Chevalier et al. (2004)

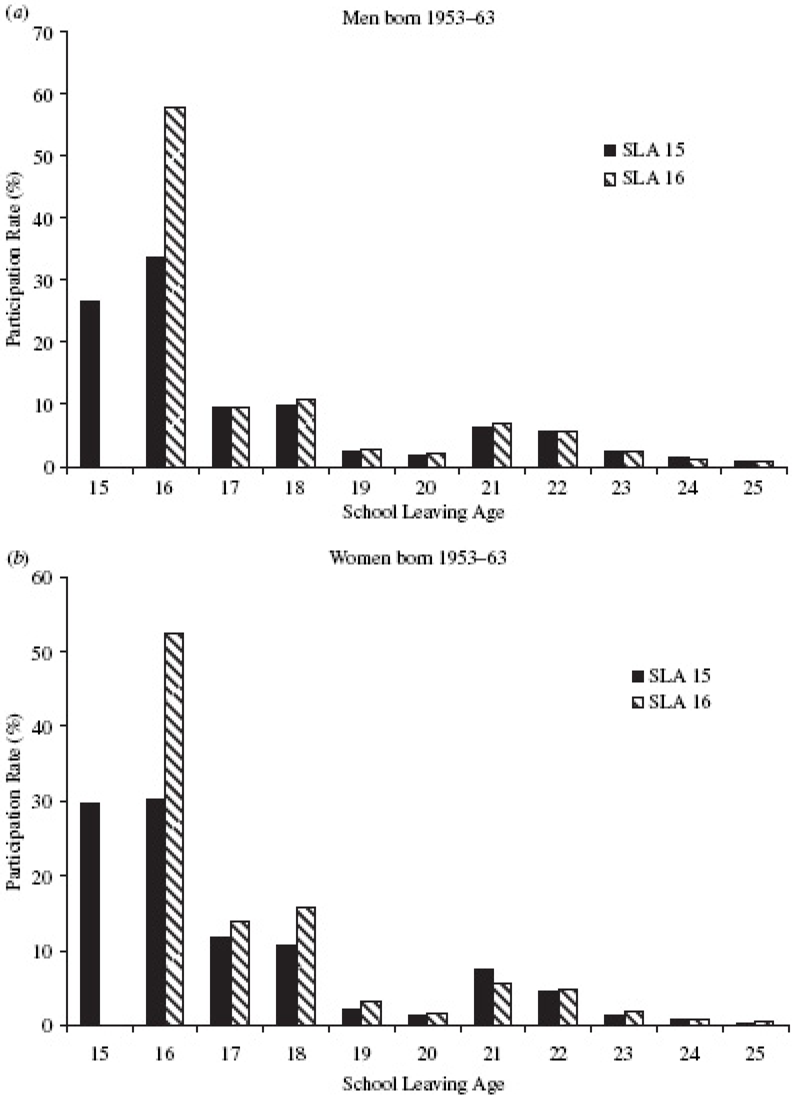


Fig. 5. *Pre- and Post-RoSLA School Leaving Age Distributions*

Labor Economics
Handout on Bedard - Signalling paper

Bedard uses a signalling model with continuous ability types (θ) and three schooling groups (d, h, u). The cost of high school is $C_h(\theta)$ and the cost of university is $C_h(\theta)+ C_u(\theta)$. A fraction $1-p$ of individuals is constrained from going to university.

