Friends’ plans for college and adolescents’ educational expectations: an instrumental variable approach

Brian V. Carolan

The Graduate School, Montclair State University, Montclair, NJ, USA

ABSTRACT
Friends are an important influence on adolescents’ educational outcomes. However, because of their similarity on numerous attributes, it is difficult to estimate whether friends influence each other, or whether they select friends who are similar to them. To address this endogeneity, this study uses instrumental variable estimation on panel data from the High School Longitudinal Study of 2009 to estimate the effect of friends’ plans for college on adolescents’ educational expectations. Results from two-stage least squares models indicate that friends’ plans for college has a significant effect on educational expectations. This effect does not significantly vary by gender. Results suggest the need for policies that focus on ways to diversify adolescent peer networks in order to provide greater access to resource-rich peers.

An emerging consensus has drawn attention to ways in which friends influence each other’s educational outcomes during adolescence (Cook, Deng, & Morgano, 2007; Flashman, 2012). This attention is overdue, particularly because friendships take-on heightened importance during adolescence and the high school years (Bukowski, Newcomb, & Hartup, 1996). But, given friends’ similarity on numerous attributes (Kandel, 1978), it is methodologically challenging to estimate whether friends influence each other’s educational outcomes, or whether they select friends who are similar to them (Cohen, 1983; Foster, 2010). Overcoming this challenge is necessary in order to more precisely assess the degree to which friends influence each other’s educational outcomes and the characteristics that moderate this association (Prinstein & Dodge, 2008).

Earlier studies (e.g. Coleman, 1965) that examined this issue provide a solid footing for the next generation of research. However, the results of more recent empirical work are tempered by several qualifications. First, research on peer influence processes has tended to focus on adolescents’ adoption of socially undesirable behaviours and attitudes (e.g. Foshee et al., 2013), and has given little attention to pro-social peer influences. Second, when examining peer influence processes as they relate to educational outcomes, in particular, many researchers have concentrated on the impacts of social-emotional supports provided by peers (e.g. Elias & Haynes, 2008; Wentzel, Battle, Russell, & Looney, 2010) and have given less attention to other potentially beneficial resources (Cherng, Calarco, & Kao, 2013). Third, most studies of peer influence processes continue to rely on standard regression-based approaches with observational data, inhibiting these studies’ ability to infer causal relationships between peer influences and adolescents’ outcomes (An, 2015).
This study addresses these issues by using instrumental variable (IV) estimation (Bollen, 2012; Bowden & Turkington, 1984) to estimate the effect of friends’ plans for college on adolescents’ educational expectations. This analysis is framed by two sets of peer influence theories – social learning theory and identity-based theories – both of which are premised on the idea that adolescents are ‘attuned to and motivated by positive regard and belongingness in a peer context’ (Brechwald & Prinstein, 2011, p. 169). Using two waves of panel data from the High School Longitudinal Study of 2009 (Ingels et al., 2013), IV estimation is employed to estimate the effect of a salient friendship characteristic – friends’ plans for college – on adolescents’ educational expectations. Also examined is whether this effect is moderated by gender.

**Background**

A consistent body of prior research has confirmed that educational expectations have a direct or intervening effect on academic achievement and ultimately educational and occupational attainment (Kao & Thompson, 2003; Reynolds & Johnson, 2011; Sewell, Haller, & Ohlendorf, 1970). For example, Beal and Crockett (2010) documented that educational expectations in adolescence were favorably linked with young adults’ educational attainment; similarly, Lee, Hill, and Hawkins (2012) concluded that high educational expectations were generally beneficial, especially for those adolescents from disadvantaged backgrounds. In sum, the literature on educational expectations suggests that they are critical for subsequent educational and occupational attainment (Domina, Conley, & Farkas, 2011) and may be especially vulnerable to peer influences (Park, Wells, & Bills, 2015).

**Peer influence**

A number of advances in the past 20 years have shed light on how friendships provide a context through which peers positively influence each other’s educational expectations; three of which are especially noteworthy (Brechwald & Prinstein, 2011). First, whereas a majority of research on peer effects has focused on deviant and risky behaviours (e.g. Hinduja & Patchin, 2013; Schaefer, 2012; Schwinn & Schinke, 2014), a growing literature recognizes that peer influence processes extend to the development of pro-social attitudes, behaviours, and expectations (Allen & Antonishak, 2008; Wentzel, 1994), including academic achievement (Wentzel, Barry, & Caldwell, 2004), and educational attainment (Kiuru et al., 2012).

