Gendered From the Start: Patterns of Kindergarten Readiness Skills, 2013-2024

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Abstract

Using population-level Kindergarten Readiness Assessment (KRA) data from 6 states, we show that girls enter school with higher average readiness than boys in literacy (0.13 SD) and social-emotional skills (0.31 SD), but similar readiness in math. Gender gaps are relatively stable over time but vary across school districts. Higher-socioeconomic status (SES) communities have less girl-favoring—or more boy-favoring—gaps across all domains, with the strongest gradient in math. Comparing these estimates to those in grades 3-8 suggests that the SES-gender gap association weakens after exposure to formal schooling. These patterns are consistent with prior research showing boys' greater sensitivity to environmental conditions and point to gendered parenting practices before school entry.

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Introduction

Gender differences in cognitive and behavioral skills are evident by the time children enter school. Girls enter school with higher average levels of social-emotional and literacy skills than boys, whereas girls and boys score similarly in math at school entry (Chatterji, 2006; DiPrete & Jennings, 2012; Fryer Jr. & Levitt, 2010; Husain & Millimet, 2009; Kuhfeld et al., 2020). Because early skills predict later academic trajectories, understanding the determinants of early gender gaps is an important consideration for educational policy (Duncan et al., 2007).

Both developmental and societal factors may contribute to early gender gaps. First, boys and girls differ in some aspects of early development, particularly the maturation of self-regulation and executive function. On average, boys develop these capacities later than girls, and the gender differences in the acquisition of these skills explain a considerable portion of the gender gap in academic outcomes during early elementary school (DiPrete & Jennings, 2012; Matthews et al., 2009; Montroy et al., 2016). Second, parental time use and socialization practices differ by child gender. Although parents do not necessarily spend more money on children of one gender over the other, research suggests that the activities they promote are often gendered (Hao & Yeung, 2015). For example, parents engage in more reading, storytelling, and verbal activities with their daughters from an early age (Baker & Milligan, 2016). Parents are also more likely to perceive sons as talented in math and science and more frequently engage in numeracy and measurement activities with 5- and 6-year-old boys than girls (Raley & Bianchi, 2006; Varnell et al., 2025).

Gender gaps in educational achievement in grades 3-8 vary considerably across community context (Reardon et al., 2019). Girls outperform boys in reading in nearly every school district (though the size of the gap varies across districts). Boys outperform girls in math in higher-socioeconomic-status (SES) communities, on average, while the opposite is true in lower-SES communities (Reardon et al., 2019).

Prior research indicates at least two channels through which community SES shapes gender gaps. First, research suggests boys may be more sensitive than girls to environmental conditions, resulting in gender gaps in behavioral, educational, and economic outcomes that are large and girl-favoring in lower-SES settings and become increasingly favorable to boys (or less favorable to girls) at higher levels of SES (Autor et al., 2019; Bertrand & Pan, 2013; Chetty et al., 2016). Second, higher-income families have more resources to invest in their children, and may invest in different early childhood educational opportunities for their daughters and sons, leading to more gendered patterns of academic skills in high- and low-SES communities (Duncan & Murnane, 2011; Lunn & Kornrich, 2018; Ramey & Ramey, 2010; Schneider et al., 2018). For example, gender gaps in children's participation in sports and performing arts are substantially larger among high-SES families than low-SES families (Lubienski et al., 2013). Math skill gaps are more boy-favoring relative to reading skill gaps in higher-SES school districts and districts with larger adult socioeconomic gaps between men and women (Reardon et al., 2019). These patterns suggest that greater economic resources lead to more differentiated and gender-stereotypical learning experiences, particularly in places where adult educational and income patterns are more gendered.

These patterns of gender differences in academic skills and their relationship to socioeconomic conditions are evident in grades 3-8 and in high school (McGraw et al., 2006; Reardon et al., 2019). However, we know little about whether these patterns of variation in gender gaps by community SES extend to skills measured at kindergarten entry, before children have had sustained exposure to formal schooling. If these patterns are produced in part by children's school experiences, they may not be present at kindergarten entry.

This study addresses this gap by leveraging a first-of-its-kind population-level dataset on kindergarten readiness spanning six U.S. states to examine gender gaps across school districts and by community SES context. The data capture nearly all kindergartners in each state, providing a comprehensive picture of gender differences in readiness at the district level. We examine two questions.

First, how do gender gaps in kindergarten readiness vary across school districts and by developmental domain? Second, how do community socioeconomic conditions relate to these gender gaps? In doing so, we extend prior work on geographic variation in gender achievement gaps to the earliest observable point in children's formal schooling careers (Reardon et al., 2019).

Data

Kindergarten readiness assessments (KRAs) are currently used in 40 states to guide instruction, identify student needs, and inform policy and resource allocation. Of these, 25 states require all kindergarteners in the state to be assessed using the same assessment. In these states, average readiness levels are comparable and representative of school districts and population subgroups.

We use publicly reported kindergarten readiness assessment data, disaggregated by school district and gender. Of the 25 states that require use of a common KRA for all students, six (ID, KY, MD, OH, OR, and WA) report data publicly by district and gender. In each of these states, we use data from multiple years, restricting to the years in which the same KRA instrument was used. Table 1 shows the count of districts and students captured by our analytic sample in available states and years. In total, our sample includes roughly 4.3 million kindergarten readiness scores (including scores on multiple domains per student) for roughly 1.9 million unique kindergarten students in over 1,200 school districts (including over 6,600 district-years).

Table 1 here

The six states in the sample use a variety of assessments and capture a range of skills (see Appendix Table A1 for assessment details by state). Most states report KRA results for several skill domains (e.g., early literacy skills; early numeracy skills; social-emotional (SEL) skills). States report the count of

students scoring in each of several of developmental levels, which we use to estimate the mean readiness scores for each district-year-domain-gender subgroup, using methods described by Reardon et al. (2017). This method produces estimates of mean readiness skills and their standard errors, standardized to the statewide distribution of skills in a given year.[1] From these subgroup means, we compute the male-female kindergarten entry readiness gap and its standard error in each district-year-domain.

