The Macroeconomics of Pre-Schooling: Simulating the Effects of Universal Early Childhood Education on the U.S. Economy

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1. Introduction

This paper uses a general equilibrium macroeconomic model for the U.S. to estimate the economic consequences of a large-scale, publicly-funded early childhood education program.

Thus far, almost all the research on early childhood education (ECE) has adopted a micro-analytic framework. This research has been extremely valuable in establishing how an economy might benefit from ECE and in affirming that small-scale ECE programs do yield a high rate of return both to participants and to the public (Calman and Tarr-Whelan, 2005; Belfield, 2005; Karoly and Bigelow, 2005; Barnett, 1995). However, such research is of less use for policies to expand ECE across larger proportions of children. Large-scale or universal programs will have general equilibrium effects affecting many sectors of the economy. For example, ECE programs allow parents to work, so households should increase labor market participation; but if large numbers of mothers enter the labor force, average wages will fall; and if ECE is publicly funded, income tax rates may rise and so reduce labor supply. The net effect on economic output is therefore ambiguous, and it may differ over the short and long run depending on how labor supply elasticities change. In addition, large-scale programs may generate spill-over effects as one worker's human capital influences another worker's productivity (Rauch, 1993; Acemoglu and Angrist, 2000). These general equilibrium and spillover effects cannot be adequately modeled using program evaluation methods such as cost-benefit or return on investment analysis.

The outline of this paper is as follows. First, we summarize the links between education and economic growth, with a particular focus on ECE. We then describe the alternative methods for estimating the economic consequences of expanding ECE and emphasize the advantages of using a macroeconomic model. Second, we describe the model used here and specify the parameters that will be affected. Third, we run simulations using this model and applying the new parameter values. Finally, we offer conclusions on what further macroeconomic research might be performed.

2. Early Education and Economic Growth: Evidence and Methods

2.1 Evidence

There is a growing body of macroeconomic evidence relating education to economic growth (Krueger and Lindahl, 2001; Temple, 1999). However, the results are far from conclusive, with both positive and negative correlations (Pritchett, 1996; Temple 2001). Moreover, the causality is difficult to establish, the exact pathways through which effects are mediated is unclear, and the impacts are sensitive to the functional form of the relationship between education and GDP (Mamuneas et al., 2006). In addition, human capital can be defined in many ways to produce different measures of the productivity of the workforce (Woessman, 2003).

Notwithstanding these empirical challenges, there is general agreement that macroeconomic growth and education levels are positively correlated (if only because the microeconomic evidence is sufficiently robust). Moreover, there is broad agreement in the literature that earlier investments in education are more likely to be effective in raising economic growth (Keller, 2006; Carneiro and Heckman, 2004).

2.2 Alternative Methods for Estimating Economic Impacts

Broadly, there are three methods for estimating the economic consequences of ECE. Each has its strengths and weaknesses.

The most commonly used approach is to calculate the net present value of an investment in ECE (Belfield, 2005; Karoly and Bigelow, 2005). In this method the investment costs of the program are compared to the discounted benefits of the program. This method is useful: for establishing that small-scale programs are likely to be high-yield public investments; for identifying the balance between public and private benefits; and for comparing across programs (Reynolds et al., 2002; Barnett and Masse, 2006). However, this method cannot provide information on macroeconomic variables or account for general equilibrium effects over time from large-scale ECE programs. (It is possible to extrapolate forward and weight the effect according to population size, see Lynch, 2004).

The second approach is to estimate GDP growth regressions within an endogenous growth framework (Aghion and Howitt, 1997). These models focus either on the stock of human capital as a source of innovation and technological advance or on the accumulation of human capital over time (e.g., Dickens et al., 2006). This method faces many of the methodological problems noted above. In addition, endogenous growth models emphasize changes in the amount or composition of human capital. Yet, investments in early education generate spillover effects for families and for society; such investments are not simply ways to augment human capital. Plus, because they are publicly-funded, the short- and medium-run effects are on government spending; increases in human capital from expanded ECE do not occur for at least 12 years. Hence, such models do not consider some of the main benefits from ECE nor do they easily include the fiscal impacts.

A third method is to directly examine the macroeconomic consequences of ECE using a model of U.S. economy. To our knowledge, this method has not been used for analyzing ECE. (A similar approach, but with far fewer parameters, is adopted by Restuccia and Urrutia (2004); but they look at intergenerational earnings mobility (rather than standard macroeconomic variables) and compare investments in higher education with investments in elementary/secondary school). Thus, our attempt at modeling should be considered as exploratory, rather than definitive.

