Schizophrenia Working Group of the Psychiatric Genomics Consortium

Stephan Ripke[1,2], Benjamin M. Neale[1,2,3,4], Aiden Corvin[5], James T. R. Walters[6], Kai-How Farh[1], Peter A. Holmans[6,7], Phil Lee[1,2,4], Brendan Bulik-Sullivan[1,2], David A. Collier[8,9], Hailiang Huang[1,3], Tune H. Pers[3,10,11], Ingrid Agartz[12,13,14], Esben Agerbo[15,16,17], Margot Albus[18], Madeline Alexander[19], Farooq Amin[20,21], Silviu A. Bacanu[22], Martin Begemann[23], Richard A Belliveau Jr[2], Judit Bene[24,25], Sarah E. Bergen [2,26], Elizabeth Bevilacqua[2], Tim B Bigdeli [22], Donald W. Black[27], Richard Bruggeman[28], Nancy G. Buccola[29], Randy L. Buckner[30,31,32], William Byerley[33], Wiepke Cahn[34], Guiqing Cai[35,36], Murray J. Cairns[39,120,170], Dominique Campion[37], Rita M. Cantor[38], Vaughan J. Carr[39,40], Noa Carrera[6], Stanley V. Catts[39,41], Kimberly D. Chambert[2], Raymond C. K. Chan[42], Ronald Y. L. Chen[43], Eric Y. H. Chen[43,44], Wei Cheng[45], Eric F. C. Cheung[46], Siow Ann Chong[47], C. Robert Cloninger[48], David Cohen[49], Nadine Cohen[50], Paul Cormican[5], Nick Craddock[6,7], Benedicto Crespo-Facorro[210], James J. Crowley[51], David Curtis[52,53], Michael Davidson[54], Kenneth L. Davis[36], Franziska Degenhardt[55,56], Jurgen Del Favero[57], Lynn E. DeLisi[128,129] , Ditte Demontis[17,58,59], Dimitris Dikeos[60], Timothy Dinan[61], Srdjan Djurovic[14,62], Gary Donohoe[5,63], Elodie Drapeau[36], Jubao Duan[64,65], Frank Dudbridge[66], Naser Durmishi[67], Peter Eichhammer[68], Johan Eriksson[69,70,71], Valentina Escott-Price[6], Laurent Essioux[72], Ayman H. Fanous[73,74,75,76], Martilias S. Farrell[51], Josef Frank[77], Lude Franke[78], Robert Freedman[79], Nelson B. Freimer[80], Marion Friedl[81], Joseph I. Friedman[36], Menachem Fromer[1,2,4,82], Giulio Genovese[2], Lyudmila Georgieva[6], Elliot S. Gershon[209], Ina Giegling[81,83], Paola Giusti-Rodríguez[51], Stephanie Godard[84], Jacqueline I. Goldstein[1,3], Vera Golimbet[85], Srihari Gopal[86], Jacob Gratten[87], Lieuwe de Haan[88], Christian Hammer[23], Marian L. Hamshere[6], Mark Hansen[89], Thomas Hansen[17,90], Vahram Haroutunian[36,91,92], Annette M. Hartmann[81], Frans A. Henskens[39,93,94], Stefan Herms[55,56,95], Joel N. Hirschhorn[3,11,96], Per Hoffmann[55,56,95], Andrea Hofman[55,56], Mads V. Hollegaard[97], David M. Hougaard[97], Masashi Ikeda[98], Inge Joa[99], Antonio Julià[100], René S. Kahn[34], Luba Kalaydjieva[101,102], Sena Karachanak-Yankova[103], Juha Karjalainen[78], David Kavanagh[6], Matthew C. Keller[104], Brian J. Kelly[120], James L. Kennedy[105,106,107], Andrey Khrunin[108], Yunjung Kim[51], Janis Klovins[109], James A. Knowles[110], Bettina Konte[81], Vaidutis Kucinskas[111], Zita Ausrele Kucinskiene[111], Hana Kuzelova-Ptackova[112], Anna K. Kähler[26], Claudine Laurent[19,113], Jimmy Lee Chee Keong[47,114], S. Hong Lee[87], Sophie E. Legge[6], Bernard Lerer[115], Miaoxin Li[43,44,116] Tao Li[117], Kung-Yee Liang[118], Jeffrey Lieberman[119], Svetlana Limborska[108], Carmel M. Loughland[39,120], Jan Lubinski[121], Jouko Lönnqvist[122], Milan Macek Jr[112], Patrik K. E. Magnusson[26], Brion S. Maher[123], Wolfgang Maier[124], Jacques Mallet[125], Sara Marsal[100], Manuel Mattheisen[17,58,59,126], Morten Mattingsdal[14,127], Robert W. McCarley[128,129], Colm McDonald[130], Andrew M. McIntosh[131,132], Sandra Meier[77], Carin J. Meijer[88], Bela Melegh[24,25], Ingrid Melle[14,133], Raquelle I. Mesholam-Gately[128,134], Andres Metspalu[135], Patricia T. Michie[39,136], Lili Milani[135], Vihra Milanova[137], Younes Mokrab[8], Derek W. Morris[5,63], Ole Mors[17,58,138], Kieran C. Murphy[139], Robin M. Murray[140], Inez Myin-Germeys[141], Bertram Müller-Myhsok[142,143,144], Mari Nelis[135], Igor Nenadic[145], Deborah A. Nertney[146], Gerald Nestadt[147], Kristin K. Nicodemus[148], Liene Nikitina-Zake[109], Laura Nisenbaum[149], Annelie Nordin[150], Eadbhard O'Callaghan[151], Colm O'Dushlaine[2], F. Anthony O'Neill[152], Sang-Yun Oh[153], Ann Olincy[79], Line

Olsen[17,90], Jim Van Os[141,154], Psychosis Endophenotypes International Consortium[155], Christos Pantelis[39,156], George N. Papadimitriou[60], Sergi Papiol[23], Elena Parkhomenko[36], Michele T. Pato[110], Tiina Paunio[157,158], Milica Pejovic-Milovancevic[159], Diana O. Perkins[160], Olli Pietiläinen[158,161], Jonathan Pimm[53], Andrew J. Pocklington[6], John Powell[140], Alkes Price[3],[162], Ann E. Pulver[147], Shaun M. Purcell[82], Digby Quested[163], Henrik B. Rasmussen[17,90], Abraham Reichenberg[36], Mark A. Reimers[164], Alexander L. Richards[6], Joshua L. Roffman[30,32], Panos Roussos[82,165], Douglas M. Ruderfer[6,82], Veikko Salomaa[71], Alan R. Sanders[64,65], Ulrich Schall[39,120], Christian R. Schubert[166], Thomas G. Schulze[77,167], Sibylle G. Schwab[168], Edward M. Scolnick[2], Rodney J. Scott[39,169,170], Larry J. Seidman[128,134], Jianxin Shi[171], Engilbert Sigurdsson[172], Teimuraz Silagadze[173], Jeremy M. Silverman[36,174], Kang Sim[47], Petr Slominsky[108], Jordan W. Smoller[2,4], Hon-Cheong So[43], Chris C. A. Spencer[175], Eli A. Stahl[3,82], Hreinn Stefansson[176], Stacy Steinberg[176], Elisabeth Stogmann[177], Richard E. Straub[178], Eric Strengman[179,34], Jana Strohmaier[77], T. Scott Stroup[119], Mythily Subramaniam[47], Jaana Suvisaari[122], Dragan M. Svrakic[48], Jin P. Szatkiewicz[51], Erik Söderman[12], Srinivas Thirumalai[180], Draga Toncheva[103], Paul A. Tooney[39,120,170] , Sarah Tosato[181], Juha Veijola[182,183], John Waddington[184], Dermot Walsh[185], Dai Wang[86], Qiang Wang[117], Bradley T. Webb[22], Mark Weiser[54], Dieter B. Wildenauer[186], Nigel M. Williams[6], Stephanie Williams[51], Stephanie H. Witt[77], Aaron R. Wolen[164], Emily H. M. Wong[43], Brandon K. Wormley[22], Jing Qin Wu[39,170], Hualin Simon Xi[187], Clement C. Zai[105,106], Xuebin Zheng[188], Fritz Zimprich[177], Naomi R. Wray[87], Kari Stefansson[176], Peter M. Visscher[87], Wellcome Trust Case-Control Consortium 2[189], Rolf Adolfsson[150], Ole A. Andreassen[14,133], Douglas H. R. Blackwood[132], Elvira Bramon[190], Joseph D. Buxbaum[35,36,91,191], Anders D. Børglum[17,58,59,138], Sven Cichon[55,56,95,192], Ariel Darvasi[193], Enrico Domenici[194], Hannelore Ehrenreich[23], Tõnu Esko[3,11,96,135], Pablo V. Gejman[64,65], Michael Gill[5], Hugh Gurling[53], Christina M. Hultman[26], Nakao Iwata[98], Assen V. Jablensky[39,102,186,195], Erik G. Jönsson[12,14], Kenneth S. Kendler[196], George Kirov[6], Jo Knight[105,106,107], Todd Lencz[197,198,199], Douglas F. Levinson[19], Qingqin S. Li[86], Jianjun Liu[188,200], Anil K. Malhotra[197,198,199], Steven A. McCarroll[2,96], Andrew McQuillin[53], Jennifer L. Moran[2], Preben B. Mortensen[15,16,17], Bryan J. Mowry[87,201], Markus M. Nöthen[55,56], Roel A. Ophoff[38,80,34], Michael J. Owen[6,7], Aarno Palotie[2,4,161], Carlos N. Pato[110], Tracey L. Petryshen[2,128,202], Danielle Posthuma[203,204,205], Marcella Rietschel[77], Brien P. Riley[196], Dan Rujescu[81,83], Pak C. Sham[43,44,116] Pamela Sklar[82,91,165], David St Clair[206], Daniel R. Weinberger[178,207], Jens R. Wendland[166], Thomas Werge[17,90,208], Mark J. Daly[1,2,3], Patrick F. Sullivan[26,51,160] & Michael C. O'Donovan[6,7]

[1]Analytic and Translational Genetics Unit, Massachusetts General Hospital, Boston, Massachusetts 02114, USA.

[2]Stanley Center for Psychiatric Research, Broad Institute of MIT and Harvard, Cambridge, Massachusetts 02142, USA.

[3]Medical and Population Genetics Program, Broad Institute of MIT and Harvard, Cambridge, Massachusetts 02142, USA.

[4]Psychiatric and Neurodevelopmental Genetics Unit, Massachusetts General Hospital, Boston, Massachusetts 02114, USA.

[5]Neuropsychiatric Genetics Research Group, Department of Psychiatry, Trinity College Dublin, Dublin 8, Ireland.

[6]MRC Centre for Neuropsychiatric Genetics and Genomics, Institute of Psychological Medicine and Clinical Neurosciences, School of Medicine, Cardiff University, Cardiff, CF24 4HQ, UK.

[7]National Centre for Mental Health, Cardiff University, Cardiff, CF24 4HQ, UK.

[8]Eli Lilly and Company Limited, Erl Wood Manor, Sunninghill Road, Windlesham, Surrey, GU20 6PH, UK. [9]Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, King's College London, London, SE5 8AF, UK.

[10]Center for Biological Sequence Analysis, Department of Systems Biology, Technical University of Denmark, DK-2800, Denmark.

[11]Division of Endocrinology and Center for Basic and Translational Obesity Research, Boston Children's Hospital, Boston, Massachusetts, 02115USA.

[12]Department of Clinical Neuroscience, Psychiatry Section, Karolinska Institutet, SE-17176 Stockholm, Sweden. [13]Department of Psychiatry, Diakonhjemmet Hospital, 0319 Oslo, Norway.

[14]NORMENT, KG Jebsen Centre for Psychosis Research, Institute of Clinical Medicine, University of Oslo, 0424 Oslo, Norway.

[15]Centre for Integrative Register-based Research, CIRRAU, Aarhus University, DK-8210 Aarhus, Denmark.

[16]National Centre for Register-based Research, Aarhus University, DK-8210 Aarhus, Denmark.

[17]The Lundbeck Foundation Initiative for Integrative Psychiatric Research, iPSYCH, Denmark.

[18]State Mental Hospital, 85540 Haar, Germany.

[19]Department of Psychiatry and Behavioral Sciences, Stanford University, Stanford, California 94305, USA.

[20]Department of Psychiatry and Behavioral Sciences, Atlanta Veterans Affairs Medical Center, Atlanta, Georgia 30033, USA.

[21]Department of Psychiatry and Behavioral Sciences, Emory University, Atlanta Georgia 30322, USA.

[22]Virginia Institute for Psychiatric and Behavioral Genetics, Department of Psychiatry, Virginia Commonwealth University, Richmond, Virginia 23298, USA.

[23]Clinical Neuroscience, Max Planck Institute of Experimental Medicine, Göttingen 37075, Germany.

[24]Department of Medical Genetics, University of Pécs, Pécs H-7624, Hungary.

[25]Szentagothai Research Center, University of Pécs, Pécs H-7624, Hungary.

[26]Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm SE-17177, Sweden.

[27]Department of Psychiatry, University of Iowa Carver College of Medicine, Iowa City, Iowa 52242, USA.

[28]University Medical Center Groningen, Department of Psychiatry, University of Groningen NL-9700 RB, The Netherlands.

[29]School of Nursing, Louisiana State University Health Sciences Center, New Orleans, Louisiana 70112, USA.

[30]Athinoula A. Martinos Center, Massachusetts General Hospital, Boston, Massachusetts 02129, USA.

[31]Center for Brain Science, Harvard University, Cambridge, Massachusetts, 02138 USA.

[32]Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts, 02114 USA.

[33]Department of Psychiatry, University of California at San Francisco, San Francisco, California, 94143 USA.

[34]University Medical Center Utrecht, Department of Psychiatry, Rudolf Magnus Institute of Neuroscience, 3584 Utrecht, The Netherlands.

[35]Department of Human Genetics, Icahn School of Medicine at Mount Sinai, New York, New York 10029 USA.

[36]Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, New York 10029 USA.

[37]Centre Hospitalier du Rouvray and INSERM U1079 Faculty of Medicine, 76301 Rouen, France.

[38]Department of Human Genetics, David Geffen School of Medicine, University of California, Los Angeles, California 90095, USA.

[39]Schizophrenia Research Institute, Sydney NSW 2010, Australia.

[40]School of Psychiatry, University of New South Wales, Sydney NSW 2031, Australia.

[41]Royal Brisbane and Women's Hospital, University of Queensland, Brisbane, St Lucia QLD 4072, Australia.

[42]Institute of Psychology, Chinese Academy of Science, Beijing 100101, China.

[43]Department of Psychiatry, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China.

[44]State Key Laboratory for Brain and Cognitive Sciences, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China.

[45]Department of Computer Science, University of North Carolina, Chapel Hill, North Carolina 27514, USA.

[46]Castle Peak Hospital, Hong Kong, China.

[47]Institute of Mental Health, Singapore 539747, Singapore.

[48]Department of Psychiatry, Washington University, St. Louis, Missouri 63110, USA.

[49]Department of Child and Adolescent Psychiatry, Assistance Publique Hopitaux de Paris, Pierre and Marie Curie Faculty of Medicine and Institute for Intelligent Systems and Robotics, Paris, 75013, France.

[50] Blue Note Biosciences, Princeton, New Jersey 08540, USA

[51]Department of Genetics, University of North Carolina, Chapel Hill, North Carolina 27599-7264, USA.

[52]Department of Psychological Medicine, Queen Mary University of London, London E1 1BB, UK.

[53]Molecular Psychiatry Laboratory, Division of Psychiatry, University College London, London WC1E 6JJ, UK.

[54]Sheba Medical Center, Tel Hashomer 52621, Israel.

[55]Department of Genomics, Life and Brain Center, D-53127 Bonn, Germany.

[56]Institute of Human Genetics, University of Bonn, D-53127 Bonn, Germany.

[57]Applied Molecular Genomics Unit, VIB Department of Molecular Genetics, University of Antwerp, B-2610 Antwerp, Belgium.

[58]Centre for Integrative Sequencing, iSEQ, Aarhus University, DK-8000 Aarhus C, Denmark.

[59]Department of Biomedicine, Aarhus University, DK-8000 Aarhus C, Denmark.

[60]First Department of Psychiatry, University of Athens Medical School, Athens 11528, Greece.

[61]Department of Psychiatry, University College Cork, Co. Cork, Ireland.

[62]Department of Medical Genetics, Oslo University Hospital, 0424 Oslo, Norway.

[63]Cognitive Genetics and Therapy Group, School of Psychology and Discipline of Biochemistry, National University of Ireland Galway, Co. Galway, Ireland.

[64]Department of Psychiatry and Behavioral Neuroscience, University of Chicago, Chicago, Illinois 60637, USA.

[65]Department of Psychiatry and Behavioral Sciences, NorthShore University HealthSystem, Evanston, Illinois 60201, USA.

[66]Department of Non-Communicable Disease Epidemiology, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK.

[67]Department of Child and Adolescent Psychiatry, University Clinic of Psychiatry, Skopje 1000, Republic of Macedonia.

[68]Department of Psychiatry, University of Regensburg, 93053 Regensburg, Germany.

[69]Department of General Practice, Helsinki University Central Hospital, University of Helsinki P.O. Box 20, Tukholmankatu 8 B, FI-00014, Helsinki, Finland

[70]Folkhälsan Research Center, Helsinki, Finland, Biomedicum Helsinki 1, Haartmaninkatu 8, FI-00290, Helsinki, Finland.

[71]National Institute for Health and Welfare, P.O. BOX 30, FI-00271 Helsinki, Finland.

[72]Translational Technologies and Bioinformatics, Pharma Research and Early Development, F. Hoffman-La Roche, CH-4070 Basel, Switzerland.

[73]Department of Psychiatry, Georgetown University School of Medicine, Washington DC 20057, USA.

[74]Department of Psychiatry, Keck School of Medicine of the University of Southern California, Los Angeles, California 90033, USA.

[75]Department of Psychiatry, Virginia Commonwealth University School of Medicine, Richmond, Virginia 23298, USA.

[76]Mental Health Service Line, Washington VA Medical Center, Washington DC 20422, USA.

[77]Department of Genetic Epidemiology in Psychiatry, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Heidelberg , D-68159 Mannheim, Germany.

[78]Department of Genetics, University of Groningen, University Medical Centre Groningen, 9700 RB Groningen, The Netherlands.

[79]Department of Psychiatry, University of Colorado Denver, Aurora, Colorado 80045, USA.

[80]Center for Neurobehavioral Genetics, Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles, California 90095, USA.

[81]Department of Psychiatry, University of Halle, 06112 Halle, Germany.

[82]Division of Psychiatric Genomics, Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, New York 10029, USA.

[83]Department of Psychiatry, University of Munich, 80336, Munich, Germany.

[84]Departments of Psychiatry and Human and Molecular Genetics, INSERM, Institut de Myologie, Hôpital de la Pitiè-Salpêtrière, Paris, 75013, France.

[85]Mental Health Research Centre, Russian Academy of Medical Sciences, 115522 Moscow, Russia.

