The Virginia Poverty Measure

An Alternative Poverty Measure for the Commonwealth

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About this Report

This is the first full report on the proposed Virginia Poverty Measure. Readers are encouraged to read the companion piece: *Insights from the Virginia Poverty Measure,* and the 2012 *Numbers Count* series: "Poverty and the Social Safety Net" from the Demographics & Workforce Group.

The Demographics & Workforce Group

Serving Virginia's demographic needs since 1944, the Demographics & Workforce Group of the Weldon Cooper Center for Public Service at the University of Virginia provides accurate and timely population analyses for a wide variety of organizations. The Group's products and services support many government entities, with an ever-expanding role in key policy decisions in Virginia.

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Executive Summary

This report conveys research undertaken by the Weldon Cooper Center to design a new poverty measure that better reflects the true economic circumstances of low-income Virginians. The proposed Virginia Poverty Measure (VPM) incorporates recommendations from the National Academy of Sciences, as well as alternative poverty measure best practices from across the country. The VPM represents an improvement over the official Census Bureau poverty measure by accounting for:

- Regional differences in the cost of living;
- Updated income thresholds based on contemporary consumption patterns;
- Family resources from in-kind government transfers;
- Taxes and credits; and
- Necessary medical expenses.

The VPM estimates that, in 2011, 11.9% (or 936,000 people) lived below the VPM poverty thresholds (an average of about \$29,000 in annual income for a two-adult, two-child family). While this rate is not significantly different from the 11.6% figure derived by the official poverty measure from the American Community Survey, significant differences emerge among population subgroups and across different geographic areas:

- While <u>Northern Virginia</u> counties and cities enjoy some of the highest median incomes in the nation, the VPM shows that the extent of economic deprivation in the region is significantly greater than suggested by official poverty statistics. The high cost of housing and other necessary goods are clearly reflected in VPM poverty statistics for Northern Virginia residents, particularly those living inside the Beltway. The VPM reports a much higher poverty rate (12.3%) for the Beltway than the official rate (7.4%).
- The <u>child poverty rate</u> in Virginia is lower using the VPM and illustrates the targeted nature of many government programs not included in official statistics. Many tax code provisions and in-kind benefits are favorable toward families with young children. By including these resources, the VPM poverty rate for children under the age of 18 in 2011 is 13.0%, significantly lower than the official rate of 15.6%.
- Including <u>necessary medical expenses</u> significantly increases poverty rates for the <u>elderly</u>, from 7.5%, according to the official measure, to 8.5% using the VPM.

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Overview

The Great Recession of 2008-2009 and the tentative economic recovery in the years after have left many individuals and families in precarious financial straits. Significant income losses have increased reliance on the nation's social safety net. Worries about unemployment and personal financial well-being are combined with increased federal spending and state budget shortfalls.

This is the context in which the Weldon Cooper Center for Public Service began its work in constructing an alternative poverty measure for Virginia and its local regions. Much has been said about the poor during the recent economic downturn, and many have struggled to comprehend the full extent of economic deprivation in the commonwealth. The goal of this project is to more accurately identify and better understand the population in economic distress in Virginia by developing an improved measure of poverty.

To do so, this work follows many of the recommendations from the National Academy of Sciences seminal 1995 report *Measuring Poverty: A New Approach* which outlines improvements to be made in the United States' official poverty measure. Since the release of that report, many researchers have investigated implementing alternative poverty measures at the national and state levels. The following work represents a continuation of these efforts and draws upon the best practices and findings from poverty researchers around the country.

The Official Poverty Measure

The official poverty measure is the statistic most frequently used to capture the economic status of lowincome individuals. The original poverty measure was developed in the early 1960s by Mollie Orshansky, a food economist working for the Social Security Administration. Based on her research on the eating habits of low-income families, Orshansky's newly developed poverty measure estimated a family's *overall* income needs based on the cost of minimal *food* consumption.¹ Specifically, poverty was defined as having cash income below three times the cost of eating on the U.S. Department of Agriculture's Economic Food Plan from the 1960s. At the time Orshansky developed the thresholds, food costs, on average, accounted for about a third of family budgets. This definition, adjusted for family size and composition, established a set of income thresholds used to determine if a family was in poverty. The Orshansky thresholds became the basis of the official U.S. measure of poverty in 1969 and have not changed in basic structure since. The thresholds are only updated for inflation. For 2011, the federal poverty line for a family of four, with two adults and two children, was just over \$22,800 in annual income.²

¹ For more information see: U.S. Census Bureau, "How the Census Bureau Measures Poverty," (Washington, DC: U.S. Census Bureau, 2010).

² U.S. Census Bureau, "Poverty Thresholds for 2011 by Size of Family and Number of Related Children Under 18 Years," (Washington, DC: U.S. Census Bureau, 2011).

After establishing the thresholds, the official poverty measure defined what resources will be considered in evaluating whether families fall above or below the thresholds. Under the official definition, only *cash* income is considered in the poverty calculation. Cash income is income from wages, interest, business profits or losses, and cash transfer programs in the social safety net, such as Social Security Retirement, Supplemental Security Income (SSI), and Temporary Assistance for Needy Families (TANF). Income from all of these resources is added together and compared to the poverty thresholds to determine whether a family is in or out of poverty.

The Current Population Survey (CPS) is used as the official data source for calculating poverty rates for the nation. The CPS is a monthly, telephone-based survey of about 60,000 sample households nationwide. The survey is administered by the Census Bureau in sponsorship with the Bureau of Labor Statistics. Its primary purpose is the measurement of labor force and employment statistics, including the official monthly unemployment rates for the nation. In March, sample households are administered the Annual Social and Economic Supplement (CPS ASEC) which asks detailed questions on income, the sources of that income, health insurance coverage, and public program participation, among other topics. The March CPS ASEC is used for calculating the official poverty rates.³

In recent decades, the accuracy and validity of the official poverty measure has been called into question. The most notable criticisms come from the National Academy of Sciences report, *Measuring Poverty: A New Approach*: ⁴

- 1. There have been significant changes in the standard of living and consumption patterns of U.S. families since the 1960s. For example, the costs of many household necessities, such as medical expenses and child care, have risen over time, while food costs (the basis for the official poverty thresholds) have declined as a proportion of family budgets.
- 2. The official poverty thresholds are the same across the nation and do not account for regional differences in the cost of living. Housing costs are particularly variable across localities and have differential impacts on family and individual budgets as a result.
- 3. Not all of the resources available to low-income households are accounted for in the official poverty measure. For instance, many of the country's largest public assistance programs and tax credits aimed at the poor are excluded from income calculations and are not factored into final poverty rates. Notably absent are Food Stamps (now the Supplemental Nutrition Assistance Program (SNAP)), public housing and voucher programs, and the Earned Income Tax Credit (EITC).

³ The CPS ASEC only surveys the civilian non-institutionalized population. The universe of people considered for poverty statistics is further limited by excluding nursing home residents, those living in college dormitories, and children under the age of 15 who are unrelated to the household head or are living alone.

⁴Constance Citro and Robert Michael, eds., *Measuring Poverty: A New Approach*, (Washington, DC: National Academy Press, 1995), 2-3.

NAS concluded in 1995 that the official poverty measure should be updated in order to remain useful and relevant for researchers, policymakers, and the broader public. The most visible attempt at implementing NAS recommendations has been the U.S. Census Bureau's Supplemental Poverty Measure.

The Supplemental Poverty Measure

In 1999, the Census Bureau began experimenting with alternative poverty measures, following many of the recommendations made by NAS in 1995. These measures incorporated a broader array of resources in family income, and subtracted necessary expenses, such as health care or child care. Thresholds were also designed and updated to better reflect contemporary consumption patterns. The Census Bureau research examined and resolved some of the technical difficulties in implementing an NAS-style poverty measure. In particular, work was done on how to most appropriately measure non-cash resources in the CPS ASEC (such as housing assistance) and necessary expenses (such as child care). In their research, the Census Bureau found that many of these new poverty measures would result in higher poverty rates (compared to the official measure) for some groups and lower rates for others. For instance, a greater number of elderly people and working families were considered poor after including medical costs and tax liabilities. Including a broader array of public assistance programs and tax credits, however, lowered poverty rates for children and some racial minorities.⁵

After a decade of research, the Census Bureau began developing the Supplemental Poverty Measure (SPM). Like the official poverty measure, the SPM uses detailed data from the CPS ASEC to create annual estimates of the number of people who are in financial distress. Unlike the official poverty measure, the SPM accounts for:

- Regional differences in the costs of living;
- Current consumption patterns among American families under newly developed thresholds;
- A broader array of financial resources available to low-income households;
- The effects of taxes and credits; and
- Necessary expenditures such as child care and health care.⁶

In 2011, the newly released SPM reported a national poverty rate of 16% for 2010, while the official rate for that year was 15.1%.⁷ Like the experimental poverty measures from a decade before, significant differences also emerged across demographic groups. For example, the SPM recorded lower poverty rates for children under the age of 18 and higher poverty rates for the elderly age 65 and over.

⁵ Kathleen Short et al., "Experimental Poverty Measures," *Current Population Reports* (U.S. Census Bureau, 1999), 60-205.

⁶ The SPM is also based on a wider universe of the population by including unrelated children under age 15 and foster children in its poverty statistics.

⁷ The official rate increases to 15.2 percent when unrelated children under the age of 15 are included in the poverty universe, the same universe as the SPM.

The Census Bureau emphasizes that the SPM is for research purposes only and will not replace the official poverty measure; nor will it be used for program eligibility determinations. Nonetheless, the SPM estimates have garnered much attention, and the new poverty estimates are now widely believed by researchers to more effectively reflect the population in poverty than the official poverty measure.

Why an Alternative Poverty Measure for Virginia?

Despite the Census Bureau's noteworthy efforts through the SPM project at the national level, local poverty statistics must still heavily rely on official definitions using the Orshansky thresholds.⁸ The only survey conducted by the Census Bureau that allows for reliable, yearly estimates at the state and substate level is the American Community Survey (ACS). The ACS is a continuous, mail-based, national survey with an annual sample of approximately three million households (250,000 per month, every month). Similar to the CPS ASEC, the ACS questionnaire asks respondents basic demographic questions relating to sex, age, race, and ethnicity. The ACS also asks questions regarding individual income, but, unlike the CPS ASEC, these questions are far less detailed. For example, the 2011 ACS questionnaire asks eight questions about personal income, and the sources of that income, while the CPS ASEC questionnaire asks over 80 questions on this topic.

The lack of detail about income in the ACS prevents the direct application of the SPM to sub-state levels. As a result, only poverty rates based on official definitions are available at the local, sub-state level through the ACS. This is unfortunate for those who wish to gain a better understanding of low-income populations in a particular locality.

In the past five years, selected states and organizations have attempted to circumvent these problems. The most notable efforts have been the "Wisconsin Poverty Measure" developed by the Institute for Research on Poverty at the University of Wisconsin;⁹ the alternative poverty measure developed for New York City by the Center for Economic Opportunity;¹⁰ and the ongoing research done by the Urban Institute.¹¹ The poverty measures developed by these organizations attempt to add information to the ACS so that an NAS-style poverty measure can be developed to produce sub-state estimates. There are many differences in the methodologies across these organizations, but their poverty measures often yield results similar to the SPM estimates.

This report provides details on a new "Virginia Poverty Measure," an NAS-style poverty measure that more accurately measures the population in economic deprivation in the commonwealth. This work draws on past Census Bureau research and the best practices from the alternative poverty measures developed for other states. Section One of this report is a methodological overview for the Virginia Poverty Measure. The section outlines the components of the measure, how it compares with the

⁸ SPM estimates are now available at the state level; however, these estimates rely on three-year averages of CPS ASEC data. Sample size limitations usually require the aggregation of two or three years of data so that the margins of error for estimates are not prohibitively large.

⁹ Yiyoon Chung et al., "Wisconsin Poverty Report: Policy Context, Methodology, and Results for 2010," (Madison: Institute for Research on Poverty, 2012).

¹⁰ Center for Economic Opportunity, "The CEO Poverty Measure, 2005-2012: A Working Paper by the NYC Center for Economic Opportunity," (New York: 2012).

¹¹ Sheila Zedlewski et al., "Measuring Poverty at the State Level," (Washington D.C.: Urban Institute, 2010).

official poverty measure and SPM, and how it uses the ACS to implement the measure. Section Two summarizes results for 2011, the most recent year for which ACS data are available, and why the new poverty estimates differ from both the official and SPM estimates from the Census Bureau. Section Three elaborates on additional avenues for research and possible refinements to the Virginia Poverty Measure.

Section One: Methodology

The Virginia Poverty Measure (VPM) is a new poverty measure for Virginia that follows many of the National Academy of Sciences (NAS) recommendations and is informed by the last decade of experimentation in alternative poverty measures. To help understand how the VPM measures poverty, five subjects will be covered in this section:

- 1. Data sources
- 2. Poverty universe and unit of analysis
- 3. Poverty thresholds
- 4. Family resources and subtractions from income
- 5. Local-level poverty estimation

The official poverty measure,¹² the SPM, and the VPM all differ in methodology. The subsections that follow detail how the VPM approaches each element in the methodology, and how it compares to the other measures.