A macroeconomic model begins with a sectoral decomposition of the economy. By convention, these sectors are households, firms, the financial market, federal government, and state government. A series of behavioral equations are then set down for each sector. For example, labor force participation by households depends on the unemployment rate, lagged participation, and total net wealth; and the number of jobs offered by firms depends on productivity levels and incomes. A series of behavioral equations are also set down to link the sectors. For example, firms cannot hire more workers than households supply; governments cannot collect tax revenue that exceeds the tax payments made by firms and households. Finally, a series of identity equations are set down to ensure that the model closes (e.g., the state cannot spend more than its revenues plus borrowing minus debt repayments). Changing the parameter values for the behavioral equations will alter the outcomes in each of the sectors. This in turn will affect macroeconomic variables such as GDP growth, unemployment, and the federal budget.

A general equilibrium macroeconomic model has several distinctions over alternative methods for estimating the consequences of ECE. Publicly financed investments have multiple sectoral effects, on households, firms, and federal and state government agencies. In addition, there are short, medium, and long run consequences for each sector. Tracing through the effects – and the iterative feedback effects – on each sector necessitates this type of model. (For example, Blankenau and Stimpson (2004) show how general equilibrium effects of public investments can offset or even negate the cross-sectional link between education and growth). Furthermore, some of the impacts of ECE (such as how government financing will influence job creation through higher marginal tax rates) are not easily 'costed out' so as to fit into a cost-benefit analysis. In contrast, macroeconomic models are based on behaviors in markets (rather than unit costs); impacts can therefore be addressed by accurately specifying the behavioral changes caused by ECE. Lastly, such models are essential for mapping out the effects of a large-scale expansion of ECE, i.e. for universal programs where general equilibrium and spillover effects will be important.

We note here that the model we apply below was not specifically developed for calculating the consequences of ECE investments. (Its main focus is on the financial sector of the economy). In some respects, this is a weakness: it is not possible to recalibrate a 'human capital' variable (because it is not included in any of the equations). However, for our purposes, the model is still useful. Our goal is to explore the full ramifications of investments in ECE across the macroeconomy (and not just the labor market for mothers of participants). And because ECE is an investment, effects in financial markets are pertinent in linking initial expenditures with later outcomes. A model that fully maps out macroeconomic variables for households, firms, and government should therefore be illuminating.

3. Model of the U.S. Economy

3.1 Fair Model

We use the model developed by Ray Fair (1994, www.fairmodel.econ.yale.edu). The Fair Model estimates economic aggregates from 1954 to 2009, using a set of behavioral and identity equations based on microeconomic decisions within each sector. The main decisions for households include consumption, labor supply and the demand for money. For firms, the main decisions are production, investment, employment, and the demand for money; they may set prices and wages within a monopolistically competitive goods market. Households and firms may make 'irrational' decisions, i.e. households may experience unemployment and firms may price their goods such that they accumulate inventory. Tax rates and government spending are exogenous in the Fair Model. (An international sector is also included in the model, but it has little influence on our analysis).

To apply the model we need to specify how ECE influences behaviors and which specific behavioral equations should be recalibrated. Given the policy of expanding ECE, the labor supply variables (of households) and labor demand variables (by firms) play a key role in our analysis. Because they are exogenous, government spending and tax rates can be recalibrated in a straightforward manner in our policy scenario.

3.2 Policy Scenario

The policy scenario proposed here is a large-scale, sustained expansion of ECE programs for 4-year olds across the U.S. (Full details of the policy scenario and changes in the values of the key variables are reported in the Technical Appendix. Throughout, all money values are reported in 2005 dollars.) This expansion would begin in t=1 with 800,000 new places (n_t) and continue over the next three decades. The program would grow proportionately with the population growth rate (1.35% p.a.) to ensure a stable percentage of the age cohort being served. By t=30, the program would be therefore be offering places to 1,180,263 children. The program would be targeted to be available only to those below an income threshold. This size of program would cover approximately 20% of the age cohort in any given year; this is close to the proportion of children who grow up in poverty in the U.S. (deNavas-Walt et al., 2005, p.11); and it is lower than the expected high school dropout rate for cohorts since 1980 (Warren, 2005). Although large-scale, the program is still 'targeted' to more disadvantaged children (similar to Head Start).

Funding: The per-child expenditure for the program (c_t) is assumed at $6,000 in 2005 dollars. This estimate is 15% above the average amount spent in 2005 by the ten highest-funding states (Belfield, 2005b, Table 8). It should therefore ensure that high-quality ECE is provided and so generate the types of outcomes that are associated with such programs. (The specific details of the program are not considered here; quality indicators are given in NIEER (2005)). Total expenditures on ECE in any given year are therefore $C_t = n_t \times c_t$.