To measure district SES, we use the same composite district average SES measure used by Reardon et al. (2019). This variable combines school-district-level measures of median family income, the proportion of adults with a bachelor's degree, the poverty rate, the SNAP eligibility rate, the unemployment rate, and the proportion of female-headed households from the American Community Survey (ACS) 2015-2019 five-year sample into a single measure of average SES. For additional details on the construction of this variable, see Fahle et al. (2026).

Model

To estimate average gender gaps, their variance, and their association with district socioeconomic status, we fit a 3-level hierarchical linear model in which district-year-gender mean scores are nested within district-years, which are nested within districts. In the model, $\hat{Y}_{gyd}$ and ω^2_{gyd} are the estimated mean score and its squared standard error for gender g in year y in district d. We fit this model separately by state-domain, as well as pooled across states within each domain. We model trends as a linear function of year (centered around the middle year for which scores are available in a given state), and model gender gaps as a linear function of district SES.[2] The full model[3] is

[1] When included in the state's sample of tested years, we standardize to 2019. When 2019 data are not available (as in MD and OH), we standardize to 2022.

[2] For MD, which has only two years of data, we fit a simplified version of the model that collapses levels 1 and 2 of the model, given that there is no residual variation at level 2 once we include the linear year term in the model.

[3] Note that the model allows the gap to vary in magnitude across districts and to change linearly over time, though it fixes the rate of change of the gender gap to be constant across districts (gender gaps change at the same rate in all districts). Put differently, we do not include random effect on the equation for α_{1yd} (the within-district trend in

$$\hat{Y}_{gyd} = \alpha_{0yd} + \alpha_{1yd}(male - 0.5) + \epsilon_{gyd}$$
$$\alpha_{0yd} = \beta_{00d} + \beta_{01d}(year - midyr) + r_{0yd}$$
$$\alpha_{1yd} = \beta_{10d} + \beta_{11d}(year - midyr)$$
$$\beta_{00d} = \gamma_{000} + \gamma_{001}(ses) + u_{00d}$$
$$\beta_{01d} = \gamma_{010} + \gamma_{011}(ses) + u_{01d}$$
$$\beta_{10d} = \gamma_{100} + \gamma_{101}(ses) + u_{10d}$$
$$\beta_{11d} = \gamma_{110}$$
$$\epsilon_{gyd} \sim \left(0, \omega^2_{gyd}\right); \boldsymbol{r}_{yd} \sim (0, \boldsymbol{\sigma}); u_d \sim (0, \boldsymbol{\tau})$$

In this model, the coefficients of interest are: γ_{100}, the average male-female gap in kindergarten readiness in the middle year observed for each state; and γ_{101}, the association between the male-female gap in kindergarten readiness and district SES.

Results

Table 2 reports male, female, and male-female differences in KRA score for the earliest and latest year available in each state, as well as the changes in these scores and gaps between the earliest and latest year. In most states and domains, girls score higher than boys, creating girl-favoring gaps. However, there are some cases where there is no score difference (Oregon math) or a slightly boy-favoring gap (Washington math). From the earliest to latest year available, readiness levels have increased in three states (Idaho, Mayland, and Washington), decreased in two states (Kentucky and Ohio), and increased in some domains while decreasing in others in one state (Oregon), though variation in these patterns may be due, in part, to differences in the years available in each state. Within each state and domain, girls' and boys' scores shift in the same direction from the earliest to latest year. Nonetheless, gender differences in score shifts create changes in the gender gap in some cases. In several state-domains, gender gaps shifted towards boys (Kentucky Literacy/Math, Oregon Literacy and Social-Emotional), while in others they shifted

gender gaps) nor on the equation for β_{11d} (the district-specific linear trend in gender gaps). Our analyses indicate there is insufficient variation in these parameters to justify including these random error terms.

towards girls (Kentucky Social-Emotional, Ohio Overall, Washington Social-Emotional). Because Table 2 shows only the earliest and latest year of data from each state and does not account for the number of available years, results in Table 2 illustrate shifts rather than annual rates of change and are not comparable across states and domains. Moreover, they do not use data from the intervening years to better estimate trends over time. In order to gain a clearer understanding of the magnitude and trends in gender gaps, we examine the results from fitting the model above to all the available data.

Table 3 presents the estimates from the pooled version of the model above, which show the magnitude and variation of gender gaps in each domain, linear time trends in gaps, and associations of gaps and trends with community SES. Results from state-specific models are available in Appendix Tables A5-A8.

Our results show that girls score higher than boys, on average, on kindergarten readiness assessments in most domains. Gaps are largest in the social-emotional domain: girls score 0.31 SDs higher than boys, on average. In literacy, gaps favor girls by 0.13 SD. In states that report a combined kindergarten readiness score, girls score 0.24 SD higher than boys. Though not directly comparable because of differences in how the domains are defined, gender gaps in literacy, social-emotional, and combined domains are fairly similar (and always girl-favoring) across reporting states. In math, gaps are near zero, with boys scoring 0.02 SD higher than girls, on average. However, gaps differ across states in our sample: math gaps favor boys by 0.04 SD in Washington and girls by 0.02 SD in Oregon (see Appendix Tables A5-A8).

The second pattern evident in Table 3 is that gender gaps have been relatively stable over time. In the pooled models, only the combined domain has any significant time trend (shifting slightly towards girls). However, there are a few notable state-domain-specific time trends (shown in Appendix Tables A5-A8). In Kentucky, literacy/math gaps narrow over time (become less girl-favoring) while SEL gaps grow (become more girl-favoring). In Oregon, gender gaps in SEL trend toward parity, becoming less girl-

favoring.

A third result shown in Table 3 is that gender gaps in kindergarten entry skills vary across school districts, though the variation is generally small (the gaps have a standard deviation of 0.02-0.04 SDs in most state-domains) relative to the size of the gender gap. District SES is associated with gender gaps in all domains: the gaps are less girl-favoring (in the literacy, socio-emotional, and combined domains) or more boy-favoring (in the math domain) in higher-SES districts than in lower-SES districts. The association is particularly strong in math, and weaker in literacy and social-emotional skills.

Discussion

In the six states for which we have data, girls enter kindergarten with higher average skills than boys in literacy and social-emotional skills, a pattern consistent with prior work using national samples (Chatterji, 2006; DiPrete & Jennings, 2012). Only two states report math data, and we find gaps near zero in both states (though boys score higher in Washington, and girls score higher in Oregon). In math, small gaps in either direction are also consistent with prior work (Cimpian et al., 2016; Fryer Jr. & Levitt, 2010).