In a separating equilibrium, there will be two cutoff productivites θ_h and θ_u, so that individuals with ability below θ_h drop out of school, those with abilities above θ_p go to university if they are not constrained, and everybody else goes to high school. In equilibrium, wages correspond to productivities. The wage of high school graduates is given by:

$$w_h = \phi = \frac{[F(\theta_u) - F(\theta_h)]\, E\left[\theta|\theta_h \leq \theta < \theta_u\right] + (1-p)\,[1-F(\theta_u)]\, E\left[\theta|\theta \geq \theta_u\right]}{[F(\theta_u) - F(\theta_h)] + (1-p)\,[1-F(\theta_u)]}$$

The cutoff points are defined implictly by equating utilities of the marginal students:

$$\begin{aligned} w_d &= w_h - C_h(\theta_h) \\ w_h - C_h(\theta_u) &= w_u - C_u(\theta_u) - C_h(\theta_u) \end{aligned}$$

Using $w_d = E\left[\theta|\theta < \theta_h\right]$ and $w_u = E\left[\theta|\theta \geq \theta_u\right]$ yields

$$\begin{aligned} E\left[\theta|\theta < \theta_h\right] &= \phi - C_h(\theta_h) \\ E\left[\theta|\theta \geq \theta_u\right] &= \phi + C_u(\theta_u) \end{aligned} \tag{1}$$

We are interested in what happens to the fraction of high school drop outs as the constraint on accessing university (p) changes. Hence, we want the derivative $d\theta_h/dp$. This is found by totally differentiating the two cutoff conditions in (1):

$$\begin{aligned} \frac{\partial w_d}{\partial \theta_h} d\theta_h &= \frac{\partial \phi}{\partial p} dp + \frac{\partial \phi}{\partial \theta_h} d\theta_h + \frac{\partial \phi}{\partial \theta_u} d\theta_u - \frac{\partial C_h(\theta_h)}{\partial \theta_h} d\theta_h \\ \frac{\partial w_u}{\partial \theta_u} d\theta_u &= \frac{\partial \phi}{\partial p} dp + \frac{\partial \phi}{\partial \theta_h} d\theta_h + \frac{\partial \phi}{\partial \theta_u} d\theta_u + \frac{\partial C_u(\theta_u)}{\partial \theta_u} d\theta_u \end{aligned}$$

Look at the first equation, and collect terms

$$\underbrace{\left[\frac{\partial w_d}{\partial \theta_h} - \frac{\partial \phi}{\partial \theta_h} + \frac{\partial C_h(\theta_h)}{\partial \theta_h}\right]}_{=\gamma_h} \quad d\theta_h = \tfrac{\partial \phi}{\partial p} dp + \tfrac{\partial \phi}{\partial \theta_u} d\theta_u$$

and similarly for the second equation

$$\gamma_u d\theta_u = \frac{\partial \phi}{\partial p} dp + \frac{\partial \phi}{\partial \theta_h} d\theta_h$$

Using this to substitute for $d\theta_u$ above yields

$$\begin{aligned}
\gamma_h d\theta_h &= \frac{\partial \phi}{\partial p} dp + \frac{\partial \phi}{\partial \theta_u} \frac{1}{\gamma_u} \left[\frac{\partial \phi}{\partial p} dp + \frac{\partial \phi}{\partial \theta_h} \right] d\theta_h \\
\left[\gamma_h \gamma_u - \frac{\partial \phi}{\partial \theta_h} \frac{\partial \phi}{\partial \theta_u} \right] d\theta_h &= \frac{\partial \phi}{\partial p} \left(\gamma_u + \frac{\partial \phi}{\partial \theta_u} \right) dp \\
\frac{d\theta_h}{dp} &= \frac{\frac{\partial \phi}{\partial p} \left(\gamma_u + \frac{\partial \phi}{\partial \theta_u} \right)}{\gamma_h \gamma_u - \frac{\partial \phi}{\partial \theta_h} \frac{\partial \phi}{\partial \theta_u}}
\end{aligned}$$

The denominator is a stability condition and is negative. $\partial \phi / \partial p < 0$ because fewer constrained individuals will lower the average ability of the high school graduate pool. Finally

$$\gamma_u + \frac{\partial \phi}{\partial \theta_u} = \frac{\partial E \left[\theta | \theta \geq \theta_u \right]}{\partial \theta_u} - \frac{\partial C_u(\theta_u)}{\partial \theta_u} > 0$$

from the definition of γ_u. This term is positive because $\partial E \left[\theta | \theta \geq \theta_u \right] / \partial \theta_u > 0$, when fewer individuals go to university the average ability of these individuals will be higher, and $\partial C_u(\theta_u) / \partial \theta_u < 0$ by the assumption necessary for a signalling model. Hence

$$\frac{d\theta_h}{dp} > 0$$

or when the constraint is relaxed and more individuals go to university, then also more individuals will choose to drop out of high school.

