A Dynamic Model of Cultural Reproduction[1]

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The authors draw on Pierre Bourdieu's theory of cultural reproduction to develop a formal model of the pathways through which cultural capital acts to enhance children's educational and socioeconomic success. The authors' approach brings conceptual and empirical clarity to an important area of study. Their model describes how parents transmit cultural capital to their children and how children convert cultural capital into educational success. It also provides a behavioral framework for interpreting parental investments in cultural capital. The authors review results from existing empirical research on the role of cultural capital in education to demonstrate the usefulness of their model for interpretative purposes, and they use National Longitudinal Survey of Youth 1979—Children and Young Adults survey data to test some of its implications.

INTRODUCTION

Pierre Bourdieu's theory of cultural capital and cultural reproduction is one of the most influential explanations in social stratification research of why inequalities in educational and socioeconomic outcomes persist over generations. The theory outlines a complex system in which parents transmit cultural capital to children, children exploit their acquired cultural capital in the

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educational system, and, as a consequence, families who possess cultural capital have an advantage that helps them reproduce their privileged socioeconomic position (Bourdieu 1977*a*, 1984; Bourdieu and Passeron 1990).

Despite the enormous popularity of the theory of cultural reproduction, we know surprisingly little about how cultural capital gets transferred from parents to children and whether it facilitates educational and socioeconomic success. The reasons for these limitations are twofold: a lack of clarity in Bourdieu's theory of cultural reproduction and, partly as a consequence of this, a large body of empirical research that provides inconclusive results. There is agreement among interpreters of Bourdieu that core concepts and mechanisms are ill defined in his writings on cultural reproduction (Lamont and Lareau 1988; Kingston 2001; van de Werfhorst 2010). For example, Bourdieu provides no consistent explanation of what cultural capital is, how parents transmit it to children, and how it leads to educational success. The lack of theoretical clarity has had a detrimental impact on empirical research, which is characterized by highly diverse approaches to measuring cultural capital, piecemeal tests of the theory of cultural reproduction, and little attention to identifying the causal pathways through which cultural capital might lead to educational success (Kingston 2001; Sullivan 2002; Lareau and Weininger 2004; Goldthorpe 2007; Jæger 2011; Xu and Hampden-Thompson 2012).

This article begins from the observation that the combination of a lack of clarity in the theory, together with limitations in empirical research that has sought to test it, warrants a new approach to analyzing cultural reproduction. We argue that if the theory of cultural reproduction is to remain a relevant explanation of intergenerational inequalities in educational and socioeconomic outcomes, it needs to provide a clear theoretical account of core concepts and mechanisms that can be tested empirically. Debates on the exact meaning of Bourdieu's writings on cultural reproduction have been ongoing for decades (DiMaggio 1982; Lamont and Lareau 1988; Mohr and DiMaggio 1995; Swartz 1997; Kingston 2001; van de Werfhorst 2010) with no sign of consensus, suggesting that effort might better be spent rethinking the core ideas of cultural reproduction rather than attempting to clarify Bourdieu's original thoughts.

In this article we present a formal model, expressed verbally, mathematically, and diagrammatically, describing the process of cultural reproduction. Compared to previous research, the main benefit of our model is that it ex-

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plicates and formalizes the different mechanisms through which cultural capital leads to educational and socioeconomic success. In doing so, it presents an encompassing model of cultural reproduction that has been absent from the literature, that helps to organize and interpret results from existing research, and that may act as a starting point for future research that seeks to test cultural reproduction theory. Borrowing terminology from economics, the model we present is structural: it attempts to describe all the relevant relationships and presents the behavioral assumptions needed to interpret its parameters. In our model, parents possess a stock of cultural capital that they transmit to children through active investments and through children's exposure to cultural capital in the home. Children convert their acquired cultural capital into educational performance within the educational system, which leads to higher educational attainment and later socioeconomic success, thereby completing the process of social reproduction.

In addition to presenting a formal model of cultural reproduction, our structural model provides a behavioral framework for interpreting the parameters in this model. We do this to address Bourdieu's lack of clarity about what motivates parents' behavior. How do parents decide on how much of their cultural capital to invest in a child? How strong are parents' beliefs that cultural capital will yield a return in the future? In order to provide answers to these questions, we build on the assumption that parents invest in children's cultural capital in the hope that these investments will promote children's educational and socioeconomic success. It is not clear from Bourdieu whether parents make cost-benefit calculations when attempting to transmit cultural capital to children or whether this process happens more or less unconsciously. We take the position that the best point of departure for analyzing cultural reproduction is to assume that parents have beliefs and goals, and, given their limitations on time, money, and information, they act to achieve these goals. We are explicit about behavioral assumptions because these are crucial for interpreting not only our model but also the results of previous empirical research. Most research documents positive correlations between empirical indicators of cultural capital, such as how often parents take children to cultural events and children's educational success. However, assumptions about what drives parental behavior are needed to interpret these correlations, and the lack of a clear behavioral framework in Bourdieu means that there is little agreement on how to do this (e.g., Do these correlations arise from deliberate investments or from parents' unconsciously repeating behavior learned through socialization?). Our structural model provides a framework for analyzing how differences in resources and beliefs (e.g., differences by race and socioeconomic group, which we discuss in detail) lead to different investments in cultural capital and to differences in educational outcomes. Thus, our model not only helps to organize results from previous research but also provides a framework for interpreting them.

As a final contribution, our model also addresses two black boxes in the theory of cultural reproduction. Although Bourdieu argued that parents transmit cultural capital to children throughout childhood, he does not explain how the transmission takes place. Similarly, the way in which children convert cultural capital into educational achievements is underspecified. We provide a dynamic account of both mechanisms. We draw on recent dynamic models of intergenerational transmissions (Todd and Wolpin 2007; Cunha and Heckman 2008; Bisin and Verdier 2011) and treat childhood as a sequence of time periods during which parents invest in transmitting cultural capital to children. In our model, parents may change their investments over time. This may be because of limitations on resources (due to events such as unemployment or illness), outcomes of past investments in cultural capital (which may or may not have yielded a return), or investments in other child skills (e.g., cognitive or social skills). We also provide a dynamic account of how children convert cultural capital into educational performance. In each time period the child converts his or her cultural capital into educational performance by affecting teachers' perceptions of his or her academic ability, which leads to greater teacher inputs (e.g., of attention and help) and better performance. Thus, in addition to describing the outcome of cultural reproduction, we provide an account of the process of cultural reproduction.

To demonstrate the usefulness of our model, we provide illustrative empirical evidence on the dynamic nature of cultural capital investments. We use longitudinal data from the National Longitudinal Survey of Youth 1979—Children and Young Adults (NLSY-CYA) and estimate dynamic panel data models describing, first, how parents invest over time in transmitting their cultural capital to children and, second, how cultural capital affects educational performance. Our findings suggest that children accumulate cultural capital from parents and, furthermore, that cultural capital has a positive effect on educational performance. And although we lack direct data on teacher inputs in children, the empirical results are consistent with our model. We also find that parents adjust their investments in cultural capital on the basis of what they believe to be the educational payoffs of past investments; a finding that is also consistent with our model.

In summary, while we seek to provide a new conceptual framework for analyzing cultural reproduction, we do not claim to have captured every aspect of Bourdieu's thoughts: our model builds on our interpretation of the theory of cultural reproduction. However, the model we propose is flexible, in the sense that it can be extended to cover more complex situations, key parameters can be modified in light of new theoretical or empirical insights, and the behavioral assumptions underlying our interpretation of mechanisms and parameters are open to modification. We hope, therefore, that it will stimulate research on the potentially complex ways in which cultural capital may facilitate educational and socioeconomic success. Furthermore,

because our model is expressed in mathematical terms, it is highly transparent, so its empirical implications can readily be derived and tested.

In the next section of the article we review the basic elements of Bourdieu's theory. Then follows the development of our theory, first in static then in dynamic form. Next we provide a review and reinterpretation of results from previous research to illustrate the usefulness of our approach, followed by empirical analyses that involve direct testing of the dynamic aspects of our model using the NLSY-CYA data. In the article's conclusion we summarize our arguments and results and consider some of the ways in which our model could be extended.

CULTURAL REPRODUCTION THEORY

The theory of cultural reproduction provides an explanation of the intergenerational reproduction of socioeconomic position. Bourdieu argued that individuals and families possess resources in the form of different types of capital—economic, social, and cultural—that can be invested to generate more resources or converted from one type of capital into another (Bourdieu 1977*a*, 1986; Bourdieu and Passeron 1990). Economic capital refers to all forms of economic resources (income, wealth, property, etc.), while social capital refers to gainful social networks (Bourdieu 1986).

