
# 2022 NPO Child Support and Shared Parenting Report Card: Technical Supplement

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# SUMMARY

The Technical Supplement provides supporting detail and analysis for National Parents Organization's ***2022 NPO Child Support and Shared Parenting Report Card*** as follows. The supplement starts with a mathematical derivation and tutorial of cross-crediting and presumptive parenting time adjustments (PTA) as a consistent framework for the evaluation criteria. The wide variety of PTA formulations is categorized in a hierarchical classification scheme to provide a contextual foundation.

**Formula Typology for Parenting Time Adjustment (PTA) under Shared Physical Custody**

| Presumptive Parenting Time Adjustment (PTA) | Typology | | | # States | Percentage | States |
|---|---|---|---|---|---|---|
| | Category | Functional Form | Specific Formula | | | |
| Presumptive<br><br>(States with a presumptive formula) | Cross-Credit<br><br>(Scaling factor applied for parenting time in each household before quantum calculated) | Linear | Multiplier Model (1.5x) | 20 | 39% | AK,CO,DC,FL,ID,IL,KS,LA,ME,MD,MA,NE,NM,NC,SC,SD,VT,WV,WI,WY |
| | | | Multiplier Model (1.4x) | 1 | 2% | VA |
| | | | Multiplier Model (1.0x) | 1 | 2% | KY |
| | | | Multiple Multipliers | 1 | 2% | OK |
| | | Nonlinear | Sigmoid Curve | 1 | 2% | OR |
| | | | Exponent Model | 2 | 4% | MI,MN |
| | | | Coupled Quadratic | 1 | 2% | CA |
| | | Fixed/Variable Model | | 4 | 8% | AZ,IN,MO,NJ |
| | Percentage<br><br>(Scaling factor applied to sole custody quantum) | | Simple | 1 | 2% | OH |
| | | | Sliding/Staircase | 5 | 10% | DE,IA,ND,PA,UT |
| | | | Per Diem | 3 | 6% | HI,MT,TN |
| | Offset - Non-temporal | | | 2 | 4% | NV,RI |
| Non-Presumptive<br><br>(States without a presumptive formula) | | | None | 9 | 18% | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | | | **51** | **100%** | |

Evaluation factors were defined by NPO in conjunction with a literature review [1]–[8]. The evaluation factors and associated grading weights address the following components of PTA design:

1. Inclusion of PTA as a presumptive factor in state guidelines;
2. Parenting time thresholds (the minimum time beyond which cost reductions in the child support transfer are recognized)—the lower, the better;
3. Cliff Effect (abrupt changes in adjustment over small time range)—the smaller, the better;
4. Explicit or implicit recognition of additional fixed costs for dual residency;
5. Consistency check that child support awards with PTA are lower than sole custody awards across the parenting time continuum;
6. Recognition that PTA varies with relative incomes as well as parenting time;
7. Recognition that PTA should incorporate cost shifting in both households; and,
8. Consistency check that child support transfer should be zero for 50:50 parenting time and equal incomes

For purposes of evaluation, presumptive PTA guidelines include advisory guidelines (*e.g.*, FL, SC, WI) provided the advisory PTA specification is comprehensive.

The grade distribution is summarized in the table below. Non-Presumptive PTA states (*i.e.*, states not having PTA defined in the Child Support Guidelines) were automatically assigned a failing grade; presumptive PTA states were assigned point values for each of the seven evaluation criteria, which were then converted to a grade.

| Grade Distribution for Parenting Time Adjustment (PTA) under Shared Physical Custody | | | | |
|---|---|---|---|---|
| **Presumptive/ Non-Presumptive** | **Grade** | **# States** | **# States with Higher Grade** | **State** |
| Presumptive (States with presumptive PTA) | A+ | 0 | 0 | |
| | A | 1 | 0 | CA |
| | A- | 3 | 1 | FL,KY,MI |
| | B+ | 5 | 4 | AZ,ID,MN,WI,WY |
| | B | 2 | 9 | CO,OR |
| | B- | 1 | 11 | IN |
| | C+ | 0 | 12 | |
| | C | 3 | 12 | AK,UT,VT |
| | C- | 3 | 15 | NJ,SC,VA |
| | D+ | 1 | 18 | MO |
| | D | 2 | 19 | DE,ND |
| | D- | 8 | 21 | DC,IL,MD,NE,NM,NC,TN,WV |
| | F+ | 13 | 29 | HI,IA,KS,LA,ME,MA,MT,NV,OH,OK,PA,RI, SD |
| Non-Presumptive (States without presumptive PTA) | F | 9 | 42 | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | | |
| Average Grade (Presumptive States only) | **D+** | | | |

The Report Card for the 50 US states and the District of Columbia represents the first documented grading of the Parenting Time Adjustment (PTA) method used in Child Support Guidelines.[1]

Report Card evaluation is based on legislative provisions only and not their application or case outcomes, especially in the outcomes for IV-D vs. non-IV-D cases.

[1] For ease of exposition, in what follows, the District of Columbia will be referred to as a state.

# GENERAL CROSS-CREDITING AND PTA MODEL

## Cross-Crediting Model

A Parenting Time Adjustment (PTA) is a reduction applied to the Basic Child Support Obligation (BCSO)[2] to reflect changing cost dynamics in a shared parenting situation in which direct household child expenses increase for the lower time parent while decreasing for the higher time parent. Regardless of the underlying child support model[3] adopted in each jurisdiction, almost all states rely—either directly or indirectly—on the cross-crediting approach of the dominant Income Shares methodology to implement PTA.[4] This section provides a general mathematical foundation underlying the PTA evaluation criteria.

The Cross-Crediting Model is based on the *Proportional Contribution* principle under which both parents are expected to contribute towards child costs relative to their financial means. Proportional contribution to total child costs is assured via calculation of child support inter-household transfer payment, Q, (also termed 'award' or 'quantum' or 'obligation') to ensure equitable contributions. For Parent 1 and Parent 2 having Available Incomes[5] of $E_1$ and $E_2$ with direct household child expenses of $C_1$ and $C_2$ respectively, parental out-of-pocket expenses (OOP) consist of the combined value of direct household child costs and the child support transfer:

$$OOP_i = C_i + Q_i \qquad \text{where } i = 1,2 \qquad (1)$$

The mathematical statement for the Proportional Contribution principle is:

$$(C_1 + Q_1)/E_1 = (C_2 + Q_2)/E_2 \qquad (2)$$

Since transfer paid must equal transfer received (*i.e.*, $Q_1 = -Q_2$), this solves to the transfer amount payable/receivable for a positive/negative result:

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[2] The BCSO is the rebuttably presumed child expenditure for a defined number of children to live at a standard of living (SOL) defined by the combined incomes of both parents. Except for Melson Models, all existing child schedules assume the pre-dissolution SOL of an intact home. The child schedules are developed using economic regression analysis techniques and may be tapered for affordability at lower income levels.

[3] For a tutorial on Child Support models, see the National Conference of State Legislatures (NCSL) web site: https://www.ncsl.org/research/human-services/guideline-models-by-state.aspx. Note that states utilizing the Percentage-of-Obligor Income (POOI) or Melson methodologies for sole custody situations change to the cross-crediting approach for shared parenting situation with the exception of Colorado.

[4] For a tutorial on parenting time orders, see the National Conference of State Legislatures (NCSL) web site: https://www.ncsl.org/research/human-services/child-support-and-parenting-time-orders.aspx

[5] There is no standard definition of Available Income. Most states rely on one of the following: Gross Income, Net Income after nominal taxes, Adjusted Gross Income with additional allowable deductions from Net Income. States utilizing Melson formula additionally deduct the Self-Support Reserve (SSR). SSR is the minimum subsistence level for an adult and is typically defined in terms of a multiple of the federal poverty level which may be adjusted for local conditions.

$$Q_1 = (E_1/E)C_2 - (E_2/E)C_1 \qquad \text{for } E=E_1+E_2>0 \qquad (3)$$

This is the standard cross-crediting equation in which the transfer amount is calculated as the difference between proportional contributions towards the household child costs of each parent. A positive result indicates Parent 1 is the paying parent, or obligor. As total costs cannot exceed available income, the calculation is subject to the constraint:[6]

$$C_1+C_2 = C \leq E \qquad (4)$$

The standard formulation may be transformed to allow additional interpretations. First,

$$Q_1 = (E_1/E)C_2 +[(E_1/E)C_1 - (E_1/E)C_1] -( E_2/E)C_1 =( E_1/E)C -C_1 \qquad (5)$$

Equation (5) stipulates that the transfer amount payable is the residual between direct child costs incurred within a household and the proportional contribution to total child costs.

Second, equation (5) may be rewritten to allow the interpretation that the transfer amount is the net difference of income and cost ratios applied to total child cost:

$$Q_1 = C(E_1/E -C_1/C) \qquad (5)$$

As intuition would suggest, if child costs are equal in each household (*i.e.*, $C_1=C_2=.5C$), then the transfer amount will be zero if, and only if, incomes are equal (*i.e.*, $E_1=E_2=.5E$).

The individual and total out-of-pocket expenses are given by:[7]

$$OOP_1 = C_1+Q_1 =(E_1/E)C \qquad (6a)$$

$$OOP_2 =C_2 +Q_2 =(E_2/E)C \qquad \text{where } Q_2 = -Q_1 \qquad (6b)$$

$$OOP =OOP_1 +OOP_2 = C_1+Q_1 + C_2 +Q_2 =C_1+ C_2= (E_1/E + E_2/E)C =C \qquad (6c)$$

Equation (6c) confirms the intuition that total out-of-pocket expenses equal total child costs which are proportionally split between households according to relative incomes.

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[6] Most states exclude SSR (Self-Support Reserve) from Available Income and instead taper the obligated transfer via a minimum required order if the quantum exceeds the SSR (*i.e.*, if $Q_1>$ SSR). Any adjustment to the transfer amount after the cross-crediting calculation inherently violates the Proportional Contribution principle.

[7] For sole custody $C_1=0$ the out-of-pocket expenses for the obligor consist only of the child support transfer amount-*i.e.*, $OOP_1 =Q_1 = (E_1/E)C_2$.

# Parenting Time Adjustment (PTA)

## Generic Model

Depending on the custody arrangement, each parent exercising any parenting time experiences some portion of the child cost, which can be mathematically expressed as a Parenting Time Factor (PTF). Defining it as the parenting time percentage[8] of Parent 1, child expenses can be summarized in terms of BCSO and add-on[9] costs. As the PTA is related only to BCSO, addon costs are excluded from discussion without loss of generality.

$$C_1(t) = BCSO^*PTF(t) \quad (7a)$$

$$C_2(1-t) = BCSO^*PTF(1-t) \quad (7b)$$

$$C(t)=C_1(t) + C_2(1-t) = BCSO[PTF(t) + PTF(1-t)] = BCSO^*NOOP(t) \quad (7c)$$

NOOP(t) as the sum of PTF functions represents the Normalized-Out-Of-Pocket expenses with respect to single residency BCSO assuming no addon costs.[10]

PTF is a function[11] of the fraction[12] of BCSO costs under sole custody incurred for a given parenting time arrangement and varies from 0% (*i.e.*, PTF(0)-no child residency) to 100% (*i.e.*, PTF(1)-full/sole residency). The exact shape of the PTF function remains a matter of legal and empirical debate [9] with limited theoretical research[13] but with a consensus that the PTF is continuous and generally having a lazy "S" shape.[14] Many jurisdictions impose a parenting time threshold before a PTF is triggered which results in a ramp function with a "cliff effect" at the threshold.

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[8] There is no standard method to measure parenting time but all methods utilize either percentage allocation or number of overnights in each household. We adopt the percentage representation here with conversion for overnights being t= No. overnights/365.

[9] Addon costs generally consist of health insurance and educational costs but may also include other individualized costs.

[10] As shown below in equation (10), in an equal parenting situation at t=.5, NOOP(.5)=1 +$f_D$ where $f_D$ is the duplicated fixed cost component of total child costs.

