

Supporting Information

The Sting of Rejection: Deferring Blood Donors due to Low Hemoglobin Values Reduces Future Motivation

Adrian Bruhin, PhD^a; Lorenz Goette, PhD^{b,c}; Simon Haenni, PhD^d;
Lingqing Jiang, PhD^e; Alexander Markovic, MD^f; Adrian Roethlisberger^f;
Regula Buchli^f; Beat M. Frey, MD^f

^aUniversity of Lausanne, Faculty of Business and Economics (HEC
Lausanne), 1015 Lausanne, Switzerland

^bUniversity of Bonn, Department of Economics, 53113 Bonn, Germany

^cNational University of Singapore, Department of Economics, 1 Arts Link,
Singapore 117570

^dUniversity of Zurich, Department of Economics, 8001 Zurich, Switzerland

^eUniversity of Essex, Department of Economics, Colchester CO4 3SQ, UK

^fBlood Transfusion Service, Swiss Red Cross, Zurich-Schlieren, Switzerland

Contents

1	Descriptive Statistics	2
2	Empirical Models	3
2.1	LHDs	3
2.2	Repeated LHDs	4
3	First-stage Regressions	5
4	LHDs in the Future Given Current Hb Values	7
5	Covariates Checks	8
6	Main Results with Hb values within [-10,10] Window	11

1 Descriptive Statistics

Table S1: Descriptive Statistics

Variable	Female Donors		Male Donors	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	39.729	13.999	42.647	13.818
Hb value	137.706	10.468	153.213	11.171
Rejection of Donation Attempts				
Rate of total deferrals	0.124	0.329	0.081	0.273
Rate of LHDs	0.047	0.212	0.012	0.111
Rate of donors having more than 1 LHDs	0.013	0.115	0.004	0.066
	#	%	#	%
Individual donors	34,326	42.86	45,734	57.12
Observations	101,619	39.08	158,407	60.92
Donor Motivation				
% of at least 1 donation attempt within 18 months †	0.655	0.475	0.717	0.450
# of donation attempts within 18 months †	1.200	1.133	1.442	1.222
	#	%	#	%
Individual donors	29,371	42.25	40,145	57.75
Observations	77,170	39.21	119,658	60.79

† Excluding observations less than 18 months before the end of the study

2 Empirical Models

2.1 LHDs

For the effects of LHDs in general we estimate the following econometric model using 2SLS:

$$Y_{it} = \alpha_0 + \alpha'_1 f(X_{it}) + \alpha_2 \mathbf{Hb}_{it} + \alpha_3 \mathbf{Hb}_{it} \times D_{it} + \alpha_4 R_{it} + \epsilon_{it} \quad (1)$$

where Y_{it} is the motivation measure for donor i at date t . The variable X_{it} is donor i 's age, the polynomials of which are included in the $f(\cdot)$ up to 3 orders. The variable \mathbf{Hb}_{it} is donor i 's Hb value at date t , and its interaction with the binary indicator of insufficient Hb value, D_{it} , to allow different slopes of the Hb variable on the left and right side of the cutoff. Finally, the variable R_{it} indicates whether the donation attempt of donor i at date t is deferred due to an insufficient Hb value.

First stage:

$$R_{it} = \beta_0 + \beta'_1 f(X_{it}) + \beta_2 \mathbf{Hb}_{it} + \beta_3 \mathbf{Hb}_{it} \times D_{it} + \beta_4 D_{it} + \nu_{it} \quad (2)$$

Second stage:

$$Y_{it} = \gamma_0 + \gamma'_1 f(X_{it}) + \gamma_2 \mathbf{Hb}_{it} + \gamma_3 \mathbf{Hb}_{it} \times D_{it} + \gamma_4 \hat{R}_{it} + u_{it} \quad (3)$$

The intuition of 2SLS estimation works as the following: In the first stage it measures how the exogenous variation in whether the Hb-value is just above or below the cutoff and the other control variables influence the probability to be deferred. This is used to make a prediction of the probability of experiencing a LHD, \hat{R}_{it} , which is exogenous with respect to all other unobserved factors that may influence donor motivation. In the second stage, we estimate the effect of LHDs on donor motivation using the predicted probability of experiencing an LHD from the first stage.