[86]Neuroscience Therapeutic Area, Janssen Research and Development, Raritan, New Jersey 08869, USA.

[87]Queensland Brain Institute, The University of Queensland, Brisbane, Queensland, QLD 4072, Australia.

[88]Academic Medical Centre University of Amsterdam, Department of Psychiatry, 1105 AZ Amsterdam, The Netherlands.

[89]Illumina, La Jolla, California, California 92122, USA.

[90]Institute of Biological Psychiatry, Mental Health Centre Sct. Hans, Mental Health Services Copenhagen, DK-4000, Denmark.

[91]Friedman Brain Institute, Icahn School of Medicine at Mount Sinai, New York, New York 10029, USA.

[92]J. J. Peters VA Medical Center, Bronx, New York, New York 10468, USA.

[93]Priority Research Centre for Health Behaviour, University of Newcastle, Newcastle NSW 2308, Australia.

[94]School of Electrical Engineering and Computer Science, University of Newcastle, Newcastle NSW 2308, Australia.

[95]Division of Medical Genetics, Department of Biomedicine, University of Basel, Basel, CH-4058, Switzerland.

[96]Department of Genetics, Harvard Medical School, Boston, Massachusetts 02115, USA.

[97]Section of Neonatal Screening and Hormones, Department of Clinical Biochemistry, Immunology and Genetics, Statens Serum Institut, Copenhagen, DK-2300, Denmark.

[98]Department of Psychiatry, Fujita Health University School of Medicine, Toyoake, Aichi, 470-1192, Japan.

[99]Regional Centre for Clinical Research in Psychosis, Department of Psychiatry, Stavanger University Hospital, 4011 Stavanger, Norway.

[100]Rheumatology Research Group, Vall d'Hebron Research Institute, Barcelona, 08035, Spain.

[101]Centre for Medical Research, The University of Western Australia, Perth, WA 6009, Australia.

[102]The Perkins Institute for Medical Research, The University of Western Australia, Perth, WA 6009, Australia.

[103]Department of Medical Genetics, Medical University, Sofia1431, Bulgaria.

[104]Department of Psychology, University of Colorado Boulder, Boulder, Colorado 80309, USA.

[105]Campbell Family Mental Health Research Institute, Centre for Addiction and Mental Health, Toronto, Ontario, M5T 1R8, Canada.

[106]Department of Psychiatry, University of Toronto, Toronto, Ontario, M5T 1R8, Canada.

[107]Institute of Medical Science, University of Toronto, Toronto, Ontario, M5S 1A8, Canada.

[108]Institute of Molecular Genetics, Russian Academy of Sciences, Moscow123182, Russia.

[109]Latvian Biomedical Research and Study Centre, Riga, LV-1067, Latvia.

[110]Department of Psychiatry and Zilkha Neurogenetics Institute, Keck School of Medicine at University of Southern California, Los Angeles, California 90089, USA.

[111]Faculty of Medicine, Vilnius University, LT-01513 Vilnius, Lithuania.

[112] Department of Biology and Medical Genetics, 2nd Faculty of Medicine and University Hospital Motol, 150 06 Prague, Czech Republic.

[113] Department of Child and Adolescent Psychiatry, Pierre and Marie Curie Faculty of Medicine, Paris 75013, France.

[114]Duke-NUS Graduate Medical School, Singapore 169857, Singapore.

[115]Department of Psychiatry, Hadassah-Hebrew University Medical Center, Jerusalem 91120, Israel.

[116]Centre for Genomic Sciences, The University of Hong Kong, Hong Kong, China.

[117]Mental Health Centre and Psychiatric Laboratory, West China Hospital, Sichuan University, Chengdu, 610041, Sichuan, China.

[118]Department of Biostatistics, Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland 21205, USA.

[119]Department of Psychiatry, Columbia University, New York, New York 10032, USA.

[120]Priority Centre for Translational Neuroscience and Mental Health, University of Newcastle, Newcastle NSW 2300, Australia.

[121]Department of Genetics and Pathology, International Hereditary Cancer Center, Pomeranian Medical University in Szczecin, 70-453 Szczecin, Poland.

[122]Department of Mental Health and Substance Abuse Services; National Institute for Health and Welfare, P.O. BOX 30, FI-00271 Helsinki, Finland

[123]Department of Mental Health, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland 21205, USA.

[124]Department of Psychiatry, University of Bonn, D-53127 Bonn, Germany.

[125]Centre National de la Recherche Scientifique, Laboratoire de Génétique Moléculaire de la Neurotransmission et des Processus Neurodégénératifs, Hôpital de la Pitié Salpêtrière, 75013, Paris, France.

[126]Department of Genomics Mathematics, University of Bonn, D-53127 Bonn, Germany.

[127]Research Unit, Sørlandet Hospital, 4604 Kristiansand, Norway.

[128]Department of Psychiatry, Harvard Medical School, Boston, Massachusetts 02115, USA.

[129]VA Boston Health Care System, Brockton, Massachusetts 02301, USA.

[130]Department of Psychiatry, National University of Ireland Galway, Co. Galway, Ireland.

[131]Centre for Cognitive Ageing and Cognitive Epidemiology, University of Edinburgh, Edinburgh EH16 4SB, UK.

[132]Division of Psychiatry, University of Edinburgh, Edinburgh EH16 4SB, UK.

[133]Division of Mental Health and Addiction, Oslo University Hospital, 0424 Oslo, Norway.

[134]Massachusetts Mental Health Center Public Psychiatry Division of the Beth Israel Deaconess Medical Center, Boston, Massachusetts 02114, USA.

[135]Estonian Genome Center, University of Tartu, Tartu 50090, Estonia.

[136]School of Psychology, University of Newcastle, Newcastle NSW 2308, Australia.

[137]First Psychiatric Clinic, Medical University, Sofia 1431, Bulgaria.

[138]Department P, Aarhus University Hospital, DK-8240 Risskov, Denmark.

[139]Department of Psychiatry, Royal College of Surgeons in Ireland, Dublin 2, Ireland.

[140]King's College London, London SE5 8AF, UK.

[141]Maastricht University Medical Centre, South Limburg Mental Health Research and Teaching Network, EURON, 6229 HX Maastricht, The Netherlands.

[142]Institute of Translational Medicine, University of Liverpool, Liverpool L69 3BX, UK.

[143]Max Planck Institute of Psychiatry, 80336 Munich, Germany.

[144]Munich Cluster for Systems Neurology (SyNergy), 80336 Munich, Germany.

[145]Department of Psychiatry and Psychotherapy, Jena University Hospital, 07743 Jena, Germany.

[146]Department of Psychiatry, Queensland Brain Institute and Queensland Centre for Mental Health Research, University of Queensland, Brisbane, Queensland, St Lucia QLD 4072, Australia.

[147]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, Maryland 21205, USA.

[148]Department of Psychiatry, Trinity College Dublin, Dublin 2, Ireland.

[149]Eli Lilly and Company, Lilly Corporate Center, Indianapolis, 46285 Indiana, USA.

[150]Department of Clinical Sciences, Psychiatry, Umeå University, SE-901 87 Umeå, Sweden.

[151]DETECT Early Intervention Service for Psychosis, Blackrock, Co. Dublin, Ireland.

[152]Centre for Public Health, Institute of Clinical Sciences, Queen's University Belfast, Belfast BT12 6AB, UK.

[153]Lawrence Berkeley National Laboratory, University of California at Berkeley, Berkeley, California 94720, USA.

[154]Institute of Psychiatry, King's College London, London SE5 8AF, UK.

[155]A list of authors and affiliations appear in the Supplementary Information.

[156]Melbourne Neuropsychiatry Centre, University of Melbourne & Melbourne Health, Melbourne, Vic 3053, Australia.

[157]Department of Psychiatry, University of Helsinki, P.O. Box 590, FI-00029 HUS, Helsinki, Finland.

[158]Public Health Genomics Unit, National Institute for Health and Welfare, P.O. BOX 30, FI-00271 Helsinki, Finland

[159]Medical Faculty, University of Belgrade, 11000 Belgrade, Serbia.

[160]Department of Psychiatry, University of North Carolina, Chapel Hill, North Carolina 27599-7160, USA.

[161]Institute for Molecular Medicine Finland, FIMM, University of Helsinki, P.O. Box 20

FI-00014, Helsinki, Finland

[162]Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts 02115, USA.

[163]Department of Psychiatry, University of Oxford, Oxford, OX3 7JX, UK.

[164]Virginia Institute for Psychiatric and Behavioral Genetics, Virginia Commonwealth University, Richmond, Virginia 23298, USA.

[165]Institute for Multiscale Biology, Icahn School of Medicine at Mount Sinai, New York, New York 10029, USA.

[166]PharmaTherapeutics Clinical Research, Pfizer Worldwide Research and Development, Cambridge, Massachusetts 02139, USA.

[167]Department of Psychiatry and Psychotherapy, University of Gottingen, 37073 Göttingen, Germany.

[168]Psychiatry and Psychotherapy Clinic, University of Erlangen, 91054 Erlangen, Germany.

[169]Hunter New England Health Service, Newcastle NSW 2308, Australia.

[170]School of Biomedical Sciences and Pharmacy, University of Newcastle, Callaghan NSW 2308, Australia.

[171]Division of Cancer Epidemiology and Genetics, National Cancer Institute, Bethesda, Maryland 20892, USA.

[172]University of Iceland, Landspitali, National University Hospital, 101 Reykjavik, Iceland.

[173]Department of Psychiatry and Drug Addiction, Tbilisi State Medical University (TSMU), **N33, 0177** Tbilisi, Georgia.

[174]Research and Development, Bronx Veterans Affairs Medical Center, New York, New York 10468, USA.

[175]Wellcome Trust Centre for Human Genetics, Oxford, OX3 7BN, UK.

[176]deCODE Genetics, 101 Reykjavik, Iceland.

[177]Department of Clinical Neurology, Medical University of Vienna, 1090 Wien, Austria.

[178]Lieber Institute for Brain Development, Baltimore, Maryland 21205, USA.

[179]Department of Medical Genetics, University Medical Centre Utrecht, Universiteitsweg 100, 3584 CG, Utrecht, The Netherlands.

[180]Berkshire Healthcare NHS Foundation Trust, Bracknell RG12 1BQ, UK.

[181]Section of Psychiatry, University of Verona, 37134 Verona, Italy.

[182]Department of Psychiatry, University of Oulu, P.O. BOX 5000, 90014, Finland

[183]University Hospital of Oulu, P.O.BOX 20, 90029 OYS, Finland.

[184]Molecular and Cellular Therapeutics, Royal College of Surgeons in Ireland, Dublin 2, Ireland.

[185]Health Research Board, Dublin 2, Ireland.

[186]School of Psychiatry and Clinical Neurosciences, The University of Western Australia, Perth WA6009, Australia.

[187]Computational Sciences CoE, Pfizer Worldwide Research and Development, Cambridge, Massachusetts 02139, USA.

[188]Human Genetics, Genome Institute of Singapore, A*STAR, Singapore 138672, Singapore.

[189]A list of authors and affiliations appear in the Supplementary Information.

[190]University College London, London WC1E 6BT, UK.

[191]Department of Neuroscience, Icahn School of Medicine at Mount Sinai, New York, New York 10029, USA.

[192]Institute of Neuroscience and Medicine (INM-1), Research Center Juelich, 52428 Juelich, Germany.

[193]Department of Genetics, The Hebrew University of Jerusalem, 91905 Jerusalem, Israel.

[194]Neuroscience Discovery and Translational Area, Pharma Research and Early Development, F. Hoffman-La Roche, CH-4070 Basel, Switzerland.

[195]Centre for Clinical Research in Neuropsychiatry, School of Psychiatry and Clinical Neurosciences, The University of Western Australia, Medical Research Foundation Building, Perth WA 6000, Australia.

[196]Virginia Institute for Psychiatric and Behavioral Genetics, Departments of Psychiatry and Human and Molecular Genetics, Virginia Commonwealth University, Richmond, Virginia 23298, USA.

[197]The Feinstein Institute for Medical Research, Manhasset, New York, 11030 USA.

[198]The Hofstra NS-LIJ School of Medicine, Hempstead, New York, 11549 USA.

[199]The Zucker Hillside Hospital, Glen Oaks, New York,11004 USA.

[200]Saw Swee Hock School of Public Health, National University of Singapore, Singapore 117597, Singapore.

[201]Queensland Centre for Mental Health Research, University of Queensland, Brisbane 4076, Queensland, Australia.

[202]Center for Human Genetic Research and Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts 02114, USA.

[203]Department of Child and Adolescent Psychiatry, Erasmus University Medical Centre, Rotterdam 3000, The Netherlands.

[204]Department of Complex Trait Genetics, Neuroscience Campus Amsterdam, VU University Medical Center Amsterdam, Amsterdam 1081, The Netherlands.

[205]Department of Functional Genomics, Center for Neurogenomics and Cognitive Research, Neuroscience Campus Amsterdam, VU University, Amsterdam 1081, The Netherlands.

[206]University of Aberdeen, Institute of Medical Sciences, Aberdeen, AB25 2ZD, UK.

[207]Departments of Psychiatry, Neurology, Neuroscience and Institute of Genetic Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland 21205, USA.

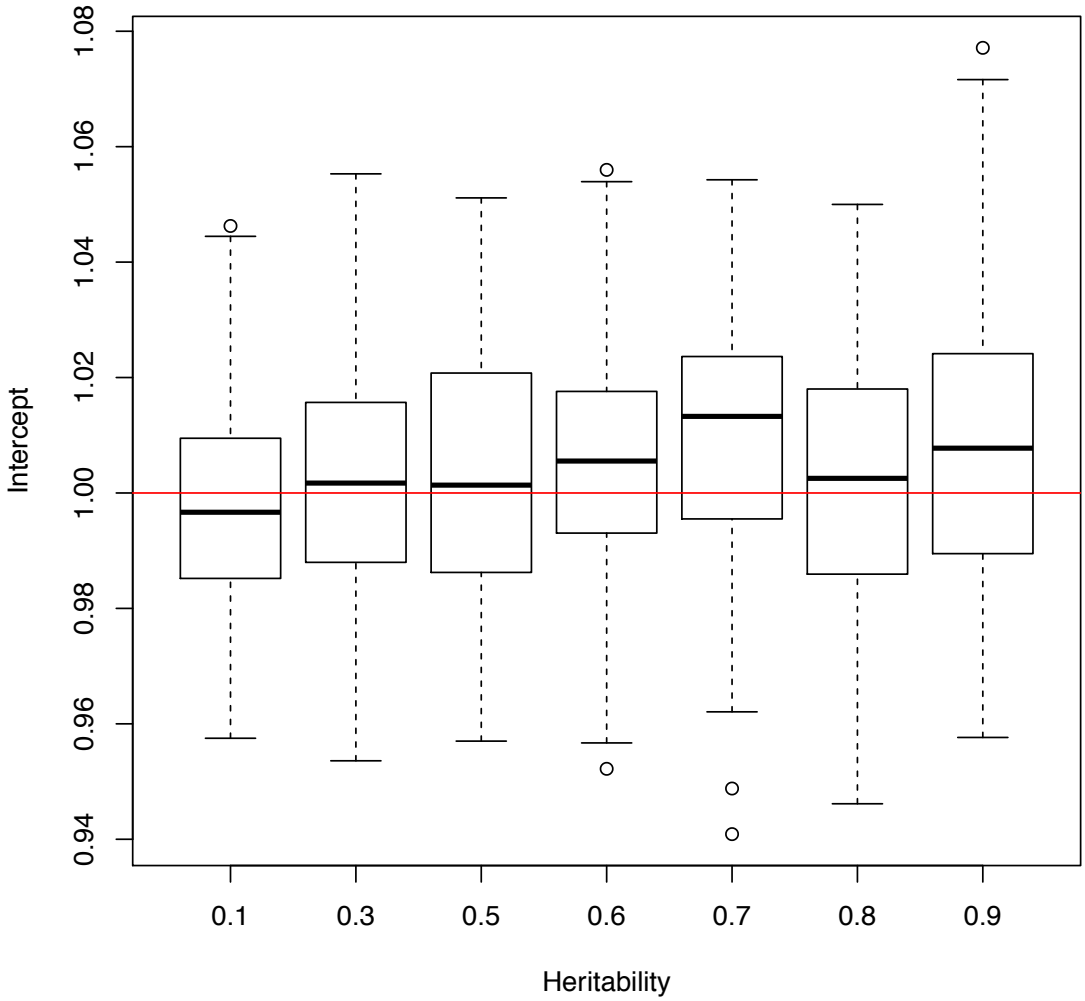
[208]Department of Clinical Medicine, University of Copenhagen, Copenhagen 2200, Denmark.

[209]Departments of Psychiatry and Human Genetics, University of Chicago, Chicago, Illinois 60637, USA.