Data Sources

The VPM relies on individual-level microdata from the ACS, which, unlike the CPS ASEC (used in the SPM and the official poverty measure), has a large enough sample size for yearly state and local estimates. Specifically, this analysis uses data from the Integrated Public-Use Microdata Series (IPUMS) project from the University of Minnesota, which provides Census Bureau microdata in a consistent format across years and samples.¹³

Using the ACS IPUMS data for the VPM is a significant, but necessary, departure from the CPS ASEC data used in creating the official poverty measure and the SPM at the national level. The CPS ASEC and the ACS differ not only in sample size, but also in sampling scheme, questionnaire format, survey administration, and ultimate purpose. While the CPS ASEC and ACS data have historically reported similar poverty rates at the national and state levels, the differences between the surveys can lead to different tabulations across demographic characteristics.¹⁴

Table 1 summarizes Virginia's poverty rates (using official definitions) across the two surveys. The largest differences between the CPS ASEC and ACS are noted in the poverty rates for Virginia's racial and ethnic minorities, particularly Hispanics. Also, the CPS ASEC has much larger margins of error for

¹² Heretofore referred to as Census Bureau methods using either the CPS ASEC or ACS to compare cash income to the original Orshansky thresholds.

¹³ The VPM methodology also uses IPUMS data from the CPS ASEC when necessary. Steven Ruggles et al., *Integrated Public Use Microdata Series: Version 5.0* [Machine-readable database], (Minneapolis: University of Minnesota, 2010).

¹⁴ Alemayehu Bishaw and Sharon Stern, "Evaluation of Poverty Estimates: A Comparison of the American Community Survey and the Current Population Survey," (U.S. Census Bureau, 2006).

	2011-2012 CPS ASEC ^a	MOE ^b (+/-)	2011 ACS	MOE ^b (+/-)
Virginia Poverty Rate	11.1	1.3	11.6	0.4
Rates by Age				
Ages 0 - 17	14.0	2.0	15.6	0.9
Ages 18 - 64	10.3	1.4	11.0	0.4
Ages 65 and Over	9.9	2.5	7.5	0.6
Rates by Race				
Whites	8.4	1.4	8.7	0.4
Blacks	21.8	4.4	19.1	1.2
Asians	8.2	4.8	8.1	1.7
Hispanics	11.0	4.0	18.2	2.5
Others	10.0	7.6	16.2	3.3
Rates by Sex / Marital Status				
Single Females	17.6	2.1	18.6	0.8
Single Males	14.1	2.6	15.2	0.7
Married Females	5.1	0.9	4.3	0.4
Married Males	4.8	0.9	3.9	0.4

^a The CPS ASEC asks respondents to report income from the previous calendar year. The 2011 and 2012 CPS ASEC datasets are aggregated together to report a 2010-2011 average poverty rate, resembling the timeframe for the 2011 ACS income questions which ask respondents in each month of 2011 to report income from the previous 12 months.

b Margins of error form a 95% confidence interval.

subpopulations within Virginia than the ACS, even when aggregating multiple years of data. Using the ACS for the VPM will ensure more precise estimates for Virginia and its demographic groups.

Poverty Universe and Unit of Analysis

Poverty rates for the VPM are calculated for all people living in households. This practice differs from the one employed by the official poverty measure which calculates poverty rates for those in households and some in non-institutional group quarters. Unfortunately, the ACS IPUMS data does not have enough information on those who live in non-institutional group quarters to discern who should be included in the poverty universe (e.g. those in group homes or shelters) and who should not (e.g. those

in military barracks or college dormitories). Due to this limitation, the universe for the VPM is limited to those who live in households; this includes houses, apartments, condos and similar domiciles.¹⁵

The official poverty measure also excludes from its poverty universe children under the age of 15 who are not related to the household head (such as foster children). The SPM adds these unrelated children into its universe. The VPM follows this SPM practice.

Within households, the official poverty measure uses the "family" as the basic unit of analysis for aggregating resources, rather than the entire household. For instance, *family units* for the official poverty measure group individuals within a household only if they are related by birth, marriage, or adoption; all other individuals over the age of 15 are either their own individual unit or a part of unrelated families. Unmarried partners, foster children, and other unrelated minors are counted separately from the family of the household head. In contrast, the SPM groups unmarried partners, family members of the unmarried partner, most foster children, and unrelated children under the age of 15 as being in the same *resource unit* as the household head. This alternative arrangement is widely believed to better reflect actual resource sharing within contemporary American households.¹⁶

The VPM constructs resource units similarly to the method employed by the SPM. Unmarried partners, their family members, and unrelated children under the age of 15 are grouped with the family of the household head. Other individuals within a household either form individual resource units or form unrelated families as identified by the ACS IPUMS data.¹⁷ Further elaboration and details concerning family units for the VPM are located in Appendix A.

Poverty Thresholds

Poverty thresholds define who is, and who is not, in poverty. To better understand the VPM poverty thresholds, an overview of the official and SPM methodologies is prudent.

First, the official poverty measure relies on the Orshansky thresholds developed in the 1960s. These thresholds, adjusted for family size and composition, are based on three times the cost of minimal food consumption. As outlined by the NAS report, contemporary consumption patterns for American families have changed significantly since the 1960s. Food costs are no longer one third of the average family budget, and the share of other expenses has risen sharply. For this reason, the newly developed SPM takes a different approach in constructing income thresholds to define poverty.

¹⁵ A similar approach is used by many other poverty researchers relying upon the ACS. See Trudi Renwick et al., "Using the American Community Survey (ACS) to Implement a Supplemental Poverty Measure (SPM)," (U.S. Census Bureau, Social, Economic and Housing Statistics Division, 2012), 4.

¹⁶ Ashley J. Provencher, "Unit of Analysis for Poverty Measurement: A Comparison of the Supplemental Poverty Measure and the Official Poverty Measure," (Paper Prepared for the Joint Statistical Meetings, 2011).

¹⁷ The IPUMS project imputes information in the ACS microdata to provide more detail on the relationships between people residing in a particular household. These relationship imputations allow for the identification of unrelated subfamilies within a household and aided in the creation of resource units for the VPM.

	Official Poverty	SPM	VPM
PRIMARY DATA SOURCE	CPS ASEC	CPS ASEC	ACS IPUMS
POVERTY UNIVERSE	Poverty is measured for the civilian, non-institutionalized population excluding college dormitories, nursing homes, and unrelated children under the age of 15.	The SPM measures poverty for the same population as the official measure but includes unrelated children under age 15.	Only persons living in households are included in poverty calculations. All group quarters residents are excluded from analysis.
UNIT OF ANALYSIS	The family is the base unit of analysis for aggregating resources to determine poverty status. Families are defined by being related by birth, marriage, or adoption.	The SPM uses the family as its unit of analysis as in the official measure, but groups unrelated children under 15, foster children, and unmarried partners and their children with the family of the household head.	Same as the SPM.
BASIS FOR THE THRESHOLDS	Thresholds are set at three times minimum food costs in the 1960s and annually adjusted for inflation.	Thresholds are based on updated consumption patterns for food, clothing, shelter, and utilities at the 33rd percentile of family spending as reported in the Consumer Expenditure Survey.	The VPM thresholds are the same as in the SPM but with the addition of necessary medical expenses along with food, clothing, shelter, and utilities.
VARIATION IN THE THRESHOLDS	The thresholds vary by family size, age of householder, and number of dependent children.	Not only do the thresholds vary by family size and composition as in the official poverty measure, but they also vary by housing tenure and whether home owners have a mortgage.	The VPM thresholds vary just as in the SPM but with additional variation due to the inclusion of medical expenses. Necessary medical costs vary by family size, age of members, and type of health insurance coverage.
ADJUSTMENTS FOR REGIONAL VARIATION IN COSTS OF LIVING	None.	SPM thresholds are adjusted across different regions by only varying the housing portion of the threshold. ACS 5- year data on median gross rents for two- bedroom units serve as the basis for these regional cost of living adjustments.	The entire food, clothing, shelter, utilities, and health care bundle is adjusted for regional differences in the costs of living. The Regional Price Parities produced by the Bureau of Economic Analysis serve as the basis for the adjustments.

Table 2: Data source, poverty universe, and thresholds in comparison

The SPM uses recent data from the Consumer Expenditure Survey (CE) to construct its thresholds. The CE is a national survey conducted by the Bureau of Labor Statistics. One of the primary uses of the CE is to revise the Consumer Price Index (CPI) which is used for official inflation adjustments. Of greater importance for poverty researchers, the CE provides detailed information on how American families spend their money.

Unlike the official Orshansky thresholds, which are based solely on food consumption, the SPM defines the thresholds using updated CE consumption data on food, clothing, shelter, and utilities (FCSU) as the basis for necessary spending. FCSU spending for a two-child consumer unit at the 33rd percentile of all such units in the CE define the base thresholds for the SPM. These base thresholds vary according to family size and composition and further according to whether a family owns a home with a mortgage, owns a home free and clear, or rents their home in order to better capture the different spending needs across these groups.¹⁸

¹⁸ Thesia Garner, "Supplemental Poverty Measure Thresholds: Laying the Foundation," (Bureau of Labor Statistics, Division of Price and Index Number Research, 2010).

VPM thresholds start with the thresholds developed for the SPM. The SPM base thresholds for a twoadult, two-child family are applied to the ACS data based on reported resource unit characteristics, tenure, and mortgage status. The end result is that every VPM resource unit is assigned an FCSU poverty threshold.

Unlike the SPM, the VPM makes an addition to the FCSU thresholds to account for <u>necessary medical</u> <u>costs</u>. With growing medical costs since the 1960s, one of the most significant recommendations from NAS was to account for these expenses in any new poverty measure. The SPM does this through a new series of questions added to the CPS ASEC that ask respondents how much they spend, out-of-pocket, on health care (including insurance premiums, co-pays, and over-the-counter drugs). These totals are then subtracted from resources during the poverty calculation. Despite its simplicity, the SPM method for accounting for out-of-pocket medical expenses has drawn criticism from other poverty researchers.¹⁹ Among the concerns is that the SPM conflates *actual* spending on medical care with *necessary* spending on medical care. For instance, the SPM method does not account for under-utilization of health care serves by low-income households.

An alternative approach is to incorporate medical expenses in the poverty thresholds and treat medical costs like food or shelter (FCSUM thresholds). This method has been endorsed by the Wisconsin Institute for Research on Poverty and the Urban Institute and is used in their local-level NAS-style poverty measures.

Following this alternative, the VPM creates FCSUM poverty thresholds <u>by adding out-of-pocket medical</u> <u>expenses</u> to the base poverty thresholds described previously. Since medical needs vary tremendously by family type, relative health status, and insurance coverage, the medical portion of the FCSUM thresholds is modified using Census Bureau methods to account for variation in family size, health insurance coverage, and age of family members.²⁰ The adjusted medical portions of the poverty thresholds are added to the FCSU portions of the thresholds for each VPM resource unit in the ACS data.

The last adjustment made to the poverty thresholds is for <u>regional differences in the cost of living</u>. Unlike the official poverty measure, the SPM modifies its thresholds to account for geographic differences in housing costs. The housing portions of the FSCU thresholds for the SPM are adjusted using 5-year ACS data on median gross rents by metropolitan area.

The VPM takes a different approach in making geographic cost of living adjustments. Instead of only adjusting the housing portions of the thresholds, the VPM accounts for regional differences in the costs of <u>all</u> major goods and services. To do this, the FCSUM thresholds for each VPM family unit are adjusted using Regional Price Parities produced by the Bureau of Economic Analysis, which are available for all major metropolitan areas within each state and represent 5-year averages in price differences.²¹ These indices are used to adjust dollar values across geography in a manner similar to how the CPI is used to adjust dollar values across time. Geographically-specific indices are matched to ACS data using the

¹⁹ Erin Kalinosky and Beth Kohler, "Treatment of Medical Care Expenditures in Poverty Measurement: The National Academy of Science Panel Proposal," *Institute for Research on Poverty,* Accessed January 2012, <u>http://www.irp.wisc.edu/research/method/kalinkohl.htm</u>.

²⁰ Short, "Experimental Poverty Measures," A-11–A-12.

²¹ Bettina H. Aten, Eric B. Figueroa, and Troy M. Martin, "Regional Price Parities for States and Metropolitan Areas, 2006-2010," *Survey of Current Business*, (Bureau of Economic Analysis, 2012), 229-242.

geographic pointers for identifiable metropolitan areas. All records that cannot be identified with a major metropolitan area are given the average regional index for all non-metropolitan areas within Virginia.²²

After making these geographic adjustments, VPM poverty thresholds are complete, defining poverty by accounting for cost differences across regions, medical expenses, family size and composition, and updated spending patterns among American families. Table 3 compares the VPM thresholds for a two-adult, two-child family to the official and SPM calculations. Note the increase in the VPM thresholds compared to the SPM due to the inclusion of medical expenses. Appendix B provides further details on how the VPM thresholds were constructed.

Table 3: Poverty thresholds for two-adult, two-child units in comparison

	Withou	With Geo. Adj.		
	Official Orshansky ^a	SPM (FCSU) ^a	VPM (FCSUM) ^b	VPM (FCSUM) ^b
Owners without Mortgage	\$22.811	\$21 175	\$73.763	\$23.657
Owners with Mortgage Renters	22,811 22,811 22,811	25,703 25,222	27,920 27,179	29,442 28,314

^a The official Orshansky thresholds do not vary by tenure and ownership status. The SPM thresholds are the base thresholds for consumer units at the national level for 2011.

^b The VPM thresholds represent averages due to the additional variation in the medical portion of the thresholds and the geographic adjustments for regional differences in the cost of living.

Family Resources and Subtractions from Income

The official poverty measure and SPM rely on the CPS ASEC to calculate family resources for their poverty rates. The primary advantage of using the CPS ASEC to measure resources is that the survey is detailed in its questions on income, the sources of that income, and the public programs in which families participate. On the contrary, any poverty measure, like the VPM, that relies on the ACS will not have this level of detail. As a result, this necessary information must be imputed.

