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### Why growth rate differences persist

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# References

- Abramovitz, M. (1956), Resources and Output Trends in the United States Since 1870. In: M. Abramovitz (ed., 1991), *Thinking About Growth*, Cambridge UP, pp.127-147.
- Abramovitz, M. (1991), *Thinking About Growth*, Cambridge UP.
- Abramovitz, M. (1993), The Search for the Sources of Growth: Areas of Ignorance, Old and New. *Journal of Economic History* 53:2, pp.217-243.
- Abramovitz, M. and P.A. David (1973), Reinterpreting Economic Growth: Parables and Realities. *American Economic Review* 63:2, pp.428-39.
- Abramovitz, M. and P.A. David (1996), Convergence and Deferred Catch-Up. Productivity Leadership and the Waning of American Exceptionalism. In: R. Landau, T. Taylor and G. Wright (eds.), *The Mosaic of Economic Growth*, Stanford UP.
- Acemoglu D., P. Aghion and F. Zilibotti (2002), Distance to Frontier, Selection, and Economic Growth. NBER Working Paper 9066.
- Acemoglu, D., S. Johnson and J. Robinson (2005), Institutions as the Fundamental Cause of Long-Run Growth. In: P. Aghion and S.N. Durlauf (eds.), *Handbook of Economic Growth*, North Holland, Amsterdam (forthcoming).
- Aghion, P. and P. Howitt (1992), A Model of Growth Through Creative Destruction. *Econometrica* 60:2, pp.323-352.
- Aghion, P. and P. Howitt (1998a), *Endogenous Growth Theory*. MIT, Cambridge MA.
- Aghion, P. and P. Howitt (1998b), On the Macroeconomic Effects of Major Technological Change. In: E. Helpman (ed.), *General Purpose Technologies and Economic Growth*, MIT, Cambridge MA.
- Aghion, P. and P. Howitt (2005), Growth with Quality-Improving Innovations: An Integrated Framework. In: P. Aghion and S.N. Durlauf (eds.), *Handbook of Economic Growth*, North Holland, Amsterdam (forthcoming).
- Albers, R.M., B. van Ark and M. Rensman (1997), Capital Intensity and Productivity Performance in the UK and the USA, 1840-1990. Revisiting the Empirical Evidence on 150 years of Technological Leadership. Paper (summary version) presented at seminars LSE and Warwick. University of Groningen, November 1997, mimeo.
- Ames, E. and N. Rosenberg (1968), The Enfield Arsenal in Theory and History. *Economic Journal* 78, pp.827-842.
- Antenbrink, P., K. Burger, M. Cornet, M. Rensman and D. Webbink (2005), *Nederlands onderwijs en onderzoek in internationaal perspectief*. CPB Document 88, CPB Netherlands Bureau of Economic Policy Analysis, The Hague.
- Archibugi, D. and M. Pianta (1992), *The Technological Specialization of Advanced Countries. A Report to the EEC on International Science and Technology Activities*. CEC/Kluwer, Dordrecht.
- Ark, B. van (1996), Sectoral Growth Accounting and Structural Change in Post-war Europe. In: B. van Ark and N.F.R. Crafts (eds.), *Quantitative Aspects of Post-war European Economic Growth*, CEPR/Cambridge UP, pp.84-164.
- Arrow, K.J. (1962), The Economic Implications of Learning by Doing. *Review of Economic Studies* 29, pp.155-173.
- Atack, J., F. Bateman and R.A. Margo (2004), Skill Intensity and Rising Wage Dispersion in Nineteenth-Century American Manufacturing. *Journal of Economic History* 64:1, pp.172-192.

- Atack, J, F. Bateman and R.A. Margo (2005), Capital Deepening and the Rise of the Factory: The American Experience During the Nineteenth Century. *Economic History Review* 58:3, pp.586-595.
- Atkinson, A.B. and J.E. Stiglitz (1969), A New View of Technological Change. *Economic Journal* 79, pp.573-578.
- Baltagi, B.H. (2001), *Econometric Analysis of Panel Data*, John Wiley.
- Barro, R.J. (1991), Economic Growth in a Cross Section of Countries. *Quarterly Journal of Economics* 106:2, pp.407-443.
- Barro, R.J. and X. Sala-i-Martin (1995), *Economic Growth*. McGraw-Hill, New York.
- Barro, R.J. and X. Sala-i-Martin (1997), Technological Diffusion, Convergence, and Growth. *Journal of Economic Growth* 2, pp.1-27.
- Basu, S. and D.N. Weil (1998), Appropriate Technology And Growth. *Quarterly Journal of Economics* 113:4, pp.1025-1054.
- Baumol, W.J., S.A.B. Blackman and E.N. Wolff (1989), *Productivity and American Leadership*. MIT, Cambridge MA.
- BEA (1993), *Fixed Reproducible Tangible Wealth in the United States*, Washington D.C.
- Bean, C.R. and N.F.R. Crafts (1996), British Economic Growth Since 1945: Relative Economic Decline... and Renaissance? In: N.F.R. Crafts and G. Toniolo (eds.), *Economic Growth in Europe Since 1945*. CEPR/Cambridge UP, pp.131-172.
- Becker, G.S. (1964), *Human Capital: A Theoretical and Empirical Analysis*. Columbia UP, New York.
- Ben-David, D. and D.H. Papell (1995), The Great Wars, the Great Crash, and Steady State Growth: Some New Evidence About an Old Stylized Fact. *Journal of Monetary Economics* 36, pp.453-475.
- Ben-David, D. and D.H. Papell (1996), The Unit Root Hypothesis in Long-Term Output: Evidence From Two Structural Breaks for 16 Countries. CEPR Discussion Paper 1336.
