Demographic Transitions and Children's Resources: Bonus or Divergence?

By

Parfait M. Eloundou-Enyegue and C. Shannon Stokes*

ABSTRACT

How do fertility transitions affect children's resources? Existing perspectives provide two seemingly different answers: "Dilution" arguments focusing on family size predict growth in average resources, while "divergence" arguments focusing on family structure predict increased inequality. We suggest that these two perspectives are complementary and reconcilable within an integrated framework, which shows how changes in family size and structure jointly (additively and interactively) shape growth and divergence in children's resources. Thus, the resource implications of fertility transitions depend not only on the *quantum* of fertility change but on its *distribution* and on accompanying changes in family structure. Failure to consider these interactions and distributional aspects can bias estimation. We illustrate with data from Cameroon.

[Key Words: fertility transitions, children's resources, inequality, resource dilution, demographic bonus, demographic dividend, decomposition, family size, family structure] Word count: 5,214

* PM Eloundou-Enyegue is Associate Professor of Development Sociology and Demography, Cornell University. CS Stokes is Professor of Rural Sociology and Demography, The Pennsylvania State University. Please direct correspondence to *pme7@cornell.edu*.

1. Introduction

How do demographic transitions affect the family resources available to children? Current demographic theory offers two seemingly distinct predictions. On the one hand, "resource dilution" perspectives predict a resource bonus: As fertility declines, societies concentrate resources on smaller birth cohorts in ways that raise the average endowments of individual children (Blake 1981; Lloyd 1994; Downey 1995; Birdsall et al. 2001). On the other hand, a more recent perspective (hereafter labeled "divergence") predicts growing inequality, warning that "*trends associated with the second demographic transition [notably changes in family structure… are] leading to greater disparities in children's resources*" (McLanahan 2004:607).

Both perspectives are insightful but partial in their focus, whether on the left-hand or right-hand sides of the transition-resource link. On the left-hand side, dilution arguments emphasize changes in family size while the divergence argument emphasizes change in family structure. On the right-hand side, dilution arguments address average resource levels while the divergence argument addresses resource inequality. An integration of these two perspectives is warranted since contemporary fertility transitions often involve changes in both family size and structure but also because the welfare of children depends on both average endowments and inequality. The benefits of integration would be twofold: It would (1) broaden theoretical focus and (2) refine empirical estimation of the changes in children's resources associated with demographic transitions.

The purpose of this paper is to attempt such integration. The paper is organized around two main sections. The first, theoretical, section summarizes and integrates the dilution and divergence arguments, then draws the implications of this integrated framework. A second, empirical, section illustrates these implications with data from Cameroon. The main caveats in this theoretical argument and its empirical illustration are discussed in a concluding section.

2. Theory

2.1 Dilution and divergence

Dilution and divergence represent two different perspectives on the resource consequences of demographic transitions. Proponents of the dilution perspective see large families as straining the resources available to individual children and therefore, national declines in fertility should enhance the resources available per capita. To be sure, dilution arguments differ in their unit of analysis. Some focus on family-level dilution (Blake 1981, 1989; Cassen 1994) while others contemplate national-level dilution associated with the average family size of children (Preston 1976), relative cohort size (Easterlin 1987), the proportion of children living in large families (Knodel et al. 1990; Bhat 2002) or age dependency (Birdsall et al. 2001). Despite these differences, dilution arguments concur on three points that contrast with the divergence perspective. First, they define fertility transitions quantitatively in terms of the number of births or closely-related outcomes like family size or age dependency, whereas the divergence argument focuses on qualitative changes in the structure of families and the family contexts under which births occur (Lesthaeghe 1995; McLanahan 2004). Second, dilution arguments focus on changes in average resources while divergence arguments emphasize inequality. Third, dilution arguments are today usually invoked for high-fertility settings, whereas divergence arguments are emphasized in lower-fertility settings undergoing their "second" transition, i.e., such changes as "*delays in fertility and marriage; increases in cohabitation, divorce, and non-marital childbearing; and increases in maternal employment*" (McLanahan 2004:607).

While it is tempting to restrict divergence to the second transitions in developed nations and to restrict dilution processes to high-fertility countries, such a two-tiered theory is limiting: The changes in family structure identified as hallmarks of the second transition (Lesthaeghe 1995; McLanahan 2004) do not occur uniformly across developed nations (Raymo et al. 2004) nor are they confined to these nations (Lloyd 2005; Williams et al. 2005). Figure 1 shows recent changes in family size and marriage in 23 developing nations. Over this period, some countries (Columbia, The Dominican Republic, Guatemala; Malawi, Rwanda, Uganda) experienced little change in either marriage or fertility. Other countries experienced uni-dimensional transitions, whether in fertility (Zimbabwe, Kenya) or marriage (Mali, Senegal). Finally, a cluster of countries experienced changes in both fertility and marriage (Cameroon, Egypt, Jordan, Ghana, Nigeria, and Togo). For such countries, focusing exclusively on family size would miss part of the picture. A fuller appraisal of effects of fertility transitions requires insights from both dilution and divergence perspectives.

[Figure 1 about here]

2.2. Integration

Conceptually, the proposed integration merely juxtaposes the dilution and divergence arguments, as they play out at a macro-level (Figure 2). Whereas dilution arguments link declines in fertility to growth in average resource endowments, and while the divergence argument links changing family structure to increased inequality, their juxtaposition covers both aspects of fertility transitions (changes in family size and structure) and both outcomes (average resources and resource inequality).

[Figure 2 about here]

While this juxtaposition draws attention to the complementarity of dilution and divergence arguments, a more formal analysis is needed for quantification purposes. Our formal analysis begins with the notions of family structure and family type. A family type (j) is a unique combination of parental attributes that affect the resources available to children, such as parents' SES, human capital, support networks, parenting experience, or time available to raise children (Mauldon 1990; McLanahan 2004). For instance, using maternal marital status and employment as criteria, families headed by single and unemployed mothers represent one type, and families with married and employed mothers represent another type. At the micro-level, family structure (T) is thus the variable defined by the set of all possible family types. At the macro-level, family structure is measured by the distribution of children across different family types. Given a finite set of mutually exclusive family types, the resource endowments of children can be specified. Average resource levels, in particular, can be expressed at any time (t) as a weighted average of resource levels within family types

$$R_t = \bar{\bar{X}}_t = \sum_j w_{jt} X_{jt} \qquad [1]$$

where
w_{jt} *= proportion of children in families of type j*
X_{jt} *= level of resource per child in this family type. Further,*

$$X_{jt} = C - (\beta_S S_{jt} + \beta_T T_j) \qquad [2]$$

where
C= the resource endowment for a child in the reference family type
β_S *and* β_T *= resource dilution coefficients associated with family size (S) and family structure (T), respectively;*

The change in average resource levels between two time points is:

$$\Delta R \approx [\sum \Delta w_j * \bar{X}_j] + [\sum \Delta X_j * \bar{w}_j] \qquad [3]$$

$$\Delta R \approx [\sum \Delta w_j * \overline{X}_j] + [\beta_s * \sum \Delta S_j * \overline{w}_j] \qquad [4]$$

where $\overline{X}_j$ *and* $\overline{w}_j$ *represent the average resource endowment and prevalence of each family type during this period (e.g.* $\overline{w}_j = [w_{j(t+1)} + w_{j(t)}]/2$*).*

$\Delta R \approx$ [Structure component] + [Size component] [4a]

Expression [4a] thus indicates that the change in average resource level results from addition of a "family structure component" associated with changes in the distribution of family types, and of a "family size component" associated with changes in family size within family types. One can similarly decompose the change in resource inequality. A decomposable measure of inequality is the mean logarithmic deviation (MLD):

$$\text{MLD}_t = \sum_j w_{jt} \log(1/r_{jt}) \qquad [5]$$

where r_{jt} is the resource ratio of group j, $r_{jt} = X_{jt} / \overline{X}_t$ [6]

Following work on income inequality by Firebaugh and Goesling (2004), the change in MLD can be decomposed as:

$$\Delta MLD \cong [\sum_j (\overline{r}_j - \overline{\ln r_j}) \Delta w_j] + [\sum_j (\overline{w_j r_j} - \overline{w}_j) \Delta \ln(r_j)] \qquad [7]$$

$\Delta MLD \approx$ [Structure component] + [Size component] [7a]

As in [4], the total change in resource inequality results from addition of a "family structure component" and of a "family size component."