[210]University Hospital Marqués de Valdecilla, Instituto de Formación e Investigación Marqués de Valdecilla, University of Cantabria, E-39008 Santander, Spain

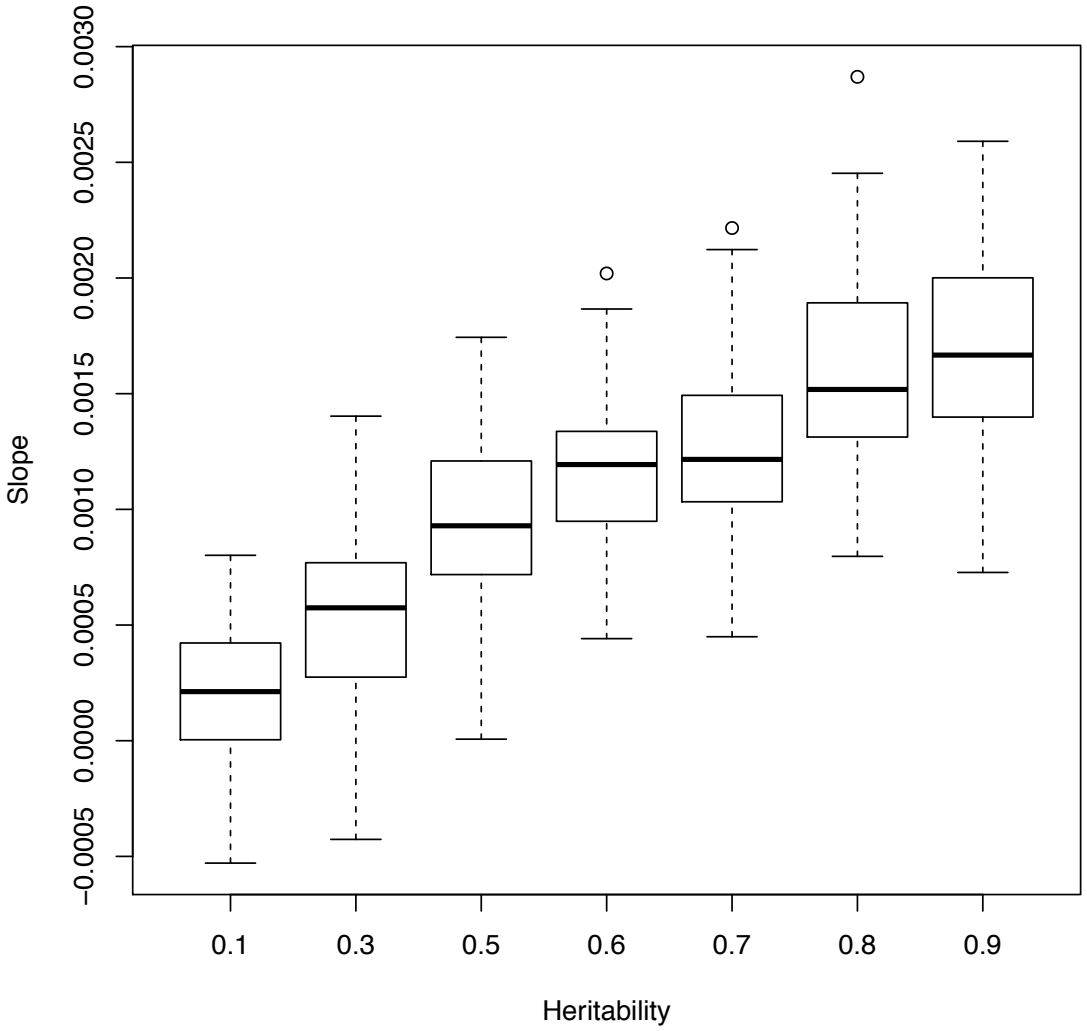
Supplemental Figures

Supplementary Figure 1: Intercepts from simulations with varying heritability



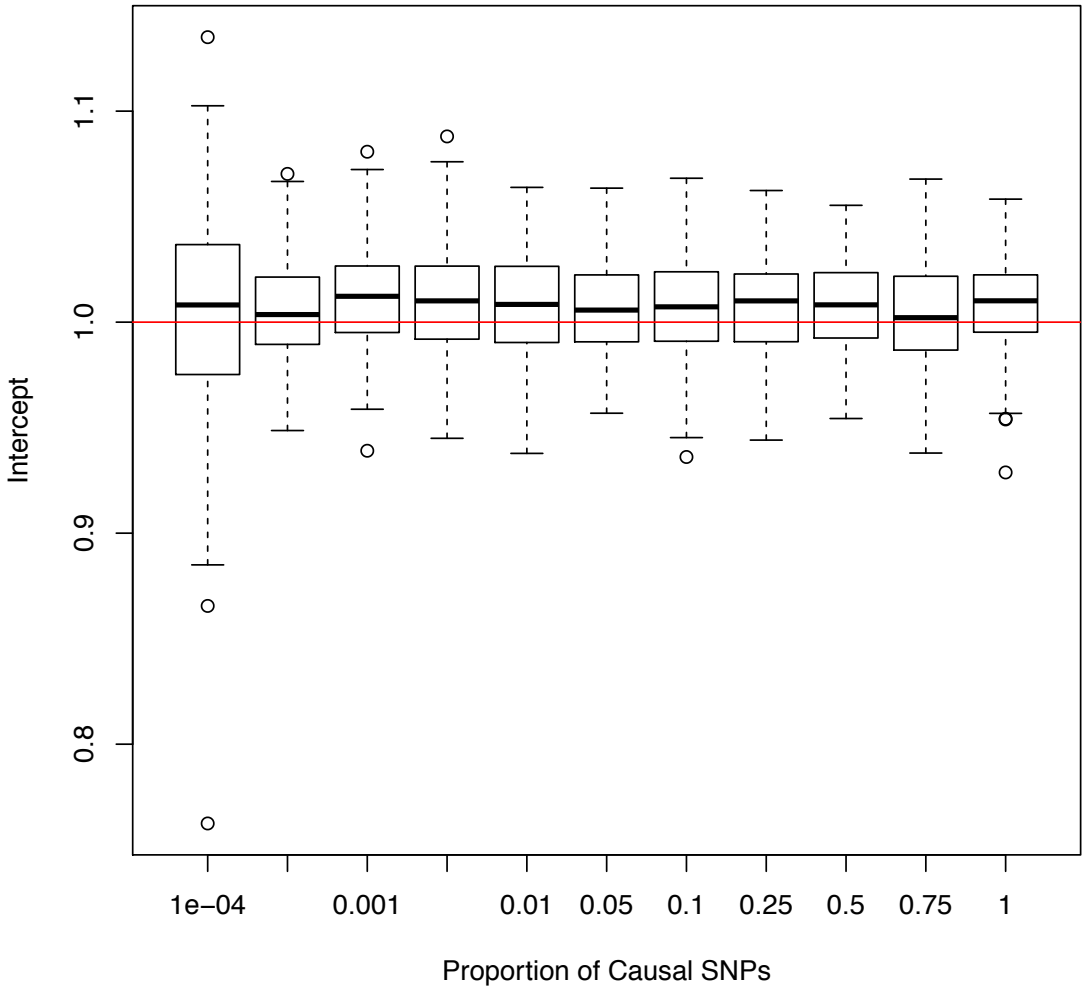
The *x*-axis displays different heritabilities specified for simulations, and the *y*-axis displays LD Score regression intercepts from 100 simulation replicates for each value of heritability. The red line shows the expected LD Score regression intercept in the absence of confounding bias. For all simulations, 1% of SNPs were causal.

Supplementary Figure 2: Slopes from simulations with varying heritability



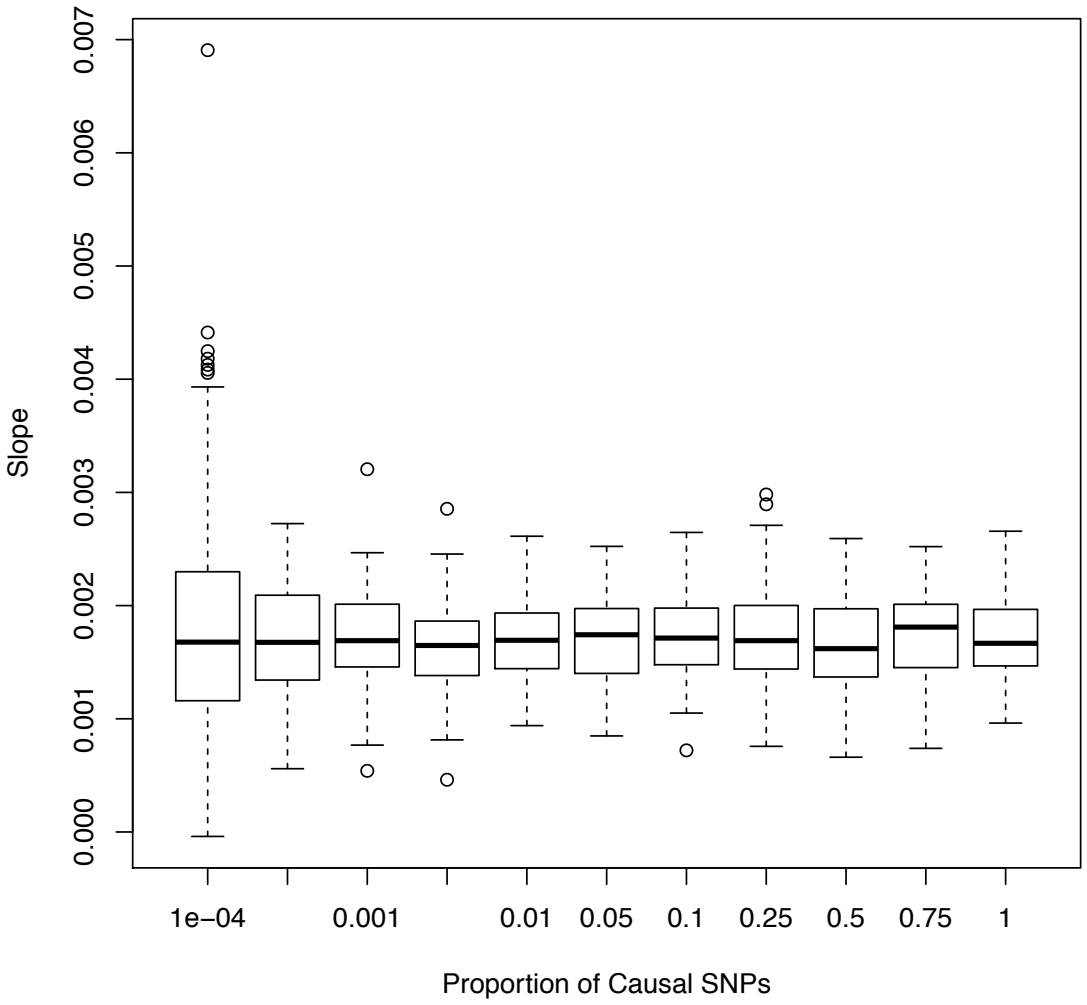
The *x*-axis displays different heritabilities specified for simulations, and the *y*-axis displays LD Score regression slopes from 100 simulation replicates for each value of heritability. For all simulations, 1% of SNPs were causal.

Supplementary Figure 3: Intercepts from simulations with various proportions of causal SNPs



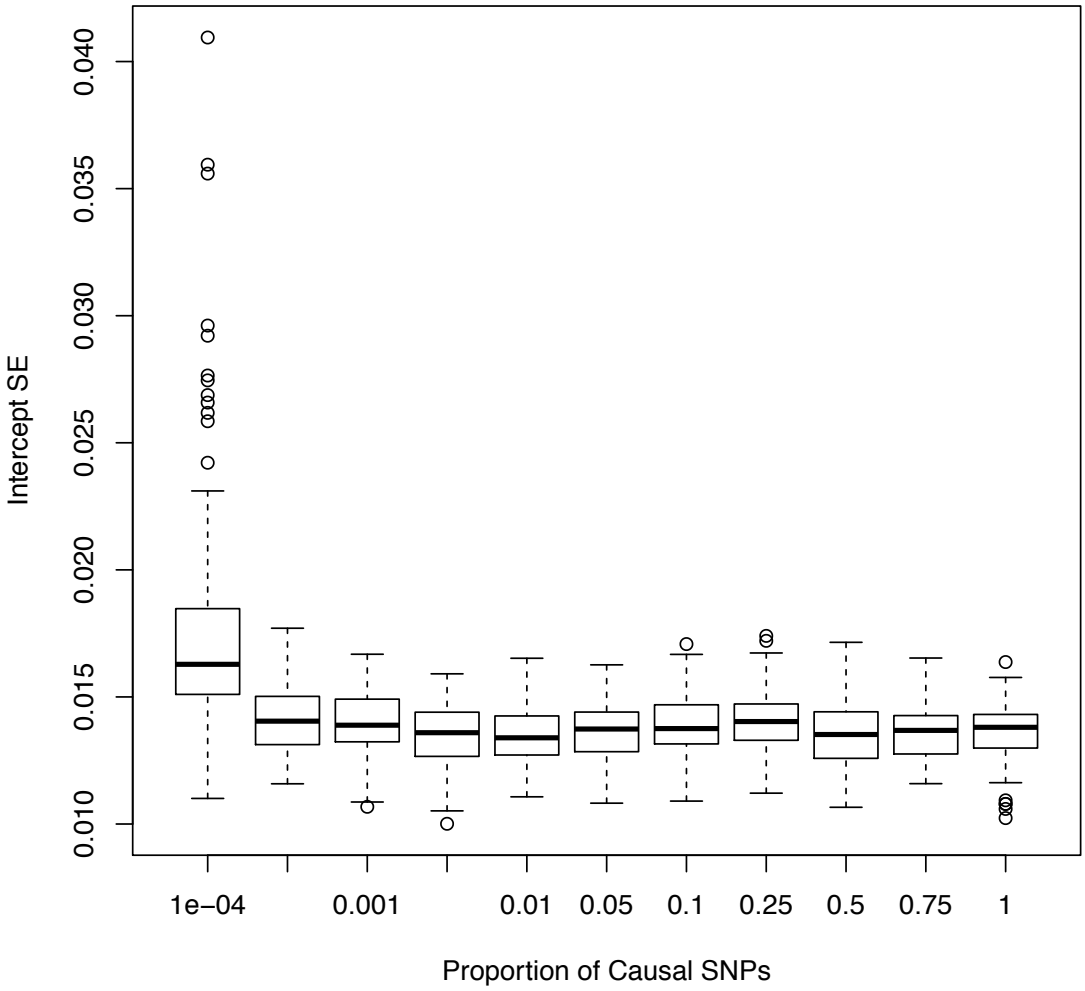
The *x*-axis displays different proportions of causal SNPs specified for simulations, and the *y*-axis displays LD Score regression intercepts from 100 simulation replicates for each value of the proportion of causal SNPs. For all simulations, the heritability was 0.9.

Supplementary Figure 4: Slopes from simulations with various proportions of causal SNPs



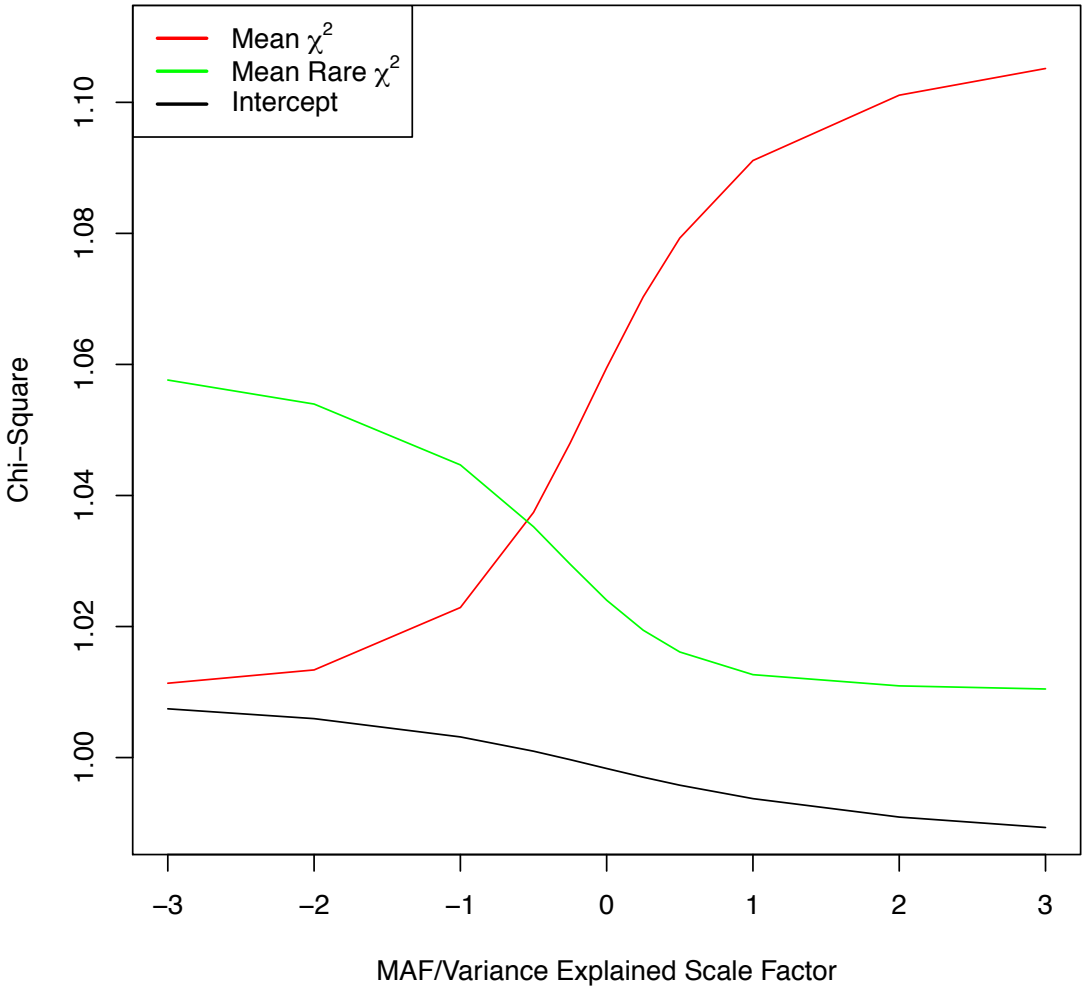
The *x*-axis displays different proportions of causal SNPs specified for simulations, and the *y*-axis displays LD Score regression slopes from 100 simulation replicates for each value of the proportion of causal SNPs. For all simulations, the heritability was 0.9.

Supplementary Figure 5: Estimated standard error from simulations with various proportions of causal SNPs



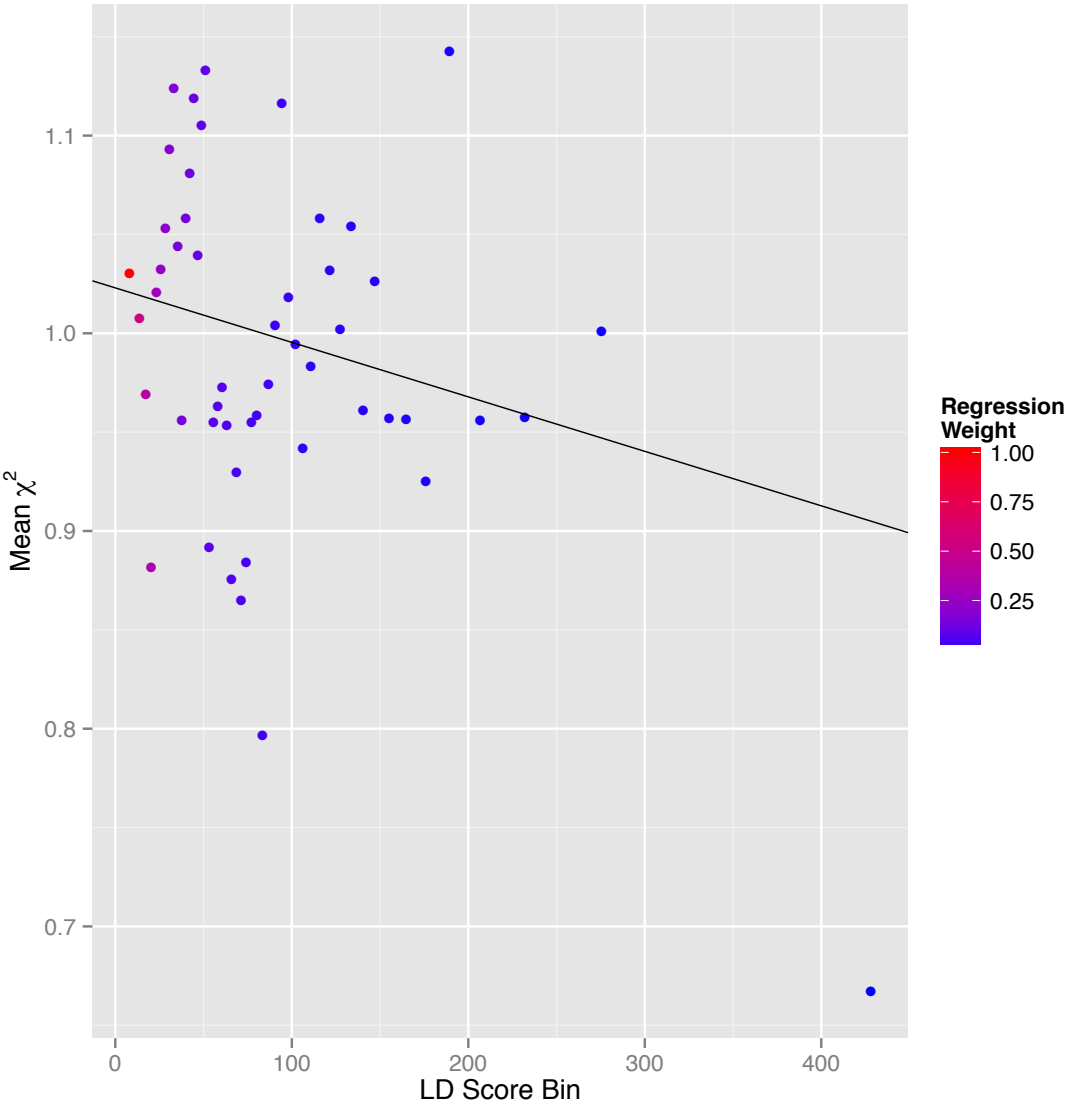
The *x*-axis displays different proportions of causal SNPs specified for simulations, and the *y*-axis displays block jackknife estimates of the standard error of the intercept from each of 100 simulation replicates for each proportion of causal SNPs. For all simulations, the heritability was 0.9.

