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1: 25 – 2: 40 p.m., MW, 111 Soc. Sci. Bldg.
Office Hours: 3: 00 – 5: 00 p.m. Mondays

Last Revised: Oct. 19, 2015

Economics 881.13
Human Capital

Goals

In this course, we cover the literature on Human Capital. We focus on primary focus on models of human capital acquisition, skill formation, choices made over schooling, returns to schooling, school quality, general equilibrium considerations, etc. We analyze the econometric issues that arise in analyzing the key questions in this literature, such how to estimate the rate of return to schooling and schooling quality in the face of ability sorting or the estimation of human capital production functions in the fact of unobserved (by the econometrician) inputs.

Course Pre-Requisites

This course presumes that students have successfully completed graduate-level coursework in econometrics and/or regression analysis and graduate-level coursework in microeconomic theory. Students who do not have this background may find that they need to either postpone taking this course or be prepared to consult graduate textbooks in econometrics (e.g., William Greene, *Econometric Analysis*, 7th Edition. Prentice Hall) and microeconomic theory (e.g., Andreu Mas-Colell, *Microeconomic Theory*, Oxford University Press; Ariel Rubinstein, *Lecture Notes in Microeconomic Theory: The Economic Agent*, 2nd Ed., Princeton University Press; David Kreps, A Course in Microeconomic Theory, Prentice Hall).

Course Structure, Requirements, and Grading

This will not be a lecture course. This is a "critically read and discuss papers" course.

All students in the course will be expected to read the papers before class and to actively participate in these discussions. To foster this participation and to fulfill the requirements of this course, *all students* are required to serve as a ***student leader*** for ***two classes*** and to ***post comments and questions*** on the readings for the classes for which they are not student leaders. Below, I describe each of these student responsibilities.

Student Leader

In their role as the **student leader** for a class session, the student is responsible for:

(a) preparing a ***written summary*** of the readings to be covered in the class ***notes*** (no more than 7-10 pages) and providing a set of ***key discussion questions*** for the class;

(b) make a short (10 minutes maximum) ***presentation*** of the key points of the papers and initiate

the discussion of the key questions. (It would be good to use ***slides***, adapted from your written summary, for the presentation.)

In terms of the written summary, the student leader should address the following points:

- What is the main point(s) of the papers?

- If there were model developed in the papers, briefly summarize them. (This should be done with a minimum of equations, showing the models but not the derivations.)

- If the papers present empirical work, briefly summarize the (i) data used; (ii) econometric methods and/or identifying strategies that are used; and (iii) key empirical findings.

- Finally, the presenter may want to offer thoughts and/or questions about the contribution of the papers to the human capital literature and/or what concerns the presenter has about the approach taken in any of the papers.

The summary notes should be ***posted*** on the course website on Sakai in the folder for the class you are leading ***no later than 6: 00 p.m. on the day before the class***. These notes, and any slides that the student wishes to use during their class presentation, should be posted of the Sakai course website. More on where to post and find things on the course website below.

Posting Comments & Questions on Readings for Classes

As noted above, all students are expected to read all of the papers, whether they are acting as a student leader or not. To help encourage everyone to keep up with the readings and the class, ***all students are expected to post their comments and questions on the readings before class***. These comments will be posted to the ***Forum*** section of the Sakai course website.

Sakai Course Website

All of the classes in this course will be organized on the course website on Sakai, under the **Resources** and **Forums** sections listed in the menu on the lefthand side of the screen when you are logged in to ECON.881.13.F15 on Sakai.

Within the folder "Student Leader Summaries & Slides" in the **Resources** section of the Sakai course website, there are subfolders for each class in the courses, labeled by the day and date of the class. Within each Class subfolder students will find:

(a) list of the **papers to be covered** for that class;

(b) copy of any of these papers (as an **attachment**) that may be difficult to find

(c) **summary notes** of the **student leader(s)** for that class, that the student will post before class as an attachment.

As noted above, the student leader(s) should have their summary notes posted by 6: 00 p.m. on the day before the class. This will allow student notes at least **24 hours before the class** she/he is

leading.

