Child Care Subsidies and the Economic Well-Being of Recipient Families: A Survey and Implications for Kentucky

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A technical report prepared for the
Kentucky Youth Advocates
and underwritten by the
Kentucky Cabinet for
Health and Family Services

June 2008

Acknowledgements

We thank Kentucky Youth Advocates (KYA) and the Kentucky Cabinet for Health and Family Services for the financial support that made this report possible, and especially to Lacey McNary of KYA who initiated the idea to study the economics of child care. The opinions and conclusions are solely our own and do not necessarily reflect the opinions of the Cabinet, KYA, or any other sponsoring agency.

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I. Executive Summary

The secular increase over the past several decades in the number of families where both the husband and wife work in the paid labor force, coupled with the surge in labor force participation of single mothers in the 1990s, has heightened policy focus on child care options for working parents. The 1996 Personal Responsibility and Work Opportunity Reconciliation Act expanded and consolidated the Child Care and Development Block Grant (CCDBG) of 1990 into the Child Care and Development Fund (CCDF). The CCDF enabled states to use funds from their Temporary Assistance to Needy Families (TANF) program for child care assistance. In fiscal year 2005 $5.3 billion of Federal funds were spent on the CCDF, and another $3.2 billion of TANF funds were spent on child care.[1] This is on top of the nearly $7 billion a year spent on the Head Start program. In addition a series of tax credits are designed to assist working families. The oldest of these is the Child and Dependent Care Tax Credit, which allows working families with children under age 13 to claim a credit of up to $3,000 for one child and $6,000 for two or more children. Expenditures on this credit in fiscal year 2003 totaled more than $2.8 billion (Green Book 2004). The Child Tax Credit, established as part of the Taxpayer Relief Act of 1997, provides a refundable credit of up to $1,000 per child, with outlays of $8.9 billion in fiscal year 2004 (GAO 2005).[2] Collectively these programs and credits reveal that Federal and state governments are now major players in the provision of child care in the United States.

Kentucky provides child care subsidies through the Kentucky Transitional Assistance Program (K-TAP) and CCDF. Kentucky families face annual infant child care costs of $6,240 for full-time center care and $4,956 for school age children during non-school hours.[3] For single mothers, these costs take up a large share of annual income. In particular, these costs represent 20 to 25 percent of annual income for Kentucky single mothers. [4]

1. http://www.nccic.org/poptopics/ecarefunding.html
2. The GAO estimates a revenue loss in 2004 of $22.4 billion from the Child Tax Credit, which coupled with the $8.9 billion in outlays, makes the credit one of the larger tax expenditures in the U.S. tax system, just below the Earned Income Tax Credit (GAO 2005, Table 2).
3. http://www.naccrra.org/randd/data/docs/KY.pdf
4. Authors calculations based on an average annual income of $25,329 reported below in Table 3.

The purpose of this report is to provide a selective survey of the literature on the economic consequences of child care for recipient families, and to relate the results to families residing in Kentucky using data from the Annual Social and Economic Study in the Current Population Survey. The survey is selective both because of its exclusive focus on child care research by economists and because the literature is vast even within economics such that only articles deemed to be important contributions to the labor supply and child care literature are included. There are extensive literatures on child care in the fields of social work and sociology, but in a bid to narrow the focus on the types of questions and methodologies employed this survey excludes this research. The implication is that certain topics relating to child care quality and child well being that are more prominent in social work and sociology research will receive scant attention. Instead the focus will be on the labor-market implications of child care, which tends to be the primary domain of child care research in economics. The restriction to key contributions in economics is based both on objective criteria such as prominence of the article in the profession, as well as our own personal biases regarding methodology and topic. A more comprehensive review of the economics of child care is found in Blau (2003a).

The literature review reveals that in the domain of child care the economics profession has focused primarily on the labor-market consequences of child care subsidies, particularly the effect of subsidies on the decision to work, on total hours of work conditional on being employed, on hourly wages, and on whether to use formal child care. There is less extensive evidence on the effects of child care subsidies on welfare participation, on school attendance, and job satisfaction, and no direct evidence on the issue of the anti-poverty effectiveness of child care subsidies. Much of the research focuses on the implications of child care for single mother families (though several authors do focus on married women). The emphasis by economists on single mother families is justified on one level because many of the government programs alluded to earlier are targeted to low-income working families; however, some categorically exclude the very poor such as the Child and De-

pendent Care Tax Credit and the Child Tax Credit, each of which are restricted to families earning enough to pay Federal income taxes. This implies that the literature may be less informative of the labor-market effects of child tax credits for middle class families.

Nearly all the papers reviewed herein contain estimated elasticities of employment with respect to the price of child care. This tells us how responsive labor-market participation is to any given change in the price of child care. Given the prominence of work in the 1996 welfare reform legislation knowledge of child care employment elasticities is a key input to policy evaluation. The range of estimates for single mothers is from –0.15 to –0.5, with a modal range of –0.3 to –0.4. This implies that a 10 percent reduction in the price of child care will increase the employment of single mothers by 3 to 4 percent. For married women the estimated elasticity is larger in absolute value, ranging closer to –0.5 to –0.6. As a point of comparison, the typical employment elasticity with respect to the minimum wage is in the range of –0.1 to –0.2 (Brown 1999), while the employment elasticity of women with respect to the EITC is closer to 1.0 (Hotz and Scholz 2003). This implies that women's responsiveness to the generosity of child care subsidies lies between the other two major social policies frequently touted as incentives to work—the minimum wage and the EITC.

Using data pooled across the 2005 to 2007 survey years of the Current Population Survey (CPS), a nationally representative survey of the employment and incomes of families, about two-thirds of single mothers in Kentucky with dependent children under age 18 are employed. Based on the elasticity estimates from the literature, holding all else equal, a 25 percent reduction in the price of child care would lift employment of single mothers in Kentucky to 69 to 74 percent, which is an employment level commensurate with that of single mothers living outside of Kentucky. In terms of the number of single mothers in Kentucky with children under age 6 in the CPS, and the cost of child care from NACCRRA, we estimate that the annual cost of child care subsidies of 10 and 25 percent for single mothers would range between $14 million and $47 million, respectively. These cost

estimates compare favorably to the estimates in Meade and Ziliak (2007) on the costs of a refundable state Earned Income Tax Credit.

II. An Economic Model of Child Care

To facilitate discussion of the research results on the effect of child care on economic well being it is instructive to begin with an economic framework common to much of the literature (Blau 2003a). As much of the research focuses on single mothers the canonical model is one of a single decision maker who in any given period is assumed to choose hours of leisure (L) and a composite of market consumption goods (C) to maximize well being denoted by the utility function U(C, L). A stripped down version of the child care market is typically assumed where there is no informal care option provided by relatives and friends, and thus every hour of market work (h) involves paying an hourly price of child care (p) to a formal care provider. Assuming nonlabor income of V and a market hourly wage rate w, then the budget constraint facing the mother is

(1) $C \leq (w\text{-}p)h + V$

where the price of the composite consumption good C is normalized to equal 1, and hours of market work come from the time constraint $L + h = 1$. The budget constraint in equation (1) says that if the mother works in the paid labor market, consumption in any period is equal to the sum of labor market earnings (wh) plus non-labor income (V) less child care costs (ph).

The inequality in (1) reflects the fact that the mother may opt out of the labor force, in which case her only income source is nonlabor income but child care costs are zero. In this sense paying for child care is akin to a tax on earnings. The higher the price of child care, the lower the take-home wage net of child care, which lowers the probability of employment. For those currently working, a higher price of child care may increase, decrease, or leave unchanged hours of work depending on the whether the substitution effect (which says that work is less attractive with a higher price of care) is dominated by, dominates, or offsets the income effect (which says that work is more attractive with a higher price of care) of a wage change.

If the state or Federal government, or perhaps a private employer, steps in to subsi-

dize the price of child care with an hourly subsidy rate of s then the budget constraint in (1) becomes

(2) $C \leq (w - p + s)\, h + V$,

which has the effect of raising the take-home wage and thus unambiguously raises the likelihood of work. Much like the EITC, a child care subsidy in theory acts as an incentive to draw single mothers off of welfare and into work, and thus is often viewed favorably by policymakers. However, the effect of the linear subsidy on hours of work for those already in the labor force is indeterminate a priori, again because of offsetting substitution and income effects of the net wage on hours of work. In more elaborate child care subsidy programs designed more in line with the structure of the EITC, such as the CCDF, there are earnings ranges of the program where it is possible to predict the effect of the subsidy on hours of work, but like the EITC, the programs generally reduce the incentive to work longer hours at the fixed wage rate.

