

**The Virginia Unemployment Trust Fund
Predicting the Balance**

by

Cathy Cestone, Steven Combs, Sara Zhang


 *Thomas Jefferson Program in Public Policy*

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The Virginia Unemployment Trust Fund Predicting the Balance

Project Background

“Over the last few years, legislators have requested JLARC (*Joint Legislative Audit and Review Commission*) staff to conduct technical assessments of the Unemployment Insurance Trust Fund. The Unemployment Insurance Trust Fund must maintain a reserve so that, in the event of a period of relatively higher unemployment claims (which generally occurs as a result of an unexpected economic downturn), the Trust Fund should have enough money in it to pay all unemployment benefits specified in Section 60.2 of the *Code of Virginia*. In these technical assessments, JLARC staff needed projections of (1) benefits to be paid out and (2) fund balances in the next four years. Not having their own model for making these projections, JLARC staff would request these projections from Virginia Employment Commission (VEC) staff. Rather than generating their own projections, VEC staff would obtain projections from a model written in FORTRAN that is maintained on a mainframe computer at the U.S. Department of Labor (DOL) in Washington, D.C. The purpose of this project is to develop a PC-based model (preferably in Excel) that JLARC staff can use to project more directly ‘ballpark estimates’ of benefits to be paid out and fund balances in future years, under alternative conditions.”¹

“JLARC staff have a copy of the “State Unemployment Insurance Benefit Financing Model User’s Manual,” which documents how the mainframe program works. Replicating in full detail the mainframe program in a PC-based model is not necessary. What is needed, however, is a reasonable method for projecting benefits to be paid out in future years, and for calculating the resulting Unemployment Insurance Trust Fund balance, using a model that can more explicitly show the assumed relationships between key variables, and how changing conditions can affect them.”²

¹ Thomas Jefferson Program in Public Policy, College of William & Mary, *Policy Research Seminar (PRS) – PUBP 610 – Fall 2003 Project Descriptions*, undated

² Ibid

Project Overview

“The project would be in two phases. The first phase would be planning and construction of the model. Key research questions for construction of the model can be characterized as follows.

- What are the key factors that affect benefits paid out, the balance of the fund, and the “Adequate Fund Balance?” For example, total wages, new monthly unemployment claims, duration of these claims, interest rates, and employer taxes (such as those described in Sections 60.2-531 and 60.2-533 of the *Code of Virginia*) should be among these key factors.
- Would some of the input data be projections as well? What would be the sources for key input data?
- How would changes in the laws (such as those changing eligibility or duration of unemployment benefits, or employer tax rates) affect projected benefits to be paid out and the projected fund balances in the next four years?”³

“The second phase would entail testing and sensitivity analyses of the model. Key questions for testing how well the model works and whether it makes sense are:

- How well does the model track variation in benefits paid out and fund balances in the past?
- How sensitive are benefits paid out, the balance of the fund, and the “Adequate Fund Balance” to the key factors identified above? (For example, what impacts would changes in unemployment rates or interest rates have?)
- How sensitive would be benefits paid out, the balance of the fund, and the “Adequate Fund Balance” to changes in the laws affecting unemployment benefits or employer tax rates?”⁴

³ Ibid

⁴ Ibid

Introduction

The unemployment insurance system was created through the federal Social Security Act of 1935.⁵ To conform with this act the Virginia General Assembly enacted the Virginia Unemployment Compensation Law during a special session in 1936-37. The 1936 regular session failed to enact a law governing unemployment insurance because of opposition from the Virginia Manufacturers Association and the coal operators.⁶

The Federal–State Unemployment Compensation (UC) Program, part of the Federal-State Unemployment Insurance (UI) System, has three main purposes. First, UC attempts to provide temporary and partial wage replacement to those who have lost their jobs through no fault of their own. Participants in the program cannot have voluntarily quit their jobs, nor can they have been fired for poor performance. UC benefits are available to those who are “laid off,” “let go,” “downsized,” or “right-sized,” to use a recent euphemism. Second, UC aims to stabilize the economy during recessions and other periods of high unemployment by providing income to unemployed workers. UC benefits enable workers to at least partially pay for necessities such as food and shelter. Finally, UC endeavors to promote reemployment, as each participant in the UC Program must actively seek work to qualify for benefits.⁷ It is important to note that UC only covers the unemployed, not the underemployed.

UC Benefits come in two types – regular and extended. Regular UC benefits are collected first, and are available in most states for 26 weeks. Funding of regular UC benefits is a state responsibility. As will be discussed in more detail later in this paper, extended benefits are collected after eligibility for regular benefits has been exhausted, and are available for an

⁵ Melton, Page Boineist. *Cover Story Left Out*, Virginia Business, May 2000, p.11

⁶ Pate, James Ernest. *Procedure of the Unemployment Compensation Commission of Virginia*, reprinted from The Virginia Law Review, Volume XXXI, No. 4, September 1945, p. 964

⁷ House of Delegates, Commonwealth of Virginia, *Report of the Joint Subcommittee Studying The Funding Requirements of the Virginia Unemployment Trust Fund*, House Document No. 113, Richmond, 2000, p. 2

additional 13 weeks in most states. Extended benefits are jointly funded by the federal government and the states.