Within the folder use is labeled, "Course Topics and Papers Forum," in the **Forum** section of the course website, a separate **Topic** has been set up for each class, with headings indicating the date of and topic for the class. Under each Class, all students are encouraged to **post comments and questions** about the readings for each class. To post their comments/questions, students should go to the Class listed in the Course Topics & Paper Forum and either click on the **Start a New Conversation** to start a new comment or click on **Reply to Initial Message** within an existing thread to add a comment/question. Students (and me!) should read the threads before class so that we can make efficient use of our time in class, focusing on issues that the class finds most interesting and/or about which there are more questions.

Schedule for Student Leaders

The following is the schedule for student leaders. I was not able to always assign you to one of your first three choices, given the extent of the overlaps in students' preferences. Please consult with me before your presentation so we can talk over what you try to cover in your presentation.

Class	Date	Student Leader
Class 1	10/14/15	Joe Hotz
Class 2	10/19/15	Joe Hotz
Class 3	10/21/15	Xian Jiang
Class 4	10/26/15	Amanda Grittner
Class 5	10/28/15	Chuhang Yin
Class 6	11/02/15	Kanat Abdulla
Class 7	11/04/15	Ning Fu
Class 8	11/09/15	Joe Hotz
Class 9	11/11/15	Ahmet Degerli
Class 10	11/16/15	Allison Saito
Class 11	11/18/15	Rebecca Sayers
Class 12	11/23/15	Daniel Garrett

Schedule of Classes, Topics and Papers

Those papers in **bold** will be the focus of class discussion. Papers that are underlined are papers that provide surveys and critical assessments of topics; they should be read by all students, even if they are not the focus of a particular class.

Earnings functions and human capital investment models

Class 1: Wed., Oct. 14 — Introduction (Hotz); **Willis (1986, pages 525-556)**; Ben-Porath (1967); Mincer (1974); **Heckman, Lochner & Todd (2006; pp. 310-341)**.

Class 2: Mon., Oct. 19 — **Willis and Rosen (1979)**; **Willis (1986, pages 556-590)**

The Roy Model & Pricing of Skills

Class 3: Wed., Oct. 21 — **Willis (1986; 574-581); Willis & Rosen (1979)**; Heckman & Sedlaceck (1986); Heckman & Honore (1990); **Gould (2002)**

Estimating the returns to education

Class 4: Mon., Oct. 26 — **Card (1999)**, Card (2001); **Carneiro, Heckman and Vytlacil (2011)**

Class 5: Wed., Oct. 28 — **Angrist and Krueger (1991); Rosenzweig and Wolpin (2000, especially Sect. 3)**

Skill Formation and Human Development

Class 6: Mon., Nov. 2 — **Cunha and Heckman (2007b)**; Cunha and Heckman (2008); **Todd and Wolpin (2003)**

Effects of School Quality

Class 7: Wed., Nov. 4 — **Card and Krueger (1992a); Heckman, Layne-Farrar, and Todd (1996)**

Heterogeneity in Human Capital Investment: College Major Choice & Consequences

Class 8: Mon., Nov. 9 — **Altonji (1993); Arcidiacono (2004);** Altonji, Blom and Meghir (2012); **Arcidiacono, Hotz and Kang (2012)**

Class 9: Wed., Nov. 11 — **Grogger & Eide (1995);** Malamud (2011); **Arcidiacono, Aucejo & Hotz (2015)**

Heterogeneity in Human Capital Investment: Post-Educational Skill Acquisition

Class 10: Mon., Nov. 16 — Sanders and Taber (2012); **Altonji & Williams (2005)**; **Dustmann & Meghir (2005)**

Class 11: Wed., Nov. 18 — **Gathmann and Schonberg (2010)**; Kambourov & Manovskii (2009); **Yamaguchi (2012)**

Structural Models of Human Capital Accumulation

Class 12: Mon., Nov. 23 — **Keane and Wolpin, (1997); Imai and Keane (2004)**

Reading Lists by Topic

This a more comprehensive list of readings than we will cover in class. These papers are provided for students who wish to read further on particular topics and for those who are considering writing a field paper related to one or more of the topics we consider in this course. Papers in bold will be covered in class.