Financing: We model three alternative financing mechanisms for the program. The first (financing mechanism I) is state-financed and publicly-provided: the state spends $2C_t/3$ to hire additional workers (∂JS>0) and invests in physical capital to the amount of $C_t/3$ (∂CCS>0). No additional revenue is budgeted for, so this mechanism is equivalent to deficit-financing. The second alternative (II) is to fund the ECE investment by raising state corporate taxes (∂TFS>0); this is similar to a proposal for an Early Learning Fund for ECE in Minnesota (Grunewald and Rolnick, 2005). The third alternative (III) is to fund the investment by raising household income taxes (∂THS>0). Alternatives I and III are probably more likely than II, although a mixture of each is possible.

It is important to allow the short-, medium-, and long-run effects of the policy change to play out: longitudinal analyses of the High/Scope Perry Pre-school program show very long-run benefits at least to age 40 (Belfield et al., 2006). Therefore, we model the effects over the period 1979-2009, i.e. t_0 is 1979, t_1 is 1980, etc. This simulation is therefore a historical counterfactual: what path would the U.S. economy have followed if it had invested in ECE? (Approximately, this is the period since the publication of *A Nation at Risk*, in which the education system was regarded as far short of expectations). The advantage of such a counterfactual is that we can rely on the baseline prediction as being correct and so focus only on the new scenario. In contrast, a prediction into the future would require an accurate specification of both a baseline economy and an economy with expanded ECE.

3.3 Changes in Parameter Values

Evidence from published research on the impacts of ECE is used to calibrate changes in the parameter values for each sector within the model. The key microeconomic variables are summarized in the Technical Appendix.

The domains of anticipated impacts are well-established: increased time for parents; improved school readiness for participants; lower school system expenditures, criminal justice system expenditures, and welfare expenditures and higher tax revenues for the state; and enhanced labor market outcomes for the participants in adulthood (see Barnett, 1995; Temple and Reynolds, 2006). However, because of the magnitude of the proposed policy there is no exact evidence available to estimate its effects: most of the research either has been conducted on small samples or has omitted collecting data on general equilibrium effects. Our approach is therefore to take the most conservative impacts across the pre-school programs (and to apply sensitivity analysis).

Increased time for parents

For the cohort of n_t there are $0.95n_t$ mothers. There are two effects on their behavior: one is that some mothers will newly enter the labor market ($\partial L2$>0); the second is that mothers already working will get a boost in productivity because they do not have to worry about child care commitments ($\partial PROD$>0). Danziger et al. (2004) estimate a very strong effect of child care subsidies: female labor force participation rises from 60% to 75% and productivity rises by 12%. This last effect seems too large, so we cut it to 6%. So, the increase in the female labor force is $0.15*0.95n_t$ in period t=1 and the increase in productivity is 6% for $0.75*0.95n_t$ and in period t=1.

As well as higher labor force participation, the mothers will also claim less welfare. We assume that welfare rolls fall from $0.1n_t$ to $0.08n_t$. Transfer payments from state government to households therefore fall ($\partial TRGH<0$).

Costs to the education system

There are two sets of effects of ECE on the education system. The medium-run effects are that the school system is more efficient: fewer children are placed in special education; fewer are retained in grade; and overall learning productivity is enhanced because children are better prepared for school (for estimation of these effects and a full discussion, see Belfield, 2005a). Based on state-level data, these cost-savings amount to 20%-60% of the initial investment C_t in present value terms. Applying the lower bound and assuming a discount rate of 3.5%, there will be an annual cost-saving to the state of $0.0185C_t$ for the 13 years after the initial investment ($\partial SS>0$).

The long-run effects to the education system are concomitant with the higher attainment of participants. As noted above, some of the ECE participants will stay in school and some will go on to college; and the state pays some amount of this. We use NCES (2002) data to calculate the state burden of extra attainment (see Belfield et al., 2006). Of the $0.08n_t$ staying in school so as to graduate from higher school, the state pays $3,000 each. Of the $0.02n_t$ progressing to two-year college, the state pays $7,000 each per year. Of the $0.02n_t$ progressing to four-year college, the state pays $10,000 per year. The effect is to raise state-level expenditures, which is equivalent to reduced saving by the state ($\partial SS<0$)

Enhanced labor market outcomes for participants

Studies show that ECE is causally associated with increased rates of high school graduation and college progression. We assume that the results reported in Reynolds et al. (2002) apply to this cohort: for each cohort of n_t children, there will be $0.08n_t$ new high school graduates at time 13 years later, $0.02n_t$ persons with two-year college degrees at time 15 years later, and $0.02n_t$ persons with four-year college degrees at time 17 years later. In addition, we count the additional year of schooling embodied in the ECE program itself: we assume this is beneficial to $0.78n_t$ of the cohort.

