

The Economic Role of Paid Child Care in the U.S.

A Report Series — Part 3: Economic Growth Modeling

Executive Summary

This report is the third in a four-part series focused on the use of paid child care in the U.S. The report provides extensive empirical analysis on a group of factors that potentially underlie differences in paid child care usage across the states and over time. These factors were introduced and discussed in the [first report in the series](#).

Time series tests of both short- and long-run statistical causality are used to examine the empirical relationships between these factors and paid child care usage. The report then develops a model of long-run economic growth and uses it to examine the potential effects of increased maternal and female labor force participation on real income growth and paid child care usage.

The results provide a helpful empirical view of the historical linkages between these factors and paid child care usage as well as the role of paid child care in economic growth. For policymakers, the results also inform the ongoing policy debate over the economic role of paid child care.

Factors Explaining Paid Child Care Usage

The empirical tests performed throughout the report examine two groups of potential factors driving paid child care usage. The first group includes economic and demographic factors that mostly address which parents need paid child care and are best able to afford it. Three additional factors capture the unique characteristics of the child care market in each state and focus on measuring the degree of accessibility and affordability of paid child care.

Economic and Demographic Factors. The report examines three economic and demographic factors:

- labor force attachment (particularly for mothers),
- household income, and
- educational attainment.

Historical time series survey data indicate that all three factors are associated with higher paid child care usage at the state level. Each factor also carries a sound theoretical basis for influencing paid child care usage.

Child Care Market Structure. The empirical tests also examine three characteristics of the child care market in each state:

- Child care expenditures as a share of income (or cost burden),
- Federal and state child care subsidies and cost offsets (such as tax credits) as a share of income, and
- The availability of alternative sources of publicly provided child care (primarily the share of preschool children ages 3 and 4 in public preschool).

These factors closely correspond to three areas of ongoing child care policy concern:

- the high cost of care,
- the degree of public funding of child care, and
- the role of public preschool provision.

50-State Panel Dataset

A key aspect of the empirical tests is the use of a 50-state panel dataset that captures the unique characteristics of paid care usage across the states. Panel techniques can provide for more robust estimates because they simultaneously utilize the information contained in the economic behavior of multiple regions and in the time dimension of the data.

The empirical tests use a balanced panel of data covering all six factors for the 50 states. Paid child care usage and the economic and demographic factors are available for 2000 to 2020. A balanced panel for child care market characteristics extends from 2009 to 2019. Hence, a combined panel using all six factors is available for the 2009 to 2019 period.

Unit root tests of stationarity are applied to the panel dataset and provide strong evidence that all the data series used in the empirical tests are nonstationary in levels or possess a unit root. Subsequent unit root tests on first differences of each series indicate that all the data series are stationary in differences for a strong majority of cross sections (states). The stationarity characteristics of the panel dataset are used to inform the application of the time series techniques used in the remainder of the report.

Empirical Causality Tests

Both short- and long-run tests of statistical causality are used to address the key question of whether economic, demographic, and child care-related characteristics of each state can be used to inform the future use of paid child care. The tests also shed light on the reverse question of whether changes in paid child care usage influence the future value of the economic, demographic, and child care market factors across the states.

The initial empirical tests use Granger causality tests of short-run lead-lag relationships. Granger causality is a statistical notion of causality that tests for increased predictability of the future path of one variable, X, using another variable, Y. While not addressing the issue of economic causality in the traditional sense, the tests provide an empirical measure of the historical responses and timing embodied in the relationships among the data. When coupled with a theoretical basis for inclusion in a model, Granger causality tests provide valuable observational evidence on the historical relations among a set of time series variables.

Long-run cointegration tests are subsequently used to examine potential long-run relationships present among the variables over time. The concept of cointegration is closely tied to the notion of Granger causality but focuses on the long-run dimension of the relationship among a group of variables over time. A set of cointegrated variables maintain a long-run equilibrium relationship over time. The linkages between cointegrated variables can be quantified as long-run elasticities.