Although Bourdieu's definition of cultural capital is far from clear (Lamont and Lareau 1988; Kingston 2001; van de Werfhorst 2010), at the most general level it refers to familiarity with the dominant culture in a society. Lamont and Lareau (1988, p. 156) proposed an influential definition of cultural capital as "widely shared, high-status cultural signals (attitudes, preferences, formal knowledge, behaviors, goods and credentials) used for social and cultural exclusion." We follow this definition in the current article. As with economic and social capital, cultural capital is a resource that can be invested in order to promote one's relative position within a social hierarchy populated by individuals with different compositions and amounts of capital. Cultural capital exists in three states—*embodied* (linguistic competence, mannerisms, cultural knowledge, etc.), *objectified* (cultural goods, paintings, books, etc.), and *institutionalized* (educational credentials; Bourdieu 1977*a*, 1986; Bourdieu and Passeron 1990)—and it can contribute to social reproduction in all three states.

According to Bourdieu, cultural reproduction is an important mechanism through which social reproduction takes place. Society is composed of different *fields*, that is, subsystems in which the different types of capital carry different weight (Bourdieu 1986). Education is a major subfield, and one in which cultural capital is particularly important. Bourdieu argues that the educational system is biased toward valorizing cultural capital, ascribing positive qualities to individuals and families that possess it. This bias arises

from cultural capital being associated with high culture and social status, and it means that the embodied cultural capital that students put "on display" in school conveys an impression of academic brilliance that leads to favorable treatment by teachers and to educational success. Thus, cultural capital creates a false impression of academic brilliance that yields a real return in the form of educational success. Since families in advantaged socioeconomic positions tend to possess more cultural capital than those in less advantaged positions, and because children tend to inherit capital from parents, cultural capital contributes to social reproduction by increasing the likelihood of educational success (institutionalized cultural capital) and subsequent socioeconomic success (because socioeconomic position in adulthood is heavily dependent on educational credentials).

Intergenerational Transmission of Cultural Capital

We begin the presentation of our formal model with a simple version describing the intergenerational transmission of cultural capital. We let C denote the child's cultural capital and subscripts c and P, respectively, the child and parents. For now we assume that there is only one child in the family. Cultural reproduction theory argues that parents possess a stock of cultural capital and furthermore that they transmit some of this to their child. Transmission of cultural capital takes place through two channels: parents actively investing in transmitting their cultural capital to their child (e.g., by taking the child to the theater and by reading to the child) and the child passively acquiring cultural capital via exposure to objectified cultural capital in the home (e.g., works of art). The child's acquisition of cultural capital also depends on family resources other than cultural capital (e.g., parents' socioeconomic resources) and on the child's academic ability. We let S denote parents' total stock of cultural capital and θ the amount that they actively invest in the child. We then write

$$C_c = \beta_1\theta_p + \beta_2 S_p + \beta_3 X_p + \beta_4 A_c + L_c, \quad (1)$$

which states that the child's cultural capital depends on parents' active investments in transmitting their cultural capital to the child ($\beta_1\theta_p$) and on the child's passive exposure to cultural capital in the home ($\beta_2 S_p$). The return (in terms of the child's cultural capital) to parental investments in the child's cultural capital is β_1, and β_2 is the "passive" rate of transfer of cultural capital from parents to the child. The child's cultural capital also depends on parents' socioeconomic resources X_p, the child's academic ability A_c (which we assume to be constant over time), and luck L. The relative sizes of β_1 and β_2 are not clear from Bourdieu's writings, but both are assumed to be greater than zero. Below, we review research that provides empirical estimates of β_1 and β_2.

Cultural Capital, Educational Success, and Social Reproduction

In addition to accounting for parental transmission of cultural capital to children, cultural reproduction theory argues that children convert their (embodied) cultural capital into educational success (institutionalized cultural capital), which in turn promotes socioeconomic success. Consequently, cultural capital is a means to an end. Bourdieu (1986, p. 247) writes that cultural capital is "a symbolically and materially active, effective capital insofar as it is appropriated by agents and implemented." He furthermore writes that "academic success is directly dependent upon cultural capital and on the inclination to invest in the academic market" (Bourdieu 1977*a*, p. 504).[2]

It is not entirely clear from Bourdieu how children convert their embodied cultural capital into educational success. He argues that the educational system is intrinsically biased toward misconceiving cultural capital as academic brilliance, and, as a consequence, children who possess cultural capital use it to present an impression of brilliance that is rewarded by teachers (Bourdieu and Passeron 1990; Moore 2004). The reason teachers misconceive cultural capital as academic brilliance is that it signals familiarity with high culture and social status, and, as a consequence, teachers implicitly associate cultural capital with other desirable qualities (Ganzeboom 1982; Crook 1997). Bourdieu uses the concept of the *habitus* to capture the ways in which children's cultural capital, acquired from parents and manifested in values, tastes, and behaviors, helps to create such an impression (Bourdieu 1977*b*). And although the impression of academic brilliance associated with cultural capital is false (in the sense that, unlike economic capital, cultural capital has no intrinsic value other than that ascribed to it), its consequences are real. Children who possess cultural capital are perceived as more academically gifted than children who do not (thus leading to better subjective evaluations by teachers and better grades). Moreover, they are treated in a more favorable way by teachers, which may lead to a better learning environment and so to better educational performance.[3] Thus, it follows that the main channel through which embodied cultural capital is converted into institutionalized cultural capital (educational credentials) is through educational performance. We now incorporate this idea into our model. Specifi-

[2] In their influential paper, Lamont and Lareau (1988, p. 154) interpret Bourdieu's writings as follows: "Indeed, they [Bourdieu and Passeron] argued that individuals' social position and family background provide them with social and cultural resources which need to be actively 'invested' to yield social profits."

[3] Bourdieu's idea that teachers are inclined toward valorizing cultural capital has some empirical merit. For example, DiMaggio (1982) cites research showing that although teachers are often recruited from the lower middle class, they are overrepresented among consumers of highbrow culture. In her qualitative study, Lareau (2003, pp. 14–32) finds that teachers place high value on pupils' cultural activities and actively promote such activities among their own children.

cally, letting E_c denote final educational attainment, P_c educational performance, and U and J luck, we write

$$\begin{aligned} E_c &= \eta_1 P_c + \eta_2 X_p + \eta_3 A_c + U_c, \\ P_c &= \sigma_1 C_c + \sigma_2 A_c + J_c. \end{aligned} \tag{2}$$

Equation (2) states that final educational attainment depends on educational performance, but furthermore that educational performance depends on the child's cultural capital and on academic ability. Consequently, the parameter σ_1 captures the "bonus" to educational performance from the impression of academic brilliance generated by cultural capital (net of the effect of actual ability A). Cultural reproduction theory tells us that $\sigma_1 > 0$. Furthermore, the parameter η_1 captures the effect of educational performance on final educational attainment (again, net of actual academic ability), and we assume $\eta_1 > 0$. Note that the reason we use different letters across equations to capture the luck component is that the factors that go into this component need not be the same across the different outcomes that the equations describe.

The final stage in cultural reproduction theory is the link between educational attainment (institutionalized cultural capital) and socioeconomic success. Letting Y_c denote the child's socioeconomic position in adulthood and Q luck, we write

$$Y_c = \rho_1 E_c + \rho_2 X_p + \rho_3 A_c + Q_c. \tag{3}$$

In this model cultural capital has no direct effect on socioeconomic success but nevertheless contributes to it by improving educational performance, which in turn facilitates educational success, which directly affects socioeconomic position (so we assume $\rho_1 > 0$).

A DYNAMIC MODEL OF CULTURAL REPRODUCTION

The model presented above summarizes the main features of cultural reproduction theory. Equation (1) describes how parents transmit their cultural capital to the child, equation (2) describes how cultural capital is converted into educational success, and equation (3) describes how educational success is converted into socioeconomic success. These are the basic building blocks in the theory of cultural reproduction. Our model, however, and Bourdieu's writings on cultural reproduction, does not describe the actual mechanisms that lead to the outcomes summarized in equations (1)–(3). Building on recent models of intergenerational transmissions in economics (Todd and Wolpin 2007; Cunha and Heckman 2008; Bisin and Verdier 2011), we now extend our model to address two important black boxes in Bourdieu's writings: (1) the mechanism through which parents invest in transmitting cultural

capital to the child and (2) the mechanism through which the child converts cultural capital into educational success.

A necessary condition for the theory of cultural reproduction to be consistent is that children acquire cultural capital from parents. In our model, we explicate this condition by assuming that $\beta_1 > 0$ and $\beta_2 > 0$. Bourdieu (1986, p. 249) writes that "the initial accumulation of cultural capital, the precondition for the fast, easy accumulation of every kind of useful cultural capital, starts at the outset, without delay, without wasted time. . . . The accumulation period covers the whole period of socialization." We take this formulation to suggest that children accumulate cultural capital throughout childhood and, furthermore, that parents actively seek to transmit their cultural capital to their child. We now extend our model to accommodate this idea.