Because the predictions of economic theory are clear that child care subsidy programs are an incentive to enter the labor force, much of the literature has then directed attention to quantifying the empirical magnitude of subsidies on the probability of working. Quantifying the effects of subsidies on employment is important because if the economic magnitudes are small then it becomes more difficult to justify subsidies based on employment gains. This does not rule out other reasons for the subsidies, but does make the case weaker that subsidies enhance economic self sufficiency. On the other hand, if the responsiveness of employment to changes in the subsidy is sizable then a compelling employment case can be made. This leads to the typical empirical specification for employment of

(3) $E = \alpha w + \beta p + X\gamma + u$

where E = 0,1 depending on whether the mother works (=1) or does not work (=0), w and p are the hourly wage rate and the hourly price of child care, X is a vector of control variables such as the education, race, and age of the mother, along with the number and ages of children in the family, and u is the model's error term. The coefficients α and β tell

us the marginal effect of a change in the wage rate or price of child care on the probability of working, respectively, and are used in the calculation of employment elasticities with respect to the hourly wage rate or price of care.

The basic empirical specification in (3) is used to model other outcomes of interest as well, including whether or not the mother participates in paid or unpaid child care, how much the mother spends on child care, whether or not the mother participates in welfare, and whether or not the mother works part-time or full-time. Depending on the outcome under consideration a host of estimation issues must be confronted. Chief among these for the employment decision are that the hourly wage rate and the hourly price of child care are only observed for workers, and not non-workers, and thus the wage and child care price must be treated as endogenous in estimation because of possible non-random selection into employment. This typically implies that additional variables must be available to serve as instruments to identify the effects of wages and child care prices on the likelihood of working. These and related nuances are described in greater detail below in the survey of estimates from the literature.

III. Survey of the Effects of Child Care on Employment and Related Outcomes

Research on the economics of child care has been conducted using a wide variety of techniques ranging from structural models of household behavior to random assignment experiments to non-experimental reduced form models. Our review draws from all of these approaches, but each has its benefits and costs. For example, the key advantage of the structural approach is that it is conducive for out-of-sample policy simulations, such as simulating the labor-market consequences of expanding the child tax credit. The cost, however, is that fairly stringent restrictions on consumer behavior are often imposed to identify model parameters. Random assignment experiments take their advantage from the transparent identification of the policy impact by comparing outcomes across members of treatment and control groups, but most of these experimental designs are narrow in scope

and not generalizable to a wider population or to out-of-sample policy simulations. Non-experimental reduced form models are the easiest to implement because they are typically based on secondary analyses of survey datasets, but identification is often less transparent than that from random assignment experiments owing to possible non-random selection into a program. Moreover, unlike their structural counterparts, reduced-form models are not conducive for out-of-sample simulations.

Perhaps the greatest limitation to our understanding of the economics of child care is the paucity of data collected and publicly available to researchers. Data have been drawn from household surveys such as the Current Population Survey (CPS), the Survey of Income and Program Participation (SIPP), and the National Survey of American Families (NSAF), as well as from government sponsored demonstration projects including random assignment experiments. However, none of the survey datasets collect comprehensive information on receipt of child care subsidies, the child tax credit, out-of-pocket child care expenditures, or receipt of informal care from relatives and friends. Even though the CPS is used for official estimates of poverty and inequality in the U.S., only in recent years have questions been added on child care receipt, and these are only asked of the low-income population and no data on expenditures is collected. The dataset that covers the most topics on child care is the NSAF, and thus it has been the preferred data source for non-experimental analyses (both structural and reduced-form) in recent years. However, the NSAF is only available for 1997, 1999, and 2002, was collected in just 13 states (the only state fully in the U.S. interior included in the sample is Colorado), and is plagued with high nonresponse rates compared to the CPS and SIPP. The implication is that estimates from non-experimental studies are frequently based on fairly crude proxies for child care, and the results below must be interpreted with some caution. At the same time a general consensus across studies is emerging on a few key parameters in spite of the limitations highlighted.

Because some of the studies reviewed combine structural with reduced form methods, while others combine experimental with non-experimental analyses, we chose to orga-

nize our literature review in chronological order. Table 1 summarizes the major features of the papers including the key issue, the data and sample, the dependent variable (outcome of interest), estimation method, and key findings. The majority of papers use their model estimates to produce employment elasticities with respect to the price of child care and/or with respect to the before-tax hourly wage rate. Table 2 summarizes the range of employment elasticities in the papers reviewed, and also present other elasticities such as the elasticity of welfare participation with respect to the price of child care when available.

Many of the econometric models in the literature use maximum likelihood estimation methods. As shown in equation (3), the dependent variable of interest, employment, takes on two values—zero if the mother does not work or one if the mother works. Probit maximum likelihood estimation, or probit, addresses this dichotomous nature of the dependent variable by calculating the likelihood of the outcome occurring. When the dependent variable often takes on the value of zero, as is the case with child care expenses, researchers use Tobit maximum likelihood estimation, or tobit.

A common problem in the literature is the key variables of interest in equation (3) — hourly price of child care and hourly wage—are not available for all observations. This is problematic because we want to capture the entire distribution of mothers with child care costs and wages, not just those who pay or work. The sample selection correction procedure, called the Heckman Two-Step, accounts for this problem by predicting costs and wages for all mothers. The Heckman Two-Step involves estimating a reduced form employment or child care use equation to construct the inverse Mills ratio. The inverse Mills ratio, which serves as a way to correct the observed costs or wages, is added to a linear regression model of costs or wages to predict sample-selected costs and wages for all mothers. These predicted values enter into the employment equation (3).

Finally, it is convenient to note that many of the papers surveyed below use a fairly common set of control variables. These may include, but are not limited to: race, educational attainment, age, number and age of children, wages, estimates of child care prices,

and receipt of child care subsidies.

A. Child Care Studies from the 1990s

We begin with research by former University of Kentucky economists Mark Berger and Dan Black. Berger and Black (1992) examined the labor supply effects of child care subsidies using a unique data set of low-income single mothers participating in two Kentucky child care subsidy programs. Specifically, the data came from participant and administrative data for Louisville's 4C program and Kentucky's Title XX subsidy program. The 4C program (Community Coordinated Child Care) was established in 1969, serving to coordinate the provision of a variety of child care related services, including nutritional programs for children, training for providers, coordination of prospective parents with child care providers, and subsidization of child care services across the Louisville metropolitan region. The program currently serves 18 area counties, including 3 within bordering Indiana. The 4C program distributes child care assistance using funds from the Kentucky Cabinet for Health and Family Services' Child Care Assistance Program (CCAP).[5] Similar child care services are provided for the rest of the Commonwealth through four regional providers.[6] Title XX of the Social Security Act was signed into law in 1975 providing funds to states for the purpose of promoting economic self sufficiency, and preventing and reducing the neglect, abuse, or exploitation of children and adults.[7] To that end, states are given discretion to use Title XX funds towards child care subsidies, as in the case of Kentucky. The 4C program gives a maximum child care subsidy for families at 80 percent of state median family income, and the Title XX program subsidizes child care for those making under 60% of state median family income. Both programs require that parents work a minimum of 20 hours per week for receipt of benefits.

The authors adopted the canonical labor supply model for employment and hours

5. http://www.4cforkids.org/about_us
6. http://chfs.ky.gov/dcbs/dcc/ccap.html
7. http://www.ssa.gov/OP_Home/ssact/title20/2001.htm

worked similar to that described in equation (3), and used probit estimators for the likelihood of employment as a function of control variables and participation in a child care subsidy program. Additional models control for use of formal versus informal child care.

There were two main strategies for estimating the effects of the child care subsidy: (1) comparison of results for program participants to those on the waiting list, and (2) comparison of results for program participants to a sample of comparable low-income Kentucky mothers with children from the Current Population Survey. The policy effect of interest, referred to as a subsidy effect, is thought to co-occur with three other effects that could bias results. These effects, based upon three forms of sample selection bias, are addressed by the authors. First, the sign-up effect concerns differences that may exist between wait-listed mothers versus those who choose not to sign up at all. Second, a waiting list effect occurs if the mother changes employment patterns towards work in anticipation of program participation. Next, the creaming effect implies that program administrators show preference towards applicants with relatively stronger labor market skills, making the program appear successful. Identifying the subsidy effect was the primary focus of this paper – by addressing the other three effects, it is possible to come to a better understanding of the effect of the child care subsidy. Disentangling the subsidy effect from these other three effects matters, as the importance of the child care subsidies may be overstated by some previous research projects' collective failure to account for bias. The sign-up effect was tested by comparing employment of a comparable set of CPS mothers to the waiting list sample before they entered the waiting list, with large differences in employment suggesting a sign-up effect. Since the sample included current and past employment of subsidy recipients and wait list individuals, the wait list, creaming, and subsidy effects can be estimated as well to capture differences in employment behavior across individuals.

Berger and Black found single mothers who received child care subsidies were more likely to be employed and were more likely to be satisfied with the care their children receive. Specifically they found an 8.4 percent lower bound increase in employment from

the child care subsidy. Factoring in the waiting list selection effect drives overall employment response to 25.3 percent, reflecting unobserved differences between the control (subsidy recipients) and experimental group (waiting list). The sign up and creaming effects had a 22.6 percent and 4.0 percent effect on employment, respectively. Consistent with other findings, the effects of child care subsidies on hours worked were modest. The 8.4 percent subsidy effect represents the estimated increase in employment due to subsidizing child care.