[11] The function is typically summarized in terms of a table with the fraction of sole custody costs being indexed by parenting time percentage

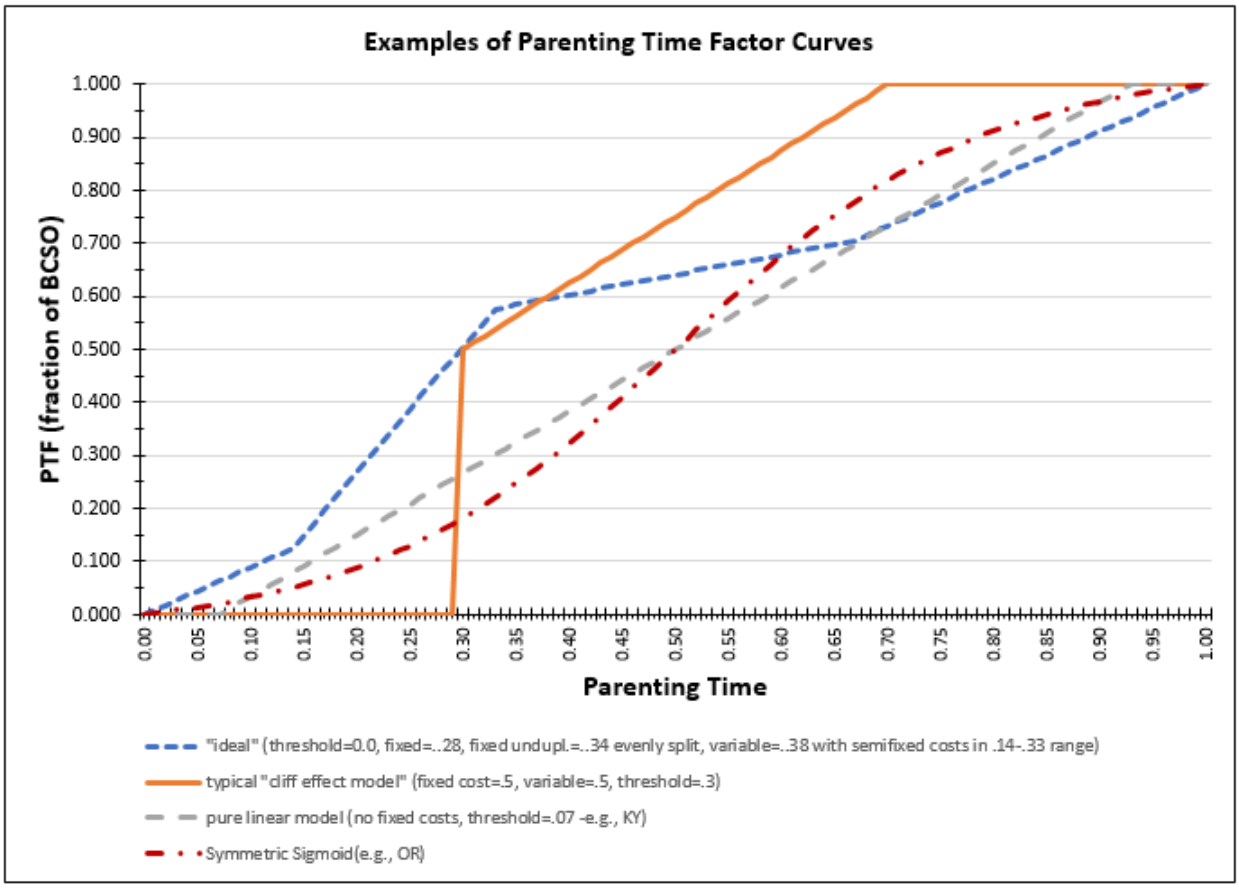
[12] For convenience, fractions are interchangeably expressed as percentages to aid clarity of exposition. Thus, PTF(t) in the range of [0,1] for zero to full residency is equivalent to [0%,100%].

[13] Betson [4, p. 12] was perhaps the first to posit what is now increasingly accepted as an S-curve representation for the PTF function. He proposed a right-skewed curve (*i.e.*, longer right hand tail, and shorter left tail) to reflect incurrence of fixed costs at lower parenting times.

[14] In addition, there is an implicit mathematical assumption that the PTF function is symmetrical around t=.5. This seemingly esoteric assumption is equivalent to the assumption that both households follow the same parenting time curve which, in turn, requires the underlying assumption that variable costs and fixed unduplicated costs are evenly split at t=.5.

Illustrative PTF distributions are provided in Fig. 1. While the values are similar at the extremes of 0% and 100%, there are wide variations in between.

*Figure 1: Illustrative Parenting Time Factors*




The child support transfer for any parenting time arrangement, t, is obtained by combining equations (7a) and (7b) into equation (3) to yield:

$$Q_1(t) = BCSO\ [(E_1/E)\ PTF(1-t) - (E_2/E)\ PTF(t)] \quad (8)$$

The equation retains its cross-crediting format and is modulated by the parenting time factors.

The out-of-pocket expenses for any time-sharing arrangement are obtained by substituting equation (7c) in equation (6):

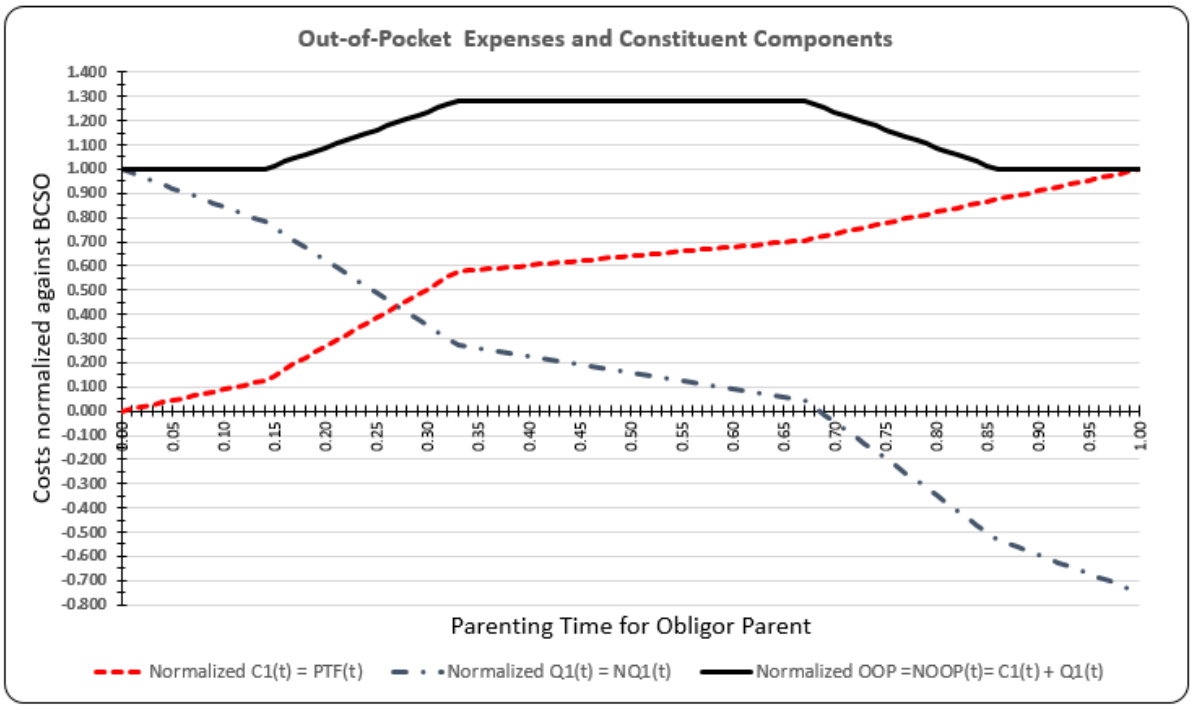
$$OOP_1(t) = C_1(t) + Q_1(t) = (E_1/E)\ BCSO^*NOOP(t) \quad (9a)$$

$$OOP_2(1-t) = C_2(1-t) + Q_2(1-t) = (E_2/E)\ BCSO^*NOOP(t) \quad (9b)$$

$$OOP(t) = OOP_1(t) + OOP_2(1-t) = C(t) = BCSO^*NOOP(t) \quad (9c)$$

By way of illustration, Figure 2 shows the cost dynamics obligor out-of-pocket expenses and its two constituent components across the parenting time continuum for parents with an income ratio of $b=E_2/E_1$ =.75 assuming the "Ideal" PTF curve of Figure 1.[15]

*Figure 2: Illustrative Cost Dynamics of Out-of-Pocket Expenses*




As parenting time increases, child support transfer, $Q_1(t)$, decreases while direct household child expense, $C_1(t)$, increases for *the obligor*. At some point *(t=.69* in this example*)* the child support transfer obligation 'flips' with the obligor parent becoming the obligee. The out-of-pocket expense, OOP(t), is the sum of both component costs peaking at 1.28 to reflect the fixed cost fraction of the "ideal" PTF curve from Figure 1 and in accordance with equation (10) below.

Note that out-of-pocket expenses are lowest under a sole custody arrangement but increase under a timesharing arrangement. While some authors[16] have postulated that fathers as the

[15] While the curves will obviously change with different PTF curves, the overall characteristic shape of the curves and dynamics will remain the same.

[16] These assertions go back to the early 1980's ([10], [11], [12, p. 549]) and have been reported to the present era: "the interest of secondary parents in shared custody is primarily in reduced child support, not in time with their children" [1, p. 546]; "Many lawyers, and a minority of family relationship professionals, felt that clients were seeking to manipulate the levels of contact to influence their child support responsibilities" [13, p. 68]; "Laws that require joint physical custody could also lead to the elimination of child support in some states, women's advocates say" [14]. However, in a general review of literature, Smyth and Rodgers [15] conclude:" Despite the common perception that separated parents frequently attempt to structure their

dominant child support payers are interested in shared parenting merely to lower their costs, the graphs undercut that argument. The graphs confirm that child support transfer, $Q_1$, decreases in shared parenting arrangement, but that this is more than offset by increases in direct household child expenses, $C_1$, leading to an overall increase[17] in out-of-pocket expenses, $OOP_1$.

Indeed, as both parents contributed proportionately to child costs, the out-of-pocket expenses increase for both parents under shared parenting. This stems directly from the economic reality that there is an additional set of fixed costs in a dual residency situation while variable and fixed unduplicated costs remain constant but are split between households.

While there is debate as to the exact parenting time at which both households both incur full fixed costs component of sole custody, $f_D$,, there can be no argument that this occurs under 50:50 parenting time. Drawing on equation (7c), the total child costs under 50:50 is given by:

$$C(.5) = BCSO[PTF(.5) + PTF(.5)] = BCSO\ (1 + f_D) \quad (10)$$

This leads to the conclusion that:

$$PTF(.5) = (1 + f_D)/2 \quad \text{since} \quad PTF(t) = PTF(1-t) \text{ at } t=.5 \quad (11)$$

Hence, the value of the PTF at t=.5 allows the underlying assumption of fixed costs to be determined. For example, with reference to Fig. 1, it can be seen that linear and sigmoid curves are symmetrical around the horizontal axis midpoint and have a value of PTF(.5)=.5 indicating that these models have an underlying assumption of zero fixed costs for the second household ($f_D$= 0).[18]

## Parenting Time Adjustment and Credits

Parenting Time Adjustment (PTA) is a reduction from the Child Support Transfer Payment under sole custody to reflect the different cost dynamics under shared parenting. The adjustments may be expressed either as fractional scaling or as a credit offset from the sole custody amount.

### Cross-crediting Scaling

The normalized scaling function for Parent 1 for parenting time, t, with respect to sole custody transfer is expressed as:

$$NQ_1(t) = Q_1(t)/Q_1(0) \quad \text{where } Q_1(0) \text{ is a non-negative value} \quad (12)$$

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parenting arrangements for financial gain, our review suggests this type of strategic bargaining is not widespread". Czapanskiy [16] argues against parenting time adjustment on broader grounds. However, as Melli [17, p. 231] notes: "There is widespread agreement that shared time increases the total cost of raising a child because certain expenses are duplicated".

[17] However, in the particular instance of a linear PTF curve which inherently assumes that sole custody costs are apportioned according to parenting time, t, out-of-pocket costs for shared parenting are the same as sole custody.

[18] From equation (11), $f_d = 2\ PTF(.5) -1 = 2(.5) - 1 = 0$

The sole custody transfer due by Parent 1 in a sole custody arrangement (t=0) is obtained[19] from equation (8):

$$Q_1(0) = BCSO\ (E_1/E) \quad (13)$$

Combining equation (8) and (13) in equation (12) yields what is termed the *cross-crediting scaling function*:

$$NQ_1(t) = PTF(1-t) - b^*PTF(t) \quad (14)$$

Where the income ratio, b, is given by:

$$b = E_2/E_1 \quad (15)$$

Adopting the assumption that Parent 1 is always the higher earning parent (*i.e.*, $E_1 \geq E_2$), the income ratio falls in the range of b= [0,1].[20] The cross-crediting scaling function falls in the range of [1,-b] across the parenting time continuum of t=[0,1] with negative values representing the fraction of sole custody transfer due to Parent 1 by Parent 2 as obligor/obligee roles 'flip' at higher parenting times for a given income ratio, b.