Supplementary Figure 6: Simulations with frequency-dependent architecture



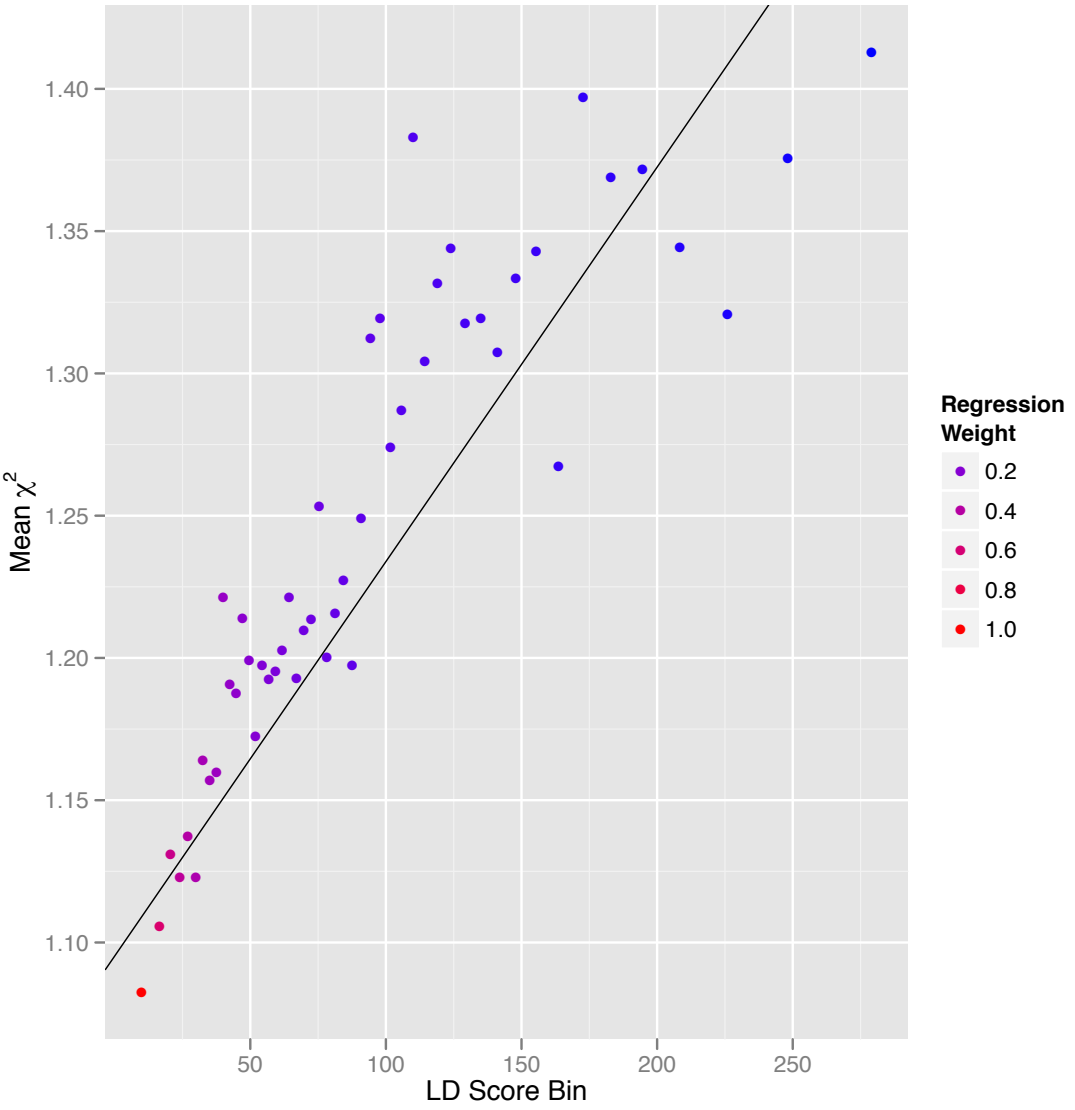
The *x*-axis describes the simulate relationship between minor allele frequency and effect size. Precisely, per-normalized genotype effects for 10,000 causal variants were drawn from $N(0, (p(1-p))^x)$, where *p* is MAF and *x* is the *x*-coordinate. To prevent singleton and doubleton variants from having extreme effects for large negative values of *x*, we drew the effect sizes for variants with MAF < 1% from $N(0,0.0099^x)$. The red line is the mean χ^2 among the common HapMap 3[4] variants retained for LD Score regression. The green line is the mean χ^2 among variants with MAF < 1%. The black line is the LD Score regression intercept. Each data point is the average across 10 simulation replicates with randomly chosen effects. Our model holds when *x=0*, which corresponds to moderate negative selection on the phenotype in question, similar to a typical disease phenotype. *x=1* is an appropriate model for a selectively neutral phenotype. Values of *x* outside the range [0,1] represent extreme genetic architectures.

Supplementary Figure 7: Simulation where all causal variants are rare



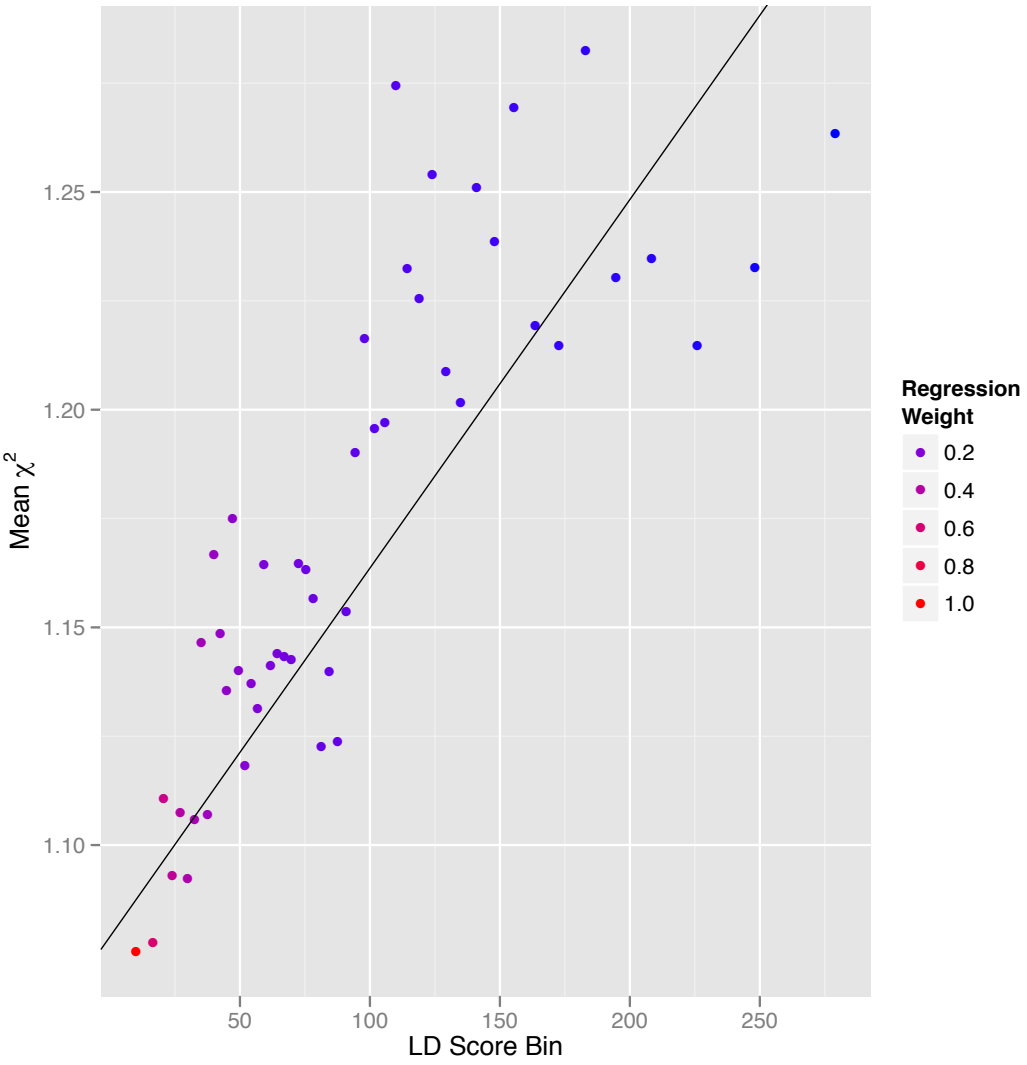
LD Score regression plot for a simulation with 1000 Swedish samples and ~700,000 SNPs on chromosome 1 where all causal variants had MAF < 1%. Each point represents an LD Score quantile, where the *x*-coordinate of the point is the mean LD Score of variants in that quantile and the *y*-coordinate is the mean χ^2 of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line. The slope of the LD Score regression line is -3.2E-4, which is statistically significantly less than zero (block jackknife p=0.013).

Supplementary Figure 8a: LD Score plot for IBD



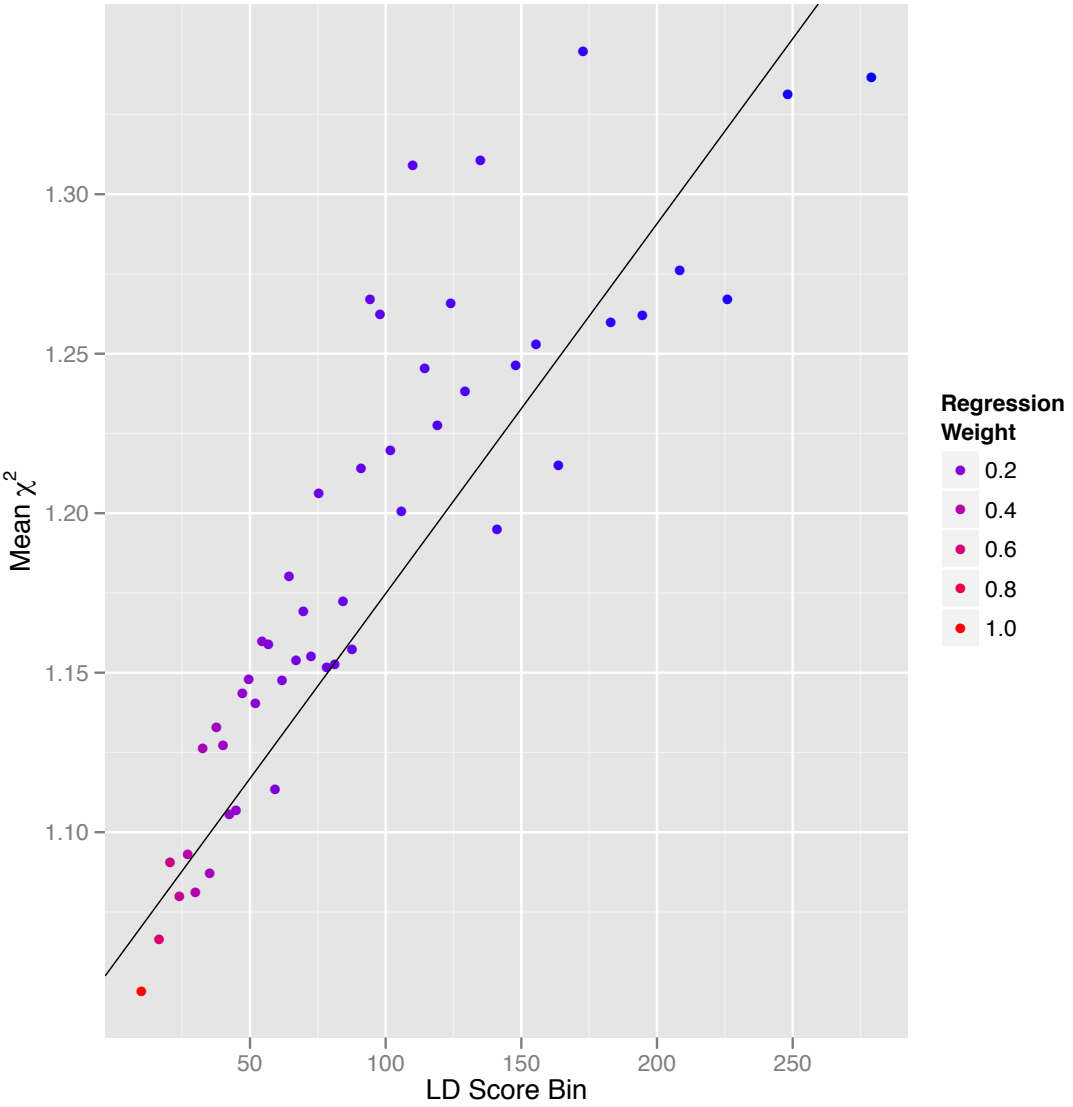
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8b: LD Score plot for Ulcerative Colitis



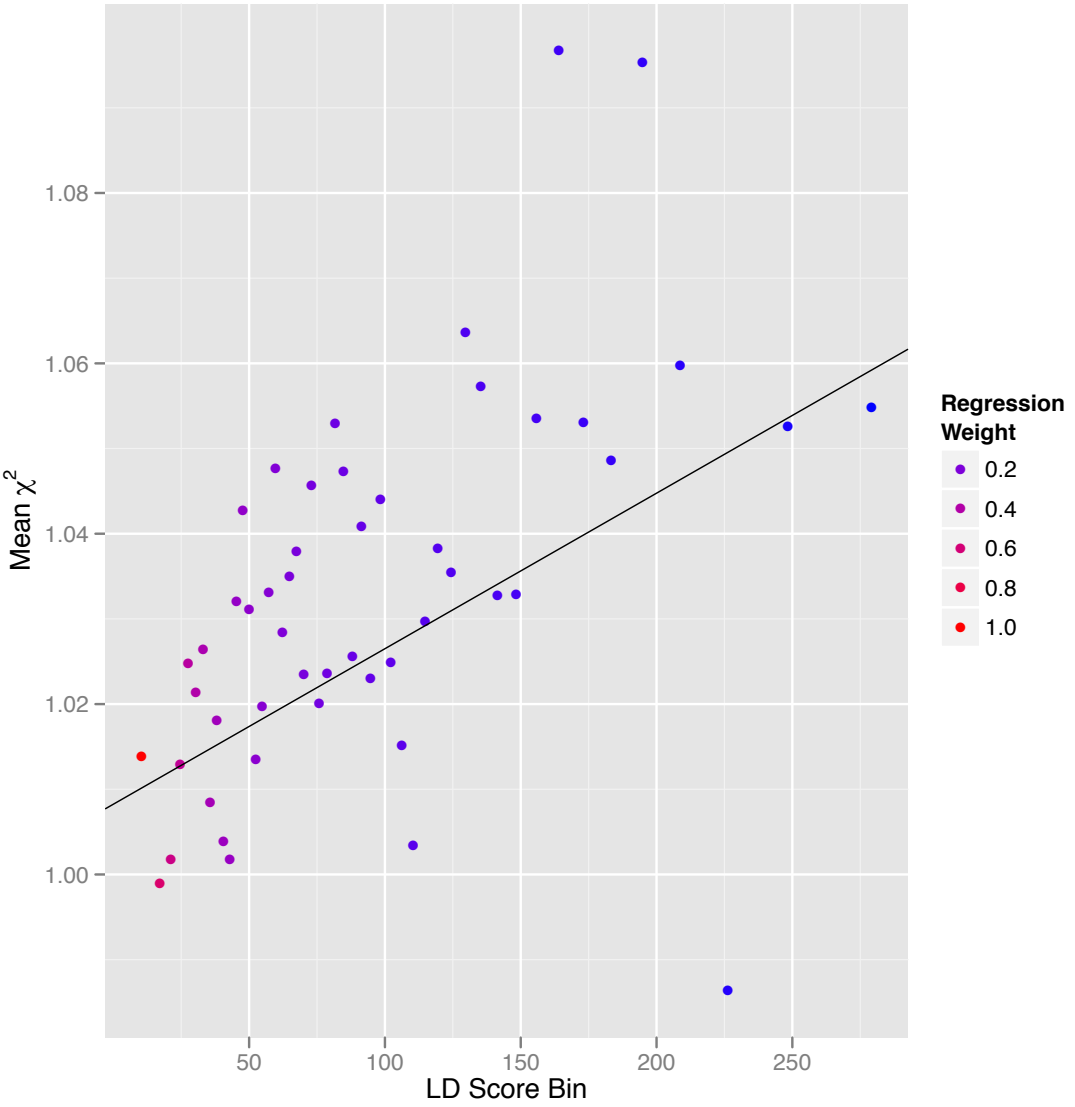
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8c: LD Score plot for Crohn's Disease