- Benhabib, J. and M.M. Spiegel (1994), The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data. *Journal of Monetary Economics* 34:2, pp.143-173.
- Benhabib, J. and M.M. Spiegel (2005), Human Capital and Technology Diffusion. In: P. Aghion and S.N. Durlauf (eds.), *Handbook of Economic Growth*, North Holland, Amsterdam (forthcoming).
- Bernard, A.B. and C.I. Jones (1996a), Technology and Convergence. *Economic Journal* 106, pp.1037-1044.
- Bernard, A.B. and C.I. Jones (1996b), Productivity Across Industries and Countries: Time Series Theory and Evidence. *Review of Economics and Statistics* 78:1, pp.135-146.
- Brezis, E.S., P.R. Krugman and D. Tsiddon (1993), Leapfrogging in International Competition. A Theory of Cycles in National Technological Leadership. *American Economic Review* 83:5, pp.1211-1219.
- Broadberry, S.N. (1993), Manufacturing and the Convergence Hypothesis: What the Long-Run Data Show. *Journal of Economic History* 53, pp.772-795.
- Broadberry, S.N. (1994a), Technological Leadership and Productivity Leadership in Manufacturing Since the Industrial Revolution: Implications for the Convergence Debate. *Economic Journal* 104, pp.291-302.
- Broadberry, S.N. (1994b), Comparative Productivity in British and American Manufacturing during the Nineteenth Century. *Explorations in Economic History* 31, pp.521-548.
- Broadberry, S.N. (1997a), Forging Ahead, Falling Behind and Catching-Up: A Sectoral Analysis of Anglo-American Productivity Differences, 1870-1990. *Research in Economic History* 17, pp.1-37.
- Broadberry, S.N. (1997b), *The Productivity Race: British Manufacturing in International Perspective, 1850-1990*, Cambridge UP.
- Broadberry, S.N. (2003a), Human Capital and Skills. In: R.C. Floud and P. Johnson (eds.), *The Cambridge Economic History of Modern Britain, Vol.2: Economic Maturity, 1860-1939*, Cambridge UP, pp.56-73.
- Broadberry, S.N. (2003b), Relative Per Capita Income Levels in the United Kingdom and the United States Since 1870: Reconciling Time-Series Projections and Direct-Benchmark Estimates. *Journal of Economic History* 63:3, pp.852-863.
- Broadberry, S.N. (2004a), The Performance of Manufacturing. In: R.C. Floud and P. Johnson (eds.), *The Cambridge Economic History of Modern Britain, Vol 3: Structural Change and Growth, 1939-2000*, Cambridge UP, pp.57-83.
- Broadberry, S.N. (2005), Economic Growth in Europe and the US Since 1870: A Quantitative Economic Analysis Incorporating Institutional Factors. In: D. Coates (ed.), *Varieties of Capitalism, Varieties of Approaches*. Palgrave, London, pp.85-105.

- Broadberry, S.N. and N.F.R. Crafts (2003), UK Productivity Performance from 1950 to 1979: A Restatement of the Broadberry-Crafts View. *Economic History Review* 56:4, pp.718-735.
- Broadberry, S.N. and S. Ghosal (2002), From the Counting House to the Modern Office: Explaining Anglo-American Productivity Differences in Services, 1870-1990. *Journal of Economic History* 62:4, pp.967-998.
- Broadberry, S.N. and D.A. Irwin (2004), Labour Productivity in the United States and the United Kingdom During the Nineteenth Century. NBER Working Paper 10364.
- Broadberry, S.N. and M. O'Mahony (2004), Britain's Productivity Gap with the United States and Europe: A Historical Perspective. *National Institute Economic Review* 189, pp.72-85.
- Broadberry, S.N. and K. Wagner (1996), Human Capital and Productivity in Manufacturing During the Twentieth Century: Britain, Germany and the United States. In: B. van Ark and N.F.R. Crafts (eds.), *Quantitative Aspects of Post-war Economic Growth*, CEPR/Cambridge UP, pp.244-270.
- Brock, W.A. and S.N. Durlauf (2001), Growth Empirics and Reality. *World Bank Economic Review* 15:2, pp.229-272.
- Buechtemann, C.F. and E. Verdier (1998), Education and Training Regimes: Macro-Institutional Evidence. *Revue d'Economie Politique* 108:3, pp.291-320.
- Caballero, R.J. and A.B. Jaffe (1993), How High Are the Giants' Shoulders: An Empirical Assessment of Knowledge Spillovers and Creative Destruction in a Model of Economic Growth. In: O.J. Blanchard and S. Fischer (eds.), *Macroeconomics Annual 1993*, NBER, Cambridge, pp.15-86.
- Cain, L.P. and D.G. Paterson (1986), Biased Technical Change, Scale and Factor Substitution in American Industry, 1850-1919. *Journal of Economic History* 46:1, pp.153-164.
- Canton, E., D. Lanser, J. Noailly, M. Rensman and J. van de Ven (2005), Crossing borders; when science meets industry. CPB Document 98, CPB Netherlands Bureau of Economic Policy Analysis, The Hague.
- Cantwell, J.A. (2000), Technological Lock-In of Large Firms Since the Interwar Period. *European Review of Economic History* 4, pp.147-174.
- Carlin, W. (1996), West German Growth and Institutions, 1945-90. In: N.F.R. Crafts and G. Toniolo (eds.), *Economic Growth in Europe Since 1945*. CEPR/Cambridge UP, pp.455-497.
- Caselli, F. and W.J. Coleman II (2002), The US Technology Frontier. *American Economic Review* 92:2, pp.148-152.
- Caselli, F. and W.J. Coleman II (2005), The World Technology Frontier. CEPR/NBER, mimeo.