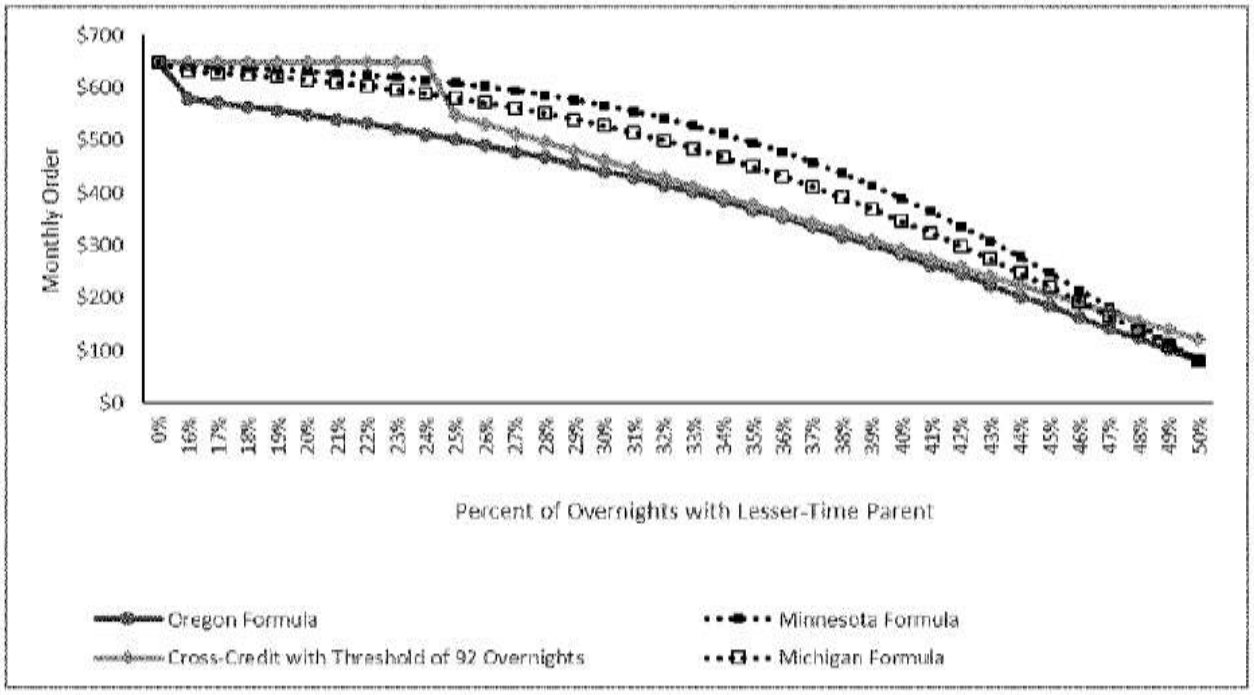
Some states apply a parenting time credit (also called offset) as a reduction of the sole custody obligation. The credit, expressed as a fraction of the sole custody award is simply:

$$Credit_1(t) = 1 - NQ_1(t) \quad (16)$$

Figure 3 shows sample cross crediting scaling functions for parenting time adjustment.

[19] For sole custody with parenting time t=0 for Parent 1, PTF(t)=0 and PTF(1-t) =1.
[20] The convention is not unique. Many jurisdictions define the reference parent (Parent 1) as the lower time parent. Mathematically, any labelling convention may be adopted.

*Figure 3: Illustrative Cross-Crediting Scaling Formulas*




Source: Oldham and Venohr [8] Figure 5 for income ratio $b=E_2/E_1$ =.75

### Percentage Scaling

In contrast to states which utilize underlying parenting time factors in the cross-crediting scaling approach, some states elect to directly apply a percentage factor, PCT(t), to the sole custody calculation:

$$Q_1(t)= Q_1(0)^* PCT(t) \quad (17)$$

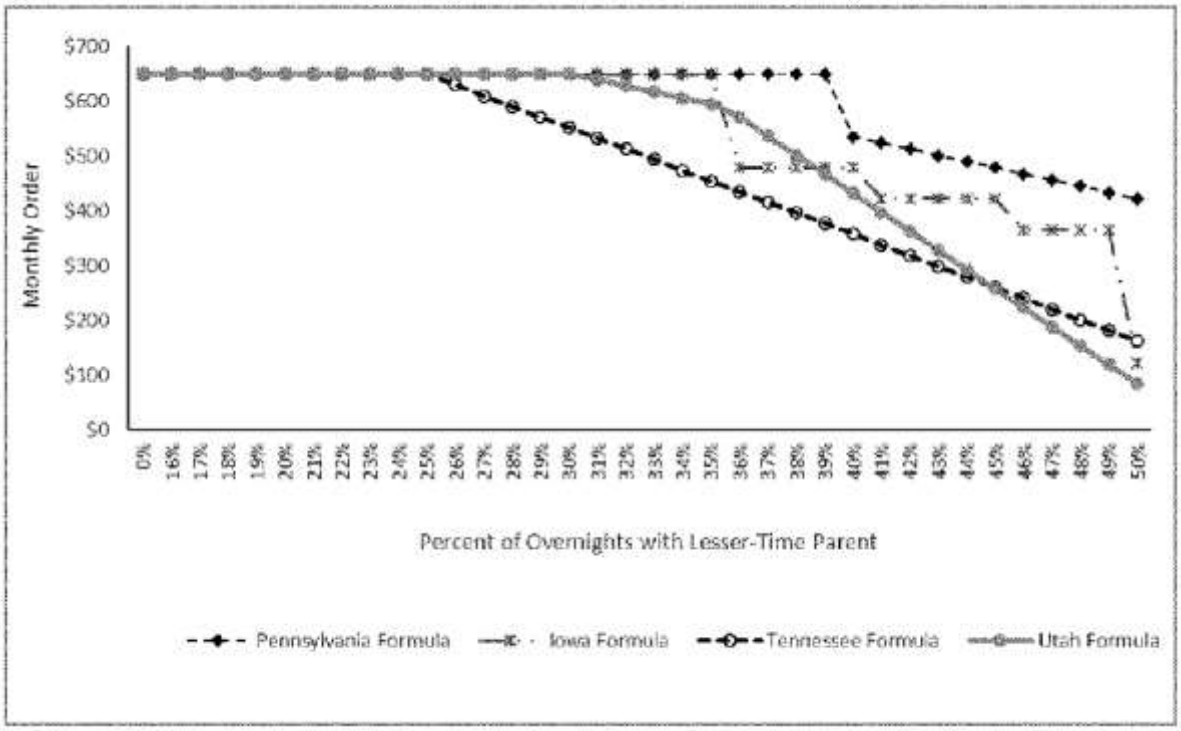
The percentage scaling factors are typically expressed as a flat rate, sliding rate, downward staircase or look-up table. The Percentage Scaling approach is simpler but hides the intuition behind the selection of the percentage factors sometimes leading to implausible results. While this approach differs from the cross-crediting scaling approach of equation (14), both approaches are identical if the percentage scaling formula is of the form:

$$PCT(t) = NQ_1(t)= PTF(1-t) - b^*PTF(t) \quad (18)$$

For example, some states may elect to implement the results of cross-crediting scaling approach directly as a percentage adjustment table indexed by parenting time, t.

Figure 4 illustrates several Percentage Model curves. As with Figure 3, Percentage Model curves show the same downward progression but may have a tendency to be more choppy.

*Figure 4: Examples of Percentage Scaling Approaches*




Source: Oldham and Venohr [8] Figure 7 for income ratio $b=E_2/E_1$ =.75

## PTA Classification

Aside from general agreement that a) zero residency attracts zero household child costs while full residency attracts 100% of BCSO (Basic Child Support Obligation), and b) the intervening household child costs on the [0,1] parenting time continuum increase according to some lazy-S pattern,[21] there is currently no accepted theoretical model of a Parenting Time Adjustment. The only consistent conceptual framework lies in fixed/variable attribution of child costs found in academic literature and in case law. Some states have gone beyond conceptual models to formulate PTA in terms of fixed/variable cost models.

[21] Even here, a few jurisdictions view the lazy-S curve as being stretched into a straight line while others, notably the Percentage models, often have no formal conceptualization of any underlying lazy-S curve.

*Table 1: Formula Typology for Parenting Time Adjustment (PTA)*

| Formula Typology for Parenting Time Adjustment (PTA) under Shared Physical Custody | | | | | | |
|---|---|---|---|---|---|---|
| Presumptive Parenting Time Adjustment (PTA) | Typology | | | # States | Percentage | States |
| | Category | Functional Form | Specific Formula | | | |
| Presumptive<br><br>(States with a presumptive formula) | Cross-Credit<br><br>(Scaling factor applied for parenting time in each household before quantum calculated) | Linear | Multiplier Model (1.5x) | 20 | 39% | AK,CO,DC,FL,ID,IL,KS,LA,ME,MD,MA,NE,NM,NC,SC,SD,VT,WV,WI,WY |
| | | | Multiplier Model (1.4x) | 1 | 2% | VA |
| | | | Multiplier Model (1.0x) | 1 | 2% | KY |
| | | | Multiple Multipliers | 1 | 2% | OK |
| | | Nonlinear | Sigmoid Curve | 1 | 2% | OR |
| | | | Exponent Model | 2 | 4% | MI,MN |
| | | | Coupled Quadratic | 1 | 2% | CA |
| | | Fixed/Variable Model | | 4 | 8% | AZ,IN,MO,NJ |
| | Percentage<br><br>(Scaling factor applied to sole custody quantum) | | Simple | 1 | 2% | OH |
| | | | Sliding/Staircase | 5 | 10% | DE,IA,ND,PA,UT |
| | | | Per Diem | 3 | 6% | HI,MT,TN |
| | Offset - Non-temporal | | | 2 | 4% | NV,RI |
| Non-Presumptive<br><br>(States without a presumptive formula) | | | None | 9 | 18% | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | | | **51** | **100%** | |

Not surprisingly, there is a great variety of formulaic approaches to PTA as summarized in Table 1.[22] Currently, nine states have no presumptive PTA guideline models relying instead on deviation factors.[23] Of the 42 states with presumptive PTA models, a majority (31 states) utilize some form of *cross-credit scaling* while nine use the *percentage scaling* with two adopting non-temporal offsets not dependent on parenting time. The most popular model is the Linear Multiplier Model used by 23 states with the next most popular approach being variants of the Fixed/Variable and sliding/staircase percentage approaches adopted by four states in each category.

The Multiplier Model starts off with the assumption that child costs are linearly proportional to the parenting time percentage in each household and then multiplies the standard cross-credit child support transfer calculation by a multiple, M, with most states using a value of 1.5. The multiplier value is generally interpreted as an adjustment for the fixed costs associated with the second household except in the specific case of a multiplier value of 1 indicating that the fixed costs of a single household are split between two households.[24] Multiplier Models can be

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[22] The reader will appreciate there is no standard PTA typology. We have endeavored to categorize PTA models in a multi-level hierarchical framework and have drawn heavily on recent analysis by Oldham and Venohr [8] but have adopted our own typology and classification definitions. The classifications are not mutually exclusive as model types share characteristics with other classifications. Some states employ multiple approaches. For example, Iowa utilizes a sliding scale but shifts to a 1.5 Multiplier Model for equal parenting.

[23] The number of non-presumptive PTA states has been decreasing over time. Oldham and Venohr [8, p. 144] reference 27 non-presumptive states in 1998.

[24] While this may seem to underestimate total child costs, selection of a unity multiplier value must be understood within a broader context of child cost schedules being based on the assumption that the pre-

considered as an approximation of Fixed/Variable Models and therefore provide a degree of intuitive understanding for the dynamics underlying PTA.

The Nonlinear Cross-Credit formulations rely on different mathematical expressions to create an S-curve.[25] The Sigmoid and Exponent Models are perfectly symmetrical around the mid-point (.5,.5) respectively corresponding to parenting time fraction and fraction of sole custody cost implying the fixed cost allocation for the second household is zero[26] whereas the coupled Quadratic curve of California is based on the underlying assumption that the fixed cost of the second household represents 50% of child costs in that household. The S-curve formulation is mathematically elegant but with limited intuitive explanation of the underlying assumptions. This formulation differs from other approaches in that it assumes the parenting time threshold—the point at which costs of dual residency are acknowledged—is low, consistent with consensus that thresholds have little basis in economic reality.