Increased attainment conveys two advantages: higher wages and higher labor force participation leading to employment ($\partial WF>0$; $\partial L1>0$; $\partial L2>0$; $\partial L3>0$; $\partial U>0$). The magnitude of these advantages is well-established (Carneiro and Heckman, 2004). The earnings premium to an additional year of education is 10% (Rouse, 2005); we therefore assume that labor productivity for these persons is 10% higher. The effect on labor market participation is equally strong. We assume that high school graduates (both genders) will be participating in the labor market at rates of 67%; and those with college will be participating at rates of 72%. In contrast, we assume that only 49% of high school dropouts will be participating in the labor market. For the $0.78n_t$ of the cohort that receives an additional year of schooling, we assume $0.26n_t$ enter the labor market at t=14 with a labor market participation rate of 58%; $0.26n_t$ enter at t=16 with a labor market participation rate of 69%; and $0.26n_t$ enter at t=18 with a labor market participation rate of 74%.

Savings to the criminal justice system

The effect on criminal activity is one of the most economically important consequences of increased ECE. Using Census and NLSY data, Lochner and Moretti (2004) calculate the effects of education on crime and estimate the economic returns. They find very strong impacts: each additional male graduate yields annual social benefits of between $1,170 and $2,100 (including victim costs). We take the midpoint of these estimates ($1,600) and assume females commit crimes in the same proportion to males as their incarceration rates. So, starting in year t=14 the state gets returned $0.12*n_t*0.5*\$1600$ (males) plus $0.12*n_t*0.5*\$1600*0.1$ (females). This saving to the state persists for the duration of the simulation ($\partial SS>0$).

A second effect of reduced criminal activity is to increase the labor force participation rate through lower rates of incarceration. However, these effects are already captured via the educational effect on labor force participation rates.

4. Model Simulation

Here we report the macroeconomic effects of changing the key variables in the model, as set out above. The full paths of the variables are given in Figures 1 to 5.

Figure 1 shows the path of GDP for the baseline US economy from the period 1955 to 2005 (red). The path of GDP under the policy scenario of ECE is also shown (blue). The two paths track very closely together. This reflects the fact that the main change is the increased flow of highly qualified workers approximately 15 years after the intervention. In the initial period after the introduction of ECE, GDP appears to fall sharply; however, it then rebounds more quickly. The ECE scenario therefore raises the short-run volatility of GDP. However, in the 1990s GDP under ECE appears to be slightly higher than the baseline. The effect is likely to be significant, given the scale on the vertical axis of Figure 1.

Figure 2 shows the path of output for the baseline US economy from the period 1955 to 2005 (red). The path of output under the policy scenario of ECE is also shown (blue). Again, the two paths track very closely, with a sharper dip in the years immediately after the introduction of the ECE program.

Figure 3 shows the path of labor force participation for males aged 25-54, females aged 25-54, and those aged 16-24. The main effect is on labor force participation rates for females. With the scenario, these rates are consistently above those under the baseline, both in the short run and the long run. Male participation rates appear unaffected or perhaps slightly elevated in the short run.

Figure 4 shows the path of state government saving for the baseline US economy from the period 1955 to 2005 (red) and for the policy scenario from 1980 (blue). In both cases, state government saving trends increasingly negative (i.e., there are budget deficits for the states). However, the paths are significantly different: the policy scenario introduces considerably more volatility in state government saving. Initially, ECE induces lower state saving. Then it pushes back the fall in saving (years 5 through 10). At the time 15 years after the policy scenario, state saving becomes highly volatile. After 25 years the effects of increased labor market participation on state tax revenues have filtered through; the baseline scenario shows higher deficits than under the ECE scenario.

Finally, the unemployment rates are compared in Figure 5. In the first years of the ECE program the unemployment rate falls. But after five years unemployment shows a sharper spike and steeper trend between high and low unemployment. But after 20 years, the ECE scenario shows significantly lower unemployment.

5. Conclusions

These preliminary simulations show important effects of ECE policies on the macroeconomy. First, as anticipated, the path of GDP and output are higher. But there does not appear to be significant divergence over time (as other researchers have found). Instead, the growth rate is slightly higher with the introduction of the policy. Second, female labor force participation rates are increased somewhat, although the effects appear to be largely a function of mothers' entry into the workforce a few time periods earlier than they otherwise might have. The labor force participation effects for those who receive ECE are also positive. Third, state-financing of ECE appears to increase the volatility of state deficits in both the short-run and medium-run.