In addition to employment estimates, models capturing quality-of-care measures suggest that satisfaction increases with the age of the youngest child, and that the subsidies appear to increase the quality of care obtained. Many parents seem to prefer the option of choosing informal care, and this would presumably lower the costs by allowing for greater choice and competition. Extending the results from the case of Kentucky to the federal Child Care and Development Block Grants for FY 1991, Berger and Black showed that extending subsidies to families nationwide, assuming a $50 per week subsidy with fully enrolled programs, results in an 18,173 to 54,736 employment gain on a baseline of 216,000 families. Costs for the subsidy would range, depending on the employment gain, from $10,277 to $30,952 per job created each year.

Ribar (1992) provided one of the more ambitious efforts at the time to estimate a joint model of child care costs and wages on the labor supply of married women, an approach considerably different than Berger and Black (1992). Ribar examined employment and the use of paid and unpaid child care for married women. He assumed that the mother maximizes her utility, which is a function of market goods, child care quality, and leisure subject to the mother's time constraint, money budget constraint as in equation (2), and a production function for quality of care that includes market (paid) and nonmarket (unpaid) care. The model generated a few behavioral predictions based on economic theory: (1) labor force participation increases with wage and decreases with the marginal cost of paid care use and (2) unpaid care use decreases with the marginal cost of unpaid care use.

The data on married women came from Wave 5 of the 1984-85 SIPP. Ribar jointly estimated three reduced form equations corresponding to the solutions of the mother's optimization problem: (1) labor force participation; (2) paid child care use; and (3) unpaid child care use. The labor force participation equation was estimated via probit while the paid and unpaid child care use equations are modeled with Tobit to account for the fact that child care expenses are zero for many families. Each equation is a function of wages, market care costs, observable determinants of work and child care, and unobservable (to the researcher) determinants of work and child care. Ribar dealt with three data problems: unobserved child care use data for nonworking mothers, unobserved wage data for nonworking mothers, and unobserved paid care costs for families who do not use paid care. With child care utilization data unobserved for nonworking mothers, the child care equations were estimated as simultaneous Tobit models, conditional on the mother's employment. To address unobserved wage and market care costs Ribar estimated a full reduced form of the model (substituting for wage and care costs) and a model with predicted values of wages and costs, corrected for selection. In the second model identification of wages came from state unemployment rate, and identification of costs came from state average hourly wage rate for care.

The empirical model provided evidence consistent with economic theory. Wages have a strong positive effect on labor force participation while paid child care costs have a strong negative effect. Moreover, higher unearned income raised the use of paid child care, suggesting it is a normal good. Unearned income also had a strong negative effect on unpaid child care use, indicating unpaid care is an inferior good. Paid child care use falls as costs rise, and both paid and unpaid care exhibited positive cross price effects, suggesting they are substitutes. As such, an increase in the price of one type of care, results in mothers' use of the other type of care as a substitute. Table 2 provides the range of wage and hourly child care cost elasticities for the sample of married mothers from two sets of simulations. The first set of simulations estimated wage elasticities for labor supply, paid child

care use, and unpaid child care use at 0.68, 1.41, and –0.01, respectively, and the hourly paid care cost elasticity of labor supply, paid care use, and unpaid care use at –0.74, –1.86, and 0.03, respectively. The second set of simulations found wage elasticity estimates for labor supply, paid care use, and unpaid care use of 0.58, 1.21, and –0.19, respectively, and the cost elasticities of –0.64, –1.39, and 0.14. Overall, the results suggested policies to raise the effective wage rate would encourage employment among married mothers, while policies subsidizing child care costs would promote employment and paid child care utilization.

In a paper published as part of the proceedings from the annual American Economic Association meetings, Kimmel (1995) used the theoretical and empirical framework developed by Ribar (1992) to estimate a model of employment responsiveness to child care subsidies for single mothers living in poverty. Unlike Ribar, who examined child care use and employment, Kimmel focused attention on a labor force participation probit model where the hourly price of child care and the hourly wage rate are the variables of interest as in equation (3).

Because the key variables of interest—hourly price of child care and hourly wage—are not available for all observations, Kimmel adopts a two-stage estimation procedure of predicting the hourly wage and hourly price of care controlling for sample selection bias, and then uses the predicted values in the labor force participation model. She estimates the model for the entire sample of single mothers, and then separately for white single mothers and black single mothers. Similar to Ribar, Kimmel used data from the SIPP (1987 and 1988 panels covering July to December 1988). Over 50 percent of the mothers received income support from the main cash welfare program at the time, Aid to Families with Dependent Children.

Results for the full sample of poor, single mothers showed a price elasticity of employment of –0.35 while the elasticities for white and black mothers were –1.36 and –0.35, respectively (See Table 2). Black mothers were much less price elastic than white mothers

and the elasticity for whites was not statistically different from zero. The reasons for this difference by race were not explored by the author, and researchers after Kimmel have not shed any additional light on the possible racial differences in the labor-market response to the price of child care. Unlike child care, all sample demographic groups had wage elasticities of employment near 2.0.

Kimmel conducted a policy simulation of three price subsidy schemes and their effect on the probability of employment. These schemes included a 50-percent subsidy, a 100-percent subsidy, and a sliding-scale fee subsidy. The sliding-scale works in the following way: (1) if income is less than 50 percent of the poverty level for a given family size, then the subsidy is 100 percent; (2) if income is between 50 percent and 75 percent of poverty level, then the subsidy is 75 percent; and (3) if income is between 75 and 100 percent of poverty level, then the subsidy is 50 percent. Based on the estimated elasticities, white mothers exhibited the strongest response to the various subsidy schemes while black mothers and the entire sample showed milder responses. The 50-percent subsidy raised the average labor force participation probability for white mothers from 30 percent to 50 percent. The other subsidy schemes have stronger effects for white mothers, raising the employment probability to 70 percent (100 percent subsidy) and 62 percent (sliding-scale). Given that the sliding-scale subsidy was less costly to finance and produces similar effects across subsidy schemes for each group, it is the preferred subsidy on a cost-benefit comparison.

Following the lead of Ribar and Kimmel, Averett, Peters, and Waldman (1997) estimated a structural model of labor supply with child care costs, but with a focus on the Child Care Tax Credit (CCTC). The CCTC was incorporated into the Federal tax code in 1976 as a non-refundable tax credit for low-income families with dependent children under age 13. The credit rate today ranges from 20 to 35 percent, and varies inversely with adjustable gross income. Families whose incomes are so low they do not owe any tax liability are ineligible for the credit.

Averett, et al. adopted a static model of labor supply along the lines developed in

Section II, where the mother is assumed to be the primary caregiver and the father's income is exogenous to the wife's labor supply decision. Within the model, mother's work is calculated as the amount of formal and informal child care consumed – this is similar to a fixed time endowment. Child care costs, including the CCTC and federal income tax, enter via the standard budget constraint as in equation (3). However, unlike equation (3), which is linear, the CCTC and federal tax code make the budget constraint nonlinear, thus complicating estimation and identification. To capture the non linearity of the tax policies, the authors specified piecewise linear budget sets with a maximum of 25 budget segments and 24 interior kink points. Costs of formal care were estimated in the context of opportunity costs, namely earnings per hour worked as the hourly cost of formal child care. The price of formal care is used as a proxy for informal child care.

The data for their study came from the 1986 wave of the National Longitudinal Survey of Labor Market Experience of Youth (NLSY). The sample consisted of married women between the ages of 21 and 29 and who had one or more children less than 6 years old. The age restriction was a by-product of the 8-year age cohort that selected into the NLSY. Estimation in their paper was complicated because the CCTC and federal income tax rate make the after-tax wage rate endogenous, and the price of formal care was also endogenous because of possible non-random sample selection into work and paid child care. Tax rates are highly related to taste for work, whereby women with greater taste for work/labor force participation will likely pay higher taxes and receive lower CCTC subsidies. As such, OLS will erroneously yield predictions that low child care subsidies (low CCTC) yield more labor force participation among women. To address this, they used instrumental variables estimators for the probit and Tobit models to account for possible endogeneity highlighted above.

Averett, et al. found that as the number of children increases, and as nonwage income increases, the probability of purchasing formal child care also increases – although the former estimate is statistically insignificant. However, as education increases, mothers

are less likely to purchase formal child care. Alternatively, Hispanic women were more likely to purchase formal child care, which supports previous findings by Leibowitz (1988). Finally, the effects of having older siblings for young children and/or adults present had an insignificant effect on the probability of purchasing informal care – held out by the authors as a surprising result.

The elasticity of labor supply with respect to cost of formal child care was –0.78 from the fully specified model, and wage elasticities of labor supply were positive and greater than one (see Table 2). This implies labor supply is elastic with respect to changes in effective wage, which accounts for child care subsidies such as the CCTC. Through simulations, they found increases in the value of the CCTC to have positive and statistically significant effects on labor supply for married women with young children. This labor supply effect was larger than policies increasing the annual expenditure limits on the credit or those that make the CCTC refundable.

Anderson and Levine (1999) extended the literature by focusing on U.S. child care policies' post-welfare reform effects for labor supply of less-skilled women. The paper provided an overview of previous literature, demonstration projects, and detailed federal child care spending in the nation before and after welfare reform, including the current Child Care and Development Fund block grant to states. Their approach was less structural than Ribar and Averett, et al., but they did address many of the concerns raised in the previous literature in their empirical models such as endogenous wages and child care prices, and possible non-random sample selection into work. Specifically, they developed a four-equation framework consisting of a wage equation, a market price of child care equation, a conditional use of paid care equation, and a labor force participation equation.