Fixed/variable formulations[27] derive from well-established economic theory applied to child costs which segregate basic child costs into three categories: fixed costs *(e.g.*, housing, utilities), fixed unduplicated costs (*e.g.*, clothing, electronic devices), and variable costs (*e.g.*, food). The exact splits and distribution remain a matter of some debate,[28] and some jurisdictions simplify the categorization by merging fixed unduplicated costs into the other two categories.

Percentage scaling models subsume the shared parenting cost dynamics of each parental household in an aggregate scaling of the sole custody BCSO to arrive at the child support transfer in a time-sharing environment. The percentage scaling ranges from a simple flat rate or a *per diem* or a downward staircase look-up table applied to the BCSO, either as a scaling factor or as a discount. Percentage scaling has the advantage of being simple but provides the least intuitive insight into policy rationale. Additionally, because it aggregates several factors, it is the most prone to policy error.

Non-temporal models refer to PTA calculations that do not utilize parenting time as an adjustment factor but instead rely on income ratio. Both states in this category have adopted a high parenting time threshold.

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dissolution standard of living in the intact household (*i.e.*, continuity of expenditure principle) will continue to apply post-dissolution, which is generally often not the lived reality of post-dissolution families, especially lower income households. The unity multiplier value can be considered as an implicit policy to acknowledge that the continuity of expenditure principle becomes less applicable at lower income levels.

[25] Betson [4, p. 12] was among the earliest to postulate an S-curve as a reference design.

[26] See equation (11) and associated note.

[27] See Betson [4], Shockey [2] and, most recently, Rogers [7] for fixed/variable model formulations. Note that AZ, IN, MO, NJ have premised their designs on fixed/variable constructs but have implemented the formula as a sliding scale lookup tables. In the case of AZ, the origins of the fixed/variable approach have become murky over time.

[28] As Oldham and Venohr [8, p. 17] note: ”There is a dearth of research confirming whether a particular expense is variable, duplicated fixed or non-duplicated fixed.”

# GRADING METHODOLOGY & RESULTS

NPO has utilized a conventional two-level weighting methodology applied to the evaluation factors listed in Table 2. The weights reflect the relative importance assigned by NPO to each factor. The rationale for each factor is presented in the following sections. Evaluators reviewed state guidelines and associated worksheets to arrive at scores. Scoring was based only on legislative text and not on application.

*Table 2: Evaluation Factors and Associated Weights*

| NPO CHILD SUPPORT REPORT CARD-PARENTING TIME ADJUSTMENT (PTA) FACTOR LIST (degree to which a state PTA laws and regulations promote or inhibit shared parenting) | | | | |
|---|---|---|---|---|
| **Level 1** | **Level 2** | **Final Weight (=Level1*Level2)** | **Line** | **Factor** |
| 0% | 100% | 0% | 1. | Is there a Presumptive Parenting Time Adjustment Factor? |
| 15% | | | 2. | Is the threshold for PTA reasonable? |
| | 100% | 15% | 2a. | <= 26 days |
| | 80% | 12% | 2b. | 27-52 days inclusive |
| | 67% | 10% | 2c. | 53-73 days inclusive |
| | 50% | 8% | 2d. | 74-92 days inclusive |
| | 30% | 5% | 2e | 93- 110 days inclusive |
| | 15% | 2% | 2f. | 111-146 days inclusive |
| | 0% | 0% | 2g. | greater than 146 days |
| 25% | | | 3. | Is the PTA continuous without "cliff effects"? |
| | 100% | 25% | 3a. | Smooth (no cliff effect) |
| | 80% | 20% | 3b. | 1% -9% cliff size |
| | 60% | 15% | 3c. | 10%-19% cliff size |
| | 30% | 8% | 3d. | 20%-29% cliff size |
| | 0% | 0% | 3e. | >= 30% cliff size |
| 15% | | | 4. | What explicit or implicit value does the PTA ascribe to additional fixed duplicated costs of dual residency? |
| | 0% | 0% | 4a. | = 0% ( duplicated costs not recognized) |
| | 15% | 2% | 4b. | 1%-19% inclusive |
| | 50% | 8% | 4c. | 20%-27% inclusive |
| | 100% | 15% | 4d. | 28%-40% inclusive |
| | 60% | 9% | 4e. | 41-50% inclusive |
| | 20% | 3% | 4f. | >50% |
| 5% | | | 5. | Does the PTA always result in a lower child support transfer than for sole custody? |
| | 100% | 5% | 5a. | Yes |
| | 0% | 0% | 5b. | No |
| 15% | | | 6. | Does the adjustment recognize the effect of relative Income on Parenting Time Adjustment? |
| | 100% | 15% | 6a. | Yes |
| | 0% | 0% | 6b. | No |
| 15% | | | 7. | Does the adjustment incorporate changing child costs in both households (*i.e.*, cost-shifting)? |
| | 50% | 7.5% | 7a. | Conditional on Recipient Income |
| | 40% | 6% | 7b. | Obligor only |
| | 60% | 9% | 7c. | Obligee only |
| | 100% | 15% | 7d. | Both obligor and obligee |
| | 0% | 0% | 7e. | Neither obligor or obligee |
| 10% | | | 8. | Is the award zero for 50:50 time under equal earnings? |
| | 100% | 10% | 8a. | Yes |
| | 0% | 0% | 8b. | No |
| **100%** | | | | |

The resulting scores were converted to a Grade for each state using the conversion brackets of Table 3.

*Table 3: Point-to-Grade Conversion Table*

| Numeric Score to Grade Conversion Table | |
|---|---|
| Grade | Conversion Range |
| A+ | 98% - 100% |
| A | 89% - 97% |
| A- | 80% - 88% |
| B+ | 77% - 79% |
| B | 74% - 76% |
| B- | 70% - 73% |
| C+ | 67% - 69% |
| C | 64% - 66% |
| C- | 60% - 63% |
| D+ | 57% - 59% |
| D | 53% - 56% |
| D- | 50% - 52% |
| F+ | 1% - 49% |

Note: Grade "F" assigned to non-presumptive PTA states

The resulting grades are graphically summarized in Fig. 5 and enumerated by state in Table 4. The grade of "F" denotes non-presumptive PTA states; all other grades are for presumptive PTA states.

*Figure 5: Parenting Time Adjustment- Grade Distribution*

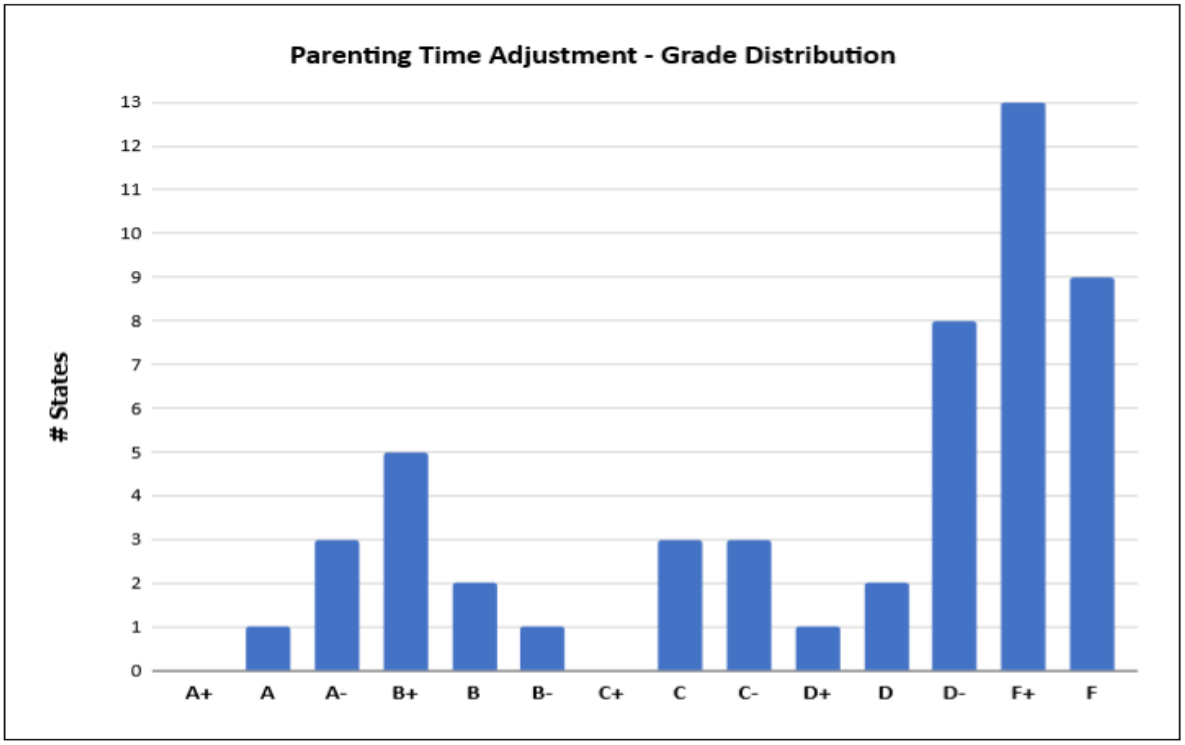

*Table 4: PTA Grade Distribution by State*

| Grade Distribution for Parenting Time Adjustment (PTA) under Shared Physical Custody | | | | |
|---|---|---|---|---|
| Presumptive/ Non-Presumptive | Grade | # States | # States with Higher Grade | State |
| Presumptive (States with presumptive PTA) | A+ | 0 | 0 | |
| | A | 1 | 0 | CA |
| | A- | 3 | 1 | FL,KY,MI |
| | B+ | 5 | 4 | AZ,ID,MN,WI,WY |
| | B | 2 | 9 | CO,OR |
| | B- | 1 | 11 | IN |
| | C+ | 0 | 12 | |
| | C | 3 | 12 | AK,UT,VT |
| | C- | 3 | 15 | NJ,SC,VA |
| | D+ | 1 | 18 | MO |
| | D | 2 | 19 | DE,ND |
| | D- | 8 | 21 | DC,IL,MD,NE,NM,NC,TN,WV |
| | F+ | 13 | 29 | HI,IA,KS,LA,ME,MA,MT,NV,OH,OK,PA,RI, SD |
| Non-Presumptive (States without presumptive PTA) | F | 9 | 42 | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | | |
| Average Grade (Presumptive States only) | **D+** | | | |

# EVALUATION FACTORS

This section explains the evaluation factors itemized in Table 2.

## Factor 1: Is There a Presumptive Parenting Time Adjustment Factor?

Federal law under 45 CFR 302.56 mandates "specific descriptive and numeric criteria" resulting in a presumptively "correct amount of child support to be awarded" and that the guidelines be reviewed "at least once every four years to ensure that their application results in the determination of appropriate child support award amounts." While a plain text reading of federal requirements suggests shared parenting situations would be inherently included, in practice this has not been the case.

NPO takes the view that presumptive parenting time adjustments (PTA) constitute an integral requirement of existing law. Statistics suggest most states agree with that position, with progress made over the years.[29]

States without a presumptive PTA relying instead on deviation factors were graded with a "F". Presumptive states were numerically scored on the additional factors in Table 2 with the total score converted to a final grade.

## Factor 2: Is the Threshold for PTA Reasonable?

The parenting time threshold is the minimum amount of timesharing required by the lesser time parent before any presumptive adjustment to a child support obligation is applied. In essence, the imposition of a threshold extends the economics of single residency into the parenting time continuum without recognition of the changing cost dynamics in a dual residency environment. The NPO evaluation criterion is based on the increasingly accepted view that thresholds find little to no support from an economic perspective. The resulting economic distortion overcompensates the higher time parent at the expense of the lesser time parent and promotes litigation conflict.[30]

Evaluation is based on reported thresholds in state guidelines.[31] However, for the case of states using continuous S-curves (OR, MN, MI, and CA) which theoretically have zero-thresholds but may have long S-tails resulting in de facto thresholds, we have measured the parenting time threshold as the point at which the adjustment reaches 5%.

Fig. 6 summarizes the results by increasing threshold value. Assessed threshold values range from 0% to 49% with a mean/median value of 29% corresponding to 106 overnights.

Social Science research has accepted the view that full shared parenting occurs at 30-35% parenting time. This suggests that the transition "visitation" zone occurs at approximately 14% (52 overnights). The best policy option to remove economic distortion in determining PTA is the outright removal of thresholds.