2.2 Repeated LHDs

For the effects of repeated LHDs we estimate the following econometric model using 2SLS, analogously to the general model described above:

$$Y_{it} = \lambda_0 + \lambda'_1 f(X_{it}) + \lambda_2 \mathbf{Hb}_{it} + \lambda_3 \mathbf{Hb}_{it} \times D_{it} \\ + \lambda_4 R_{it} + \lambda_5 P_{it} + \lambda_6 R_{it} \times P_{it} + \epsilon_{it}$$

where Y_{it} is the measure of future motivation for donor i at date t . The variable X_{it} is donor i 's age, the polynomials of which are included in the $f(\cdot)$ up to three orders. The variable \mathbf{Hb}_{it} is donor i 's Hb value at date t , and its interaction with the binary indicator of insufficient Hb value, D_{it} . The variable R_{it} indicates whether the donation attempt of donor i at date t is deferred due to an insufficient Hb value. The variable P_{it} is a binary indicator of whether the donor i has been deferred due to an insufficient Hb value before the current donation attempt at date t . Finally, the interaction of R_{it} and P_{it} is also included.

First stages:

$$R_{it} = \eta_0 + \eta'_1 f(X_{it}) + \eta_2 \mathbf{Hb}_{it} + \eta_3 \mathbf{Hb}_{it} \times D_{it} + \eta_4 D_{it} + \eta_5 D_{it} \times P_{it} + \nu_{it} \quad (4)$$

$$R_{it} \times P_{it} = \xi_0 + \xi'_1 f(X_{it}) + \xi_2 \mathbf{Hb}_{it} + \xi_3 \mathbf{Hb}_{it} \times D_{it} + \xi_4 D_{it} + \xi_5 D_{it} \times P_{it} + \tau_{it} \quad (5)$$

Second stage:

$$Y_{it} = \sigma_0 + \sigma'_1 f(X_{it}) + \sigma_2 \mathbf{Hb}_{it} + \sigma_3 \mathbf{Hb}_{it} \times D_{it} + \sigma_4 \hat{R}_{it} + \sigma_5 \widehat{R_{it} \times P_{it}} + \sigma_6 \hat{P}_{it} + u_{it} \quad (6)$$

3 First-stage Regressions

Table S2: First stage of Hb-indicator (D) on the LHDs

OLS regression	Female	Male
Outcome variable: LHDs		
D	0.915*** (0.0118)	0.802*** (0.0232)
Hb	8.10e-07 (1.06e-05)	1.85e-06 (6.31e-06)
D×Hb	-0.00384** (0.00188)	-0.0166*** (0.00371)
Age	-0.000126 (0.000363)	0.000124 (0.000243)
Age ²	2.49e-06 (8.87e-06)	-2.15e-06 (5.79e-06)
Age ³	-1.45e-08 (6.81e-08)	1.42e-08 (4.37e-08)
Observations	72,025	101,650
R-squared	0.929	0.881

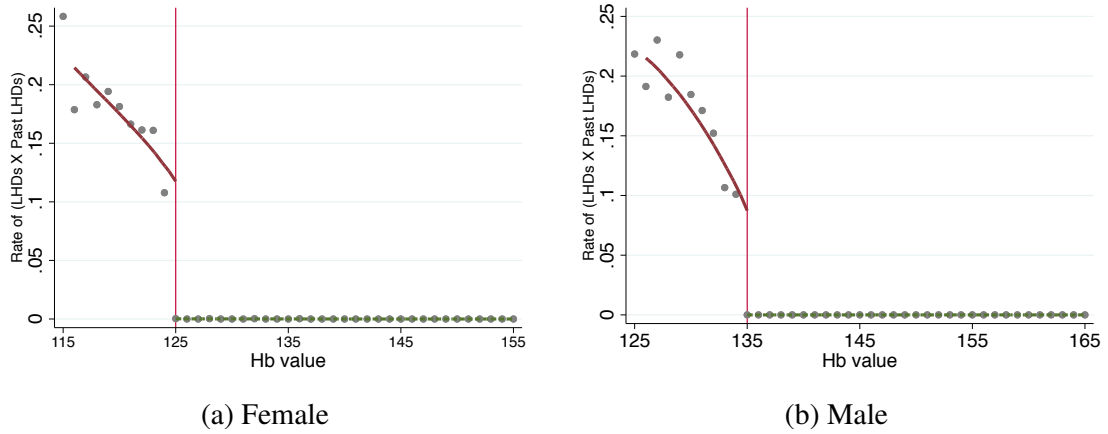
All regressions include 53 month fixed effects and controlling for blood types. Individual cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table S3: First stage of Hb-indicator (D) on LHD \times Past LHD