However, these effects need to be substantiated in two ways. First, they can be re-estimated using different parameter values for the model, where these values are drawn from alternative sources of evidence on the impacts of ECE. Second, they can be compared with alternative policies, such as reducing taxes for low-income families or changing welfare terms. These two tasks are to be completed in the second phase of this macroeconomic modeling.

References

Acemoglu, D and J Angrist. 2000. How large are human capital externalities? Evidence from compulsory schooling laws. *NBER Macroeconomics Annual*. NBER: Cambridge, MA.

Aghion, L and P Howitt. 1997. *Endogenous Growth Theory*. MIT Press: Cambridge, MA.

Anderson, PM and P Levine. 2000. Child care and mothers' employment decisions." In *Finding Jobs: Work and Welfare Reform* by D Card and R Blank (Eds). New York, NY: Russell Sage Foundation.

Barnett, WS and L Masse. 2006. Early childhood education programs. *Economics of Education Review*, forthcoming.

Barnett, WS. 1995. Long-term effects of early childhood programs on cognitive and school outcomes. *The Future of Children*, **4**, 25-50

Barnett, WS. 2005. Maximising returns from prekindergarten education. *Education and Economic Development*, Federal Reserve Bank of Cleveland.

Belfield, CR. 2005a. The fiscal impacts of universal pre-K: Case study evidence from four states. Invest in Kids Working Paper, www.ced.org.

Belfield, CR. 2005b. The promise of early education. Teachers College, Columbia University, working paper.

Blankenau, WF and NB Simpson. 2004. Public education expenditures and growth. *Journal Of Development Economics*, **73**, 583-605.

Calman, LJ and L Tarr-Whelan. 2005. *Early Education for All. A Wise Investment*. Legal Momentum, New York, NY.

Carneiro, P and JJ Heckman. 2003. Human capital policy. In Heckman JJ and AB Krueger (Eds.) *Inequality in America: What Role for Human Capital Policies?* MIT Press: Cambridge, MA.

Danziger, S, Oltmans Ananat, E and K Browning. 2004. Childcare subsidies and the transition from welfare to work. *Family Relations*, **53**, 219-228.

deNavas-Walt, C, Proctor, B and C Hill Lee. 2005. *Income, Poverty and Health Insurance Rates in the United States.* US Government Printing Office, Washington, DC.

Dickens, WT, Sawhill, B and J Tebbs. 2006. The effects of early education on economic growth. Brookings Institute, working paper.

Fair, R. 1994. *Testing Macroeconometric Models.* Cambridge, MA: Harvard University Press.

Karoly, LA and JH Bigelow. 2005. *The Economics of Investing in Universal Pre-School Education in California.* RAND, Pittsburgh, PA.

Keller, KRI. 2006. Investment in primary, secondary, and higher education and the effects on economic growth. *Contemporary Economic Policy*, **24**, 18-34.

Krueger, AB and M Lindahl. 2001. Education for growth: Why and for whom? *Journal Of Economic Literature*, **39**, 1101-1136.

Lynch, RG. 2004. *Exceptional Returns: Economic, Fiscal, and Social Benefits of Investment in Early Childhood Development.* Economic Policy Institute: Washington, DC.

Mamuneas, TP, Savvides, A and T Stengos. 2006. Economic development and the return to human capital: A smooth coefficient semiparametric approach. *Journal Of Applied Econometrics*, **21**, 111-132.

NIEER. 2005. *Early Education Yearbook.* National Institute for Early Education, Rutgers University, www.nieer.org.

Press, JE, Fagan, J and L Laughlin. 2006. Taking pressure off families: Child-care subsidies lessen mothers' work-hour problems. *Journal of Marriage and Family*, **68**, 155-171.

Pritchett, L. 1996. Where has all the education gone? World Bank: New York, mimeo.

Rauch, GE. 1993. Productivity gains from geographic concentration of human capital: evidence from the cities. *Journal of Urban Economics*, **34**, 380-400.

Restuccia, D and C Urrutia. 2004. Intergenerational persistence of earnings: The role of early and college education. *American Economic Review*, **94**, 1354-1378.

Reynolds AJ, Temple JA, Robertson DL, and EA Mann. 2002. Age 21 cost-benefit analysis of the Title I Chicago Child-Parent Centers. *Educational Evaluation and Policy Analysis*, **24**, 267-303.

Temple, J. 1999. The new growth evidence. *Journal of Economic Literature*, **37**, 112-156.