1. Human Capital Investment Models: Schooling, Work Experience and Earnings Functions

Becker, G. (1993), *Human Capital*, 3rd Edition, Chicago: University of Chicago Press.

Ben Porath, Y. (1967), "The Production of Human Capital and the Life Cycle of Earnings." *Journal of Political Economy*, 75(4, Part 1): 352-65.

Bowlus, A. J. and C. Robinson (2012). "Human Capital Prices, Productivity, and Growth." *American Economic Review*, 102(7): 3483-3515.

Card, D. (1999), "The Causal Effect of Education on Earnings," in *Handbook of Labor Economics*, Vol. 3, O. Ashenfelter and D. Card, eds., 1801-1863.

Heckman, J., L. Lochner and P. Todd (2006), "Earnings Functions, Rates of Return and Treatment Effects: The Mincer Equation and Beyond," in *Handbook of the Economics of Education*. Vol. I, E. Hanushek and F. Welch, ed., North-Holland, pp. 310-458.

Mincer, J. (1974), *Education, Experience, and Earnings*, New York: Columbia University Press, Chapter 1 and 2.

Rosen, S. (1977), "Human Capital: A Survey of Empirical Research." In *Research in Labor Economics*, ed., by R. G. Ehrenberg, Vol. 1, 3-40.

Rubinstein, Y. and Y. Weiss (2006), "Post Schooling Wage Growth: Investment, Search and Learning," in *Handbook of the Economics of Education*, Vol. I, E. Hanushek and F. Welch, ed., North-Holland, 1-67.

Gould, E. (2002), "Rising Wage Inequality, Comparative Advantage, and the Growing Importance of General Skills in the United States," *Journal of Labor Economics*, vol. 20, no. 1, 105-147.

Weiss, Y., (1986), "The Determination of Life Cycle Earnings: A Survey," in *Handbook of Labor Economics*, Vol. 1, O. Ashenfelter and R. Layard, ed., North-Holland, 1986.

Willis, R. (1986), "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions", in *Handbook of Labor Economics*, Vol. 1, O. Ashenfelter and R. Layard, ed., North-Holland, 1986.

2. Estimating the Returns to Education

Angrist, J. and A. Krueger, (1991), "Does Compulsory Schooling Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics*, 106(4), November, 979-1014.

Arcidiacono, P., J. Cooley and A. Hussey (2008), "The Economic Returns to an MBA," *International Economic Review,* 49(3): 873-899.

Arcidiacono, P. and J. Vigdor (2010), "Does the River Spill Over? Estimating the Economic Returns to Attending a Racially Diverse College," *Economic Inquiry*, 48(3): 537-557.

Ashenfelter, O. and A. Krueger, (1994), "Estimates of the Economic Return to Schooling from a New Sample of Twins,"*American Economic Review*, 84(5): 1157-73.

Bound, J., D. Jaeger, and R. Baker (1995), "Problems with Instrumental Variables Estimation when the Correlation between the Instruments and the Endogenous Explanatory Variable is Weak," *Journal of the American Statistical Association*, 90(430): 443-50.

Card, D. (1995), "Earnings, Schooling, and Ability Revisited," in *Research in Labor Economics,* S. Polachek, ed., Vol. 14, 23-48.

Card, D. (1999), "The Causal Effect of Education on Earnings," in *Handbook of Labor Economics*, Vol. 3, O. Ashenfelter and D. Card, eds., 1801-1863.

Card. D. (2001), "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems." *Econometrica*, 69(4): 1127-1160.

Carneiro, P., K. Hansen and J. Heckman (2003), "Estimating Distributions of Treatment Effects with an Application to the Returns to Schooling and Measurement of the Effects of Uncertainty on College Choice," *International Economic Review*, 44(2): 361–422.

Carneiro, P., J. Heckman and E. Vytlacil (2011), "Estimating Marginal Returns to Education," *American Economic Review*, 101: 2754-2781.

Cunha, F. and J. Heckman (2007a), "Identifying and Estimating the Distributions of Ex Post and Ex Ante Returns to Schooling," *Labour Economics* 14: 870-893.