In order to analyze differences in responses to child care costs by skill differences (proxied by education attainment), Anderson and Levine used probit models relating maternal employment to wages and child care costs, controlling for sample selection problems. The data are from wave 3 of the 1990, 1991, and 1993 panels of the Survey of Income and

Program Participation (SIPP). These particular waves of the SIPP contain supplemental child care questionnaires regarding use of care during the fall of the survey year.

Anderson and Levine found women with lower skills used lower-priced paid care on average, and were more likely to pay for care from relatives. That is, children of the least skilled women were more likely to be cared for by a relative, but the relatives of lower-skilled women had a higher likelihood of receiving compensation for providing this care. As a percentage of income, this group paid more for child care. Increases in child care costs were associated with statistically significant, but economically modest, decreases in labor force participation. Specifically, the price elasticity of employment with respect to changes in child care costs for women with children under 13 ranged from –0.055 to –0.358. This range was fairly wide because Anderson and Levine estimated models across a variety of populations of mothers based on marital status, education level, and poverty status.

In spite of their efforts to uncover the importance of childcare policies, the authors concluded that the variety of policies under the umbrella of welfare reform make it hard to isolate the singular effect of child care policies for the target population. Child care policies were thought to be helpful but modest in terms of effect size when viewed alongside other social supports.

B. Child Care Studies from the 2000s

Following the trend begun with Anderson and Levine (1999), Han and Waldfogel (2001) adopted a more quasi-structural approach to examine the effects of child care costs on the employment of single and married mothers with pre-school-aged children, incorporating measures of child care quality and child care availability. In this case quasi-structural is meant to imply that the authors made econometric adjustments for endogeneity and self selection, but do not estimate direct consumer preferences. The main sources of data include the 1991 to 1994 March CPS and the 1990 to 1993 SIPP. The sample includes mar-

ried and unmarried women with at least one child under the age of 6.

Because the CPS does not ask about child care costs, two measures of child care costs were imputed from the SIPP: a cost without correcting for sample selection and a cost correcting for sample selection. They also used predicted wages based on a sample selection correction. The authors also added measures of child care quality and child care availability. For child care quality they constructed an index gauging the state's child care regulatory environment and a variable for the intensity of child care inspections. For child care availability they counted the number of state child care openings in day care centers.

Han and Waldfogel estimate probit models separately for married women and single women with and without correcting for sample selection when imputing child care costs. Generally, higher wages and education improved a woman's employment probability while black race and hispanic ethnicity, number of children less than 18, presence of younger children, and income lower it. The model with imputed child care costs not corrected for sample selection showed a rise in child care costs lowers the likelihood of work, meaning married mothers are 14 percent less likely to work and single mothers are 21 percent less likely to work. The marginal effects were smaller when correcting for sample selection (married mothers are 11 percent less likely and single mothers 18 percent less likely). Table 2 translates these child care effects to price elasticities and gives a range of –0.30 to –0.40 for married women and –0.50 to –0.73 for single women. Controlling for child care quality and availability along with sample selection bias due to missing child care costs for unemployed mothers did not qualitatively change this finding.

A tighter regulatory environment, as measured by the child care regulatory index, had a small, positive employment effect for married mothers (0.9 percent increase) and no significant effect on single mothers. Intense child care inspections had a small positive effect on single mothers (0.7 percent increase) and no significant effect on married mothers. Child care availability yielded the higher marginal effect for married mothers (around 25 percent) but may be endogenous. Finally, Han and Waldfogel used the estimates from

their models without the child care quality or availability variables to simulate three subsidy schemes: (1) reducing total costs by 25 percent; (2) reducing hourly costs by $0.50 per hour; and (3) reducing hourly costs by $1.00 per hour. Simulations of reducing child care costs showed a more pronounced positive effect on single mother employment. For example, a 25 percent subsidy increases single mother employment by 5–6 percent, nearly double that for married mothers. In addition, subsidies that reduce the hourly cost of care are more effective for increasing employment than a subsidy based on a percentage of costs. Lowering hourly costs by $0.50 raises single mother employment by 8–9 percent, nearly 50 percent greater than the flat 25% subsidy.

Baum (2002) adopted a highly structural approach to estimating the dynamic effects of child care costs on the employment of low-income women. He differed from the literature, which to date focused on static decision making, by examining the dynamics of employment that permitted him to not only identify the effect of child care costs on the probability of employment but also to estimate the effect on the timing of work after child birth. Baum began by specifying value functions for working mothers and non-working mothers, both before and after child birth, which then led to a hazard model framework to estimate the effect of child care costs on return to work among low-income mothers. Hazard models estimate the "hazard" of an event occurring – return to work, for example. Theoretically, child care costs function like a tax on maternal wages if the mother is paying for child care services. Because these costs comprise a larger share of the budget for low-income mothers, Baum hypothesized that the overall net benefit of working is reduced (as if taxed) for these mothers relative to high-income mothers.

Similar to Anderson and Levine (1999), Baum focused on low-income working mothers, the likely targets of child care credits and welfare reform. Baum related his work to the PRWORA welfare reform of the mid 1990's, finding child care costs served as significant barriers to work for low-income mothers relative to other income groups. The sample for his analysis was comprised of women who gave birth and lived in poverty from

the 1988-1992 National Longitudinal Survey of Youth (NLSY), and are subsequently compared to samples of non-low income women and all women. The women were between 14 and 21 years old when first interviewed in 1979, putting them within child-bearing age for 1988-1992. Baum broke his analysis into two major components, one on employment transitions models and one on hours of work. We restrict our discussion on the transitions models and just note in passing that his results on hours of work suggest that hours are not very sensitive to child care costs. This insensitivity with respect to hours worked may reflect both labor-market and child-care constraints that force poor mothers to work either part time or full time, with very little flexibility to adjust hours worked.

Baum found that the effect of child care costs per hour worked on low-income mothers is negative: child care costs reduce the probability that low-income mothers will work after they give birth. The elasticity of working one year after giving birth with respect to child care costs is –0.59. The work-child care elasticity two years after giving birth is –0.52. Together, it appears child care cost effects diminish as the child ages. These are larger elasticities than much of the literature finds, with the exception of Kimmel's (1998) elasticity of –0.98. The elasticity of returning to work one year after giving birth with respect to child care costs is –0.185 for all mothers and –0.025 for non-low-income mothers. The elasticity falls to –0.155 for all mothers but rises to –0.035 for non-low-income mothers after two years have passed since childbirth (see Table 2). Baum found that a 30% child care subsidy increased a low-income mother's hazard of return to work from 9.5% to 11.5%. A year after childbirth, a 30% child care subsidy increased this rate from 2.2 to 2.8%. By simulating the number of low-income mothers who work with no child care subsidy versus those who do (30%), he estimated that the subsidy increases the percentage working one year after giving birth from 41 to 48.5%. Also, the probability that a mother works increased with the wage rate, nonwage income, being married, and the number of adults present. Employment transitions of 'all mothers' and 'non-low-income' mothers are less sensitive with respect to child care costs.

Connelly and Kimmel (2003) extended the literature by incorporating the choice of welfare participation as an explicit alternative to work, and studied the effect of child care prices on both welfare use and employment for a sample of single mothers. The theoretical model was the standard one discussed in Section II of a mother maximizing her utility over goods and child services, but in this case there were four explicit constraints on behavior: a money budget constraint, production of child care services, mother's time constraint, and child's time constraint. This theoretical model produces estimating equations for AFDC participation and employment. The sample, consisting of single mothers with children under the age of 5, was taken from the 1992 and 1993 SIPP panels.

Connelly and Kimmel considered four specifications for estimation on the sample of single mothers: (1) separate AFDC participation and employment probits; (2) estimate AFDC participation and employment jointly with a bivariate probit; (3) the bivariate probit from (2) with additional variables (education, age, and age squared); and (4) a multinomial logit for the four possibilties corresponding to on/off AFDC and employed/not employed (on AFDC and employed; on AFDC and unemployed; off AFDC and employed; off AFDC and unemployed).

These models share a common set of covariates, the most prominent being the predicted child care price and predicted wage rate. The predicted wage was estimated using Heckman two-step procedures for selection bias as in earlier studies. Child care price per hour of employment for the youngest child (not child care used) was the price measure. This price was also constructed in two steps: first, a bivariate probit model that includes an employment equation and a paying for child care equation was estimated on the full sample of married and single mothers. Second, two correction terms from the bivariate probit model were then included in a price of child care equation. The identification came by excluding mother's health status from the price of care equation.