2.3. Implications

The proposed framework implies that the dilution and divergence perspectives are complementary and reconcilable. They can in fact be seen as two special cases of the same framework. The dilution argument can be viewed as a special case, where one assumes a uni-dimensional transition in family size only (i.e., all Δw_j =0). In this case, equation [4] reduces to its second bracketed term. A decline in fertility (most ΔS_j <0) will increase the average level of resources (since β_s is also negative) as predicted by dilution arguments. Conversely, the divergence argument can also be seen as a special case involving no change in the *quantum* and distribution of fertility (i.e., all ΔS_j =0) but some change in aggregate family structure, i.e., in the prevalence of different family types (i.e., some $\Delta w_j \neq 0$). In this case, equation [7] reduces to its first bracketed term, and the predictions would be consistent with those made under the divergence perspective. In practice, fertility transitions often combine the two idealized types outlined above. In these cases, the resource implications of declining family size can be tempered/compounded by changes in family structure. Overall, the key analytical insights from this integration can be summarized in three propositions, reviewed below.

2.3.1. Additivity

As the formulas [4] and [7] indicate, the total resource effect of a fertility transition is obtained by adding two components: a "family size component" (driven largely by changes in family size) and a "family structure component" largely driven by changes in family structure. These "size" and "structure" components can offset or compound each other.

> *Proposition P1. The resource implications of fertility transitions depend additively on two components, a "family size" component and a "family structure" component. Failure to add the two components can bias understanding of the magnitude or even direction of the resource implications of transitions.*

2.3.2. Interactivity

While the resource implications of transitions require adding two *components*, either component reflects in fact some interaction between family size and structure. These interactions are visible in the formulas in [4] and [7]. In [4] for instance, the "size component" depends on changes in family size (the ΔS_j) but also on the $\bar{w}_j$ (which depend on the initial level and change in family structure between the two time periods). Conversely, the "structure component" depends on changes in family structure (the Δw_j) but also on the $\bar{X}_j$. Overall, how much a decline in fertility affects the resources of children depends on patterns and changes in family structure. Conversely, how much a change in family structure affects the resources of children will depend on the levels and changes in fertility. For these reasons, one expects the following.

Proposition P2. The implications of a dual fertility transition (i.e., one involving change in both family size and structure) are more than the mere sum of two unidimensional transitions (i.e., one involving change in family size only and the other involving change in family structure only);

2.3.3. Distributional considerations

The resource implications of a change in national fertility depend not only on the magnitude of this change, but also on how it is distributed across the national population. Intuitively, a fertility decline that is evenly distributed across all groups will less likely exacerbate inequality than one concentrated among groups that were already better off. The relevance of distributional aspects can be seen in formulas [4] and [7] where the size component depends on *group-specific* changes in family size (the ΔS_j) or resource ratios (the Δr_j). Put differently, the resource implications of fertility transitions depend not only on the *quantum* of fertility change but also on its *locus*, i.e., how this change is distributed across family types. A third proposition is thus

Proposition P3. The resource implications of fertility transitions depend on both the quantum of this change and its locus. The same decline in national fertility will have different implications depending on how evenly this decline occurs across the national population

3. Empirical Illustration

3.1. Data and Measures

Although our argument is framed at the macro-level –it examines the national changes in average resources and resource inequality that accompany demographic transitions—its empirical illustration requires micro-level data. As the formulas [4] and [7] indicate, computing the relevant macro-level changes in average resources and inequality requires detailed historical information on the family circumstances of children. Such historical data were available for Cameroon, from a national demographic survey (*Enquête Population Scolarisation II* or EPS II) completed in 1999. The survey involved using life history calendars to retrospectively reconstruct the demographic histories of a nationally representative sample of 3,369 women as well as the histories of their spouses and children. These data were used to create appropriate fertility history and schooling history data sets to generate estimates for the key framework measures, including period-specific measures of fertility and family structure (the S_{jt} and w_{jt}) but also resource dilution coefficients associated with family size and structure (β_S and β_T). Details on this survey and data can be found elsewhere (Eloundou-Enyegue and Williams 2006). The resulting data were consistent with other national estimates of fertility, schooling, and employment, and with known trends and patterns in these outcomes. In particular, our TFR estimates for 1991 and 1998 (5.8 and 4.6, respectively) were close to the Cameroon DHS estimates for these years (5.8 and 4.8 respectively). However, because we measured maternal residence as time-varying (rather than time-invariant as in the CDHS), our estimates of rural fertility (6.5 for 1991 and 5.4 for 1998) were higher than CDHS estimates (6.3 and 5.4) and our estimates of urban fertility (4.9 and 3.7) were lower than CDHS estimates (5.2 and 3.8, respectively).

3.1.1. *Family size* (S_{jt}).

We approximate family size by the total fertility rate (TFR) and these were estimated for each family type and successive time periods (<1980, 1980-84, 1985-89, 1990-94, and 1995-98). It is worth noting that we use total fertility rates and not family size. Family size more closely approximates the resource experience of children but it has two drawbacks for the purpose of this analysis. First, because it is affected by past fertility, it lags behind changes in fertility and such lag would delay observation of the changes in family size associated with Africa's recent fertility transitions. Second, since changes in family size are also affected by changes in child mortality, this measure would not isolate the specific effects of changing fertility.

3.1.2. Family structure (w_{jt}).

Family structure, at the aggregate level, reflects the relative representation (w_{jt}) of different family types. Types can be defined on the basis of several criteria, but we selected maternal marital status and residence, as well as father's employment, because of their direct relevance for the material resources and opportunities available to children. All three variables were dichotomized. Maternal residence distinguished between rural and urban mothers; marital status distinguished between married versus unmarried mothers (whether single, divorced/separated, or widowed); father's employment distinguished between fathers employed off-farm and those who were not. Based on these dichotomized criteria, five family types were created, including families with mothers that were "rural and unmarried," "rural married," "urban unmarried," "urban married with an unemployed partner," "urban married with an employed partner," respectively. Among married rural women, no distinction was made between women with employed and those with unemployed partners because few women were found in the latter category.

3.1.3. Resource dilution coefficients (β_S and β_T).

Family size and structure are both expected to affect/dilute the resources available to children, including material resources (e.g., money) and non-material ones (e.g., time, attention, parenting experience). While both material and non-material resources are important (Blake 1989; Mauldon 1990; McLanahan 2004), they are not easily fungible or convertible into the same unit, making it difficult to evaluate their dilution along a common metric. Our conversion strategy was to use as a common metric the statistical effects on an important resource-related outcome such as school dropout. Since this outcome is dichotomous, the dilution coefficients associated with family size and type (β_s and β_T, respectively) were derived from logistic regression analysis of the effects of corresponding variables on school dropout (see Table A1 in appendix) and were expressed in odds ratio units. For the same reasons, instead of being obtained by subtraction from a baseline (as per the additive model in equation [2]), resource dilution is obtained by division from a baseline, specifically

$$X_{jt} = C / [(\beta_s^{Sjt})*(\beta_T^{Tj})] \qquad [2a]$$

Practically, we use as baseline a child with no sibling and with a mother who is "urban and married to an employed partner." This baseline child is assigned a resource index of 100. The resources available to other children are obtained from [2a]. For instance, assume that an additional child dilutes resources by a factor of 1.1 (β_s=1.1) and that resources are diluted by 1.2 for a child from an urban mother married to an unemployed partner (β_s=1.2). In that case, a child with 3 siblings and with a mother married to an unemployed partner is expected, on average, to have a resource index of about $100/ [(1.1)^3*(1.2)]$ or about 62.6.