Dahl, G. B. (2002). Mobility and the Return to Education: Testing a Roy Model with Multiple Markets. *Econometrica*, 70(6), 2367-2420.

Goldin, C. and L. Katz (1999), "The Returns to Skill in the United States Across the Twentieth Century," NBER Working Paper 7126, May.

Griliches, Z. (1977), "Estimating the Returns to Schooling: Some Econometric Problems," *Econometrica*, 45(1): 1-22.

Heckman, J., L. Lochner and P. Todd (2006), "Earnings Functions, Rates of Return and

Treatment Effects: The Mincer Equation and Beyond," in *Handbook of the Economics of Education*, Vol. 1, E. Hanushek and F. Welch, eds., 307-458.

Heckman, J., L. Lochner and P. Todd (2008), "Earnings Functions and Rates of Return," *Journal of Human* Capital, 2(1): 1-31.

Kane, T. and C. Rouse (1995), "Labor-Market Returns to Two- and Four-Year College," *American Economic Review*, 85(3): 600-614.

Willis, R. and S. Rosen (1979), "Education and Self-Selection," *Journal of Political Economy* 87(5, Part 2): S7-S36.

Ashenfelter, O. and D. Zimmerman (1994), "Estimates of the Returns to Schooling from Sibling Data: Fathers, Sons, and Brothers," *Review of Economics and Statistics*, LXXIX(1): 1-9.

Griliches, Z. and W. Mason (1972), "Education, Income and Ability," *Journal of Political Economy*, 80(3, Part 2): S74-S103.

Griliches, Z. (1979), "Sibling Models and Data in Economics: Beginnings of a Survey," *Journal of Political Economy* 87(5, Part 2): S37-S64.

Rosenzweig, M. and K. Wolpin (2000), "Natural 'Natural Experiments' in Economics," *Journal of Economic Literature*, 38: 827-874.

3. The Effects of School Quality

Abdulkadiroglu, A., Angrist, J.D., Dynarski, S.M., Kane, T.J., and P.A. Pathak. (2011), "Accountability and Flexibility in Public Schools: Evidence from Boston's Charters and Pilots." *Quarterly Journal of Economics*, 125: 699-748.

Abdulkadiroglu, A., J. D. Angrist, and P. A. Pathak. (2011). "The Elite Illusion: Achievement Effects of Boston and New York Exam Schools." NBER Working Paper 17264.

Altonji, J., and T. Dunn (1996), "Using Siblings to Estimate the Effects of School Quality on Wages" *Review of Economics and Statistics*, 78(4): 665-671.

Angrist, J. D., S. M. Dynarski, T. J. Kane, P. A. Pathak, and C. Walters. (2010). "Inputs and Impacts in Charter Schools: KIPP Lynn." *American Economic Review: Papers and Proceedings*, 100: 239-243.

Angrist, J. and V. Lavy (1999), "Using Maimonides Rule to Estimate the Effect of Class Size on Scholastic Achievement," *Quarterly Journal of Economics*, 114(2):

Card, D. and A. Krueger (1992a), "Does School Quality Matter: Returns to Education and Characteristics of Public Schools in the United States," *Journal of Political Economy*, 100(1): 1-40.

Card, D. and A. Krueger (1992b), "School Quality and Black-White Relative Earnings: A Direct Assessment," *Quarterly Journal of Economics*, 117(1): 151-200.

Chetty, R., Friedman, J.N., and J. Rockoff, (2011). "The Long-Term Impacts of Teachers: Teacher Value-Added and Student Outcomes in Adulthood." NBER Working Paper 17699.

Chetty, R., Friedman, J.N., Hilger, N.. Saez, E., Whitmore Schanzenbach, D. and D. Yagan. (2011). "How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project Star." *Quarterly Journal of Economics*, 126: 1593-1660.

Clark, D. (2010). "Selective Schools and Academic Achievement." *B.E. Journal of Economic Analysis & Policy*, 10 (Advances), Article 9.

Cullen, J., B. Jakob, and S. Levitt (2005). "The Impact of School Choice on Student Outcomes: An Analysis of the Chicago Public Schools." *Journal of Public Economics*, 85: 729-760.