²² See Trudi Renwick, "Alternative Geographic Adjustments of U.S. Poverty Thresholds: Impact on State Poverty Rates," (U.S. Census Bureau, 2009).

The ACS reports the following sources of income for families:

- 1. Wages, salary, and tips
- 2. Profits or losses from businesses and farms
- 3. Interest, dividends, and rents
- 4. Retirement pensions
- 5. Social Security Administration programs
- 6. TANF and other benefits from cash assistance welfare programs

These sources of *cash* income are added together to create the set of family resources to compare against official poverty thresholds. The NAS, however, recommends including a broader array of resources not reported in ACS data. For instance, the SPM includes the following <u>additions</u> to the resources above:

- 7. Food Stamps (SNAP)
- 8. Low-income Home Energy Assistance Program (LIHEAP)
- 9. Housing assistance (i.e. public housing and housing voucher programs)
- 10. Women, Infants, and Children (WIC)
- 11. The National School Lunch Program
- 12. Federal and state refundable tax credits (e.g. the Earned Income Tax Credit)

The SPM also takes into consideration possible <u>subtractions</u> from family resources that represent necessary expenditures:

- 13. Payroll taxes
- 14. Federal and state income taxes
- 15. Necessary work-related expenses (e.g. child care and transportation)
- 16. Out-of-pocket medical expenses

While providing data on resources 1-6, the ACS provides no information on resources and subtractions 7-16.²³ This data must be imputed into the ACS data. There are two major sets of imputations done to the ACS data for constructing the VPM: (1) imputing public program participation and the value of benefits; and (2) imputing tax credits, liabilities, and other subtractions from income.

Most imputations for the VPM are informed by information available in the CPS ASEC. Specifically, program participation and benefit amounts are imputed using a statistical match with CPS ASEC microdata²⁴ – where household and individual records in the CPS ASEC are matched to similar household and individual records in the ACS through logistic or regression modeling. The relevant pieces of information from the matched CPS ASEC data, in this case program participation and benefit amounts, are then donated to the ACS.

²³ The one exception to this is that the ACS reports program participation in SNAP, but does not report the amount of benefits received. Also, because the VPM accounts for medical expenses in its thresholds, estimating out-of-pocket medical expenses and subtracting this from income is not necessary.

²⁴ In order to provide quality estimates and offset sample size discrepancies between the ACS and CPS, three years of CPS ASEC microdata are aggregated for statistical matching purposes.

Official Poverty	SPM	VPM
 Wages, Salary, and Tips Business and Farm Income Rents Investment Income Retirement and Pension Income Social Security Benefits Supplemental Security Income (SSI) TANF and Other Welfare Benefits Unemployment Benefits Child Support 	 Wages, Salary, and Tips Business and Farm Income Rents Investment Income Retirement and Pension Income Social Security Benefits Supplemental Security Income (SSI) TANF and Other Welfare Benefits Unemployment Benefits Child Support 	 Wages, Salary, and Tips Business and Farm Income Rents Investment Income Retirement and Pension Income Social Security Benefits Supplemental Security Income (SSI) TANF and Other Welfare Benefits "Other Income" "Other Income"
In-Kind Benefits	 SNAP (Food Stamps) LIHEAP (Energy Assistance) WIC National School Lunch Program Housing Assistance 	 SNAP (Food Stamps) LIHEAP (Energy Assistance) WIC National School Lunch Program Housing Assistance
Resource Subtractions	 Payroll Taxes Federal Income Taxes State Income Taxes Child Care Expenses Work-Related Expenses Necessary Medical Expenses Child Support Payments 	 Payroll Taxes Federal Income Taxes State Income Taxes Child Care Expenses Work-Related Expenses
Adjustments		 Participation and benefit amounts for SNAP, Welfare, SSI, and Energy Assistance are controlled to state administrative totals.

Table 4: Resource additions and subtractions in comparison

State administrative records on participation in SNAP, LIHEAP, SSI, and welfare programs are used as control totals for the imputation process. Participation and payments for these programs are made to closely match those reported by the Virginia Department of Social Services and the Social Security Administration.^{25, 26} Further elaboration on this imputation methodology and controlling participation totals is provided in Appendix C.

For programs that do not have benefit amounts reported in the CPS ASEC (such as WIC, the National School Lunch Program, and Housing Assistance), Census Bureau methods for the SPM are used to estimate benefit amounts. Details on how each of these benefits are calculated can be found in Appendix C.

²⁵ Virginia Department of Social Services, "2012 Annual Statistical Report," (VDSS, 2013), Accessed January 2013, http://www.dss.virginia.gov/files/about/reports/agency_wide/annual_statistical/pdf_versions/2012.pdf.

²⁶ U.S. Social Security Administration, SSI Recipients by State and County, 2011, (Office of Research, Evaluation, and Statistics; Office of Retirement and Disability Policy, 2012), Accessed January 2013, http://www.ssa.gov/policy/docs/statcomps/ssi_sc/index.html.

Federal and state income taxes, as well as payroll taxes, are simulated using federal and state tax rules. All persons with earned income are assumed to pay payroll taxes, and the appropriate rates and rules are applied to earned income for all workers identified in the ACS data. For income taxes, all households in the ACS are divided into tax filing units, and a simulated IRS 1040 federal income tax form is completed for each unit (all units are assumed to file a tax return). Filing statuses, adjusted gross income, exemptions, deductions, and credits are all simulated using available ACS data. Using information from the simulated 1040 federal return, a Virginia Resident Form 760 is then simulated for each unit. All units with positive tax liabilities have these totals subtracted from their income. All units with negative liabilities (as a result of refundable tax credits that exceed income taxes) have these totals added to their income.²⁷ Appendix D provides more details on the VPM tax simulator and how its tax estimates compare to IRS totals.

Child care expenses are imputed for families in the ACS data using a statistical match with the CPS ASEC. Only families with dependent children and no non-working adults are considered for imputation. Other work-related expenses (such as transportation) are calculated using Census Bureau methods for the SPM. See Appendix C for more details.

Local-level Poverty Estimation

With an alternative poverty measure that uses the ACS as its base dataset, local-level, sub-state estimates for poverty rates can be calculated. For local-level VPM poverty rates, geographic units must be based on Public-Use Microdata Areas (PUMAs), the smallest unit of geography for estimation in public-use ACS microdata. PUMAs adhere to county jurisdictional boundaries and are formed so that population totals are roughly 100,000 people. In rural areas, PUMAs contain multiple counties, while counties contain multiple PUMAs in urban areas.

Figures 1 and 2 display Virginia's PUMAs and the 11 VPM regions aggregated from them. VPM regions were constructed around PUMAs using three criteria: (1) regions define parts of Virginia with similar demographic and economic characteristics, (2) sample sizes in the ACS microdata for each region are sufficient for precise estimates, and (3) regions show meaningful variation in poverty rates across the commonwealth. Appendix E lists the specifications for each VPM region.

²⁷ Most low-income families have little to no federal or state income tax liabilities. They do, however, often receive income tax refunds as the result of credits, such as the Earned Income Tax Credit (EITC) or the Additional Child Tax Credit.

Figure 1: Virginia's Public-Use Microdata Areas (PUMAs)



Figure 2: VPM regions with county outlines



Section Two: Results

Compared to the official measure, the VPM reports a similar poverty rate for all of Virginia (for 2011), but finds significant differences among population subgroups and across geographic areas. By accounting for the effects of taxes, medical expenses, in-kind benefits, regional differences in the costs of living, and updated thresholds, the VPM highlights differential impacts of these elements across different populations in Virginia.

Poverty Rates for Virginia and Population Sub-Groups

Using the VPM, the poverty rate for Virginia for 2011 is 11.9%, or 936,000 people, below the VPM poverty thresholds (an average of about \$29,000 in annual income for a two-adult, two-child family but with significant variation based on housing tenure, regional costs of living, and necessary medical expenses). This total is not significantly different from the 11.6% rate derived by the official poverty measure in the ACS. Significant differences emerge, however, among population subgroups. Table 5 presents poverty rates found by the VPM in comparison to official definitions and the SPM.

Some of the most significant differences between VPM and official poverty rates are across age groups. For example, many low-income benefit programs target or give preferential benefits to families with children. In fact, it is often difficult for many low-income Virginians who are single and have no children to be eligible for benefits unless they also have a serious disability or are elderly. By using a broader definition of resources for the VPM that includes more of these benefit programs, children are less likely to be classified as impoverished. The inclusion of SNAP, WIC, school lunch subsidies, and refundable tax credits, such as the EITC and Additional Child Tax Credit, dramatically lower child poverty rates reported by the VPM. As shown in Table 5, the VPM reports a 13% poverty rate for children under the age of 18, 2.6 points lower than the official poverty measure using the ACS (15.6%). Conversely, the inclusion of necessary medical expenses, along with tax liabilities and work-related expenses, contributes to significantly higher poverty rates among working-age adults (12.2%) and the elderly over the age of 65 (8.5%), compared to official estimates.

The VPM also reports significantly lower poverty rates for single females, and higher rates for married couples, compared to official rates. The lower rate for single females (17.1%) is the result of a similar dynamic seen with families with children. Single-female families also receive preferential benefits from low-income programs, and more favorable tax rates and credits. In contrast, tax liabilities and medical expenses contribute to the significantly higher poverty rates for married couples (5.8% for married females, 5.6% for married males).

Across racial groups, the VPM poverty rates are similar to official estimates. Only the differences for Asians (12.3%) and Hispanics (23.1%) can be said to be significant. The large margins of error on the single-year VPM estimates for Virginia's minority groups prevent solid conclusions. The large increase in the Asian and Hispanic poverty rates between the two measures, however, is notable, and similar increases are observed in the SPM over the official rates. Citizenship, program eligibility, language barriers, outreach, and cultural issues might be factors for these low-income populations in receiving enough government benefits to offset expenses. Also, Hispanics and Asians in Virginia predominately live in high-cost metropolitan areas, particularly Northern Virginia.

	2011-2012 C	PS ASEC		CS			
	SPM	MOE ^a (+/-)	Official Poverty Measure	MOE ^a (+/-)	VPM	MOE ^b (+/-)	
Virginia Poverty Rate	13.3	1.6	11.6	0.4	11.9	0.7	
Rates by Age							
Ages 0 - 17	14.6	2.5	15.6	0.9	13.0	1.4	
Ages 18 - 64	12.7	1.5	11.0	0.4	12.2	0.7	
Ages 65 and Over	13.9	3.3	7.5	0.6	8.5	1.0	
Rates by Race							
Whites	9.5	1.5	8.7	0.4	8.5	0.6	
Blacks	22.3	3.9	19.1	1.2	18.1	2.0	
Asians	16.1	6.6	8.1	1.7	12.3	3.3	
Hispanics	19.6	5.7	18.2	2.5	23.1	4.6	
Others	18.4	14.1	16.2	3.3	16.1	3.9	
Rates by Sex / Marital Status							
Single Females	17.9	2.2	18.6	0.8	17.1	1.2	
Single Males	16.4	2.8	15.2	0.7	15.4	1.1	
Married Females	8.4	1.3	4.3	0.4	5.8	0.7	
Married Males	8.1	1.2	3.9	0.4	5.6	0.8	

Table 5: Virginia Poverty Rates by population subgroup, data source, and poverty measure*

* Totals for the official poverty measure, SPM, and VPM are based on different poverty universes and come from CPS ASEC or ACS IPUMS microdata.

^a Margins of error form a 95% confidence interval.

b Margins of error for the VPM are larger than for the ACS poverty rates using official definitions due to the error added from the imputation process. See Appendix F for details on variance estimation for VPM estimates. Margins of error form a 95% confidence interval.

Gradations of VPM Poverty

Despite the closeness of the VPM estimate to the official poverty rate for all of Virginia, differences emerge when considering varying levels of deprivation. Two additional gradations of the poverty thresholds are examined. Those who are in *deep poverty* fall below 50% of the poverty income thresholds while those who are in *near poverty* fall between 100 and 150% of the poverty thresholds. The VPM reports that 26.5%, over one in four Virginians, is in or near poverty (annual income under about \$43,500 for a two-adult, two-child family). This is compared to 19.3% under the official poverty measure. In contrast, the official poverty measure reports a greater proportion in deep poverty (5.3%) compared to the VPM (3.7%). The addition of in-kind benefit programs for low-income households in the VPM poverty calculation contributes to the significantly lower proportion of people in deep poverty. Yet, the higher VPM thresholds, in conjunction with the addition of tax liabilities and work-related expenses, bring a quarter of Virginia residents into poverty or near poverty. The SPM reports a similar pattern as the VPM: 27.1% are in or near poverty while 4.8% are in deep poverty. Figure 3 displays the proportion of people under these gradations of poverty for each measure.



Figure 3: Distribution of Virginians by income-to-threshold ratios

^a 2011 ACS data.

^b Data are from the 2011-2012 CPS ASEC for the SPM, 2011 ACS for official rates. The official poverty measure and SPM also have slightly different universes from the VPM which only considers those living in households and omits the group quarters population.