3.2. Methods of analysis

The input measures described above are used to estimate, decompose, and simulate the resource implications of Cameroon's transition. To estimate the average resource levels during any given period, we begin by using equation [2a] to calculate the resource index at the group level. These values are then aggregated, using equation [1]. Likewise, to estimate resource inequality, we use equation [6] to calculate resource ratios (r_{jt}) for each family type, then apply these ratios to calculate overall resource inequality, as per equation [7].

Following the above computation of period-specific resource levels and inequality, one can estimate the marginal change between any two periods, then decompose these marginal changes into their "size" and "structure" components, using formulas [4] and [7]. This decomposition serves to illustrate our theoretical proposition *P1*, about the additivity of "size" and "structure" components of fertility transitions.

Finally, we use simulation to illustrate the theoretical propositions *P2* and *P3.* Two simulation scenarios are considered. To illustrate *P2* (about interactivity), we simulate the resource implications that would be observed under two uni-dimensional transitions, one involving change in fertility with no change in family structure, and the other involving change in family structure with no change in fertility. The presence of an interaction is assessed by comparing the sum of these two unidimensional transitions with Cameroon's actual transition (which was a dual transition in size and structure). If the influences of family size and family structure do not interact, then the sum of the resource implications of the two uni-dimensional transitions should equal the resource implications of Cameroon's dual transition. To illustrate *P3* (about distributional considerations), we simulate the resource implications that would be observed if Cameroon's fertility transition were evenly distributed across all family types. Comparison of this hypothetical scenario with Cameroon's actual transition indicates how the resource implications of a fertility transition depend on the distribution of this change.

3.3. Findings

3.3.1. Cameroon's transition

Table 1 shows Cameroon's transition in some detail. It shows, for successive time periods (<1980, 1980-84, 1985-89, 1990-94, and 1995-98), the fertility levels within family type as well as the prevalence of each family type. The trends in national fertility were plateau-shaped, similar to many African countries over the last three decades. Compared to pre-1980 levels, the national TFR increased and stayed above 6 in the 1980s, then declined in the 1990s. This decline was more pronounced among urban than rural women. However, it was more uniform across the marital and employment categories considered here. Importantly, Cameroon's decline in fertility was accompanied by changes in family structure, specifically an increase in the percentage of urban unmarried mothers (from 11.1 percent before the 1980s to 30.4 percent in 1995-98) and a remarkable decline in the percentage of rural married mothers (from 50 percent before the 1980s to 30.4 percent in 1995-98). Such transformations in family structure should affect the resource endowments of children at the national level, if family types vary in the resources availed to children. Transformations in family structure can be examined from the perspective of mothers or from the perspective of children (Preston 1976), the latter being more relevant here. An analysis from children's perspective shows similar --but less dramatic-- changes in family structure. The percentage of children born to rural married mothers decreased from about 59 to 55 percent, while the percentage born to urban unmarried women increased from 5 to 12 percent. Although these changes were not linear, the main point here is that Cameroon's transition was dual in nature, affecting both fertility levels and family structure.

[Table 1 about here]

3.3.2. Resource implications

The resource implications of Cameroon's fertility transition are described in detail in Table 2 and they are summarized in Figure 3. As Table shows, the average resource index increased from 7.85 before the 1980s to 10.07 in 1995-98. This represents a gain (bonus) of about 2.22 or 28 percent. This growth was uneven, with small gains and minor setbacks during the earlier periods but larger gains during the later two periods, when fertility began to decline. Similarly, the level of resource inequality also increased during that time period, from 0.09 to 0.20, i.e., a 122 percent increase (divergence). Much of this divergence occurred in the 1990s. These results clearly indicate that Cameroon's fertility transition was accompanied by both a resource bonus and divergence, with divergence being in fact more remarkable (122%) than the bonus (28%) during this time period. Such findings draw attention to potential dis-equalizing effects of fertility transitions, even when they foster a resource bonus. The next issue is to understand which aspects of Cameroon's transition account for these changes.

[Table 2 and Figure 3 about here]

3.3.3. Decomposition results

The decomposition results are presented in detail in Table 3 and summarized in Figure 4. The leftmost frame in Figure 4 shows the change in average resource endowment (bonus) between consecutive periods while the rightmost frame shows the change in average resource inequality (divergence). The frames also show the decomposition results in nominal units, specifically, how much the "size" and "structure" components of Cameroon's transition contributed to the national bonus and divergence, respectively. Results are shown for adjacent periods but also (in Table 3) for the overall change between the pre-1980 and 1995-98 periods.

[Table 3 and Figure 4 about here]

Looking at the leftmost frame, Figure 4 shows a negligible bonus (0.03) between the first two periods, a mildly negative bonus between 1980-84 and 1985-89 (-0.42), and positive and increasing bonuses (0.97 then 1.64) since then, for a total bonus of 2.22 between the pre-1980 and 1995-98 periods. The decomposition results indicate that the "size component" of Cameroon's transition initially made negative contributions to the total bonus but these contributions became positive after 1985-89. Conversely, the "structure component" of Cameroon's transition initially made positive contributions but these contributions declined over time and became negative after 1990-94. Over the entire period between the pre-1980s and 1995-98, the decomposition results (Table 3) indicate that the "size component" of Cameroon's transition accounted for about 55 percent of the bonus while the "structure component" accounted for 45 percent of the bonus. The findings in Figure 4 and Table 3 thus illustrate our first proposition P1 about the additivity of "size" and "structure" components of fertility transitions. Because each of these two components accounts for a sizeable portion of the total bonus, focusing exclusively on either one component would substantially bias estimation of the total bonus. The direction and extent of this bias vary. For the overall change between the pre-1980 and 1995-98 periods, the contributions of the "size" and "structure" components to the bonus were both positive (1.21 and 1.01, respectively). Therefore, failure to consider either component would under-estimate the total bonus. For some of the marginal changes between adjacent periods (e.g., between pre-1980s and 1980-84 (point A in Figure 4) or between 1985-89 (point B in Figure 4)), failure to consider the influences of changing family structure would under-estimate the bonus. For other periods (between 1995-98 period (point D in Figure 4)), failure to consider the influences of changing family structure would overestimate the bonus.

The conclusions from the rightmost frame are similar. Resource inequality has generally increased over time, with much of this divergence occurring during the 1990s. Decomposition analysis for the entire period between the pre-1980s and 1995-98 (Table 3) indicates that the "size" component of Cameroon's transition accounted for 74% of this divergence, while the "structure" component accounted for the remaining 26%. Again, failure to consider either component would bias estimation of the total change in resource inequality during this period. Remarkably, the "size" component --not the "structure" component-- explains a larger share of the divergence in children's resources, a finding that draws attention to the distributional aspect of fertility change. This point is considered further in the following section. For now, the key insight from this decomposition is to underscore the importance of adding the "size" and "structure" components, if one is to fully estimate the resource transformations accompanying fertility transitions.