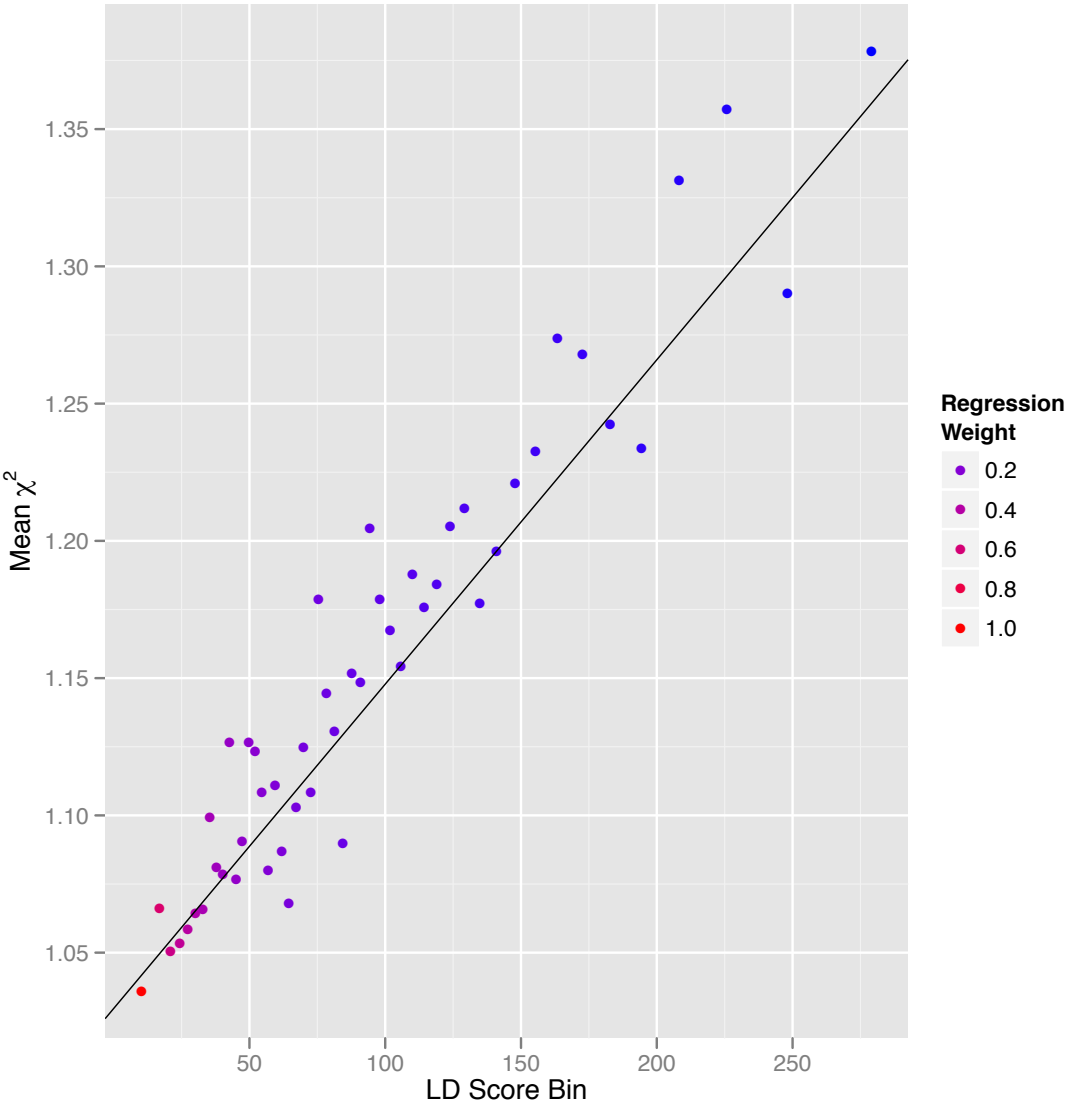
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8d: LD Score plot for ADHD



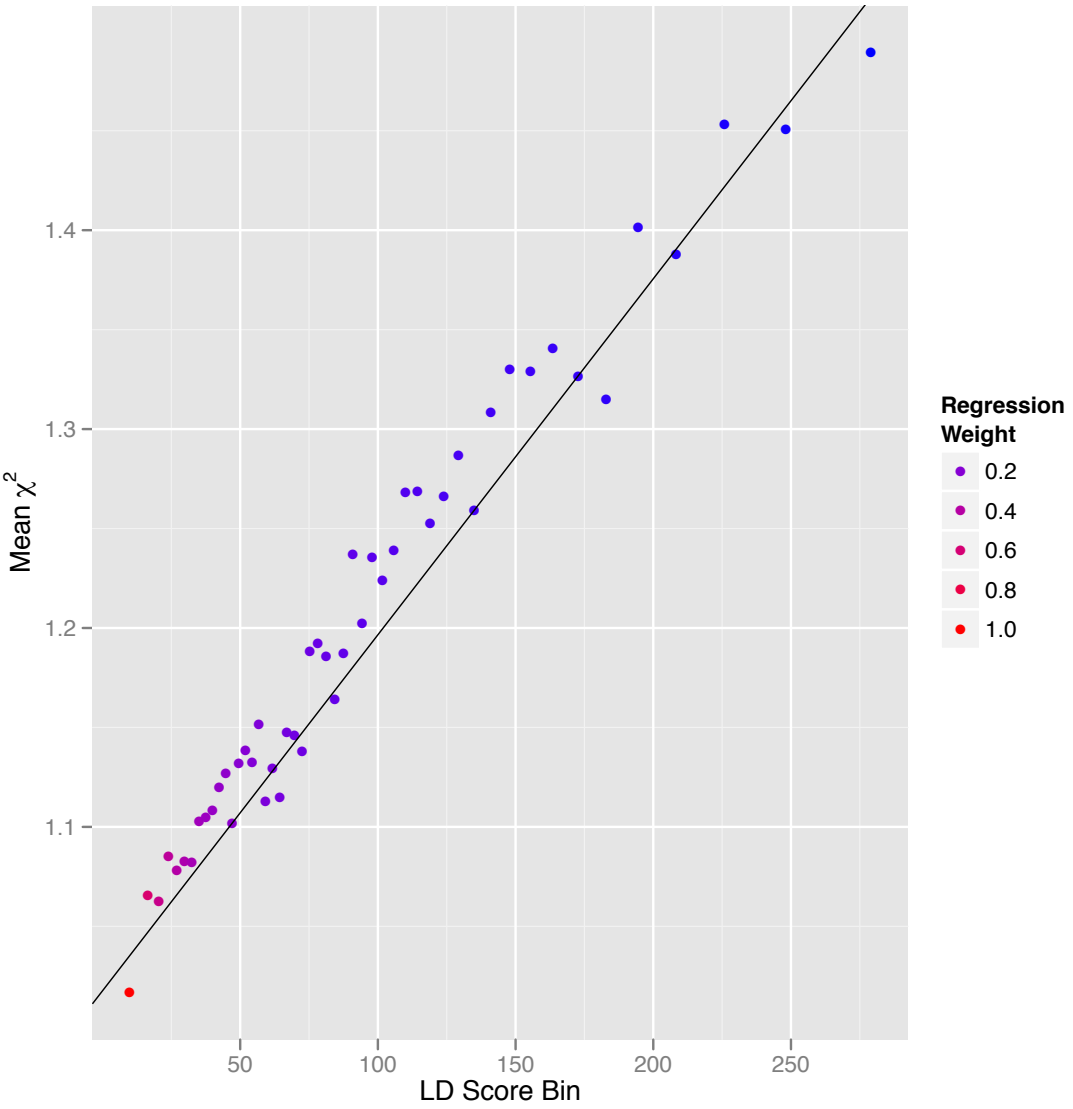
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8e: LD Score plot for Bipolar Disorder



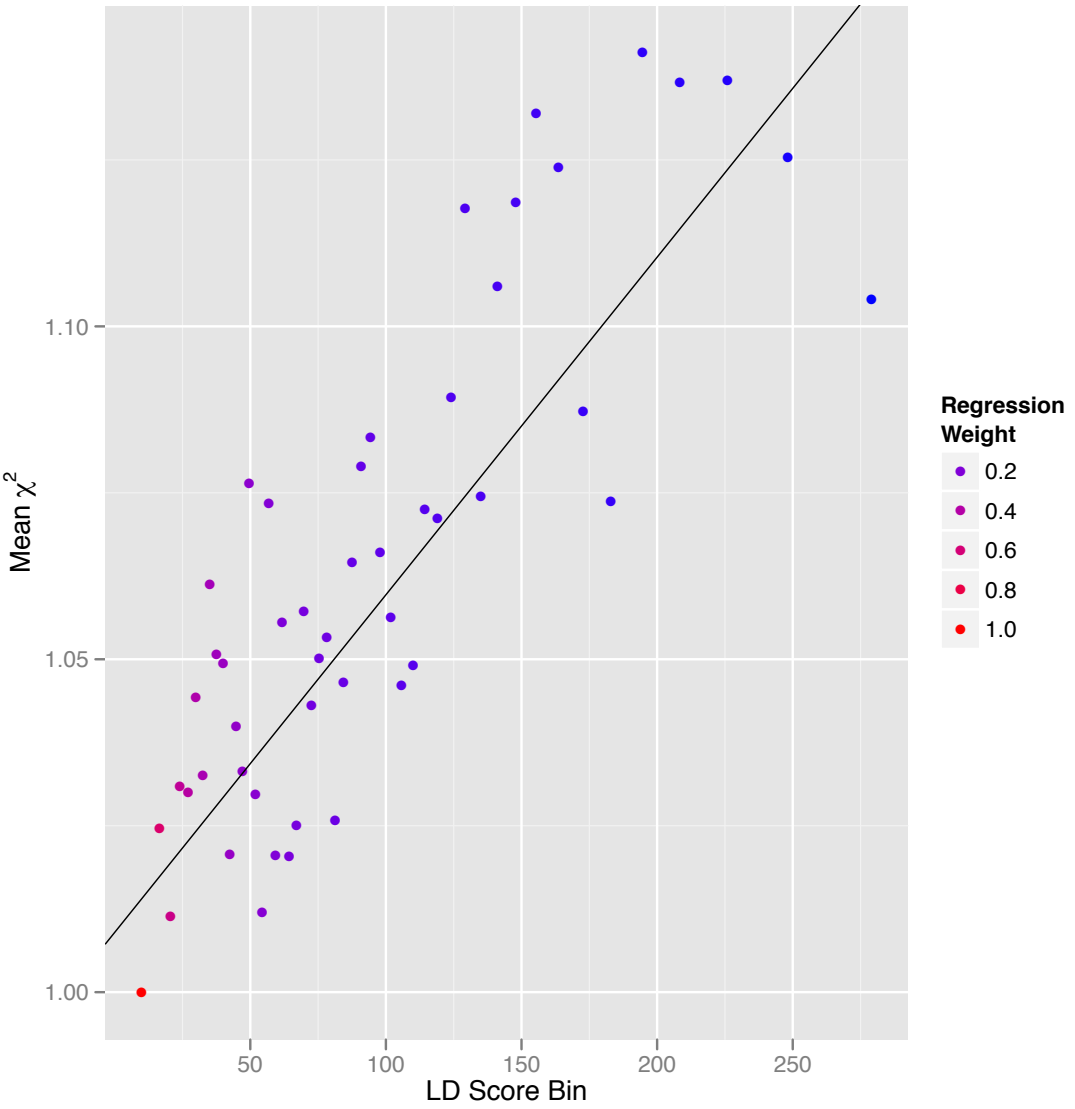
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8f: LD Score plot for PGC Cross-Disorder Analysis



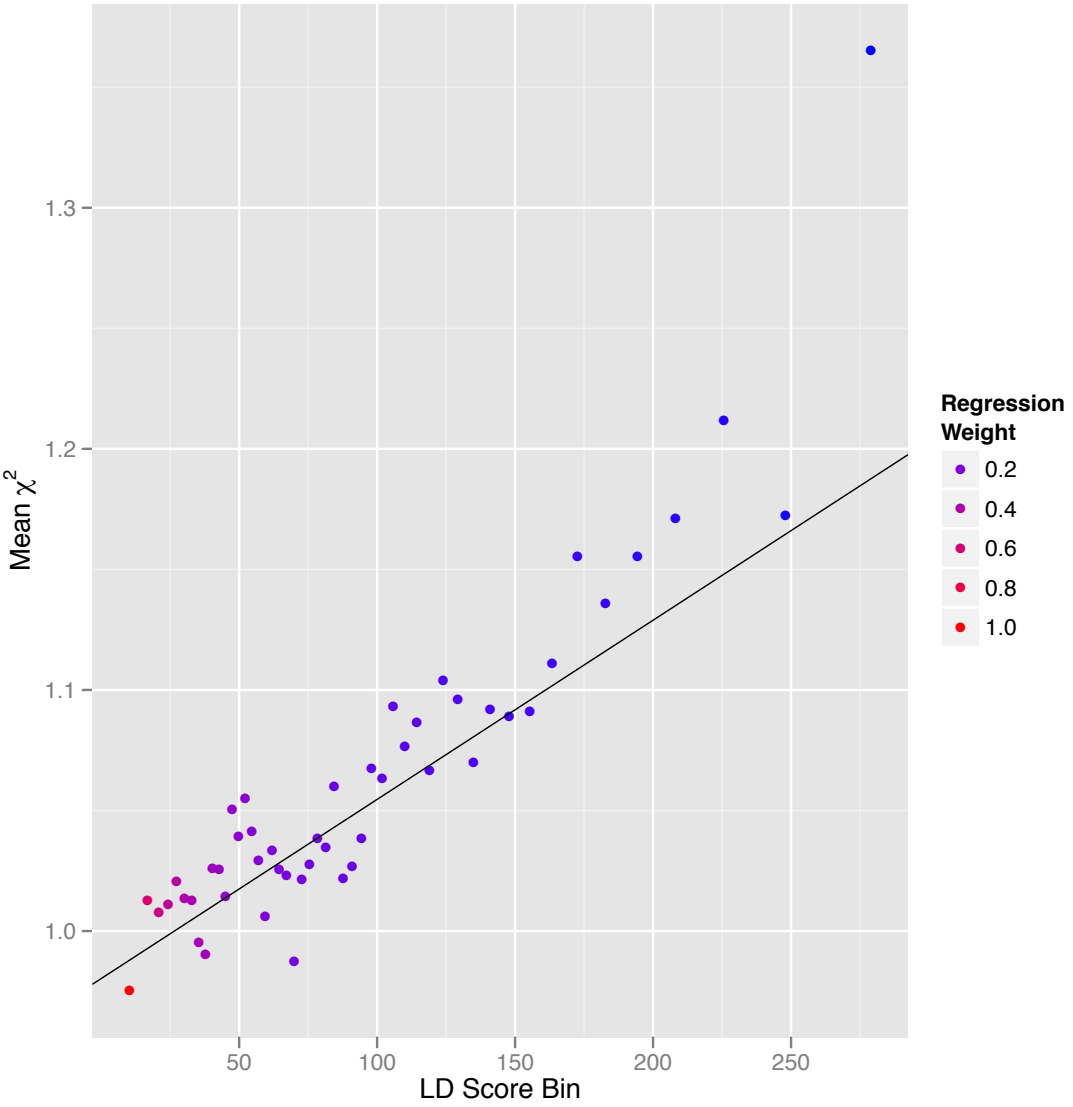
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8g: LD Score plot for Major Depression



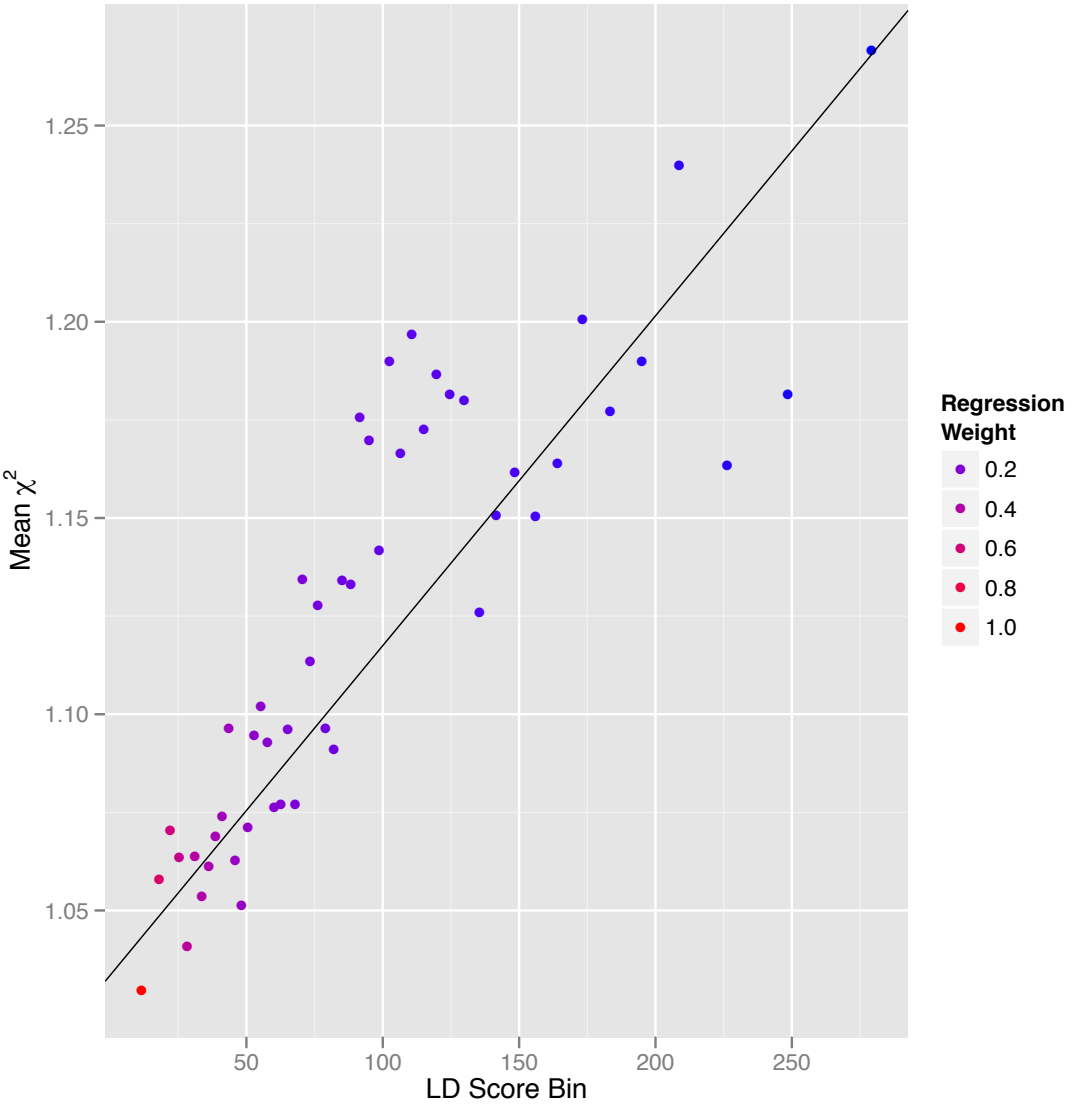
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8h: LD Score plot for Rheumatoid Arthritis