Regular UC benefits and the role of the States

In 2002, 128 million workers nationwide were covered by UC.⁸ Currently, each state, as well as each United States territory, has its own UC program, administered within the minimum guidelines set forth by federal statute. The Social Security Act (SSA) and the Federal Unemployment Tax Act (FUTA) of 1939 establish “broad coverage provisions, some benefit provisions, the federal tax base and rate, and administrative requirements.”⁹

Operating within the federal minimum guidelines, states are responsible for establishing regular and extended benefit programs and determining how the programs will be funded. For example, to fund the regular benefit program and the state’s share of the extended benefits program, the Commonwealth of Virginia taxes employers at various rates, between 0.2 percent and 6.3 percent, on the first \$8,000 of income paid to each employee.¹⁰ Other states use a higher taxable wage base; Hawaii’s is the highest at \$29,300.¹¹ Virginia determines the tax rate on employers by analyzing employers’ lay-off history, while other states (New Jersey, Pennsylvania, and Alaska) place an additional tax on employees.¹²

Although states cannot deny benefits to individuals for refusing to work as strike-breakers or individuals who refuse to take jobs requiring union membership, states are allowed some degree of autonomy in creating a UC program. States determine the funding system that is used to finance the program, meaning the state determines how big the state trust fund balance should be and how that money is managed. States also determine eligibility requirements. Most

⁸ United States Department of Labor, Office of Workforce Security, Division of Legislation, *Unemployment Compensation, Federal-State Partnership*, April 2002, Introduction, pg. 2, downloaded from <http://workforcesecurity.doleta.gov/unemploy/pdf/partnership.pdf>

⁹ Ibid, pg. 1

¹⁰ Virginia Employment Commission, *Report to the Commission on Unemployment Compensation*, June 17, 2003, <http://www.vec.state.va.us/pdf/trustfund061703.pdf>

¹¹ United States Department of Labor, Office of Workforce Security, Division of Legislation, *Unemployment Compensation, Federal-State Partnership*, April 2002, State Taxes, pg. 10, downloaded from <http://workforcesecurity.doleta.gov/unemploy/pdf/partnership.pdf>

¹² Ibid, pg. 9

states, including Virginia, require that recipients work four out of the last five quarters in order to receive benefits, though Virginia amended this law in July 2003 to read “if the claimant has earned insufficient wages in the first 4 of the last 5 completed calendar quarters to become eligible for benefits, then such claimant’s ‘base period’ shall be the 4 most recent completed calendar quarters immediately preceding the first day of the claimant’s benefit year.”¹³ Additionally, states decide weekly benefit amounts potential weeks of benefits. Virginia and most other states pay a maximum of twenty-six weeks of compensation. Two states, Massachusetts and Washington, pay thirty weeks of basic unemployment benefits.¹⁴ Finally, states determine the taxable wage base to fund state-specific taxes. As stated earlier, Virginia taxes only employers on the first \$8,000 paid to each employee.

¹³ Virginia Employment Commission, Economic Services Division, *Major Legislative Changes in the Virginia Unemployment Compensation Act 1982-2003*, June 2003, pg. 4

¹⁴ United States Department of Labor, Office of Workforce Security, Division of Legislation, *Unemployment Compensation, Federal-State Partnership*, April 2002, State Taxes, pg. 12, downloaded from <http://workforcsecurity.doleta.gov/unemploy/pdf/partnership.pdf>

Extended UC Benefits

Extended UC benefits are usually adopted during periods of high unemployment and provide an additional 13 to 20 weeks of benefits to individuals who have exhausted their regular benefits. The mandatory trigger for extended benefits is when the “insured unemployment rate (IUR) for the previous 13 weeks is at least 5 percent and is 120 percent of the rate for the same 13 week period in the two previous years.”¹⁵ States also have two optional triggers: a state may pay extended benefits if the “IUR for the previous 13 weeks is at least 6 percent,” and “if the average total unemployment rate (TUR), seasonally adjusted for the most recent three months, is at least 6.5 percent and is 110 percent of the rate for the same three-month period in either of the two previous years.”¹⁶ Extended benefit plans were implemented twice in the 1970s, and once each in the 1980s and 1990s. The most recent extended benefit program was adopted through the Temporary Unemployment Compensation Act of 2002 and was effective from March to December of 2002.¹⁷ Extended benefits are funded jointly by the states and the Federal government.