After the child's birth, parents have a finite time horizon in which they can invest in her cultural capital (and in other endowments that facilitate educational success, such as human capital). We assume that parents seek to transmit as much as possible of their cultural capital to the child, and they begin investing when the child is young (below, we discuss parents' investment strategies in detail). For the purposes of our model, we represent childhood as divided into T time periods ($t = 1, \ldots, T$), beginning at birth and ending at the time the child leaves compulsory education (around age 16 in most countries).[4] As described in equation (2), returns to cultural capital are manifest in educational performance, in the form of grades, test scores, or placement in a prestigious educational track. This occurs because cultural capital conveys an impression of academic brilliance, leading to favorable evaluations, more attention, and ultimately better performance (captured by the parameter σ_1 in eq. [2]). However, equation (2) is silent as to the mechanism through which cultural capital is converted into educational performance, and we now address that issue. We write

$$\begin{aligned} P_{ct} &= \alpha_1 T_t + \alpha_2 A_c + \alpha_3 X_{pt} + W_{ct}, \\ T_t &= \varphi_1 P_{ct-1} + \varphi_2 C_{ct} + V_{ct}, \end{aligned} \tag{4}$$

where P_{ct} is educational performance at time t, T_t is teacher inputs (evaluations, attention, etc.), C_{ct} is the child's cultural capital, A is academic ability, and X_{pt} is parental resources. Variables W and V capture the influence of luck and other unmeasured factors that affect performance and teacher inputs, respectively. Equation (4) states that cultural capital affects educational

[4] Parents may still transmit cultural capital to the child after age 16. However, we interpret Bourdieu as suggesting that the main thrust of parental investments in cultural capital takes place when the child is comparatively young. Also, it may be difficult for parents to transmit cultural capital when the child has left the home, for example, to attend higher education. Instead, parents may rely on their economic or social capital.

performance by improving teachers' evaluations of the child (via φ_2) that, in turn, determine the inputs teachers provide to the child (via α_1). We expect $\varphi_2 > 0$ (more cultural capital leads to higher teacher inputs) and $\alpha_1 > 0$ (higher teacher inputs lead to better educational performance). Our model also states that teachers' inputs in period t depend on the child's educational performance in the previous period: teachers are not myopic, and they adjust their inputs in the child on the basis of her past educational performance (so, we expect $\varphi_1 > 0$). Equation (4) thus describes the mechanism through which embodied cultural capital is converted into educational performance. High educational performance during compulsory school leads to high educational attainment (eq. [2]), which in turn leads to high socioeconomic status (eq. [3]), thus completing the process of social reproduction.

Moving back in the causal chain, we now describe the mechanism through which parents invest in transmitting cultural capital to their child. Parents possess a stock of cultural capital, S. In each time period they actively invest amount θ in their child. In addition, the child acquires cultural capital via passive exposure to cultural capital in the home. Finally, given the cumulative nature of cultural capital formation, the child's stock of cultural capital at time t also depends on how much cultural capital she had in the previous period. Putting these components together, we write the process through which the child acquires cultural capital:

$$C_{ct} = \gamma_1 C_{ct-1} + \gamma_2 \theta_{pt} + \gamma_3 S_p + \gamma_4 X_{pt} + \gamma_5 A_c + L_{ct}. \quad (5)$$

Equation (5) states that the child's stock of cultural capital in period t depends on her stock in the previous period, her parents' active investments in the present period, her passive exposure to cultural capital in the home, and other factors. On the basis of cultural reproduction theory, we expect $\gamma_1 > 0$, $\gamma_2 > 0$, and $\gamma_3 > 0$; that is, we expect the child to have more cultural capital in the present period if she had more cultural capital in the previous period and if parents invest more in cultural capital. Note that θ_t can be larger than S since parents may try to inculcate cultural capital in their child that they do not themselves possess, for example, by organizing suitable out-of-school activities.

WHAT MOTIVATES PARENTS' INVESTMENTS?

In his writings, Bourdieu devotes little attention to describing what parents actually do to transmit their cultural capital to children. In relation to our model, this means that it is not clear from cultural reproduction theory how parents decide how much of their cultural capital to invest in each time period, and, consequently, the preferences and behaviors that generate the parameters α_1, γ_1, γ_2, and γ_3 are unspecified.

We combine the two mechanisms described in equations (4) and (5) and propose a behavioral framework for interpreting the parameters in these equations. We assume that parents are utility maximizers who seek to transmit as much as possible of their cultural capital to the child, but they may differ in their beliefs about the returns to investments in cultural capital. We realize that this approach departs from a conventional interpretation of Bourdieu, but we find it more analytically meaningful than simply assuming that parents more or less unconsciously reproduce behaviors learned through socialization. Moreover, our approach is motivated by an influential body of empirical research that documents that, at least in the U.S. context, middle-class parents deliberately and strategically organize children's time and leisure activities with the intent of cultivating their cognitive and social skills (Lareau 1989, 2003; Calarco 2014).[5]

We begin by specifying a model for the different factors that determine the child's educational performance. Putting together equations (4) and (5) yields the following expression for the child's performance in time period t:

$$\begin{aligned} P_{ct} &= \alpha_1[\varphi_1 P_{ct-1} + \varphi_2 C_{ct} + V_t] + \alpha_2 A_c + \alpha_3 X_{pt} + W_{ct} \\ &= \alpha_1\varphi_1 P_{ct-1} + \alpha_1\varphi_2[\gamma_1 C_{t-1} + \gamma_2\theta_{pt} + \gamma_3 S_p + \gamma_4 X_{pt} + \gamma_5 A_c + L_t] \\ &\quad + \alpha_2 A_c + \alpha_3 X_{pt} + \alpha_1 V_{ct} + W_{ct} \\ &= \alpha_1\varphi_1 P_{ct-1} + \alpha_1\varphi_2\gamma_1 C_{t-1} + \alpha_1\varphi_2\gamma_2\theta_{pt} + \alpha_1\varphi_2\gamma_3 S_p + (\alpha_1\varphi_2\gamma_5 + \alpha_2)A_c \\ &\quad + (\alpha_1\varphi_2\gamma_4 + \alpha_3)X_{pt} + \alpha_1\varphi_2 L_{ct} + \alpha_1 V_{ct} + W_{ct} \\ &= m_0 P_{ct-1} + m_1 C_{t-1} + m_2\theta_{pt} + m_3 S_p + m_4 A_c + m_5 X_{pt} + \varepsilon_{ct}. \end{aligned} \tag{6}$$

In this model, the child's educational performance in time t depends on her performance in the previous period, her cultural capital, parents' active investments in cultural capital, passive exposure to cultural capital, academic

[5] Lareau (2003, p. 238) summarizes some of her key findings as follows: "In these [middle class] families, parents actively fostered and assessed their children's talents, opinions, and skills. They scheduled their children for activities. They reasoned with them. They hovered over them and outside the home they did not hesitate to intervene on the children's behalf. They made a sustained and deliberate effort to stimulate children's development and to cultivate their cognitive and social skills." Lareau also argues that the propensity to invest in children, and beliefs about returns to investments, varies by social class background. Below, we discuss how our model accommodates this idea.

ability, and parental resources, as well as a term capturing luck, ε_{ct}.[6] The weight of each component is captured by the parameter m ($m = 0, \ldots, 5$). No one knows the true values of the parameters m (i.e., the values that maximize the child's educational performance), but parents have beliefs about all of them originating in past experiences and socialization (Haller 1982; Kerckhoff 1989). Our model thus states that parents differ in the extent to which they believe that the child's past performance, her cultural capital, parents' own investments in cultural capital, and other factors affect their child's educational performance. We believe these assumptions are in line with cultural reproduction theory. Given the available information and their beliefs about m, parents must choose how much of their stock of cultural capital (S) they wish to invest (θ) in each time period. We assume that parents seek to maximize utility; that is, they wish to make the optimal investment in each period given their beliefs and resources. We write the objective function that parents want to maximize in each time period:

$$\mu P_{ct} - c(\theta_{pt}). \tag{7}$$

The objective function has two components that reflect the benefits and costs of investing cultural capital in the child's educational performance. The parameter μ captures altruism (although all parents care about their child's educational performance, some care more than others) and parents' beliefs about the importance of educational performance relative to other factors that might affect their child's socioeconomic outcomes.[7] The term $c(\theta_{pt})$ is a cost function: it captures the costs associated with investing in the child's cultural capital. Costs principally include time and resources that could have been used for other purposes (e.g., investments in other types of skills).