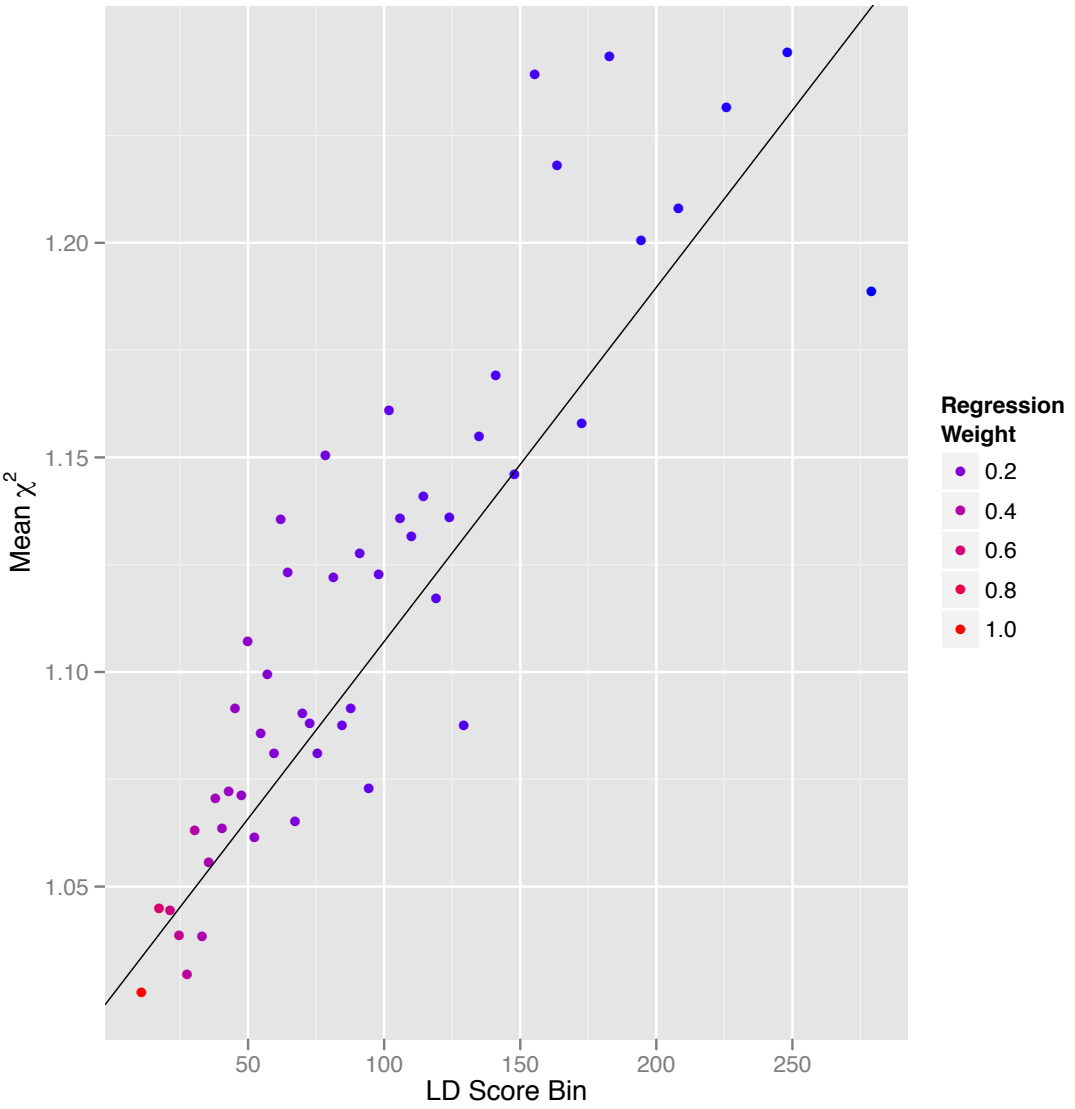
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8i: LD Score plot for Coronary Artery Disease



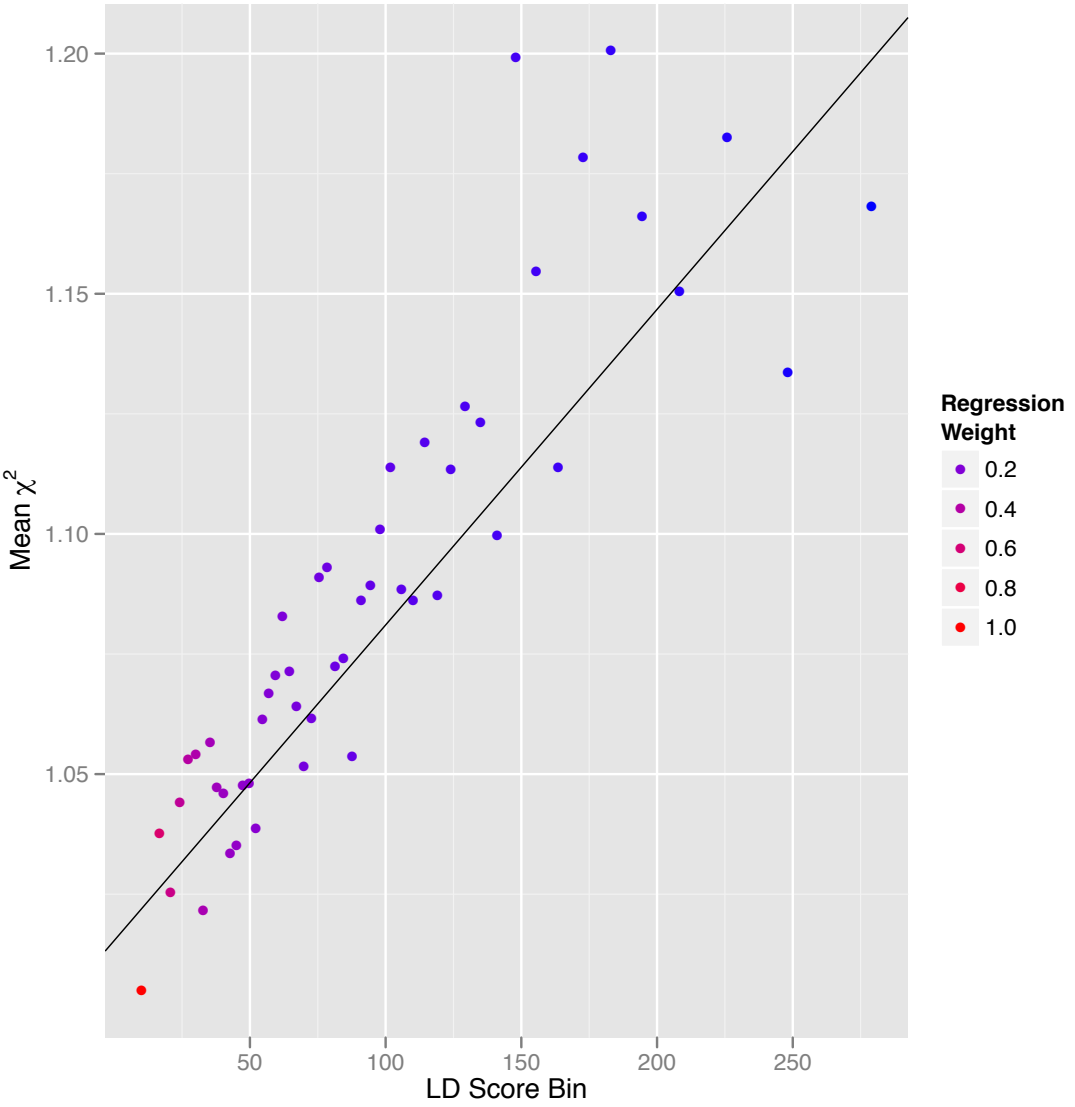
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8j: LD Score plot for Type-2 Diabetes



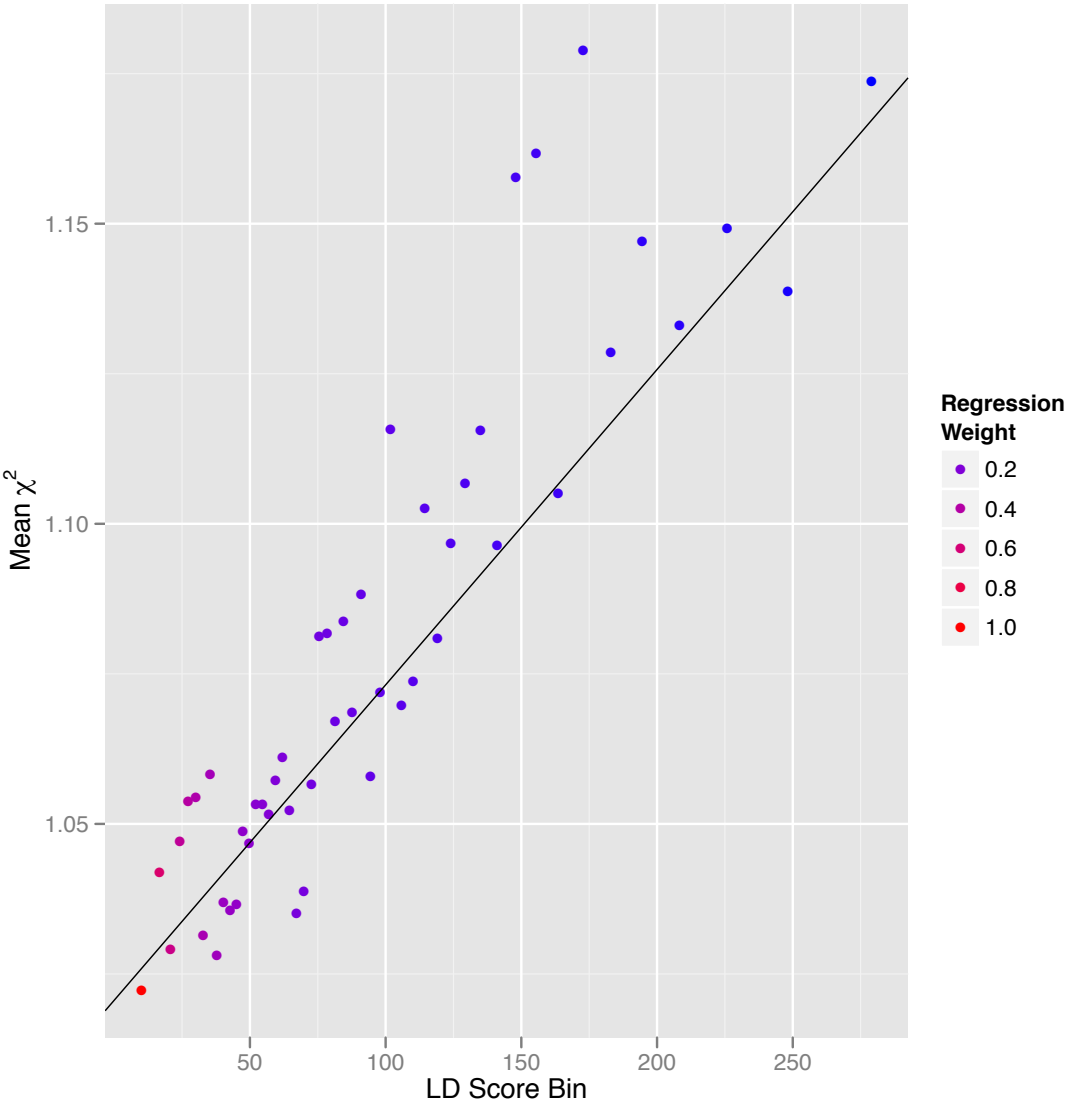
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8k: LD Score plot for BMI-Adjusted Fasting Insulin



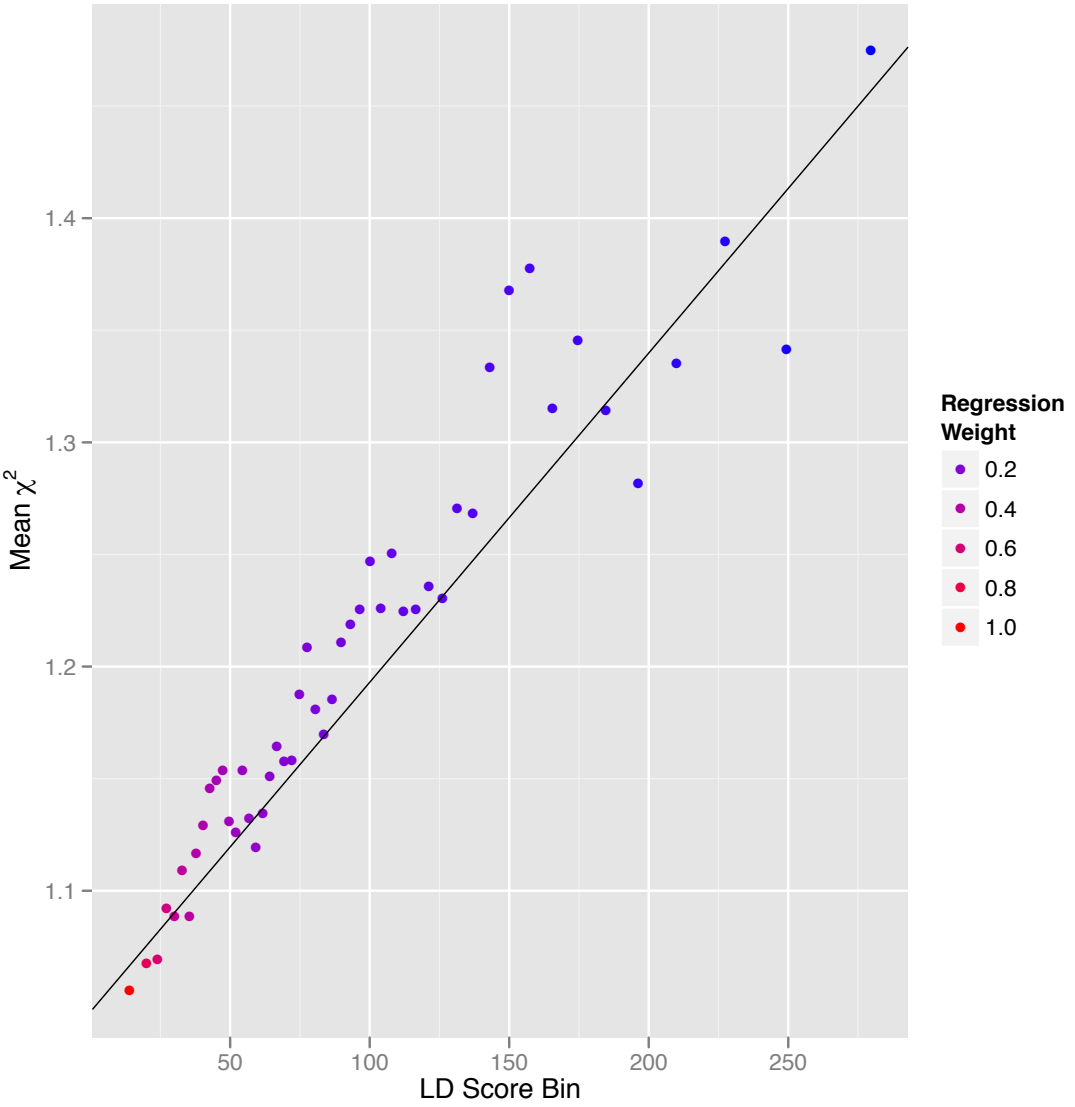
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8l: LD Score plot for Fasting Insulin



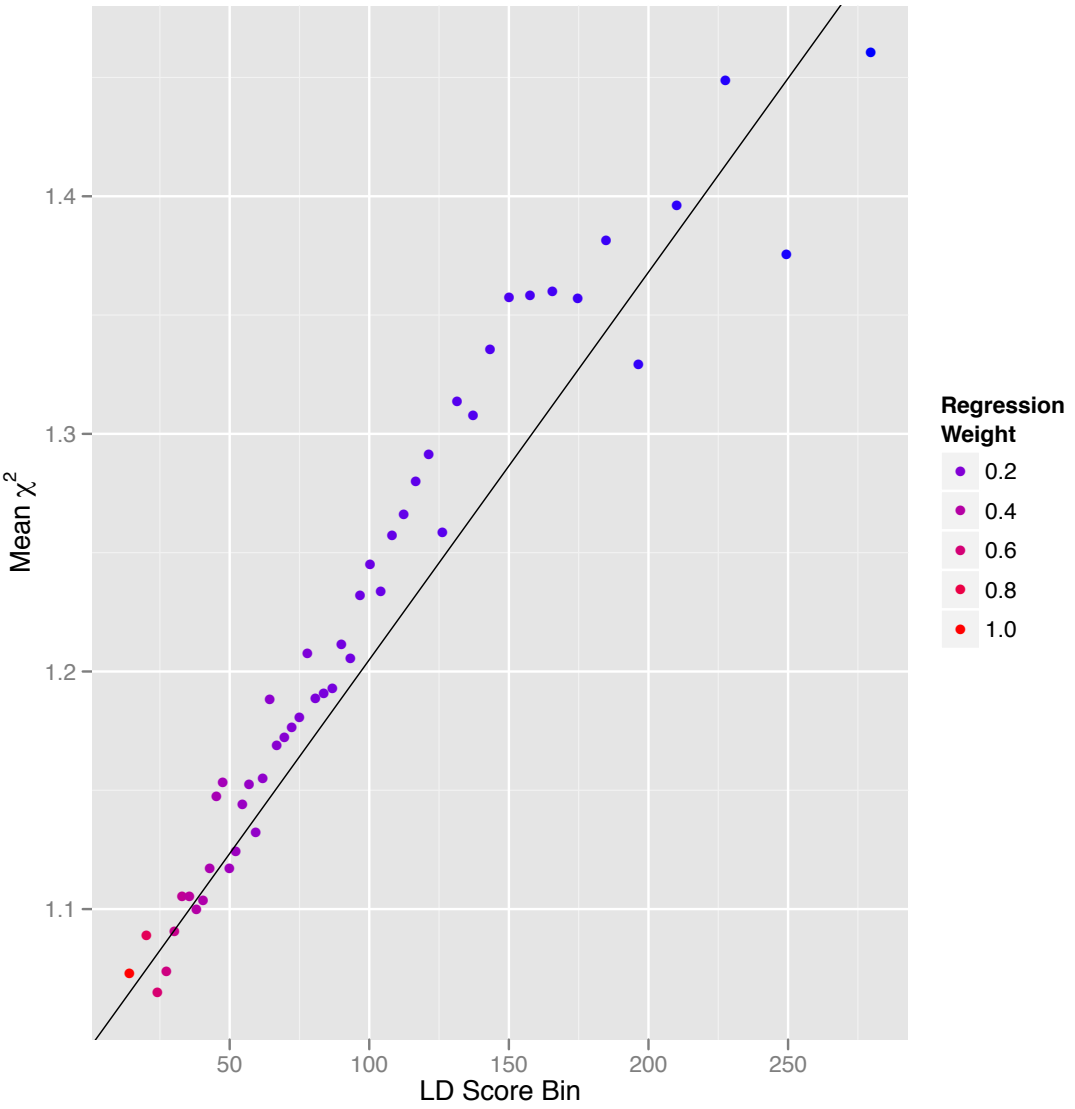
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8m: LD Score plot for College