In order to gain intuition on this, consider the case where we start from a situation with $p = 1$, i.e. nobody is constrained. Now lower p by a little bit. Some individuals previously attending university will now go to high school only, and the average abilty of high school graduates will rise. Therefore their wage will rise. In fact, with $p = 1$, this effect is just $\partial \phi / \partial p$. Therefore, it becomes attractive for the highest ability high school drop outs to graduate from high school in order to get the higher high school graduate wage. This will lower the both the high school drop out and high school graduate wage. Marginal university graduates will now also decide to just get a high school degree, hence increasing the high school wage. The algebra says that these second round effects cannot dominate, and even with $p < 1$, some high school drop outs will be induced to graduate as p falls.

TABLE V

DIFFERENCE-IN-DIFFERENCES ESTIMATES OF THE IMPACT OF THE GED ON 1995 EARNINGS OF DROPOUTS WHO TESTED IN 1990 (STANDARD ERRORS ARE IN PARENTHESES.)

	Experiment 4			Experiment 3			Experiment 3*		
	State passing standard is		Low-High standard	State passing standard is		Low-High standard	State passing standard is		Low-High standard
	Low	High	contrast	Low	High	contrast	Low	High	contrast
Panel A: Whites									
Test score is									
Low	9628	7849	1779	9362	7843	1509	9362	8616	746
	(361)	(565)	(670)	(400)	(312)	(507)	(400)	(219)	(456)
High	9981	9676	305	9143	9165	−23	9143	9304	−162
	(80)	(65)	(103)	(135)	(63)	(149)	(135)	(135)	(150)
Difference-in-differences for whites			1473*			1531**			907~
			(678)			(529)			(481)
Panel B: Minorities									
Test score is									
Low	6436	8687	−2252	7005	7367	−363	7005	6858	147
	(549)	(690)	(882)	(347)	(347)	(495)	(347)	(290)	(452)
High	7560	8454	−894	7782	8375	−593	7782	7568	214
	(184)	(96)	(207)	(214)	(93)	(233)	(214)	(133)	(252)
Difference-in-differences for minorities			−1357			231			−67
			(906)			(548)			(518)

** = significant at the 0.01 level, * = significant at the 0.05 level, ~ = significant at the 0.10 level.

Experiment 4: Test Score Low: score group = 4; Test Score High score groups = 5–10.

Passing Standard Low: 35 minimum score and 45 mean score; Passing Standard High: 40 minimum score and 45 mean score.

Low Passing Standard states: All states except for TX, LA, MS, NE, FL, NY, CA, WA, and CT; High Passing Standard states: NY and FL.

Experiment 3: Test Score Low: score group = 3; Test Score High score groups = 5–10.

Passing Standard Low: 40 minimum score *or* 45 mean score; Passing Standard High: 40 minimum score and 45 mean score.

Low Passing Standard states: TX, LA, MS, and NE; High Passing Standard states: NY and FL.

Experiment 3*: Test Score Low: score group = 3; Test Score High: score groups = 5–10.