¹⁵ Ibid, pg. 12

¹⁶ Ibid, pg. 12-13

¹⁷ Ibid, pg. 2

Federal Role (extended benefits and loans)

Though the primary focus of the UC program is at the state level, the Federal government plays three significant roles. First, it is the Federal government that establishes the minimum program requirements under which the state programs must operate. Second, the Federal Government funds half of the extended benefits program. Finally, the Federal government loans money to those states which have exhausted their regular benefit funds. To fund and administer Federal UC programs:

“FUTA imposes a 6.2 percent gross tax rate on the first \$7,000 paid annually by covered employers to each employee. Employers in States with programs approved by the Federal Government and with no delinquent Federal loans may credit 5.4 percentage points against the 6.2 percent tax rate, making the minimum net Federal unemployment tax rate 0.8 percent. Since all States have approved programs, 0.8 percent is the effective Federal tax rate.”¹⁸

This means that the federal government collects 0.8 percent on the first \$7,000 of income per employee. There is no reimbursement from the federal government to the state governments of the additional 5.4%. Rather, the money is a “credit” and is never really collected by the Federal government. What the Federal government does do, however, is “share” with the States the portion of the 0.8% FUTA tax over and above what is required to operate the UC program at the Federal level. For example, Virginia employers paid \$191 million in FUTA taxes in 2000. Of this, \$54 million, or just over 28%, was transferred to the Virginia Employment Commission.¹⁹

¹⁸ Committee on Ways and Means, U.S. House of Representatives, *2000 Green Book*, downloaded from the Department of Health and Human Services website, <http://aspe.hhs.gov/2000gb/>

¹⁹ Virginia Employment Commission, *Report to the Commission on Unemployment Compensation*, June 17, 2003, downloaded from <http://www.vec.state.va.us/pdf/trustfund061703.pdf>

Virginia Unemployment

In 2002, 173,432 individuals collected unemployment benefits from the Commonwealth of Virginia. This amounted to a total of \$744,277,134 in regular benefits paid for the year.²⁰ Beginning on July 6, 2003, the maximum amount of benefits paid each week is \$316, while the minimum benefit is \$50 per week. This is a decrease over the previous period, September 2001 to January 2003, where the maximum weekly benefit was \$368 per week.²¹ The average unemployed worker in Virginia received 12.8 weeks of benefits at an average benefit of \$297.72 per week.²²

²⁰ Virginia Employment Commission, *About Unemployment Insurance – Overview and History of the UI Program*, downloaded from http://www.vec.state.va.us/vecportal/about_vec.cfm#about_UI

²¹ Virginia Employment Commission, Economic Services Division, *Major Legislative Changes in the Virginia Unemployment Compensation Act 1982-2003*, June 2003, pg. 6

²² Ibid, pg. 7

Trust Fund Solvency

In the most basic terms, trust fund solvency means that the Virginia Unemployment Trust Fund should have enough money in it to meet all valid UC claims in a period of high unemployment. In the last thirty years, Virginia has experienced four recessionary periods, each coming at the beginning of the decade: 1973-75, 1981-82, 1991 and 2001. Each of these recessions had a different duration and magnitude, and each have affected Virginia unemployment differently.

To calculate the duration of a recessionary period, the General Assembly mandated 1997 that the Virginia Employment Commission (VEC) have reserves equaling 1.38 years or 16.5 months.²³ This assumed duration is multiplied by the “average cost rate” and “wages” to arrive at the trust fund solvency threshold.

$$\text{Solvency} = 1.38 \times \text{Average Cost Rate} \times \text{Wages}^{24}$$

The “average cost rate” is the magnitude of demand for unemployment benefits. This can be calculated as the ratio of unemployment benefits paid by the VEC to the taxable wages paid by employers. The current formula for “average cost rate” is based on twenty years of unemployment data. “Wages” refers to current taxable wages paid by employers. This enables the VEC to bring the Trust Fund reserve in line with the current size of the Virginia economy.²⁵

²³ Dr. Greg Rest, Joint Legislative Audit and Review Commission, Commonwealth of Virginia, *Memorandum, To File, From Greg Rest, Unemployment Trust Fund: What kind of economic downturn do you want to guard against?* January 31, 2000, pg. 3

²⁴ James Ellenberger, Deputy Commissioner Virginia Employment Commission, *Report to the Commission on Unemployment Compensation*, June 17, 2003, pg. 15.

²⁵ Dr. Greg Rest, Joint Legislative Audit and Review Commission, Commonwealth of Virginia, *Memorandum, To Robert Vaughn and Neil Menkes, From Greg Rest and Daniel Oney, Preliminary technical assessment of Unemployment Insurance Trust Fund*, February 1, 2000

Factors that affect the Virginia Unemployment Trust Fund – A complex model

Although JLARC wants to be able to predict the balance of the VUTF on a macro-level, the team analyzed the inflow and outflow variables of the VUTF and put together a complex model for predicting its balance. All of the variables below (see also Appendix 1) were considered in the original model and then modified or discarded to achieve a more simplified model.