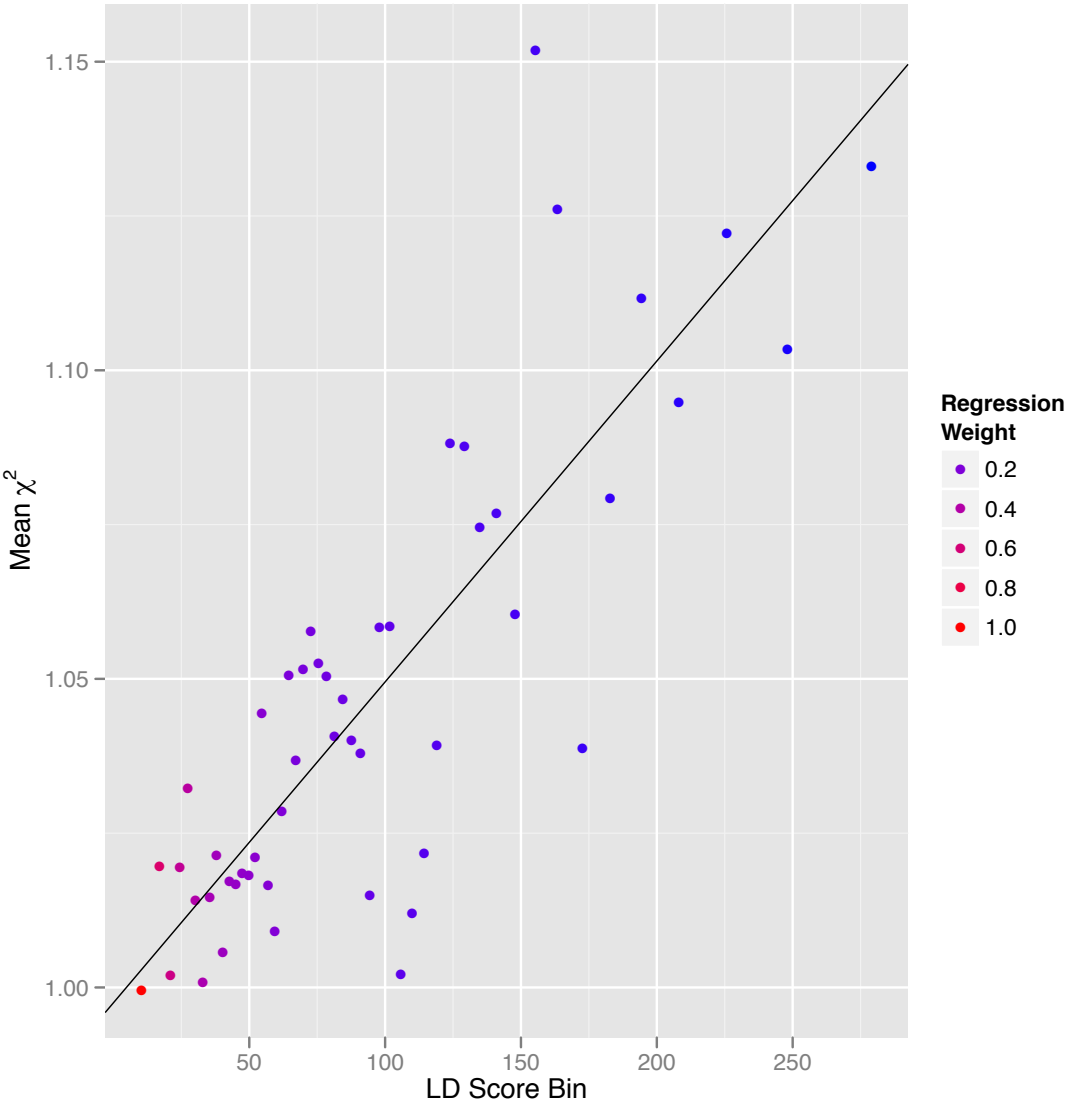
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8n: LD Score plot for Years of Education



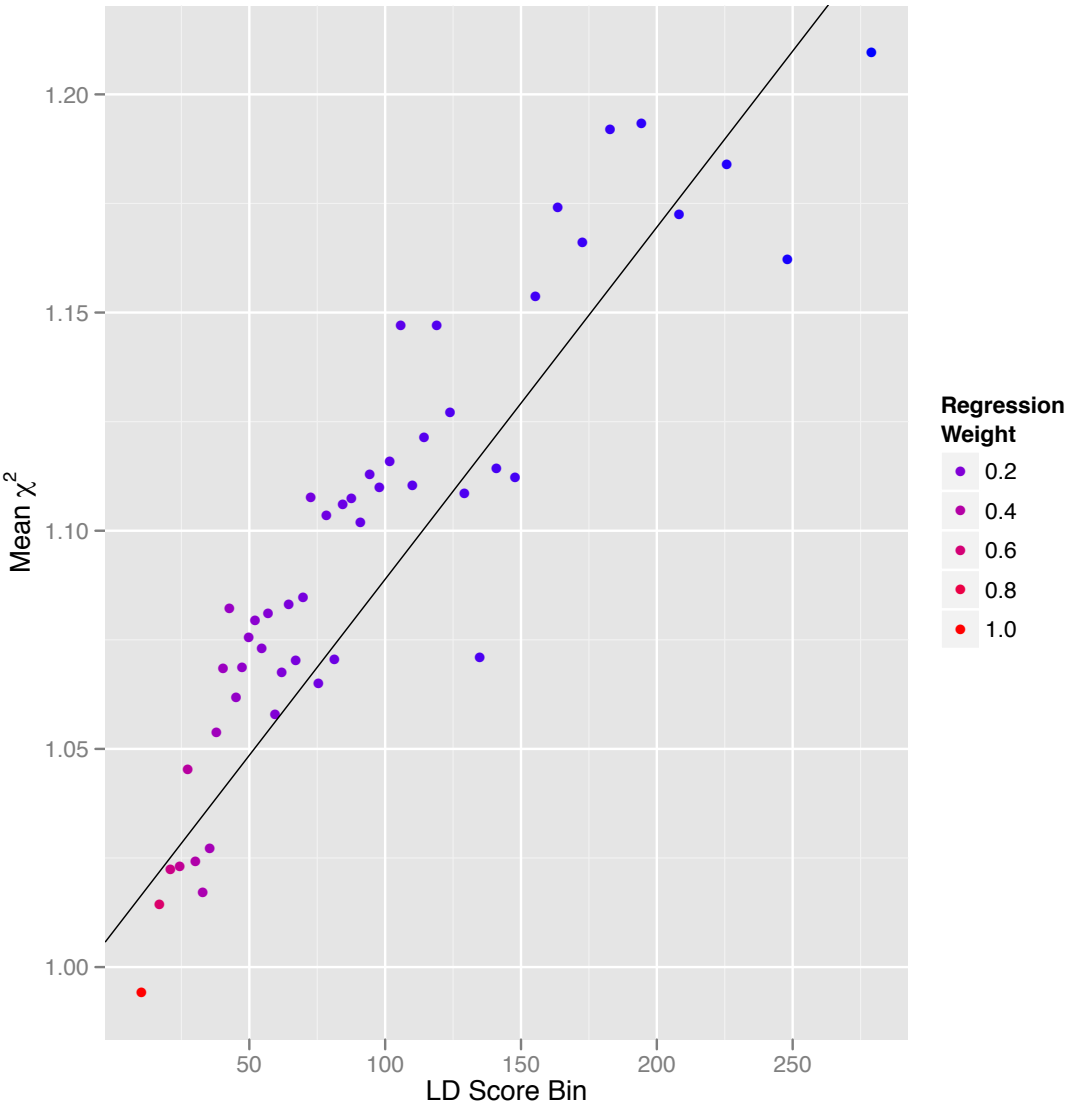
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 80: LD Score plot for Cigarettes Per Day



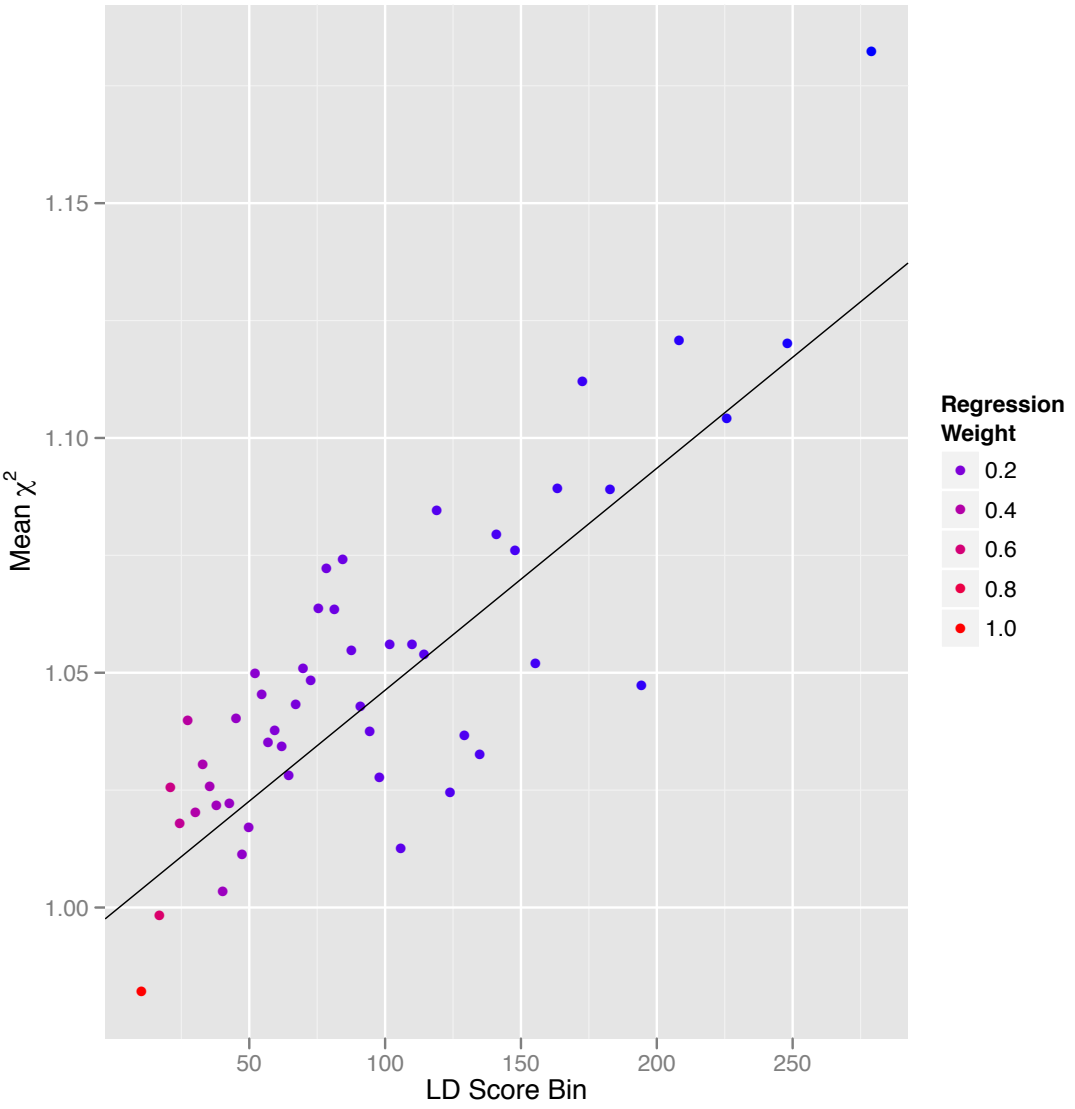
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8p: LD Score plot for Ever Smoked?



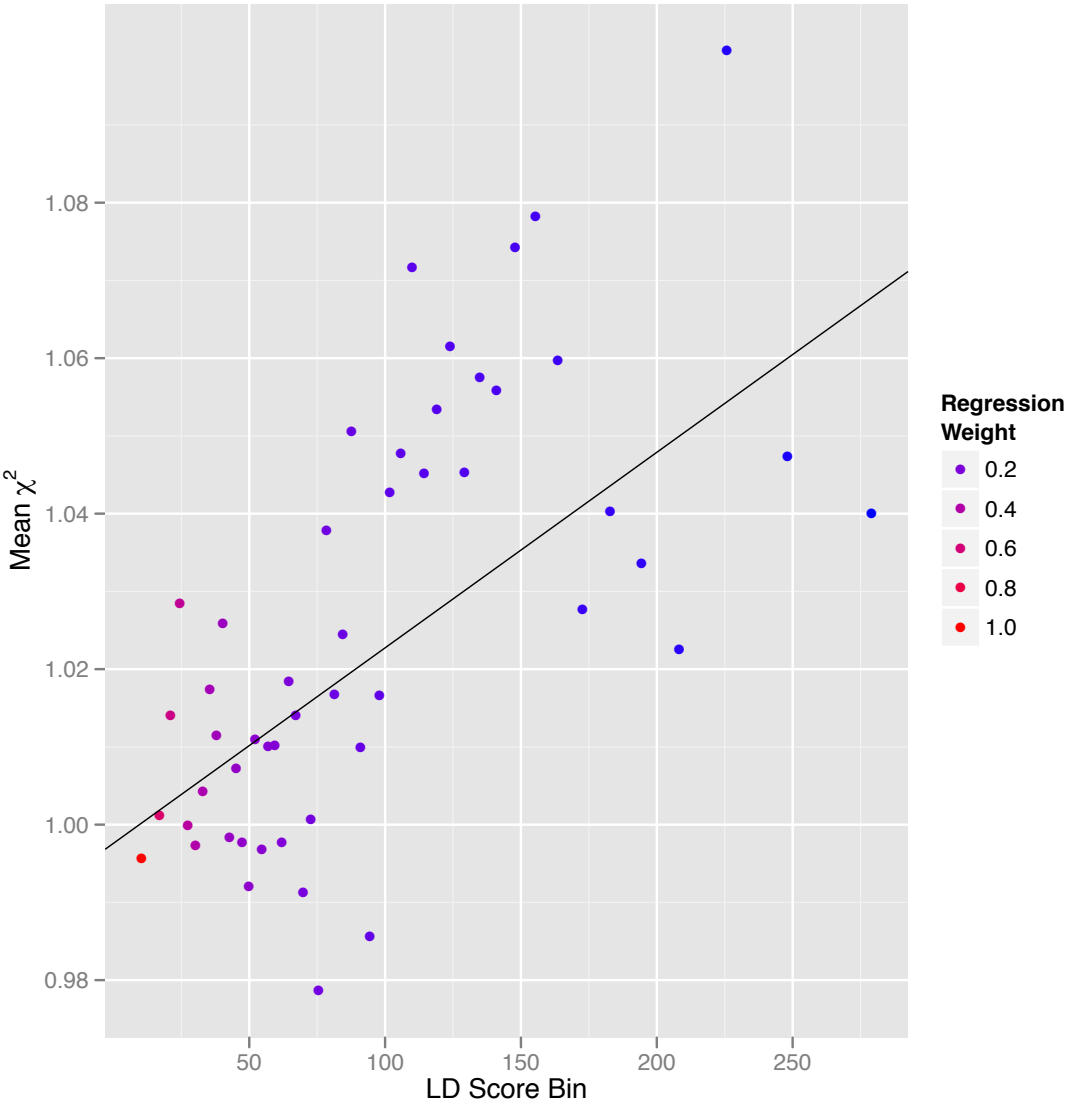
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8q: LD Score plot for Former Smoker?



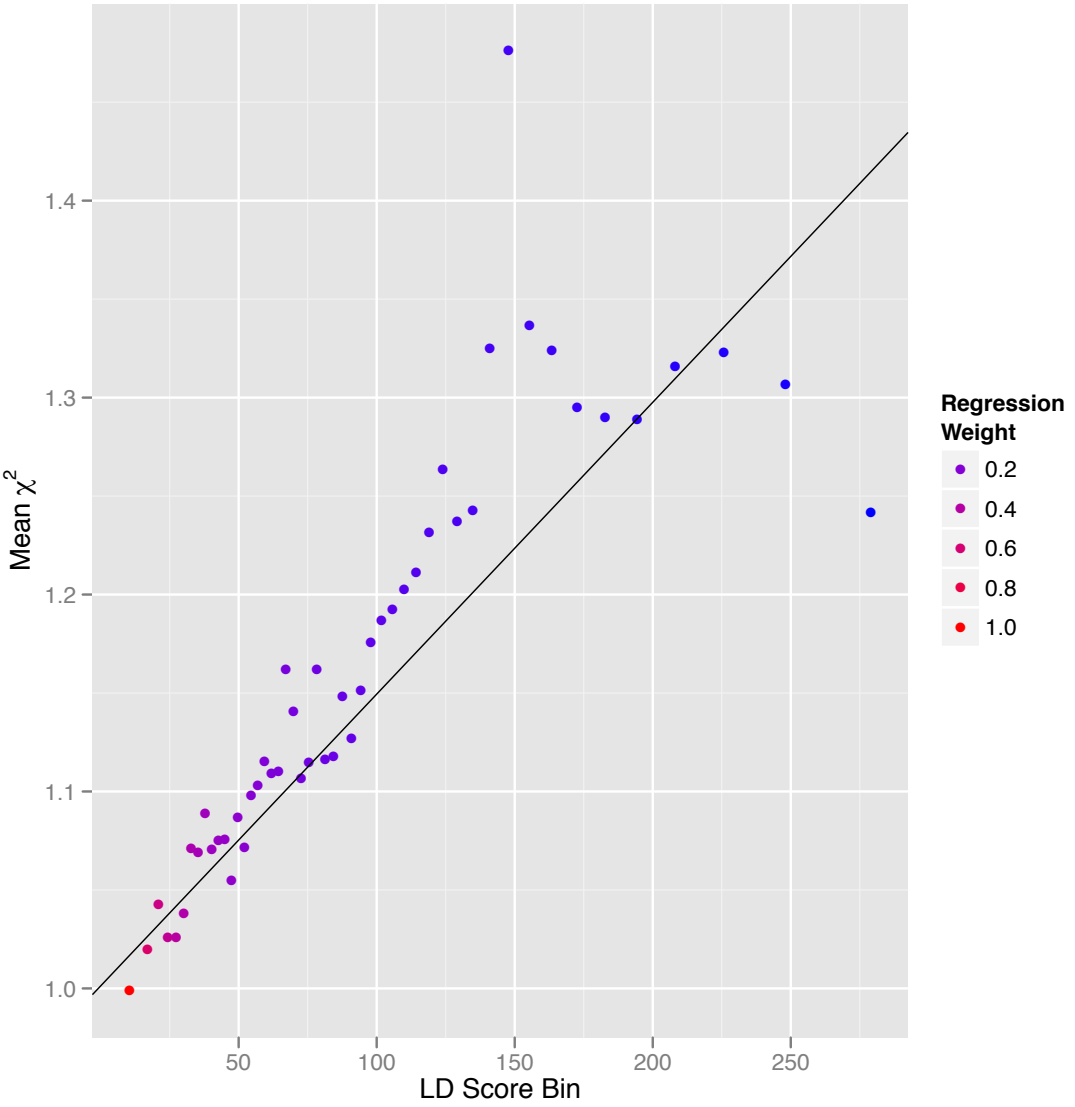
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8r: LD Score plot for Smoking Age of Onset