They found that both AFDC recipiency and employment are sensitive to the hourly price of child care and the hourly wage. Table 2 shows the welfare participation elastic-

ity with respect to price of child care varies by specification, falling in the range of 1.01 to 1.94. Employment was less sensitive to the price of child care with elasticities ranging from –0.32 to –0.42. The range of welfare participation elasticities with respect to the wage was –0.83 to –2.25, implying that work and welfare are substitutes, while the range of employment elasticities with respect to the wage was 0.81 to 1.58. They considered several policy simulations that include a simple price subsidy, a means-tested price subsidy, and a means-tested price subsidy along with a reduction in AFDC benefits. The simulations show a decline in welfare use and increased employment. The simple 50 percent price subsidy produced the lowest welfare use and highest employment. Connelly and Kimmel also calculated the costs and savings for each simulation. AFDC savings occurred if a mother who was predicted to be on AFDC was not on AFDC in the simulation. Child care subsidy costs were calculated if the mother was predicted to be employed in the simulation and only applied to the youngest child. Costs also included any additional government expenditures for the EITC. The net cost of the subsidy compared total costs, the subsidy cost plus the EITC cost, with the AFDC savings. Connelly and Kimmel concluded the net cost of the subsidy seemed to be low due to the large savings from lower AFDC participation rates.

The child care industry has received an influx of federal funds since the mid 1980's. By 1999, government child care subsidies were valued at or around $19 billion. This growth in spending has come with increased regulation, and Blau (2003b) estimated the effects of these regulations on outcomes in the child care market, as well as on the labor market for mothers of young children receiving care. Regulations are meant to prevent and/or reduce risks associated with exposure to child care environments, such as disease, impairment, and injury. Violators are subject to fines and could lose their license to sell child care services within the state. These regulations differ across states, and there have been changes over time within these states as well. Theoretically these regulations raise the costs associated with the provision of child care services.

Blau's (2003b) baseline hypothesis posited that limited funds for enforcement

would render child care regulations unimportant for child care markets and labor markets of mothers. Economic theory states that regulations in competitive markets should reduce the supply of child care while raising quality and average prices. He considered the possibility of input substitutions: if regulations require a certain number of teachers, child care centers could respond by relaxing standards on unregulated inputs such as group size.

Data on child-staff ratios and other regulations were assembled by V. Joseph Hotz and M. Rebecca Kilburn for the U.S. over the period spanning 1983 to 1996. Child care records and expenditure data came from the SIPPs child care topical module. The data were treated as repeated cross sections, and the panel component was ignored. In particular, Blau used data on type, expenditure, and hours of the primary child care arrangement of the youngest child in a family. Finally, the analysis of child care and maternal labor market effects used data from the Current Population Survey for 1984 to 1997.

Blau (2003b) modeled the type of child care used in a multinomial logit framework, allowing for multiple child care choices including center-based, family day time, relative, and parental forms of care. Binomial logits models were used to model whether to use paid care, whether to be a child care worker (child care market effects), and whether to work (maternal labor market effects).

Whereas the previous literature could only exploit cross-state variation but did not have variation over time within states, Blau is able to look over the period 1983 to 1996. Using this feature of the data, he found current regulations have small effects on child care and maternal labor markets. However, he did not find a convincing, consistent pattern across his results – most regulation effects were either small or statistically insignificant. It is noted that results using state fixed effects could be biased by time-varying sources of unobserved heterogeneity across states that remains uncontrolled. This is relevant since only two time-varying variables, unemployment rate and welfare benefit, are included in the model specification.

The effect of the group size regulation on expenditure per hour was negative, sug-

gesting a modest cost reduction with an elasticity of –0.095; an increase in child-to-staff ratio regulation was associated with a lower likelihood of paying for care with an elasticity of –0.064. More stringent indoor space requirements for a given type of child care reduced use of that type of care. The model with state fixed effects yielded elasticities of –0.233 for centers and –0.109 for family day care homes with respect to changes in indoor space requirements, consistent with higher costs by way of increased space per child. Although regulations in the child care market impose costs on child care providers, which may be passed on to consumers, the negative effects of regulations were small based on the results of Blau's study. However, the documented loose enforcement of regulations, perhaps due to limited funds, implied extensive regulatory frameworks were not the most effective way to improve quality in child care markets.

Tekin (2007) estimated a model of child care subsidies on the employment of single mothers, adding to the literature by using a post-welfare reform sample, incorporating the decision to choose full-time versus part-time work, and adjusting child care prices for subsidy receipt. Tekin modeled a mother maximizing her utility as a function of leisure, quality of children, consumption, unpaid childcare hours, and a categorical variable corresponding to seven work and subsidy status arrangements. The theoretical model leads to a multinomial logit representing the seven choices of work and subsidy arrangements.

The data came from the 1997 National Survey of America's Families (NSAF) and covered single mothers with at least one child under age 13. Wages and child care prices suffer from endogenous sample selection bias, so Tekin estimated additional equations for child care prices, part-time wages, and full-time wages. The multinomial logit equation along with the equations for wages and price were estimated jointly using full information maximum likelihood, allowing for correlation across error terms. The state fixed effects serve as the identification of child care prices and wages. Unlike other researchers who strictly used child care expenditures, Tekin used child care hourly price net of the subsidy when the mother chooses to receive a subsidy. The subsidy is based on hourly state reim-

bursement rates.

Tekin found that the price of child care and the wage rate affect single mothers in ways that match economic theory: a lower price of child care and higher wage raise child care utilization and employment. Table 2 shows full-time mothers exhibit a stronger wage elasticity to the full-time wage rate (0.874) than part-time mothers with respect to the part-time wage rate (0.431). Full-time mothers were also more sensitive to the price of child care than part-time mothers (price elasticities are –0.139 and –0.068, respectively). Tekin simulated policies based on raising the wage and lowering child care price, and reducing the eligibility limit. To gauge subsidy cost-effectiveness Tekin calculated the extra number of hours worked generated per subsidy dollar by imposing a number of standard assumptions in the literature. These assumptions included: no general equilibrium feedback effects of the subsidy, and that the subsidy only affects whether the mother chooses full-time versus part-time work and not the number of hours within full-time or part-time status. Using this approach, a child care subsidy appears more cost-effective than a full-time or part-time wage subsidy. At first glance this result is counter-intuitive because the wage elasticity of employment exceeds the child-care subsidy elasticity of employment. Tekin argued that this result was a consequence of his experimental design, where the wage subsidy provided benefits to all working mothers while a childcare subsidy provided benefits only to those working mothers who use paid childcare. Thus, the childcare subsidy generated more hours of work per dollar spent by the government, making it a more cost-effective policy tool.

Using a sample of single mothers following welfare reform, Blau and Tekin (2007) studied the relationship between household characteristics and the receipt of a child care subsidy, and how subsidy receipt affects employment, unemployment, school enrollment of the mother, and welfare participation. Separating out employment from unemployment is new to the literature on child care subsidies, as is school enrollment. Only a few papers, including the Connelly and Kimmel (2003) paper reviewed here, examine the effect of subsidies on welfare participation. However, unlike much of the previous research by Blau

and Tekin, they adopted a quasi-structural approach in this paper in lieu of a fully specified structural framework. The data come from the 1999 National Survey of American Families (NSAF), with the sample consisting of single mother families.

Blau and Tekin estimated the effect of subsidy receipt on their four outcomes using both ordinary least squares and instrumental variables, the latter when treating subsidy receipt as endogenous. They avoid using state rules affecting eligibility for the subsidy as an instrument because these rules affect the value of employment and receiving the subsidy through the subsidy amount. Instead, they used county dummy variables as identifying instruments. The motivation for these instruments came from the fact that subsidies are rationed at the county level. Conditional on receiving a subsidy, the rationing at the county level does not affect the outcomes of interest. The within-state variation in subsidy receipt identifies the effect of the subsidy. In some specifications, they included variables for whether the family received welfare since January 1997 and whether the family received a subsidy during the first three months after leaving welfare since 1997 to control for any unobserved heterogeneity that could be correlated with the outcome and receiving the subsidy.

Results from the estimation of the model for subsidy receipt show that African Americans were more likely to receive a subsidy than whites and mothers of other races. A mother with a child aged 6-12 and no child aged 0-5 was 8.9 percent less likely to receive a subsidy relative to a mother with children in both age categories, suggesting that the presence of children under age 6 are a major correlate of subsidy program enrollment. Including the variables for past welfare use and receiving a subsidy after leaving welfare shows receiving a subsidy after leaving welfare dramatically raised the likelihood of subsidy receipt (by 53 percent).

OLS estimation of the outcome equations showed subsidy receipt raised the likelihood of employment and receiving welfare by 13 percent and 15 percent, respectively, and did not have a significant impact on attending school or unemployment. Blau and Tekin argued that, to the extent subsidy receipt led to increased work-related activities and in-

creased welfare participation, the increased probably stems from the priority that current and former welfare recipients receive for a subsidy and the work requirement for subsidy receipt. Adding the variables for past welfare and subsidy receipt after leaving welfare does not change the employment effect much and causes the effect on current welfare receipt to be insignificant. However, instrumental variables estimation of the outcome equation produced different results than OLS estimation. The subsidy effect on employment was no longer significant while the effect was significant for unemployment and current welfare receipt (increases probability by 20 percent and 47 percent, respectively). Including the lagged welfare and subsidy receipt variables produced significant results for employment (increases by 33 percent) and unemployment (increases by 20 percent), making the subsidy effect on welfare participation go to zero. The latter suggests that the positive link between subsidy receipt and welfare participation may be due more to unobserved heterogeneity than as a causal relationship. Overall, the results of this paper suggest child care subsidies promote employment and economic self sufficiency of single mothers.