Second, Brechwald and Prinstein (2011) note that there is a growing appreciation of the different peer contexts that wield varied socialization effects on adolescents. Earlier work tended to rely on asking respondents to report on their actual or hypothetical peers or friends, broadly and ambiguously defined (e.g. Utech & Hoving, 1969). More recent work recognizes that not all peer relations exert the same influence, generating a research agenda that delineates among the effects associated with best friends (Prinstein, Brechwald, & Cohen, 2011), romantic partners (Kreager & Haynie, 2011), and classmates (Ladd, Herald-Brown, & Reiser, 2008). In fact, advances in peer relations research has established that close friends exert a stronger influence on adolescents than other peers (Payne & Cornwell, 2007).

Third, contemporary peer influence research has drawn on classic theoretical insights to unravel how adolescents influence each other. Two related theoretical models, both based on the assumption that affirmation and belongingness are salient for adolescents, elucidate these mechanisms (Brechwald & Prinstein, 2011). The first of these is social learning theory, which suggests that individuals adopt new attitudes and behaviours through modelling and imitation (Bandura, 1977). In turn, these attitudes and behaviours are social rewarded or punished by proximate, valued peers. Second, classic identity-based theories, such as social comparison theory (Festinger, 1954) and reference group theory (Merton, 1968), complement social learning theory by drawing further attention to the importance of valued peer groups. These latter theories emphasize that mimicking the behaviours and attitudes of valued others within the context of a reference group provides a meaningful sense of self. Both theoretical models identify cohesive friendship relations as the primary mechanism for transmitting influence, implying
that as adolescents seek more support from their peers, they also use feedback and approval from these same peers as a foundation for their emerging identities and expectations (Brechwald & Prinstein, 2011).

**Gender as a moderator of peer influence**

However, the effects of peer influence mechanisms depend on one of four types of variables that moderate an adolescent’s susceptibility to peer influence (Brechwald & Prinstein, 2011; Hartup, 2005). The first includes characteristics related to the influencing source, including attributes such as peer group status (e.g. Ellis & Zarbatany, 2007), whereas the second type involves the relationship characteristics between the target adolescent and the peer or peer group influencer. A third type focuses on the behaviour itself; for example, an adolescent may be more or less susceptible to influence depending on the importance he or she attaches to the target behaviour (e.g. Ryan, 2001). The last type of peer influence moderator variables are related to the target adolescent’s characteristics. Gender has been a central focus of this last type, especially as it pertains to educational outcomes (e.g. Véronneau & Dishion, 2011), even in studies of young children (Martin et al., 2013).

The research literature on the differential educational effects of peer influence by gender has been mixed. For example, girls in Grades 7 and 8 have been found to be more susceptible to the negative peer effects of having held-back and therefore older students in their grade (Muschkin, Glennie, & Beck, 2014). Others have found that minority boys, in particular, may be more strongly influenced by peers in their school environment than other students (Bryant, Schulenberg, O’Malley, Bachman, & Johnston, 2003). Still, others have concluded that gender alone does not moderate peer influence processes as they relate to outcomes that are consequential for education (Rice, Kang, Weaver, & Howell, 2008). However, prior research has also shown that girls, on average, are both more autonomous and more resistant to peer pressure than boys (Berndt, 1979; Steinberg & Silverberg, 1986). Therefore, further empirical work is needed to investigate whether the effects of peer influences on educational outcomes are moderated by gender.

**Estimating peer influence**

Researchers encounter several difficulties when estimating the cause-and-effect of peer influences and whether these effects are moderated by different characteristics. Bollen (2012) identifies three of these. First, variables are not free of measurement error. Second, there may be concerns about common causes due to omitted variables or simultaneity bias. Finally, sample selectivity has an effect on who has contributed valid observations. These challenges share the commonality that they create a correlation between the covariates and the model’s error, meaning that commonly used estimators (e.g. OLS) are biased and inconsistent (Angrist, Imbens, & Rubin, 1996).