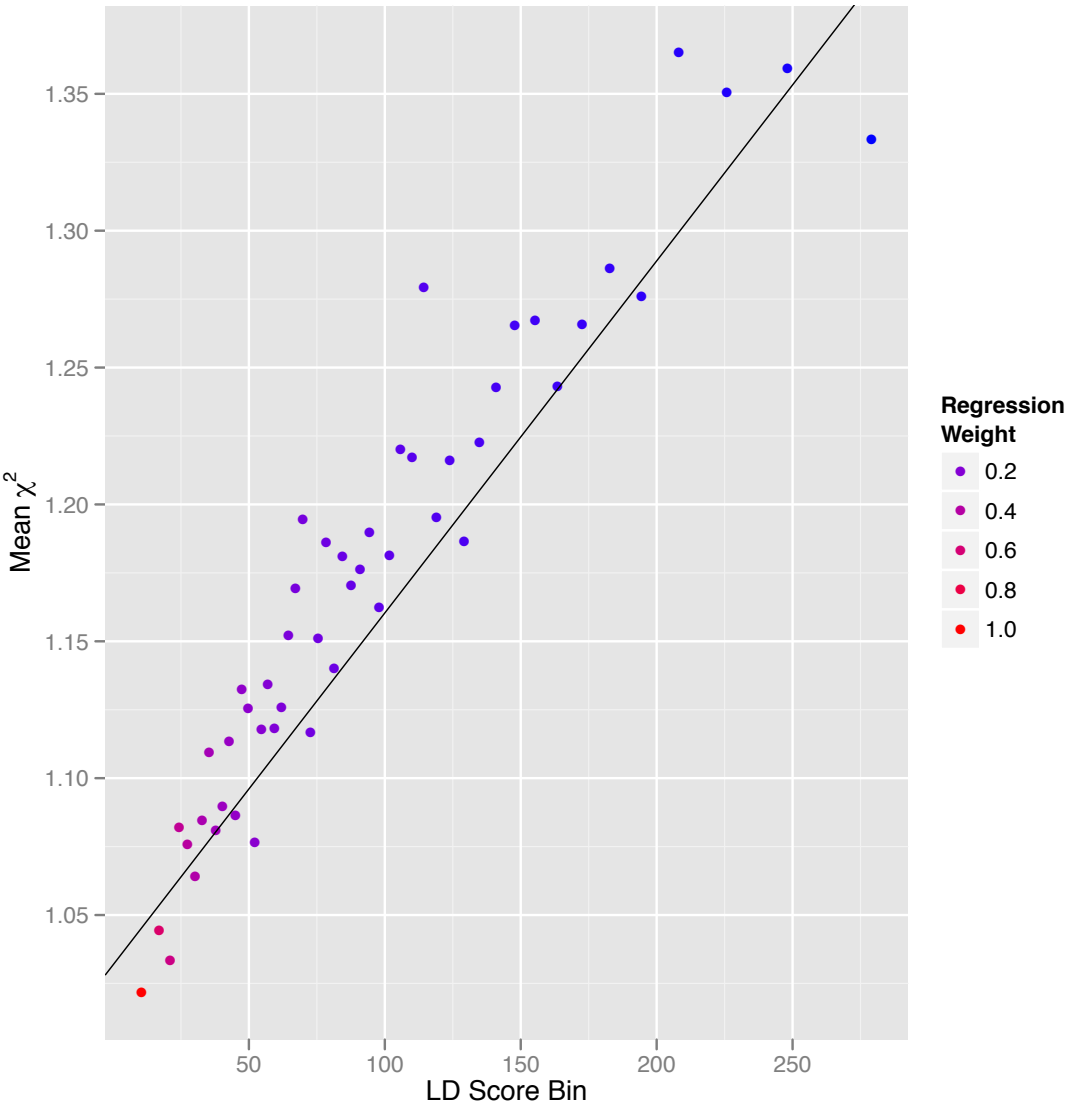
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8s: LD Score plot for Femoral Neck Bone Mineral Density



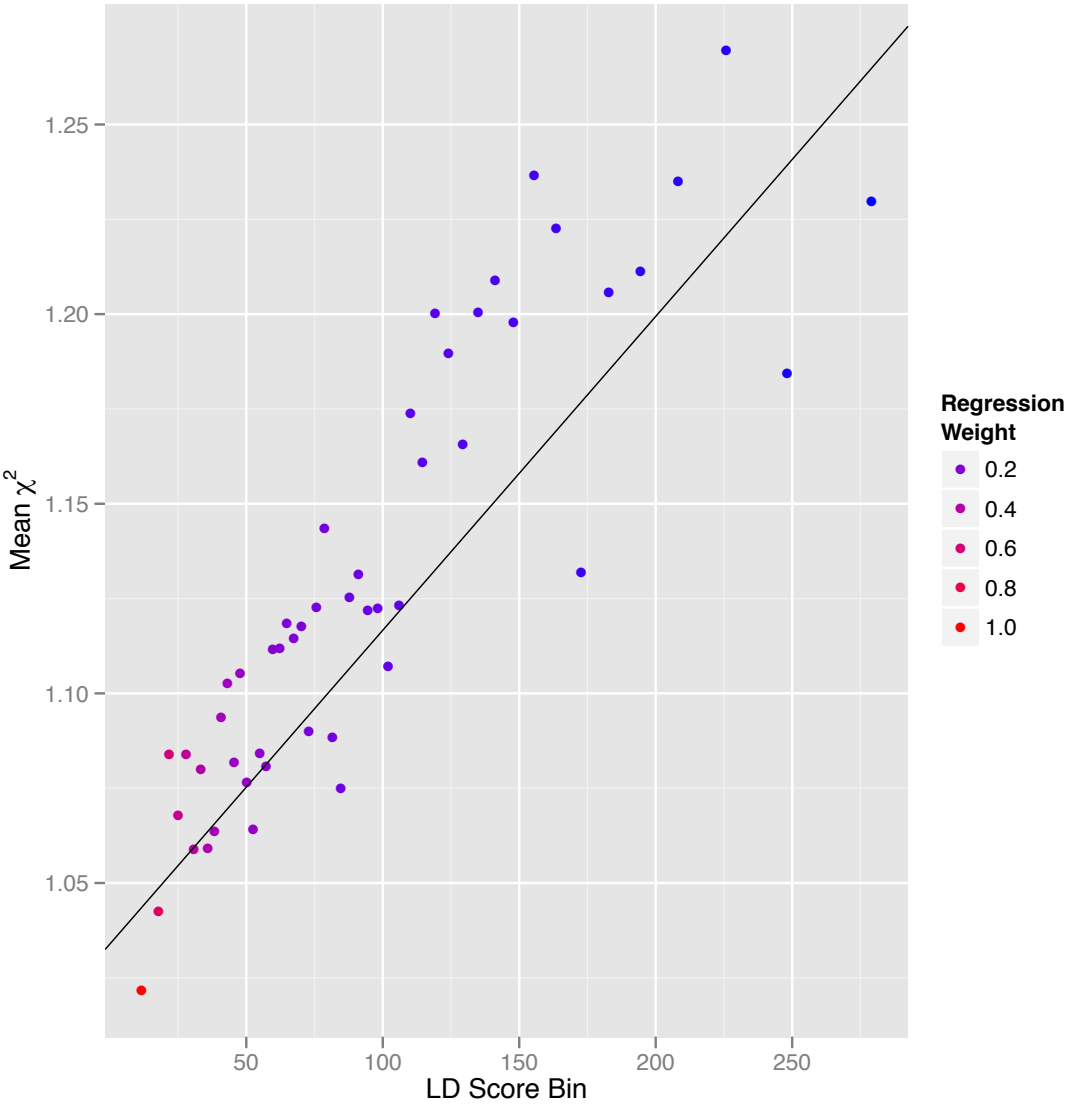
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8t: LD Score plot for Lumbar Spine Bone Mineral Density



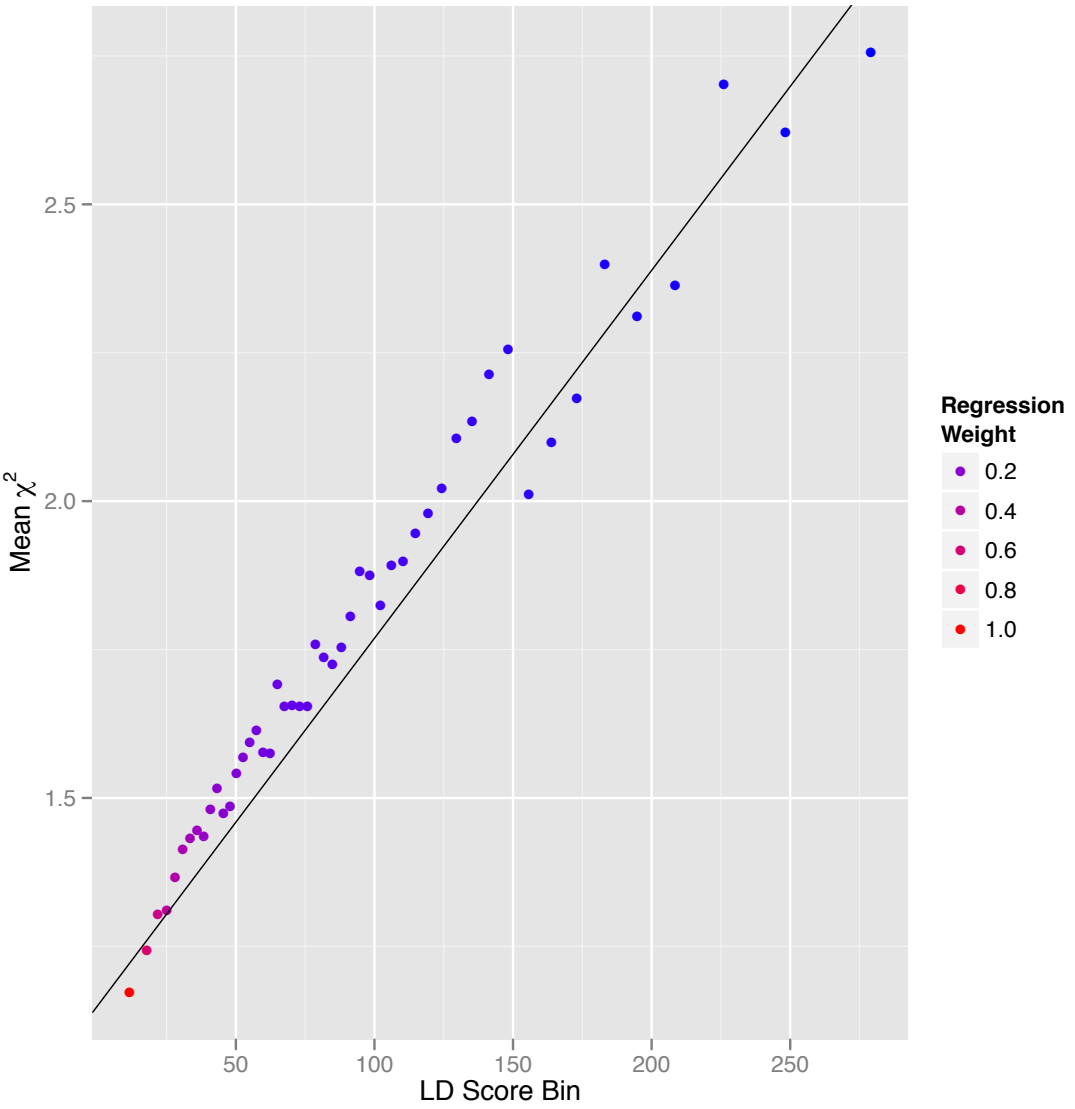
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8u: LD Score plot for Waist-Hip Ratio



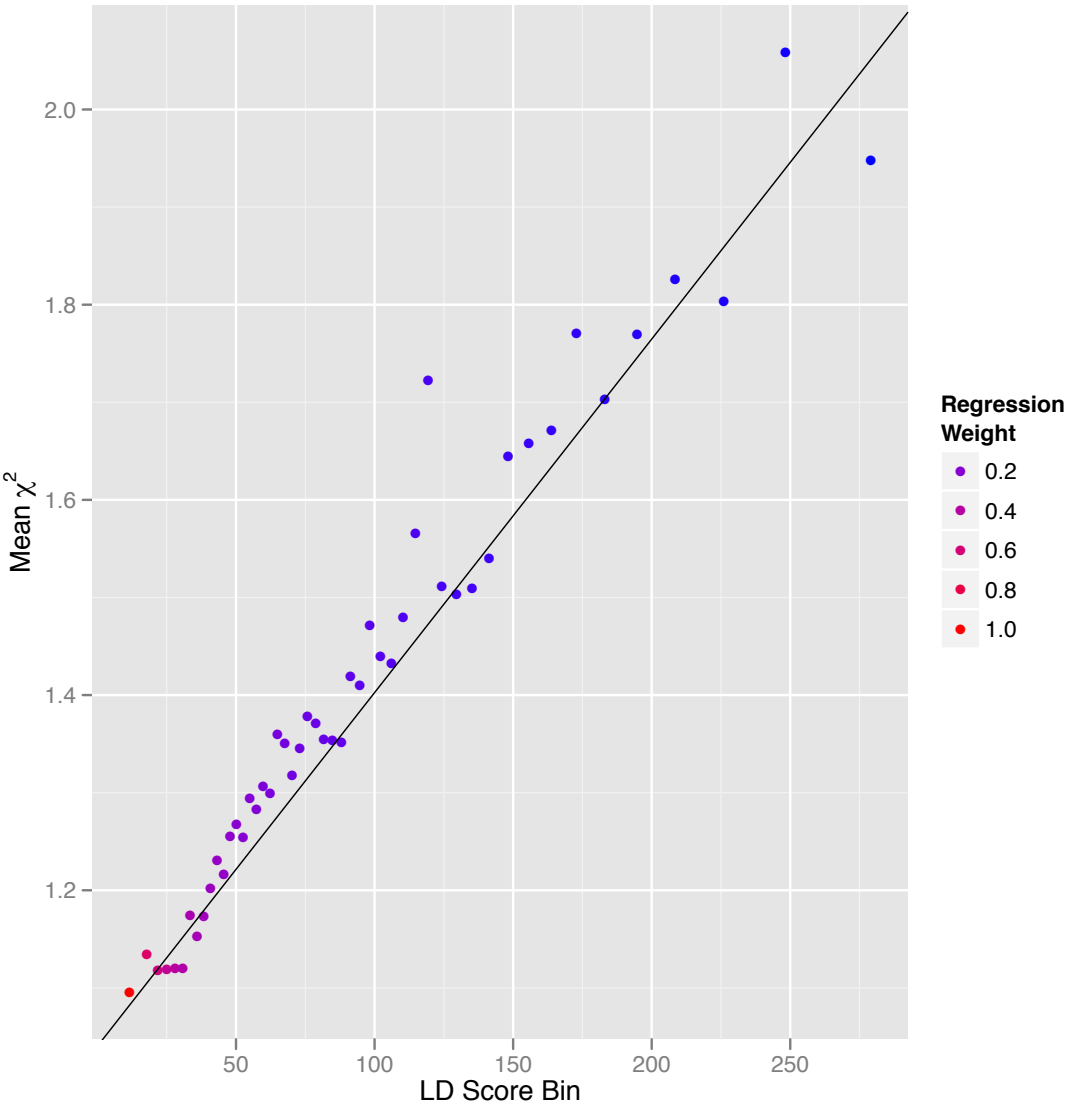
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8v: LD Score plot for Height



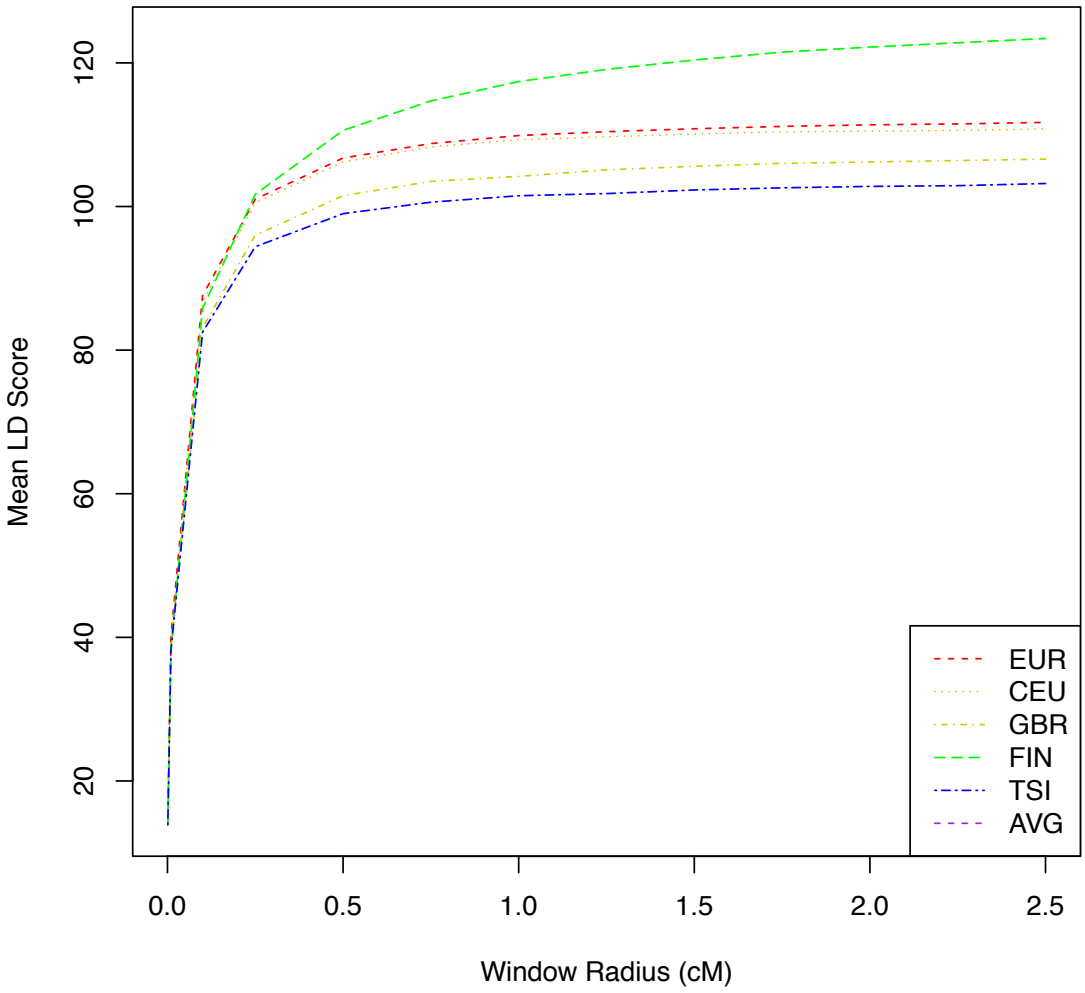
Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 8w: LD Score plot for Body Mass Index



Each point represents an LD Score quantile, where the *x* coordinate of the point is the mean LD Score of variants in that quantile and the *y* coordinate is the mean χ2 statistic of variants in that quantile. Colors correspond to regression weights, with red indicating large weight. The black line is the LD Score regression line.

Supplementary Figure 9: LD Score estimates with varying window size



The *x*-axis displays the window radius used for estimating LD Score. The *y*-axis displays the mean LD Score among variants with sample MAF > 1% in all four 1000 Genomes European subpopulations. Each colored line represents one of the four 1000 Genomes European subpopulations: Europeans (EUR, 378 individuals), Utah Residents with Northern and Western European Ancestry (CEU, 85 individuals), British in England and Scotland (GBR, 88 individuals), Finnish in Finland (FIN, 93 individuals) and Toscani in Italia (TSI, 98 individuals). The line labeled AVG is the mean of the four subpopulation LD Scores, and is almost entirely obscured by the EUR line.