IV. Implications for Single Mother Families in Kentucky

In this section we relate the estimated employment and welfare participation elasticities from the child care literature to a sample of single mother families in Kentucky. We select single mothers because this is the population for whom most of the literature has focused and is the target group for many government sponsored child care subsidy programs.

The data for our analysis draws from the 2005 to 2007 waves of the Annual Social and Economic Study in the Current Population Survey (CPS). The CPS surveys about 60,000 households nationally each year, but with our focus on single mother families in Kentucky we pool the last three years of data in order to increase our sample size. To be included in the sample the respondent must be a single (widowed, divorced, separated, or never married) woman who is the head of the household and has a dependent child under age 18. These selection criteria yield 332 single mother families in Kentucky. After ap-

plying sample weights, this sample represents 395,688 single mother families in Kentucky over the three years. As a point of comparison we also draw a sample of single mother families in the U.S. residing outside of Kentucky and test whether the average single mother in Kentucky differs statistically from the average single mother in the rest of the nation across a variety of economic and demographic outcomes.

Table 3 contains the mean and standard deviation for demographics such as age, race, education, and family size, a variety of income and poverty measures, and several employment outcomes. In addition, in recent years the CPS has added several questions to the survey that are asked of low-income families regarding the receipt of child care. The final column of Table 3 records the p-value for the test of equality of mean values of outcomes between single mothers in Kentucky versus single mothers in the other 49 states and District of Columbia. The lower the p-value the stronger the rejection of the null hypothesis of equal means—a p-value of 0.05 yields a t-statistic of 1.96 or the 95% confidence interval. In other words, low p-values indicate strong evidence in favor of the means differing, or single mothers in Kentucky significantly differ from single mothers elsewhere.

Single mothers in Kentucky are significantly younger (by just over one year), more likely to be a white person (80.4% versus 68.8%), less likely to be of another race or ethnicity such as Hispanic (0.6% versus 6.69%), to have smaller families (2.9 versus 3.1 persons), but are no different in terms of education attainment. Although education attainment is comparable, the annual income of single mothers in Kentucky is about $7,000 less than for single mothers outside the state ($25,329 versus $32,716), which is primarily accounted for by the lower earnings in the labor market.[8] As a consequence, single mothers in Kentucky are significantly more likely to be living below the poverty line (44% versus 35%) and more likely to have incomes below two times the poverty line (70% versus 65%).

8. Family earnings represents earnings from wage and salary income, non-farm self-employment, and farm employment. Family income includes family earnings plus income from government programs (TANF, SSI, SSDI, Food Stamps and school lunch, EITC, and other nonlabor income). Family earnings and family income are adjusted for inflation using the personal consumption deflator with 2007 base year. Family earnings and family income are also calculated excluding allocated data. Allocated data refers to the Census Bureau's procedure to assign income and earnings for individuals who have missing data.

Welfare participation rates are no different between Kentucky and single mothers in other states. The lower incomes are partially explained by the fact that single mothers in Kentucky are about 5 percentage points less likely to work full-time (54.5% versus 59.4%), and possibly from lower hourly earnings (not reported). The lower rates of full time employment, however, do not seem to stem from any significant difference in receipt or payment for child care.

In the economic model of child care presented in Section II, aid to mothers can come in the form of subsidizing the price of child care which raises the mother's take-home wage. Using the baseline values of employment (total, full-time, and part-time) and welfare participation from the CPS we simulate how employment and welfare participation of single mothers in Kentucky would change in response to either a 10% or 25% cut in the hourly price of child care or increase in the hourly wage rate. To make these calculations we use elasticity estimates from four of the studies reviewed herein—Kimmel (1995), Anderson and Levine (1999), Connelly and Kimmel (2003), and Tekin (2007)—and report the results in Table 4. Tekin (2007) and Connelly and Kimmel (2003) pool all single mothers together, thus we lead with this pooled sample in the table. Kimmel (1995) focused on single mothers living in poverty, and by race, while Anderson and Levine (1999) reported results from a number of samples. Here, we focus on the samples separated by education attainment. For each of the samples we first report the baseline probability and then the simulated employment (or welfare participation) levels after the reduction in child care price or increase in wage. The simulations 'hold all else equal' and thus do not incorporate so-called general equilibrium feedback effects on the child care market. Thus, the simulations are meant to be illustrative.

Beginning with a baseline employment level of 66.9%, Tekin's (2007) results suggest a 10% reduction in the price of child care paid by mothers in Kentucky would raise employment to 67.7%, and a 25% reduction in the price lifts employment to 68.9%. Connelly and Kimmel's (2003) estimates suggest that the 25% reduction in child care price

would raise employment of single mothers in Kentucky to 72.2–73.9%, and reduce welfare participation from 10.8% to between 5.3% and 7.7%. The higher employment estimates from Connelly and Kimmel owe to the larger elasticities from their model as reported in Table 2. Given that the national employment rate of single mothers is 70.7%, and holding all else equal, these estimates suggest that if Kentucky lowered the hourly price of child care of single mothers residing in the Commonwealth by 25%, the state could lift employment of single mothers to a level more in line to that found in the rest of the nation, and perhaps reduce poverty and the income gap across states highlighted in Table 3.

It is difficult to assess whether the subsidy would lower the poverty gap because Tekin (2007) is the only researcher to separate full-time and part-time employment responses. Because the full-time response to the 25% reduction in child care only narrows the five percentage point gap in full-time employment between Kentucky mothers and mothers outside Kentucky by one percentage point, it is not clear to what extent the poverty gap would be narrowed. Perhaps a more direct route to reduce the gap is to provide a direct wage subsidy (examples include an Earned Income Tax Credit). The simulations in Table 4 show that raising the full-time wage by 10% lifts full- time employment of single mothers in Kentucky to 59%, or to a level comparable to that found in the rest of the country. The effect of an increase in the full-time wage on overall employment ranges from 71% to 78% depending on the elasticity, or to employment levels exceeding those found in the rest of the nation for this population. Tekin (2007) argued that the child care subsidy was more cost effective than the wage subsidy because the child care subsidy was made available only to those paying for care whereas the wage subsidy was universal. We are not able to make such a direct cost comparison here for lack of data, but we note that it is possible to target the wage subsidy much like the EITC to make it more cost effective. We discuss these alternatives further in the concluding section.

The simulations based on Kimmel (1995) and Anderson and Levine (1999) provide a sense of how the subsidies affect different segments of the single mother population. For

example, the baseline employment rate of single mothers living in poverty in Kentucky is 42.5%. Poor, white mothers face a similar baseline employment rate, 42.2%, while poor, black mothers face a higher employment rate at 44.5%. White mothers in poverty experience the highest employment gains from a reduction in child care price as they are the most responsive group to child care price, according to Kimmel (1995). Baseline employment rates by education range from 38.9% for mothers with less than a high school education to 79.2% for mothers with more than a high school education. A price subsidy produces similar improvements in employment for the lower education groups with a 25% price reduction leading to gains of more than 6 percentage points. The same subsidy raises employment for mothers with more than a high school education by about 4.6 percentage points.

Simple "back-of-the envelope" calculations reported in Table 5 demonstrate the projected annual cost of extending a child care subsidy to working single mothers in Kentucky. The National Association of Child Care Resource & Referral Agencies (NACCRRA) estimates the annual cost of child care in Kentucky for an infant in full-time center care at $6,240, and for a school-age child in a center at $4,956.[9] In the 2007 CPS we estimate that there are 44,102 single mother families with children present under the age of 6 in Kentucky, and of this group, 60.5 percent are employed. In Table 2 we reported an employment elasticity with respect to the price of child care of –0.51 from Anderson and Levine (1999) for single mothers with children under age 6. Incorporating the positive employment response into our calculations shows that if the state provided a 10 percent child care subsidy to working single mothers with children under age 6, and all eligible mothers received the subsidy, the annual cost would range from $14 million to $17.5 million. The range is a function of the age distribution of children—infants, toddlers, and kindergarteners—who each face different costs of care.[10] Applying a 25 percent subsidy yields a cost

9. Annual costs are taken from 2008 Child Care in the State of Kentucky produced by NACCRRA. See http://www.naccrra.org/randd/data/docs/KY.pdf.

10. Calculations based on 44,102 single mothers in Kentucky with a child under 6 as reported in the 2007 CPS, and 60.5 percent are employed, or 26,682. A 10 percent subsidy implies a gain of employment of 5.1 percent based on an elasticity of –0.51, or total employment of 28,042 after the subsidy. Assuming 100 percent participation in the subsidy implies an annual cost of $14 million to $17.5 million depending on whether one assumes all children are school age (subsidy cost of $495 per child) or all are infants (subsidy cost of $624 per child).

range of $37.5 million to $46.9 million.[11] These cost estimates are meant to be illustrative, and may be too high or too low depending on a variety of factors. The estimates may be biased upward because we assume 100 percent program participation, whereas take-up rates in most income assistance programs in the U.S. are in the range of 60–80 percent. Also, we do not net out possible savings to the state from reduced transfer payments for mothers who enter the workforce in response to the subsidy. At the same time they may be too low because we do not account for the fact that some mothers have multiple children under age 6, and we ignore the fact that the subsidy programs may put upward pressure on the price of child care due to the heightened demand (assuming there is no concomitant increase in the supply of child care providers).