- Cass, D. (1965), Optimum Growth in an Aggregative Model of Capital Accumulation. *Review of Economic Studies* 32, pp.233-240.
- Chambers, R.G. (1988) *Applied Production Analysis: A Dual Approach*, Cambridge UP.
- Chandler, A.D. (1990), *Scale and Scope: The Dynamics of Industrial Capitalism*. Belknap, Cambridge MA.
- Chandler, A.D. (1992), Organizational Capabilities and the Economic History of the Industrial Enterprise. *Journal of Economic Perspectives* 6:3, pp.79-100.
- Coe, D.T. and E. Helpman (1995), International R&D spillovers. *European Economic Review* 39, pp.859-887.
- Cohen, W.M. and D.A. Levinthal (1989), Innovation and Learning: The Two Faces of R&D. *Economic Journal* 99, pp.569-596.
- Collins, W.J. and J.G. Williamson (2001), Capital-Goods Prices and Investments, 1870-1950. *Journal of Economic History* 61:1, pp.59-94.
- Comin, D. and B. Hobijn (2004), Neoclassical Growth and the Adoption of Technologies. NBER Working Paper 10733.
- Conference Board and Groningen Growth and Development Centre (2006), Total Economy Database, January 2006, <http://www.ggdc.net>.
- Crafts, N.F.R. (1994), Revealed Comparative Advantage in Manufacturing, 1899-1950. *Journal of European Economic History* 18, pp.127-137.
- Crafts, N.F.R. (1995), The Golden Age of Economic Growth in Western Europe, 1950-1973. *Economic History Review* 48:3, pp.429-447.
- Crafts, N.F.R. (1996), Endogenous Growth: Lessons for and from Economic History. CEPR Discussion Paper 1333.
- Crafts, N.F.R. (1998), Forging Ahead and Falling Behind: The Rise and Relative Decline of the First

- Industrial Nation. *Journal of Economic Perspectives* 12:2, pp.193-210.
- Crafts, N.F.R. (2003a), Long-Run Growth. In: R.C. Floud and P. Johnson (eds.), *The Cambridge Economic History of Modern Britain, Vol.2: Economic Maturity, 1860-1939*, Cambridge UP, pp.1-24.
- Crafts, N.F.R. (2003b), Quantifying the Contribution of Technological Change to Economic Growth in Different Eras: A Review of the Evidence. LSE Working Paper 79/03, London.
- Crafts, N.F.R. (2004), Fifty Years of Economic Growth in Western Europe: No Longer Catching Up But Falling Behind? Stanford Institute for Economic Policy Research, Discussion Paper, 10 November, Stanford University, CA.
- Crafts, N.F.R. and G. Toniolo (1996), Postwar growth: An Overview. In: N.F.R. Crafts and G. Toniolo (ed.), *Economic Growth in Europe Since 1945*, CEPR/Cambridge UP, pp.1-37.
- CSO (1985), *Sources and Methods*, London.
- CSO (1995), *United Kingdom National Accounts*, London.
- David, P.A. (1975), *Technical Choice, Innovation and Economic Growth. Essays on American and British Experience in the Nineteenth Century*, Cambridge UP.
- David, P.A. (1991), Computer and Dynamo. The Modern Productivity Paradox in a Not-Too-Distant Mirror. In: OECD, *Technology and Productivity*, Paris, pp.315-347.
- David, P.A. and G. Wright (2003), General Purpose Technologies and Productivity Surges: Historical Reflections on the Future of the ICT revolution. In: P.A. David and M. Thomas (eds.), *The Economic Future in Historical Perspective*, Oxford UP.
- Davis, L.E. and R.E. Gallman (1978), Capital Formation in the United States During the Nineteenth Century. In: P. Mathias and M.M. Postan (eds.), *Cambridge Economic History of Europe Vol.VII, Part II*, Cambridge, pp.1-69.
- Dean, G. (1964), The Stock of Fixed Capital in the United Kingdom in 1961. *Journal of the Royal Statistical Society, series A* 127, pp.327-351.
- Denison, E.F. (1962), *The Sources of Economic Growth in the United States and the Alternatives Before Us*. Committee for Economic Development, New York.
- Denison, E.F. (1967), *Why Growth Rates Differ*. Brookings, Washington.
- Deutsches Patentamt (1951-1978), *Blatt für Patent, Muster- und Zeichenwesen*, Technical report, Berlin.
- Dixit, A.K. and J.E. Stiglitz (1977), Monopolistic Competition and Optimum Product Diversity. *American Economic Review* 67:3, pp.297-308.
- Domar, E.D. (1946), Capital Expansion, Rate of Growth, and Employment. *Econometrica* 14, pp.137-147.
- Dosi, G., K.L.R. Pavitt and L.L.G. Soete (1990), *The Economics of Technical Change and International Trade*. Harvester Wheatsheaf, New York.
- Dowrick, S. and D.T. Nguyen (1989), OECD Comparative Economic Growth 1950-85: Catch-Up and Convergence. *American Economic Review* 79:5, pp.1010-1030.
- Durlauf, S.N. and D.T. Quah (1999), The New Empirics of Economic Growth. In: J.B. Taylor and M. Woodford (eds.), *Handbook of Macroeconomics*, North Holland, Amsterdam.
- Durlauf, S.N., P.A. Johnson and J.R.W. Temple (2005), Growth Econometrics. In: P. Aghion and S.N. Durlauf (eds.), *Handbook of Economic Growth*, North Holland, Amsterdam (forthcoming).
- Eaton, J. and S. Kortum (1996), Trade in Ideas: Patenting and Productivity in the OECD. *Journal of International Economics*, 40, pp.251-278.