3.3.4. Simulation results

The framework's second proposition (P2) posits an interaction between changes in fertility and family structure. The resource implications of changing family size depend on accompanying transformations in family structure and, conversely, the resource implications of changing family structure depend on accompanying changes in family size. What this means in practical terms is that the changes in children's resources that will follow a dual transition (i.e., one involving changes in both family size and structure) are not the mere sum of changes from the corresponding uni-dimensional transitions (one in family size only and the other in family structure only). This proposition was tested through simulation. First we simulated the resources implications of Cameroon's transition if it had involved change in fertility only, but no change in family structure. Then we also simulated the implications if Cameroon's transition had involved change in family structure only but no change in fertility. The results, shown in Table 4, indicate the following. A uni-dimensional transition in fertility would yield a 12% bonus (rather than the 28% under the actual scenario) and a 78% divergence (rather than the 122% under the actual scenario). Likewise, a uni-dimensional transition in family structure would yield a 10% bonus and a 22% divergence. The sum of these two uni-dimensional transitions yields a bonus of 22%

and a divergence of 100%, i.e., lower values than observed under Cameroon's actual (dual) transition. The difference in results between this dual transition and the sum of its corresponding uni-dimensional transitions reflects the interaction between change in family size and structure. These interactions are important. Even if one is only interested in the influences of changing family size on children's resources, the patterns and change in family structure still matter, and *vice-versa*.

[*Table 4 about here*]

Another simulation was used to illustrate the importance of distributional considerations. Following the proposition P3, analyses of the resources implications of fertility change should depend on the *quantum* of fertility change but also its *locus*, i.e., its distribution across the national population. The same decline in national fertility will have different resource implications, depending on how evenly this decline is distributed across the national population. To illustrate this proposition, we simulated the resource implications that would have been observed if Cameroon's fertility decline had been evenly distributed across all the family types. The results (Table 4) indicate that the same change in national TFR would have different resource implications. Had fertility declined evenly across all groups, the resource bonus from Cameroon's transition would have been larger (40%, compared to 28% under Cameroon's actual scenario). This bonus would have been accompanied by milder divergence (22% as opposed to 122% under the actual scenario). In sum, had Cameroon's decline been evenly distributed across all family types, it would have been accompanied by a larger and more equitable resource bonus for children.

4. Conclusion and Discussion

We suggest in this paper that an integration of existing dilution and divergence perspectives would broaden analysis and refine estimation of the resource implications of fertility transitions. The integration broadens analytic focus by making it possible to consider transition-related transformations in both family size and family structure, while also documenting implications on both average resource level and inequality. The framework refines estimation by considering the interactions and distributional considerations: the resource bonus from declining fertility depends not only on the *quantum* of fertility decline, but on its *locus (*how evenly the decline is distributed across the national population) and its *make-up* (i.e., whether this decline occurs concurrently with changes in family structure). Failure to consider these interactions and distributional aspects can substantially bias estimates of the resource implications of transitions. Cameroon illustrates a transition that was followed by both a bonus and divergence and where estimation of these changes would have been biased by failure to consider the locus and makeup of the country's transition.

Several caveats must be considered in assessing the value of this framework and its purported link between fertility transitions and children's resources. The first caveat is about the theoretical linkage itself and whether it is reasonable to view fertility transitions as exogenous causes of changes in children's resources. Rather than exogenous developments, fertility transitions could instead be the result of changing preferences and norms regarding parental investments in children, themselves driven in part by changes in the returns to investments in child quality. The relevance of preference for child quality and the potential importance of a quantity/quality tradeoff in triggering fertility declines is recognized (Becker 1960; Pritchett 1994; Galor and Weil 2000). While other research (NAS 1993; Bongaarts 1994; Tsui) suggests the influence of possible exogenous forces such as economic downturns of family planning programs, one cannot rule out the potential influence of endogenous quantity/quality tradeoffs in triggering the recent decline in fertility observed in sub-Saharan Africa. In that case, the observed changes in children's resources should be interpreted at best as *accompanying* –rather than being caused by-- fertility transitions.

Other caveats have to do with empirical analysis, specifically measures for the key variables in this framework. First, we used total fertility rates (TFR) rather than family size. Although this measure permits focus on the effects of changes in fertility, a more complete account of the actual experiences of children must incorporate changes in sibling mortality, as well changes in the earnings of families and in the practice of fosterage, among other factors. Our analysis thus only addresses the changes in children's resources associated with changes in fertility and family structure, rather than possible changes in all the set of circumstances facing families over that time period. Likewise, our typology of families (based on maternal marital status and parental employment and residence) could have been modified to include other criteria, for instance indicators of parenting experience, child fosterage, or family extension. We considered another typology that combined maternal age, marital status and residence. The results (available on request) showed substantively similar conclusions. Finally, there are questions about the best way to capture resource dilution. Using school dropout as a metric and the regression coefficients associated with family size (structure, respectively) is not unproblematic. Research in this area acknowledges the difficulty in making causal inferences about the effects of family size or structure (Ginther and Pollack 2004; Moffit 2005). Despite control for many covariates (grade level, child's ability, birth order, maternal birth cohort, sex, and selection), estimates of these coefficients can be biased if other family-level and supply-side determinants are missing. At the other end, over-control for covariates –some of which could be mediator variables-- can obscure the total relationship between these family factors and schooling outcomes (see Psacharopoulos and Patrinos (2003) in the case of earning returns to education)). We presented both the gross and net dilution coefficients but used the gross coefficients. Analyses based on net coefficients yield similar conclusions. However, the relative contributions of family size and structure depend on how adjustment for covariates affects their respective dilution coefficients.

A third general caveat has to do with generalization. Since our empirical illustration is based on a single country, the question arises whether the patterns noted in this study apply to other developing countries. As Figure 1 indicates, recent national transitions in developing countries vary in their makeup. One would therefore expect cross-country variation in the resource bonus and divergence that accompany fertility transitions. To study this variation, our future research will use DHS data and extend analysis to a sample of countries with contrasting transition experiences.

5. Acknowledgments:

The data in this article come from a survey completed in 1999. Data collection was supported by the Rockefeller Foundation, the Spencer Foundation, and the Futures Policy Project, with funding from USAID. We acknowledge comments from Linda Williams, Fatou Jah, Sarah Giroux, and useful documentation from Brian Goesling. Remaining errors are ours.

REFERENCES

Becker, G. S. 1960. "An Economic Analysis of Fertility." Pp. 209-231 in National Bureau of Economic Research (ed). *Demographic and Economic Change in Developed Countries.* Princeton: Princeton University Press.

Bhat. P.N. 2002. *Demographic Transition, Family Size and Child Schooling.* National Council of Applied Economic Research Working Paper Series nº 86. (New Delhi, India).

Birdsall, N., A. Kelly and S. Sinding (eds.) 2001. *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*. New York: Oxford University Press.

Blake J. 1981. "Family Size and the Quality of Children." *Demography* 18(4):421-442.

Blake, J. 1989. *Family Size and Achievement*. University of California Press.

Bongaarts, J. 1994. "The Impact of Population Policies: Comment." Population and Development Review 20:616-620.

Cassen, R. (ed.). 1994. *Population and Development: Old Debates, New Conclusions.* Washington D.C. Overseas Development Council.

Demographic and Health Surveys (DHS). 2004. StatCompiler, ORC, Macro. Measure DHS+ Project. Available on line at http://www.measuredhs.com.

Downey, D.B. 1995. “When Bigger is not Better: Family Size, Parental Resources, and Children’s Educational Performance.” *American Sociological Review* 60 (October): 746-761.

Easterlin, R.A. 1987. *Birth and Fortune: The Impact of Numbers on Personal Welfare*. Chicago: University of Chicago.

Eloundou-Enyegue P.M. and L.B. Williams. 2006. “Family Size and Schooling in Sub-Saharan African Settings: A Reexamination.” *Demography* 43(1):25-52.

Firebaugh, G. and B. Goesling. 2004. "Accounting for the Recent Decline in Global Income Inequality." *American Journal of Sociology* 110(2):283–312.

Ginther, D.K. and R.A. Pollack. 2004. “Family Structure and Children’s Educational Outcomes: Blended Families, Stylized Facts, and Descriptive Regressions.” *Demography* 41(4):671-696.

Galor, O., and D. N. Weil. 2000. “Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond.” *American Economic Review* 90(4):806-828.

