\def \data #1{/Users/danielposthumus/thesis\_independent\_study/work/writing/rough\_draft/analysis/#1}

I organize my results by outcome variable: each sub-section will include my OLS, fixed-effects, and instrumental variable estimates for kindergarten's effects on that outcome variable. I have included results and discussion of an analysis of selection into kindergarten attendance in \nameref{sec:kinder\_sel}. I conclude with a discussion of heterogeneity of kindergarten's effects, particularly along class, religious, and geographical lines.

\subsection{Years of Education}

First, I examine years of education as the outcome variable. All of the individuals in my sample were between 20 and 27 years old by 2014, when the data on years of education completed was collected, ensuring that every individual had the opportunity to finish high school and advance into college before the variable was collected.\footnote{When focusing on outcomes such as school attendance and stay-on rates, I exclude grades beyond the 14th because, although every individual would have had the opportunity to complete high school and enter into college, the data on students' college years is incomplete.} I employ four model specifications for the OLS and fixed-effects, as can be found in Table ~\ref{table:full\_results}.\footnote{I do not include the point estimates of every covariates' coefficient for conciseness. Also note that I incorporate province fixed-effects in Model (3), alongside the other community controls that are only included in Model (3).}

To begin, there is variation in the years of education completed; in my sample, 37.3\% of individuals completed exactly 12 years of education, 38.19\% of individuals completed fewer than 12 years of education, and 34.51\% of individuals completed more than 12 years of education. The distribution of years of education completed is nearly identical within the switching sample.\footnote{Within the switching sample, 37.56\% completed exactly 12 years of education, 36.65\% completed fewer than 12 years of education, and 35.79\% completed more than 12 years of education.} Overall, I find significant, positive effects of attending kindergarten. The OLS specifications operate as I intuited: the inclusion of greater controls reduces the effect of kindergarten until, in the fully-specified model, kindergarten adds 0.71 years to a child's education. Other significant positive predictors of years of education include the mother's level of education, and household wealth, while being male has a significant negative effect on the years of education completed. The mother fixed-effects model, however, has clouded results: in which I find none of the included covariates exhibit any significant effect on the years of education completed. I suspect that this is because of the bias introduced by the high rates of attrition into the switching sample used to fit the fixed-effects model--something I discuss in greater detail in \nameref{sec:switching} and which a robustness check, discussed in \nameref{sec:switching\_ols}, confirms.

Next, I employ Instrumental Variable (IV) estimation, the results of which can be found in Table ~\ref{table:iv\_main\_results}. Surprisingly, the IV estimation for kindergarten's effects is actually greater in magnitude than that for the OLS and fixed-effects models--for all IV specifications. In particular, the fully specified model estimates that kindergarten adds 1.89 years of education--compared to 0.71 years in the fully specified OLS model. Two coefficients are very different in these results: the dummy variables indicating whether a household was urban in 1997 and the dummy variable for whether a household had both parents of a child in 1997. Whereas each of these coefficients where statistically insignificant in the OLS and fixed-effects models, they are positive and significant in the IV estimation--though the urban coefficient is only urban for the model including community-level controls.\footnote{ All covariates in this model are the same as the ones I described above; thus, the community controls in this model are the elementary schools per 10,000 people in 2000, junior highs per 10,000 people in 2007, and senior highs per 10,000 people in 2014.}

\subsection{School Completion}

Completed years of education is only a long-term outcome, however. And recalling the theoretical framework of my research, I am interested in the interaction between human capital investments in different periods of childhood. Thus, I am interested in more granular educational outcomes and the natural starting point is to find the effects of kindergarten on school completion--focusing on three dummy outcome variables: whether a student completed elementary school, whether a student completed junior high school, and whether a student completed senior high school. The results of that analysis can be found in Table ~\ref{table:full\_complete}.

School completion is a slightly challenging outcome to analyze. First, for elementary school completion there is almost no variance--only 5.29\% of the sample failed to completed elementary school. On the other hand, 18.68\% failed to complete junior high school and 38.19\% failed to complete senior high school. I suspect in large part as a result of this lack of variance, the OLS model finds no significant effects of kindergarten on the completion of elementary school.

There is significant heterogeneity across the three model types: OLS, mother fixed-effects, and IV estimation. Focusing on junior and senior high school, the OLS model finds significant positive effects for both junior high and senior high completion. Similar to the estimates for years of education, fixed-effects once again finds no significant effect of kindergarten attendance. The IV estimates, on the other hand, suggest fadeout; there is a very strong significantly positive effect of kindergarten attendance on the completion of junior high school that `fades' to insignificance for senior high school.Completion of school is still a broad outcome, and we can focus on even more granular outcomes.

Importantly, the estimates for the covariates' coefficients are very similar across the OLS and IV estimates. Household expenditures become increasingly important over time (particularly the most recent observation in 2007), and the mother's years of education becomes more significant over time as well. This stands in contrast to the declining effects of kindergarten post-junior high found above, and that will also be found below in Figure ~\ref{fig:inschl\_reg}. This suggests that the increased estimate of kindergarten's effect in junior high is not merely a function of greater variance in the outcome variable, as we don't see a similarly increased estimate for senior high completion, the outcome with the greatest variance among the three analyzed here.