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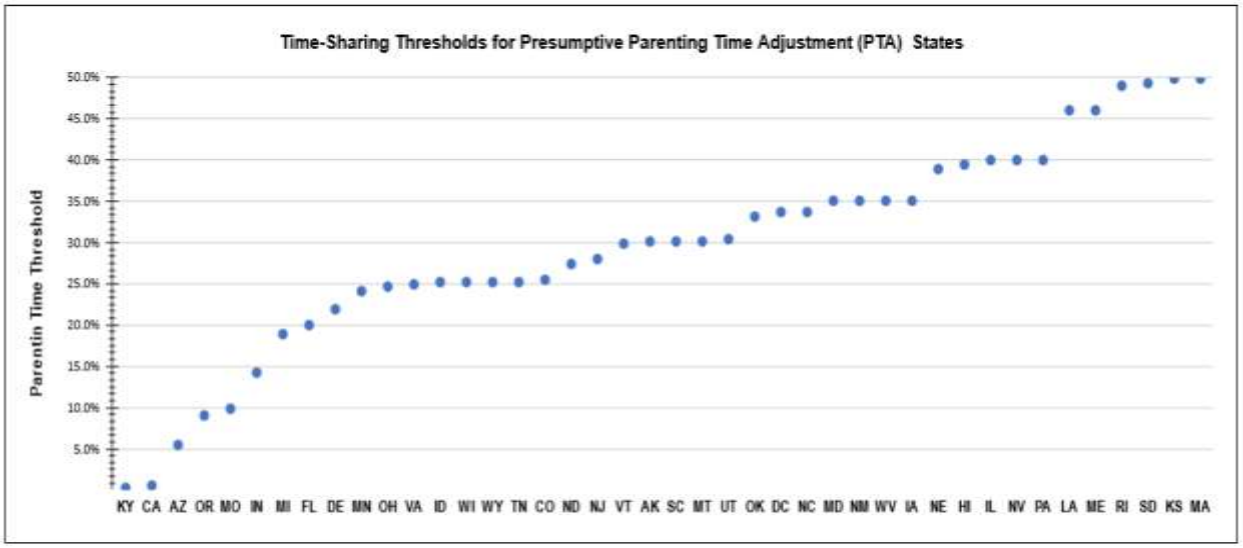
[29] *Supra* note 23.
[30] For an early discussion of thresholds, see Betson [18].
[31] Only mandatory thresholds were included. SD has a discretionary threshold providing an abatement "If the child resides with the obligor ten or more nights in a month" (SD Codified Law 25-7-6.14). Discretionary thresholds were excluded.

*Figure 6: Parenting Time Thresholds by State*



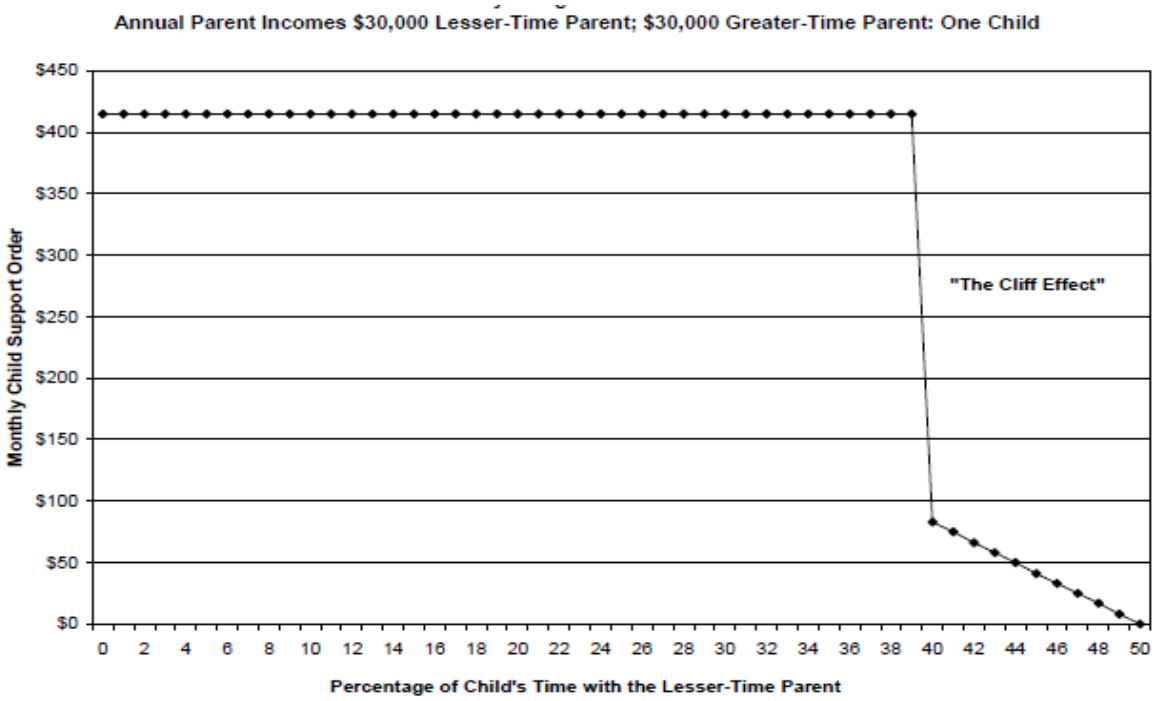

NOTE: Average= 29%, Median=30%, Standard Deviation=13%

## Factor 3: Does the PTA Avoid "Cliff Effects"?

"Cliff Effect" is the term used to describe a sharp or precipitous change in child support obligation over a small change in parenting time (*e.g.*, 1% parenting time interval or several overnights). Cliff effects are typically associated with thresholds—generally the higher the threshold, the higher the cliff effect. In most instances, cliff effects occur in Multiplier Models but are also found in Percentage Models with decreasing staircase adjustments.

Figure 7 illustrates the cliff effect in a particular instance. For some model types—specifically the Multiplier Model—the cliff effect becomes more pronounced with increasing thresholds.

*Figure 7: Example of Cliff Effects*




Source: Brown and Brito [5] Figure 1

There is no economic rationale in the literature for incorporating a cliff effect. The closest rationale would argue that cliff effects constitute the point at which the fixed costs of the second household are recognized. But even here, there is no supporting logic for: a) an instantaneous increase, b) selecting a given point in time for that increase (typically the threshold point), and c) the typically increasing size of the cliff effect, which grows with higher threshold points.

Aside from the lack of economic rationale, the primary concern with cliff effects is that they promote unnecessary parental conflict and litigation in which the lower time parent seeks minor parenting time changes to capture the comparatively large reduction in child support while the higher time parent opposes it to preserve the artificial "windfall".

NPO has assessed cliff effects for all states at a baseline income ratio of b=.75. This has been done by: measurement from previously reported analyses; direct calculation in the specific case of Multiplier Models; or adjustments using Percentage of Income cross-crediting.[32] In several instances, reviewers relied on comparative analysis of parenting time cost reduction curves to estimate the general range of the cliff effect. As shown in Table 2, states with higher cliff effects were accorded lower scores.

[32] See Annexes A and C.

Table 5 provides a summary of cliff effect size by state. We note that only 8 of 42 presumptive states have either no cliff effect or what may be deemed as an acceptably small cliff effect.

*Table 5: Summary of Cliff Effect Size by State*

| "Cliff Effect" Size for Parenting Time Adjustment (PTA) under Shared Custody | | | | |
|---|---|---|---|---|
| **Presumptive Parenting Time Adjustment (PTA)** | **Cliff Effect Size** | **# States** | **Percentage (presumptive States only)** | **States** |
| Presumptive (States with a presumptive formula) | Smooth (no cliff effect) | 6 | 14% | CA,KY,MI,MN,OR,UT |
| | 1% -9% cliff size | 2 | 5% | AZ,FL |
| | 10%-19% cliff size | 8 | 19% | CO,ID,IN,MO,NJ,OH,WI,WY |
| | 20%-29% cliff size | 9 | 21% | AK,DE,NV,ND,PA,SC,TN,VT,VA |
| | >= 30% cliff size | 17 | 40% | DC,HI,IL,IA,KS,LA,ME,MD,MA,MT,NE,NM,NC,OK,RI,SD,WV |
| Non-Presumptive (States without a presumptive formula) | N/A | 9 | N/A | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | **100%** | |

NPO recognizes that cliff effects and parenting time thresholds of Factor 2 are highly correlated for some model types (*e.g.*, Multiplier Models), arguably resulting in some degree of double counting. However, as the degree of correlation varies depending on model types and policy parameter choices, it was decided to evaluate these as separate factors.

## Factor 4: What Explicit or Implicit Value Does the PTA Ascribe to Additional Fixed Duplicated Costs of Dual Residency?

Dual residency under a shared parenting arrangement involves additional fixed cost for the child's second household (*e.g.*, housing, utilities) with other costs being split between households in some fashion. The central economic issues related to fixed costs are: a) at what parenting time threshold should the additional fixed costs be recognized, b) at what rate are full fixed costs incurred (*i.e.*, the transition period from semifixed to full fixed costs), and c) what portion of basic child costs (BCSO) can be attributed to fixed costs. This factor addresses the latter point.

The empirical research on the fixed costs component of child costs is sparse. This report has adopted the 1995 Shockey [2] economic analysis as its reference point. Shockey determined that child cost components can be categorized into three components with the following average distribution:

- Fixed duplicated costs (*e.g.*, housing, utilities)- 28%
- Fixed unduplicated costs (*e.g.*, clothing) - 34%
- Variable costs (*e.g.*, food) - 38%

By comparison, IN and NJ as Fixed/Variable Model states have adopted values of 50%/15%/35% and 38%/25%/37% respectively for fixed duplicated/fixed unduplicated/variable cost components.

As many states utilize a reduced framework of fixed duplicated and variable costs only (notably the Multiplier Model), this analysis has incorporated fixed unduplicated costs into the other two components resulting in the preferred range of 28%-40% for the fixed cost component. States with higher or lower values receive correspondingly lower scores as shown in Table 2.

The fixed costs value for each state was determined in one of several ways:

- Direct reference in state guidelines or quadrennial economic review analysis;
- Formula:
    - Multiplier States (See Annex A)
    - Sigmoid Models (See Annex B)
    - Percentage-of-Obligor-Income cross-crediting approach (See Annex C)
- Comparative analysis with PTA curves from other states

As shown in Table 6, only 17% of presumptive PTA states assumed a fixed cost in the preferable 28%-40% range; another 19% bracketed the preferred range. Few economists would support the view that fixed costs account for as much as 50% of child costs, and yet, 33% of presumptive PTA states have adopted that value; in most instances, these are Multiplier Model states with a high parenting time threshold. Ten states (24% of presumptive PTA states) predicate their PTA on the implicit assumption of zero fixed costs; in essence, these states assume that the child costs in a single household are split between two households in a parenting time arrangement.

*Table 6: Fixed Cost Analysis by State*

| Ascribed Fixed Cost Component for Parenting Time Adjustment (PTA) under Shared Custody | | | | |
|---|---|---|---|---|
| **Presumptive Parenting Time Adjustment (PTA)** | **Ascribed Fixed Cost Component** | **# States** | **Percentage (Presumptive states only)** | **States** |
| Presumptive (States with a presumptive formula) | = 0% ( duplicated costs not recognized) | 10 | 24% | HI,KY,MI,MN,MT,NV,OH,OR,RI,TN |
| | 1%-19% inclusive | 3 | 7% | DE,PA,UT |
| | 20%-27% inclusive | 3 | 7% | AZ,IA,ND |
| | 28%-40% inclusive | 7 | 17% | CO,FL,ID,NJ,VA,WI,WY |
| | 41-50% inclusive | 5 | 12% | AK,CA,IN,SC,VT |
| | >50% | 14 | 33% | DC,IL,KS,LA,ME,MD,MA,MO,NE,NM,NC,OK,SD,WV |
| Non-Presumptive (States without a presumptive formula) | N/A | 9 | | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | **100%** | |

## Factor 5: Does the PTA Always Result in a Lower Child Support Transfer than for Sole Custody?

As direct child costs increase with parenting time for the lower time parent while decrease in some fashion for the higher time parent, it follows that the child support transfer should be less than the sole custody amount.[33] However, due to the inherent mathematical structure, states employing Multiplier Models are prone to "overshoot" in which PTA adjustments lead to higher transfers than under sole custody. As discussed in Annex A, overshoot occurs when states select a threshold, $t_A$, below a critical level, $t_{crit}$, dependent on the multiplier value, M, and the income ratio, b:

$$t_A < (M-1)/M(1-b) \leq (M-1)/M \qquad (19)$$

For those states, a parenting time arrangement, t, will result in overshoot in the interval $[t_A, (M-1)/M)$. For example, using the 1.5 multiplier used by all but two of the 23 multiplier states, any state with a threshold below (M-1)/M-(1.5-1)/1.5=33% in percentage terms is prone to overshoot for certain income ratios.[34]

Table 7 lists the states prone to overshoot[35] and subject to the grading of Table 2.