Knodel, J., N. Havanon, and W. Sittitrai. 1990. “Family Size and the Education of Children in the Context of Rapid Fertility Decline.” *Population and Development Review* 16 (1):31-62.

Lesthaeghe, R. 1995. “The Second Demographic Transition in Western Countries: An Interpretation.” Pp. 17-62 in *Gender and Family Change in Industrialized Countries*, edited by K. Mason and A. Jensen. Oxford: Clarendon Press.

Lloyd, C.B. 1994. "Investing in the Next Generation: the Implications of High Fertility at the Level of the Family." Research Division Working Papers, No. 63. New York: The Population Council.

Lloyd, C.B. 2005. *Growing Up Global*. Washington DC. National Academy Press.

Mauldon, J. 1990. “The Effect of Marital Disruption on Children’s Health.” *Demography* 27(3):431-446.

McLanahan, S. 2004. "Diverging Destinies: How Children Are Faring Under the Second Demographic Transition." *Demography* 41(4):607-627.

Moffit, R. 2005. “Remarks on the Analysis of Causal Relationships in Population Research.” *Demography* 42(1):91-108.

National Academy of Sciences (NAS). 1993. *Demographic Effects of Economic Reversals in sub-Saharan Africa*. Washington DC: National Academy Press.

Preston, S. H. 1976. "Family Sizes of Children and Family Sizes of Women."

Demography 13(1):105-114.

Pritchett, L. H. 1994. "Desired Fertility and the Impact of Population Policies." Population and Development Review 20:1-55.

Psacharopoulos G. and H.A. Patrinos. "Returns to Investments in Education: A Further Update." *Education Economics* 12(2):111-134.

Raymo J.M., L. Bumpass, and M. Iwasawa. 2004. "Marital Dissolution in Japan." *Demographic Research* vol. 11-14:396-419.

Tsui, A. O. 2001. "Population Policies, Family Planning Programs, and Fertility: The Record." Global Fertility Transition (Supplement to Population and Development Review 27:184-204.) Eds. R. A. Bulatao and J. B. Casterline.

Williams, L., P. Guest, and A. Varangrat. 2005. *Early Forties and Still Unmarried: A Continuing Trend in Thailand*. Manuscript.

Table 1. Cameroon's fertility transition

	CHANGES IN FAMILY SIZE (TFR within family type (Sj))						CHANGES IN FAMILY STRUCTURE proportion in family type (wj) FROM MOTHERS' PERSPECTIVE						FROM CHILDREN'S PERSPECTIVE					
FAMILY TYPE	< 1980	1980-84	1985-89	1990-94	1995-98	ΔSj	< 1980	1980-84	1985-89	1990-94	1995-98	Δwj	< 1980	1980-84	1985-89	1990-94	1995-98	Δwj
Rural Unmarried	3.09	3.31	4.56	3.59	3.26	*0.17*	0.182	0.138	0.130	0.147	0.174	*-0.008*	0.098	0.074	0.091	0.093	0.122	*0.025*
Rural Married	6.85	7.48	8.15	8.05	7.16	*0.31*	0.500	0.441	0.411	0.371	0.360	*-0.140*	0.595	0.535	0.514	0.527	0.556	*-0.040*
Urban Unmarried	2.78	2.54	3.1	2.84	1.88	*-0.90*	0.111	0.162	0.208	0.280	0.304	*0.193*	0.054	0.067	0.099	0.140	0.123	*0.070*
Urban Married Unemployed Partner	7.01	7.62	7.19	7.74	5.68	*-1.33*	0.081	0.078	0.074	0.054	0.042	*-0.039*	0.099	0.096	0.082	0.074	0.051	*-0.047*
Urban Married Employed Partner	7.08	7.79	7.92	6.32	5.71	*-1.37*	0.126	0.181	0.177	0.148	0.120	*-0.006*	0.155	0.228	0.215	0.165	0.148	*-0.007*
TOTAL	5.86	6.21	6.54	5.67	4.66	-1.2	*1.0*	*1.0*	*1.0*	*1.0*	*1.0*		*1.0*	*1.0*	*1.0*	*1.0*	*1.0*	

Table 2. Estimation of the resource implications of Cameroon's transition

Cameroon's transition

FAMILY TYPE	RESOURCE DILUTION Coefficients: Size β_S	Structure β_T	CHANGES IN FAMILY SIZE: TFR within family types (S_{jt}) < 1980	1980-84	1985-89	1990-94	1995-98	CHANGES IN FAMILY STRUCTURE: Proportion in family type (w_{jt}) <1980	1980-84	1985-89	1990-94	1995-98
Rural Unmarried (RU)	2.88	2.88	3.09	3.31	4.56	3.59	3.26	0.098	0.074	0.091	0.093	0.122
Rural Married (RM)	2.88	2.47	6.85	7.48	8.15	8.05	7.16	0.595	0.535	0.514	0.527	0.556
Urban Unmarried (UU)	2.88	1.98	2.78	2.54	3.1	2.84	1.88	0.054	0.067	0.099	0.140	0.123
Urban Married Unemployed Partner (UMU)	2.88	1.57	7.01	7.62	7.19	7.74	5.68	0.099	0.096	0.082	0.074	0.051
Urban Married Employed Partner (UME)	2.88	1	7.08	7.79	7.92	6.32	5.71	0.155	0.228	0.215	0.165	0.148
TOTAL			5.86	6.21	6.54	5.67	4.66	*1*	*1*	*1*	*1*	*1*

Resource Implications

FAMILY TYPES	RESOURCE INDEX X_{jt} <1980	1980-84	1985-89	1990-94	1995-98	RESOURCE RATIOS r_{jt} <1980	1980-84	1985-89	1990-94	1995-98
RU	10.53	9.79	6.98	8.98	9.95	1.34	1.24	0.94	1.07	0.99
RM	5.29	4.82	4.40	4.46	5.05	0.67	0.61	0.59	0.53	0.50
UU	17.12	18.84	15.26	16.74	25.90	2.18	2.39	2.05	1.99	2.57
UMU	8.12	7.43	7.90	7.31	10.14	1.03	0.94	1.06	0.87	1.01
UME	12.61	11.40	11.20	14.22	15.84	1.61	1.45	1.50	1.69	1.57
	National Resource Average (Rt)					National Resource Inequality (MLDt)				
	7.85	7.88	7.46	8.43	10.07	0.09	0.11	0.11	0.16	0.20
Change between adjacent periods		0.03	-0.42	0.97	1.64		0.02	0.00	0.04	0.04
Change between <1980s and 1995-98					2.22					0.11
					Bonus					Divergence

Table 3. Decomposition of the resource implications of Cameroon's transition

Resource Implications

Periods	RESOURCE INDEX [1] <1980	[2] 1980-84	[3] 1985-89	[4] 1990-94	[5] 1995-98	RESOURCE RATIOS [1] <1980	[2] 1980-84	[3] 1985-89	[4] 1990-94	[5] 1995-98
Family types										
(RU)	10.53	9.79	6.98	8.98	9.95	1.34	1.24	0.94	1.07	0.99
(RM)	5.29	4.82	4.40	4.46	5.05	0.67	0.61	0.59	0.53	0.50
(UU)	17.12	18.84	15.26	16.74	25.90	2.18	2.39	2.05	1.99	2.57
(UMU)	8.12	7.43	7.90	7.31	10.14	1.03	0.94	1.06	0.87	1.01
(UME)	12.61	11.40	11.20	14.22	15.84	1.61	1.45	1.50	1.69	1.57
	Rt					MLDt				
Period-specific totals	7.85	7.88	7.46	8.43	10.07	0.09	0.11	0.11	0.16	0.20
Marginal changes		(1->2)	(2->3)	(3->4)	(4->5)		(1->2)	(2->3)	(3->4)	(4->5)
		0.03	-0.42	0.97	1.64		0.02	0.00	0.04	0.04
Total change (1--> 5)					2.22					0.11
					BONUS					DIVERGENCE