Gender gaps vary across place, with higher-SES districts exhibiting more boy-favoring (or less girl-favoring) gaps across all domains, with the strongest associations in math and the weakest in literacy and social-emotional skills. This pattern is consistent with research suggesting that boys' developmental and academic outcomes are more sensitive to environmental conditions than girls', with gender gaps becoming more boy-favoring at higher levels of socioeconomic advantage (Autor et al., 2019; Chetty et al., 2016).

How do kindergarten gender gaps and SES associations relate to those in later grades?

It is useful to compare the estimated kindergarten entry gender gaps to those in grades 3–8 reported by Reardon et al. (2019). Our estimate of the girl-favoring literacy gap at kindergarten entry (0.13

SD) is roughly half of the average reading gap they report in for grades 3–8 (0.23 SD). Reardon et al. (2019) find reading gender gaps shift in favor of girls from grades 3 through 8, so using our evidence to extend this trend back to kindergarten suggests that literacy gaps grow increasingly girl-favoring throughout K-8 schooling. The comparison for math is less straightforward. The average math gap at kindergarten entry (0.02 SD) is similar to their estimate for grades 3-8 (0.03 SD), but our estimate is constructed from only two states with gaps in opposite directions, so it is difficult to draw conclusions about how math gaps shift across grades. We note that Reardon et al. (2019) capture kindergarten cohorts from 2001-2013 and find that the gender gaps narrow over time. As our study uses more recent data (from 2013-2024 kindergarten cohorts), differences in our findings may reflect broader time trends than trends within-cohort across grades. A longitudinal study of 2016-2024 kindergarten cohorts using NWEA MAP data finds kindergarten entry gaps similar to our estimates and shows that reading gaps remain stable and math gaps grow more boy-favoring through 5th grade (Kuhfeld & Burchinal, 2025).

We also compare associations between gender gaps and SES. In math, the association between district SES and the gender gap is present at both kindergarten entry and grades 3–8, but our pooled estimate is roughly twice the magnitude of the corresponding estimate in Reardon et al. (2019). In literacy, the association between district SES and the gender gap is small but statistically significant at kindergarten entry, and by grades 3–8, this association is effectively zero. Notably, we find that the association between district SES and gender gaps is prevalent across all domains (math, literacy, social-emotional domains), whereas Reardon et al. (2019) find this association in math and not in literacy. In both subjects, the association between district SES and gender gaps is smaller or absent after several years of formal schooling relative to school entry, suggesting that schooling may weaken SES-associations with gender gaps that are present before school entry, though the degree of this attenuation differs across domains. As noted before, these differences may be due to differences in the population of students represented: in this report, the kindergarten data represent only a subset of states and more recent

cohorts of children than the national sample in the Reardon et al. (2019) study.

Why do girls enter school with higher kindergarten readiness?

The most common explanation for this pattern is differential timing in the development of early skills, especially self-regulation and executive functioning, which girls generally develop earlier than boys (DiPrete & Jennings, 2012; Matthews et al., 2009; Montroy et al., 2016). Our results support this finding, as gaps are largest in social-emotional skills. These early SEL skills may support the development of academic skills earlier among girls than boys (DiPrete & Jennings, 2012). They may also influence how teachers rate girls and boys on kindergarten readiness assessments. Prior research indicates that teachers grade boys less favorably than girls with the same literacy or math skills, especially boys with lower noncognitive skills (Cornwell et al., 2013; Robinson & Lubienski, 2011). Since kindergarten readiness assessments are observational, teacher-reported measures in many states, teacher biases could be contributing to girl-favoring gaps. However, studies of kindergarten readiness skills that rely on direct assessments from trained assessors find similar gaps at kindergarten entry, suggesting that potential teacher gender measurement biases play little role in the gaps we observe (Chatterji, 2006; Cimpian et al., 2016; Fryer Jr. & Levitt, 2010).

While developmental differences may partly shape the gaps in kindergarten skills, differences in gender gaps across domains may point to gender-differentiated socialization practices in early childhood. Parents often promote gendered activities with their children, reading and storytelling more with girls, while engaging in more numeracy and measurement activities with boys (Baker & Milligan, 2016; Varnell et al., 2025). Gender-differentiated parenting practices have been shown to account for much of the gender gap in academic skills (Vasilyeva et al., 2025). The fact that we find large girl-favoring gaps in literacy and SEL and small boy-favoring gaps in math suggests that these gendered practices are happening on a large scale even in early childhood, before school starts.

Why do boys do better relative to girls in high SES communities?

Variation in the gender gap by community SES may be due to either different inputs to girls and boys in low and high SES places or differential effects of the same input by child gender. Though overall investment in boys and girls does not appear to vary by SES, it is possible that gender-differentiated inputs, such as gendered parenting activities, increase with SES (Bertrand & Pan, 2013; Hao & Yeung, 2015). Since parents are engaging in different (gendered) activities with boys and girls before kindergarten and families in higher SES communities have more resources to enact these practices, we would expect more gendered inputs, and therefore larger gender gaps in their stereotypical directions, in high SES places (Baker & Milligan, 2016; Duncan & Murnane, 2011; Ramey & Ramey, 2010; Varnell et al., 2025). The SES gradient in math follows this pattern. However, boys in high-SES communities also do better relative to girls in literacy and social-emotional domains, suggesting that boys in these places may not only be getting more access to gender-stereotypical activities (such as those that might enhance their early numeracy skills), but also more access than low-SES boys to a wide range of developmental experiences.