Finally, cointegration results are used to construct a 50-state model of long-run income growth. The model is used to estimate the size of potential economic growth effects and changes in paid child care usage that may result from changes in labor force participation.

Short-Run Causality Tests – Paid Care and Labor Force Attachment

The Granger causality tests provide considerable evidence on the short-run linkages between paid child care usage and labor force attachment. Four overall findings emerge from the tests:

1. **Evidence of bi-directional Granger causality is found between the share of children in paid care and the female labor force participation rate.** The implication of bi-directional causality is that paid care evolves jointly over time as women move in and out of the labor force, with each series forecasting the future movement of the other. This is consistent with expectations that a dynamic relationship with feedback exists between the share of women in the labor force and the share of children in paid care.

2. All other remaining significant Granger causal relationships are present in only one direction, from the share of children in paid care to labor force attachment. **In other words, greater use of paid care leads to increased future labor force attachment.** For policymakers, this indicates that changes in the availability of paid care are far more likely to result in increased labor force attachment than increased attachment is to precede more paid care usage. As anticipated, any increase in paid care is most likely to come from the increased attachment of mothers.
3. **An increase in the share of children in paid care is likely to precede an increase in overall labor force attachment, with both male and female attachment responding to increased paid care usage.** This evidence points toward a broader labor force attachment effect for both males and females rather than simply increased female participation as a greater share of paid care is used.
4. **Future paid child care usage is far more closely associated with the labor force participation rate than the employment ratio.** The implication is that workers who are unemployed but remain in the labor force play a role in explaining paid care usage.

Additional tests of maternal participation for various groups of mothers by age of the child in care are performed. Three groups of mothers are examined: those with all children ages 0 to 4, those with a youngest child ages 0 to 4, and those with a youngest child ages 0 to 14. The expectation is that mothers with younger children generate a greater causal response relative to paid care usage. The findings suggest that:

1. The presence of younger children is far more closely associated with the use of paid care across the states than the presence of older children.
2. There are two distinct components to the finding on mothers and the age of the child.
 - a. First, the share of children in paid care is significantly Granger caused only by the participation of mothers with all children between the ages of 0 and 4.
 - b. Second, the causal linkages are most significant for explaining the future share of children ages 0 to 4 in paid care versus those ages 0 to 14.
3. The relationship for mothers with all children ages 0 to 4 has an estimated elasticity that is more than twice as large as that for children ages 0 to 14 in paid care.
4. None of the maternal measures of labor force attachment are statistically significant for future paid care usage when examining the broader group of children ages 0 to 14 in paid care. Only overall female labor force attachment is significant for ages 0 to 14 in paid care. This finding may be proxying for the effect of improved overall economic conditions on the use of paid child care by all households, including those formerly using unpaid care.

Short-Run Causality Tests – Paid Care and Other Economic Factors

Additional tests add the remaining two economic and demographic factors – education and income – to labor force attachment in a system Granger causality test of the relationship between paid care usage and the three economic and demographic factors.

Based on prior findings, we use paid care usage for children ages 0 to 4 and the labor force participation rate for mothers with all children ages 0 to 4. Education is defined as average years of schooling and income is measured initially as real personal income per capita. The estimates are formed using a balanced panel in the 2000 to 2019 period.

The findings provide an expanded backdrop for evaluating the role of economic factors in determining paid care usage:

1. Consistent with earlier evidence, the results continue to find bi-directional Granger causality between the share of children in paid care and maternal participation.
2. The short-run link from education to paid care usage is found significant but has a seemingly counterintuitive negative sign. While surveys consistently find a positive relationship between the *level* of education and paid care usage, the Granger causality test instead measures the *change* in education relative to paid care usage. The negative sign may be highlighting underlying behavior where higher income households are using a lower share of paid care as their incomes rise, but still have a far higher use of paid care than lower income households, as seen in survey data.
3. The level of real personal income per capita is not found Granger causal for paid care in the short run. This indicates limited evidence of a near-term effect on paid care usage where short-run fluctuations in income lead to greater use of paid child care, but does not rule out causality in the long-run. **However, in testing the sensitivity of this finding to the variable definition used for income, both nominal personal income per capita and median household income are found Granger causal for paid child care.** The significance of the two nominal measures suggests the presence of a macroeconomic effect and may simply reflect diminished concerns over inflation during the extended period of low and stable inflation covering most of the sample period used for the model. **On balance, the short-run tests are consistent with the notion that increased income leads to increased future use of paid child care.**

Short-Run Causality Tests – Paid Care and Market Characteristics

Two variables reflecting child care market characteristics at the state level are added to the model. The first is the measure of the net cost burden of child care (*cccosthnet*) to families with a child in paid care and is calculated from two of the market characteristics. The variable is calculated as the difference between the child care cost burden (cost per child as a share of household income) and federal and state subsidy and cost offsets as a share of household income, both as detailed in the report. The new variable provides a measure of net child care costs as a share of household income faced by families with children ages 0 to 14 in paid care. The second child care market variable added is the share of children ages 3 and 4 in various forms of publicly funded preschool.

The findings provide mixed evidence on the short-run role played by market characteristics in explaining paid care usage:

1. Bi-directional short-run Granger causality is still found between the share of children in paid care and maternal participation when the market characteristic variables are included in the model. Maternal labor force participation (*lfprfc04*) is the only explanatory variable found individually Granger causal in the short run for paid care usage. The estimated elasticity from maternal labor force participation to paid care remains highly stable when market characteristics are included in the equation.
2. Tests of a link from the net cost burden for paid care to paid care usage provide little evidence that changes in the cost burden for child care precedes changes in paid care usage for younger children. These findings do not suggest the absence of a relationship between the cost of care and the use of paid care but merely identify no short-run lead-lag relationship between the two in either direction. Alternative modeling approaches may be better suited for examining the response of child care usage to cost.
3. The share of children in public preschool is found inversely related to the share of children in paid care, as expected, but is marginally insignificant. Nevertheless, the estimated coefficient (-0.1635) suggests that a 1 percent rise in the share of children in public preschool would reduce the share of children in paid care by 0.16 percent.
4. The relatively small sample size for the market characteristics limits our confidence in the findings on market characteristics.

Panel Cointegration Tests and Model Estimates

Testing for cointegration among child care variables is promising because it tests for the presence of stable long-run statistical relationships among the set of factors believed to influence paid child care. Much like short-run Granger causality tests, they inform the joint behavior of the group of variables as they evolve over time.

Panel cointegration techniques are used to test for the presence of long-run cointegrating relationships between paid child care usage and the economic and demographic factors. Child care market characteristics are excluded from the tests due to the short sample period for which these data series are available.

The findings on the presence of cointegrating relationships shed considerable additional light on the statistical long-run relations present between paid child care and the other variables:

1. **The share of children in paid care (for both age groups) has a significant long-run cointegrating relationship with the full group of economic variables in the period tested.**
2. **Most importantly, maternal labor force participation has a highly significant long-run relationship with paid care across the states.** For children ages 0 to 4, a 1 percent increase in the maternal participation rate ($lfprfc04$) is associated with a 1.6 percent long-run change in the share of children in paid care. Paid care and maternal labor force participation were similarly found to have a significant bi-directional short-run relationship in earlier Granger causality tests.
3. **Real personal income per capita is found to have a stable long-run relationship with paid care usage.** The cointegration model estimates suggest that a 1 percent increase in real personal income per capita is associated with a 0.30 percent long-run increase in the share of children in paid care. This relationship was marginally insignificant in the short-run causality tests but suggests an economically significant long-run relationship.
4. **Educational attainment is statistically significant** in the cointegration relation but has an estimated negative sign as found in the Granger causality tests. This likely reflects the persistent uptrend in educational attainment in the period. It may also reflect some redundancy with income.