OLS regression	(1)		(2)		(3)		(4)	
	Female	LHD	Female	LHD \times Past LHD	Male	LHD	Male	LHD \times Past LHD
D	0.929*** (0.0116)		-0.00429 (0.00564)		0.807*** (0.0232)		-0.0156** (0.00747)	
D \times Past LHD	-0.104*** (0.0167)		0.852*** (0.0161)		-0.0436 (0.0267)		0.857*** (0.0256)	
Hb	-1.57e-06 (1.08e-05)		6.83e-06*** (2.20e-06)		1.66e-06 (6.36e-06)		1.67e-06 (1.62e-06)	
D \times Hb	-0.00457** (0.00186)		-0.000782 (0.00104)		-0.0170*** (0.00373)		-0.00303*** (0.00145)	
Age	-0.000113 (0.000365)		-0.000171 (0.000196)		0.000133 (0.000243)		-0.000113 (8.99e-05)	
Age ²	2.96e-06 (8.89e-06)		4.70e-06 (5.03e-06)		-2.35e-06 (5.80e-06)		2.87e-06 (2.35e-06)	
Age ³	-2.28e-08 (6.80e-08)		-3.92e-08 (4.04e-08)		1.58e-08 (4.38e-08)		-2.14e-08 (1.91e-08)	
Observations	72,025		72,025		101,650		101,650	
R-squared	0.930		0.851		0.882		0.859	

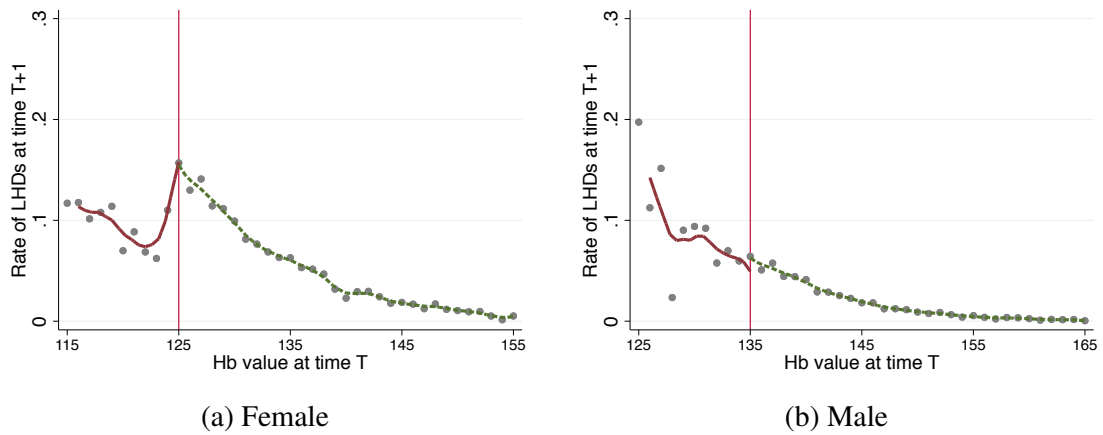
All regressions include 53 month fixed effects. Individual cluster robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Figure S1: Rate of (Hb-Rejection \times Past Hb-Rejection)



4 LHDs in the Future Given Current Hb Values

Figure S2: Rate of LHDs at time T+1, at each recorded Hb measurement at time T, for female donors (Hb < 125g/L) and male donors (Hb < 135g/L)