Temple, J. 2001. Generalizations that aren't? Evidence on education and growth. *European Economic Review*, **45**, 905-918.

Warren, JR. 2005. State-level high school completion rate: Concepts, measures, and trends. *Education Policy Analysis Archives*, **13**(51).

Woessmann, L. 2003. Specifying human capital. *Journal of Economic Surveys*, **17**, 239-270.

Grunewald, R and A Rolnick. 2005. A proposal for high returns on early childhood development. minneapolisfed.org/research/studies/earlychild/draft_ecd_proposal.pdf

Figure 1 The Path of GDP – Baseline and with ECE (Scenario 2)
($ billion, 1990 prices)

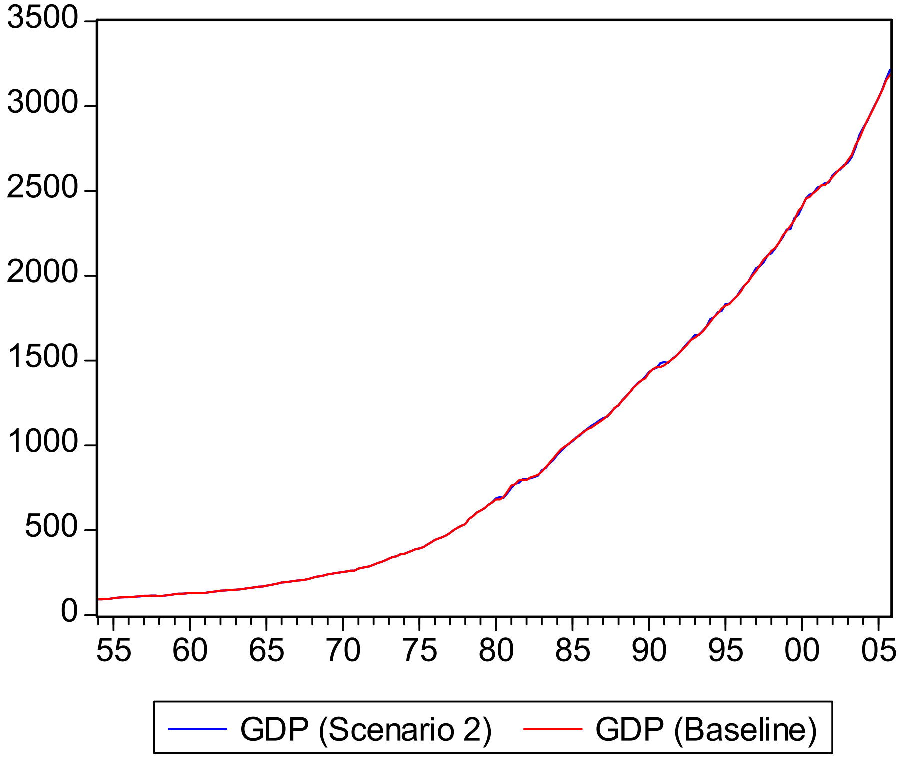


Figure 2 The Path of Output – Baseline and with ECE (Scenario 2)
($ billion, 1990 prices)