As with the Granger causality tests, the cointegration results are tested for sensitivity to the age of children in care and the measure of labor force attachment. The base case cointegrating equation is re-estimated using children in paid care in two groups – ages 0 to 4 and ages 0 to 14 – and

both the labor force participation rate and the employment ratio for various groups of the population ages 18-54. Labor force groupings include the overall population, males, females, females with all children ages 0 to 4, females with a youngest child ages 0 to 4, and females with a youngest child ages 0 to 14.

The findings strongly confirm the presence of a stable long-run relationship between multiple measures of labor force attachment and the share of children in paid care.

1. **Importantly, a significant long-run relationship is found between paid care usage and labor force attachment for mothers with both younger and older children in paid care.** The relationship is significant for nearly every measure of labor force attachment. Only the male employment ratio is not cointegrated with the share of older children ages 0 to 14 in paid care. This suggests that increased labor force attachment of nearly all demographic groups is expected to be accompanied by a rising share of children in paid care.
2. **The estimated long-run elasticities are generally larger for younger children ages 0 to 4 relative to the older group of children ages 0 to 14 for a given demographic group.** This too is consistent with short-run findings from the Granger causality tests. For the overall female participation rate, the elasticity of 1.22 for younger children is roughly 20 percent higher than the estimate of 1.03 for older children.
3. **The estimated response of paid care to maternal labor force attachment is greater as the definition used for mothers widens.** For mothers with all children ages 0 to 4, the estimated elasticity with respect to children ages 0 to 4 in paid care is 0.493. However, mothers with a youngest child ages 0 to 4 have an estimated elasticity of 0.837, while mothers with a youngest child ages 0 to 14 have an estimated elasticity of 1.21. One potential implication of this result suggested by the data is that mothers with younger children are simply less likely to change their use of paid child care as their labor force status changes.
4. Consistent with the findings of Granger causality tests, **elasticities with respect to children in paid care measured using the labor force participation rate are generally higher than those measured with the employment ratio.** Again, this suggests inclusion of the unemployed by using the participation rate when modeling paid care usage.
5. Overall and male labor force attachment rates are also found cointegrated with the share of children in paid care. This is additional evidence of a broader and more general relationship between labor force participation and paid child care use over the long run.

Labor Force Attachment and Economic Growth

State level economic development efforts often focus on increasing labor force attachment or enhancing the size of the labor force within a region. Research findings continue to point toward increased labor force participation as an underlying source of added economic growth. Economic theory suggests that higher utilization and more efficient employment of existing labor resources directly increases the potential output of a region.

Widely used approaches to increasing labor force attachment include subsidized job training following mass layoffs, high-school completion programs, targeted employment tax credits, and expanded child care availability. All these approaches are viewed as offering some potential to increase labor force attachment and economic growth.

State Income Growth Modeling

Three potential growth scenarios are examined based on increased U.S. labor force attachment through higher female and maternal labor force participation. Panel cointegration methods are used to model the co-movement of real personal income per capita across the states over time.

Along with the overall labor force participation rate, we model the contribution of three other well-known factors affecting regional economic growth: educational attainment, capital investment, and traded activity (or openness). These three factors receive considerable attention in the research literature on economic growth and have long been recognized by policymakers as viable targets for regional economic development.

A panel cointegration model is constructed with five data series:

PIPCR = real personal income per capita (dollars)
 LFPR = labor force participation rate (percent)
 AVGSCH = average years of schooling (years)
 CAPPW = net private fixed capital per worker (dollars)
 EXPPW = earnings from traded activity, or exports, per worker (dollars)

Each series is included in a balanced panel dataset for the 50 states in the 1990 to 2019 period. The initial cointegration results indicate that the five factors have a stable cointegrating relationship in the test period. Panel cointegration techniques are then used to derive empirical estimates of the effect of each growth factor on real personal income per capita across the states over time. The estimated model allows us to evaluate the expected long-run effect on state real income growth per capita given alternative scenarios for each factor.