Another possibility is that there are different patterns of "academic redshirting" (holding children out of kindergarten for a year so that they enter with more developed cognitive and behavioral skills) in higher- and lower-SES communities. Students who redshirt generally enter kindergarten with higher literacy and math scores, and this score gain is larger for boys (Datar, 2006; Kuhfeld & Postell, 2026). Redshirting is roughly twice as prevalent among boys as girls and nearly three times as prevalent in the highest-SES quintile as the lowest (Bassok & Reardon, 2013). If higher-SES districts disproportionately have older boys in their kindergarten entry cohorts, the assessed boys in those districts would score higher relative to assessed girls than in lower-SES, less differentially redshirted, districts. This pattern could contribute to the SES gradient we observe across all domains at kindergarten entry, however, the overall prevalence of redshirting is modest (4–5.5% nationally), so it is unlikely to entirely account for the

observed gender gaps.[4]

Finally, another possible explanation is that the resources available in higher-SES communities are differentially beneficial for boys. Higher-SES families tend to invest more in children's education and these investments likely differentially benefit boys, potentially contributing to the broad SES gradient observed across domains at kindergarten entry (Autor et al., 2019; Bertrand & Pan, 2013; Duncan & Murnane, 2011; Ramey & Ramey, 2010). Higher-SES families provide greater emotional supportiveness and more enriching family activities (things like shared reading and outings to libraries, museums, etc.), which appear to generate larger returns for boys (Bertrand & Pan, 2013). Although higher-SES communities also have higher rates of enrollment in high-quality preschool programs, it is unlikely that there are differential benefits to preschool by gender (Bassok et al., 2016; Magnuson et al., 2016).

Limitations and implications

Though we do not have data to test possible mechanisms, we provide large-scale descriptive evidence documenting substantial gender gaps and variation in gender gaps by SES context. Boys start kindergarten with literacy and social-emotional skills already behind those of girls and may fall further behind in reading through 8th grade (Reardon et al., 2019). Gaps are especially pronounced in lower-SES places in all domains, but especially in math. Regardless of why boys have lower readiness on average and in low-SES places, these patterns have important implications: early disadvantages may shape boys' sense of academic skill, their interest and engagement in school, and their longer-term educational ambitions. Larger disparities in lower-SES areas illustrate the need to support early educational opportunity for boys to realize equitable educational outcomes.

[4] A back-of-the-envelope calculation suggests that the gender gap in redshirting is at most 1% percentage points larger in districts that differ by 1 SD of SES; if redshirted students score, on average, 1 SD above non-redshirted students, this would account for at most 0.01 of the observed SES-x-gender interaction in our models. The coefficients in the math and overall models in Table 3 are larger than this, so it is unlikely that redshirting accounts for the associated between SES and gender gaps.

Tables and Figures

Table 1: Analytic Sample

State	Domain	Statistic	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	Total
ID	Literacy	N districts						66	52	56	54	47	51	326
		N students						19,155	18,589	18,244	18,286	16,274	16,102	106,650
KY	Literacy/Math	N districts	169	168	167	165	166	169	168	167	169			1,508
		N students	50,444	48,980	46,694	46,432	41,886	47,856	47,711	49,398	48,278			427,679
	Social-Emotional	N districts	168	165	163	163	164	169	165	159	162			1,478
		N students	48,077	45,418	44,478	44,777	40,574	46,985	44,966	48,873	47,810			411,958
MD	Overall	N districts									21	22		43
		N students									42,206	56,014		98,220
OH	Language/Literacy	N districts								568	575	572	515	2,230
		N students								109,656	106,326	104,448	101,016	421,446
	Overall	N districts								565	572	573	418	2,128
		N students								106,854	104,123	102,760	87,639	401,376
OR	Literacy	N districts	152	154	153	154	152	157	140					1,062
		N students	40,074	39,598	39,098	39,857	40,089	40,261	40,233					279,210
	Math	N districts					153	157	140					450
		N students					40,298	40,347	40,270					120,915
	Social-Emotional	N districts	153	155	154	155	153	157	140					1,067
		N students	41,055	40,450	40,181	40,549	40,685	40,745	40,543					284,208
WA	Literacy	N districts					199	209	203	206	210	221	204	1,452
		N students					77,073	77,855	78,923	72,645	71,945	71,879	68,478	518,798
	Math	N districts					203	213	204	208	211	222	205	1,466
		N students					77,074	78,007	78,995	72,822	71,936	72,036	68,510	519,380
	Social-Emotional	N districts					204	212	205	207	213	222	205	1,468
		N students					77,266	78,088	79,192	72,466	72,298	72,286	68,091	519,687
Total (Unique Count)		N districts	323	325	322	320	523	605	565	1,000	1,032	864	771	6,650
		N students	91,523	89,488	86,897	86,981	159,837	185,844	186,035	250,177	287,394	249,022	185,628	1,858,826

Note: bottom row indicates approximate number of unique students/districts.

Table 2: Average kindergarten readiness, by state, gender, earliest and latest year available