Several different methods have been developed to address this correlation (VanderWeele & An, 2013). Two of these are noteworthy, but limitations inhibit their more frequent use. The first, stochastic actor-based models, rely on complete longitudinal network data to model both selection and influence simultaneously (Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). A second set of methods rely on an experimental framework to randomly assign participants to social contacts, or self-select into comparable ‘pre-treatment’ groups (e.g. Zimmerman, 2003). However, both are often practically unfeasible or potentially unethical, and may lack external validity (An, 2015).

In those instances where only observational data are available and maybe even preferable, four types of quasi-experimental methods are possible, including panel methods, matching and weighting estimators, regression discontinuity (RD) designs, and IV estimation (Angrist & Pischke, 2009; Bowden & Turkington, 1984). The last of these can be especially useful in identifying endogenous peer effects, and their use has been advocated in many social science disciplines including economics (Davidson & Mackinnon, 1993) and only more recently in developmental psychology (Foster, 2010). Despite their advantages, relatively few studies have used IV estimation to estimate peer effects (An, 2015).
**Hypotheses**

This study estimates the effect of adolescents’ friends’ cultural resources on their educational expectations, but does so using IV estimation in an effort to reduce the correlation between the covariates and the model’s error and therefore generate a less biased estimate of the association. An IV estimator is employed in a series of two-stage least squares (2SLS) models on data from a nationally representative panel of adolescents in high school to address two questions. First, to what degree does a friends’ cultural resource – specifically, friends’ plans for college – influence an adolescent’s educational expectations? Second, building from the research and theory on peers, gender, and educational outcomes (Fan, 2011), is this relationship moderated by gender? It is predicted that friends’ plans for college will positively influence an adolescent’s own educational expectations. Also, despite the conflicting empirical work on gender as a moderator of peer influence processes, it is predicted that this association between friends’ plans for college and an adolescent’s educational expectations will vary for boys and girls.

**Method**

**Sample**

Data were drawn from the public-use 2009 base-year and 2011 first follow-up waves of the High School Longitudinal Study of 2009 (HSLS: 09) – a nationally representative sample of Grade 9 students in 2009 in public and private U.S. high schools that was collected by the National Center for Educational Statistics (NCES). The HSLS: 09 sampling strategy consisted of a two-stage random stratified sampling design, which yielded a base-year sample of approximately 24,000 U.S. students from 940 schools. The analytic sample includes those who: (1) were enrolled in school in the fall of 2009 and spring of 2012; (2) have valid scores on the dependent and main explanatory variables; and (3) have a non-zero longitudinal weight. These criteria resulted in a final weighted analytic sample of 14,386 adolescents.

**Variables**

**Dependent variable**

In the first follow-up student questionnaire when most, but not all adolescents, were in Grade 11, respondents were asked, ‘how far do you expect to go in school?’ Responses to this item, ranging from 1 to 12, serve as the measure of *educational expectations* (e.g. 1 = less than high school, 6 = complete an Associate’s degree, and 12 = complete a Ph.D., M.D., law degree, or any other terminal degree). Using responses to a single survey item to measure *educational expectations* is consistent with a vast majority of the research on the antecedents and consequences of this construct (Bozick, Alexander, Entwistle, Dauber, & Kerr, 2010; Morgan, 2005) and has been shown to have consistent predictive validity in relation to educational attainment (Andrew & Hauser, 2011).

**Main explanatory variable**

The endogenous explanatory variable, drawn from the first follow-up student questionnaire (Grade 11), is *friends’ plans for college* and reflects respondents’ perceptions regarding how many of their friends plan to attend a four-year college. Measured on a five-point scale (0 = none, 1 = less than half, 2 = about half, 3 = more than half, 4 = all), this variable serves as the operational measure for the respondents’ perceptions of their friends’ cultural resources. Conceptually, this measure reflects the extent to which a target adolescent perceives that his or her friendship network consists of others who possess normative expectations regarding their educational plans. Empirically, this measure is similar to others that have sought to capture peer influences processes in relation to educational expectations (e.g. Picou & Carter, 1976). Moreover, though there are concerns about quality of self-reports (Alwin, 2007), respondents are generally accurate when asked to report on characteristics of those with whom they are close (Kogovsek & Ferligoj, 2005).
**Instrumental variable**