Cullen, J., B. Jakob, and S. Levitt (2006). "The Effect of School Choice on Student Outcomes: Evidence from Randomized Lotteries." *Econometrica*, 74: 1191-1230.

Dale, S. and A. Krueger (2002), "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables," *Quarterly Journal of Economics* 118(4): 1491-1528.

Dale, S. and A. Krueger (2011), "Estimating the Return to College Selectivity over the Career

Using Administrative Earnings Data," Princeton University, Industrial Relations Working paper, 563.

Evans, W. and R. Schwab (1995). "Finishing High School and Starting College: Do Catholic Schools Make a Difference?" *Quarterly Journal of Economics*, 110: 941-974.

Gould, E. D., V. Lavy, and M. D. Paserman. (2004). "Immigrating to Opportunity: Estimating the Effect of School Quality Using a Natural Experiment on Ethiopians in Israel." *Quarterly Journal of Economics*, 119: 489-526.

Heckman, J., A. Layne-Farrar, and P. Todd (1996), "Human Capital Pricing Equations with an Application to Estimating the Effect of Schooling Quality on Earnings," *Review of Economics and Statistics*, 78(4): 562-610.

Hoekstra, M. (2009): "The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Based Approach," *Review of Economics and Statistics*, 91(4), 717{724.

Jackson, C. K. (2010). "Do Students Benefit from Attending Better Schools? Evidence from Rule-Based Student Assignments in Trinidad and Tobago." *Economic Journal*, 120: 1399-1429.

Krueger, A. (1999), "Experimental Estimates of Education Production Functions," *Quarterly Journal of Economics*, 114(2): 497-532.

MacLeod, B., and M. Urquiola (2009): "Anti-Lemons: School Reputation and Educational Quality," NBER Working Paper, 15112.

Malamud, O. and C. Pop-Eleches. (2011). "School Tracking and Access to Higher Education among Disadvantaged Groups." *Journal of Public Economics*, 95(11-12): 1538-1549.

Pop-Eleches, C. and M. Urquiola. (2010). "Going to a Better School: Effects and Behavioral Responses." Mimeo, Columbia University.

Rothstein, J. (2010). "Teacher Quality and Educational Production: Tracking, Decay, and Student Achievement." *Quarterly Journal of Economics*, 125: 175-214.

4. The Effects Types of Schools (Public vs. Private)

Altonji, J, (1995), "The Effects of High School Curriculum on Education and Labor Market Outcomes", *Journal of Human Resources*, 30(3): 409-438.

Altonji, J., T. Elder and C. Taber (2005), "An Evaluation of Instrumental Variable Strategies for Estimating the Effects of Catholic Schooling," *Journal of Human Resources*, 40(4): 791-821.

Altonji, J., T. Elder and C. Taber (2005), "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *Journal of Political Economy*, 113(1): 151-184.

Evans, W. and R. Schwab (1995), "Finishing High School and Starting College: Do Catholic Schools make a Difference?" *Quarterly Journal of Economics*, 110: 947-974.

Hoxby, C. (2000), "The Effects of Class Size on Student Achievement: New Evidence from Population Variation". *Quarterly Journal of Economics* 115(4): 1239-1286.

Neal, D. (1997), "The Effects of Catholic Secondary Schooling on Educational Attainment," *Journal of Labor Economics* 15: 98-123.

5. Education Production Functions

Angrist, J. and V. Lavy (1999), "Using Maimonides Rule to Estimate the Effect of Class Size on Scholastic Achievement," *Quarterly Journal of Economics*, 114(2): 533-575.

Hanushek, E. (1986), "The Economics of Schooling: Production and Efficiency in Public Schools," *Journal of Economic Literature* 24(3): 1141-1177.

Hoxby, C. (2000), "The Effects of Class Size on Student Achievement: New Evidence from Population Variation," *Quarterly Journal of Economics*, 115(4): 1239-1285.

Krueger, A. (1999), "Experimental Estimates of Education Production Functions," *Quarterly Journal of Economics*, 114(2): 497-532.