1. Inflow Variables: **taxable wages**: a) Construction, b) Finance, Insurance, and Real Estate, c) Government, d) Manufacturing, e) Mining, f) Retail Trade, g) Services, h) Transportation and Public Utilities, and i) Wholesale Trade, **Virginia payroll tax rate**: a) Construction, b) Finance, Insurance, and Real Estate, c) Government, d) Manufacturing, e) Mining, f) Retail Trade, g) Services, h) Transportation and Public Utilities, and i) Wholesale Trade, and **interest income**

Taxable wages are a major inflow into the VUTF. Because different industries are taxed at different levels, data from these industries needs to be used to see how they affect the funding of the VUTF. Some industries have been very stable over the past decades while the other industries have not. Therefore, their contributing abilities towards the VUTF have been different.

2. Outflow Variables: **duration of benefits, amount of benefits, number of claimants**
Minimum and maximum amount of benefits and maximum duration of benefits can be easily manipulated by the General Assembly. Additionally, the average number of claimants can change from quarter to quarter. This is where the sensitivity analysis will apply.

3. Other Variables: **US GDP, age and gender**
GDP- This variable is a macro-level variable that will help explain the model more. If the general economic situation in US is good, then people might be more confident about finding a job sooner and therefore less likely to claim the funds. Lagged GDP will help to rid the model of potential autocorrelation problems in the time series data.

Age- Unemployment data from different age groups, 18-24, 25-34, 35-44, 45-54, 55-65, should be used. Different age groups will have different attitudes towards the claiming of the funds. If in the current year, a higher percentage of claimants are 35-44 and it is forecast that more people in the labor force will be 35-44 in the next 10 years, the expected demand for the unemployment funds will be higher.

Gender- As with age, males and females might have different attitudes toward the claiming of unemployment benefits. This could influence the model. In addition, depending on the type of data, an interaction term, such as unemployed women in the 35-44 age group, should be used.

Factors that affect the Virginia Unemployment Trust Fund – A simplified model

In the most simple terms, the Virginia Unemployment Trust Fund (VUTF) is a product of three factors – money coming into the fund through payroll taxes, transfers, and interest; money paid out of the fund in the form of benefits, and the fund balance itself. Each of these factors is in turn a product of many other factors.

1. Inflow – payroll taxes, transfers, and interest:

a. Payroll Taxes: This is the major cash inflow to the VUTF, and is a function of three factors:

i. Taxable Payroll

1. Definition
2. Size

ii. Tax Rate

1. Definition
2. Range
3. Average

iii. Employer experience rating

1. Definition
2. Industry examples

b. Transfers: As discussed above, the Federal government transfers to the states part of the money collected through the FUTA tax. On average, Virginia receives \$54 million per year from the Federal government.

c. Interest: The Commonwealth earns interest on the balance of the Virginia Unemployment Trust Fund. In 2003, interest revenue was \$21 million. With a January 1 balance of \$528 million and a projected December 31 balance of \$186.8 million, the average fund balance for 2003 would be \$357.4 million. Dividing this amount by the amount of interest earned – \$21 million – means that the Commonwealth earned 5.88% on the Trust Fund balance in 2003. Obviously, lower Trust Fund balances will yield lower amounts of interest income.

2. Outflow (benefits paid). Three primary factors affect how much money flows out of the VUTF – the number of people collecting UC benefits, the duration of those benefits, and the amount collected:

Options for forecasting inflows, outflows, and trust fund balance

Data on Unemployment Trust Fund Inflows, Outflows, and Balances can be obtained through a variety of methods. One option, used at present, is to rely on data received from the U.S. Department of Labor (U.S. DOL) and the Virginia Employment Commission. Three methods examined here would provide an independent source of this information. These include replicating the U.S. DOL model in Excel, creating a new model in Excel, or creating a model that uses Excel in combination with a commercial forecasting program. Each method has plusses and minuses, discussed in detail below.

1. Option 1 – rely on data received from U.S. DOL and VEC

a. Benefits:

- i. Model already established and proven
- ii. Model accounts for almost all factors that affect Virginia Unemployment Trust Fund
- iii. Model has generally been a reliable source of information

b. Limitations:

- i. Obtaining data is slow – JLARC must request data through VEC. It can sometimes take several weeks to receive requested data
- ii. It is difficult for JLARC to perform the sensitivity analysis necessary to examine changes in eligibility, benefit levels, etc.
- iii. Independent analysis not possible – JLARC does not have a way to verify the information it receives from U.S. DOL and VEC

2. Option 2 – replicate the U.S. DOL model in Excel

a. Benefits

- i. Would allow JLARC to obtain data in-house, without having to go to U.S. DOL and VEC
- ii. Timeliness of data greatly improved
- iii. Would provide an independent verification of the U.S. DOL/VEC data
- iv. Would allow JLARC to perform in-house sensitivity analysis

b. Limitations

- i. Model would be difficult and time-consuming to construct, and is beyond the technical ability of our team
- ii. Constructing and operating this type of model requires an in-depth understanding of how all variables work together
- iii. Data needed to operate the model requires constant updating – something that may be difficult in an office with many other responsibilities