A single binary measure, closest friend plans to go to college, serves as the IV. This measure, from the base-year (Grade 9) student questionnaire, reflects a salient characteristic of the respondents’ closest friend, specifically whether the target adolescent reports that the closest friend plans to go to college (1 = yes, 0 = no). This auxiliary instrument variable (Bollen, 2012) can be claimed to have no direct theoretical causal association with educational expectations (i.e. any effect must be mediated by the equation’s other variables). Because of the general stability in the types of individuals and groups with whom adolescents affiliate (Brown & Larson, 2009), the characteristics of a respondent’s closest friend in Grade 9 should be correlated with friends’ cultural resources in Grade 11, and therefore indirectly associated with educational expectations. Apart from this, there is no other compelling theoretical reason for a direct association between closest friend plans to go to college in Grade 9 and educational expectations as measured in Grade 11. Finally, due to the longitudinal nature of these data, it is plausible to conclude that the measure of friends’ cultural resources in Grade 11, friends’ plans for college, has no recursive effect on the IV measured in Grade 9.

**Moderator variable**

A binary indicator for female (1 = yes, 0 = no) serves as the moderator variable. This measure was derived from the base-year student questionnaire that asked respondents to identify as male or female. Responses were verified by those on the parent questionnaire that asked a similar question.

**Covariates**

To better estimate the relationship between the explanatory variable, friends’ plans for college, and educational expectations, the models include a number of covariates to address issues of confound- edness. These covariates, all of which have been observed in Grade 9, reflect characteristics related to adolescents’ socio-demographic characteristics, their schools, and prior academic experiences. For example, from the base-year student and parent questionnaires, controls for race/ethnicity, parent expectations, students’ own expectations, and a NCES-derived measure for socio-economic status (SES) are included. From the base-year administrator questionnaire, controls for school sector and urbanicity are also included. Finally, a control for respondents’ prior academic experiences, also drawn from the base-year, is included – a standardized measure reflecting the respondent’s math achievement test score. Table 1 describes all variables.

**Analytic procedure**

These analyses use design-based (Lee & Forthofer, 2006) two-stage least squares models (2SLS) that account for the HSLS complex sampling design and incorporate multiple imputation to address missing data (Azur, Stuart, Frangakis, & Leaf, 2011). The use of covariates in this longitudinal 2SLS modelling framework further reduces, but does not eliminate, the bias of the estimates (Angrist & Pischke, 2015). The 2SLS procedure comes from the fact that the estimate is obtained from a sequence of two regressions. In the first stage, friends’ plans for college is predicted from the instrument – closest friend plans to go to college. Fitted values from this first stage are then used in a second stage regression to estimate changes in educational expectations. All covariates appear in both stages. Consistent with convention, only the results of the second stage regressions are reported.

In addition, adjustments for effects related to the HSLS sampling design were made, enabling inferences to the target population of all Grade 9 students in the United States in 2009. Finally, some covariates were missing a small (<10%) number of values. To preserve these observations, multiple imputation based on multivariate imputation by chained equations (White, Royston, & Wood, 2011) was used to create five separate imputed data sets, each of which was then analyzed separately. The typical practice is to combine results across the imputed data sets in order to retain between-imputation variation (Little & Rubin, 1987); however, this was not possible due to the use of balanced repeated replication weights. Because the reported estimates were checked against those derived from the other four imputations,
it is reasonable to assume that there was minimal between-imputation variation. All variables with no missing values were used in predicting missing values.

**Results**

**OLS estimates**

The analysis follows the standard practice of first estimating the association between the measure of friends’ cultural resources, *friends' plans for college*, and *educational expectations* through a series of OLS regression models. Table 2, Model 1 establishes the association between *adolescents’ educational expectations* and *friends’ plans for college*. Next, Model 2 examines the relative effects of *friends’ plans for college* and additional cultural and material resources. Overall, Model 2 shows that above and beyond the significant and strong associations of these additional resources, every one-unit increase