				Earliest Year				Latest Year				Change (Latest - Earliest Year)			
State	Domain	Earliest	Latest	All	Female	Male	M-F Gap	All	Female	Male	M-F Gap	All	Female	Male	M-F Gap
ID	Literacy	2018	2024	0.024	0.103	-0.013	-0.117***	0.180	0.252	0.162	-0.090***	0.156***	0.149***	0.175***	0.027
	Literacy			(0.009)	(0.012)	(0.012)	(0.017)	(0.009)	(0.013)	(0.013)	(0.018)	(0.013)	(0.018)	(0.018)	(0.025)
KY	Literacy/Math	2013	2022	-0.006	0.088	-0.092	-0.181***	-0.076	-0.009	-0.137	-0.128***	-0.069***	-0.097***	-0.045***	0.052***
				(0.005)	(0.007)	(0.008)	(0.011)	(0.006)	(0.008)	(0.008)	(0.011)	(0.008)	(0.011)	(0.012)	(0.016)
	Social-Emotional	2013	2022	0.009	0.163	-0.142	-0.305***	-0.064	0.107	-0.227	-0.334***	-0.073***	-0.056***	-0.085***	-0.029**
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.009)	(0.010)	(0.014)
MD	Overall	2022	2023	-0.016	0.119	-0.003	-0.121***	0.066	0.160	0.030	-0.130***	0.081***	0.042*	0.033***	-0.009
				(0.004)	(0.017)	(0.009)	(0.020)	(0.005)	(0.017)	(0.008)	(0.019)	(0.007)	(0.024)	(0.012)	(0.027)
OH	Language/Literacy	2021	2024	0.077	0.136	0.004	-0.132***	0.059	0.110	-0.034	-0.143***	-0.018***	-0.026***	-0.038***	-0.012
				(0.003)	(0.005)	(0.005)	(0.007)	(0.004)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)	(0.007)	(0.010)
	Overall	2021	2024	0.006	0.126	-0.079	-0.205***	-0.029	0.111	-0.119	-0.230***	-0.035***	-0.016**	-0.040***	-0.025***
				(0.003)	(0.004)	(0.005)	(0.006)	(0.003)	(0.005)	(0.005)	(0.007)	(0.004)	(0.007)	(0.007)	(0.009)
OR	Literacy	2013	2019	-0.110	-0.071	-0.146	-0.075***	-0.002	0.024	-0.025	-0.049***	0.109***	0.095***	0.121***	0.026*
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.010)	(0.010)	(0.014)
	Math	2017	2019	0.057	0.065	0.052	-0.012	0.000	0.000	-0.003	-0.003	-0.057***	-0.065***	-0.056***	0.009
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.010)	(0.010)	(0.014)
	Social-Emotional	2013	2019	0.067	0.314	-0.164	-0.479***	-0.033	0.201	-0.249	-0.450***	-0.101***	-0.113***	-0.084***	0.029**
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.010)	(0.010)	(0.014)
WA	Literacy	2017	2024	-0.189	-0.143	-0.247	-0.104***	-0.131	-0.077	-0.184	-0.107***	0.058***	0.065***	0.063***	-0.003
				(0.004)	(0.005)	(0.005)	(0.008)	(0.004)	(0.006)	(0.006)	(0.008)	(0.006)	(0.008)	(0.008)	(0.011)
	Math	2017	2024	-0.120	-0.133	-0.109	0.024***	-0.016	-0.024	0.000	0.024***	0.104***	0.109***	0.109***	0.001
				(0.004)	(0.005)	(0.006)	(0.008)	(0.004)	(0.006)	(0.006)	(0.008)	(0.006)	(0.008)	(0.008)	(0.011)
	Social-Emotional	2017	2024	-0.184	-0.055	-0.321	-0.267***	-0.049	0.093	-0.192	-0.285***	0.135***	0.147***	0.129***	-0.018*
				(0.003)	(0.005)	(0.005)	(0.007)	(0.004)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)	(0.007)	(0.010)

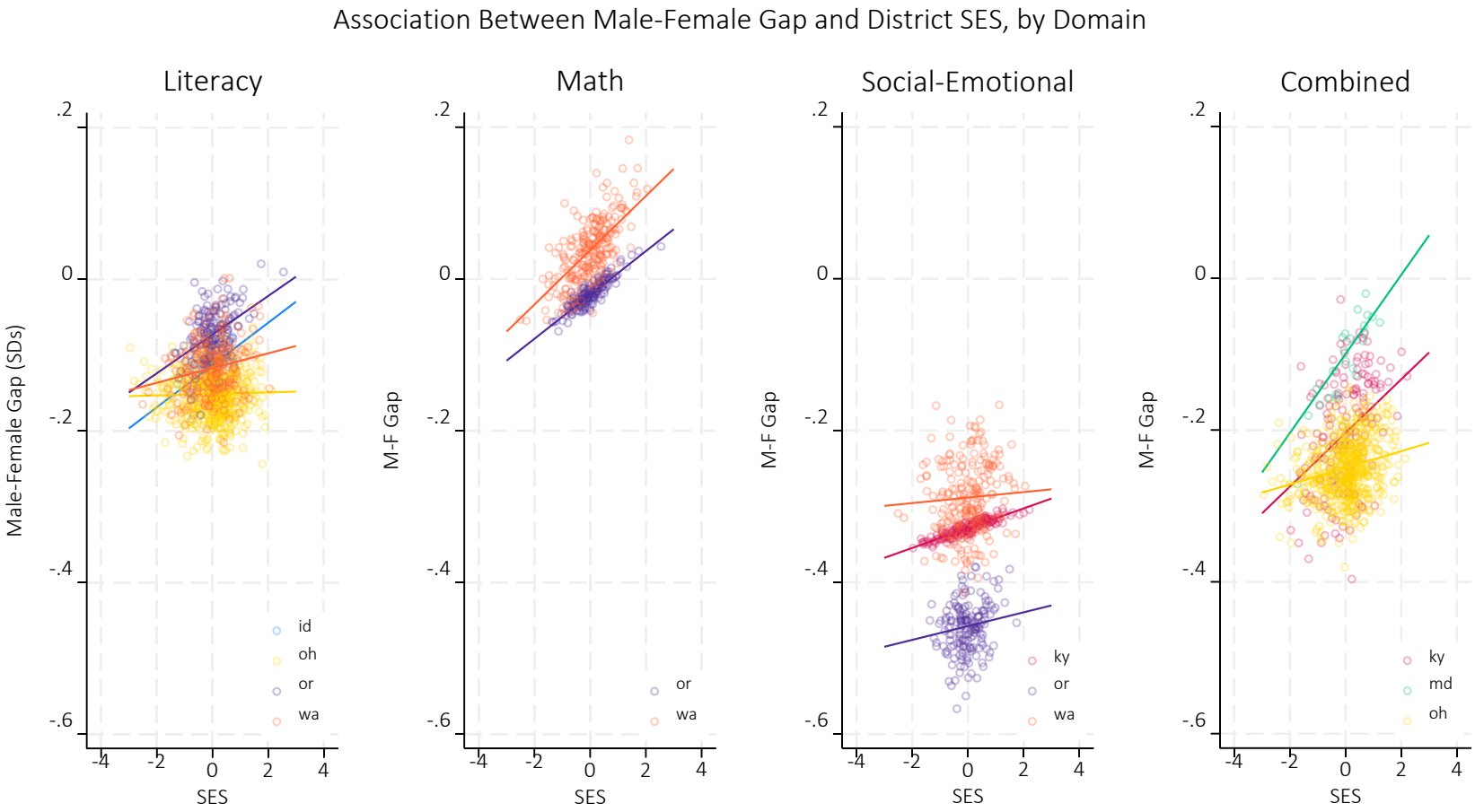
Table 3: Model output, pooled domain models