5 Covariates Checks

Table S4: Covariates Checks

	(1)	(2)	(3)	(4)
2SLS regression	Female	Male	Female	Male
VARIABLES	Age	Age	Don_1styear	Don_1styear
Panel A: Without Month Fixed Effects				
Hb	0.0836*** (0.00939)	-0.245*** (0.00731)	-0.00294*** (0.000878)	-0.00257*** (0.000720)
D	0.274 (0.281)	0.286 (0.394)	0.0266 (0.0288)	0.0608 (0.0400)
Constant	38.55*** (0.157)	46.92*** (0.150)	2.176*** (0.0154)	2.303*** (0.0147)
Observations	72,025	101,650	28,148	46,503
R-squared	0.002	0.022	0.001	0.001
Panel B: With Month Fixed Effects				
Hb	0.0925*** (0.00921)	-0.229*** (0.00728)	-0.00312*** (0.000880)	-0.00276*** (0.000726)
D	0.167 (0.276)	0.528 (0.395)	0.0249 (0.0287)	0.0652* (0.0395)
Constant	35.27*** (0.486)	45.18*** (0.424)	1.704*** (0.0510)	1.799*** (0.0873)
Observations	72,025	101,650	28,148	46,503
R-squared	0.063	0.071	0.021	0.019

"Donation in the first year" is one year after the first time we observe each individual donor in our sample. Individual cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table S5: Covariates Checks: Blood Types (Female)

OLS regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	O_neg	O_pos	A_neg	A_pos	B_neg	B_pos	AB_neg	AB_pos
Panel A: Without Month Fixed Effects								
Hb	0.000470** (0.000190)	0.000468 (0.000310)	-0.000193 (0.000182)	-0.00126*** (0.000311)	0.000231*** (8.94e-05)	0.000285* (0.000172)	-3.78e-05 (5.45e-05)	3.16e-05 (0.000128)
D	-0.000516 (0.00576)	0.00952 (0.0101)	-0.00414 (0.00562)	-0.00695 (0.0101)	-0.000483 (0.00277)	0.00735 (0.00574)	0.00138 (0.00230)	-0.000616 (0.00378)
Constant	0.0799*** (0.00321)	0.338*** (0.00540)	0.0809*** (0.00322)	0.366*** (0.00549)	0.0138*** (0.00142)	0.0763*** (0.00297)	0.00910*** (0.00103)	0.0361*** (0.000218)
R-squared	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: With Month Fixed Effects								
Hb	0.000464** (0.000193)	0.000517 (0.000315)	-0.000215 (0.000185)	-0.00134*** (0.000315)	0.000235*** (9.09e-05)	0.000348** (0.000174)	-4.24e-05 (5.53e-05)	3.71e-05 (0.000130)
D	-0.000224 (0.00576)	0.00911 (0.0101)	-0.00430 (0.00562)	-0.00710 (0.0101)	-0.000553 (0.00278)	0.00763 (0.00575)	0.00135 (0.00229)	-0.000591 (0.00378)
Constant	0.0657*** (0.00985)	0.312*** (0.0179)	0.0788*** (0.0102)	0.414*** (0.0188)	0.00742** (0.00376)	0.0877*** (0.0110)	0.0117*** (0.00401)	0.0225*** (0.000581)
Observations	72,025	72,025	72,025	72,025	72,025	72,025	72,025	72,025
R-squared	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001

Individual cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table S6: Covariates Checks: Blood Types (Male)

OLS regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	O_neg	O_pos	A_neg	A_pos	B_neg	B_pos	AB_neg	AB_pos
Panel A: Without Month Fixed Effects								
Hb	-1.35e-06 (0.000154)	0.000488* (0.000273)	0.000263* (0.000143)	-0.00141*** (0.000277)	7.86e-05 (6.60e-05)	0.000486*** (0.000140)	6.81e-05* (4.05e-05)	2.63e-05 (0.000106)
D	0.0204** (0.00944)	-0.0165 (0.0150)	0.000842 (0.00781)	0.00248 (0.0152)	0.00210 (0.00378)	-0.0112* (0.00662)	0.00188 (0.00255)	4.60e-05 (0.00538)
Constant	0.0767*** (0.00328)	0.347*** (0.00574)	0.0699*** (0.00304)	0.392*** (0.00587)	0.0129*** (0.00138)	0.0631*** (0.00286)	0.00463*** (0.000760)	0.0332*** (0.00223)
R-squared	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
Panel B: With Month Fixed Effects								
Hb	3.30e-05 (0.000157)	0.000509* (0.000278)	0.000261* (0.000145)	-0.00148*** (0.000282)	8.09e-05 (6.78e-05)	0.000508*** (0.000142)	6.71e-05 (4.16e-05)	2.45e-05 (0.000108)
D	0.0205** (0.00944)	-0.0166 (0.0150)	0.00130 (0.00782)	0.00214 (0.0153)	0.00223 (0.00379)	-0.0114* (0.00661)	0.00177 (0.00256)	0.000125 (0.00539)
Constant	0.0548*** (0.00820)	0.350*** (0.0168)	0.0761*** (0.00954)	0.423*** (0.0172)	0.00885** (0.00349)	0.0586*** (0.00879)	0.00342 (0.00233)	0.0256*** (0.00576)
Observations	101,650	101,650	101,650	101,650	101,650	101,650	101,650	101,650
R-squared	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000