3. Option 3 – construct relatively simple model in Excel
 - a. Benefits
 - i. Microsoft Excel software is widely available
 - ii. Model relies on relatively simple regression techniques
 - iii. Since the model is Excel based and relies on a relatively limited data-set, it would be easier to conduct sensitivity analysis
 - b. Limitations
 - i. Can only give “ball park” figures
 - ii. Opportunity for error is significant
 - iii. Should not be used for major policy decisions
4. Option 4 – construct more elaborate model using Excel and some type of forecasting software (EViews, Forecast Pro, etc.)
 - a. Benefits
 - i. More likely provide more accurate forecasts than Excel-based model
 - ii. Model would be better able to capture seasonal and trend data
 - iii. Model would allow for “expert judgment” to adjust forecasts
 - b. Limitations
 - i. Requires forecasting software
 - ii. Requires understanding of forecast software
 - iii. “Expert judgment” can be wrong
 - iv. Can only give “ball park” figures
 - v. Opportunity for error is significant
 - vi. Should not be used for major policy decisions

Model Selection and Development

In accordance with the wishes of JLARC, the team developed the Option 3 model. The model was developed in the following sequence.

1. Forecast Taxable Wages, 2004 – 2007
 - a. Using the *Exponential Smoothing* feature of the *Forecast Pro* software package, Taxable Wages were forecast for 2004 – 2007
 - b. The forecast model for Taxable Wages used *Holt Exponential Smoothing*:, and was found to have a linear trend with no seasonality (since annual data was used)
 - c. Measure of fit statistics are good for this model:
 - i. Adjusted R-square 0.9982
 - ii. Durbin-Watson 1.831
 - iii. Ljung-Box(18)=16.9 P=0.4701
 - iv. MAPE 0.02473
 - d. Results for 2004 – 2007 are shown in Appendix 2 (in millions of \$). See Appendix 3 for forecasts beyond 2007.
2. Forecast Fund Balance Interest Rate, 2004 – 2007
 - a. An approximation of interest rates for the past 20 years was determined by dividing the past period Dec. 31 fund balance (in millions of \$) by the current period interest (in millions of \$)
 - b. The interest rates for the past 10 years have been relatively steady, between 6.2% and 7.5%. This is in contrast to the prior 10 periods, which saw the interest rate fluctuate from just below 9% to almost 28%.
 - c. Averaging the interest rates for the past 10 years gives an average rate of 6.89%.
 - d. This amount will be used to forecast interest payments for 2004 – 2007.
 - e. Calculations are shown in Appendix 2.
3. Forecast Unemployment Rate, 2004 – 2007
 - a. Plotting the monthly unemployment rate for the past 25 years using *Forecast Pro* reveals a highly cyclical pattern, with the unemployment rate approaching 8% in 1983 and bottoming out just above 2% in 2000. The most recent peak was at 4.3% in April 2003, and the unemployment rate seems to be on the decline.
 - b. Appendix 2 shows the annualized unemployment rates for the past 25 years. The annual rate of change over this 25-year period is $\pm 0.69\%$, meaning that on average there has been a 0.69% rise or fall in the unemployment rate year-to-year over the past 25 years.
 - c. With the unemployment rate seemingly on the decline, a 0.69% decline each year from 2004 – 2007 would quickly put the unemployment rate below the floor represented by the natural unemployment rate. Thus it is not likely that the unemployment rate will change at the average rate over the next four years. (See Appendix 4, which shows the unemployment rate reaching zero by March 2007).
 - d. For purposes of estimation, we have assumed that the unemployment rate will drop by approximately 0.25% over each of the next four years, from 3.75% in

2004 to 3% in 2007. When using the model in subsequent, current unemployment rate figures can be substituted to obtain more accurate numbers.

4. Forecast Benefits Paid Out, 2004 – 2007

- a. Using the historic information for *Benefits Paid Out*, *Taxable Wages*, and the *Unemployment Rate*, we ran a regression with *Benefits Paid Out* as the dependent variable and *Taxable Wages* and *Unemployment Rate* as the independent variables.
- b. The resulting regression gives the following forecast:
 - i. $\text{Wages paid out} = -202.338168 + 0.002988 (\text{Taxable Wages}) + 51.369954 (\text{Average Unemployment Rate})$.
 - ii. This regression result has an Adjusted R-square of 0.8403. Thus 84% of the variation in Benefits Paid Out is explained by just two independent variables, both of which have good t-statistic values (11.52 and 8.61 respectively).
 - iii. See Appendix 5 for detailed regression output.
- c. Using the *Taxable Wages* and *Unemployment Rate* forecasts developed above, Benefits Paid Out can be forecast for 2004 – 2007. These calculations are shown in Appendix 6, with the data entered in Appendix 2.