How do parents decide how much of their cultural capital to invest in each time period? Bourdieu provides no answer to this question, and we need to make several assumptions in order to provide one. Our first assumption is that, given their beliefs about the values of m, parents choose the optimum investment, θ^*_{pt}, by finding the value of θ_{pt} that maximizes the objective function described in equation (7). In other words, we assume that parents choose whatever amount of investment they think will yield the highest return for a given cost. Our second assumption is that $\partial c_c(\theta_p)/\partial\theta_p$ is greater than zero. This means that parents incur greater costs, the greater their active investment in the child's cultural capital, or, put differently, high investments are

[6] The error term in eq. (6) is given by $\varepsilon_{ct} = \alpha_1\varphi_2 L_t + \alpha_1 V_t + W_t$.

[7] Some families may use means other than education to promote social reproduction (e.g., social connections or money). Families may also invest in other types of skills, e.g., social skills, or simply in making their child happy. Our model focuses on parents' investments in cultural capital, and investments in other types of skills enter our model through the cost function that is described next.

more costly than low investments. Our third assumption is that parents' relative cost of investing in cultural capital decreases with the size of their overall stock of cultural capital, S. This means that it is less costly for parents who have a lot of cultural capital to invest in their child's cultural capital compared with parents who have little cultural capital. Combining these assumptions, and letting the term $h\theta$ capture our third assumption that the relative cost of investing in cultural capital decreases when the stock of cultural capital S increases (and where h is smaller, the larger is the stock of parental cultural capital), the optimum investment at time t is

$$\theta^*_{pt} = \frac{\mu \hat{m}_{2t}}{h}. \tag{8}$$

Here, $\hat{m}_{2t}$ is parents' belief at time t in the return (in terms of the child's educational performance) to active investment in the child's cultural capital. Equation (8) shows that the optimum investment at time t is given by the combination of parents' beliefs about the returns to investing in cultural capital $\hat{m}_{2t}$ and their altruism μ weighted by the cost of making the investment, which, as noted, is smaller for parents with a greater stock of cultural capital. In other words, the optimum investment is the one that reconciles parents' expectations about which investment will generate the highest return, how much they care about their child's educational performance, and how costly it is for them to make the investment. It also follows from our model that

$$\frac{\partial \theta^*_{pt}}{\partial S_p} > 0; \quad \frac{\partial \theta^*_{pt}}{\partial \mu} > 0; \quad \frac{\partial \theta^*_{pt}}{\partial \hat{m}_2} > 0;$$

that is, parents invest more when they have a greater stock of cultural capital, when they care more about their child's educational performance, and when they believe that investing in their child's cultural capital has a bigger payoff in terms of educational performance. We believe these assumptions are consistent with Bourdieu's idea that cultural capital is principally a means for those who possess cultural capital to promote social reproduction.

Finally, we need to consider how parents' beliefs about the returns to cultural capital, $\hat{m}_2$, evolve over time. Bourdieu does not provide any insights into how parents might change their beliefs about the usefulness of investments in cultural capital. Instead, we draw on research that suggests that parents use information on the outcomes of past investments to decide on current investments (Behrman 1997; Ayalew 2005; Todd and Wolpin 2007). This research emphasizes that a feedback mechanism exists from the child's behavior to parents' beliefs and investments. Building on this research, we propose in our model that parents use new information about the child's educational performance from grades and test scores to inform their

belief about the returns to investing in cultural capital. We implement this idea by assuming that parents update their belief according to the following rule:

$$\hat{m}_{2t} = \hat{m}_{2t-1}\left[1 + \pi\left(\frac{P_{ct-1} - P_{ct-2}}{\theta_{t-1} - \theta_{t-2}}\right)\right]. \tag{9}$$

Equation (9) captures the idea that if increases (decreases) in cultural capital investments, θ, between one period and the next are associated with increases (decreases) in educational performance (i.e., the sign of $\theta_{t-1} - \theta_{t-2}$ is the same as the sign of $P_{ct-1} - P_{ct-2}$), then parents increase their belief about the size of m_2, whereas, if they have opposite signs, their belief declines. In other words, if investing in cultural capital seems to pay off, parents strengthen their belief in the value of such investments; otherwise, their belief diminishes. The degree to which their belief increases or decreases for a given change in performance, relative to a change in investment, is captured by the adjustment parameter, π. Below, we provide illustrative empirical evidence that parents adjust their investments in cultural capital in light of the outcomes of past investments.

Figure 1 provides a summary of the main parts of our dynamic model. For ease of presentation, we do not show either the "luck" (or error) terms of our equations or the effects of the X variables, and we show the underlying relationships at only two points in time. The notation in the figure is the same as in the equations. The underlying logic of the model is very straight-

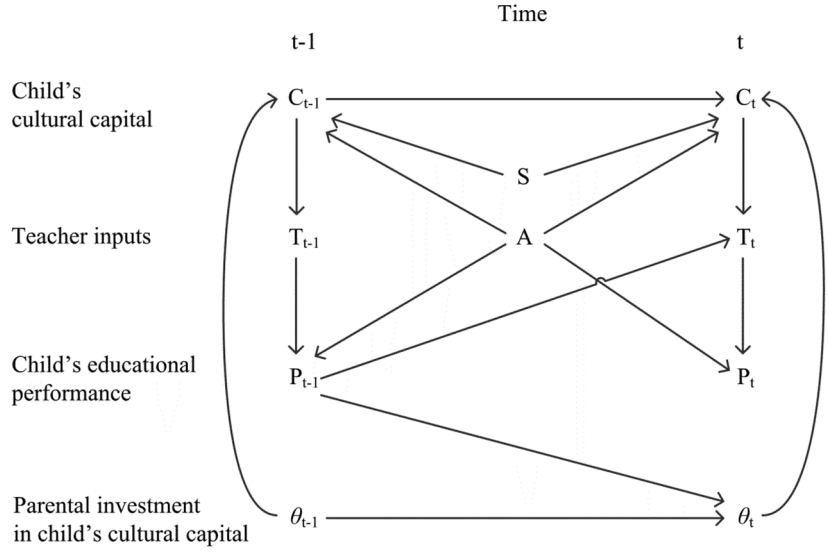

FIG. 1.—Dynamic model of cultural reproduction

forward. Parents' investment in their child's cultural capital helps to determine the child's cultural capital. This influences teachers' perceptions of (and inputs in) the child, which, in turn, affects the child's educational performance. The child's educational performance leads parents to update their investment, and this new investment, together with existing cultural capital, shapes the child's later cultural capital, which affects teacher perceptions, and so on. This process continues throughout the period of compulsory schooling, eventually leading to final educational attainment, which affects socioeconomic success.

IMPLEMENTING OUR MODEL

In the remainder of the article, we illustrate the usefulness of our model for past and future research on cultural reproduction. First, we argue that our model helps to organize results from previous research that has sought to test cultural reproduction theory. Second, we argue that our model can be used to improve interpretations of results from a wide range of research that uses cultural reproduction theory to explain persisting socioeconomic differences in educational success (e.g., differences by race and social class). Third, we use data from the NLSY-CYA to provide an illustrative test of the assumption in our model that the processes through which children accumulate cultural capital from parents and convert this capital into educational performance are dynamic.

Organizing Previous Research

We begin by using our theoretical model to organize previous empirical research on cultural capital and educational success. Table 1 summarizes the operational measures of cultural capital used in each study in our review (distinguishing indicators of highbrow culture, reading climate, educational resources, cultural communication, and extracurricular activities), the main finding, and the country in which the study was conducted. The table shows that previous empirical research can be classified into three groups focusing on, respectively, (a) the link between parents' and children's cultural capital, (b) the direct effect of cultural capital on educational success, and (c) the ways in which cultural capital is converted into educational success.

From the perspective of our model, research that addresses *the transmission of cultural capital from parents to children* seeks to identify the parameters β_1 and β_2 in equation (1). This research includes indicators of parents' active investments in cultural capital (cultural activities, cultural communication, etc.) and their passive cultural capital (cultural objects, books, etc.) and relates these measures to children's cultural capital. Most studies find that there is a positive correlation between parents' cultural capital (both

TABLE 1
SUMMARY OF RESULTS FROM PREVIOUS RESEARCH

Study	Dimension of Cultural Capital	Main Result	Country
Transmission of cultural capital from parents to children:			
Kraaykamp (2003)	R	Positive effect	Netherlands
Georg (2004)	H/R/C	Positive effect	Germany
Kraaykamp and van Eijck (2010)	H	Positive effect	Netherlands
Yaish and Katz-Gerro (2012)	H	Positive effect	Israel
Cultural capital and educational success:			
Outcome—academic achievement:*			
DiMaggio (1982)	H	Positive effect	United States
De Graaf (1988)	R	Positive effect	Germany
Katsillis and Rubinson (1990)	H	No effect	Greece
Downey (1995)	H/E	Positive effect	United States
Sullivan (2001)	H	Positive effect	United Kingdom
Dumais (2002)	H	Positive effect	United States
Eitle and Eitle (2002)	H/E	Mainly positive effect	United States
Cheung and Andersen (2003)	R	Positive effect	United Kingdom
Barone (2006)	H/C	Positive effect	25 countries
Lee and Bowen (2006)	C	Positive effect	United States
Van de Werfhorst and Hofstede (2007)	H	Positive effect	Netherlands
Bodovski and Farkas (2008)	H/R/X	Positive effect	United States
Cheadle (2008)	H/C	Positive effect	United States
Jæger (2009)	H/E/C	Positive effect	Denmark
Wildhagen (2009)	H	Positive effect	United States
Covay and Carbonaro (2010)	X	Positive effect	United States
Flere et al. (2010)	H	Positive effect	Slovenia
Tramonte and Willms (2010)	H/C	Positive effect	28 countries
Jæger (2011)	H/R/X	Positive effect	United States
Byun, Schofer, and Kim (2012)	H	Positive effect	South Korea
Xu and Hampden-Thompson (2012)	H/C/E	Positive effect	22 countries
Gaddis (2013)	H/R	Positive effect	United States