	Literacy		Math		Social-Emotional		Combined	
Intercept	-0.010	-0.043***	-0.052**	-0.056***	-0.075***	-0.072***	0.073***	0.058***
	(0.011)	(0.008)	(0.017)	(0.014)	(0.010)	(0.010)	(0.012)	(0.009)
Year	0.006**	0.006**	0.007*	0.006*	0.007***	0.007***	-0.000	-0.000
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
Male	-0.127***	-0.128***	0.023***	0.016***	-0.313***	-0.315***	-0.240***	-0.242***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)
Year X Male	-0.000	-0.000	0.001	0.002	-0.001	-0.001	-0.008**	-0.008**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
SES		0.296***		0.252***		0.079***		0.260***
		(0.010)		(0.020)		(0.011)		(0.010)
SES X Year		-0.004		0.008*		0.004*		-0.001
		(0.002)		(0.004)		(0.002)		(0.002)
SES X Male		0.006*		0.045***		0.008*		0.017***
		(0.003)		(0.005)		(0.004)		(0.004)
SD(Intercept)	0.329	0.233	0.311	0.253	0.184	0.174	0.316	0.221
SD(Year)	0.030	0.030	0.034	0.033	0.026	0.026	0.018	0.018
SD(Male)	0.032	0.032	0.043	0.035	0.037	0.037	0.055	0.052
Included States	ID, OH, OR, WA		OR, WA		KY, OR, WA		KY, MD, OH	

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Figure 1: Association between male-female kindergarten readiness gaps and SES, by domain and state



Appendix Tables

Table A1: Kindergarten Readiness Assessment details

State	Assessment	Type	Reported Domains
ID	iStation indicators of progress for early reading	Direct, online	Literacy
KY	BRIGANCE	Mix of selected response, performance task, observational	Language, Literacy/Math, Physical, Social-Emotional, Self Help
MD	MD-OH KRA	Mix of selected response, performance task, observational	Overall
OH	MD-OH KRA	Mix of selected response, performance task, observational	Language/Literacy
OR	State-developed (OKR)	Mix of direct and observational	Literacy, Math, Social-Emotional
WA	Adaptation of TS GOLD	Observational, teacher-reported	Cognitive (approaches to learning), Language, Literacy, Math, Physical, Social-Emotional

Table A2: Analytic sample, additional domains

State	Domain	Statistic	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	Total
ID	Literacy	N districts						66	52	56	54	47	51	326
		N students						19,155	18,589	18,244	18,286	16,274	16,102	106,650
KY	Language	N districts	170	170	168	165	166	169	168	167	168			1,511
		N students	50,468	49,038	46,716	46,432	41,886	47,856	47,711	49,335	48,134			427,576
	Literacy/Math	N districts	169	168	167	165	166	169	168	167	169			1,508
		N students	50,444	48,980	46,694	46,432	41,886	47,856	47,711	49,398	48,278			427,679
	Physical	N districts	169	168	167	165	166	168	167	168	168			1,506
		N students	50,435	48,983	46,687	46,432	41,886	47,825	47,679	49,455	48,213			427,595
	Social-Emotional	N districts	168	165	163	163	164	169	165	159	162			1,478
		N students	48,077	45,418	44,478	44,777	40,574	46,985	44,966	48,873	47,810			411,958
	Self Help	N districts	167	163	162	163	164	168	164	160	162			1,473
		N students	48,047	45,368	44,452	44,777	40,574	46,960	44,939	48,937	47,810			411,864
MD	Overall	N districts									21	22		43
		N students									42,206	56,014		98,220
OH	Language/Literacy	N districts								568	575	572	515	2,230
		N students								109,656	106,326	104,448	101,016	421,446
	Overall	N districts								565	572	573	418	2,128
		N students								106,854	104,123	102,760	87,639	401,376
OR	Literacy	N districts	152	154	153	154	152	157	140					1,062
		N students	40,074	39,598	39,098	39,857	40,089	40,261	40,233					279,210
	Math	N districts					153	157	140					450
		N students					40,298	40,347	40,270					120,915
	Social-Emotional	N districts	153	155	154	155	153	157	140					1,067
		N students	41,055	40,450	40,181	40,549	40,685	40,745	40,543					284,208
WA	Approaches to Learning	N districts					202	212	204	207	212	220	205	1,462
		N students					77,072	77,995	79,030	72,626	71,951	71,932	68,124	518,730
	Language	N districts					201	211	203	205	213	222	205	1,460
		N students					77,187	77,970	79,025	72,739	72,106	72,104	68,171	519,302
	Literacy	N districts					199	209	203	206	210	221	204	1,452
		N students					77,073	77,855	78,923	72,645	71,945	71,879	68,478	518,798
	Math	N districts					203	213	204	208	211	222	205	1,466
		N students					77,074	78,007	78,995	72,822	71,936	72,036	68,510	519,380
	Physical	N districts					199	210	202	204	209	217	202	1,443
		N students					77,130	77,977	79,070	72,578	71,923	71,763	68,111	518,552
	Social-Emotional	N districts					204	212	205	207	213	222	205	1,468
		N students					77,266	78,088	79,192	72,466	72,298	72,286	68,091	519,687
Total (Unique Count)		N districts	323	325	322	320	523	605	565	1,000	1,032	864	771	6,650
		N students	91,523	89,488	86,897	86,981	159,837	185,844	186,035	250,177	287,394	249,022	185,628	1,858,826

Note: bottom row indicates approximate number of unique students/districts.

Table A3: Kindergarten readiness assessment participation rate by state, year

State	Domain	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	Total
ID	Literacy						98%	97%	97%	98%	96%		97%
KY	Language	98%	98%	98%	99%	99%	99%	99%	100%	100%			99%
	Literacy/Math	98%	98%	98%	99%	99%	99%	99%	100%	100%			99%
	Physical	98%	98%	98%	99%	99%	99%	99%	100%	100%			99%
	Social-Emotional	93%	91%	94%	95%	96%	97%	93%	99%	99%			95%
	Self Help	93%	91%	94%	95%	96%	97%	93%	99%	99%			95%
MD	Overall									96%	97%		97%
OH	Language/Literacy								91%	91%	91%	91%	91%
	Overall								89%	89%	89%	87%	88%
OR	Literacy	95%	96%	95%	96%	97%	97%	97%					96%
	Math					97%	97%	97%					97%
	Social-Emotional	97%	98%	97%	98%	98%	98%	97%					98%
WA	Approaches to Learning					97%	97%	97%	96%	95%	97%	98%	96%
	Language					97%	97%	97%	96%	95%	97%	98%	97%
	Literacy					97%	97%	97%	96%	95%	96%	98%	97%
	Math					97%	97%	97%	96%	95%	97%	98%	97%
	Physical					97%	97%	97%	96%	95%	96%	98%	97%
	Social-Emotional					97%	97%	97%	95%	95%	97%	98%	97%
Total	Total	96%	96%	96%	97%	97%	98%	97%	96%	96%	95%	93%	96%