- Eaton, J. and S. Kortum (1997), Engines of Growth: Domestic and Foreign Sources of Innovation. *Japan World Economy* 9, pp.235-259.
- Eaton, J. and S. Kortum (1999), International Patenting and Technology Diffusion: Theory and Measurement. *International Economic Review* 40, pp.537-570.
- Eaton, J. and S. Kortum (2001), Trade in Capital Goods. *European Economic Review* 45:7, pp.1195-1235.
- Eaton, J. and S. Kortum (2002), Technology, Geography, and Trade. *Econometrica* 70:5, pp.1741-1779.
- Edgerton, D.E.H. and S.M. Horrocks (1994), British Industrial Research and Development Before 1945. *Economic History Review* 47:2, pp.213-238.
- Edquist, C. (1997), *Systems of Innovation: Technologies, Institutions, and Organizations*. Pinter, London.
- Eichengreen, B. (1996), Institutions and Economic Growth: Europe after World War II. In: N.F.R. Crafts and G. Toniolo (eds.), *Economic Growth in Europe Since 1945*, CEPR/Cambridge UP, pp.38-72.

- Eichengreen, B., and T. Iversen (1999), Institutions and Economic Performance: Evidence from the Labour Market. *Oxford Review of Economic Policy* 15:4, pp.121-138.
- Eichengreen, B. and P. Vazquez (2000), Institutions and Economic Growth in Postwar Europe: Evidence and Conjectures. In: B. van Ark, S.K. Kuipers and G.H. Kuper (eds.), *Productivity, Technology and Economic Growth*, Kluwer Academic Publishers, Boston, pp.91-128.
- Engerman, S.L. and K.L. Sokoloff (2003), Institutional and Non-Institutional Explanations of Economic Differences. NBER Working Paper 9989.
- Fabricant, S. (1954), *Economic Progress and Economic Change*. Annual Report 34 (May), Part One, NBER, Cambridge.
- Fagerberg, J. (1987), A Technology Gap Approach to Why Growth Rates Differ. *Research Policy* 16, pp.87-99.
- Fagerberg, J. (1988), Why Growth Rates Differ. In: G. Dosi, C. Freeman, R.R. Nelson, G. Silverberg and L.L.G. Soete (eds.), *Technical Change and Economic Theory*. Pinter, London, pp.432-457.
- Fagerberg, J. (1994), Technology and International Differences in Growth Rates. *Journal of Economic Literature* 32, pp.1147-1175.
- Fagerberg, J. (1995), Convergence or Divergence? The Impact of Technology on "Why Growth Rates Differ". *Journal of Evolutionary Economics* 5, pp.269-284.
- Fagerberg, J. (2003), Schumpeter and the Revival of Evolutionary Economics: An Appraisal of the Literature. *Journal of Evolutionary Economics* 13, pp.125-159.
- Fagerberg, J. and H.H.G. Verspagen (2002), Technology-gaps, Innovation-diffusion and Transformation: An Evolutionary Interpretation. *Research Policy* 31, pp.1291-1304.
- Feinstein, C.H. (1972), *National Income, Expenditure and Output of the United Kingdom, 1855-1965*, Cambridge.
- Feinstein, C.H. (1988), National statistics. In: C.H. Feinstein and S. Pollard (eds.), *Studies in Capital Formation in the United Kingdom, 1750-1920*, Oxford UP.
- Field, A.J. (1985), On the Unimportance of Machinery. *Explorations in Economic History* 22, pp.378-401.
- Field, A.J. (2003), The Most Technologically Progressive Decade of the Century. *American Economic Review* 93:4, pp.1399-1414.
- Frantzen, D. (2000), R&D, Human Capital and International Technology Spillovers: A Cross-Country Analysis. *Scandinavian Journal of Economics* 102:1, pp.57-75.
- Freeman, C. (1962), Research and Development: A Comparison Between British and American Industry. *National Institute Economic Review* 20, pp.21-39.
- Freeman, C. and L.L.G. Soete (eds., 1987). *Technical Change and Full Employment*. Basil Blackwell, London.
- Fremdling, R.R. (1999), *Historical Precedents of Global Markets*. Research Memorandum GD-43, Groningen Growth and Development Centre, University of Groningen.
- Fujita, M., P.R. Krugman and A.J. Venables (2001), *The Spatial Economy. Cities, Regions, and International Trade*, MIT, Cambridge MA.
- Gallman, R.E. (1960), Commodity Output, 1839-1899. In: W. Park (ed.), *Trends in the American Economy in the Nineteenth Century*, New York.
- Gallman, R.E. (1986), The United States Capital Stock in the Nineteenth Century. In: S.L. Engerman and R.E. Gallman (eds.), *Long Term Factors in American Economic Growth*, Chicago/London.
- Gallman, R.E. (1987), Investment Flows and Capital Stocks: US Experience in the Nineteenth Century. In: P. Kilby (ed.), *Quantity and Quiddity: Essays in U.S. Economic History*, Middletown, Connecticut.
- Gallman, R.E. (1992), American Economic Growth before the Civil War: The Testimony of the Capital Stock. In: R.E. Gallman and J.J. Wallis (eds.), *American Economic Growth and Standards of Living before the Civil War*, Chicago/London.
- Gerschenkron, A. (1962), *Economic Backwardness in Historical Perspective*. Belknap, Cambridge MA.
- Goldin, C. (2001), The Human Capital Century and American Leadership: Virtues of the Past. *Journal of Economic History* 61:2, pp.263-292.
- Goldin, C. and L.F. Katz (1998), The Origins of Technology-Skill Complementarity. *Quarterly Journal of Economics* 113, pp.693-732.