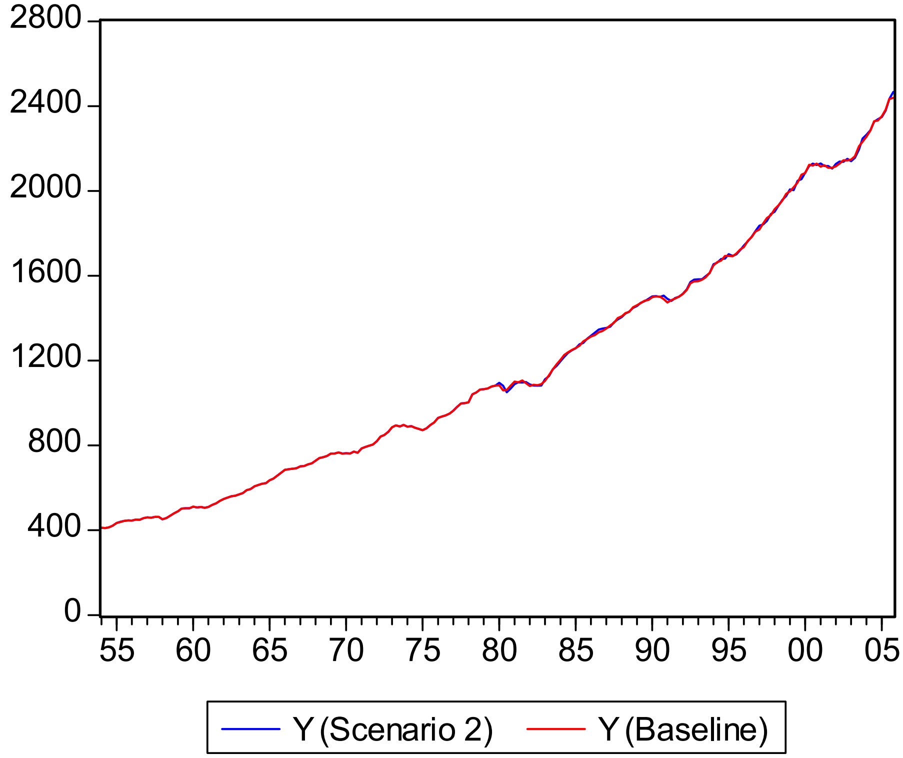


Figure 3 The Path of Labor Force Participation Rates – Baseline and with ECE (Scenario 2)

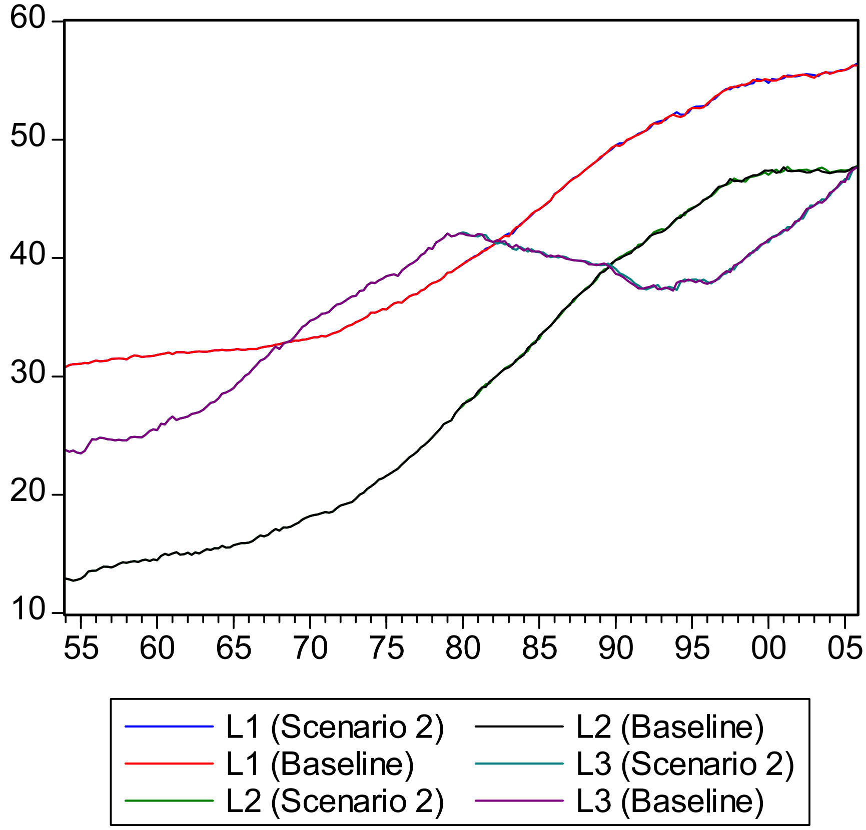


Figure 4 The Path of State Government Saving – Baseline and with ECE (Scenario 2) ($ billion, 1990 prices)