Table A4: Average kindergarten readiness, by gender, year, additional domains

				Earliest Year				Latest Year				Change (Latest - Earliest Year)			
State	Domain	Earliest	Latest	All	Female	Male	M-F Gap	All	Female	Male	M-F Gap	All	Female	Male	M-F Gap
ID	Literacy	2018	2024	0.024	0.103	-0.013	-0.117***	0.180	0.252	0.162	-0.090***	0.156***	0.149***	0.175***	0.027
				(0.009)	(0.012)	(0.012)	(0.017)	(0.009)	(0.013)	(0.013)	(0.018)	(0.013)	(0.018)	(0.018)	(0.025)
KY	Language	2013	2022	-0.093	0.028	-0.217	-0.245***	-0.114	0.012	-0.243	-0.256***	-0.021***	-0.016*	-0.026***	-0.010
				(0.005)	(0.006)	(0.007)	(0.009)	(0.005)	(0.006)	(0.007)	(0.009)	(0.007)	(0.009)	(0.010)	(0.013)
	Literacy/Math	2013	2022	-0.006	0.088	-0.092	-0.181***	-0.076	-0.009	-0.137	-0.128***	-0.069***	-0.097***	-0.045***	0.052***
				(0.005)	(0.007)	(0.008)	(0.011)	(0.006)	(0.008)	(0.008)	(0.011)	(0.008)	(0.011)	(0.012)	(0.016)
	Physical	2013	2022	0.036	0.186	-0.110	-0.295***	-0.052	0.088	-0.183	-0.272***	-0.087***	-0.097***	-0.074***	0.024
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.008)	(0.010)	(0.007)	(0.010)	(0.011)	(0.014)
	Social-Emotional	2013	2022	0.009	0.163	-0.142	-0.305***	-0.064	0.107	-0.227	-0.334***	-0.073***	-0.056***	-0.085***	-0.029**
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.009)	(0.010)	(0.014)
	Self Help	2013	2022	0.113	0.317	-0.093	-0.411***	-0.061	0.130	-0.249	-0.379***	-0.174***	-0.187***	-0.156***	0.032**
				(0.005)	(0.007)	(0.008)	(0.010)	(0.005)	(0.007)	(0.008)	(0.010)	(0.007)	(0.010)	(0.011)	(0.014)
MD	Overall	2022	2023	-0.016	0.119	-0.003	-0.121***	0.066	0.160	0.030	-0.130***	0.081***	0.042*	0.033***	-0.009
				(0.004)	(0.017)	(0.009)	(0.020)	(0.005)	(0.017)	(0.008)	(0.019)	(0.007)	(0.024)	(0.012)	(0.027)
OH	Language/Literacy	2021	2024	0.077	0.136	0.004	-0.132***	0.059	0.110	-0.034	-0.143***	-0.018***	-0.026***	-0.038***	-0.012
				(0.003)	(0.005)	(0.005)	(0.007)	(0.004)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)	(0.007)	(0.010)
	Overall	2021	2024	0.006	0.126	-0.079	-0.205***	-0.029	0.111	-0.119	-0.230***	-0.035***	-0.016**	-0.040***	-0.025***
				(0.003)	(0.004)	(0.005)	(0.006)	(0.003)	(0.005)	(0.005)	(0.007)	(0.004)	(0.007)	(0.007)	(0.009)
OR	Literacy	2013	2019	-0.110	-0.071	-0.146	-0.075***	-0.002	0.024	-0.025	-0.049***	0.109***	0.095***	0.121***	0.026*
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.010)	(0.010)	(0.014)
	Math	2017	2019	0.057	0.065	0.052	-0.012	0.000	0.000	-0.003	-0.003	-0.057***	-0.065***	-0.056***	0.009
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.010)	(0.010)	(0.014)
	Social-Emotional	2013	2019	0.067	0.314	-0.164	-0.479***	-0.033	0.201	-0.249	-0.450***	-0.101***	-0.113***	-0.084***	0.029**
				(0.005)	(0.007)	(0.007)	(0.010)	(0.005)	(0.007)	(0.007)	(0.010)	(0.007)	(0.010)	(0.010)	(0.014)
WA	Approaches to Learning	2017	2024	-0.174	-0.069	-0.279	-0.210***	0.024	0.152	-0.097	-0.249***	0.198***	0.221***	0.182***	-0.039***
				(0.004)	(0.005)	(0.005)	(0.007)	(0.004)	(0.006)	(0.006)	(0.008)	(0.006)	(0.008)	(0.008)	(0.011)
	Language	2017	2024	-0.174	-0.072	-0.279	-0.206***	-0.070	0.059	-0.193	-0.252***	0.104***	0.131***	0.086***	-0.045***
				(0.004)	(0.006)	(0.006)	(0.008)	(0.004)	(0.006)	(0.006)	(0.009)	(0.006)	(0.008)	(0.008)	(0.012)
	Literacy	2017	2024	-0.189	-0.143	-0.247	-0.104***	-0.131	-0.077	-0.184	-0.107***	0.058***	0.065***	0.063***	-0.003
				(0.004)	(0.005)	(0.005)	(0.008)	(0.004)	(0.006)	(0.006)	(0.008)	(0.006)	(0.008)	(0.008)	(0.011)
	Math	2017	2024	-0.120	-0.133	-0.109	0.024***	-0.016	-0.024	0.000	0.024***	0.104***	0.109***	0.109***	0.001
				(0.004)	(0.005)	(0.006)	(0.008)	(0.004)	(0.006)	(0.006)	(0.008)	(0.006)	(0.008)	(0.008)	(0.011)
	Physical	2017	2024	-0.261	-0.139	-0.393	-0.254***	-0.061	0.087	-0.207	-0.294***	0.200***	0.226***	0.186***	-0.039***
				(0.004)	(0.006)	(0.005)	(0.008)	(0.004)	(0.006)	(0.006)	(0.009)	(0.006)	(0.008)	(0.008)	(0.011)
	Social-Emotional	2017	2024	-0.184	-0.055	-0.321	-0.267***	-0.049	0.093	-0.192	-0.285***	0.135***	0.147***	0.129***	-0.018*
				(0.003)	(0.005)	(0.005)	(0.007)	(0.004)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)	(0.007)	(0.010)