- Goldin, C. and L.F. Katz (1999), *The Shaping of Higher Education: The Formative Years in the United*

- States, 1890 to 1940. *Journal of Economic Perspectives* 13:1, pp.37-62.
- Goldin, C. and L.F. Katz (2003), The 'Virtues' of the Past: Education in the First Hundred Years of the New Republic. NBER Working Paper 9958.
- Greasley, D. and L. Oxley (1998), Comparing British and American Economic and Industrial Performance 1860-1993: A Time Series Perspective. *Explorations in Economic History* 35, pp.171-195.
- Griffith, R., S. Redding and J. van Reenen (2004), Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Countries. *Review of Economics and Statistics* 86:4, pp.883-895.
- Griliches, Z. (1957), Hybrid Corn: An Exploration in the Economics of Technological Change. *Econometrica* 25, pp.501-522.
- Griliches, Z. (1992), Productivity and Technological Change: Some Measurement Issues. In: OECD (ed.), *Technology and Economy: The Key Relationships*, OECD, Paris, pp.229-231.
- Griliches, Z. (1994), Productivity, R&D, and the Data Constraint. *American Economic Review* 84:1, pp.1-23.
- Groote, P. and B. van Ark (1996), The Dynamics of Capital Intensity and Total Factor Productivity Levels During the Post-war Period, Groningen Growth and Development Centre, University of Groningen, mimeo.
- Grossman, G.M. and E. Helpman (1991), *Innovation and Growth in the Global Economy*, MIT, Cambridge MA.
- Guellec, D. and B. van Pottelsberghe de la Potterie (2001), R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries. *OECD Economic Studies* 33, pp.103-126.
- Habakkuk, H.J. (1962), *American and British Technology in the Nineteenth Century. The Search for Labour-Saving Inventions*. Cambridge UP.
- Hall, A.R. (ed., 1968), *The Export of Capital from Britain, 1870-1914*, Methuen, London.
- Harberger, A.C. (1998), A Vision of the Growth Process. *American Economic Review* 88:1, pp.1-32.
- Harrod, R.F. (1939), An Essay in Dynamic Theory. *Economic Journal* 49, pp.14-33.
- Hatton, T.J. (2004), Emigration from the UK, 1870-1913 and 1950-1998. *European Review of Economic History* 8, pp.149-169.
- Hayami, Y. and V.W. Ruttan (1985), *Agricultural Development: An International Perspective*. John Hopkins UP, Baltimore/London.
- Heijdra, B.J. and F. van der Ploeg (2002), *Foundations of Modern Macroeconomics*, Oxford UP.
- Helpman, E. (ed., 1998), *General Purpose Technologies and Economic Growth*, MIT, Cambridge MA.
- Hibbert, J., T.J. Griffin and R.L. Walker (1977), Development of Estimates of the Stock of Fixed Capital in the United Kingdom. *Review of Income and Wealth* 23, pp.117-135.
- Hill, R.C., W.E. Griffith, and G.C. Judge (2001), *Undergraduate Econometrics*, John Wiley.
- Ho, M.S. and K.J. Stiroh (2001), The Embodiment Controversy: You Can't Have Two Prices in a One-Sector Model. Mimeo, Federal Reserve Bank of New York, May.
- Howitt, P. (2000), Endogenous Growth and Cross-Country Income Differences. *American Economic Review* 90:4, pp.829-846.
- Howitt, P. (2002), The Research Agenda: Peter Howitt on Schumpeterian Growth Theory. *Economic Dynamics Newsletter* 3:2, April 2002.
- Howitt, P. and D. Mayer-Foulkes (2005), R&D, Implementation and Stagnation: A Schumpeterian Theory of Convergence Clubs. *Journal of Money, Credit and Banking* 37:1, pp.147-177.
- Inklaar, R., M. O'Mahony and M.P. Timmer (2005), ICT and Europe's Productivity Performance: Industry-level Growth Account Comparisons with the United States. *Review of Income and Wealth* 51:4, pp.505-536.
- Institut National de la Propriété Industrielle (1958-1978), *Bulletin Officiel de la Propriété Industrielle*, Paris.
- Islam, N. (1995), Growth Empirics: A Panel Data Approach. *Quarterly Journal of Economics* 110, pp.1127-1170.
- Jaffe, A.B., M. Trajtenberg and R. Henderson (1993), Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations. *Quarterly Journal of Economics* 101:3, pp.577-598.
- James, J.A. and J.S. Skinner (1985), The Resolution of the Labor-Scarcity Paradox. *Journal of Economic*

- History 45:3, pp.513-540.
- Jones, C.I. (1995), R&D-Based Models of Economic Growth. *Journal of Political Economy* 103, pp.759-784.
- Jorgenson, D.W. (ed., 1995), *Productivity*, MIT, Cambridge MA.
- Jorgenson, D.W. and Z. Griliches (1967), The Explanation of Productivity Change. In: D.W. Jorgenson (ed., 1995), *Productivity*, MIT, Cambridge MA.
- Jorgenson, D. and Z. Griliches (1972), Issues in Growth Accounting: A Reply to Edward F. Denison. In: D.W. Jorgenson (ed., 1995), *Productivity*, MIT, Cambridge MA.
- Kaldor, N. (1961), Capital Accumulation and Economic Growth. In: Lutz, F.A. and D.C. Hague (eds., 1965), *The Theory of Capital*, MacMillan, London, pp.177-222.
- Keller, W. (1998), Are International R&D Spillovers Trade Related? Analyzing Spillovers among Randomly Matched Trade Partners. *European Economic Review* 42, pp.1469-1481.
- Keller, W. (2002), Geographic Localization of International Technology Diffusion. *American Economic Review* 92, pp.120-142.
- Keller, W. (2004), International Technology Diffusion. *Journal of Economic Literature* 42, pp.752-782.