5. Forecast Revenues, 2004 – 2007

- a. Using the *Ratio of benefits paid out to taxable wages*, the *Change in average unemployment rate from last period*, the *Change in average unemployment rate from last period (squared)*, and *Adequate Fund Balance* as the independent variables, with each lagged two years, we ran a regression with *Revenues* as the dependent variable.
- b. The resulting regression gives the following forecast:
 - i. $\text{Wages paid out} = -64.745 + 31379.141 (\text{Ratio of benefits}) + 22.146 (\text{Change in average rate}) + 18.973 (\text{Change squared}) + 0.156 (\text{Adequate Fund Balance})$
 - ii. This regression result has an Adjusted R-square of 0.8505. Thus 85% of the variation in Revenues is explained by the independent variables, all of which have good t-statistics.
 - iii. See Appendix 7 for detailed regression output.
- c. Using the forecasts developed above, Revenues can be forecast for 2004 – 2007. These calculations are shown in Appendix 8, with the data also entered in Appendix 2.

Conclusion

By using the appendices and following the steps above, our results can be replicated, or updated as new information becomes available. As per our client's wishes, this model is designed to provide ballpark estimates only. We strongly caution that this model should not be used for substantive policy decisions, as many factors have not been considered in this relatively simple model. Still, the data presented here should provide a general idea of trend and scope for the next four years, and can be used to highlight areas where more detailed research is required or desired.

Appendix 1 – Location and Availability of Data for Complex Model

VARIABLE NAME	SOURCE OF DATA	DATA PUBLIC? ²⁶	AGE OF DATA
wageconstruct	Bureau of Labor Statistics	yes	back to 1952
wagefinance	Bureau of Labor Statistics	yes	back to 1952
wagegov	Bureau of Labor Statistics	yes	back to 1952
wagemanuf	Bureau of Labor Statistics	yes	back to 1952
wagemining	Bureau of Labor Statistics	yes	back to 1952
wageretail	Bureau of Labor Statistics	yes	back to 1952
wageservices	Bureau of Labor Statistics	yes	back to 1952
wagetransport	Bureau of Labor Statistics	yes	back to 1952
wagewholesale	Bureau of Labor Statistics	yes	back to 1952
payconstruct	Need data	no	n/a
payfinance	Need data	no	n/a
paygov	Need data	no	n/a
paymanuf	Need data	no	n/a
paymining	Need data	no	n/a
payretail	Need data	no	n/a
payservices	Need data	no	n/a
paytransport	Need data	no	n/a
paywholesale	Need data	no	n/a
durbenefits	Need data	no	n/a
amtbenefits	Need data	no	n/a
claimants	Need data	no	n/a
USAGDP	Department of Commerce/ Bureau of Economic Analysis	yes	yearly 1929 quarterly 1946
gender	Bureau of Labor Statistics	yes	n/a
age	Bureau of Labor Statistics	yes	n/a

²⁶ Data available to the public via the Internet or published sources

Appendix 2 - Data Sheet

Period	Taxable Wages [\$millions]	Benefits Paid Out [\$millions]	Revenues (from employer taxes) [\$millions]	Revenues (from interest on fund balance) [\$millions]	Dec. 31 Fund Balance [\$millions]	"Adequate Fund Balance" [\$millions]
1978	16,400	94.9	n/a	n/a	n/a	n/a
1979	18,700	104.3	n/a	n/a	n/a	n/a
1980	20,400	169.2	117.2	7.5	65.8	n/a
1981	22,400	170.3	163.2	6.5	67.5	322.1
1982	23,500	245.1	181.2	5.8	9.4	355.3
1983	26,000	175.6	238.3	2.6	75.8	384.2
1984	29,300	122.0	306.9	13.5	274.9	428.5
1985	32,700	144.7	255.1	33.4	417.8	478.0
1986	36,100	141.7	193.5	44.7	514.2	527.0
1987	40,200	134.9	162.8	49.8	592.0	584.0
1988	44,100	142.7	141.8	52.4	643.0	650.0
1989	47,000	143.3	142.5	57.9	700.6	711.0
1990	49,100	198.1	136.6	63.4	702.5	751.0
1991	49,500	328.0	140.4	58.1	573.0	761.5
1992	52,500	296.9	177.3	55.7	498.2	782.3
1993	54,900	227.9	236.6	37.9	544.7	828.2
1994	58,100	222.4	279.3	39.2	640.9	878.7
1995	62,000	210.0	289.9	48.2	769.0	937.6
1996	66,700	203.5	255.1	56.7	877.2	994.5
1997	73,100	187.0	205.6	62.4	958.2	805.9
1998	80,300	186.8	143.4	66.4	981.2	888.0
1999	87,500	178.5	146.3	67.1	1017.5	974.9
2000	93,100	202.9	141.9	68.2	1024.7	1031.1
2001	98,200	274.7	120.4	65.5	935.9	1003.2
2002	103,600	312.0	148.9	58.3	831.2	947.2
2003	108,800	322.2	185.6	51.7	746.2	774.4
2004	114,033	331.0	201.5	51.4	668.1	876.3
2005	119,265	333.8	146.5	46.0	526.8	916.6
2006	124,497	336.6	160.2	36.3	386.7	941.1
2007	129,729	339.4	162.1	26.6	236.0	980.6