Table A5: Model output, literacy

	ID		OH		OR		WA		Pooled	
Intercept	-0.025	-0.022	0.098***	0.097***	-0.052*	-0.053**	-0.152***	-0.155***	-0.010	-0.043***
	(0.038)	(0.033)	(0.015)	(0.010)	(0.020)	(0.017)	(0.023)	(0.017)	(0.011)	(0.008)
Year	0.039***	0.039***	0.002	0.003	0.025***	0.024***	-0.001	-0.001	0.006**	0.006**
	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Male	-0.114***	-0.113***	-0.151***	-0.151***	-0.073***	-0.073***	-0.117***	-0.117***	-0.127***	-0.128***
	(0.008)	(0.009)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)
Year X Male	0.002	0.002	-0.002	-0.002	0.004	0.004	0.001	0.001	-0.000	-0.000
	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
SES		0.352***		0.305***		0.220***		0.295***		0.296***
		(0.079)		(0.012)		(0.030)		(0.023)		(0.010)
SES X Year		0.015		-0.010*		-0.003		0.001		-0.004
		(0.013)		(0.004)		(0.006)		(0.004)		(0.002)
SES X Male		0.028		0.001		0.025**		0.010		0.006*
		(0.020)		(0.004)		(0.009)		(0.006)		(0.003)
SD(Intercept)	0.287	0.249	0.353	0.232	0.247	0.209	0.332	0.245	0.329	0.233
SD(Year)	0.026	0.025	0.054	0.054	0.027	0.027	0.027	0.027	0.029	0.029
SD(Male)	0.020	0.023	0.031	0.031	0.029	0.027	0.038	0.037	0.032	0.032

Table A6: Model output, math

	OR		WA		Pooled	
Intercept	0.039	0.037	-0.106***	-0.109***	-0.053**	-0.056***
	(0.022)	(0.019)	(0.023)	(0.017)	(0.017)	(0.014)
Year	-0.027***	-0.027***	0.009**	0.009**	0.007*	0.007*
	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)	(0.003)
Male	-0.018**	-0.021***	0.041***	0.038***	0.024***	0.017***
	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)
Year X Male	0.004	0.004	0.002	0.002	0.001	0.001
	(0.007)	(0.007)	(0.001)	(0.001)	(0.001)	(0.001)
SES		0.222***		0.301***		0.250***
		(0.033)		(0.024)		(0.020)
SES X Year		0.012		0.008		0.008
		(0.012)		(0.004)		(0.004)
SES X Male		0.029**		0.036***		0.045***
		(0.010)		(0.006)		(0.005)
SD(Intercept)	0.262	0.224	0.335	0.244	0.310	0.253
SD(Year)	0.019	0.019	0.034	0.034	0.034	0.033
SD(Male)	0.017	0.009	0.039	0.029	0.044	0.035

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table A7: Model output, social-emotional

	KY		OR		WA		Pooled	
Intercept	-0.017	-0.018	0.022	0.023	-0.099***	-0.101***	-0.074***	-0.071***
	(0.010)	(0.010)	(0.019)	(0.018)	(0.014)	(0.013)	(0.010)	(0.010)
Year	-0.006***	-0.006***	-0.023***	-0.023***	0.015***	0.015***	0.007***	0.007***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)	(0.002)
Male	-0.323***	-0.329***	-0.458***	-0.458***	-0.287***	-0.289***	-0.313***	-0.315***
	(0.003)	(0.004)	(0.006)	(0.006)	(0.005)	(0.005)	(0.003)	(0.003)
Year X Male	-0.003**	-0.003**	0.005**	0.005**	-0.002	-0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
SES		0.043***		0.114***		0.102***		0.079***
		(0.012)		(0.031)		(0.018)		(0.011)
SES X Year		-0.001		0.010		0.008		0.004
		(0.002)		(0.007)		(0.004)		(0.002)
SES X Male		0.013**		0.009		0.004		0.008*
		(0.005)		(0.009)		(0.007)		(0.004)
SD(Intercept)	0.126	0.120	0.225	0.214	0.193	0.175	0.185	0.174
SD(Year)	0.013	0.013	0.035	0.035	0.034	0.033	0.026	0.026
SD(Male)	0.004	0.005	0.035	0.034	0.048	0.049	0.037	0.037

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table A8: Model output, combined domains

	KY		MD		OH		Pooled	
Intercept	-0.066***	-0.068***	0.101***	0.101***	0.094***	0.093***	0.073***	0.058***
	(0.017)	(0.014)	(0.024)	(0.022)	(0.014)	(0.010)	(0.012)	(0.009)
Year	-0.010***	-0.010***	0.036*	0.047**	0.001	0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.017)	(0.017)	(0.003)	(0.003)	(0.003)	(0.003)
Male	-0.200***	-0.203***	-0.111*	-0.099**	-0.250***	-0.250***	-0.240***	-0.242***
	(0.008)	(0.007)	(0.045)	(0.035)	(0.004)	(0.004)	(0.004)	(0.004)
Year X Male	0.009***	0.009***			-0.010***	-0.010***	-0.008**	-0.008**
	(0.001)	(0.001)			(0.003)	(0.003)	(0.003)	(0.003)
SES		0.147***		0.055		0.296***		0.260***
		(0.017)		(0.028)		(0.011)		(0.010)
SES X Year		-0.003		-0.055**		-0.001		-0.001
		(0.002)		(0.018)		(0.003)		(0.002)
SES X Male		0.035***		0.052		0.011**		0.017***
		(0.009)		(0.053)		(0.004)		(0.004)
SD(Intercept)	0.214	0.176	0.065	0.060	0.345	0.228	0.316	0.221
SD(Year)	0.016	0.016	0.025	0.015	0.042	0.042	0.018	0.018
SD(Male)	0.072	0.065	0.104	0.059	0.040	0.038	0.055	0.052

Standard errors in parentheses

* p<0.05, ** p<0.01, *** p<0.001

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