*Table 7: Overshoot Conditions*

| Overshoot (Multiplier Type Models only) for Parenting Time Adjustment (PTA) under Shared Custody | | | |
|---|---|---|---|
| **Overshoot Occurs** | **# States** | **Percentage** | **States** |
| Yes | 8 | 35% | CO,FL,ID,OK,SC,VA,WI,WY |
| No | 15 | 65% | AK,DC,IL,KS,KY,LA,ME,MD,MA,NE,NM,NC, SD,VT,WV |
| **Total** | **23** | **100%** | |

Overshoot occurs when the child support transfer under shared parenting exceeds the sole custody transfer amount. With the exception of FL, the other 7 states have incorporated limit

[33] Note that, while the child support transfer decreases, direct child household costs increase so that out-of-pocket expenses are actually larger under shared parenting than under sole residency. The only exception occurs if the Parenting Time Factor (PTF(t)) is linear under the assumption that costs of single residency are split between both households under dual residency (*i.e.*, fixed costs are zero). In this instance, out-of-pocket expenses remain constant as decreases in child support transfer are exactly offset by increases in direct child household expenses.

[34] VA uses a multiplier value of 1.4 with a critical threshold of $t_{crit}$=(m-1)/M= (1.4-1)/1.4=28.6%. With a threshold of 25%, VA is vulnerable to overshoot in the range of t= [.25, .286). KY has a multiplier value of 1 with a critical threshold of (1-1)/1=0%. As the KY threshold has been defined as 0%, it is not vulnerable to overshoot.

[35] Unlike other states, OK utilizes three multiplier values of 2.0/1.75/1.5 depending on number of overnights.

checks to cap the award at, but not less than, the sole custody amount via limit checks in the child support calculator (OK, SC, WI, WY) and or via statute (CO, ID, OK, VA, WI)

As discussed in Annex A, the mathematical construct of the Multiplier Model requires unavoidable policy tradeoffs between: undesirably high parenting time thresholds, overshoot conditions, and undesirably low implicit fixed costs. Unfortunately, the Multiplier Model does not allow a 'sweet spot' in which all three conditions are simultaneously satisfied.

## Factor 6: Does the Adjustment Recognize the Effect of Relative Income on Parenting Time Adjustment?

This report card adopts the fundamental premise that a well-behaved Parenting Time Adjustment (PTA) should incorporate the effects of parenting time cost dynamics (*i.e.*, parenting time factor) as well as the relative parental incomes (*i.e.*, income ratio) as developed in equations (8) and (14), repeated for reader convenience.

$$Q_1(t) = BCSO\ [(E_1/E)\ PTF(1\text{-}t)\ \text{-}(E_2/E)\ PTF(t)] \quad (8)$$

$$NQ_1(t) = PTF(1\text{-}t) - b^*PTF(t) \quad (14)$$

Factor 6 examines whether the PTA is based on consideration of both parental incomes. While this is a straightforward evaluation for states in which formula are explicitly defined, it becomes a more nuanced exercise for Percentage Model states (see Table 1).

As shown in Table 8, OH is the only state that did not satisfy this factor. Ohio simply allows a flat rate 10% reduction after the threshold is reached.

*Table 8: Relative Income Inclusion in PTA*

| Inclusion of Relative Income as Factor for Parenting Time Adjustment (PTA) under Shared Custody | | | | |
|---|---|---|---|---|
| **Presumptive Parenting Time Adjustment (PTA)** | **Relative Income Included** | **# States** | **Percentage (Presumptive PTA states)** | **States** |
| Presumptive (States with a presumptive formula) | Yes | 41 | 98% | AK,AZ,CA,CO,DE,DC,FL,HI,ID,IL,IN,IA,KS,KY,LA,ME,MD,MA,MI,MN,MO,MT,NE,NV,NJ,NM,NC,ND,OK,OR,PA,RI,SC,SD,TN,UT,VT,VA,WV,WI,WY |
| | No | 1 | 2% | OH |
| Non-Presumptive (States without a presumptive formula) | | 9 | N/A | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | **100%** | |

## Factor 7: Does the adjustment incorporate changing child costs in both households (*i.e.,* cost-shifting)?

With reference to equations (8) and (14), a child support transfer adjusted for parenting time is a function of relative incomes as well as parenting time factors (PTF) applied to both the obligor and obligee. As summarized in Table 9, 71% of presumptive PTA states include the PTF adjustment for both obligor and obligee whereas 21% of the states apply the PTF to only one parent thereby skewing the adjustment, typically in favor of the obligee. This skewness may be interpreted as an anti-poverty 'private welfare' supplement to the benefiting parent, typically the lower income obligee.

Four states have incorporated an explicit anti-poverty policy into parenting time adjustment by making adjustments conditional on obligee income level.

*Table 9: Inclusion of Obligor/Obligee in PTA Calculation*

| Inclusion of Obligor/Obligee Parenting Time Adjustment (PTA) under Shared Custody | | | | |
|---|---|---|---|---|
| **Presumptive Parenting Time Adjustment (PTA)** | **Adjustment Mechansim** | **# States** | **Percentage (Presumptive PTA states)** | **States** |
| Presumptive (States with a presumptive formula) | Conditional on Recipient Income | 4 | 10% | MO,NJ,OR,VA |
| | Obligor Only | 8 | 19% | AZ,HI,IA,ND,OH,PA,TN,UT |
| | Obligee Only | 1 | 2% | DE |
| | Both Obligor and Obligee | 27 | 64% | AK,CA,CO,DC,FL,ID,IL,IN,KS,KY,LA,ME,MD,MA, MI,MN,MT,NE,NM,NC,OK,SC,SD,VT,WV,WI,WY |
| | Neither obligor or obligee | 2 | 5% | NV,RI |
| Non-Presumptive (States without a presumptive formula) | N/A | 9 | N/A | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | **100%** | |

## Factor 8: Is the Award Zero for 50:50 Time under Equal Earnings?

Intuition suggests that no child support transfer is presumptively appropriate in the special case of equal parental incomes with a 50:50 parenting time arrangement excluding considerations of addon costs.[36] As shown in Table 10, five states did not satisfy this requirement.

[36] See equation (5) for the mathematics behind the intuition.

*Table 10: Check for Zero Award under 50:50 Parenting Time and Equal Income*

| Check for Zero Transfer under Equal Incomes and Equal Parenting Time | | | | |
|---|---|---|---|---|
| **Presumptive Parenting Time Adjustment (PTA)** | **Zero CS Transfer under 50:50 time and equal earnings** | **# States** | **Percentage (Presumptive PTA States)** | **States** |
| Presumptive<br><br>(States with a presumptive formula) | Yes | 37 | 88% | AK,AZ,CA,CO,DE,DC,FL,HI,ID,IL,IA,KS,KY,LA, ME,MD,MA,MI,MN,MT,NE,NV,NM,NC,ND, OK,OR,RI,SC,SD,TN,UT,VT,VA,WV,WI,WY |
| | No | 5 | 12% | IN,MO,NJ,OH,PA |
| Non-Presumptive<br><br>(States without a presumptive formula) | | 9 | N/A | AL,AR,CT,GA,MS,NH,NY,TX,WA |
| **Total** | | **51** | **100%** | |

The requirement for zero orders is based on the assumption that all Basic Child Support Obligation (BCSO) costs are equally shared between households. In the specific instance of Fixed/Variable models, this translates to the specific assumption that non-duplicated (aka controlled) expenses are presumptively shared equally. IN and NJ, both Fixed/Variable model states, explicitly assume that the primary time parent is responsible for the controlled expense portion of BCSO thereby precluding a zero calculation.

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# ANNEX A: MULTIPLIER MODEL FORMULA

## Multiplier Model Formula

Multiplier PTA models are based on a Cross-Crediting Model in which the parenting time adjustment above a minimum threshold, $t_A$, is directly related to parenting time, t, and the result is inflated by a multiplier, M, typically justified on the basis to factor in the increased costs of dual residency. Thus, the basic cross-crediting equation (8) becomes:

$$Q_1(t) = BCSO\,[(E_1/E)\,PTF(1-t) - (E_2/E)\,PTF(t)]$$

$$= BCSO\,[(E_1/E)[\,M(1-t)] - (E_2/E)\,[Mt]] \quad \text{for } t=[t_A,\ 1-t_A] \quad (A.1)$$

where the parenting time factor is given by:

$$PTF(t) = 0 \quad \text{for } t=[0,\ t_A)$$

$$= Mt \quad \text{for } t=[t_A,\ 1-t_A]$$

$$= 1^{37} \quad \text{for } t=(1-\ t_A,\ 1] \quad (A.2)$$

The parenting time factor is zero below the threshold, $t_A$, as any costs incurred by Parent 1 are not recognized by policy; by implication, this means that costs in the complementary time zone $(1-\ t_A,\ 1]$ remain unchanged in what may be considered an extended sole custody cost zone.

Recall from equation (13) that the sole custody award is:

$$Q_1(0) = BCSO\,(E_1/E) \quad (A.3)$$

Hence, using equation (12), the fractional award for parenting time, t, relative to sole custody is:

$$NQ_1(t) = Q_1(t)/Q_1(0)$$

$$= 1 \quad \text{for } t=[0,\ t_A)$$

$$= M[1-(1+b)t] \quad \text{for } t=[t_A,\ 1-t_A]$$

$$= -b = -E2/E1 \quad \text{for } t=(1-\ t_A,\ 1] \quad (A.4)$$

The following charts depict sample PTF and NQ curves for indicated threshold choices and income ratio. The lower threshold value of .2 corresponds to the overshoot example discussed below; the threshold value of .4 corresponds to a typical Multiplier Model without overshoot.

[37] Multiplier models are generally defined with Parent 1 as the lower time parent and hence operate in the parenting time range of t=[0, .5] in which case the definition of the $(1-\ t_A,\ 1]$ zone is not applicable but is included for mathematical completeness.

Figure A1: Illustrative PTF curves

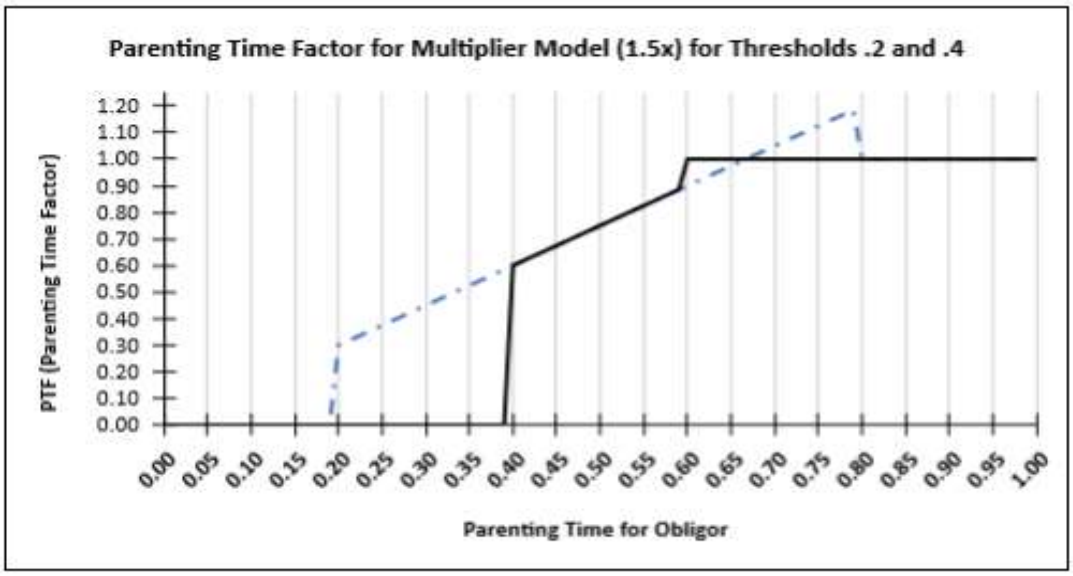
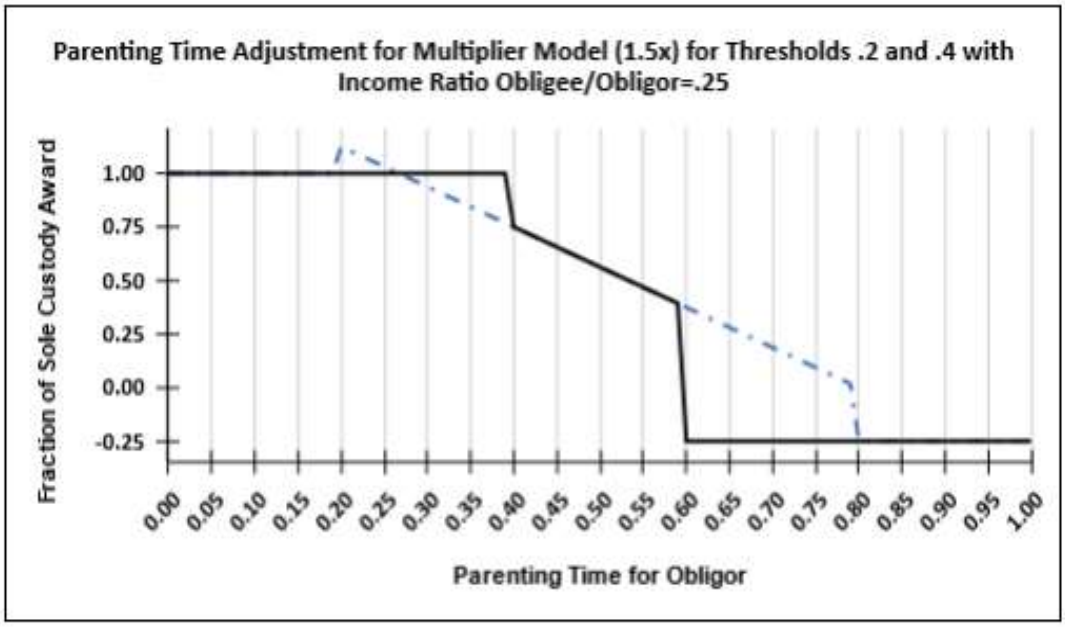