Decomposition

Bonus decomposition

	Size component 1-> 2	2->3	3->4	4->5	1->5	Structure component 1-> 2	2->3	3->4	4->5	1->5
(RU)	-0.06	-0.23	0.18	0.10	-0.06	-0.24	0.14	0.02	0.28	0.25
(RM)	-0.27	-0.22	0.03	0.32	-0.14	-0.31	-0.10	0.06	0.13	-0.20
(UU)	0.10	-0.30	0.18	1.21	0.78	0.23	0.55	0.66	-0.37	1.50
(UMU)	-0.07	0.04	-0.05	0.18	0.15	-0.02	-0.11	-0.06	-0.20	-0.43
(UME)	-0.23	-0.04	0.57	0.25	0.49	0.88	-0.15	-0.63	-0.26	-0.10
	-0.53	-0.75	0.92	2.06	1.21	0.55	0.33	0.05	-0.42	1.01
					54.6%					45.4%

Divergence decomposition

	Size component 1-> 2	2->3	3->4	4->5	1-> 5	Structure component 1-> 2	2->3	3->4	4->5	1-> 5
(RU)	-0.002	-0.002	0.000	0.000	-0.005	-0.025	0.017	0.002	0.029	0.025
(RM)	0.019	0.008	0.025	0.014	0.070	-0.066	-0.023	0.016	0.033	-0.045
(UU)	0.007	-0.015	-0.004	0.043	0.021	0.019	0.046	0.055	-0.025	0.105
(UMU)	0.000	0.000	0.000	-0.001	0.000	-0.002	-0.015	-0.008	-0.023	-0.047
(UME)	-0.010	0.004	0.013	-0.007	-0.002	0.081	-0.015	-0.056	-0.020	-0.008
	0.01	-0.01	0.03	0.05	0.08	0.01	0.01	0.01	-0.01	0.03
					73.6%					26.4%

Table 4. Simulation of the resource implications of Cameroon's transition, under different hypothetical scenarios

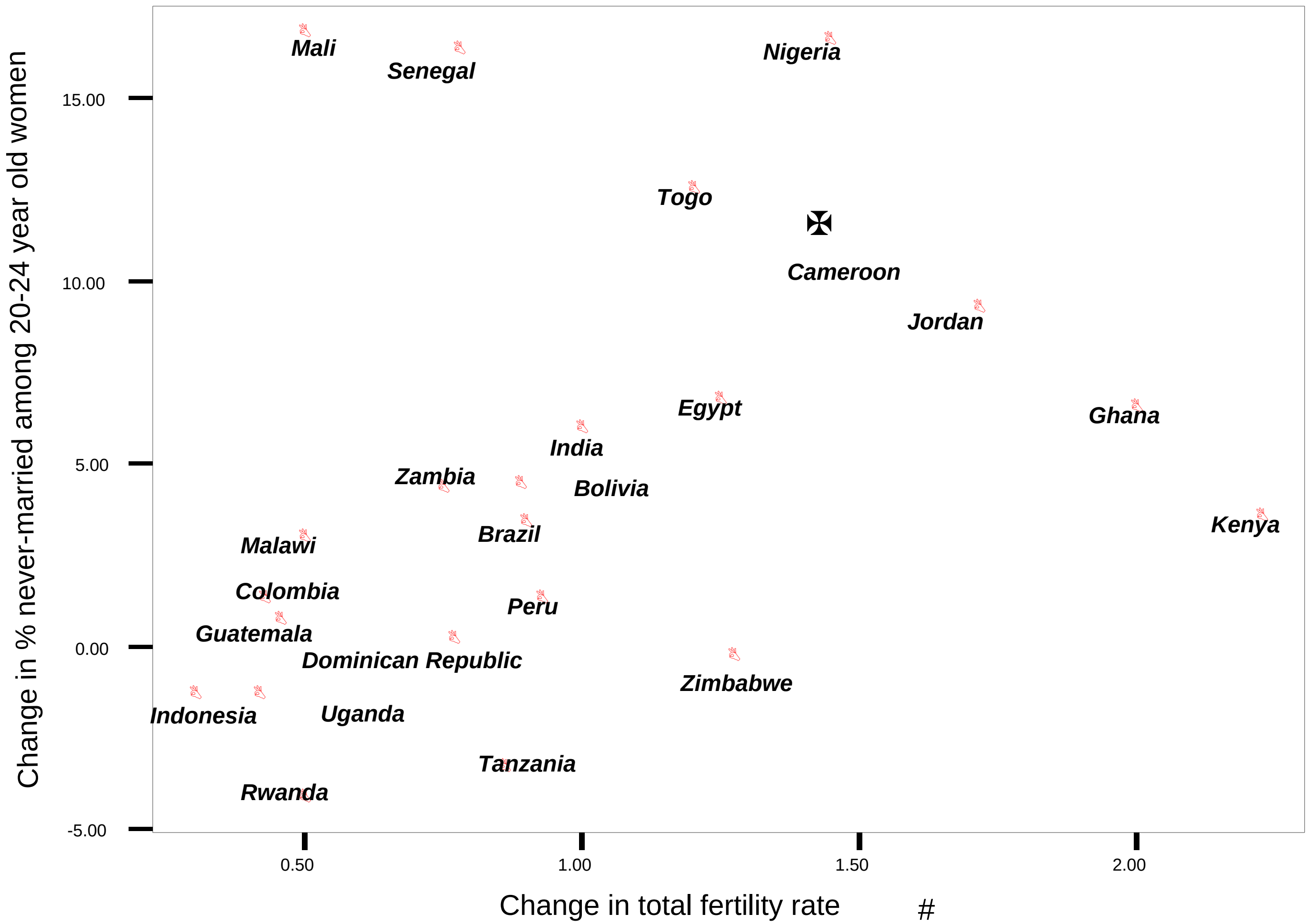
THEORETICAL PROPOSITIONS AND CORRESPONDING SIMULATION SCENARIOS	BONUS AND ITS DECOMPOSITION: Average resource level <1980	1995-98	Change (bonus)	Decomposition: "size cpnent" %	"structure cpnent" %	INEQUALITY AND ITS DECOMPOSITION: Resource inequality <1980	1995-98	Change (divergence)	Decomposition: "size cpnent" %	"structure cpnent" %
Proposition P2: "The implications of a dual transition are more than the mere sum of two unidimensional transitions"										
Cameroon's actual (dual) transition	7.85	10.07	*2.22 [28%]*	55%	45%	0.09	0.2	*0.11 [122%]*	74%	26%
1. Unidimensional transition in fertility	7.85	8.82	*0.97 [12%]*	100%	0%	0.09	0.16	*0.07 [78%]*	100%	0%
2. Unidimensional transition in family structure	7.85	8.61	*0.76 (10%) [10%]*	0%	100%	0.09	0.11	*0.02 [22%]*	0%	100%
(1)+(2)			*1.73 [22%]*					*0.09 [100%]*		
Proposition P3: "The same decline in national fertility has different resource implications depending on how evenly this decline occurs across the populatio										
Cameroon's actual (uneven) transition	7.85	10.07	*2.22 (28%) [28%]*	55%	45%	0.09	0.2	*0.11(122%) [122%]*	74%	26%
3. Even transition in fertility	7.85	10.98	*3.13 (40%) [40%]*	72%	28%	0.09	0.11	*0.02(22%) [22%]*	0%	100%

Table A1. Logistic regression resutls for the effects of selected variables on the risk of school dropout, Cameroon