Poverty Rates across Regions

The larger sample size afforded to the VPM by using the ACS, rather than the CPS ASEC, makes sub-state poverty estimates possible. Table 6 presents VPM poverty rates across 11 Virginia regions. The most striking result is the significantly higher poverty rates in Northern Virginia compared to official estimates. The cost of living adjustments in the VPM had a particularly dramatic effect on rates in this region. Poverty rates in Fairfax (9.7%) and surrounding exurbs (9.4%), while still some of the lowest in Virginia, are substantially greater than what is reported by the official poverty measure. Residents inside the Beltway have a 66% higher poverty rate (12.3% under the VPM compared to 7.4% under official definitions). Southwest (16%) and Southside (14.7%) still report some of the highest rates in Virginia, but are significantly lower than official estimates. Interestingly, Virginia Beach and Chesapeake Region residents have one of the lowest rates in Virginia (9.7%) while their neighboring region just to the west (Norfolk, Hampton, Newport News, and Suffolk) has one of the highest poverty rates (15.4%) in the commonwealth. These results underscore the shortcomings of a "one-size-fits-all" poverty measure that does not account for regional differences in the cost of living.

		Official Poverty Rate	MOE ^a (+/-)	VPM	MOE ^a (+/-)	Percent Difference
1	Beltway	7.4	1.3	12.3	2.2	66.2
2	Fairfax	6.4	1.5	9.7	2.4	51.6
3	Northern Virginia Exurbs	6.5	1.2	9.4	2.0	44.6
4	North Valley and Piedmont	14.2	1.8	13.2	2.2	-7.0
5	South Valley and Piedmont	13.8	1.4	11.7	3.6	-15.2
6	Richmond Area	12.2	1.2	12.0	1.7	-1.6
7	Northern Neck and Eastern Shore	11.1	1.6	9.7	1.9	-12.6
8	Western Hampton Roads	15.8	1.5	15.4	2.3	-2.5
9	Southside	17.7	1.6	14.7	3.0	-16.9
10	Southwest	21.0	2.1	16.0	4.3	-23.8
11	Virginia Beach and Chesapeake	9.0	1.5	9.7	2.2	7.8

Table 6: 2011 VPM and official poverty rates by region

^a Margins of error form a 95% confidence interval



VPM and SPM Estimates in Comparison

The VPM rate for Virginia (11.9%) is lower than that of the SPM (13.3%). Despite many similarities, the VPM and SPM have two major methodological differences that account for most of the divergence in poverty rates. Table 7 presents poverty rates for the VPM under two alternative designs that more closely resemble the SPM. The first is a VPM that, like the SPM, does *not* control program participation totals to state administrative records. The second starts with the same VPM and uses SPM geographic adjustments in place of the Regional Price Parities. As shown, these two changes make the VPM estimates much closer to the SPM (the large difference in the rates for Hispanics is partly explained by the inherent differences between the ACS and CPS ASEC in measuring this population, see Table 1). Yet, these two VPM methodological differences are viewed as improvements on the SPM methodology, as elaborated in Section One.²⁸

VPM	Uncontrolled VPM	Uncontrolled VPM with SPM Geo. Adjustments	SPM
11.9	12.6	13.2	13.3
13.0	14.3	15.3	14.6
12.2	12.7	13.2	12.7
8.5	9.1	9.2	13.9
8.5	8.9	9.0	9.5
18.1	19.3	20.1	22.3
12.3	13.5	15.4	16.1
23.1	24.3	27.4	19.6
16.1	17.3	17.9	18.4
17.1	18.1	19.0	17.9
15.4	16.2	16.9	16.4
5.8	6.3	6.6	8.4
5.6	6.0	6.4	8.1
	VPM 11.9 13.0 12.2 8.5 18.1 12.3 23.1 16.1 17.1 15.4 5.8 5.6	VPM Uncontrolled VPM 11.9 12.6 13.0 14.3 12.2 12.7 8.5 9.1 8.5 9.1 8.5 13.0 11.9 12.6 11.9 12.6 13.0 14.3 12.2 12.7 8.5 9.1 8.5 10.1 12.3 13.5 23.1 24.3 16.1 17.3 17.1 18.1 15.4 16.2 5.8 6.3 5.6 6.0	VPM Uncontrolled VPM Uncontrolled VPM Uncontrolled VPM with SPM Geo. Adjustments 11.9 12.6 13.2 13.0 14.3 15.3 12.2 12.7 13.2 8.5 9.1 9.2 8.5 9.1 9.2 11.9 13.2 13.2 12.2 12.7 13.2 8.5 9.1 9.2 8.5 19.1 9.2 11.1 19.3 20.1 12.3 13.5 15.4 23.1 24.3 27.4 16.1 17.3 17.9 17.1 18.1 19.0 15.4 16.2 16.9 5.8 6.3 6.6 5.6 6.0 6.4

Table 7: VPM poverty rates under alternative designs resembling the SPM

^a Uncontrolled VPM totals are after imputing LIHEAP and SNAP participation and benefit amounts but before controlling to state administrative totals.

^b This is the Uncontrolled VPM using the average SPM geographic adjustments by metropolitan area for regional differences in the cost of living as reported in the CPS ASEC IPUMS data.

²⁸ A third major methodological difference with the SPM is the treatment of necessary medical expenses. Short and Garner (2002) found that national-level experimental poverty rates for 2000 were 0.5 percentage points lower when accounting for medical expenses by subtracting them from resources (SPM method) rather than accounting for medical expenses in the thresholds (VPM method). Further research is needed on how such a change would affect VPM poverty rates.

Component Effects on Poverty Rates

Particular additions to, and subtractions from, family resources have different impacts on final VPM poverty rates. For example, the addition of SNAP benefits to family resources has a much greater impact on Virginia poverty rates than the inclusion of school lunch subsidies. Figure 4 highlights how each resource addition and subtraction in the VPM affects its poverty rates. Table 8 shows these effects by demographic group.

Tax credits have the greatest effects on VPM poverty rates. Because many low-income families have negative income tax liabilities due to credits, such as the Earned Income Tax Credit or Additional Child Tax Credit, accounting for these in the VPM results in a two-point decrease in VPM poverty rates. Since these two major tax credits particularly benefit families with multiple children, their inclusion also results in a four-point decrease in VPM child poverty rates.

Other components of the VPM that add resources to family budgets also lower final poverty rates. The effect that SNAP benefits have on final rates is particularly notable. The program provides families with enough resources to lower the Virginia VPM poverty rate by 1.3 points. Also, the addition of SNAP benefits lowers the child poverty rate by 2.6 points. These results highlight another shortcoming of the official poverty measure, which does not account for the effects of taxes, SNAP benefits, and the other important in-kind benefit programs on low-income family budgets.

Necessary work expenses contribute the greatest increases in VPM poverty rates. As a result of their broad impact on every worker in Virginia, the inclusion of necessary work expenses, other than child care, results in a one point increase in VPM poverty rates. Payroll taxes have a similar effect.



Figure 4: Point Difference in VPM poverty rates after including selected components

	Tax Credits	SNAP	Housing Assistance	School Lunches	Energy Assistance	wic	Work Expenses	Payroll Taxes	Federal Income Taxes	Child Care Expenses	Virginia Income Taxes
Virginia Poverty Rate	-2.0	-1.3	-0.5	-0.2	-0.1	-0.1	1.0	0.8	0.4	0.4	0.3
Rates by Age											
Ages 0 - 17	-4.3	-2.3	-0.9	-0.5	-0.2	-0.2	1.2	1.2	0.4	0.8	0.3
Ages 18 - 64	-1.5	-1.0	-0.4	-0.1	-0.1	0.0	1.1	0.8	0.5	0.3	0.3
Ages 65 and Over	-0.2	-0.8	-0.4	0.0	-0.2	-0.1	0.2	0.2	0.1	0.1	0.0
Rates by Race											
Whites	-1.4	-0.8	-0.3	-0.1	0.0	0.0	0.7	0.5	0.3	0.2	0.2
Blacks	-3.3	-2.3	-1.3	-0.5	-0.4	-0.2	1.3	1.5	0.7	0.8	0.5
Asians	-1.6	-0.9	-0.1	0.0	-0.1	0.0	2.0	0.9	0.3	0.5	0.1
Hispanics	-3.6	-3.1	-1.0	-0.2	0.0	-0.4	2.7	1.3	1.4	1.1	1.0
Others	-2.6	-1.4	-0.8	-0.3	-0.3	-0.1	1.0	0.9	0.1	0.6	0.0
Rates by Sex / Marital Stat	us										
Single Females	-2.6	-2.1	-1.1	-0.3	-0.2	-0.2	1.4	1.0	0.5	0.6	0.3
Single Males	-2.4	-1.6	-0.6	-0.2	-0.1	-0.1	1.2	1.0	0.6	0.5	0.4
Married Females	-1.3	-0.5	-0.1	-0.1	0.0	0.0	0.7	0.5	0.2	0.2	0.2
Married Males	-1.2	-0.5	-0.1	-0.1	0.0	0.0	0.7	0.5	0.3	0.2	0.1

Table 8: Percentage point change in VPM poverty rates after including selected components*

* The effects of SNAP and Energy Assistance (LIHEAP) are calculated after participation totals are controlled to state administrative records.

Section Three: Discussion

The Virginia Poverty Measure fulfills the goal of providing poverty estimates that better reflect the actual population in economic distress in Virginia. This report's findings are consistent with Census Bureau research on the SPM at the national level and the results of alternative poverty measures in other states. The VPM represents an improvement over the <u>official Census Bureau poverty measure</u> by accounting for:

- Regional differences in the cost of living;
- Updated income thresholds based on contemporary consumption patterns;
- Family resources from in-kind government transfers;
- Taxes and credits; and
- Necessary medical expenses.

Several other improvements over the SPM methodology were implemented, including:

- Using the American Community Survey to allow for local-level estimates;
- Controlling program participation and benefit amounts to state administrative records; and
- Using the Regional Price Parities for the geographic adjustments.

More research on the VPM and its design, however, is warranted in the years to come. All poverty measures involve decisions about how poverty is defined and how the measure is implemented. As a benchmark, the VPM follows recommendations from the 1995 NAS report, and it employs a methodology based on Census Bureau research on the SPM and the best practices of organizations in other states that have designed their own alternative poverty measures. In addition, the author of this report identifies several avenues for further research and possible refinements to the VPM.

Further Research

By using the ACS as the basis for a poverty measure, researchers must make a number of imputations to develop an NAS-style poverty measure, a significant limitation of this approach. The methodology for these imputations not only contributes error to final estimates,²⁹ but also assumes that estimates from the CPS ASEC (the dataset which informs most of the imputations) are true and unbiased. All surveys are prone to error, and the CPS ASEC is no exception, especially when it comes to measuring participation and benefit amounts for low-income government programs. The VPM uses a statistical match to the CPS ASEC for its imputations because this method has been shown to provide better estimates of the mean and distribution of values over alternative methods (such as regression techniques), but the procedure is not perfect and still must rely on a survey with its own sources of error. The small sample size of the CPS ASEC for Virginia also poses a challenge for statistical matching. Since the ACS sample size is much larger than the CPS ASEC, one observation from the CPS ASEC may

²⁹ See Appendix F.

have to be matched to many ACS records. To help minimize this, the VPM uses three aggregated years of CPS ASEC data. Adding more years to improve the match, however, would only increase time frame discrepancies with the base ACS dataset.

One possible avenue for improving the quality of the VPM imputations is to use state administrative microdata on program participants for the statistical match. If available, this data would provide an excellent basis for imputation, as the administrative microdata would be comprehensive and provide actual benefit amounts. The main barriers are data availability and the process for obtaining this sensitive data. Also, any microdata made available to researchers may have data omitted for privacy reasons, thus possibly limiting the number of matching variables common to both datasets to make an accurate match.³⁰

Second, the VPM controls program participation totals to state administrative records for SNAP, LIHEAP, SSI, and welfare programs to provide more accurate poverty estimates. Participation in other programs (such as WIC, housing assistance, or free and reduced-price school lunches) is not adjusted. The decision on which programs to adjust and which to not adjust was based on the size of the programs (in terms of enrollment and total dollars) and the availability of quality administrative data that could be used to match totals. While these smaller programs have less impact on final poverty rates, as Table 8 illustrates, further experimentation on controlling participation in these other programs is currently being done and future iterations of the VPM may include more programs in this process.

The VPM also makes a significant departure from SPM methodology, and the methodology of other alternative poverty measures, in its cost of living adjustments. These geographic adjustments have a dramatic impact on poverty rates, and even small changes to the adjustments can result in large differences in final poverty rates. By relying on the Regional Price Parities, the VPM adjusts the poverty thresholds across the entire bundle of necessary goods, making it an attractive method. The SPM only adjusts the housing portion of the thresholds using ACS data on median gross rents. Housing is indeed one of the biggest expenses in family budgets, and housing costs vary the most across regions. As shown in Table 12 in Appendix B, the SPM adjustments show a much higher cost of living for the Washington D.C. metropolitan area than the Regional Price Parities, which considers all goods. It was decided that the Regional Price Parities better reflected the true variation in the cost of living and would be used for the VPM, but more research on each method, and possible alternatives, is needed.

Finally, the method for imputing necessary, work-related expenses (other than child care) in the VPM follows Census Bureau methods, but more nuanced approaches could be devised. These work-related expenses have a large impact on final poverty rates because they affect all wage earners. The VPM assigns work-related expenses to each worker over the age of 18 in each household in the ACS data. For 2011, this is set at \$27.16 per week worked for every worker. Yet, we know that work-related expenses, such as transportation, vary significantly based on a number of factors such as travel time to work, or the availability of public transportation. The Wisconsin Poverty Measure uses ACS data on commuting times to further adjust the Census Bureau estimates, and the VPM may employ a similar method in future.

 $^{^{30}}$ The VPM tax simulator could also benefit from matching to public-use IRS microdata on 1040 federal tax returns.