| Variable | HSLS source variable | Mean (SE) | Range (min, max) |
|----------|----------------------|-----------|------------------|
| Dependent variable | | | |
| Educational expectations | s2eduexp | 8.02 (.06) | 1 to 12 |
| Main explanatory variable | | | |
| Friends’ plans for college | s2fr4y | 2.52 (.02) | 0 to 4 |
| IV | | | |
| Closest friend plans to go to college (Grade 9) | s1frndclg | .92 | 0 = no, 1 = yes |
| Moderator variable | | | |
| Female | x1sex | .51 | 0 = no, 1 = yes |
| Covariates | | | |
| Parent's educational expectations | x1paredexpct | 7.30 (.04) | 1 to 11 |
| Education expectations (Grade 9) | x1stuedexpct | 7.52 (.05) | 1 to 11 |
| SES | x1ses | −.02 (.02) | −1.93 to 2.57 |
| Mathematics achievement test score | x1txmscor | 50.74 (.22) | 24.10 to 82.19 |
| Anglo-American | x1race | .53 | 0 = no, 1 = yes |
| African-American | x1race | .14 | 0 = no, 1 = yes |
| Asian-American | x1race | .04 | 0 = no, 1 = yes |
| Hispanic-American | x1race | .21 | 0 = no, 1 = yes |
| Other | x1race | .09 | 0 = no, 1 = yes |
| Public school | x1control | .92 | 0 = no, 1 = yes |
| City | x1locale | .32 | 0 = no, 1 = yes |
| Town | x1locale | .11 | 0 = no, 1 = yes |
| Suburb | x1locale | .34 | 0 = no, 1 = yes |
| Rural | x1locale | .23 | 0 = no, 1 = yes |

Note: N = 14,386. Descriptive statistics are adjusted for design effects.

*aStandard errors reported only for continuous variables. The SEs were calculated using the method of balanced repeated replication.

All covariates and IV were drawn from the base-year when all respondents were in Grade 9.

Table 2. OLS estimates of adolescents’ educational expectations Grade 11.

| Variable | Model 1 | Model 2 | Model 3 | Model 4 (males) | Model 5 (females) |
|----------|---------|---------|---------|-----------------|------------------|
| Friends’ plans for college | 1.05 *** (.04) | .75 *** (.04) | .65 *** (.04) | .74 *** (.06) | .53 *** (.05) |
| Parent’s educational expectations | .16 *** (.02) | .11 *** (.02) | .11 *** (.02) | .10 *** (.02) | .10 *** (.02) |
| Educational expectations (Grade 9) | .20 *** (9.02) | .18 *** (.02) | .18 *** (.02) | .18 *** (.02) | .18 *** (.02) |
| SES | .64 *** (.06) | .45 *** (.06) | .60 *** (.06) | .38 *** (.09) | .38 *** (.08) |
| Control variables | No | No | Yes | Yes | Yes |
| R² | .15 | .25 | .29 | .33 | .24 |
| N | 14,386 | 14,386 | 14,386 | 6998 | 7388 |

Note: Balanced repeated replicate (BRR) standard errors in parentheses.

*aControl variables include all those covariates noted on Table 1.

***p < .001 (two-tailed tests).
in adolescents’ friends’ plans for college is associated with an increase in educational expectations of .75 points (b = .75, t = 23.86, p < .001). Model 3 presents an estimate for friends’ plans for college after adjusting for a number of relevant covariates. Even with these additional controls, the point estimate for friends’ plans for college remains strong and significant (b = .65, t = 15.11, p < .001), suggesting that the cultural resources available through friends uniquely and positively influence an adolescent’s own educational expectations.

The final two models in Table 2, Models 4 and 5, provide separate point estimates for males and females. Therefore, these two models test whether the association between friends’ plans for college and educational expectations varies by gender. From these models it is evident that friends’ plans for college has a stronger positive association with educational expectations for males than it does for females (.74 vs. .53). An adjusted Wald test indicates that this difference is significantly different than 0, F (1, 14,385) = 7.93, p = .005. Considered together, these two models provide preliminary evidence that suggests that peer effect processes in relation to adolescents’ educational expectations vary by gender.

However, even after adjusting for numerous covariates, including those related to the family’s material (SES) and cultural resources (parent’s educational expectations and the respondent’s own educational expectations in Grade 9), these OLS estimates do not warrant a causal interpretation. These estimates may be biased and inconsistent due to a number of reasons (e.g. omitted variable bias). Therefore, friends’ plans for college is instrumented on using closest friend plans to go to college (Grade 9) in a series of 2SLS models that follow the same model building progression reported in Table 2.