	B	Exp(B)		B	Exp(B)	
Ln Family size	1.059	2.88	***	0.317	1.37	***
Family type						
Rural unmarried mother	1.057	2.88	***	0.914	2.50	***
Rural married mother	0.906	2.47	***	0.945	2.57	***
Urban unmarried mother	0.683	1.98	***	0.381	1.46	**
Urban married mother with unemployed partner	0.452	1.57	***	0.495	1.64	***
Urban married mother with employed partner	ref			ref		
Child is female	0.197	1.22	***	0.257	1.29	***
Rank in birth order	-0.208	0.81	***	-0.098	0.91	***
Maternal birth cohort						
Pre 1940 (reference)	ref			ref		
1940-49	-0.301	0.74	***	-0.191	0.83	**
1950-59	-0.801	0.45	***	-0.494	0.61	***
1960+	-1.685	0.19	***	-0.927	0.40	***
Grade level						
Kindergarten				-0.846	0.43	***
Grade 1 (reference)				ref		
Grade 2				1.636	5.13	***
Grade 3				2.015	7.50	***
Grade 4				2.608	13.58	***
Grade 5				2.885	17.90	***
Grade 6				4.293	73.19	***
Grade 7				3.490	32.78	***
Grade 8				3.778	43.72	***
Grade 9				3.514	33.58	***
Grade 10				4.147	63.24	***
Grade 11				3.600	36.61	***
Grade 12				3.645	38.29	***
Grade 13				3.881	48.46	***
Grade 14				3.216	24.92	***
Grade 15				3.867	47.81	***
Grade 16				5.283	196.88	***
Grade 17+				4.083	59.34	***
Child repeats current grade				1.185	3.27	***
Child repeats current grade for nth time (n>1)				1.149	3.16	***
Index of inordinate ability				0.355	1.43	
Constant	-4.522	0.01	***	-4.366	0.01	***
N person years =63,338; N events= 2,684						
Nagelkerke R square	0.07			0.29		

*, **, and *** denote statistical significance at the 0.05, 0.01, and 0.001 levels, respectively

*Figure 1. Recent Transitions in Selected DHS Countries **



Note: Selected countries include countries where at least two DHS surveys were fielded over the last two decades, with an inter-survey period of 7+ years (6 years in the case of India). For specific survey years per country, see www.measuredhs.com. Since the inter-survey period varied across countries, the changes were pro-rated to a 10-year period.

Figure 2. Conceptual Integration of Dilution and Divergence Arguments

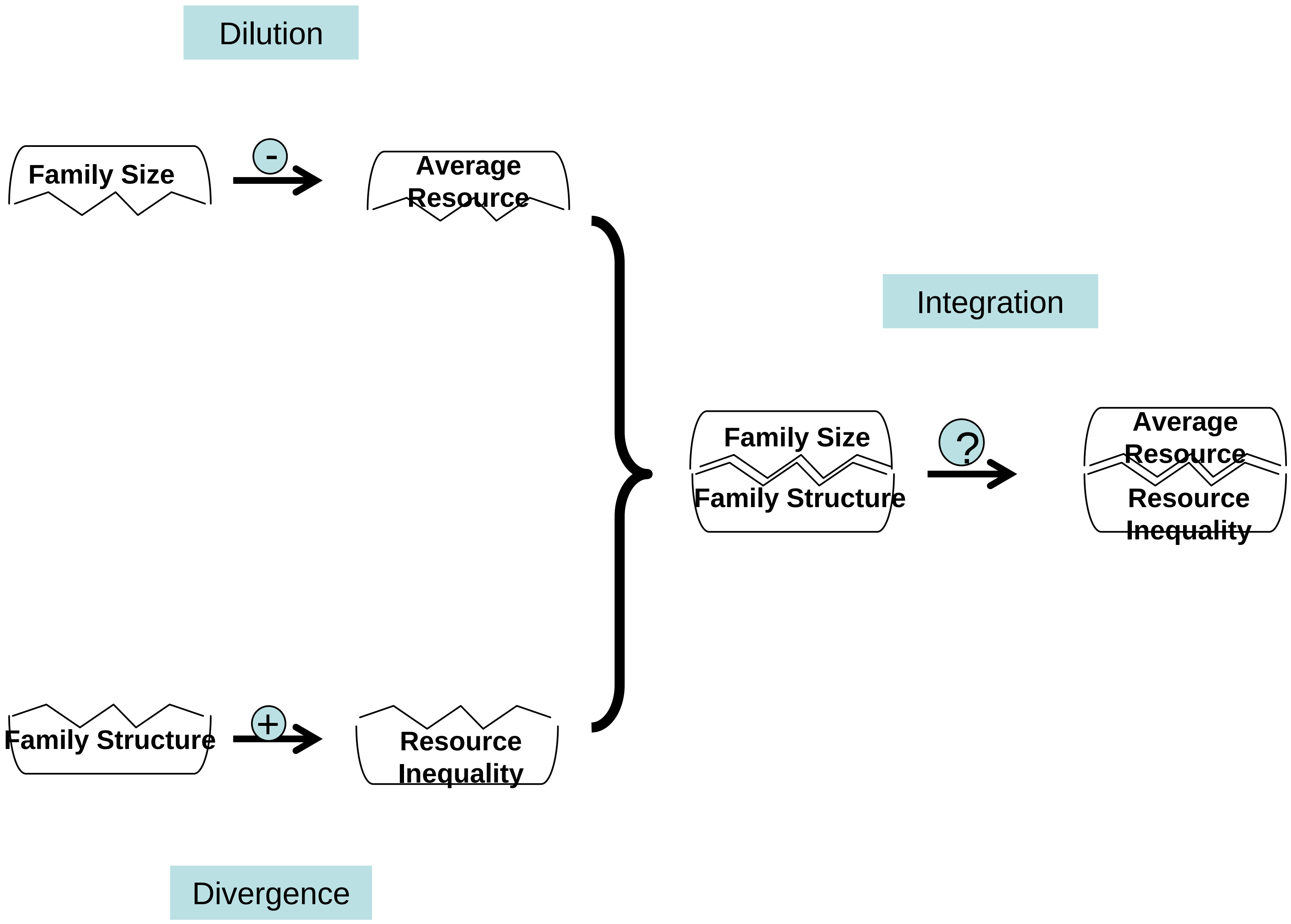

Dilution
Family Size
-
Average Resource
Integration
Family Size
Family Structure
?
Average Resource
Resource Inequality
Family Structure
+
Resource Inequality
Divergence