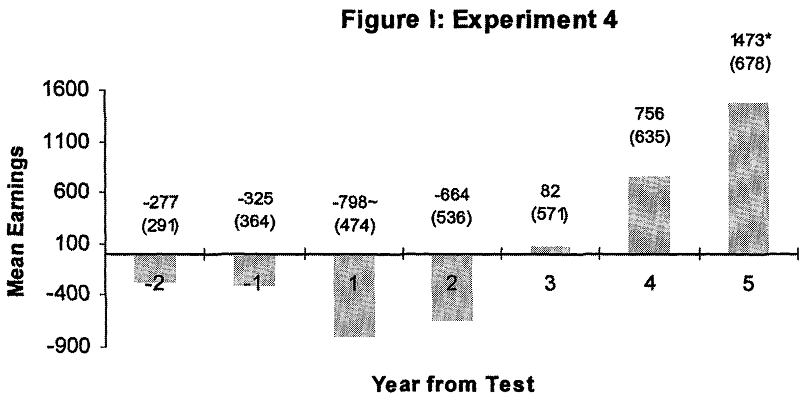
Passing Standard Low: 40 minimum score *or* 45 mean score; Passing Standard High: 35 minimum score and 45 mean score.

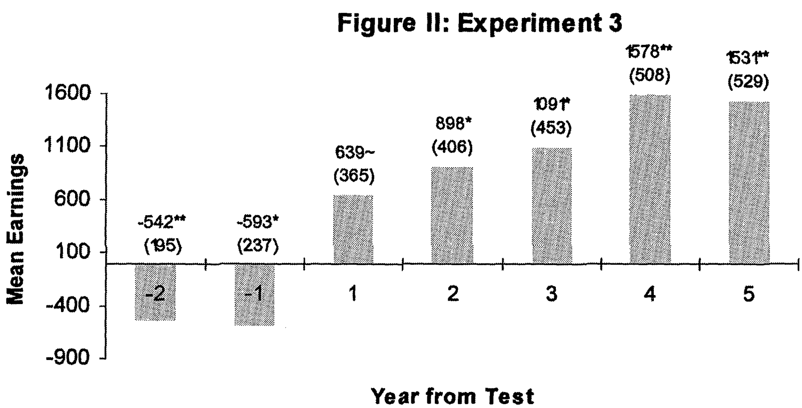
Low Passing Standard states: TX, LA, MS, and NE; High Passing Standard states: all states except TX, LA, MS, NE, NY, FL, and CT.

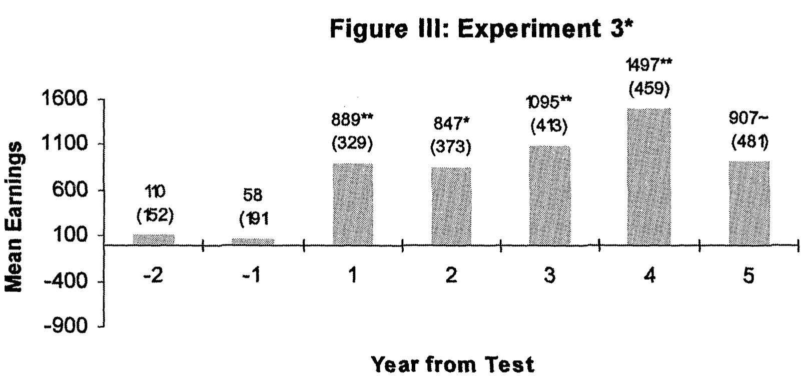
The results for nonwhite dropouts differ sharply from the results for white dropouts. The three experiments yield no statistically significant evidence that acquisition of a GED results in higher earnings for minority dropouts. We return to the minority results later. Based on the results from experiments 4, 3, and 3*, our estimates are robust to the use of different treatment and comparison groups.

B. Timing of GED Treatment Effects

To avoid underestimating the impact of the GED by measuring earnings too close to receipt of the credential, we have







FIGURES I–III

Pretreatment and first through fifth year Difference-in-Differences Estimates for Young White Dropouts. (** = Significant at the 0.01 Level; * = Significant at the 0.05 Level; ~ = Significant at the 0.10 Level.)