### Evaluating the IV

Prior to presenting the estimates derived from the 2SLS models, it is important to check two diagnostics in order to ensure that the estimates from the 2SLS models are less biased than those from the OLS models. First, the instrument is assessed to determine whether it is weak; that is, whether there is a weak association between the instrument and the main explanatory variable friends’ plans for college. A weak association can inflate standard errors. Two different techniques are employed to screen for this. The first diagnostic is to correlate the IV, closest friend plans to go to college, and the main explanatory variable, friends’ plans for college. The point-biserial correlation between these two variables is r = .23, p < .001, fulfilling the criterion that the instrument be correlated with the endogenous explanatory variable, but not too strongly. An additional diagnostic relies on the F-statistic (Staiger & Stock, 1997) for the joint significance of the key instrument in the first-stage regression of the endogenous explanatory variable (Table 3, bottom). In all five models in Table 3, the F-statistic exceeds 10, the conventional point at which an instrument is not considered weak (Cameron & Trivedi, 2009).

### Table 3. 2SLS estimates of adolescents’ educational expectations Grade 11.

|                      | Model 6     | Model 7     | Model 8     | Model 9 (males) | Model 10 (females) |
|----------------------|-------------|-------------|-------------|-----------------|-------------------|
| Friends’ plans for college | 2.38***     | 1.87***     | 1.68***     | 1.44***         | 1.94**            |
|                      | (.28)       | (.35)       | (.38)       | (.35)           | (.74)             |
| Parent’s educational expectations | .09***      | .07***      | .08**       | .04             |                   |
|                      | (.03)       | (.03)       | (.03)       | (.04)           |                   |
| Educational expectations (Grade 9) | .16***      | .15***      | .15***      | .16***          |                   |
|                      | (.02)       | (.02)       | (.02)       | (.03)           |                   |
| SES                  | .20         | .18         | .40**       | −.02            |                   |
|                      | (.16)       | (.13)       | (.13)       | (.03)           |                   |
| Control variables<sup>a</sup> | No          | No          | Yes         | Yes             |                   |
| Postestimation tests for the IV<sup>b</sup> | Wu-Hausman T<sub>2</sub> | 983.41*** | 391.46*** | 262.15*** | 139.58*** | 76.69*** |
|                      | F-statistic | 3143.30*** | 1613.47*** | 1243.98*** | 833.70*** | 378.17*** |
|                      | N           | 14,386      | 14,386      | 14,386         | 6998              | 7388              |

Note: Balanced repeated replicate (BRR) standard errors in parentheses.
<sup>a</sup>Control variables include all those covariates noted on Table 1.
<sup>b</sup>These post-estimation tests were conducted on models without adjustments for design effects.

<sup>**p < .01; ***p < .001 (two-tailed tests).**
Second, the presumed endogenous explanatory variable, *friends’ plans for college*, is assessed to determine whether it should instead be treated as exogenous. The OLS estimator is more efficient if *friends’ plans for college* is exogenous; therefore, testing for endogeneity verifies whether an IV estimator is even necessary. The results of the Wu-Hausman test of endogeneity (Hausman, 1978; Wu, 1974) for all five models reject the null that the IV can be treated as exogenous. As a result of these diagnostics, there is greater confidence that the results from the 2SLS models reported in Table 3 provide less biased, more consistent estimates than those derived from the OLS models.

**2SLS estimates**

The same modelling process is followed for this series of IV estimates. Model 6 includes the one endogenous explanatory variable that has been instrumented on using *closest friend plans to go to college* as the instrument. The 2SLS estimate increases to 2.38 (*t* = 8.37, *p* < .001), which is more than double the OLS estimate of 1.05 from Model 1. A similar picture emerges when additional covariates are included. The estimated effect of *friends’ plans for college on educational expectations* remains strong and significant when measures related to the family’s material (SES) and cultural resources (*parent’s educational expectations*), as well as the adolescents’ *educational expectations* from Grade 9 is included. Model 7, in particular, shows that above and beyond these other resources, *friends’ plans for college* has a strong and significant effect on adolescents’ *educational expectations* (*b* = 1.87, *t* = 5.34, *p* < .001).