\subsection{School Attendance and Stay-On Decision}

The next, more granular outcome to examine is grade-by-grade school attendance--captured by a dummy indicating whether a child completed every single grade.\footnote{ I focus on grades 1-14, for reasons described above.} In Figure ~\ref{fig:inschl\_reg}, I have plotted the attendance rates themselves by grade and then the effects of attending kindergarten by grade. The vertical lines on the attendance rate graph indicate the 6th, 9th, and 12th grades, which are the final grades for elementary, junior high, and senior high school, respectively--note the steep drop-offs in attendance following the conclusion of each grade.

We can make a few observations: first, as I mentioned above, there is nearly no variation in school attendance throughout primary school--particularly for children who attend kindergarten. However, the estimated near-insignificance of kindergarten's effects throughout grades 1-6 (consisting of elementary school) suggests the gap between kindergarten and non-kindergarten children is explained by other factors. The estimated effect of kindergarten is greatest in junior high school--for the OLS and IV estimates. After junior high, however, kindergarten's effects fade to near-insignificance once again and become nearly exactly zero after high school. We once again have preliminary evidence of fadeout.

Examining school attendance over time has a critical advantage--the sample is kept constant across time. The disadvantage of this approach, however, is that once a child stops attending school, the only possible values for the remaining attendance dummy variables is 0. Thus, I corroborate analyzing school attendance with looking at `stay-on'; a dummy variable conditional on a student already being in a grade, taking on a value of 1 if they \textit{continue} in school, and 0 if they exit school after that grade.\footnote{For the stay-on analysis, the sample varies across grades since if a student had dropped out after the 4th grade, say, their assigned value for the 6th grade stay-on variable is missing and not zero. For school attendance by grade, on the other hand, the attendance dummy for 6th grade in this situation would be zero, not missing.} The results of that analysis can be found in Table ~\ref{table:full\_stayon}.

These results provide strong evidence of fade-out. The OLS estimates suggest that kindergarten has a strongly significant positive effect on whether a student stays on after the 6th grade, and a weaker effect corresponding to the 9th and 12th grades. The fixed-effects model suggests there is no effect, though there is some very weak suggestion of a negative effect for whether a student stays on after the 12th grade.

Finally, the IV estimates--my primary empirical method--show a very strong significant positive effect for 6th grade and absolutely insignificant effects for staying on after 9th and 12th grades. This corroborates the evidence from the school attendance analysis: kindergarten may not have an effect on completing elementary school, but it may lead children to attend junior high school, after which kindergarten has no \textit{enduring} effect. Interestingly, there is no evidence that the number of schools in a locality has any effect on whether a student stays on--suggesting that supply side forces are not powerful in explaining educational attainment, though this is outside the scope of this research and motivates further work.

\subsection{Cognitive Test Scores}

Thus far, my educational outcomes have been different measures of educational attainment; however, as I make clear in the \nameref{sec:intro}, in Indonesia, student \textit{learning} is not keeping up with rapid advances in school attendance. I am not able to match standardized test scores, such as the PISA, to individuals in the dataset; however, the IFLS has a book in which interviewees are subject to a basic cognitive test. I standardize each individual's test score according to their age group's performance on the test. I then use individuals' performance on these tests in 2000, 2007, and 2014 to effectively track their cognitive abilities over time.\footnote{I create a sub-sample for this analysis, restricting the sub-sample to only those individuals who completed all 3 tests in order to effectively compare tests over-time.} The results of that analysis can be found in Table ~\ref{table:full\_ek}.\footnote{All individuals completed the same cognitive test; therefore, I have added age fixed-effects to account for the differing intercept based on age that we would expect.}

These results are rather perplexing; the OLS estimates of kindergarten's effects tell a clear story of fade-out. Kindergarten has a strong positive effect on the 2000 scores, then a still significant and positive, although weaker, effect on 2007 scores, before fading to insignificance for the 2014 scores. The Fixed-Effects results suggest insignificant effects, and the IV--most perplexingly--also suggest insignificant effects.

The IV estimates stand in contrast to the IV findings' on kindergarten's effects on educational attainment--suggesting a clear divergence between the effect kindergarten has on students completing school and on students learning from school. This would confirm fears outlined in the \nameref{sec:intro} and \nameref{sec:indo\_educ} that increasing enrollment and school completion are effectively empty numbers as students are not learning the skills they need.

We can also look at change in performance across time: for this analysis, I focus on IV estimation. First, we can look at percent change in test performance from 2000 to 2007. For both un-standardized and standardized percent change (standardized according to age the same as above), kindergarten has a positive insignificant effect. Second, looking at change from 2007 to 2014, that effect lessens in magnitude and remains positive insignificant, for both standardized and un-standardized change. It is tempting to suggest these results suggest fadeout; however, there was no significant effect of kindergarten to begin with, preventing me from interpreting these results with any significance or weight.

The lack of significant results using IV estimation is made more robust in light of the fact that IV estimates were so strong for the educational attainment variables. If there was some upward bias of the IV method in estimating kindergarten effects, then they would also be at work here--but we see no significant estimate of kindergarten's effect. This divergence is also critical in light of the fact that the covariates previously demonstrated to be powerful in explaining educational attainment--namely household expenditure in 2007 and the mother's years of education--are still powerfully positive in explaining cognitive test performance. I will discuss the interpretation and significance of these results in greater detail in \nameref{sec:conclusion}

\subsection{Heterogeneity}