Table II

Dif-in-Dif Bias Term Using 1993-95 Earnings of HSD and HSG in the Treatment and the Comparison States

	Experiment 4			Experiment 3			Experiment 3*		
	Wages			Wages			Wages		
	HSD	HSG	β	HSD	HSG	β	HSD	HSG	β
Treatment	17872	27776	0.44	17872	27776	0.44	19150	23518	0.21
Comparison	19125	23474	0.20	20831	23052	0.10	20831	23052	0.10
The bias term $\beta_H - \beta_L$:									
			0.24			0.34			0.11
The Dif-inDif estimates of the impact of the GED on 1995 earnings of high school dropouts who tested in 1990 according to TMW									
			0.19			0.20			0.10

Notes:

Sub-sample of white males, born between 1968 to 1975 who work Full-Time Full-Year.

Experiment 3: treatment-states:TX,LA,MS, and NE. Comparison-states: NY and FL

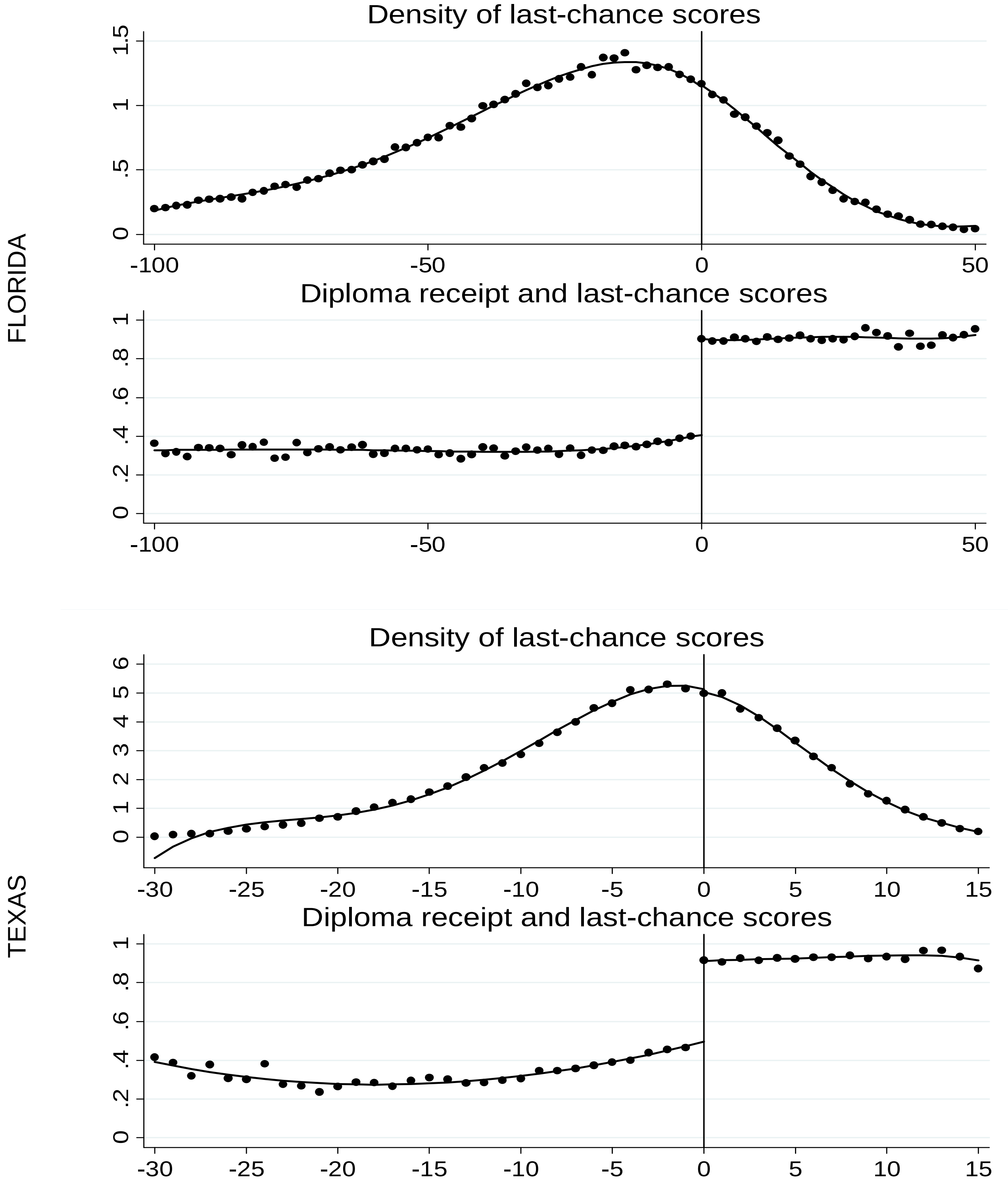
Experiment 3*: treatment-states:TX,LA,MS, and NE.