- Kendrick, J.W. (1956), *Productivity Trends: Capital and Labor*. NBER Occasional Paper 53.
- Kendrick, J.W. (1961), *Productivity Trends in the United States*, NBER/Princeton UP.
- Kendrick, J.W. (1976), *The Formation and Stocks of Total Capital*. NBER, New York.
- Kendrick, J.W. (1993), How Much Does Capital Explain? In: A. Szirmai, B. van Ark and D. Pilat (eds.), *Explaining Economic Growth. Essays in Honour of Angus Maddison*, North Holland, Amsterdam, pp.129-146.
- Khan, B.Z. (2004), Technological Innovations and Endogenous Changes in US Legal Institutions, 1790-1920. NBER Working Paper 10346.
- Khan, B.Z. and K.L. Sokoloff (2004), Institutions and Technological Innovation During Early Economic Growth: Evidence from the Great Inventors of the United States, 1790-1930. CESifo Working Paper 1299.
- Klenow, P.J. and A. Rodriguez-Clare (2005), Externalities and Growth. In: P. Aghion and S.N. Durlauf (eds.), *Handbook of Economic Growth*, North Holland, Amsterdam (forthcoming).
- Klundert, T. van de (1997), *Groei en instituties: over de oorzaken van economische ontwikkeling*, Tilburg UP.
- Koopmans, T.C. (1965), On the Concept of Optimal Economic Growth. In: *The Econometric Approach to Development Planning*, North Holland, Amsterdam.
- Kremer, M. (1993), Population Growth and Technological Change: One Million B.C. to 1990. *Quarterly Journal of Economics* 101:3, pp.681-716.
- Krueger, D. and K.B. Kumar (2004a), Skill-Specific Rather than General Education: A Reason for US-Europe Growth Differences? *Journal of Economic Growth* 9, pp.167-207.
- Krueger, D. and K.B. Kumar (2004b), US-Europe Differences in Technology-driven Growth: Quantifying the Role of Education. *Journal of Monetary Economics* 51, pp.161-190.
- Kuznets, S. (1965), *Economic Growth and Structure: Selected Essays*. Oxford UP.
- Lamoreaux, N.R. and J.L. Rosenthal (2004), Legal Regime and Business's Organization Choice: A Comparison of France and the United States During the Mid-Nineteenth Century. NBER Working Paper 10288.
- Lamoreaux, N.R. and K.L. Sokoloff (1997), Inventors, Firms and the Market for Technology: US Manufacturing in the Late Nineteenth and Early Twentieth Centuries. NBER Historical Paper 98.
- Lamoreaux, N.R. and K.L. Sokoloff (1999), Inventive Activity and the Market for Technology in the United States, 1840-1920. NBER Working Paper 7107.
- Lazear, E.P. (2004), Balanced Skills and Entrepreneurship. *American Economic Review* 94:2, pp.208-211.
- Levine, R. and D. Renelt (1992), A Sensitivity Analysis of Cross-Country Growth Regressions. *American Economic Review*, 82:4, pp.942-963.
- Lichtenberg, F.R. (1992), R&D Investment and International Productivity Differences. NBER Working Paper 4161.
- Lichtenberg, F.R. and B. van Pottelsberghe de la Potterie (1998), International R&D Spillovers: A Comment. *European Economic Review* 42:8, pp.1483-1491.



- Lichtenberg, F.R. and B. van Pottelsberghe de la Potterie (2001), Does Foreign Direct Investment Transfer Technology Across Borders? *Review of Economics and Statistics* 83:3, pp. 490-497.
- Lucas, R.E. (1988), On the Mechanics of Economic Development. *Journal of Monetary Economics* 22, pp.3-42.
- Lucas, R.E. (1993), Making a Miracle. *Econometrica* 61:2, pp.251-272.
- Maddison, A. (1991), *Dynamic Forces in Capitalist Development*, Oxford UP.
- Maddison, A. (1993), *The Nature of US Economic Leadership 1820-1990*, University of Groningen, Faculty of Economics, mimeo.
- Maddison, A. (1995a), *Monitoring the World Economy, 1820-1992*. OECD Development Centre Studies, Paris.
- Maddison, A. (1995b), *Standardised Estimates of Fixed Capital Stock: A Six Country Comparison*. In: A. Maddison, *Explaining the Economic Performance of Nations: Essays in Space and Time*, Aldershot.
- Maddison, A. (2001), *The World Economy: A Millennial Perspective*. OECD Development Centre Studies, Paris.
- Maddison, A. (2003), *The World Economy: Historical Statistics*, OECD Development Centre Studies, Paris.
- Maddison, A. and B. van Ark (1994), *The International Comparison of Real Product and Productivity*. Research Memorandum GGDC 567 (GD-6), University of Groningen.
- Mankiw, N.G., D. Romer and D.N. Weil (1992), A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics* 107:2, pp.407-437.
- Mansfield, E. (1968), *The Economics of Technological Change*. Longmans, London.
- Matthews, R.C.O., C.H. Feinstein and J.C. Odling Smee (1982), *British Economic Growth, 1856-1973*, Oxford UP.
- Mayes, D.G. and G. Young (1994), *Improving the Estimates of Capital Stock*. National Institute Economic Review, London.
- Meade, J.E. (1961), *A Neoclassical Theory of Growth*. Allen and Unwin, London.
- Mokyr, J. (2002), *The Gifts of Athena: Historical Origins of the Knowledge Economy*. Princeton/Oxford UP.
- Mokyr, J. (2005), *Long-Term Economic Growth and the History of Technology*. In: P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, North Holland, Amsterdam (forthcoming).