Conclusion

By following the conclusions and recommendations from the National Academy of Sciences 1995 report, the VPM represents an improvement on the official poverty measure. Although the VPM and the official poverty measure report similar poverty rates for all of Virginia in 2011, the VPM shows stark differences among Virginia's sub-populations and regions. Among these findings:

- The VPM reports a much higher poverty rate for Northern Virginia compared to official estimates. This is particularly true for the difference between the VPM poverty rate for Beltway residents (12.3%) and the official rate for that region (7.4%).
- The child poverty rate in Virginia is lower using the VPM and illustrates the targeted nature of many government programs not included in official statistics. By including these resources, the VPM poverty rate for children under the age of 18 in 2011 is 13.0%, significantly lower than the official rate of 15.6%.
- Including necessary medical expenses significantly increases poverty rates for the elderly, from 7.5% according to the official measure to 8.5% using the VPM.

These differences reflect (1) a more comprehensive definition of income and resources that better captures the true financial circumstances of Virginians, (2) updated thresholds that account for a broader array of goods and reflect the consumption patterns of contemporary American families, and (3) regional differences in the cost of living, among other modifications.

References

- Aten, Bettina H., Eric B. Figueroa, Troy M. Martin. "Regional Price Parities for States and Metropolitan Areas, 2006-2010." *Survey of Current Business*. Bureau of Economic Analysis, 2012.
- Bishaw, Alemayehu and Sharon Stern. "Evaluation of Poverty Estimates: A Comparison of the American Community Survey and the Current Population Survey." Washington, DC: U.S. Census Bureau, 2006.
- Bureau of Labor Statistics. "2011 Supplemental Poverty Measure Thresholds Based on Consumer Expenditure Survey Data." Accessed January 2013. http://www.bls.gov/pir/spm/spm_thresholds_2011.htm.
- Center for Economic Opportunity. "The CEO Poverty Measure, 2005-2012: A Working Paper by the NYC Center for Economic Opportunity." 2012.
- Chung, Yiyoon, Julia B. Isaacs, Timothy M. Smeeding, and Katherine A. Thornton. "Wisconsin Poverty Report: Policy Context, Methodology, and Results for 2010." Madison: Institute for Research on Poverty, 2010.
- Citro, Constance, and Robert Michael, eds. *Measuring Poverty: A New Approach*. Washington, DC: National Academy Press, 1995.
- Garner, Thesia. "Supplemental Poverty Measure Thresholds: Laying the Foundation." Bureau of Labor Statistics, Division of Price and Index Number Research, 2010.
- Johnson, Paul, Trudi Renwick, and Kathleen Short. "Estimating the Value of Federal Housing Assistance for the Supplemental Poverty Measure." Washington D.C.: U.S. Census Bureau, Social, Economic, and Housing Statistics Division, 2010.
- Kalinosky, Erin and Beth Kohler. "Treatment of Medical Care Expenditures in Poverty Measurement: The National Academy of Science Panel Proposal." Accessed October 2012. http://www.irp.wisc.edu/research/method/kalinkohl.htm.
- Little, Roderick and Donald Rubin. *Statistical Analysis with Missing Data*, 2nd Ed. New York: Wiley-Interscience, 2002.
- Levitan, Mark and Trudi Renwick. "Using the American Community Survey to Implement a National Academy of Sciences-Style Poverty Measure: A Comparison of Imputation Strategies." Presented at the Joint Statistical Meetings, Social Statistics Section. Vancouver, British Columbia, 2010.
- Marks, Joanna, Julia Isaacs, Timothy Smeeding, and Katherine Thornton. "Wisconsin Poverty Report: Technical Appendix for 2009." Madison: Institute for Research on Poverty, 2011.

- Potter, Frank, Eric Grau, John Czajka, Dan Scheer, and Mark Levitan. "Imputation Variance Estimation Protocols for the NAS Poverty Measure: The New York City Poverty Measure Experience." Paper presented at the Joint Statistical Meetings, Social Statistics Section, Vancouver, British Columbia, 2010.
- Provencher, Ashley J. "Unit of Analysis for Poverty Measurement: A Comparison of the Supplemental Poverty Measure and the Official Poverty Measure." Paper Prepared for the Joint Statistical Meetings, 2011.
- Renwick, Trudi. "Alternative Geographic Adjustments of U.S. Poverty Thresholds: Impact on State Poverty Rates." Washington, DC: U.S. Census Bureau, 2009.
- Renwick, Trudi, Kathleen Short, Ale Bishaw, and Charles Hokayem. "Using the American Community Survey (ACS) to Implement a Supplemental Poverty Measure (SPM)." Washington D.C.: U.S. Census Bureau; Social, Economic and Housing Statistics Division, 2012.
- "School Programs Meal, Snack and Milk Payments to States and School Food Authorities." *Federal Register* Vol. 75, No. 137, 2012.
- Short, Kathleen and Thesia Garner. "Experimental Poverty Measures Under Alternate Treatments of Medical Out-of-Pocket Expenditures: An Application of the Consumer Expenditure Survey." U.S. Bureau of Labor Statistics, Office of Prices and Living Conditions, 2002.
- Short, Kathleen, Thesia Garner, David Johnson, and Patricia Doyle. "Experimental Poverty Measures." *Current Population Reports*. Washington, DC: U.S. Census Bureau, 1999.
- Short, Kathleen. "Experimental Poverty Measures: 1999." *Current Population Reports*. Washington, D.C.: U.S. Census Bureau, 2001.
- Short, Kathleen. "The Research Supplemental Poverty Measure: 2011." *Current Population Reports*. Washington, D.C.: U.S. Census Bureau, 2012.
- Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. *Integrated Public Use Microdata Series: Version 5.0* [Machine-readable database]. Minneapolis: University of Minnesota, 2010.
- Thesis, Michael, Beth Jones, and William McMakin. "Annual Statistical Report." Office of Research and Planning, Virginia Department of Social Services, 2012.
- U.S. Census Bureau. "How the Census Bureau Measures Poverty." Washington, DC: U.S. Census Bureau, 2010.
- U.S. Census Bureau. "Poverty Thresholds for 2011 by Size of Family and Number of Related Children Under 18 Years." Washington, DC: U.S. Census Bureau, 2011.
- U.S. Census Bureau. "Poverty Thresholds for Two-Adult Two-Child Families Following NAS Recommendations: 1999-2011." Washington, DC: U.S. Census Bureau, 2011.

- U.S. Department of Agriculture. "WIC Program: Average Monthly Benefit Per Person." Accessed January 2013. http://www.fns.usda.gov/pd/25wifyavgfd\$.htm.
- U.S. Department of Housing and Urban Development. 2011 Fair Market Rents: County Level Data File. Accessed January 2013.
- U.S. Internal Revenue Service. "Table 2. Individual Income and Tax Data, by State And Size of Adjusted Gross Income, Tax Year 2010." Accessed January 2013. http://www.irs.gov/uac/SOI-Tax-Stats---Historic-Table-2.
- U.S. Social Security Administration. *SSI Recipients by State and County, 2011*. Office of Research, Evaluation, and Statistics; Office of Retirement and Disability Policy, 2012. Accessed January 2013. http://www.ssa.gov/policy/docs/statcomps/ssi_sc/index.html.
- Wheaton, Laura and Linda Giannarelli. "Underreporting of Means-Tested Transfer Programs in the March CPS." American Statistical Association 2000 Proceedings of the Sections on Government Statistics & Social Statistics, 2000.
- Zedlewski, Sheila, Linda Giannarelli, Laura Wheaton, and Joyce Morton. "Measuring Poverty at the State Level." Washington D.C.: Urban Institute, 2010.

Appendix A: Unit of Analysis for Aggregating Resources

The VPM assumes there is a greater amount of resource sharing among household members than the official poverty measure, but less than what would be assumed if there was complete resource sharing within a household. Multifamily households, which are more prevalent among households with lower incomes, are of particular concern, and the reason why the household is not the primary unit of analysis for the VPM. Instead, the "family" is the primary unit for aggregating resources. In constructing the VPM, three different types of resource units are created and used to aggregate individual resources:

- 1. *Primary Families*. The household head and anyone related to the household head by birth, marriage, or adoption forms the basis of the primary family. Unmarried partners, children of the unmarried partner, foster children, and other unrelated children under the age of 15 are also grouped together as part of the primary family. The IPUMS family and relationship imputations help identify the family members of the unmarried partner.
- 2. Unrelated Subfamilies. All household members not a part of the primary family but who have other relatives within a household form unrelated subfamilies "unrelated" due to the fact that none of the members of such a family are related to the household head. The IPUMS family and relationship imputations allow for identifying these subfamilies within the ACS microdata.
- Unrelated Individuals. All household members who are not related to the household head and not related to other members of the household form individual resource units. For example, an unrelated roommate, boarder, or friend would form their own individual unit.

Table 9: Virginia Households and Resource Units by Dataset and Poverty Measure

	2011 CPS ASEC ^a		2011 ACS ^a		
	Official Measure	SPM	Official Measure	VPM	
Number of Sample Households	1,614	1,614	31,525	31,525	
Number of Weighted Households	3,023,718	3,023,718	2,990,657	2,990,657	
Number of Sample Resource Units	1,860	1,714	35,349	33,387	
Number of Weighted Resource Units	3,507,693	3,258,222	3,364,679	3,194,488	

^a Totals are from IPUMS microdata.

Appendix B: Constructing VPM Poverty Thresholds

Similar to the SPM thresholds, the poverty thresholds used by the VPM are partially based on updated consumer spending data on food, clothing, shelter, and utilities (FCSU) from the national Consumer Expenditure Survey. Unlike the SPM, however, the VPM thresholds use a different methodology for accounting for necessary medical expenses and regional differences in the cost of living.

Base FCSU Thresholds

FCSU spending for a two-child family at the 33rd percentile of all such families defines the base thresholds for the SPM. These base thresholds vary according to family size and composition and further according to whether a family owns a home with a mortgage, owns a home free and clear, or rents their home. These variations are employed in order to better capture different spending patterns across these groups.

The methodology for creating poverty thresholds for the VPM starts with these three annual SPM thresholds published by the Bureau of Labor Statistics for the two-adult, two-child family.³¹ These FCSU thresholds are directly applied to the ACS IPUMS data using the IPUMS variables on housing tenure and mortgage status. They are then adjusted for family size and composition using the Census Bureau's "Three Parameter Equivalence Scales" as follows:

One- and two-adult units:	Scalar = $(adults)^{1/2}$
Single parent families:	Scalar = $(adults + (0.8 * firstchild) + (0.5 * otherchildren))^{7/10}$
All other families:	Scalar = $(adults + (0.5 * children))^{7/10}$

The equivalence scales provide scalar multipliers – based on the number of adults and children in a resource unit – that can be used to adjust the baseline thresholds to account for the varying needs of different family types and economies of scale. After these adjustments are made, every VPM resource unit in the ACS IPUMS dataset is given a base FCSU poverty threshold resembling the ones used in the SPM.

Table 10: VPM poverty thresholds by housing tenure and ownership status

	Average VPM Poverty Threshold for a Two-Adult, Two-Child Family	Standard Deviation
Families who own a home with a mortgage	\$29,442	\$3,418
Families who own a home without a mortgage	23,657	2,843
Families who rent their home	28,314	3,533

³¹ Bureau of Labor Statistics, "2011 Supplemental Poverty Measure Thresholds Based on Consumer Expenditure Survey Data," Accessed January 2013, http://www.bls.gov/pir/spm/spm_thresholds_2011.htm.

Medical Expenses in the Thresholds

The VPM then adds necessary medical expenses to the base poverty thresholds. To do so, the VPM uses the medical portion of the experimental FCSUM thresholds created by the Census Bureau (2011) for a reference family of four.³² However, this portion, if applied to final poverty calculations, would treat the medical needs of all families in the same manner, despite the fact that medical needs vary significantly by family type and insurance coverage. To account for this, the unadjusted medical portion of the threshold is modified to account for variances in family size, health insurance coverage, and age of family members using Census Bureau methods.³³ Table 11 shows the risk factors used to adjust for various family types. These risk factors account for the fact that most families with elderly members and larger families incur greater costs, while families with public health insurance incur less out-of-pocket health care costs.

The adjusted medical portions of the poverty thresholds are then added to the base FCSU portions of the thresholds for each resource unit in the ACS. The result is a higher average income threshold than what is used in either the official poverty measure or SPM.

Geographic Adjustments for Differences in the Cost of Living

Geographic adjustments used for the VPM rely on the Regional Price Parities (RPPs) produced by the Bureau of Economic Analysis.³⁴ Instead of only adjusting the housing portion of the FSCU threshold, as the SPM does, this approach accounts for regional differences in the costs for <u>all</u> major goods and services. These RPP indices are used to adjust prices across geography much like the CPI is used to adjust prices across time; because they account for the entire range of goods and services, they can be multiplied by the entire FCSUM thresholds. RPPs are available for all major metropolitan areas within each state and represent 5-year averages in price differences. Geographically-specific RPPs are matched to ACS data using the geographic pointers for identifiable metropolitan areas. All records that cannot be identified with a major metropolitan area are given the RPP index average for all non-metropolitan areas within a state. Table 12 provides the RPP indices for 2006-2010 for each ACS IPUMS-identifiable metropolitan area in Virginia. A RPP index of 100 represents the national average across all prices for all measured goods and services. Virginia, as a whole, has a relatively higher cost of living compared to the national average with a 103.1 index value. Much of this is due to the high cost of living in the Washington D.C. metropolitan area which has a 118.6 index value, one of the highest in the nation.