Outcome—educational attainment:†			
DiMaggio and Mohr (1985)	H	Positive effect	Denmark
De Graaf (1986)	H/R	Mainly positive effect	Netherlands
Teachman (1987)	E	Positive effect	United States
Graetz (1988)	H	Positive effect	Australia
Kalmijn and Kraaykamp (1996)	H	Positive effect	United States
Aschaffenburg and Maas (1997)	H	Positive effect	United States
Roscigno and Ainsworth-Darnell (1999)	H/E	Positive effect	United States
De Graaf, de Graaf, and Kraaykamp (2000)	H/R	Positive effect	Netherlands
Georg (2004)	H/R	Positive effect	Germany
Kaufman and Gabler (2004)	X	Positive effect	United States
Jæger and Holm (2007)	H/R	Positive effect	Denmark
Evans et al. (2010)	R	Positive effect	27 countries
Yamamoto and Brinton (2010)	H/R	Positive effect	Japan
Effect of cultural capital on teachers' perceptions:‡			
Farkas et al. (1990)	Appearance, absenteeism, disruptiveness, work habits	Positive effect of student SES on teacher rating of classroom skills	United States
Takei, Johnson, and Clark (1998)	X	No effect of cultural capital on teacher rating of student's classroom skills	United States
Roscigno and Ainsworth-Darnell (1999)	H/E	Teacher perceptions of student's academic skills mediates some of the effect of cultural capital on academic achievement	United States
Dumais (2006)	H	Positive effect of cultural capital on teacher ratings of student's language and math skills; however, effect for low-SES children only	United States
Bodovski and Farkas (2008)	H/R/X	No effect of index of "concerted cultivation" on teacher rating of student's academic skills	United States
Wildhagen (2009)	H	No effect of cultural capital on teacher rating of student's classroom skills	United States

TABLE 1 (*Continued*)

Study	Dimension of Cultural Capital	Main Result	Country
Dumais, Kessinger, and Ghosh (2012)	Parental involvement (volunteering)	Effect of parental involvement on teacher rating of children's academic skills varies by parental SES	United States
Lareau (1987, 1989, 2003); Lareau and Horvat (1999)	X	(1) Parents use extracurricular activities to foster cultural capital in children and (2) parents use cultural capital to promote children's success in school; (3) variations in effects by SES and race	United States

NOTE.—Type of cultural capital measure: H = highbrow culture, E = educational resources/objects, C = cultural communication/interaction/involvement; X = extracurricular activities; R = reading behavior/climate.

* GPA, test scores, etc.

† Years of schooling, college completion, etc.

‡ Teachers' perceptions of children's academic ability.

active investments and passive cultural capital) and children's cultural capital, thereby establishing that, as we argue in our model, cultural capital is passed on from parents to children ($\beta_1 > 0$, $\beta_2 > 0$).

Research that addresses *the direct effect of cultural capital on educational success* (which makes up the majority of existing empirical research) analyzes the effect of cultural capital on different measures of educational achievement. In the terminology of our model, this research can be conceptualized as directly identifying σ_1 in equation (2) (the positive effect of cultural capital on educational performance) or, if the outcome variable is final educational attainment, indirectly identifying this effect through η_1 (the effect of educational performance on final educational attainment that is attributable to cultural capital). Table 1 shows that most studies report a positive correlation between cultural capital and educational success, thereby suggesting that embodied cultural capital is converted into educational performance and attainment.

Finally, research that addresses *the effect of cultural capital on teachers' perceptions of children* deals with the mechanisms that lead to the expected positive sign of σ_1 in equation (2). After controlling for observable academic ability, some studies find that indicators of children's cultural capital are positively correlated with teachers' perceptions of children's academic and social skills. This research corroborates the assumption in cultural reproduction theory and in our model that the reason σ_1 is positive—even after taking children's actual academic ability into account—is due to systematic misrecognition of cultural capital as academic ability.

Our review of previous research on cultural capital and educational success from the perspective of our model shows that this research has addressed, and found empirical support for, some of the core hypotheses in cultural reproduction theory. However, our review also highlights that the studies summarized in table 1 test parts of Bourdieu's theory rather than the whole. To our knowledge, no research has attempted to analyze the theory of cultural reproduction in its structural form, that is, specifying and testing all the causal pathways through which cultural capital leads to educational and socioeconomic success. Again borrowing terminology from economics, all of the studies listed in table 1 are "reduced form" in the sense that they test only a subset of empirical implications of the theory of cultural reproduction, in particular the implication that cultural capital has a direct positive effect on educational success. And although this research has yielded important insights into the link between cultural capital and educational success, at present we have no empirical evidence on whether parental investments in cultural capital in childhood actually lead to socioeconomic success in adulthood (i.e., to social reproduction). An advantage of our structural model is that it could be used as a starting point for analyzing the entire

causal chain through which investments in cultural capital lead to social reproduction.

Better Interpretations of Past Research

In addition to organizing results from previous research, our model provides a new framework for interpreting results from research that has used cultural reproduction theory to explain persisting socioeconomic differences in educational outcomes. In what follows, we use our model to reinterpret findings from three influential lines of research that have analyzed (*a*) black-white differences in educational outcomes, (*b*) social class differences in educational outcomes, and (*c*) institutional differences in returns to cultural capital. The objective of this section is to demonstrate that our model accommodates a wide range of proposed explanations of why cultural capital might account for socioeconomic differences in educational outcomes.

Black-white differences.—Drawing on Bourdieu, several studies argue that black-white differences in educational attainment in the United States are partly mediated by cultural capital (Farkas et al. 1990; Farkas 1996; Kalmijn and Kraaykamp 1996; Lareau and Horvat 1999; Roscigno and Ainsworth-Darnell 1999). Explanations of why cultural capital mediates these differences build on empirical observations that blacks are (1) less likely to participate in highbrow cultural activities than whites (DiMaggio and Ostrower 1990; Kalmijn and Kraaykamp 1996), (2) less likely to organize cultural trips or extracurricular activities for their children (Roscigno and Ainsworth-Darnell 1999; Charles, Roscigno, and Torres 2007), (3) more mistrustful toward schooling (Lareau and Horvat 1999), and (4) less likely to convert cultural capital (if possessed) into educational performance (Roscigno and Ainsworth-Darnell 1999). Our model accommodates all of these explanations since black-white differences in educational attainment may arise if (1) blacks possess less cultural capital than whites (i.e., they have different values of S in eq. [1]), (2) they are less likely to invest this cultural capital (i.e., even for a fixed S, θ is lower among blacks than whites), (3) they have weaker beliefs than whites that cultural capital yields a return (i.e., different values of m_2 in eq. [6]), or (4) their actual rate of return to cultural capital is lower than that of whites (i.e., a lower value of σ_1 in eq. [2] even for constant A). In our model, all of these factors lead to different levels of parental investment in cultural capital (eq. [8]) and, in the end, different levels of educational attainment, as has been reported in empirical research.

Social class differences.—Lareau and colleagues argue that cultural capital mediates social class inequalities in educational success (Lareau 1987, 1989, 2003; Lareau and Horvat 1999; Calarco 2014). The argument in this literature is that middle-class parents engage in *concerted cultivation*; that is, they organize children's leisure time activities with the intention of in-

culcating skills and behaviors in children that promote future socioeconomic success. In addition to organizing activities outside the home, middle-class parents engage children in conversations and discussion, teaching them to be analytical, reasoning, and argumentative. Working-class parents, by contrast, are much less likely to engage in these activities and to find them useful. All these elements speak directly to our dynamic model of parental investments, which can be used to analyze how social class differences in child-rearing practices and investments lead to educational inequalities. Class differences in the stock of cultural capital are captured in different average values of S. Investments in cultural capital with extracurricular activities purchased in the market means, in our terms, that θ_t may exceed S.[8] That middle-class parents have stronger beliefs that cultural capital matters for educational success would be captured in higher values of m_2, and this belief might be updated according to the rule described in equation (9). Lareau and colleagues also argue that middle-class families tend to be more involved than working-class parents in their children's schooling, for example, by volunteering at school events or by requesting special treatment for their children. In our model, we may think of these practices as investments over and above those made directly in the child's cultural capital (eq. [5]) that either affect teachers' perceptions of the child (resulting in a higher value of φ_2 in eq. [4]) or, if parents are successful in obtaining special treatment, lead to higher teacher inputs in the child (a higher value of α_1 in eq. [4]). Both strategies lead to higher educational performance in our model and help to explain how cultural capital may mediate social class differences in educational success.