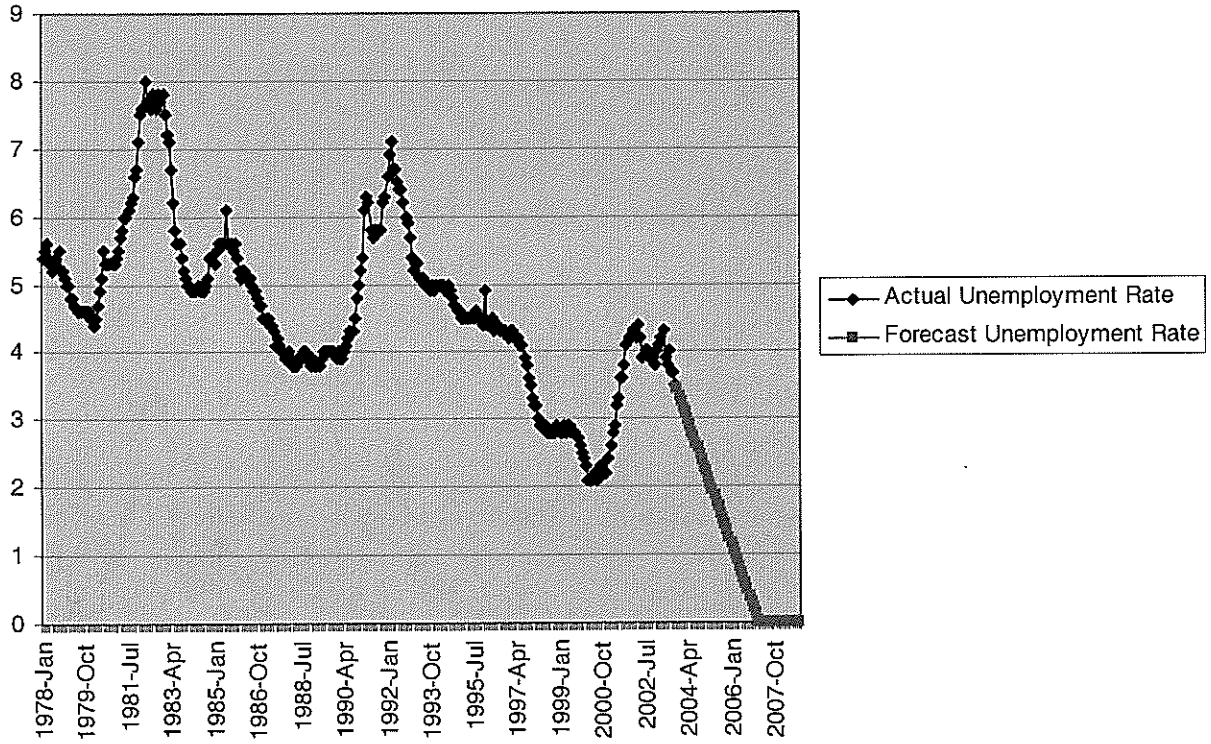
Appendix 2 - Data Sheet (continued)

Ratio of benefits paid out to taxable wages	Average of three highest ratios in past 20 years	Years with highest ratios	Revenue/Dec 31 Fund Balance	Interest	Average interest rate: 1994 - 2003	Average Unemployment Rate	Change in average unemployment rate from last period	Change (squared)	Average annual change)
0.829%						5.34	-0.63	0.40	
0.760%						4.71	0.30	0.09	
1.043%			9.88%			6.12	1.11	1.23	
0.675%			8.59%			7.71	1.59	2.53	
0.416%			27.66%			6.03	-1.68	2.81	
0.443%			17.81%			5.03	-1.00	1.00	
0.393%			12.15%			5.58	0.55	0.30	
0.336%			10.70%			4.99	-0.59	0.35	
0.324%			9.68%			4.23	-0.76	0.58	
0.305%			8.85%			3.89	-0.34	0.12	
0.403%			9.00%			3.93	0.03	0.00	
0.663%			9.05%			4.35	0.43	0.18	
0.566%			8.27%			5.93	1.58	2.51	
0.415%			9.72%			6.43	0.49	0.24	
0.383%			7.61%			5.10	-1.33	1.76	
0.339%			7.20%			4.87	-0.23	0.05	
0.305%			7.52%			4.50	-0.37	0.13	
0.256%			7.37%			4.39	-0.11	0.01	
0.233%			7.11%			3.96	-0.43	0.19	
0.204%			6.93%			2.92	-1.04	1.09	
0.218%			6.84%			2.78	-0.14	0.02	
0.280%			6.70%			2.20	-0.58	0.33	
0.301%			6.39%			3.39	1.19	1.42	
0.296%		1985, 1991, 1992	6.23%			4.07	0.67	0.46	
0.290%	0.557%	1985, 1991, 1992	6.56%		6.89%	3.92	-0.15	0.02	0.71
0.280%	0.557%	1985, 1991, 1992	6.89%			3.75	-0.17	0.03	
0.270%	0.548%	1991, 1992, 1993	6.89%			3.5	-0.25	0.06	
0.262%	0.548%	1991, 1992, 1993	6.89%			3.25	-0.25	0.06	
						3	-0.25	0.06	