³² These thresholds can be found from the Census Bureau (2011) excel table "Poverty Thresholds for Two-Adult Two-Child Families Following NAS Recommendations: 1999-2011." The file reports that the medical portion for 2011 is 7.1% of the FCSUM thresholds without mortgage principal payments, which translates into \$1,995.60 for the reference family. This figure is then geographically adjusted for Virginia using the average regional price parity factor for medical goods and services in the commonwealth, which yields \$1,974.64 for 2011.

³³ Short, 2001, "Experimental Poverty Measures," A-11–A-12.

³⁴ Aten, "Regional Price Parities," 229-242.

Table 11: Risk factors for adjusting medical portion of VPM threshold

	Census Bureau Risk Factor ^a	VPM Medical Addition to Threshold
Reference family	1.00	\$1,975
Families with no elderly members		
1 person with private insurance	0.60	\$1,175
2 people with private insurance	1.01	1,994
3 or more people with private insurance	1.13	2,231
1 person with public insurance	0.05	89
2 or more people with public insurance	0.06	118
1 person who is uninsured	0.69	1,363
2 or more people who are uninsured	1.05	2,073
Families with elderly members		
1 person with private insurance	1.25	2,468
2 or more people with private insurance	2.11	4,167
1 person with public insurance	0.47	928
2 or more people with public insurance	0.96	1,896

^a The data and the table is adapted from Short (2001, pp. A11-A12). Although Short also reports risks factors by health status, it is not well understood how this information can be applied to the ACS, which does not ask questions regarding health status. The Wisconsin IRP and Urban Institute measures of poverty "infer" health status in the ACS, but this is not done for the VPM. As a result, the VPM methodology averages across differences in health status reported by Short.

Table 12: 2006-2010 Regional Price Parities and SPM geographic adjustments

	Regional Price	SPM Geographic
	Parity Index	Adjustment ^a
Virginia	103.1	107.2
Metropolitan Virginia	105.8	110.4
Non-Metropolitan Virginia	89.8	85.4
Selected Metropolitan Statistical Areas		
Washington-Arlington-Alexandria, VA-MD-WV	118.6	126.2
Virginia Beach-Norfolk-Newport News, VA-NC	99.6	104.1
Richmond, VA	97.6	101.0
Roanoke, VA	92.6	91.0
Lynchburg, VA	91.7	86.5
Charlottesville, VA	99.9	N/A
Danville, VA	89.0	N/A

^a Data are from 2012-2011 CPS ASEC. Charlottesville and Danville are not identifiable in the CPS ASEC IPUMS microdata.

Compared to the geographic adjustments used for the VPM, the SPM adjustments (which are only based on housing costs) report higher costs of living for metropolitan areas and lower costs for nonmetropolitan areas in Virginia. This results in an average geographic adjustment of 107.2 for all of Virginia in the SPM calculations, four points higher than what is used for the VPM. As a result, using the RPPs in accounting for the costs of the entire array of goods and services in the VPM tends to <u>lower</u> poverty rates compared to the SPM.³⁵ See Table 7 on page 20 to understand the effect of using the SPM geographic adjustment instead of the VPM adjustments on final VPM poverty rates.

Table 13 presents the average VPM thresholds that result from these geographic adjustments for each VPM region. A four-person family living in the Northern Virginia exurbs must earn nearly \$33,000 annually to avoid poverty while a similar family living in Southwest Virginia must earn \$24,000.

	Average Geographic Adjustment	Average VPM Threshold for a Two-Adult, Two- Child Family
Beltway	118.6	\$32,678
Fairfax	118.6	32,579
Northern Virginia Exurbs	118.6	32,783
North Valley and Piedmont	93.2	25,853
South Valley and Piedmont	91.5	25,020
Richmond Area	97.6	26,928
Northern Neck and Eastern Shore	95.0	26,438
Western Hampton Roads	99.6	27,315
Southside	91.5	24,727
Southwest	89.8	24,163
Virginia Beach and Chesapeake	99.6	27,574
Virginia	102.8	28,825

Table 13: 2011 VPM poverty thresholds by region

³⁵ This finding is consistent with the conclusion of Renwick (2009) who found that ACS-based adjustments using only housing costs resulted in higher poverty rates (using official definitions) for Virginia compared with using an RPP-based approach. Renwick, "Alternative Geographic Adjustments of U.S. Poverty Thresholds: Impact on State Poverty Rates," Table 3.

Appendix C:

Imputation Procedures for Program Participation and Benefit Amounts

Statistically Matched Imputations with the CPS ASEC

Most VPM imputations for program participation and the amount of the associated benefits are made through a statistical match between ACS and CPS ASEC microdata. The matching algorithm used is commonly referred to as Predicted Means Matching (PMM) with neighborhood selection.

The PMM algorithm first requires the selection of *matching variables* common to both the ACS and CPS ASEC that will be used to estimate a *distance function* whose values represent the "closeness" of given households and individuals between the two datasets. The matching variables are chosen based on results of regression analyses and academic literature to explain as much of the variance in the data as is reasonable. The matching variables used in the VPM statistical matches are listed in Table 14. For a particular record in the ACS that needs a value to be imputed (in this case participation in a particular program or the amount of those benefits), the algorithm uses the distance function to select a set of the closest records in the CPS ASEC that define the *neighborhood* of possible matches.³⁶ An observation from this neighborhood is then chosen randomly, and its value for program participation (Yes or No) or benefit amount (in dollars) is donated to the given ACS observation. The random selection method based on neighborhoods allows for the estimation of variance due to the imputation process.³⁷

Statistical matching provides an alternative to methods that rely solely on using program eligibility and benefit rules, or linear regression modeling. Such methods can provide accurate estimates of averages, but often fail to adequately capture the distribution of values.³⁸ Statistical matching, on the contrary, accurately captures both the average and the distribution of values. This is important as state rules for program benefit amounts often involve discrete jumps and discontinuities that do not follow the smooth distributions assumed by regression approaches.

Participation in SNAP, LIHEAP, Welfare, and SSI programs are controlled to state administrative totals reported by the Virginia Department of Social Services and the Social Security Administration.^{39,40} Participation is imputed until total participation in Virginia for a particular program closely matches state administrative totals. Both the ACS and CPS ASEC have a history of under-reporting participation in many means-tested programs, and controlling participation to state totals has a significant

³⁶ In order to help account for the wide discrepancy between the sample sizes of the ACS and CPS, all imputations based on statistical matching use the three most recent years of CPS data. Also, for SNAP participants, the data are celled by whether or not the household is a single or multi-person household only. No partitions of the data were made for other programs due to sample size concerns at the state level.

³⁷ See Appendix F.

³⁸ Mark Levitan and Trudi Renwick, "Using the American Community Survey to Implement a National Academy of Sciences-Style Poverty Measure: A Comparison of Imputation Strategies," (Paper Presented at the Joint Statistical Meetings, Social Statistics Section, Vancouver, British Columbia, 2010).

³⁹ Virginia Department of Social Services, "2012 Annual Statistical Report."

⁴⁰ U.S. Social Security Administration, *SSI Recipients by State and County, 2011.*

	Matching Variables	SNAP	Welfare (TANF/GA)	SSI	LIHEAP	School Lunch	Free or Reduced Price Lunch	WIC	Housing Assistance
	Household size	x	x	х	x			x	x
	Household is rented	x	x	х	x				
	Household income less than \$30,000	x							
	Natural log of household income	x	x	х	x	x	x	х	x
tics	Household members receive welfare	x			x	x	x	х	x
cterist	Household members receive Medicaid	x	x	x		x	x	x	x
ara	Household members receive SNAP		x	х	x	x	x	х	x
ld Ch	Has household members age 65 and over	x	x	х					
oyası	Has household members who are disabled	x		x					
ЪР	Household has children			х	x				
_	Number of children age 0 to 5							х	
	Number of children age 5 to 10	x	x	х		x	x		
	Number of children age 11 to 13		x	х		x	x		
	Number of children age 14 to 18		x	х		x	x		
þe	Head of household without HS diploma	x							x
ld hea	Head of household education between HS and associate's degree					x	x	х	x
Iseho	Head of household education at or above bachelor's degree					x	x	х	
hou	Head of household is female	x				x	x		
he	Head of household works part-time	x				x	x		
oft	Head of household works full-time	х			x				
stics (Head of household did not work last year	x			x	x			
ieri	Head of household is single				x		X		
aract	Head of household is single with own child	x							x
Ċ	Head of household is in or near poverty		х	х					
s	Age		x	x				x	
stic	Female		x	x				x	
eri	Individual receives SSI		x						
act	Education less than HS			х					
l char	Education between HS and Associate's Degree		x	x					
eve	Individual works part-time		x	х				x	
al-le	Individual works full-time		x	х					
iqu	Individual did not work last year		x	х				х	
div	Individual is single		x	x				x	
<u>_</u>	Individual is single with own child			х					

Table 14: Matching variables used for Predicted Means Matching

impact on poverty rates.⁴¹ This is particularly true when SNAP benefits are added to resources, as the ACS and CPS ASEC grossly underestimate the number of people enrolled and the total benefits paid. Table 15 provides the reporting rates if the VPM were not controlled to state administrative totals. After participation is controlled, final adjustments are made to benefit amounts in order to match state records on total benefit payments.⁴²

⁴¹ Wheaton, Laura and Linda Giannarelli, "Underreporting of Means-Tested Transfer Programs in the March CPS," (American Statistical Association 2000 Proceedings of the Sections on Government Statistics & Social Statistics, 2000).

⁴² This is done by multiplying all benefit amounts by the ratio of total payments reported by the state over what is found by aggregating all benefits after controlling for participation.

	State Admin. Records ^a	Uncontrolled VPM After Statistical Match ^b	Reporting Rate (VPM / Admin.)
Food Stamps (SNAP)			
Average Monthy Caseload	396,613	244,515	0.62
Total Payments	\$1,306,000,000	\$735,971,760	0.56
Energy Assistance (LIHEAP)			
Total Households Served	180,756	54,767	0.30
Total Payments	\$57,300,000	\$26,188,913	0.46
Welfare (TANF + General Relief)			
Average Monthy Caseload	40,383	48,546	1.20
Total Payments	\$131,600,000	\$196,996,750	1.50
Supplemental Security Income (SSI)			
Average Monthy Caseload	149,757	116,193	0.78
Total Payments	\$904,200,000	\$1,166,121,700	1.29

Table 15: Virginia participation in selected programs SFY 2011 and reporting rates

^a SNAP, LIHEAP, and welfare programs data are from the Virginia Department of Social Services for state fiscal year 2011. SSI totals are from the Social Security Administration, a December average for 2010 and 2011.

^b Uncontrolled VPM totals are after imputing LIHEAP and SNAP information but before controlling to state administrative totals. Welfare and SSI dollar totals are directly from ACS data without modification. Average monthly caseloads are calculated by using a statistical match to the CPS ASEC to obtain the number of participating months for welfare and SNAP beneficiaries. Months on SSI benefits are approximated based on program rules and reported benefit amounts in the ACS.

Both the ACS and CPS ASEC measure the total number of unique households or individuals participating in public programs over the course of a year. State administrative records for SNAP, welfare, and SSI programs, however, report monthly totals. Although the majority of households and individuals receive benefits for 12 months out of the year, as many as a third of recipients report fewer than 12 months of benefits.⁴³ To add more detail, the CPS ASEC asks questions on the number of months in a year households and individuals participate in SNAP and welfare programs. This data can then be used to compute average monthly participation totals that allow for comparison with state administrative records. Unfortunately, the ACS does not report the number of months beneficiaries receive payments for any of these programs. In order to match ACS participation. A statistical match with CPS ASEC data is used to inform imputations on months of receipt for SNAP and welfare participation. The number of months of receiving SSI benefits is inferred from program rules, family structure, and reported benefit amounts in the ACS. All imputed LIHEAP recipients are assumed to participate for 12 months. The CPS ASEC does not report the number of months participation.

⁴³ CPS ASEC national data 2001-2011 for months on SNAP and months on welfare.

WIC, School Lunch, and Housing Assistance Benefit Amounts

No information on benefit amounts for WIC, the National School Lunch Program, or housing assistance is available through the CPS ASEC. Although participation in these programs is imputed with a statistical match with the CPS ASEC, different methods are used to impute benefit amounts:

1. WIC Benefits

For Virginia, the average monthly WIC benefit per person was \$36.64 in 2011, and this average was used as the basis for imputing WIC values in the ACS.⁴⁴ The CPS ASEC, on average, reports that 87.5% of all children ages 0 to 5 in WIC households receive benefits. This figure is used to scale the average benefit per eligible person in each WIC household.⁴⁵ All WIC recipients are assumed to participate for 12 months out of the year, so monthly totals for each family are multiplied by 12 to obtain annual benefit amounts.

2. School Lunches

Most children who eat a hot lunch at school are receiving a government-subsidized meal. The amount of this school lunch subsidy depends on whether the children come from a household that is eligible for free or reduced-price school lunches. The CPS ASEC has information on whether (1) children in a household eat a hot lunch at school, and (2) if those children eat a free or reduced-price lunch. A statistical match with the CPS ASEC is used to first determine whether children in a household eat a hot lunch at school, and reported income in the ACS are then used to determine whether that family's children receive the free or the reduced-price school lunch.

For those households that were imputed as having children who eat hot lunches at school but were not imputed as participating in the free or reduced-price lunch programs, the annual dollar value of the government subsidy was valued at the federal reimbursement rate for "fully paid" lunches (\$0.34 per meal in 2011), times the number of children between the age of 5 and 18, times 167 days in a school year.⁴⁶ Dollar amounts for free-lunch households were calculated using the federal reimbursement rate for free lunches (\$2.89) while reduced-price households were calculated using the reduced-price rate (\$2.49). Like full-price households, these rates were multiplied by the number of school age children and 167 days in the school year to obtain an annual dollar value.