Institutional differences.—A final example of how our model can be used to improve the interpretation of results from previous research relates to DiMaggio's (1982) influential cultural mobility model. DiMaggio argued that cultural capital may be a means of upward mobility for children from disadvantaged socioeconomic backgrounds. The reason cultural capital is particularly beneficial for children from disadvantaged backgrounds is that they tend to populate educational settings in which there is little cultural capital, and, compared to children from more advantaged backgrounds, they face less competition when attempting to show off their cultural capital. This model turns Bourdieu on his head by suggesting that returns to cultural capital, if possessed, are higher for those from less advantaged backgrounds than for those from more advantaged backgrounds (DiMaggio

[8] The strategy of purchasing extra inputs (extracurricular activities, tutoring, etc.) to supplement in-house investments in cultural capital is particularly relevant in many non-Western contexts. For example, research shows that in Japan and South Korea parents invest extensively in "shadow education" to promote children's educational success (Yamamoto and Brinton 2010; Lee and Rouse 2011; Byun, Schofer, and Kim 2012).

1982; Aschaffenburg and Maas 1997; de Graaf, de Graaf, and Kraaykamp 2000). DiMaggio's model is inconsistent with Bourdieu's ideas but can be accommodated within our model in which it implies, holding constant resources, investments, and beliefs (i.e., S, θ, and m_2), that returns to cultural capital (via φ_2 and α_1) are higher for children from disadvantaged socioeconomic backgrounds than for those from advantaged backgrounds. Our model does not address the question why returns to cultural capital might be different for children from different socioeconomic backgrounds, but it could be extended to include such factors. For example, variation in φ_2 and α_1 by socioeconomic background could arise from differences across schooling environments in the mean level of cultural capital in these environments. In that case, returns might be higher in environments characterized by low levels of cultural capital because less cultural capital is needed to stand out relative to one's peers. In our model we could capture this scenario by extending equation (4) to include $\overline{C}$, where $\overline{C}$ is the mean level of cultural capital in the school or class context.

DYNAMIC ANALYSIS OF CULTURAL REPRODUCTION

We have argued that our model can be used to organize findings from research on cultural capital and to improve the interpretation of a diverse body of research that has used the theory of cultural reproduction to account for socioeconomic differences in educational success. In this final section we provide empirical evidence on the dynamic nature of cultural capital investments. Our aim is to illustrate three aspects of our model that have not been addressed in previous research: (1) parents invest continuously in children's cultural capital, (2) children's cultural capital affects their educational performance, and (3) parents modify investments in cultural capital in light of the outcomes of previous investments. We use longitudinal data from the NLSY-CYA and estimate empirical approximations of equation (5) (describing the process through which the child accumulates cultural capital over time) and equation (6) (describing the process through which cultural capital is converted into educational performance). We also provide tentative empirical evidence that parents update their beliefs about returns to investments in cultural capital on the basis of the outcomes of past investments (as described by eq. [9]).

Data and Variables

We use data from NLSY-CYA, a panel study conducted biannually between 1986 and 2010, which collects information on all biological children of female participants in the National Longitudinal Survey of Youth 1979 (see CHRR 2006*a*, 2006*b*). We use the NLSY-CYA because, unlike other

available data sets, it includes longitudinal information on cultural capital for NLSY 1979 mothers and for children age 10 and older. Our indicators of children's cultural capital are mainly collected from children themselves, and, consequently, we focus on children 10–14 years old, for most of whom we have three observations. The NLSY-CYA also includes longitudinal information on children's academic achievement and socioeconomic background. Unfortunately, the NLSY-CYA does not include direct measures of teacher inputs in children, a point to which we return below.

We include four types of variables to capture the core ingredients in our theoretical model. These variables measure (1) the child's cultural capital, (2) parents' cultural capital, (3) the child's educational performance, and (4) socioeconomic background and demographic controls. Table A1 presents detailed information and summary statistics for all variables included in the analyses.

Child's cultural capital.—Previous research has used empirical indicators of highbrow culture, reading behavior, extracurricular activities, cultural communication, and educational resources to capture different aspects of cultural capital (see table 1 for a summary). In the NLSY-CYA we are limited to including indicators of reading behavior when constructing a measure of the child's cultural capital (C in eqq. [1], [2], and [4]–[6]).[9] Specifically, we construct a composite index that is composed from three items: (1) the mother's report of how much the child reads for enjoyment, (2) whether the child reports that she typically reads a book or magazine not assigned at school, and (3) whether the child reports that she reads books or magazines for fun on a usual summer day. This index, which captures the child's reading habits, is constructed by first rescaling the indicator of how much the child reads for enjoyment to lie in the range 0–1 and then summarizing the child's total score on the three indicators included in the index. In the empirical analysis, we rescale the index to lie in the range 0–1.

Parents' cultural capital.—We construct two indicators of parents' cultural capital. The first indicator, *active cultural investments*, is a composite index intended to capture how much parents actively invest in transmitting their cultural capital to the child (θ in eqq. [1], [5], and [6]). It is made up of five items capturing (1) how often in the last year a family member has taken the child to any type of museum, (2) how often in the last year a family member has taken the child to any type of musical or theatrical performance, (3) how many books the child has, (4) whether the family encourages the child to start and keep doing hobbies, and (5) whether the child gets special lessons or does extracurricular activities. The index, which com-

[9] Keeping this limitation in mind, we note that, among the different aspects of cultural capital that have been included in previous research, reading behavior is the aspect that has been found to be most strongly correlated with educational success (e.g., de Graaf et al. 2000; Jæger 2009; Gaddis 2013).

bines indicators of highbrow cultural participation, reading climate, and extracurricular activities, summarizes parents' response to all five items, and it is rescaled to lie in the range 0–1. The second indicator, *passive cultural capital*, is intended to capture the influence of cultural capital in the home, net of parents' active investments (S in eqq. [1], [5], and [6]). We use two indicators to create this index: (1) whether the family gets a daily newspaper and (2) whether there is a musical instrument in the home that the child can use. The index summarizes parents' responses to these two questions, and it is rescaled to lie in the range 0–1.

Educational performance.—The NLSY-CYA includes two time-varying indicators of the child's academic achievement, the Peabody Individual Achievement Tests (PIAT) in math and reading recognition. We use these measures as proxies for educational performance (P in eqq. [2]–[4] and [6]). We use percentile scores for each PIAT test, normed to children's age.

Controls.—We include a range of socioeconomic and demographic control variables (X in eqq. [1]–[6]), which are described in appendix table A1.

Analytical Strategy

We use linear dynamic panel data (DPD) models to estimate approximations of equations (5) and (6) in the theoretical model. DPD models are a variant of traditional panel regression models in which present values of the dependent variable are treated as dynamic in the sense that they may depend on past values of the dependent variable, as well as on present and past values of explanatory variables (e.g., Arellano and Bond 1991; Arellano and Bover 1995; Blundell and Bond 1998). The models we estimate are "reduced form" because they involve statistical estimation of relationships that are derived from our structural model. We interpret the empirical results in light of our underlying structural model that specifies the mechanisms and behaviors that are assumed to generate these results. Like standard panel regression models, DPD models exploit longitudinal information in the panel data to control for the effect of unobserved individual characteristics that affect the outcomes of interest.

We estimate the following reduced form DPD model for the child's cultural capital (eq. [5]):

$$C_{i,t} = \tilde{\gamma}_1 C_{i,t-1} + \tilde{\gamma}_2 \theta_{i,t} + \tilde{\gamma}_3 S_{i,t} + \tilde{\gamma}_4 X_{i,t} + T + u_i + e_{1i,t}, \qquad (10)$$

where $C_{i,t}$ is the child's cultural capital (reading behavior) and where i indexes individuals ($i = 1, \ldots, N$) and t indexes time ($t = 1986$–2010). The $\tilde{\gamma}$ are parameters to be estimated, and the tildes are used to indicate that these are our empirical estimates of the parameters of equation (5). The pa-

rameter u_i is a child-specific effect that captures time-invariant unobserved characteristics that affect cultural capital.[10] In this model the child's cultural capital in period t depends on her cultural capital in the previous period (thus capturing the idea that cultural capital accumulated in the past affects cultural capital in the present), parents' active cultural investments and passive cultural capital in the present period (θ and S, respectively), and parents' resources in the present period (X). The model also includes dummies for survey year T (1986–2010) to capture time trends and an error term e_1.