V. Conclusion

This report provided a brief survey of the literature on the economics of child care, with a particular focus on the employment effects of child care subsidies as this has received the bulk of the attention within the economics profession. We then related selected employment and welfare elasticities from the literature to a sample of single mother families residing in Kentucky to examine how employment and welfare participation would respond to either a 10% or 25% reduction in the hourly price of child care or to an equal sized increase in the before-tax hourly wage rate.

The survey revealed that the model range of estimated employment elasticities with respect to the price of child care for single mothers is from –0.3 to –0.4. Data from the 2005–2007 waves of the Current Population Survey indicate that single mothers in Kentucky are less likely to work and more likely to live in poverty compared to single mothers living in other states. Based on the elasticity estimates from the literature, holding all else equal, a 25 percent reduction in the price of child care would lift employment of single mothers in Kentucky to 69 to 74 percent, which is an employment level commensu-

11. See previous footnote for method of calculation.

rate with that of single mothers living outside of Kentucky. As a point of comparison, the typical employment elasticity with respect to the minimum wage is in the range of –0.1 to –0.2 (Brown 1999), while the employment elasticity of women with respect to the EITC is closer to 1.0 (Hotz and Scholz 2003). This implies that women's responsiveness to the generosity of child care subsidies lies between the other two major social policies frequently touted as incentives to work.

Because much of the literature found that the employment response to the before-tax hourly wage rate was much larger (in absolute value) than the response to the hourly price of child care, it would appear at first glance that a direct wage subsidy would be more effective to spur employment than an indirect wage subsidy by reducing the price of child care. Indeed, this conventional wisdom led the UKCPR to issue a policy brief a year ago (Meade and Ziliak 2007) discussing the merits of a state EITC for working families in Kentucky where it was noted that a state EITC would affect around 360,000 Kentucky families in terms of spurring labor force participation and reducing poverty. However, in a careful simulation exercise Tekin (2007) showed that a child care subsidy may be more cost effective than a direct wage subsidy in terms of encouraging employment because the child care subsidy is targeted only to those receiving care whereas the wage subsidy is universal. Because the EITC is not a universal wage subsidy in the same way that Tekin modeled his simulation, and instead is targeted to the low-income population, it may be the case that targeted wage subsidies may be more cost effective than child care subsidies.

Meade and Ziliak (2007) estimated that the cost of refundable state EITC in 2008 ranged from $32 million to $96 million depending on whether the credit was set at 5 percent or 15 percent of the federal EITC. In this report our estimates of child care subsidies

for working single mothers under age 6 ranged from $14 million to $47 million depending on whether the subsidy rate was set 10 percent or 25 percent and on the age distribution of children in the family. That is, child care subsidies of the type considered here appear to compare favorably to the cost of a state EITC. This does not mean that the policies should be viewed as substitutes. Indeed, a state EITC coupled with a child care subsidy could be very effective anti-poverty tools to raise the employment and incomes of Kentucky's low-income working families.

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Table 1: Summary of Child Care Subsidy Literature

Authors and Date	Key Issue	Data and Sample	Dependent Variable	Estimation Method	Key Findings
Berger and Black (1992)	Evaluation of KY child care subsidy programs; Effects of child care subsidy on LFP, hours worked, satisfaction	Program/Admin Data from Louisville 4C & KY Title XX programs; low-income single mothers (n=527)	LFP, Hours worked	Probit, Ordered Probit	Child care subsidies increase employment among low-income single moms. Single women are less sensitive to child care costs than married women. Parents seem to prefer informal care. Nationally, subsidies could yield 18,173 employment gain.
Ribar (1992)	Effect of child care costs on employment and child care use	1984-1985 SIPP, Married mothers (n=3,738)	Employment, Paid care use, Unpaid care use	Probit, Tobit	Employment increases with wage and decreases with child care price. Paid care (unpaid care) is a normal (inferior) good. Paid care and unpaid care are substitutes.
Kimmel (1995)	Effects of child care costs on employment	1987-1988 SIPP, Single mothers in poverty	Employment	Probit, Heckman Two-Step	Employment of poor white mothers is more sensitive to child care price than employment of poor Black mothers.
Averett, Peters, and Waldman (1997)	Effect of child care tax credit on labor supply for women with young kids	1986 wave NLSY; women 21-29 with one or more children under age of 6 (n=749)	Hours of work, Purchase of childcare	Tobit, Probit, Dual-error term modeling	As number of kids increase, women are more likely to purchase formal care. As nonwage income increases, women are less likely to purchase formal care. Older siblings' presence has no effect on purchasing informal care.
Anderson and Levine (1999)	Effect of post PRWORA child care policies on labor supply of lower skill women	Wave 3 1990, 1991, 1993 SIPP (n=20,587)	Employment	Probit	Least skilled workers using child care are less likely to pay and will pay less when they do pay. Kids of least skilled more likely to be cared for by relative. Increases in child care costs are associated with modest decreases in labor force participation. It's difficult to isolate child care policies of welfare reform.
Han and Waldfogel (2001)	Effect of child care costs on employment	1991-1994 March CPS and 1990-1993 SIPP, Single and married mothers (n=41,118)	Employment	Probit, Heckman Two-Step	Single mothers have a stronger negative response to child care price than married mothers.
Baum (2002)	Effect of child care costs on LFP of low-income mothers	1988-1992 NLSY; 14-21 year old women in 1979 – of child bearing age between 1988-1992 (n=694)	Labor force participation, after birth of child, Hours of work	Hazard model	Child care costs reduce probability of low-income mothers work after birth of child. Mothers work more hours as child care costs per hour worked increase. Low-income moms may be working towards a target income amount.
Connelly and Kimmel (2003)	Effect of child care costs and wages on employment	1992-1993 SIPP, Single mothers (n=1,523)	Employment, Welfare participation	Probit, Heckman Two-Step, Bivariate Probit	Higher child care costs positively affect welfare participation and negatively affect employment. Higher wages lower welfare participation and raise employment.

Table 1 continued

Blau (2003)	Effect of regulations on CC market and labor market for mothers of kids	Regulations data from Hotz and Kilburn for 1983-96, 1984-1995 SIPP and CPS 1984-1997 (n=17,370)	Choice of child care type, work decision	Multinomial, Logit, OLS	Regulations have small effects on child care and maternal labor markets. Overall effects are inconsistent across specifications. Tougher indoor space requirements reduce likelihood of being a child care worker. Stringent child/teacher ratio reduces likelihood of paying for care.
Blau and Tekin (2007)	Effects of subsidy receipt on employment, school attendance, unemployment and welfare participation	1999 NSAF, Single mothers (n=2,461)	Employment, School attendance, Unemployment, and Welfare participation	OLS, IV	Subsidy receipt raises employment and unemployment while having no effect on school attendance or welfare participation.
Tekin (2007)	Effect of child care subsidies on employment and child care use	1997 NSAF, Single mothers (n=4,029)	Full-time employment, Part-time employment, and Paid care use	Multinomial logit	Lower price of child care and higher wage raises paid child care use. Employment and child care use of full-time mothers is more sensitive than part-time mothers.

Table 2: Summary of Elasticities From Child Care Literature		
Elasticity Measure	**Estimate**	**Sample**
Ribar (1992)		
Employment wrt wage	0.58 to 0.68	Married mothers
Paid care use wrt wage	1.21 to 1.41	Married mothers
Unpaid care use wrt wage	-0.19 to -0.01	Married mothers
Employment wrt child care price	-0.74 to -0.64	Married mothers
Paid care use wrt wage child care price	-1.86 to -1.39	Married mothers
Unpaid care use wrt child care price	0.03 to 0.14	Married mothers
Kimmel (1995)		
Employment wrt child care price	-0.346	Poor, single mothers
Employment wrt child care price	-1.362	Poor, single, white mothers
Employment wrt child care price	-0.345	Poor, single, black mothers
Averett, Peters, and Waldman (1997)		
Hours worked wrt (uncomp) wage	1.29 to 1.63	Employed women
Hours worked wrt (comp) wage	1.33 to 1.59	Employed women
Hours worked wrt total income	-0.05 to 0.04	Employed women
Hours worked wrt child care price	-0.78	Employed women
Anderson and Levine (1999)		
LFP wrt child care price	-0.358	All women
LFP wrt child care price	-0.394	Less than high school educated women
LFP wrt child care price	-0.293	More than high school educated women
LFP wrt child care price	-0.328	High school educated women
LFP wrt wage	0.912	Less than high school educated women
LFP wrt wage	0.447	High school educated women
LFP wrt wage	0.427	More than high educated women
LFP wrt alternate care price	-0.103	Less than high school educated women
LFP wrt alternate care price	-0.044	High school educated women
LFP wrt alternate care price	-0.04	More than high educated women
LFP wrt child care price	-0.688	Single, less than high school educated women
LFP wrt child care price	-0.408	Single high school educated women
LFP wrt child care price	-0.232	Single, more than high school educated women