3. Housing Assistance

The SPM calculates the value of Housing Assistance subsidies as the difference between the <u>market</u> rent for a household and the <u>actual</u> rent that is paid by the household. The SPM uses microdata from the Department of Housing and Urban Development (HUD) which is statistically matched to the CPS ASEC to

⁴⁴ U.S. Department of Agriculture, "WIC Program: Average Monthly Benefit Per Person," Accessed January 2013, http://www.fns.usda.gov/pd/25wifyavgfd\$.htm.

⁴⁵ Trudi Renwick et al., "Using the American Community Survey (ACS) to Implement a Supplemental Poverty Measure (SPM)," (Social, Economic and Housing Statistics Division, 2012), 10.

⁴⁶ Federal reimbursement rates for school lunches were found in the Federal Register, Monday, July 19, 2010, Vol. 75, No. 137. This method follows the one outlined by Renwick et. al. (2012).

obtain household estimates of market rent. Actual rent paid is then assumed to equal HUD's required household payment for housing assistance recipients. This is equal to the maximum of 30% of HUD's "adjusted household income" measure or 10% of gross household income. Subsidy values are not allowed to exceed the household portion of the SPM poverty threshold.

Instead of using HUD microdata, the VPM methodology uses HUD's Fair Market Rents as proxies for market rent.⁴⁷ Average Fair Market Rents for each metropolitan statistical area, by the number of bedrooms in a household, are calculated and appended to the ACS IPUMS metropolitan area identifiers. Non-metropolitan areas (or unidentifiable areas in ACS IPUMS data) are assigned the average Fair Market Rent value for non-metropolitan areas within Virginia.

ACS rent data are not used in calculating the value of housing subsidies. Instead, the subsidy value is calculated the same way as in the SPM. The maximum of 30 percent of "adjusted household income" – or 10% of gross income – is subtracted from market rent (as approximated by the appropriate Fair Market Rent). The difference is the value of the housing assistance subsidy. All negative values for subsidy amounts derived from this method are set to zero and participation in housing assistance is deleted.⁴⁸ Furthermore, the values of the housing subsidies are capped at the housing portion of the poverty threshold minus the required contribution toward rent as defined by HUD (30% of adjusted household income). The median housing assistance subsidy for the VPM in 2011 was \$5,134.

Child Care and Other Necessary Work Expenses

Necessary child care expenses are imputed for families in the ACS data using a statistical match with the CPS ASEC. Only families with dependent children and no non-working adults are considered for imputation. The median necessary child care expense for the VPM was \$5,200 annually for 2011. Imputed child care expenses are also used during the simulation of federal income taxes.

Other work-related expenses (such as transportation) are calculated using Census Bureau methods. All earners over the age 18 are assigned work expenses based on reported weeks worked in the ACS data and 85% of median work expenses as reported in the Survey of Income and Program Participation (SIPP). For 2011, the Census Bureau's estimate of necessary weekly expenses was \$27.16 per earner.⁴⁹

⁴⁷ As elaborated by Paul D. Johnson et al., "Estimating the Value of Federal Housing Assistance for the Supplemental Poverty Measure," (U.S. Census Bureau; Social, Economic, and Housing Statistics Division, 2010).

⁴⁸ Only 7.5% of households that were imputed as participating in Housing Assistance were calculated as having a negative, or zero, subsidy value in Virginia using this method. This is compared to 14.6% to statistical matching techniques as designed by Ibid. 15.

⁴⁹ Kathleen Short, "The Research Supplemental Poverty Measure: 2011," *Current Population Reports* (U.S. Census Bureau, 2011), 17 footnote #21.

Appendix D: Simulation of Payroll Taxes and Federal and State Income Taxes

In order to arrive at a more accurate portrayal of the financial circumstances of low-income families, the Census Bureau, in its SPM, estimates tax liabilities for each family identified in the CPS ASEC and then subtracts these liabilities from family income. To do this, the Census Bureau simulates tax filing for each family in the CPS ASEC. This simulation is informed through a statistical match between the CPS and the Statistics of Income (SOI) microdata from the IRS. Through this matching algorithm, tax information is appended to the CPS ASEC for each family.

The relative abundance of income and economic data in the CPS ASEC makes simulating taxes easier than if these types of simulations were done in the ACS. Although the Census Bureau is currently researching the efficacy of applying their tax simulator to ACS data, tax estimates for the ACS are currently unavailable to the public.

As a result, the VPM relies on its own tax simulator, based on IRS tax rules and Virginia state income tax instructions. The subsections that follow outline the process of estimating income and payroll taxes for VPM resource units.

Methodology Overview

The IRS uses five tax filing statuses for determining individual federal income taxes:

- 1. Single
- 2. Married, Filing Jointly
- 3. Married, Filing Separately
- 4. Head of Household
- 5. Qualified Widow(er) With Dependent Children

Different rules and tax rates will apply to taxpayers under each tax filing status. It is the decision of each family, and the individuals in that family, to choose the tax filing status from or under which they would benefit the most and for which they are eligible. Generally, the "Married, Filing Jointly" status enjoys the most beneficial rates and tax rules. "Single" filers generally have the least beneficial rates and rules. Not everyone in a family needs to file under the same return or the same tax filing status. For example, a married couple may choose to file together, but older children in their family, perhaps with jobs and incomes of their own, may file a separate return under the "Single" status and not be counted as a dependent for the married couple. Unlike the broad resource sharing assumptions used to create resource units within households, tax units and filing statuses are created and assigned under the assumption that there is at least some strategic decision making on behalf of families in order to minimize tax liabilities.

To account for some of this strategic thinking, the following tax simulation methodology broadly follows the basic process outlined by IRP researchers for Wisconsin's alternative poverty measure: ⁵⁰

- 1. Creation of provisional tax units and filing statuses
- 2. Estimation of payroll taxes
- 3. Provisional calculation of federal income taxes
- 4. Provisional calculation of state income taxes
- 5. Reassignment of individuals to tax units
- 6. Final calculation of tax liabilities

Provisional tax units are formed in order to calculate provisional tax returns. Using these preliminary returns, it is determined whether some subfamilies and individuals will, or should, file a return. Individuals are then reassigned to tax units, and final tax calculations are made. In other words, the tax simulation will calculate taxes twice: once for provisional tax units and again for a finalized set of tax units.

Forming Tax Units and Assigning Filing Statuses

The formation of tax units starts with the IPUMS project's family pointers and relationship imputations. First, a tax filer is identified from primary and subfamily members within households. This is usually the head of each primary or subfamily, but when a spouse or other adult in the family reports more earned income, they are designated as the tax filer. Spouses and dependents are then assigned to each tax filer using the IPUMS relationship imputations to form tax units.

At first, all persons who are age 16 or above, and are not a spouse or head of a tax unit, are given a "Single" filing status and form their own tax unit, even if they are reported as children of other household members. After provisional tax returns for these units are calculated, it is determined whether these units would be better off filing as individuals or could be counted as dependents in other tax units. This is done by checking whether they are legally required to file (using the IRS earned income thresholds) and whether they stand to gain from filing. A similar logic governs the assignment of filing statuses among members of a subfamily. If it is determined that the filer of an identified subfamily would probably not file a tax return, all of that filer's dependents will become dependents of the primary family in the household, and the original filer will become his/her own tax unit.

After all of these adjustments are made, it is assumed that all units file a tax return. As a result, the tax simulator described in this report tends to exaggerate the number of actual returns, compared to the numbers reported by the IRS.

All married-couple tax units, even if a spouse is absent from the household, are assumed to file a "Married, Filing Jointly" tax return, in order to take advantage of the favorable rates and rules that this status provides. The ACS does not provide any information on the likelihood of married couples filing a "Married, Filing Separately" return. Unmarried filers with qualified dependents are assumed to file a "Head of Household" return. All other tax units are assigned the "Single" filing status. The ACS does not provide enough information to determine if a unit could file as a qualified widow(er).

⁵⁰ Joanna Y. Marks et al., "Wisconsin Poverty Report: Technical Appendix for 2009" (Madison: Institute for Research on Poverty, 2011).

Payroll Tax Calculation

All individuals who report earned income in the ACS data are assumed to pay payroll taxes. The FICA payroll tax rates and rules that apply to Social Security and Medicare are then applied to each of these individuals (with Social Security contributions capped for wages above \$106,800). If an individual reports self-employment, the FICA self-employment rates are applied to any business or farm income reported. These totals are then added together to arrive at total payroll taxes paid by each individual.

Federal Income Tax Calculation

A simulated federal tax return is calculated for each identified tax filer. All tax filers are assumed to file an IRS 1040 tax form. The tax simulation goes though each item in the 1040 form and either fills in information directly reported from the ACS (if available) or imputed information from other parts of the VPM calculation (such as child care expenses).

The line items on income on the 1040 form are calculated from the income variables available in the ACS IPUMS microdata:

Line 7:	INCWAGE	(income from wages, tips, and salary)
Line 8a:	INCINVST	(investment income)
Line 12:	INCBUS00	(business and farm income)
Lines 16a/b:	INCRETIR	(retirement and pension income)
Lines 20a/b:	INCSS	(Social Security income)
Line 27:	Simulated fro	m INCBUS00 and CLASSWKR (self-employment)

The summation of these income sources helps determine Adjusted Gross Income (AGI). The most conspicuous omissions in this calculation are income from capital gains and unemployment insurance, which the ACS data do not report. This will tend to underestimate aggregate AGI.

The taxable amount for Social Security Benefits is calculated using IRS instructions, while all retirement income is assumed to be taxable (the ACS does not provide the detailed information necessary on pensions and annuities to determine how much of retirement income is taxable). This will tend to overestimate aggregate AGI.

The tax simulation gives primary families (tax units) who live in owner-occupied households the opportunity to itemize their tax return. All other tax units are given the standard deduction. IRS Schedule A and its instructions are used to simulate the amount of itemized deductions:

Line 5:	State and Local Income Taxes	(Added after state return calculation)
Line 6:	Real Estate Taxes	(Derived from IPUMS variable PROPTX99)
Line 10:	Home Mortgage Interest	(Derived from IPUMS variables MORTAMT1/2)

During the provisional calculation of federal income taxes, state and local income taxes are not entered into the itemized deduction calculations. They are, however, added during the final federal income tax calculation after the state return has been simulated. No attempt in imputing state and local sales taxes was made, as most tax filers gain the most from taking the state and local income tax deduction.

The ACS asks household respondents how much they paid in annual property taxes. This data is directly entered into line 6 on Schedule A for the real estate tax deduction.

The ACS also asks respondents about their monthly mortgage payments. This information is reported in the IPUMS variables MORTAMT1 and MORTAMT2 (if the household has a second mortgage). However, the ACS does not provide any further information on mortgage interest. The tax simulation assumes that the proportion of the mortgage payment paid on interest is between 20 and 80%. Households are randomly assigned a percentage within this range, and the error associated with this assumption is reflected in the margins of error for the final poverty measure.⁵¹

Charitable contributions are not simulated in Schedule A. This will tend to underestimate total itemized deductions, particularly for higher income households.

The three items simulated in Schedule A are added to obtain a total of itemized deductions. This total is compared to the standard deduction for tax units and the greater is chosen. These calculations result in two-thirds of primary family tax filers with a mortgage receiving the itemized deduction versus the standard deduction.

After calculating itemized and standard deductions, final taxable income is derived from the AGI total calculated previously. This taxable income figure is used in income tax calculations. The rates for a particular year for each income tax bracket are applied to each tax unit's taxable income using the rules set by the IRS. The Alternative Minimum Tax is not simulated.

The federal tax credit for child care expenses is simulated using imputed information derived from a statistical match with CPS ASEC data. As part of the Census Bureau's SPM project, the CPS ASEC collects data on child care expenses. The expenses are assigned to primary families and are used for the calculation of Line 48 of the 1040 tax form using IRS instructions.

Next, the Child Tax Credit is calculated based on the number of qualifying children in each tax unit. Information during this calculation is also used in calculating the Additional Child Tax Credit in the tax payments section of the 1040 form.

Two tax payments are simulated for 2011: (1) The Earned Income Tax Credit (EITC), and (2) The Additional Child Tax Credit. These two credits are particularly important for lower income filers, the receipt of which often results in a tax refund. A conspicuous omission is the First-time Homebuyer Tax Credit. The ACS provides no means for determining eligibility for this tax credit.

⁵¹ The tax simulators for the Wisconsin IRP and Urban Institute poverty measures assume that mortgage interest comprises 80% of the mortgage payment.

Virginia Income Tax Calculation

The calculation of Virginia state income taxes starts with the federal AGI calculated previously. All tax filers are assumed to fill out a 760 Virginia Resident tax form based on the tax units and filing statuses defined for the federal tax calculation.

As well as calculating state income taxes, age deductions, and spousal adjustments, the tax simulation also calculates eligibility and amounts for Virginia's Earned Income and Low-Income Tax Credits on Schedule ADJ. These credits are particularly important for low-income households but are not refundable. In other words, unlike the federal EITC or the Additional Child Tax Credit, low-income filers cannot receive cash from these credits if they exceed liabilities. Low-income households cannot claim either tax credit if they also claim an age exemption.

After individuals are assigned to final tax units, state income taxes are appended to the final federal tax return calculation to derive final tax liabilities for all units.

Verification

Table 16 on the following page compares average results from the tax simulation using <u>2010</u> ACS data with aggregate data from IRS SOI for Virginia. The table displays averages due to the randomness associated with the mortgage interest calculation. The final itemized deductions total is very sensitive to changes in the mortgage interest proportion, but the final tax liabilities are much less sensitive (due to the fact that many units use the standard deduction).