We estimate the following reduced form DPD model for the child's educational performance (eq. [6]):

$$P_{i,t} = \tilde{m}_0 P_{i,t-1} + \tilde{m}_1 C_{i,t-1} + \tilde{m}_2 \theta_{i,t} + \tilde{m}_3 S_{i,t} + \tilde{m}_5 X_{i,t} + T + u_i + e_{2i,t}, \quad (11)$$

where the child's performance on the PIAT math and reading recognition tests in period t, $P_{i,t}$, depends on her performance and cultural capital in the previous period, parents' active investments in cultural capital and passive cultural capital in the home, and parents' resources. We should note that this reduced form model is an incomplete representation of our structural model because we do not observe teacher inputs in the child in the NLSY-CYA data. Consequently, rather than estimating the effect of the child's cultural capital on teacher inputs (which is the "catalyst" through which cultural capital is assumed to be converted into educational performance in our model), we estimate $\tilde{m}_1$, which captures the combined effect of φ_2 (the effect of cultural capital on teacher inputs) and α_1 (the effect of teacher inputs on educational performance).

Finally, we estimate reduced form DPD models to substantiate our assumption that parents adjust their investments in cultural capital in light of the outcomes of past investments (described in eqq. [7]–[9]). We estimate the following model:

$$\begin{aligned} \theta_{i,t} = {} & \tilde{\tau}_1 \theta_{i,t-1} + \tilde{\tau}_2 \theta_{i,t-2} + \tilde{\tau}_3 P_{i,t-1} + \tilde{\tau}_4 (\theta_{i,t-2} \times P_{i,t-1}) + \tilde{\tau}_5 S_{i,t} \\ & + \tilde{\tau}_6 X_{i,t} + T + u_i + e_{3i,t}, \end{aligned} \quad (12)$$

where $\theta_{i,t}$ is parents' active cultural investments in the child in period t.[11] Parents' active cultural investment in period t depends on their investment in the previous period ($\theta_{i,t-1}$), their investment two periods ago ($\theta_{i,t-2}$), the

[10] Our theoretical model also includes academic ability, A_c (eq. [5]). We control indirectly for academic ability via u_i, which, among other factors, also captures the effect of academic ability on cultural capital.

[11] Note that our indicators of parents' investments in cultural capital cover the period when the child was 6–14 years old (and in some cases 0–14 years old; see table A1), which means that we have more repeated observations of parents' investments than observations of children's cultural capital.

child's educational performance in the previous period ($P_{i,t-1}$), and an interaction effect between parents' investment two periods ago and the child's educational performance in the previous period (S, X, T, u, and e are the same as above). The $\tilde{\tau}$ are parameters to be estimated. The idea in this model is to test whether, as stipulated in equation (9), parents adjust their beliefs about the returns to cultural capital, and thus their active cultural investments in the present, on the basis of the outcomes of past investments. If parents adjust their investments, the coefficient on the interaction term, $\tilde{\tau}_4$, should be positive. Parents know how much they invested two periods ago ($\theta_{i,t-2}$), they observed the outcome of this investment in the child's educational performance in the previous period ($P_{i,t-1}$), and if returns to past investments are positive, parents should update their beliefs so as to invest more in the present ($\theta_{i,t}$). Thus, the coefficient on the interaction effect captures the adjustment in parents' active cultural investments in the present that follows from a combination of investments two periods ago and academic performance one period ago.

We estimate the parameters of the DPD models using the one-step system generalized method of moments estimator implemented in the Stata ado xtabond2 (Roodman 2009). Finally, because the NLSY-CYA includes several children from the same family, we adjust all standard errors for clustering of respondents within families.

Results

Table 2 presents results from reduced form DPD regressions of the child's cultural capital and the child's score on the PIAT math and reading recognition tests. In all models, we use data on three observations for each child collected between age 10 and 14.

Results from the DPD model for the child's cultural capital are consistent with the predictions of our theoretical model. We find that the child's cultural capital (measured by reading habits) in period t depends on her cultural capital in the previous period ($\tilde{\gamma}_1 = .29$, $P < .001$), thus indicating that the child accumulates cultural capital over time. Net of this cumulative effect, we also find a positive and statistically significant effect of parents' active cultural investments in the present period on the child's cultural capital ($\tilde{\gamma}_2 = .15$, $P < .001$) and a positive effect of parents' passive cultural capital ($\tilde{\gamma}_3 = .04$, $P < .01$). These results are in line with our argument that the process through which the child accumulates cultural capital from parents is dynamic, and, moreover, parents' active cultural investments and the child's passive exposure to cultural capital both contribute to the intergenerational transmission of cultural capital.

We now turn to the results for the child's educational performance, as described in equation (6) in our theoretical model. Table 2 shows results from

TABLE 2
RESULTS FROM DPD REGRESSIONS OF CHILD'S CULTURAL CAPITAL AND PIAT MATH AND READING RECOGNITION TEST SCORES

Dependent Variable	Child's Cultural Capital	Math	Reading Recognition
Child:			
Lagged academic achievement . . .		.13	.30
		(.03)***	(.03)***
Lagged cultural capital	.29	4.52	6.31
	(.06)***	(1.15)***	(1.12)***
Parents:			
Active cultural investments	.15	10.64	8.42
	(.03)***	(2.37)***	(2.19)***
Passive cultural capital	.04	4.66	4.12
	(.02)**	(1.08)***	(1.06)***
Controls	Yes	Yes	Yes
N	4,325	4,430	4,443

NOTE.—Estimator is one-step system generalized method of moments. Models also include dummy variables for survey year (1986–2010). SEs (in parentheses) are corrected for clustering of respondents within families. See table A1 for list of controls.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

reduced form DPD regressions of the child's math and reading ability on the child and parents' cultural capital and on the controls. Results are very similar for the two measures of academic achievement. In addition to test scores in the present period depending on the test score in the previous period (reflecting a cumulative effect), math and reading ability in the present period depend on the child's cultural capital in the previous period ($\tilde{m}_{1\text{math}} = 4.52$, $\tilde{m}_{1\text{reading}} = 6.31$; both $P < .001$) and on parents' active cultural investments in the present period ($\tilde{m}_{2\text{math}} = 10.64$, $\tilde{m}_{2\text{reading}} = 8.42$; both $P < .001$) and passive cultural capital ($\tilde{m}_{3\text{math}} = 4.66$, $\tilde{m}_{3\text{reading}} = 4.12$; both $P < .001$). Keeping the limitations of the NLSY-CYA data in mind, we find that these empirical findings are consistent with our theoretical model. Since we do not observe teacher inputs, we interpret the positive effect of the child's cultural capital on educational performance as capturing the outcome of a two-stage process in which cultural capital is converted into teacher inputs, which are then converted into educational performance. In this regard, our reduced form estimates capture the "rate of return" to cultural capital in terms of educational performance, as expressed in our model.

Finally, table 3 presents results from reduced form DPD models of parents' active cultural investments. In equation (12) we stipulate that, in addition to other factors, parents' active cultural investments in the present depend on the outcomes of their investments two periods ago, manifested in the child's educational performance one period ago. If parents adjust their

TABLE 3
RESULTS FROM DPD REGRESSIONS OF PARENTS' ACTIVE CULTURAL INVESTMENTS

Measure of Educational Performance	Math	Reading Recognition
Lagged active cultural investments $(t - 1)$	.21	.22
	(.02)***	(.02)***
Lagged active cultural investments $(t - 2)$	−.10	−.12
	(.06)	(.07)
Lagged academic achievement:		
Lagged PIAT math $(t - 1)$	−.00	
	(.00)***	
Lagged PIAT reading recognition $(t - 1)$		−.00
		(.00)***
Interaction effect:		
Lagged active cultural investments $(t - 2) \times$ lagged PIAT math $(t - 1)$	.004	
	(.00)***	
Lagged active cultural investments $(t - 2) \times$ lagged PIAT reading recognition $(t - 1)$ . . .		.004
		(.00)***
Passive cultural capital	.09	.09
	(.01)***	(.01)***
Controls	Yes	Yes
N	10,059	10,044

NOTE.—Estimator is one-step system generalized method of moments. Models also include dummy variables for survey year (1986–2010). SEs (in parentheses) are corrected for clustering of respondents within families. See table A1 for list of controls.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

investments in cultural capital on the basis of the outcomes of past investments, we expect a positive coefficient on the interaction term between active cultural investments two periods ago and educational performance one period ago. Table 3 shows results from two model specifications that use, respectively, PIAT math and reading recognition as the indicators of educational performance. As hypothesized, and net of other factors, we find a positive and statistically significant coefficient on the interaction terms $\theta_{i,t-2} \times P_{i,t-1}$ in both models ($\tilde{\tau}_4 = .004$, $P < .001$). Although our approach is a crude approximation of the theoretical mechanism we propose, these results indicate, as implied by equation (9), that parents invest more in cultural capital in the present if higher investments in the past yielded higher educational performance.[12] In other words, our results are consis-

[12] The main effect on parents' active investments two periods ago is not significant, while the main effect on the child's educational performance is negative and significant. Taken together with the positive interaction term, this suggests that parents' investments

tent with the idea that parents update their beliefs about the returns to cultural capital on the basis of the outcomes of past investments. Naturally, more research, including direct testing, is needed to determine the extent to which parents adjust investments in cultural capital.