Figure A.2 Illustrative NQ Curves




## Evaluation Factor 3: Cliff-Effect

A cliff-effect is defined as an abrupt change in the child support award over a small interval of parenting time. In Multiplier Models, cliff-effects occur at the threshold point, $t_A$. The relative change can be calculated as:

$$\text{Cliff-effect}(t_A) = 1 - NQ_1(t_A)$$
$$= 1 - M[1-(1+b)t_A] \quad \text{(A.5)}$$

## Evaluation Factor 4: Fixed Cost Component

The above-threshold PTF curve of equation (A.2) may be expanded into two components:

$$PTF(t) = Mt = Mt_A + M(t-t_A) \quad \text{(A.6)}$$

This is comparable to a Fixed/Variable Model formulation in which fixed cost fraction, $f_D$, is incurred at the threshold point, $t_A$, and at which variable cost fraction, v, commences:

$$PTF(t) = f_D + v(t-t_A) \quad \text{(A.7)}$$

Comparing equations A.6 and A.7, the fixed cost and variable cost fractions are given by:

$$f_D = Mt_A \quad \text{(A.8)}$$

$$v = M \quad \text{(A.9)}$$

## Evaluation Factor 5: Overshoot

Child support awards under a time-sharing arrangement should never exceed sole custody amounts. Mathematically, this requirement can be stated as:

$$NQ_1(t) = M[1-(1+b)t] \leq 1 \qquad \text{for } t= [t_A, 1-t_A] \quad \text{(A.10)}$$

Hence, the policy selection of the threshold, $t_A$, must always be at least as large as the critical threshold value, $t_{crit}$, to satisfy these requirements is:

$$t_A \geq t_{crit} = (M-1)/M(1+b) \quad \text{(A.11)}$$

To satisfy all income combinations in the range b = [0, 1], the more general requirement becomes:

$$t_A \geq t_{crit} = (M-1)/M \quad \text{(A.12)}$$

For multiplier values of 1.5/1.4/1.0 used by states as per Table 1, the corresponding critical parenting time threshold values are 33%/26.7%/0% respectively.[38] States that select thresholds below the critical values will encounter overshoot situations depending on income ratios in the parenting time range of:

$$t_{overshoot} = [t_A, (M-1)/M(1+b)] \quad \text{(A.13)}$$

For example, consider Florida as a 1.5x multiplier state having a threshold of 20% with a situation of Parent 1 and Parent 2 with respective available incomes of $ 6,667 and $ 1,667 (income ratio, b=1,667/6.667 =.25) and a parenting time arrangement of 20%/80% for one child. Since the

[38] Note: Multiplier models with thresholds corresponding to these critical values will have the characteristic of piecewise linear curves with no overshoot or undershoot, as well as no cliff effect.

threshold of 20% is less than the critical minimum threshold of 33% for a 1.5x Multiplier Model, Florida is prone to overshoot.

From equation (A.4), the ratio of awards under parenting time relative to sole custody is:

$NQ_1(.2) = M[1-(1+b)t] = 1.5[1-(1+1667/6667)(.2)]=1.125$

Confirming empirically using the Florida child support calculator[39] yields:

- Basic Child Support Obligation (BCSO) = $ 1,317
- Sole Custody award = $ 1,053.57
- Parenting time (20%/80%) award = $ 1,185.25 which is larger

The ratio of awards is $ 1,185.25/$ 1,053.57 =1.125 confirming overshoot which is also seen in Figures A.1 and A.2.

## Evaluation Factor 6: Does the Adjustment Recognize the Effect of Relative Income on Parenting Time Adjustment?

As per equation (A.4), Multiplier Models always recognize relative incomes as incorporated in the income ratio, $b= E_2/E_1$.

### Evaluation Factor 7: Does the PTA Incorporate Changing Cost Dynamics of Both Households?

As per equation (A.1), Multiplier Models account for obligor and obligee parenting time factors, PTF(t) and PTF(1-t) respectively.

## Evaluation Factor 8: Is the Award Zero for 50:50 Time under Equal Earnings?

For t=.5 and $b=E_2/E_1=1$, the normalized child support transfer is:

$NQ_1(t) = M[1-(1+b)t] = M[1-(1+1).5] = 0$ (A.14)

Hence, Multiplier Models always produce a zero award under 50:50 parenting time with equal available incomes.

# Compatibility with Fixed/Variable Model

One of the rationales for adoption of a multiplier value is to incorporate additional fixed costs of dual residency. This raises the question of the degree to which Multiplier Models can be considered a form of Fixed/Variable models.

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[39] https://floridachildsupportcalculator.com/wp-content/FloridaChildSupportCalculatorZ/FloridaChildSupportCalculatorZ.php

A primary requirement of Fixed/Variable cost components is that they be positive values less than one, namely:

$$f_D = Mt_A = (0,1) \quad \text{(A.15)}$$

$$v = M = (0,1) \quad \text{(A.16)}$$

Current models have multiplier values of 1.5/1.4/1.0 and hence do not meet this criterion.

Secondly, cost components must sum to unity:

$$f_D + v = Mt_A + M = M(t_A+1) = 1 \quad \text{(A.17)}$$

$$M = 1/(t_A+1) \quad \text{(A.18)}$$

Hence, fixed and variable cost components may be rewritten as:

$$f_D = t_A/(t_A+1) \quad \text{(A.19)}$$

$$v = M = 1/(t_A+1) \quad \text{(A.20)}$$

Table A.1 calculates the equations A.19 and A.20 for feasible policy choices of parenting time threshold, $t_A$.

Table A1: Policy Tradeoffs

| Policy Tradeoffs for Multiplier Model Equivalence with Fixed/Variable Model | | | |
|---|---|---|---|
| Parenting Time Threshold | Fixed Cost Fraction | Variable Cost Fraction | Multiplier Value |
| $t_A$ | $f_D$ | v | M=v |
| 0.00 | 0.00 | 1.00 | 1.00 |
| 0.05 | 0.05 | 0.95 | 0.95 |
| 0.10 | 0.09 | 0.91 | 0.91 |
| 0.15 | 0.13 | 0.87 | 0.87 |
| 0.20 | 0.17 | 0.83 | 0.83 |
| 0.25 | 0.20 | 0.80 | 0.80 |
| 0.30 | 0.23 | 0.77 | 0.77 |
| 0.35 | 0.26 | 0.74 | 0.74 |
| 0.40 | 0.29 | 0.71 | 0.71 |
| 0.45 | 0.31 | 0.69 | 0.69 |

In order to achieve the logical condition for Multiplier Models that cost components should sum to unity as per equation A.17, the table illustrates the policy conflict between achieving a desirable policy goal of low thresholds and reasonable policy assumptions for fixed cost in the [.28, .40]

range. These twin policy goals are mutually exclusive.[40] Furthermore, the associated requirement for low multiplier value results in a higher cliff effect.[41]

This leads to two conclusions regarding the structural limitations of Multiplier Models:

- Thresholds (and associated cliff effects) as an integral component of Multiplier Models constrain robust policy decisions,
- High multiplier values of existing models lead to large underestimation of cost reductions due to the obligor.

While Multiplier Models have the advantage of being a simple PTA heuristic, the underlying functional form imposes limitations and inaccuracies on policy makers. This structural shortcoming of multiplier models has not been included as an evaluation factor but is included for completeness of analysis.

[40] KY arguably comes closest to meeting Fixed/Variable Model criteria. With an implicit Multiplier of M= 1 and a zero threshold ($t_A$= 0), the fixed and variable fractions sum to 1 ($f_D$ + v= 1) but with the policy assumption that the fixed cost fraction, $f_D$ , is zero.
[41] See equation A.5.

# ANNEX B: NONLINEAR CONTINUOUS MODELS

## Child Support Formulas

The child support transfer formulas for the four nonlinear cross-crediting states are shown in the accompanying table.

TABLE B.1: Formulas for States with Nonlinear Continuous PTA

| Category | State | Formula |
|---|---|---|
| Exponent Model | MI[42] | $(Ao^x \cdot Bs - Bo^x \cdot As)/(Ao^x + Bo^x)$ with exponent x= 2.5<br>Ao = Approximate annual number of overnights the children will likely spend with parent A<br>Bo = Approximate annual number of overnights the children will likely spend with parent B<br>As = Parent A's base support obligation<br>Bs = Parent B's base support obligation<br>**Note:** A negative result means that parent A pays and a positive result means parent B pays. |
| | MN[43] | Same as Michigan but with exponent x=3.0 |
| Sigmoid<br>(General Logistics Function) | OR[44] | Credit percentage=1/(1+e^(-7.14*((overnights/365)-0.5)))-2.74%+(2*2.74%*(overnights/365)). |
| Coupled Quadratic | CA[45] | $NC*K_f*H\%_{adj}$ [HN – (H%) (TN)]<br>NC = multiplier for number of children<br>$K_f$ = " K fraction"-sliding percentage based on TN<br>HN = net disposable income of higher earner<br>TN = total net disposable income<br>H% = Percentage of parenting time by higher earning parent<br>$H\%_{adj}$ = (1-H%) if H%≤ 50%,(2-H%) if H% > 50% |

[42] 2021 Michigan Child Support Formula Manual, § 3.03(A)(2). https://courts.michigan.gov/Administration/SCAO/Resources/Documents/Publications/Manuals/focb/2021MCSF.pdf

[43] Minn. Stat. § 518A.36(2)(b). https://www.revisor.mn.gov/statutes/cite/518A/full#stat.518A.36

[44] OR. ADMIN. R. § 137-050-0730(6). https://secure.sos.state.or.us/oard/viewSingleRule.action?ruleVrsnRsn=11970

[45] 2017 Review of Statewide Uniform Child Support Guideline ,p. 42-44, http://www.courts.ca.gov/documents/lr-2018-JC-review-of-statewide-CS-guideline-2017-Fam-4054a.pdf

# Parenting Time Factor (PTF)

## Exponent Models – MI and MN

The Exponent Model has the standard cross-crediting form of equation (8) repeated below for convenience:

$Q_1(t) = BCSO\ [(E_1/E)\ PTF(1\text{-}t)\ \text{-}(E_2/E)\ PTF(t)]$ (B.1)

For parent B as the obligor parent with parenting time, $t=B_o$, the form of the PTF is:

$PTF(t) = t^x/(t^x + (1\text{-}t)^x)$ for exponent x =2.5/3.0 for MI/MN (B.2)

## Sigmoid Model – Oregon (OR)

The OR model follows the form of a Generalized Logistic function[46] in the first term with the second term being a scaling factor to ensure [0,1] fit on the vertical axis. The PTF is given by:

PTF(t) = 1- Credit Percentage where t = overnights/365 (B.3)

## Coupled Quadratic – California (CA)

To uncover the PTF, expand the California formula using standard notation of this report by letting:

$TN = E = E_1 + E_2$ (B.4)

$HN = E_1$ (B.5)

$H\% = t$ (B.6)

The formula may be restated as:

$$Q_1 = (NC^*K_f)[E_1^*H\%_{adj} - (E_1 + E_2)^*t^*\ H\%_{adj}]$$
$$= (NC^*K_f)[E_1^*\ H\%_{adj}\ ^*(1\text{-}t)\ \text{-}E_2^*\ H\%_{adj}\ ^*t]$$
$$= (NC^*K_f{}^*E)[(E_1/E)^*\ H\%_{adj}\ (1\text{-}t) - (E_2/E)^*\ H\%_{adj}\ ^*t] \quad \text{(B.7)}$$

The equation is of the form of equation (B.1) with $BCSO = NC^*K_f{}^*E$ and PTF as:

$$PTF(t) = t(1+t) = t^2 + t \quad \text{for } t = [0,.5]$$
$$= t(2\text{-}t) = -t^2 + 2t \quad \text{for } t = [.5,1] \quad \text{(B.8)}$$

The two segments[47] of the quadratic equations[48] form an S-curve.