- Mowery, D.C. (1986), *Industrial Research, 1900-1950*. In: B. Elbaum and W.A. Lazonick (eds.), *The Decline of the British Economy*. Clarendon Press, Oxford, pp.189-222.
- Mowery, D.C. and N. Rosenberg (1989), *Technology and the Pursuit of Economic Growth*, Cambridge UP.
- Mustar, P. and Laredo, P. (2002), *Innovation and Research Policy in France (1980-2000) or the Disappearance of the Colbertist State*. *Research Policy* 31:1, pp.55-72.
- Nadiri, M.I. (1993), *Innovations and Technological Spillovers*. NBER Working Paper 4423.
- Nelson, R.R. (1995), *Recent Evolutionary Theorizing About Economic Change*. *Journal of Economic Literature* 33, pp.48-90.
- Nelson, R.R. and E.S. Phelps (1966), *Investments in Humans, Technological Diffusion and Economic Growth*. *American Economic Review* 61, pp.69-75.
- Nelson, R.R. and S.G. Winter (1982), *An Evolutionary Theory of Economic Change*. Belknap, Cambridge MA.
- Nelson, R.R. and G. Wright (1992), *The Rise and Fall of American Technological Leadership: The Postwar Era in Historical Perspective*. *Journal of Economic Literature* 30, pp.1931-1964.
- Nickell, S.J. and J. Van Reenen (2001), *Technological Innovation and Economic Performance in the United Kingdom*. CEP Discussion Paper 0488, Centre for Economic Performance, London School of Economics, London.
- North, D.C. (1990), *Institutions, Institutional Change and Economic Performance*. Cambridge UP.
- OECD (1966), *National Accounts Statistics, 1955-1964*, OECD, Paris.
- OECD (1984), *OECD Science and Technology Indicators: Resources devoted to R&D*, OECD, Paris.
- OECD (1991), *Basic Science and Technology Statistics*, OECD, Paris.

- OECD (1995a), Basic Science and Technology Statistics, OECD, Paris.
- OECD (1995b), Research and development Expenditure in Industry, 1973-1992, OECD, DSTI, Paris.
- OECD (1997a), Main Science and Technology Indicators, 1997-1, OECD, Paris.
- OECD (1997b), National Accounts: Main Aggregates Vol.I, 1960-1995, OECD, Paris.
- OECD (1997c), Research and Development in Industry 1974-1995: Expenditure and Researchers, Scientists and Engineers, OECD, DSTI, Paris.
- OECD (1998a), National Accounts: Main Aggregates Vol.I, 1961-1996, OECD, Paris.
- OECD (1998b), Internationalization of Industrial R&D: Patterns and Trends, Paris.
- OECD (1999a), Basic Science and Technology Statistics, OECD, Paris.
- OECD (1999b), Research and Development in Industry 1976-1997: Expenditure and Researchers, Scientists and Engineers, OECD, DSTI, Paris.
- OECD (1999c), National Accounts: Main Aggregates Vol.I, 1960-1997. OECD, Paris.
- OECD (2000), Research and Development in Industry 1977-1998: Expenditure and Researchers, Scientists and Engineers (Rev.3), OECD, DSTI, Paris.
- OECD (2002a), International Mobility of the Highly Skilled, Policy brief July 2002, Paris.
- OECD (2002b), SourceOECD, Online Statistics on Science and Technology, Tables 12 & 13a. Total R&D personnel, RSE and University Graduates in Business Enterprise Sector by Industry (ISIC, Rev.3) in FTE, 12 April 2002.
- O'Mahony, M. (1996), International Measures of Fixed Capital: A Five Country Study. In: B. van Ark and N.F.R. Crafts (eds.), Quantitative Aspects of Postwar European Economic Growth, CEPR/Cambridge UP, pp.165-214.
- O'Mahony, M. (1999), Britain's Productivity Performance 1950-1996: An International Perspective, NIESR, London.
- O'Mahony, M. (2004), Employment, Education and Human Capital. In: R.C. Floud and P. Johnson (eds.), The Cambridge Economic History of Modern Britain, Vol 3: Structural Change and Growth, 1939-2000, Cambridge UP, pp.112-133.
- O'Mahony, M. and W. de Boer (2002), Britain's Relative Productivity Performance: Updates to 1999. Final Report to DTI/Treasury/ONS, NIESR, London.
- O'Rourke, K.H. and J.G. Williamson (2000), Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy, MIT, Cambridge MA.
- Parente, S.L. and E.C. Prescott (1994), Barriers to Technology Adoption and Development. *Journal of Political Economy* 102:2, pp.298-321.
- Pindyck, R.S. and D.L. Rubinfeld (1998), *Econometric Models and Economic Forecasts*, McGraw-Hill, New York.
- Putnam, R.D. (1993), *Making Democracy Work*, Princeton UP.
- Quah, D.T. (1993), Galton's Fallacy and Tests of the Convergence Hypothesis. *Scandinavian Journal of Economics* 95:4, pp.427-443.
- Quah, D.T. (1997), Empirics for Growth and Distribution: Stratification, Polarization and Convergence Clubs. *Journal of Economic Growth* 2, pp.27-59.
- Rebelo, S. (1991), Long-Run Policy Analysis and Long-Run Growth. *Journal of Political Economy* 99:3, pp.500-521.
- Reinganum, J.F. (1989), The Timing of Innovation: Research, Development, and Diffusion. In: R. Schmalensee and R. Willig (eds.), *Handbook of Industrial Organization Vol.I*, Elsevier, pp.850-908.
- Rensman, M. (1996), Economic Growth and Technological Change in the Long Run. SOM Research Report 96C10, University of Groningen.