Table 2 Continued

LFP wrt child care price	-0.168	Married, less than high school educated women
LFP wrt child care price	-0.301	Married, high school educated women
LFP wrt child care price	-0.296	Married, more than high school educated women
LFP wrt alternate care price	-0.104	Married, less than high school educated women
LFP wrt alternate care price	-0.047	Married, high school educated women
LFP wrt alternate care price	-0.039	Married, more than high school educated women
LFP wrt alternate care price	-0.097	Single, less than high school educated women
LFP wrt alternate care price	-0.034	Single high school educated women
LFP wrt alternate care price	-0.033	Single, more than high school educated women
LFP wrt child care price	-0.473	All single women
LFP wrt child care price	-0.303	All married women
LFP wrt child care price	-0.511	All women with kids less than age 6
LFP wrt alternate care price	-0.089	All women with kids less than age 6
LFP wrt child care price	-0.186	All nonpoor women
LFP wrt alternate care price	-0.034	All nonpoor women
LFP wrt child care price	-0.375	All poor/near-poor women
LFP wrt alternate care price	-0.032	All poor/near-poor women
LFP wrt child care price	-0.649	Less than high school educated, poor/near-poor women
LFP wrt alternate care price	-0.051	Less than high school educated, poor/near-poor women
Above elasticities apply to mothers with kids less than age 13 unless otherwise noted		
Han and Waldfogel (2001)		
Employment wrt child care price	-0.30 to -0.40	Single mothers
Employment wrt child care price	-0.50 to -0.73	Married mothers
Connelly and Kimmel (2003)		
Employment wrt child care price	-0.32 to -0.42	Single mothers
Employment wrt wage	0.81 to 1.58	Single mothers
Welfare participation wrt child care price	1.01 to 1.94	Single mothers
Welfare participation wrt wage	-0.83 to -2.25	Single mothers
Baum (2002)		
Return to work 1 yr after birth wrt child care price	-0.59	Low-income mothers
Return to work 2 yrs after birth wrt child care price	-0.52	Low-income mothers
Return to work 1 yr after birth wrt child care price	-0.185	All mothers
Return to work 1 yr after birth wrt child care price	-0.025	Non low-income mothers
Return to work 2 yrs after birth wrt child care price	-0.155	All mothers
Return to work 2 yrs after birth wrt child care price	-0.035	Non low-income mothers
Blau (2003)		
Child care expenditure wrt group size regulation	-0.095	Mostly mothers of kids less than age 5
Paying for care wrt increase child/staff ratio	-0.064	Mostly mothers of kids less than age 6
Using center based care wrt indoor space requirements	-0.233	Mostly mothers of kids less than age 7
Using family day care home wrt indoor space requirements	-0.109	Mostly mothers of kids less than age 8
Tekin (2007)		
Part-time employment wrt child care price	-0.139	Single mothers
Full-time employment wrt child care price	-0.068	Single mothers
Employment wrt to child care price	-0.121	Single mothers
Part-time employment wrt full-time wage	-0.097	Single mothers
Full-time employment wrt full-time wage	0.874	Single mothers
Employment wrt to full-time wage	0.663	Single mothers
Part-time employment wrt part-time wage	0.431	Single mothers
Full-time employment wrt part-time wage	-0.09	Single mothers
Employment wrt to part-time wage	0.081	Single mothers
Note: LFP refers to "labor force participation" and wrt refers to "with respect to"		

Table 3: T-test For Difference In Unweighted Means (unpaired, unequal variances)					
Single Mothers in Kentucky and US, Current Population Survey 2005-2007					
	Kentucky (n=332)		**US (excluding KY) (n=18,758)**		
Variable Description	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**p-value**
Demographics and Education					
Age	35.69	9.66	36.74	9.32	0.0520
White	80.42%	0.40	68.80%	0.46	0.0000
Black	18.98%	0.39	24.51%	0.43	0.0115
Other race	0.60%	0.08	6.69%	0.25	0.0000
Less than high school education	16.27%	0.37	16.26%	0.37	0.9979
High school education	33.13%	0.47	32.99%	0.47	0.9560
More than high school education	50.60%	0.50	50.75%	0.50	0.9571
Family size	2.92	0.96	3.06	1.12	0.0086
Number of children less than age 6	0.53	0.79	0.47	0.71	0.2026
Number of children less than age 18	1.66	0.81	1.74	0.94	0.0509
Income, Earnings, Poverty, and Welfare					
Family income ($2007)	25329.34	22813.01	32716.08	36804.17	0.0000
Family earnings ($2007)	19117.33	20695.11	26319.65	34661.20	0.0000
Family income ($2007) excluding allocation	23991.81	21360.96	30809.11	35093.70	0.0000
Family earnings ($2007) excluding allocation	18348.31	19121.79	24858.98	33290.19	0.0000
Poor (family income below poverty line)	43.98%	0.50	35.42%	0.48	0.0020
Twice Poor (family income below two times poverty line)	69.88%	0.46	64.60%	0.48	0.0389
Welfare Participation	10.24%	0.30	10.81%	0.31	0.7347
Employment					
Employed	66.87%	0.47	70.65%	0.46	0.1477
Unemployed	8.73%	0.28	6.29%	0.24	0.1178
Employed Full Time	54.52%	0.50	59.39%	0.49	0.0786
Employed Part Time	10.84%	0.31	10.36%	0.30	0.7809
Child Care (applies only to low-income families)					
Anyone in household received child care services	9.17%	0.29	9.49%	0.29	0.8698
One person in household received child care services	100.00%	0.00	99.83%	0.04	0.1574
Anyone in household paid for child care services	22.50%	0.42	25.12%	0.43	0.2998

Table 4: Simulated Employment and Welfare Participation Using Select Elasticities For Single Mothers In Kentucky				
	Employment	**Full-Time Employment**	**Part-Time Employment**	**Welfare Participation**
Baseline probability from data	66.87	54.52	10.84	10.24
Tekin (2007)				
10% reduction in child care price	67.68	54.89	10.91	Not Applicable
25% reduction in child care price	68.89	55.45	11.22	
10% increase in full-time wage	71.30	59.29	10.73	Not Applicable
25% increase in full-time wage	77.95	66.43	10.58	
10% increase in part-time wage	67.41	54.03	11.31	Not Applicable
25% increase in part-time wage	68.22	53.29	12.01	
Connelly and Kimmel (2003)				
10% reduction in child care price	69.01-69.68	Not applicable	Not applicable	8.25-9.21
25% reduction in child care price	72.22-73.89			5.27-7.65
10% increase in wage	72.29-77.44	Not applicable	Not applicable	7.94-9.39
25% increase in wage	80.41-93.28			4.48-8.12
Kimmel (1995)	**Poor employment**	**Poor, White employment**	**Poor, Black employment**	
Baseline probability from data	42.47	42.24	44.83	
10% reduction in child care price	43.94	47.99	46.37	
25% reduction in child care price	46.14	56.62	48.69	
Anderson and Levine (1999)	**Employment for less than high school**	**Employment for high school**	**Employment for more than high school**	
Baseline probability from data	38.89	61.82	79.17	
10% reduction in child care price	41.56	64.34	81.00	
25% reduction in child care price	45.58	68.12	83.76	

Table 5: Cost of Subsidies For Single Mothers In Kentucky				
Child Care Costs			**Child Care Costs**	**Percent of Average Family Income**
Average, annual fees paid for full-time center care for an infant			$6,240	24.6%
Average, annual fees paid for full-time center care for 4-year-old			$5,720	22.6%
Average, annual fees paid for before and after school care for a school-age child in a center			$4,956	19.6%
Cost of Subsidy			**10% Subsidy**	**25% Subsidy**
Total cost for full-time center care for an infant			$17,498,442	$46,930,289
Total cost for full-time center care for 4-year-old			$16,040,239	$43,019,432
Total cost for before and after school care for a school-age child in a center			$13,897,801	$37,273,480
Note: Child care costs taken from 2008 Child Care in the State of Kentucky by NACCRRA. Applying the employment rate of 60.5% to the number of single mothers gives 26,682 mothers eligible for the subsidy. Applying the elasticity from Anderson and Levine (1999) of -0.51 with a 10% subsidy to the group of eligible mothers raises employment to 28,042. The annual cost of the 10% subsidy is $624 for an infant. Multiplying this annual cost by the new number of employed mothers (28,042) produces the total cost of the subsidy at $17,498,442. The remaining subsidy costs are calculated in a similar way.				

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The University of Kentucky Center for Poverty Research (UKCPR) was established in October 2002 as one of three federally designated Area Poverty Research Centers, with core funding from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) in the U.S. Department of Health and Human Services. The UKCPR is a nonprofit and nonpartisan academic research center housed in the Gatton College of Business & Economics, Department of Economics at the University of Kentucky. The opinions and conclusions in this brief do not necessarily represent those of the federal government or the University of Kentucky.

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