Estimated Growth Effects

The estimation results suggest a robust long-run response in real personal income per capita to changes in the labor force participation rate. A 1 percent increase in participation is associated with an estimated 0.87 percent long-run increase in real personal income per capita across the states. Based on 2020 U.S. real income per capita of \$53,701, a 1 percent change in the participation rate (from 65.6 percent to 66.3 percent) implies a \$467 average increase in real income per capita across the states in the long run.

Based on U.S. population of 331.5 million in 2021, the expected increase in total real personal income is \$154.9 billion. The estimated total real income gain is equal to 0.79 percent of current nominal U.S. personal income totaling \$19.61 trillion in 2020. In other words, a 0.7 percentage point increase in the U.S. labor force participation rate is expected to produce a nearly 0.8 percent increase in total real personal income in the long run. The predicted effects of rising participation are sizeable and similarly reflect the expected reduction in real income growth traced to falling participation rates in recent years.



Potential Long-Run Growth Effects from Higher Participation

The estimated growth model can be used to derive estimates of the long-run expected change in real personal income per capita that results from changes in labor force participation. The estimate of a 0.87 percent increase in real personal income per capita for a 1 percent increase in labor force participation can be viewed as an average long-run effect across all states and all segments of the labor force.

Paid child care usage is also expected to change along with labor force participation as captured in prior cointegration test results. Hence, scenarios of changing labor force participation rates can thus be used to estimate both changes in real personal income and changes in paid child care usage.



We examine three scenarios evaluating the long-run growth effects of increased labor force participation of women ages 18-54 on real personal income per capita:

1. **A 1 percent increase in the overall female participation rate.** This is the case of a broad effort to attract women of all maternal and marital statuses into the labor force. Using 2020 as a comparative base year, the participation rate for females would rise from 72.9 percent to 73.6 percent, or an additional 569,100 females in the labor force holding population constant. Average real personal income per capita is estimated to increase by 0.41 percent, or a \$221 average increase in real personal income per capita across the states in the long run. The expected increase in total real personal income is \$72.8 billion, or 0.4 percent of current nominal U.S. personal income in 2020.

The increase in the labor force participation of females is also accompanied by an expected long-run increase in the use of paid child care. The estimated long run cointegration coefficient for the female participation rate is 1.216 for children in paid care ages 0 to 4 and 1.027 for children in paid care ages 0 to 14. The share of children in paid care is expected to rise from 29.4 percent to 29.8 percent for those ages 0 to 4 and from 16.0 percent to 16.24 percent for those ages 0 to 14. Based on 5.71 million children ages 0 to 4 in paid care in 2019, the increased participation rate would produce an expected gain of 69,500 children ages 0 to 4; the current 12.29 million children ages 0 to 14 in paid care would increase by an estimated 126,200. Each female entrant into the labor force would place an average of 0.22 children in paid care.

2. **A 1 percent increase in the participation rate for mothers with a youngest child ages 0 to 14.** This is a narrower case of focusing only on mothers with children. The 2020 participation rate for these mothers would require an increase from 70.7 percent to 71.4 percent, or an additional 210,700 mothers in the labor force. Average real personal income per capita is estimated to increase by 0.18 percent, or an \$81 average increase in real personal income per capita across the states in the long run. The expected increase in total real personal income is \$26.9 billion, or 0.14 percent of current nominal U.S. personal income in 2020.