Appendix 3 - Taxable Wages 1978 - 2022

Year	TaxableWages - Historical Taxable Wages in millions of \$	TaxableWage - Fitted Values Taxable Wages in millions of \$	TaxableWages - Forecasted Values Taxable Wages in millions of \$
1978	16,400	18,595	
1979	18,700	16,819	
1980	20,400	20,632	
1981	22,400	22,151	
1982	23,500	24,351	
1983	26,000	24,764	
1984	29,300	28,260	
1985	32,700	32,405	
1986	36,100	36,047	
1987	40,200	39,491	
1988	44,100	44,164	
1989	47,000	48,015	
1990	49,100	50,094	
1991	49,500	51,387	
1992	52,500	50,258	
1993	54,900	55,063	
1994	58,100	57,339	
1995	62,000	61,154	
1996	66,700	65,740	
1997	73,100	71,219	
1998	80,300	79,143	
1999	87,500	87,285	
2000	93,100	94,663	
2001	98,200	99,000	
2002	103,600	103,448	
2003	108,800	108,968	
2004			114,033
2005			119,265
2006			124,497
2007			129,729
2008			134,961
2009			140,194
2010			145,426
2011			150,658
2012			155,890
2013			161,122
2014			166,354
2015			171,587
2016			176,819
2017			182,051
2018			187,283
2019			192,515
2020			197,747
2021			202,979
2022			208,212

Appendix 4 – Actual vs. Forecasted Monthly Virginia Unemployment Rates



Appendix 5 - Benefits Paid Out Regression Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.923617702
R Square	0.85306966
Adjusted R Square	0.840293109
Standard Error	26.36877372
Observations	26

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	92849.74492	46424.87246	66.76838206	2.64108E-10
Residual	23	15992.18123	695.3122275		
Total	25	108841.9262			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-202.3381684	39.1075159	-5.173894677	3.03351E-05	-283.2381186	-121.4382181	-283.2381186	-121.4382181
Taxable Wages [\$millions]	0.002987822	0.000259416	11.51750112	4.99087E-11	0.00245118	0.003524464	0.00245118	0.003524464
Average Unemployment Rate	51.3699535	5.966677108	8.609474348	1.18976E-08	39.0269583	63.7129487	39.0269583	63.7129487

Appendix 6 - Calculations of Benefits Paid Out

Formula: $-202.338168 + 0.002988 (\text{Taxable Wages}) + 51.369954 (\text{Average Unemployment Rate}) = \text{Benefits Paid Out}$

Period	Intercept	Taxable Wages	Average Unemployment Rate	Benefits Paid Out
2004	-202.338168	114,033	3.75	331.0
2005	-202.338168	119,265	3.5	333.8
2006	-202.338168	124,497	3.25	336.6
2007	-202.338168	129,729	3	339.4

Appendix 7 - Revenues Regression Output

Regression Statistics	
Multiple R	0.938300777
R Square	0.880408348
Adjusted R Square	0.850510435
Standard Error	22.61668845
Observations	21

ANOVA					
	df	SS	MS	F	Significance F
Regression	4	60250.58931	15062.64733	29.44715053	3.36542E-07
Residual	16	8184.233546	511.5145966		
Total	20	68434.82286			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-64.74523881	39.66634521	-1.632246126	0.122149954	-148.8341147	19.34663812	-148.8341147	19.34663812
Ratio of benefits paid out to taxable wages	31379.14103	3659.549782	8.574590565	2.22944E-07	23621.24381	39137.03826	23621.24381	39137.03826
Change in average unemployment rate from last period	22.14629939	6.027017642	3.674503826	0.002049826	9.369595634	34.92300314	9.369595634	34.92300314
Change (squared)	18.97286927	6.113680752	3.103346419	0.00688182	6.012447972	31.93329057	6.012447972	31.93329057
"Adequate Fund Balance" [\$millions]	0.156413816	0.033799631	4.627678184	0.000279392	0.084761815	0.228065817	0.084761815	0.228065817

Appendix 8 - Calculations of Revenues

Formula: $-64.74523831 + 31379.141034 \text{ (Ratio)} + 22.146299 \text{ (Change)} + 18.972869 \text{ (change sq)} + 0.156414 \text{ (Adq Fund Bal)} = \text{Revenues}$
 (lagged two years) (lagged two years) (lagged two years)

Period	Intercept	Ratio	Change	Change Squared	Adq. Fund Balance	Revenues
2004	-64.74523831	0.00301158	0.67	0.46	947.2	201.5
2005	-64.74523831	0.00296140	-0.15	0.02	774.4	146.5
2006	-64.74523831	0.00290293	-0.17	0.03	876.3	160.2
2007	-64.74523831	0.00279898	-0.25	0.06	916.6	162.1