Comparison-states: all states except for: TX, LA, MS,NE, NY,FL, and CT

Experiment 4: treatment-states: All states except for: TX,LA,MS,NE, FL, NY, CA,WA, and CT. Comparison-states: NY and FL

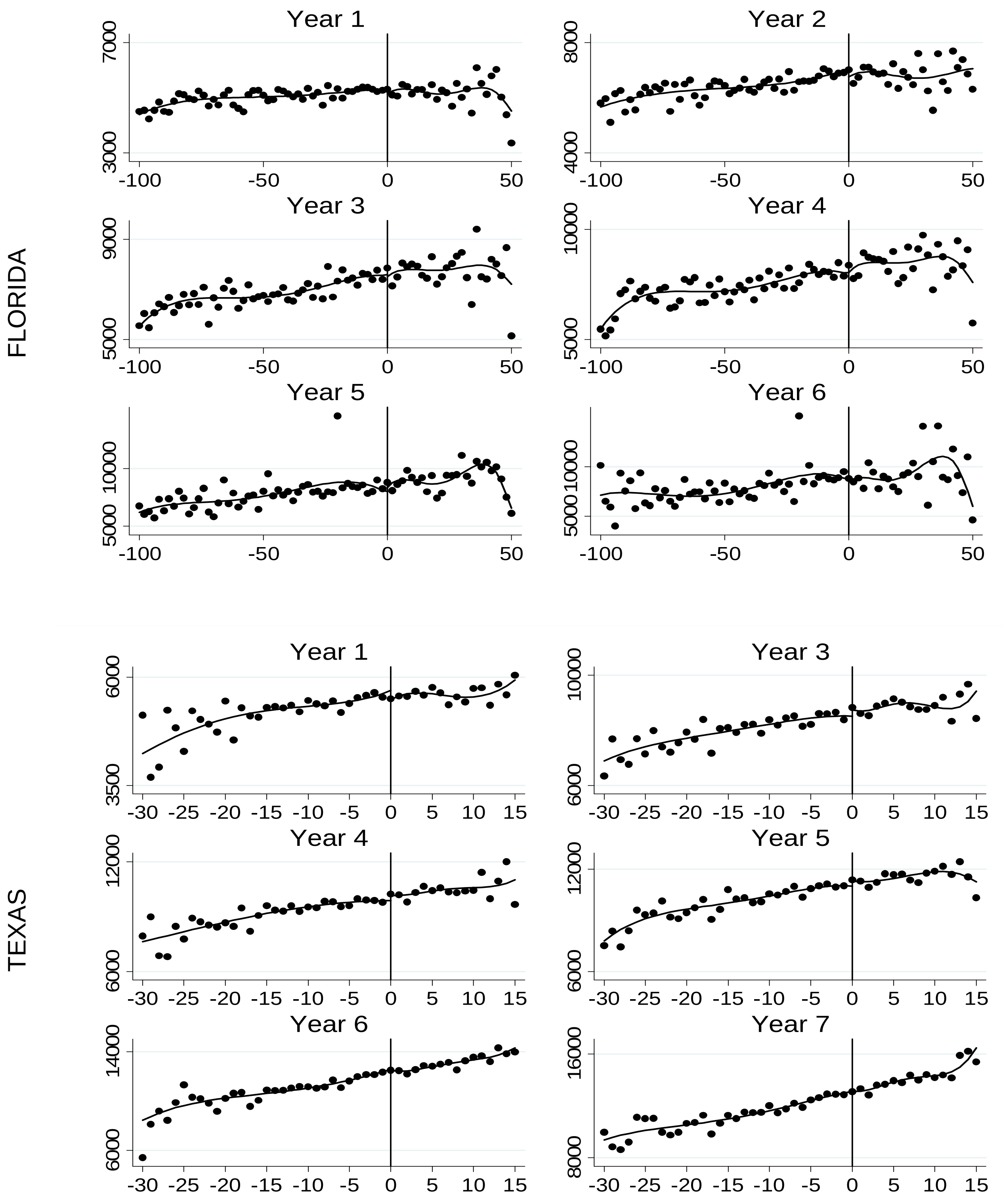
All earnings number are deflated by the CPI (2000 CPI adjusted).