The tax simulation accounts for 91% of total federal income tax liabilities. The simulator does equally well for tax units with AGI below \$100,000 and \$75,000, but progressively underestimates liabilities as AGI approaches zero. Part of the discrepancy is likely due to taxes paid by the small number of filers with negative AGI,⁵² which the tax simulation grossly underestimates. Part of the reason for this is possibly the ACS tendency to under-report family income losses. This underestimating of tax liabilities will tend to underestimate final poverty rates.

⁵² According to 2010 IRS SOI aggregate data for Virginia, 38,028 returns had AGI below \$1, which amounted to negative \$2,929,006,000 in aggregate dollars. Internal Revenue Service, "Table 2. Individual Income and Tax Data, by State And Size of Adjusted Gross Income, Tax Year 2010," Accessed January 2013, http://www.irs.gov/uac/SOI-Tax-Stats---Historic-Table-2.

	2010 VPM Tax Simulation for Virginia	2010 Federal IRS SOI Data for Virginia ^a	Ratio: ACS / SOI
Number of Filers	3,859,543	3,729,464	1.03
Number of Joint Returns	1,639,252	1,484,064	1.10
Number of Dependents	2,090,752	2,431,682	0.86
Adjusted Gross Income	225,698,903,335	244,775,082,000	0.92
Salary, Wages, and Tips	187,807,776,640	182,250,584,000	1.03
Taxable Interest and Dividends	9,931,450,327	10,879,146,000	0.91
Business and Farm Income	9,511,484,170	6,725,837,000	1.41
Taxable Social Security Income	2,477,593,526	5,229,247,000	0.47
Itemized Deductions	23,726,215,327	41,443,509,000	0.57
State and Local Taxes	6,424,924,630	8,635,796,000	0.74
Real Estate and Property Taxes	4,027,789,393	4,723,506,000	0.85
Mortgage Interest	13,500,596,729	15,584,557,000	0.87
Taxable Income	163,699,966,483	168,938,737,000	0.97
Tax Credits	1,039,809,221	1,631,165,000	0.64
Child Care Expenses Credit	61,030,961	103,929,000	0.59
Child Tax Credit	978,778,260	741,229,000	1.32
Self-Employment Taxes	1,009,018,596	1,248,234,000	0.81
Selected Tax Payments	2,798,826,524	3,651,266,000	0.77
Marking Work Pay Tax Credit	1,532,289,934	1,441,903,000	1.06
Number of claims	2,750,698	2,770,599	0.99
Earned Income Tax Credit	917,247,321	1,286,464,000	0.71
Number of claims	504,352	613,749	0.82
Additional Child Tax Credit	349,289,268	579,302,000	0.60
Number of claims	271,152	457,200	0.59
Total Tax Liabilities	29,498,714,654	32,391,653,000	0.91
Liabilities for AGI < \$100,000	7,544,808,540	8,171,711,000	0.92
Liabilities for AGI < \$75,000	4,637,896,285	5,143,927,000	0.90
Liabilities for AGI < \$50,000	1,874,610,697	2,407,083,000	0.78
Liabilities for AGI < \$25,000	260,168,229	536,245,000	0.49

Table 16: VPM tax simulation totals compared to IRS data for Virginia

^a Data from the Internal Revenue Service, Statistics of Income Division, Tax Stats by state 2010.

Appendix E: Counties and PUMAs by VPM Region

Region #	Region Name	PUMAs	Counties	
1	Beltway	100, 200, 301	Arlington, Alexandira City, Falls Church City, Part of Fairfax	
2	Fairfax	302, 303, 304, 305	Most of Fairfax, Fairfax City	
3	NoVa Exurbs	501, 502, 600, 800, 900	Loudoun, Prince William, Clarke, Warren, Fauquier, Culpeper, Stafford, Spotsylvania, King George, Manassas City, Manassas Park City, Fredericksburg City	
4	North Valley and Piedmont	400, 700, 1000	Federick, Shenandoah, Page, Rappahannock, Madison, Rockingham, Greene, Orange, Albemarle, Louisa, Fluvanna, Winchester City, Harrisonburg City, Charlottesville City	
5	South Valley and Piedmont	1100, 1600, 1700, 1800	Augusta, Highland, Nelson, Bath, Rockbridge, Amherst, Campbell, Bedford, Botetourt, Alleghany, Craig, Roanoke, Staunton City, Waynesboro City, Lexington City, Buena Vista City, Lynchburg City, Bedford City, Covington City, Salem City, Roanoke City	
6	Richmond Area	1200, 1300, 1400, 1500	Hanover, Goochland, Henrico, Powhatan, Chesterfield, Richmond City	
7	Northern Neck and Eastern Shore	1900, 2200	Westmoreland, Northumberland, Richmond, Lancaster, Essex, Middlesex, Mathews, Caroline, King & Queen, King William, Gloucester, James City, York, Accomack, Northampton, Poquoson City, Williamsburg City	
8	Western Hampton Roads	2000, 2100, 2900, 3100	Isle of Wight, Newport News City, Hampton City, Suffolk City, Portsmouth City, Norfolk City	
9	Southside	2300, 3200, 3300, 3400, 3500	Patrick, Franklin, Henry, Pittsylvania, Halifax, Charlotte, Appomattox, Buckingham, Cumberland, Prince Edward, Mecklenburg, Lunenburg, Nottoway, Amelia, Dinwiddie, Brunswick, Greensville, Southampton, Sussex, Prince George, Charles City, New Kent, Surry, Martinsville City, Danville City, Colonial Heights City, Petersburg City, Emporia City, Franklin City	
10	Southwest	2400, 2500, 2600, 2700	Lee, Wise, Dickenson, Buchanan, Scott, Russell, Tazewell, Washington, Smyth, Bland, Wythe, Grayson, Giles, Pulaski, Carroll, Floyd, Montgomery, Norton City, Bristol City, Galax City, Radford City	
11	Virginia Beach and Chesapeake	2801, 2802, 2803, 3000	Virginia Beach City, Chesapeake City	

Appendix F: Variance Estimation

The ACS and CPS ASEC are sample surveys. As a result, any estimates derived from this data will have a certain degree of error. This is reflected in the margins of error reported throughout this report. There were two sources of variation for VPM estimates: (1) sampling error and (2) imputation error. All estimates using the official poverty measure or the SPM need to account for sampling error. The VPM, however, must account for both sampling error and the error associated with the imputation process.

Sampling Error

The ACS and CPS ASEC have complex survey designs, with multiple levels of stratification and clustering within their samples. To account for this complexity, researchers use the microdata sample weights attached to each observation to estimate overall population totals. Due to this complex survey design, standard variance estimation procedures, which are based on the assumption of a simple randomized sample, cannot be applied. To solve this problem, the Census Bureau employs what is called the Successive Differences Replication (SDR) method. In short, the SDR method provides researchers with a series of alternative sample weights within the ACS and CPS ASEC microdata. By re-estimating statistics using these alternative "replicate" weights, and comparing the results with the ones derived using the base weights, researchers can obtain a reasonable estimate of the variance of any computed statistic. With this variance estimate, standard errors, confidence intervals, and margins of error can be calculated.

The following formula is used to estimate the standard errors of the official and SPM poverty rates in this report:

$$SE(\hat{X}0) = \sqrt{\frac{4}{k} \sum_{r=1}^{k} (\hat{X}_r - \hat{X}_0)^2}$$

where \hat{X}_0 is the poverty rate using the base weights provided in the ACS or CPS ASEC microdata, k is the number of replicate weights in the dataset (ACS: k = 80, CPS ASEC: k = 160), and \hat{X}_r is the poverty rate associated with the rth replicate weight. The constant 4 is inherent to the SDR method. For example, the official poverty rate for 2011 in Virginia using the ACS is 11.6% (\hat{X}_0). This calculation is done another 80 times using each of the 80 replicate weights in the ACS microdata (\hat{X}_r). These replicate poverty rate estimates could range, for example, as high as 12.2% or as low as 10.5%, but most would presumably be close to the 11.6% that was calculated using the base weight if the sample size is large. These estimates are applied to the equation above to arrive at a standard error for the poverty rate.

With these standard errors, confidence intervals and margins of error can be constructed around the poverty rates. This report uses the 95% confidence level for its estimates (the Census Bureau conventionally uses 90%). From the previous example, the 11.6% poverty rate for Virginia using the ACS

has a margin of error of +/-0.4. That is, we can be 95% confident that our error interval (11.2 to 12.0) contains the actual poverty rate of Virginia (using that particular measure).⁵³

Imputation Error

Unlike the official poverty and SPM variance estimates, the error of the VPM estimates must also account for the error associated with the series of imputations performed in the construction of the measure. Imputing missing data is not error free. For this reason, imputations made for the VPM using information from other datasets are stochastic, based on probabilities and random selection rather than deterministic values. No two sets of imputations, based on different random number streams, would be the same. This is what allows for variance estimation from the imputation process. There are two major sources of random variation in the VPM imputations:

- 1. *Neighborhood selection for the PMM algorithm.* All statistical matches using the PMM algorithm are based on randomly selecting a CPS ASEC observation from a neighborhood of possible matches that are close to the given ACS observation. The value of that matched observation is then imputed into the ACS.
- 2. *Neighborhood size for the PMM algorithm*. The size of the neighborhood of possible matches for the PMM algorithm (the number of "close" observations to randomly choose from) is also allowed to vary randomly from considering the two closest observations to the closest eight observations.⁵⁴

Running the VPM calculations on the same dataset multiple times will yield slightly different results based on the randomness of the processes above. These multiple imputations can provide an estimate of the variance of a statistic due to the imputation process. This method, called Multiple Imputation (MI), is widely used among researchers to deal with imputation.⁵⁵ However, the MI method does not account for the sampling error associated with the complex survey design of the ACS.

In order to account for both the imputation error and sampling error of the VPM estimates, the methodology for variance estimation presented here draws on the procedures outlined by Potter et al (2010) in their attempts to estimate the error associated with the Center for Economic Opportunity alternative poverty measure.⁵⁶ First, a set of 81 replicate VPM datasets, each with their own different set of imputations, are created using a different random number stream for each dataset. Each of these replicate datasets is then randomly assigned to one of the 80 ACS replicate weights described previously, and one dataset is assigned the base ASC sample weight. VPM poverty estimates are

⁵³ All statements of statistical significance in this report are based on a 90% confidence level or higher using standard significance testing.

⁵⁴ The range begins with a neighborhood size of two because that is the minimum that still allows for random variation. The choice of eight as the upper bound on the neighborhood size was more subjective, but was loosely based on the sample size of participants in the smallest public programs in the CPS ASEC, such as TANF.

⁵⁵ Roderick Little and Donald Rubin, *Statistical Analysis with Missing Data*, 2nd edition, (New York: Wiley-Interscience, 2002), 85.

⁵⁶ Frank Potter et al., "Imputation Variance Estimation Protocols for the NAS Poverty Measure: The New York City Poverty Measure Experience," (Paper presented at the Joint Statistical Meetings, Social Statistics Section, Vancouver, British Columbia, 2010).

calculated for each of the 81 replicate datasets using their assigned weight. These estimates are then applied to the standard error equation for the SDR method, where \hat{X}_0 is the estimate using the dataset that was assigned the base sample weight and \hat{X}_r represents all of the estimates derived from the other replicate datasets. The resulting standard error accounts for both the sample variance associated with the ACS (by using the replicate weights) and the variance associated with the VPM imputations (by using multiple imputed datasets). From this standard error, confidence intervals and margins of error are calculated.

Standard Errors for VPM Estimates

The imputation process adds considerable, but by no means prohibitive, error to the VPM poverty rates. On average, the imputation error contributes around 43% of the total error. Table 18 lists the standard errors of official and VPM poverty rates using the ACS by subgroup, as well as the percentage of the final standard error due to the imputation process.

	ACS Poverty Rates			Standard Errors		
	Official	VPM	Official	VPM (Sampling Error Only)	VPM (Sampling + Imputation Error)	Percent from Imputation
Virginia Poverty Rate	11.6	11.9	0.204	0.234	0.410	43.0
Rates by Age						
Ages 0 - 17	15.6	13.0	0.459	0.453	0.718	36.9
Ages 18 - 64	11.0	12.2	0.204	0.246	0.462	46.7
Ages 65 and Over	7.5	8.5	0.306	0.334	0.564	40.7
Rates by Race						
Whites	8.7	8.5	0.204	0.207	0.462	55.3
Blacks	19.1	18.1	0.612	0.604	1.282	52.9
Asians	8.1	12.3	0.867	1.298	1.641	20.9
Hispanics	18.2	23.1	1.276	1.436	1.897	24.3
Others	16.2	16.1	1.684	1.836	2.051	10.5
Rates by Sex / Marital Status						
Single Females	18.6	17.1	0.408	0.405	0.667	39.3
Single Males	15.2	15.4	0.357	0.358	0.564	36.5
Married Females	4.3	5.8	0.204	0.263	0.359	26.6
Married Males	3.9	5.6	0.204	0.268	0.359	25.4

Table 18: Official and VPM poverty rate standard errors and percent from imputation

The VPM poverty rates have standard errors that are often much greater than the official poverty rates from the ACS. Despite the larger standard errors for the VPM, poverty rates using this measure still provide more precision than the SPM estimates from the CPS ASEC, as illustrated by the margins of error reported in Table 5 on page 17. Yet, care must be taken when interpreting results for smaller populations in Virginia. Multiple-year averages of VPM data may be needed for these groups.