The increase in labor force participation for mothers with a youngest child ages 0 to 14 is expected to produce a long-run increase in the use of paid child care. The estimated long run cointegration coefficient for the participation rate for these mothers is 1.212 for children ages 0 to 4 and 0.991 for children ages 0 to 14. The share of children in paid care is expected to

rise from 29.4 percent to 29.8 percent for those ages 0 to 4 and from 16.0 percent to 16.24 percent for those ages 0 to 14. These changes roughly match the expected responses for the overall female participation rate in Scenario 1 due to nearly equal estimated elasticities for both groups. Based on 5.71 million children ages 0 to 4 in paid care in 2019, the increased participation rate would produce an expected gain of 69,300 children ages 0 to 4; the current 12.29 million children ages 0 to 14 in paid care would increase by an estimated 121,800. Each mother entering the labor force would place an average of 0.58 children in paid care.

3. **A 1 percent increase in the participation rate for women with all children ages 0 to 4.** This is a far narrower scenario of focusing only on mothers with very young children. The 2020 participation rate for this group of mothers would rise from 69.3 percent to 70.0 percent, or an additional 44,900 mothers of children ages 0 to 4 in the labor force. The expected increase in total real personal income is only about \$17 in real personal income per capita across the states in the long run, a negligible contribution to economic growth. The expected increase in total real personal income is \$5.7 billion, or 0.03 percent of current nominal U.S. personal income in 2020. Any efforts to produce economic gains from the small group of mothers with all children ages 0 to 4 is unlikely to produce any meaningful economic growth effects.

The increase in labor force participation for mothers with all children ages 0 to 4 is similarly expected to produce a long-run increase in the use of paid child care. The estimated long-run cointegration coefficient for the participation rate for these mothers is 0.493 for children ages 0 to 4 and 0.390 for children ages 0 to 14. The share of children in paid care is expected to rise from 29.4 percent to 29.56 percent for those ages 0 to 4 and from 16.0 percent to 16.13 percent for those ages 0 to 14. These changes are proportionately smaller than the responses in the first two scenarios because of smaller estimated elasticities. Based on 5.71 million children ages 0 to 4 in paid care in 2019, the increased participation rate would produce an expected gain of 28,200 children ages 0 to 4; the current 12.29 million children ages 0 to 14 in paid care would increase by an estimated 47,900. Mothers entering the labor force would place an average of slightly more than one (1.07) child in paid care. The higher share of children in paid care reflects the greater share of children under the age of 5 in the analysis. There is also typically more than one child per household in paid care. In 2019, there were 1.56 children in paid care per household among those with children in paid care

The three economic growth scenarios highlight some important conclusions for policymakers pursuing efforts to increase the labor force participation of women and mothers:

1. The modeling results provide evidence that changes in maternal labor force participation rates produce expected changes in both real income and paid child care usage.
2. While participation rate changes are believed to be a direct factor in both income growth and paid care usage, changes in paid child care use accompany economic growth only indirectly through its relationship with changes in participation.
3. The size of the pool of potential workers determines in large part the size of any potential economic gains to increased participation. The pool of mothers is declining in size over time and offers far less potential for economic growth than the broader group of women with no children. Mothers with children ages 0 to 4 are far fewer in number than women with either older children or no children and offer less potential to affect overall U.S. income trends by increasing their workforce participation.
4. The expected long-run elasticity between labor force attachment and real personal income growth plays a key role in determining the size of any potential income gain as labor force attachment increases. The estimated elasticity of 0.87 measured across the full labor force suggests a slightly less than proportional gain in real personal income per capita as participation rates increase.
5. The long-run response of paid child care use to changes in labor force participation vary greatly by both the age of the child in care and the age of children in the household. The elasticities range from just above a one-to-one response to less than a 0.5 percent response. However, the ratio of new children in paid care per new entrant in the labor force is highest for mothers, particularly those with young children at home.
6. The total potential income gains from increased labor force participation are quite large when spread across large groups of potential workers. A 1 percent increase in the participation rate for females (from 72.9 percent to 73.6 percent) is associated with an expected \$72.8 billion long-run increase in total personal income in the U.S. This increase in labor force participation would represent only a modest rebound in the participation rate relative to losses in recent years. Potential income gains are far lower from increasing the labor force participation rates among smaller groups of mothers.