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[46] Generalized Logistic Function. Wikipedia. https://en.wikipedia.org/wiki/Generalised_logistic_function.
[47] As required, both segments have the same value at t=.5, PTF(.5)=.75
[48] The standard form of a quadratic equation is $y=ax^2 + bx + c$. For a positive value of a, the equation is concave; for a negative value, it is convex. In this instance, the constant is c=0.

## Comparative Plot

The following figures depict the PTF and the normalized child support transfer (at assumed income ratio, $b=E_2/E_1 = .75$) PTA across the parenting time continuum. All four states subscribe to variants of the S-curve paradigm as the progression of child costs with increasing parenting time. MI, MN and OR exhibit rotational symmetry around the point (.5, .5) and have longer tails. MN is a sharper curve than its Exponent Model twin, MI, due to its higher exponent value. The CA curve ramps up faster indicative of recognition of fixed costs being incurred as will be discussed below.

Figure B.1a: PTF -MI, MN, OR, CA

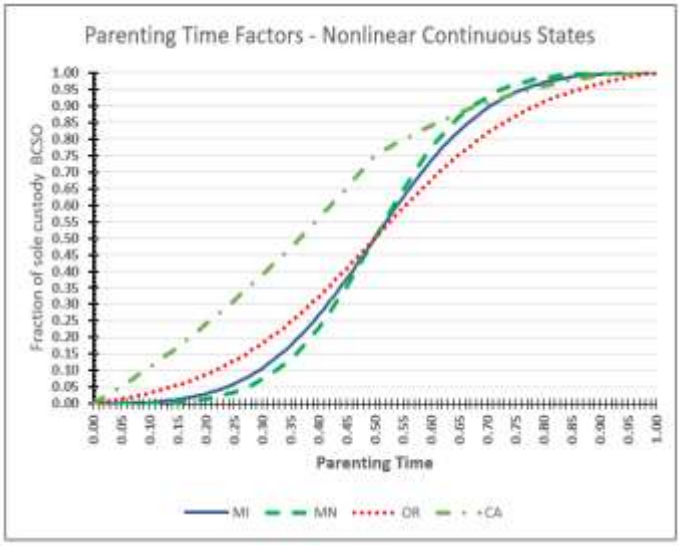
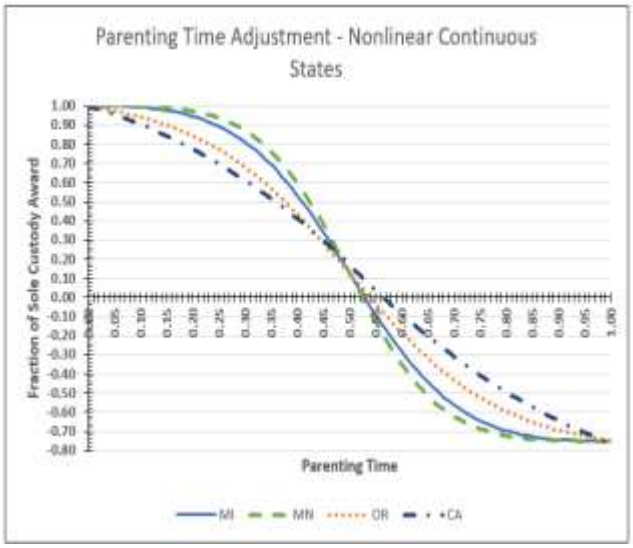



Figure B.1b: PTA- MI, MN, OR, CA




The normalized child support transfer PTA shows the lowest and slowest reduction for MN and the highest for CA reflecting the slowest/fastest recognition of child cost changes respectively in the PTF curve.

There is a 26% difference in the range t= [.26, .33] between MN as the lowest reduction and CA with the highest reduction indicating the large disparity in parenting time adjustment policies even among states using advanced PTA formulas.

## Evaluation Factor 2: Threshold

Although all four S-curves start with a value of zero at t=0 with no mathematical threshold, the long tails of the S-curve means there is little change in the PTA at lower parenting times giving rise to a *de facto* threshold. To assess the *de facto* hidden thresholds in nonlinear continuous curves, NPO has in this instance defined the threshold to be the parenting time at which the PTA discount reaches 5%.

The de facto threshold values for CA/OR/MI/MN are 6%/9%/19%/23% parenting time respectively. MN has the highest implicit threshold resulting from its adoption of a comparatively high exponent value of 3 which mathematically produces sharp S-curves with comparatively flat tails.

## Evaluation Factor 4: Fixed Cost Component

Although the four states utilizing nonlinear continuous models do not explicitly specify underlying fixed cost components, $f_D$, in their models, these values can be mathematically determined.

Recall from equation (11) that at 50% parenting time, the value of the parenting time factor is given by:

$$PTF(.5) = (1 + f_D)/2 \qquad (11)$$

$$f_D = 2*PTF(.5) - 1 \qquad (B.9)$$

As shown in the following table, only the CA formula assumes an implicit fixed cost of 50%:

Table B.2: Determination of Fixed Cost Component

| State | PTF(.5) (from Fig. B1.a) | Fixed cost value (%) $f_D = 2*PTF(.5) - 1$ |
|---|---|---|
| CA | .75 | 50% |
| MI | .5 | 0% |
| MN | .5 | 0% |
| OR | .5 | 0% |

Unfortunately, the functional form of the MI/MN Exponent Model does not accommodate adjustment to include fixed costs. The Generalized Logistic OR model can be modified with a scaling factor to shift the PTF curve leftward to incorporate an implicit fixed cost. Likewise, the parameters of the CA coupled Quadratic Model can be adapted to change fixed cost component.[49]

[49] For CA, the coupled quadratic equation (B.8) would be: PTF(t) =t(t + $f_D$ +.5) for t=[0, .5], and PTF(t) =t(2.5 - $f_D$ -t) +( $f_D$ -.5) ) for t=(.5, 1]. Note that for $f_D$=.5, the PTF equation reverts to its current form.

# ANNEX C: NON-TEMPORAL OFFSETS

## Evaluation Factor 7: Does the PTA Incorporate Changing Cost Dynamics of Both Households?

The parenting time adjustment for states with Percentage Models identified in Table 1 apply a percentage factor, PCT(t), to the sole custody award calculation as identified in equation (17) repeated here for convenience:

$$Q_1(t) = Q_1(0)^* \, PCT(t) \qquad (C.1)$$

In a well-behaved formulation, the percentage factor should approximate the general form:

$$PCT(t) \sim NQ_1(t) = PTF(1-t) - b^*PTF(t) \qquad (C.2)$$

Evaluation factor 7 examines the extent to which the PTA reasonably recognizes cost-shifting in both households represented by the two PTF functions. NPO has adopted a relaxed reasonableness check in which a partial score is given if the percentage adjustment generally follows a downward curve with increasing parenting time indicating implicit recognition of at least one PTF term. This means fixed percentages are automatically non-complaint whereas other percentage scaling (*i.e.*, sliding/staircase or per diem) are eligible for scoring.

In addition, whereas parenting time adjustments (PTA) are made based on parenting time as the term suggests, some states have opted to implement adjustment mechanisms independent of parenting time considerations. These states are not eligible for scoring under Evaluation Factor 7.

**Rhode Island (RI)**

RI defines a threshold of 49% parenting time for any adjustment which is calculated as the offset of the "Total Support Obligation" for each parent using a variant of the Income Shares methodology.[50]

Recall from equations (3) and (5) that the standard cross-crediting formula is:

$$Q_1 = (E_1/E)C_2 - (E_2/E)C_1 = (E_1/E)C - C_1 \qquad (C.3)$$

RI calculates the sole custody obligation (t=0 for reference parent) for the designated non-custodial parent (either Parent 1 or Parent 2) parent under the unusual implicit assumption that neither household absorbs any child expenses:

$$Q_1'(0) = (E_1/E)C \qquad (C.4a)$$

$$Q_2'(0) = (E_2/E)C \qquad (C.4b)$$

[50] RI Administrative Order 2018-01. Calculating Child Support for Shared Placement. https://www.courts.ri.gov/Courts/FamilyCourt/FamilyAdmOrders/18-01.pdf

Once the 49% threshold is satisfied, the transfer is calculated as the offset of the two amounts. Assuming Parent 1 is the reference parent:

$$Q_1'(t \geq .49) = (E_1/E)C - (E_2/E)C \quad \text{(C.5)}$$

The transfer amount relative to the sole custody amount is:

$$NQ_1'(t \geq .49) = Q_1(t \geq .49)/Q_1'(0) = 1 - E_2/E_1 = 1-b \quad \text{(C.6)}$$

Hence, the parenting time adjustment is a function solely of the income ratio, b, and excludes consideration of parenting time. As the RI threshold of 49% is so high, this is relevant only for technical scoring of evaluation factors; in reality, Rhode Island has a parenting time adjustment in name only.

**Nevada (NV)**

NV uses a Percentage-of-Obligor-Income (POOI) Model with variable percentages[51] applied to obligor income. For reference Parent 1, the sole custody award is simply the applicable percentage, $p_1$, applied to available income:

$$Q_1(0) = p_1E_1 \quad \text{(C.7)}$$

When the parenting time threshold of 146 days is satisfied, the NV child support transfer is calculated as the difference of awards between both parents.[52] Assuming Parent 1 is the higher earning parent:

$$Q_1(t) = p_1E_1 - p_2E_2 \quad \text{(C.8)}$$

The size of the PTA relative to sole custody is:

$$NQ_1(t) = Q_1(t)/ Q_1(0) = 1-(p_2/p_1)b \qquad \text{for } b=E_2/E_1 \quad \text{(C.9)}$$

The NV PTA is independent of parenting time and is based on the income ratio, b, as is the case for RI, but includes the additional consideration of the income-dependent variable percentage values, $p_2/p_1$. The NV model becomes identical to the RI model for similar percentages (*i.e.*, $p_1 = p_2$)

[51] Nevada Statutes NAC 425.140. https://www.leg.state.nv.us/NAC/NAC-425.html#NAC425Sec140
[52] Nevada Statutes NAC 425.115. https://www.leg.state.nv.us/NAC/NAC-425.html#NAC425Sec115

# ANNEX D: ABOUT THE AUTHORS

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# ANNEX E: ACKNOWLEDGEMENTS

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- ***Don Bieniewicz, MS:*** Mr. Bieniewicz has been involved in the analysis of child support guidelines for more than 25 years and is a recognized expert on this matter by the U.S. Department of Health and Human Services. In 1994, he authored a model child support guideline that was published by the Federal Office of Child Support Enforcement in *Child Support Guidelines: The Next Generation*. In 1995, he was appointed by the Federal Office of Child Support Enforcement to an expert panel formed to make recommendations on the states' implementation of child support guidelines. The findings of this panel were reported in *Evaluation of Child Support Guidelines*, March 1996.
- ***William S. Comanor, PhD:*** William Comanor is Professor of Health Policy and Management at the University of California, Los Angeles and also Professor of Economics at the University of California, Santa Barbara. At UCLA, he is Director of the Research Program on Pharmaceutical Economics and Policy. Dr. Comanor received his Ph.D. in Economics from Harvard University in 1964. He is the author of *The Law and Economics of Child Support Payments*.