Figure 1: Last-chance exam scores and diploma receipt



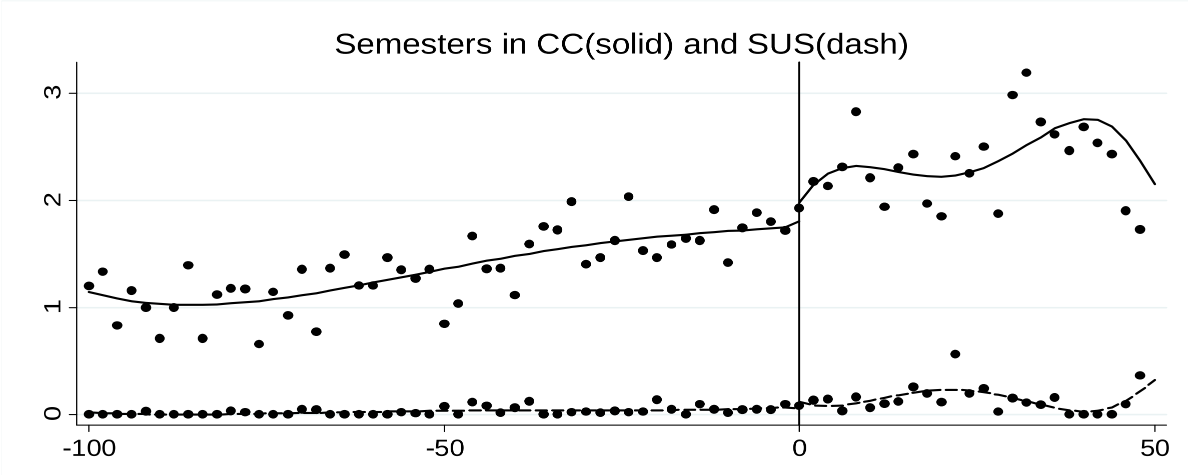
Notes: Graphs based on the last-chance samples. See Table 1 and text. For Texas, dots are cell means. For Florida, dots are averages of bins defined over two test scores (….[-2,-1], [0,1],…). Lines are fourth-order polynomials fitted separately on either side of the passing threshold.