Krueger, A. and D. Whitmore (2001), "The Effect of Attending a Small Class in the Early Grades on College-Test Taking and Middle School Test Results: Evidence from Project STAR," *Economic Journal*, 111(468): 1-28.

6. Skill Formation and Human Development

Cunha, F. and J. Heckman (2007b), "The Technology of Skill Formation," *American Economic Review*, 97(2): 31–47.

Cunha, F., J. Heckman and S. Schennach (2010), "Estimating the Technology of Cognitive and Noncognitive Skill Formation," *Econometrica*, 78(3): 883-931.

Cunha, F. and J. Heckman (2008), "Formulating, Identifying and Estimating the Technology of Cognitive and Noncognitive Skill Formation," *Journal of Human Resources*, 43(4): 738-782.

Cunha, F. and J. Heckman (2009), "The Economics and Psychology of Inequality and Human Development," *Journal of the European Economic Association* 7(2-3): 320-364.

Heckman, J., J. Stixrud and S. Urzua (2006), "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior," *Journal of Labor Economics*, 24(3): 411-482.

Howard-Jones, P.E., E.V. Washbrook, and S. Meadows (2012). "The Timing of Educational Investment: A Neuroscientic Perspective." *Developmental Cognitive Neuroscience*, 25: S18-S29.

Todd, P. and K. Wolpin (2003), "On the Specification and Estimation of the Production Function for Cognitive Achievement," *Economic Journal*, 113(485): F3-F33.

7. Models of Intergenerational Transmission of Human Capital and Skills

Abbott, B. G. Gallipoli, C. Meghir, G. Violante (2013). "Education Policy and Intergenerational Transfers in Equilibrium, NBER Working Paper #18782.

Becker, G. and N. Tomes (1976). "Child Endowments and the Quantity and Quality of Children." *Journal of Political Economy*, 84(4, Part 2): S143-S162.

Becker, G. and N. Tomes (1979). "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility, *Journal of Political Economy*, 87(6): 1153-1189.

Bellaniy, L. (2012). "Intergenerational transmission of human capital: parents' characteristics and their impact on the child's educational choice," Working Paper, CEPS/INSTEAD.

Black, S. and P. Devereux (2011). "Recent Developments in Intergenerational Mobility, in *Handbook of Labor Economics*, Volume 4b, D. Card and O. Ashenfelter, eds., 1489-1541.

Blanden, J., P. Gregg and L. Macmillan (2007). "Accounting for Intergenerational Income Persistence: Noncognitive Skills, Ability and Education," *Economic Journal*, 117(519): C43–C60.

Blanden, J., R. Haveman, T. Smeeding, K. Wilson (2014). "Intergenerational Mobility in the United States and Great Britain: A Comparative Study of Parent–Child Pathways," *Review of Income and Wealth,* 60(3): 425–449.

Catsiapis, G. and C. Robinson (1981). "The Theory of the Family and Intergenerational Mobility: An Empirical Test," *Journal of Human Resources*, 16(1): 106-116.

Chetty, R., N. Hendren, P. Kline, E. Saez and N. Turner (2014). "Is the United States Still a Land of Opportunity? Recent Trends in Intergenerational Mobility." *American Economic Review: Papers & Proceedings*, 104(5): 141–147.

Currie, J. and E. Moretti (2003). "Mother's Education and the Intergenerational Transmission of Human Capital: Evidence from College Openings." *Quarterly Journal of Economics*, 118(4): 1495-1532.

Goldberger, A. (1989). "Economic and Mechanical Models of Intergenerational Transmission," *American Economic Review*, 79(3): 504-513.

Grawe, N, and C. Mulligan (2002). "Economic Interpretations of Intergenerational Correlations," *Journal of Economic Perspectives*, 16(3): 45–58.

Han, S. and C. Mulligan (2001). "Human Capital, Heterogeneity and Estimated Degrees of Intergenerational Mobility," *Economic Journal,* 111(470): 207-243.

Heckman, J. and L. Raut (2013). "Intergenerational Long Term Effects of PreSchool, Strucutural Estimates of a Discrete Dynamic Programming Model." NBER Working Paper 19077.

