table 6a. We are grateful to Mark Asiala and James Whitehorne for statistical and content reviews of this report. We are also grateful to Joe Engmark who provided and checked some of the counts in Tables 1 and 2 as well as a review of this report. (*congress115116aPA.tex*)

## References

- [1] [https://www.census.gov/programs-surveys/decennial-census/about/rdo/congressional-districts.115th\\_Congress.html](https://www.census.gov/programs-surveys/decennial-census/about/rdo/congressional-districts.115th_Congress.html) (Redistricting data information page).
- [2] *American Community Survey Design and Methodology, Version 2.0* (January 2014), U.S. Bureau of the Census, Washington, D.C. 20233, 222 pages.