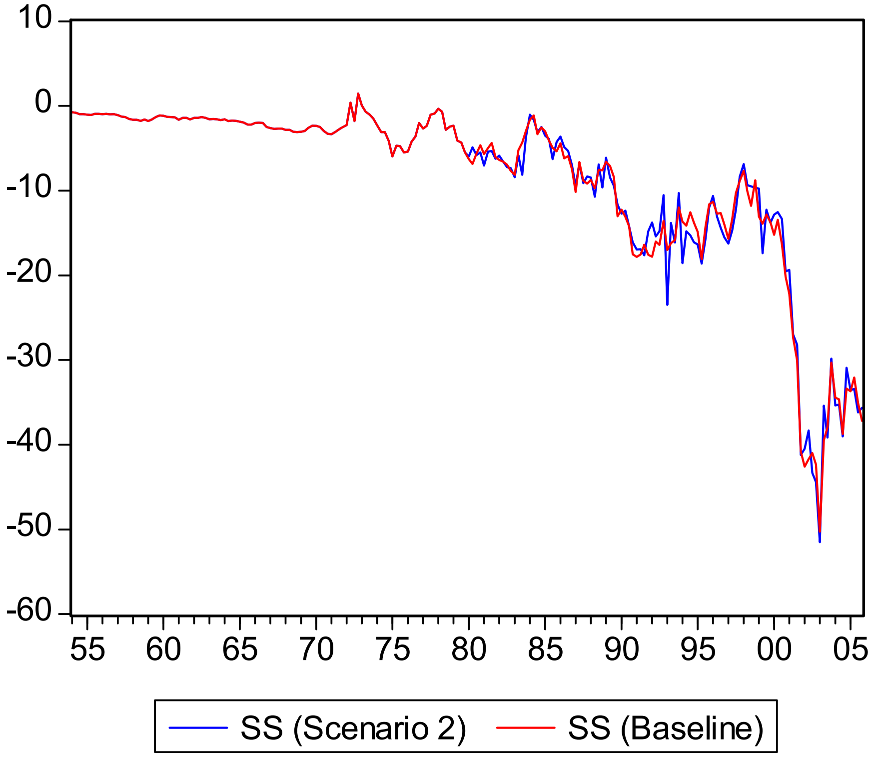
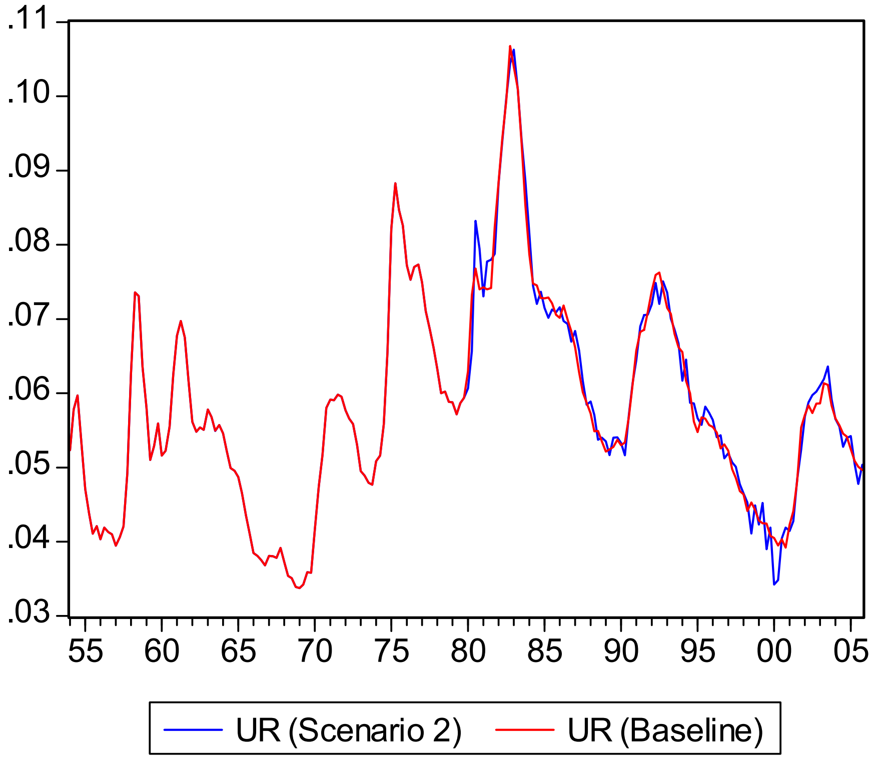


Figure 5 The Path of the Unemployment Rate – Baseline and with ECE (Scenario 2)



Technical Appendix

Sectors:	
h	Households
s	State-level government
g	Federal-level government
f	Firms
b	Financial industry
Policy scenario variables:	
n_t	Enrollment in period *t*
c_t	Per-student expenditure in period *t*
C_t	Total investment cost in period *t* (=$n_t \times c_t$)
Key macroeconomic variables:[1]	
CCS	Capital construction in the public sector, *s*
D1S	Personal income tax parameter on *h* by *s*
D2S	Profit tax rate on *f* by *s*
E	Total employment, civilian and military
GDPR	Gross Domestic Product
JF	Number of jobs, *f*
JG	Number of civilian jobs, *g*
JS	Employment in the public sector, *s*
L1	Labor force participation men 25-54, *h*
L2	Labor force participation women 25-54, *h*
L3	Labor force all others 16+, *h*
PROD	Output per paid for worker hour (“productivity”), *f*
SS	Saving, *s*
TFS	Corporate profits, *f* to *s*
THS	Personal income taxes, *h* to *s*
TRGH	Transfer payments, *s* to *h*
U	Number of people unemployed
WF	Average hourly earnings of workers, *f*
Y	Output

Note: [1] Employment/jobs numbers are in millions; money values are in billions (2000$).