Model 8 presents the estimated effect for *friends’ plans for college* derived from a 2SLS model that includes a full set of covariates. Even with these additional covariates, *friends’ plans for college* has a substantial and significant effect on *educational expectations* (*b* = 1.68, *t* = 4.38, *p* < .001). This is the strongest evidence that adolescents’ friends provide an additional source of beneficial cultural resources that positively influence their educational expectations. Considered together with Model 3 (Table 2), this estimate suggests that friendships provide a context through which valuable cultural resources are transmitted and, ultimately, positively influence adolescents’ own expectations about educational attainment.

**Gender as a moderator**

However, a different pattern emerges when the moderating role of gender is examined in the 2SLS models. Models 4 and 5 using OLS (Table 2) showed how the coefficients for *friends’ plans for college* differ for males and females. But, there is little confidence in these estimates because there is likely an association between one or more covariates and the model’s error. Because the diagnostics revealed that (1) *friends’ plans for college* is best treated as endogenous and (2) the instrument, *closest friend plans to go to college*, has adequate explanatory power, the use of an IV in 2SLS models restores unbiasedness, providing confidence that the estimates reported in Table 3 are more consistent that those reported in Table 2.

Models 9 and 10 present the estimates *friends’ plans for college* for males and females separately. Model 9 shows that, for males, a one-unit increase in *friends’ plans for college* predicts a 1.44 increase in educational expectations (*b* = 1.44, *t* = 4.09, *p* < .001). The *friends’ plans for college* coefficient for females in Model 10 is also large and significant (*b* = 1.94, *t* = 2.63, *p* = .009). What is noteworthy about this difference is that the effect is larger for females, which contrasts with the results from the OLS models (Models 4 and 5). To formally test whether gender moderates the relationship between *friends’ plans for college* and *educational expectations*, it is necessary to assess whether this difference is significantly different than 0. The adjusted Wald test indicates that this difference of .5 points is not statistically significant, indicating that gender alone does not have a moderating effect, *F* (1, 200) = .45, *p* = .50. Why might the difference be significant when the estimates are derived from OLS models, but not the 2SLS models? The reason for this disagreement is IV estimation identifies the local average treatment effects, as opposed to the average treatment effects (Angrist & Pischke, 2009, 2015).
Discussion

In contrast with most peer influence studies that focus on the adoption of negative behaviours or attitudes, this study focused on how adolescent friendships serve as a context that promotes the adoption of normative expectations towards educational attainment. An IV estimator was employed in order to provide an estimate of the effect of friends’ plans for college on adolescents’ educational expectations. Though there is no evidence that this effect is moderated by gender, the main finding confirms that a specific cultural resource – friends’ plans for college – has a positive effect on adolescents’ educational expectations. This finding supports theoretical propositions derived social learning theory and identity-based theories, both of which center on the idea that adolescents’ belongingness and need for affirmation motivate them to generally align their attitudes and expectations with those of their most valued friends.

Though prior research has found that gender moderates the strength of peer influence effects (Berndt, 1979), the 2SLS results did not reveal any significant difference between males and females. One possible explanation for this draws from Hyde’s (2005) gender similarities hypothesis, which argues that gender differences have no or little effect on most psychological variables. A second explanation emphasizes that gender may only be pertinent within two- and three-way interactions that consider other demographic factors such as an adolescent’s age, or other target adolescent characteristics such as social anxiety (Brechwald & Prinstein, 2011; Brown, Bakken, Ameringer, & Mahon, 2008). For example, Prinstein (2007) concluded that higher levels of social anxiety among adolescent females were related with increased peer contagion vulnerability.

A related explanation involves the under-appreciated role of another salient target adolescent characteristic – autonomy development. Generally, autonomy development refers to an adolescent’s ability to (1) self-regulate his or her behaviour or attitudes and (2) demonstrate independent thinking (Allen & Hauser, 1994). Therefore, autonomy development is associated with an adolescent’s susceptibility to peer influences and there’s no good theoretical reason to expect gender alone to strongly correlate with this construct. In fact, Allen, Porter, and McFarland (2006), in their study on peer influence susceptibility and its associations with risky behaviour, friendship instability, and depression, concluded that gender alone had no moderating effect, but autonomy development consistently moderated peer influence processes on all three outcomes. This and related lines of research (Goldstein, Davis-Kean, & Eccles, 2005; Sim & Koh, 2003) suggest that focusing on the psychosocial characteristics of adolescents, rather than demographic characteristics, may better elucidate the factors that conditions one’s susceptibility to peer influence.