Huang, J. (2013). "Intergenerational transmission of educational attainment: The role of household assets." *Economics of Education Review*, 33: 112–123.

Rosenzweig, M. and K. Wolpin (1993). "Intergenerational Support and the Life-Cycle Incomes of Young Men and Their Parents: Human Capital Investments, Coresidence, and Intergenerational Financial Transfers," *Journal of Labor Economics*, 11(1, Part 1): 84-112.

8. Signaling/Screening Models

Arcidiacono, P., P. Bayer and A. Hizmo (2010), "Beyond Signaling and Human Capital: Education and Revelation of Ability," *American Economic Journal: Applied Economics*, 2(4): 76-104.

Bedard, K. (2001), "Human Capital Versus Signaling Models: University Access and High School Drop-outs", *Journal of Political Economy*, 109(4): 749-775.

Lang, K. (1994), "Does the Human Capital/Educational Sorting Debate Matter for Development Policy?" *American Economic Review* 84: 353-358.

Lang, K. and Kropp (1986), "Human Capital versus Sorting: The Effects of Compulsory Attendance Laws," *Quarterly Journal of Economics*, 101(3): pp. 609-624.

Spence, M. (1973), "Job Market Signaling", Quarterly *Journal of Economics*, 87(3): 355-374.

Weiss, A. (1995), "Human Capital versus Signalling Explanations of Wages", *Journal of Economic Perspectives* 9(4): 133-154.

9. Heterogeneity in Human Capital Investment: Courses of Study in High School and College

Altonji J. (1995), "The effects of high school curriculum on education and labor market outcomes," *Journal of Human Resources*, 30: 409–38.

Altonji, J. (1993), "The demand for and return to education when education outcomes are uncertain," *Journal of Labor Economics*, 11: 48-83.

Altonji, J., E. Blom and C. Meghir (2012), "Heterogeneity in Human Investments: High School Curriculum, College Major and Careers," *Annual Review of Economics*, 4: 21.1-21.39.

Arcidiacono, P. (2004), "Ability Sorting and the Returns to College Major," *Journal of Econometrics*, 121(1-2): 343-375.

Arcidiacono, P., E. Aucejo and V. J. Hotz (2015). "University Differences in the Graduation of Minorities in STEM Fields: Evidence from California," *American Economic Review*, forthcoming.

Arcidiacono, P., V. J. Hotz and S. Kang (2012), "Modeling College Major Choices using Elicited Measures of Expectations and Counterfactuals," *Journal of Econometrics*, 166(1): 3-16.

Cunha, F., F. Karahan, and I. Soares (2011). "Returns to Skills and the College Premium," *Journal of Money, Credit and Banking*, 43(5): 39–86.

Dale, S. and A. Krueger (2002), "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables," *Quarterly Journal of Economics* 118(4): 1491-1528.

Fang, H. (2006) (2006). "Disentangling the College Wage Premium: Estimating a Model with Endogenous Education Choices," *International Economic Review*, 47(4): 1151–1185.

Finnie R, Frenette M. (2003). "Earnings differences by major field of study: evidence from three cohorts of recent Canadian graduates," *Economics of Education Review*. 22: 179–92.

Fortin, N. (2006). "Higher-education Policies and the College Wage Premium: Cross-state Evidence from the 1990s," *American Economic Review*, 96(4): 959–987.

Gemici, A. and M. Wiswall (2011). "Evolution of Gender Differences in Post-Secondary Human Capital Investments: College Majors," *Institute for Education and Social Policy (IESP) Working Paper No. 03-11*, July.

Grogger, J and E. Eide (1995), "Changes in college skills and the rise in the college wage premium," *Journal of Human Resources*, 30: 280–310.

Hamermesh, D. and S. Donald (2008), "The effect of college curriculum on earnings: an affinity

identifier for non-ignorable non-response bias," *Journal of Econometrics*, 144: 479–91

Malamud, O. (2011), "Discovering one's talent: learning from academic specialization," *Industrial and Labor Relations Review*, 64: 375–405.

Montmarquette, C, K. Cannings and S. Mahseredjian (2002), "How do young people choose college majors?" *Economic of Education Review*, 21: 543–56.

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