DISCUSSION

This article was motivated by what we regard as a discrepancy between the prominent position of the theory of cultural reproduction in social stratification research and its conceptual and empirical validity. There is widespread agreement that Bourdieu's writings on cultural reproduction are unclear with regard to core concepts and mechanisms. We argue that this lack of clarity has had a detrimental impact on research on cultural reproduction, which is characterized by little consensus on how to conceptualize and measure cultural capital and how to interpret empirical correlations between cultural capital and educational success. At present, we are not convinced that the literature provides a credible answer to Bourdieu's original question: Does cultural capital promote social reproduction?

Instead of debating the exact meaning of Bourdieu's original thoughts, we present a formal theoretical model of cultural reproduction that encapsulates what we believe to be the core ideas in his theory. This structural model brings together Bourdieu's ideas and may be used as a basis for organizing and interpreting results from previous research and as a conceptual starting point for future research. Our model describes the three components that make up the theory of cultural reproduction: how parents transmit their cultural capital to children, how children convert cultural capital into educational success, and how educational success promotes social reproduction. It extends Bourdieu's ideas by describing the mechanism through which parents invest in their children's cultural capital and the mechanism through which children convert cultural capital into educational performance. On the basis of a rational choice perspective, we also propose a flexible set of behavioral assumptions on the part of parents, children, and institutions that enables us to interpret the parameters in our structural model.

We use our theoretical model to interpret the results of existing empirical research and use NLSY-CYA data to illustrate the dynamic nature of cultural capital investments and their implications for children's educa-

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in their child's cultural capital remain unchanged if she performs poorly. If, following low parental investment, the child performs well, parents reduce their investment further, perhaps because it seems to be unnecessary to their child's educational success. But if, following relatively high parental investment, their child performs well, parents increase their subsequent investment because, as we argue, they interpret this to mean that investing in their child's cultural capital pays off.

tional performance. Our literature review suggests that results from previous research are mostly in line with cultural reproduction theory but also that research has yet to test the full implications of the theory and to identify the specific mechanisms through which cultural capital may lead to educational success. Results from our illustrative analysis of the NLSY-CYA data are consistent with the hypotheses that children accumulate cultural capital from parents, cultural capital has a positive effect on educational performance, and parents adjust their investments in cultural capital on the basis of the outcomes of past investments.

We believe that the main contribution of this article is to propose a new direction for research that uses the concepts of cultural reproduction and cultural capital to explain persisting intergenerational inequalities in socioeconomic outcomes. In our view, there is little doubt that the inequalities in socioeconomic outcomes that have been extensively documented in social stratification research are partly attributable to cultural factors in the family of origin. The challenge is how to conceptualize these cultural factors and the ways in which they operate and how to document their implications for patterns of intergenerational social mobility. We think Bourdieu's theory of cultural reproduction represents a starting point for such an investigation but is ultimately limited by its lack of clarity in several core dimensions.

A key advantage of our model is that it can be extended to accommodate a richer conceptual setup or new empirical insights. For example, our model assumes that parents have only one child. But how do parents allocate investments in cultural capital when they have more than one child? Related research shows that parents allocate resources to each child in the family on the basis of the expected costs and benefits of these allocations and on the basis of observable outcomes of past investments (Steelman and Powell 1991; Behrman 1997; Ayalew 2005). Lareau's (2003) qualitative study illustrates this point. In the Tallinger family—a white middle-class family with three boys—the parents allocate a disproportionate share of the family's resources to the oldest son, Garrett, whom they believe is the most gifted among the three children. We could extend our model to accommodate this situation by arguing that, when a family has more than one child and assuming that there is a limit on the family's resources, investment in children's cultural capital (given by θ_{ipt}, where i indexes children) will be proportional to parents' belief about each child's m_2 parameter. That is, parents will invest in proportion to how much return their investment is expected to yield, in terms of educational performance, for each child. Children who more effectively translate parental investments into educational performance will receive greater investment than will their brother or sister whose performance is less sensitive to parental investment. Future research should explore whether this type of logic applies in multichild households.

Another extension of our model might be to incorporate heterogeneity in returns to cultural capital. Our model assumes that the return to cultural capital in the form of educational performance, σ_1 (or, in the dynamic context, φ_2), is the same for all children. Yet, it may be that σ_1 varies systematically by institutional context or by socioeconomic factors. For example, Jæger (2011) found that returns to highbrow cultural capital (measured by frequency of going to museums and concerts) were higher for children from advantaged socioeconomic backgrounds than for those from less advantaged backgrounds. He argued that this difference in the rate of return to highbrow cultural capital might be due to different institutionalizations of cultural capital across schooling environments: children from advantaged backgrounds tend to be in schooling environments that appreciate familiarity with highbrow culture, while those from less advantaged backgrounds tend not to be in these environments. In a similar vein, Leopold and Shavit (2013) found that immigrants from the former Soviet Union in Israel receive a lower return to their cultural capital in Israeli schools than natives because they possess the "wrong" type of cultural capital that is not appreciated in mainstream education. In our model we could incorporate these types of heterogeneity by, for example, letting σ_1 in equation (2) be a function of a set of institutional or social characteristics. Indeed, many extensions of our model are possible, and we hope that future research will extend, modify, and test the model presented in this article and, in that process, provide a richer understanding of the ways in which cultural capital may contribute to social reproduction.

APPENDIX

TABLE A1
DESCRIPTIVE STATISTICS AND SUMMARY OF VARIABLES

Indicator	Response Category	Age Range	Mean/%	SD	*N**
Child's cultural capital:†			.56	.33	12,303
How often child reads for enjoyment	1 = never; 2 = several times a year; 3 = several times a month; 4 = several times a week; 5 = every day‡	6–14			
Child reads book or magazine after school	0 = no; 1 = yes	10–14			
Child reads books or magazines for fun on a summer day	0 = no; 1 = yes	10–14			
Parents' active cultural investments:§			.58	.18	12,153
How often in the last year child is taken to museum	1 = never; 2 = once or twice; 3 = several times; 4 = about once a month; 5 = about once a week or more often‡	3–14			
How often in the last year child is taken to concert/theater	1 = never; 2 = once or twice; 3 = several times; 4 = about once a month; 5 = about once a week or more often‡	6–14			
Number of books child has	1 = none; 2 = 1 or 2 books; 3 = 3–9 books; 4 = 10 or more books‡	0–14			
Family encourages child to take on hobbies	0 = no; 1 = yes	6–14			
Child gets special lessons/does extracurricular activities	0 = no; 1 = yes	6–14			
Parents' passive cultural capital:‖			.49	.37	11,941
Family subscribes to daily newspaper	0 = no; 1 = yes	6–14			
Musical instrument available in child's home	0 = no; 1 = yes	6–14			
Academic achievement:					
PIAT math	Peabody Individual Achievement Test,	5–14	53.47	28.53	11,871

PIAT reading recognition	Peabody Individual Achievement Test, percentile score (0–100)	5–14	57.81	29.77	11,883
Controls:					
Family income (log)	Log of total family income, indexed to 1986		10.75	1.71	10,479
Mother's education	Years of schooling		12.74	2.57	12,268
Mother's IQ	Mother's score on Armed Forces Qualification Test, percentile score (0–100)		36.09	28.36	12,303
Family size	Total number of children living in mother's household		2.61	1.21	12,285
Mother's race:					
White	Dummy variable		.43		
Black	Dummy variable		.30		
Hispanic	Dummy variable		.18		
Other	Dummy variable		.10		
Child's sex	1 = female, 0 = male		.51	.50	12,088
Child's age	Child's age in months		147.46	17.02	12,285

NOTE.—All variables were collected in the years 1986–2010, with the following exceptions: child reads book or magazine after school (1992–2010), child reads books or magazines for fun on a summer day (1992–2010), and mother's race (collected 1979).

* Child-by-year observations defined as all observations with valid response on child's cultural capital.

† First factor in principal component analysis (PCA) accounts for 65.1% of the covariance between the items in the index (estimates based on polychoric correlation matrix since all indicators are categorical). Cronbach's $\alpha = .484$.

‡ Variable rescaled to 0–1.

§ First PCA factor accounts for 44.7% of total variance. Cronbach's $\alpha = .549$.

‖ Polychoric correlation between items is .168. Cronbach's $\alpha = .193$.

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