There are two caveats to consider in regards to the significant main effect of friends’ plans for college on adolescents’ educational expectations. The first is related to the fact that adolescents’ openness to influence was not considered, which may be especially relevant given that a foundational component of social learning theory is that individuals are unable to adopt a peer’s behaviour or attitude if they neglect to pay attention to it (Brown et al., 2008). A second concerns the measurement of respondents’ perceptions of their friends’ cultural resources. This approach may reflect important ‘intrapersonal processes such as a motivation to perceive peers similar to oneself as friends, to perceive actual friends as similar to oneself, or to perceive oneself as becoming more similar to one’s friends over time’ (Gest, 2006, p. 249).

Conclusion

These caveats notwithstanding, there are three notable contributions of this study. The first is the use of an IV estimator in a 2SLS modelling framework, which helps address a host of issues in estimating peer effects, particularly omitted variable bias (An, 2015). Second, the IV has been employed in a flexible 2SLS setup, which permitted the statistical adjustment for other characteristics that may directly affect educational expectations, or modify susceptibility to peer influence (e.g. gender). This gives greater confidence in the precision of the estimated main effect for friends’ plans for college. Third, the study
continues the shift beyond those that explore on the ‘dark side’ of peer influence (Allen & Antonishak, 2008). This and similar studies focusing on the transmission of desirable behaviours and expectations (Barry & Wentzel, 2006; Wentzel & Caldwell, 1997) counters the conclusion that strong peer influences are fundamentally problematic.

Results suggest possible implications for policymakers and educators. One implication is that it may be important for policies to focus on the expansion and diversification of adolescent peer networks in order to provide greater access to resource-rich peers. For example, policies should seek to ease adolescents’ barriers to forming friendships with more resource-rich friends (Cherng et al., 2013) including efforts to confront school-level segregation level due to neighbourhood-based school assignment policies and academic tracks, both of which are used in the United States (Clotfelter, 2004; Oakes, 2005). Easing these barriers can help all adolescents access to resource-rich friends and the benefits they afford. Relatedly, policies might consider the different channels through which adolescents access information about post-secondary educational options. Cherng et al. (2013) go on to note that adolescents in today’s U.S. high schools are expected to make important decisions about future educational plans more independently, decisions that once had more input from school-based personnel (McKillip, Rawls, & Barry, 2012). Thus, the cultural resources that adolescents access through their friends are increasingly influential on their decisions about whether and how to prepare for their post-secondary educational plans. This suggests that adolescents be given opportunities to interact with resource-rich peers in intimate, personable school environments that encourage the development of reciprocal friendships, which are beneficial for an array of social and educational outcomes (Vaquera & Kao, 2008).

Future research should not only consider the limitations noted above, but it should also explicitly attend to two issues. First, given the limitations of inferred influence studies that make use of observational data and the practical challenges associated with stochastic actor-based models or experimental designs, this study encourages future research to further examine the claims of causal inferences inferred from IV estimation. This and other quasi-experimental techniques – propensity score matching methods and regression discontinuity designs – offer promising approaches to causal inference that are generally under-utilized in developmental science (Foster, 2010), and in studies on peer effects, in particular (An, 2015). Second, future research should continue to explore how peer influence processes are moderated by various characteristics in an effort to better inform the development of school-based interventions that account for these varied effects. Because friends become more influential during adolescence, it is important to understand the factors that promote vulnerability to their influences. Research on these moderators is sparse (Prinstein & Dodge, 2008) and it is likely that they operate in a complex, interdependent manner (Brown et al., 2008).

**Disclosure statement**

No potential conflict of interest was reported by the author.

**Notes on contributor**

**Brian V Carolan** is Associate Dean of The Graduate School and Professor of Quantitative Research Methods, Montclair State University. His areas of expertise include quantitative research methods and the sociology of education. He is currently working on a project that examines children’s summer learning gaps.

**ORCID**

Brian V. Carolan [http://orcid.org/0000-0003-4607-0648](http://orcid.org/0000-0003-4607-0648)
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