Individual cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6 Main Results with Hb values within [-10,10] Window

Table S7: Causal effect of LHD on donor motivation within [-10,10] window

2SLS regression	Female	Male
Panel A		
Outcome variable: Probability of making at least one donation attempt over the next 18 months		
LHD	-0.0286 (0.0242)	-0.0553 (0.0368)
Hb	1.48e-05 (0.000878)	-0.000449 (0.000811)
Hb × D	0.000930 (0.00375)	0.00704 (0.00557)
Age	-0.0475*** (0.00619)	0.0541*** (0.00623)
Age ²	0.00139*** (0.000154)	-0.000825*** (0.000146)
Age ³	-1.13e-05*** (1.21e-06)	4.04e-06*** (1.08e-06)
R-squared	0.046	0.082
Panel B		
Outcome variable: Number of donation attempts over the next 18 months		
LHD	0.0310 (0.0578)	-0.209** (0.0987)
Hb	0.00266 (0.00207)	-0.00133 (0.00240)
Hb × D	0.0122 (0.00865)	0.0106 (0.0149)
Age	-0.122*** (0.0207)	0.115*** (0.0231)
Age ²	0.00360*** (0.000530)	-0.00152*** (0.000573)
Age ³	-2.92e-05*** (4.27e-06)	6.06e-06 (4.46e-06)
R-squared	0.059	0.083
F-tests of instrument	6033.72	1190.19
Observations	31,307	28,229

All regressions include 53 month fixed effects and controlling for blood types. Individual cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table S8: Causal effect of repeated LHDs on donor motivation within [-10,10] window

2SLS regression	Female	Male
Panel A		
Outcome variable: Probability of making at least one donation attempt over the next 18 months		
LHD	-0.0140 (0.0241)	-0.0472 (0.0364)
LHD × Past LHD	-0.139*** (0.0292)	-0.115** (0.0466)
Past LHD	0.126*** (0.00934)	0.0686*** (0.0112)
Hb value	0.000721 (0.000876)	-0.000160 (0.000812)
Hb × D	0.000278 (0.00379)	0.00624 (0.00564)
Age	-0.0482*** (0.00607)	0.0537*** (0.00619)
Age ²	0.00140*** (0.000151)	-0.000817*** (0.000145)
Age ³	-1.13e-05*** (1.18e-06)	3.99e-06*** (1.08e-06)
R-squared	0.051	0.083
LHD+LHD × Past LHD=0	4.84e-05	0.00697
Panel B		
Outcome variable: Number of donation attempts over the next 18 months		
LHD	0.0698 (0.0575)	-0.212** (0.0967)
LHD × Past LHD	-0.379*** (0.0750)	-0.0951 (0.148)
Past LHD	0.413*** (0.0352)	0.307*** (0.0523)
Hb value	0.00496** (0.00206)	-5.23e-05 (0.00238)
Hb × D	0.0105 (0.00873)	0.0110 (0.0151)
Age	-0.124*** (0.0201)	0.113*** (0.0227)
Age ²	0.00363*** (0.000513)	-0.00148*** (0.000563)
Age ³	-2.93e-05*** (4.13e-06)	5.80e-06 (4.37e-06)
R-squared	0.068	0.086
LHD+LHD × Past LHD=0	0.000908	0.0873
F-tests of instrument	1764.48.	571.62
Observations	31,307	28,229

All regressions include 53 month fixed effects. Individual cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1