Figure 3. Trends in Children's Resource Levels and Inequality

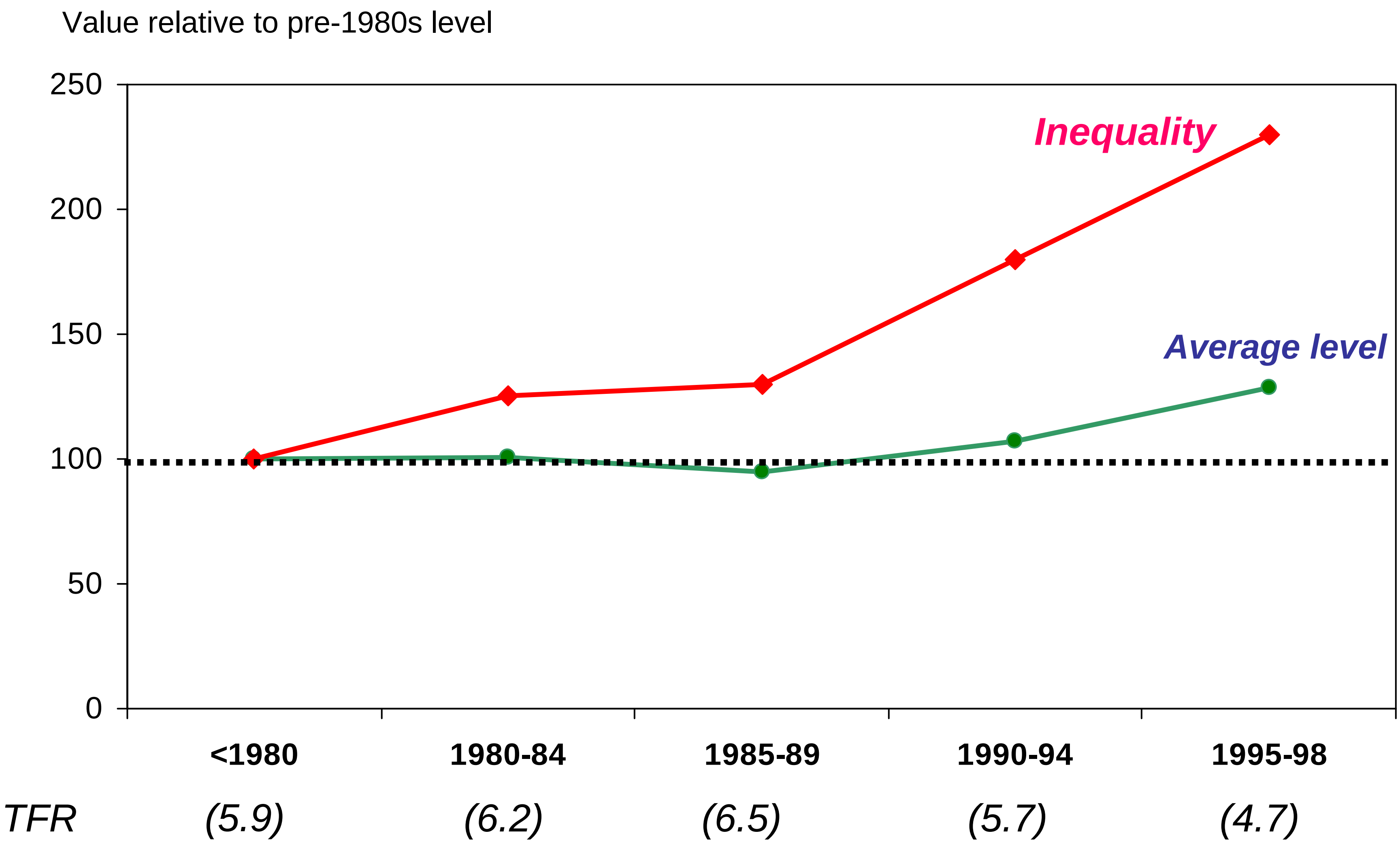

Value relative to pre-1980s level
250
200
150
100
50
0
Inequality
Average level
<1980
1980-84
1985-89
1990-94
1995-98
TFR
(5.9)
(6.2)
(6.5)
(5.7)
(4.7)

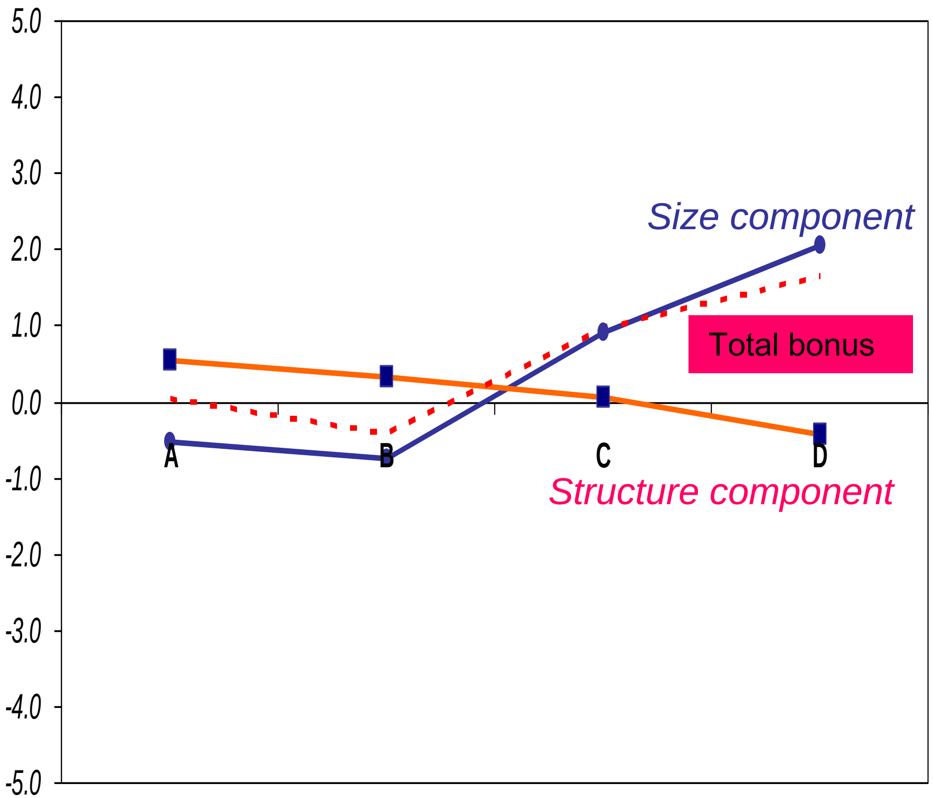
Figure 4. Decomposition Results for the Contributions of “Size” and “Structure” Components to Changes in Resource Levels and Inequality (Cameroon)

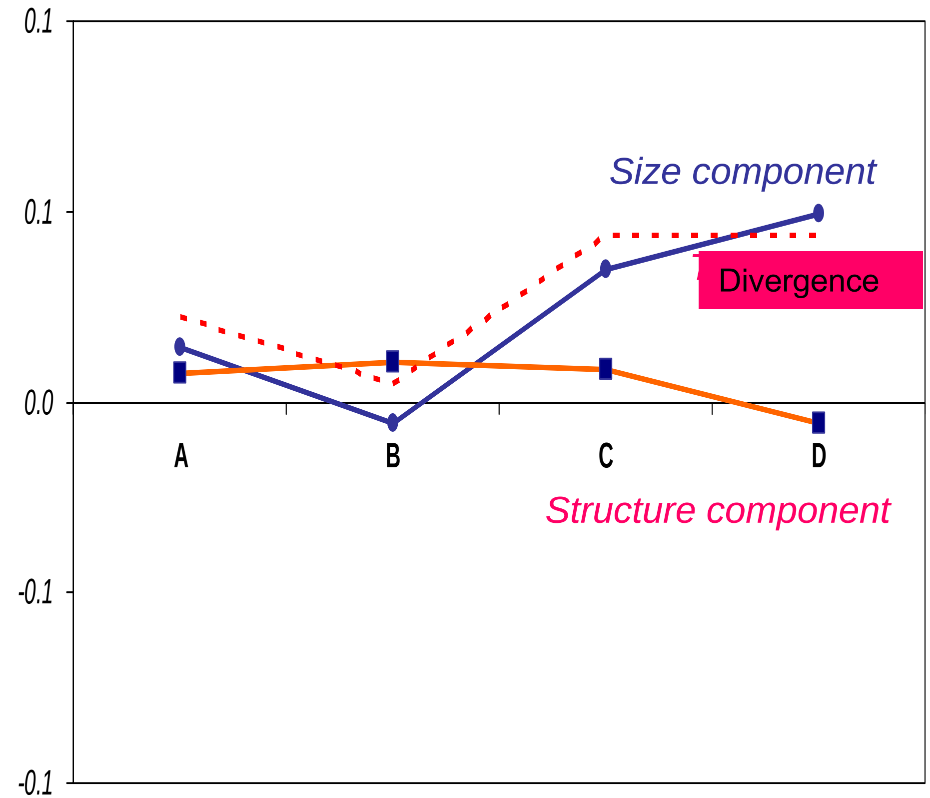
Bonus

Change in average resource

Divergence

Change in resource inequality





A: <1980 to 1980-84 **B**: 1980-84 to 1985-89

C: 1985-89 to 1990-94 **D**:1990-94 to 1995-98