Figure 3: Earnings by last-chance exam scores



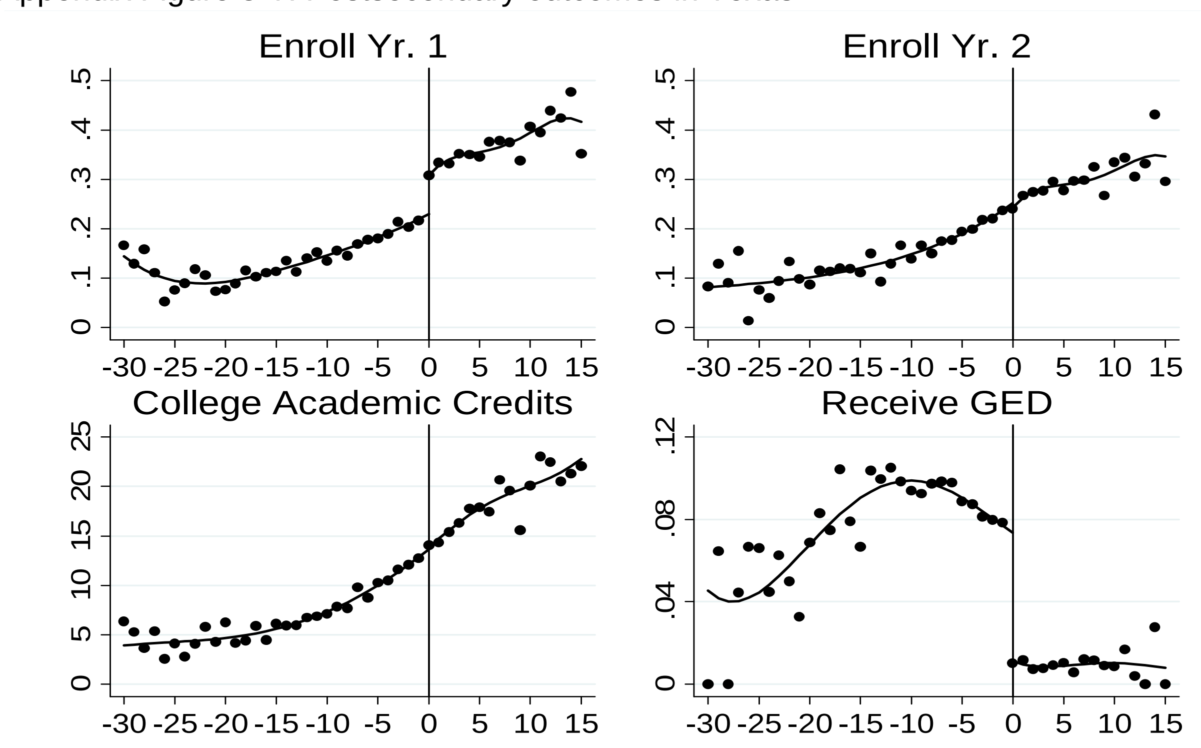
Notes: Graphs based on the last-chance samples. See Table 1 and text. For Texas, dots are cell means. For Florida, dots are averages of bins defined over two test scores (….[-2,-1], [0,1],…). Lines are fourth-order polynomials fitted separately on either side of the passing threshold. For Texas, "Year 2" exlcuded to conserve

Appendix Figure 3-F: Postsecondary outcomes in Florida



Notes: Graphs based on the 2000 cohort of the last-chance sample. See Table 1 and text. Dots are averages of bins defined over two test scores (….[-2,-1], [0,1],…). Lines are fourth-order polynomials fitted separately on either side of the passing threshold. The lines refer to the number of semesters enrolled in community colleges (CC) and the state university system (SUS) after the last-chance exam. For this cohort we observe post-secondary information for four years after the last-chance exam.

Appendix Figure 3-T: Postsecondary outcomes in Texas



Note: Graphs based on the last-chance sample. See Table 1 and text. Dots are exam score cell averages. Lines are fourth-order polynomials fitted separately on either side of the passing threshold. Estimated discontinuities (using a fully-interacted quadratic in the test score) are: 0.086 (se=0.010) for enrolled in college in Year 1, 0.005 (se=0.010) for enrolled in college in Year 2, 0.332 (se=0.677) for total college academic credits, and -0.062 (se=0.005) for receive GED degree. We observe post-secondary information for these cohorts for seven years after the last-chance exam. 2SLS estimates of diploma impacts on these outcomes would be roughly 2.5 times as large.