- Rensman, M. (2004), Eenheid of verscheidenheid in de onderzoeksagenda's? Over de bta-gerichte R&D-specialisatiepatronen van wetenschap en bedrijven in Nederland. CPB Document 74, CPB Netherlands Bureau of Economic Policy Analysis, The Hague.
- Rensman, M. and G.H. Kuper (2000), Do Technology Spillovers Matter for Growth? In: B. van Ark, S.K. Kuipers and G.H. Kuper (eds.), *Productivity, Technology and Economic Growth*, Kluwer Academic Publishers, Boston, pp.361-389.
- Robinson, J. (1965), *Collected Economic Essays*, Oxford UP.

- Rogers, M. (2004), Absorptive Capacity and Economic Growth: How Do Countries Catch Up? *Cambridge Journal of Economics* 28, pp.577-596.
- Romer, P.M. (1986), Increasing Returns and Long-Run Growth. *Journal of Political Economy* 94:5, pp.1002-1037.
- Romer, P.M. (1990), Endogenous Technological Change. *Journal of Political Economy* 98:5, part II, pp.S71-S102.
- Romer, P.M. (1994), The Origins of Endogenous Growth. *Journal of Economic Perspectives* 8:1, pp.3-22.
- Rosenberg, N. and M. Trajtenberg (2004), General-Purpose Technology at Work: The Corliss Steam Engine in the Late Nineteenth-Century United States. *Journal of Economic History* 64:1, pp.61-99.
- Rothbarth, E. (1948), Causes of the Superior Efficiency of USA Industry as Compared to British Industry. *Economic Journal* 56, pp.383-390.
- Sala-i-Martin, X. (1990), Lecture Notes on Economic Growth I/II. NBER Working Papers 3563/3564.
- Salter, W.E.G. (1960), *Productivity and Technical Change*, Cambridge UP.
- Samuelson, P.A. (1958), An Exact Consumption-Loan Model of Interest with or without the Social Convivance of Money. *Journal of Political Economy* 66:6, pp.467-482.
- Schmookler, J. (1966), *Invention and Economic Growth*. Harvard, Cambridge MA.
- Schultz, T.W. (1961). Investment in Human Capital. *American Economic Review* 51:1, pp.1-17.
- Schumpeter, J.A. (1942), *Capitalism, Socialism and Democracy*. Harvard, Harper, NY.
- Scott, M.F.G. (1989), *A New View of Economic Growth*. Clarendon, Oxford.
- Scott, M.F.G. (1992), Policy Implications of 'A New View of Economic Growth'. *Economic Journal* 102, pp.622-632.
- Sicsic, P. and C. Wyplosz (1996), France, 1945-92. In: N.F.R. Crafts and G. Toniolo (eds.), *Economic Growth in Europe Since 1945*. CEPR/Cambridge UP, pp.210-239.
- Solow, R.M. (1956), A Contribution to the Theory of Growth. In: A.K. Sen (ed., 1956), *Growth Economics. Selected Readings*, Penguin, Harmondsworth, pp.161-192.
- Solow, R.M. (1957), Technical Change and the Aggregate Production Function. In: A.K. Sen (ed., 1956), *Growth Economics. Selected Readings*, Penguin, Harmondsworth, pp.401-419.
- Solow, R.M. (1962), Substitution and Fixed Proportions in the Theory of Capital. *Review of Economic Studies* 24, pp.207-218.
- Solow, R.M. (1994), Perspectives on Growth Theory. *Journal of Economic Perspectives* 8:1, pp.45-54.
- Stiroh, K.J. (2002), Information Technology and the U.S. Productivity Revival: What Do the Industry Data Say? *American Economic Review* 92:5, pp.1559-1576.
- Stokey, N.L. (1988), Learning By Doing and the Introduction of New Goods. *Journal of Political Economy* 96, pp.701-717.
- Summers, R. and A. Heston (1991), The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988. *Quarterly Journal of Economics* 106:2, pp.327-368.
- Swan, T.W. (1956), Economic Growth and Capital Accumulation. *Economic Record* 32, pp.334-361.
- Taylor, A.M. (1996), Convergence and International Flows in Theory and History. Northwestern University/NBER, January 1996, mimeo.
- Temin, P. (1966), Labor Scarcity and the Problem of American Industrial Efficiency in the 1850s. *Journal of Economic History* 26, pp.361-379
- Temin, P. (1971), Labor Scarcity in America. *Journal of Interdisciplinary History* 1, pp.251-264.
- Temple, J.R.W. (1998), *Appropriate Technology: Five Growth Puzzles Solved?* Oxford, mimeo.
- Temple, J.R.W. (1999), The New Growth Evidence. *Journal of Economic Literature* 37, pp.112-156.
- Tinbergen, J. (1942), Zur Theorie der Langfristigen Wirtschaftsentwicklung. *Weltwirtschaftliches Archiv* 55:3.
- Tobin, J. (1965), Money and Economic Growth. *Econometrica* 32, pp.671-684.
- US (1975), *Historical Statistics of the USA, Vol.II, Series W144*, p.966.
- US Bureau of the Census (1975), *Historical Statistics of the United States, Colonial Times to 1970*, bicen-

- ennial edition, Washington D.C.
- Uzawa, H. (1965), Optimal Technical Change in an Aggregative Model of Economic Growth. *International Economic Review* 6, pp.18-31.
- Vandenbussche, J., P. Aghion and C. Meghir (2004), Growth, Distance to Frontier and Composition of Human Capital. Working Paper 04/31, Institute for Fiscal Studies, London.
- Verspagen, H.H.G. (1991), A New Empirical Approach to Catching Up or Falling Behind. *Structural Change and Economic Dynamics* 2:2, pp.359-380.
- Verspagen, H.H.G. (1996), Technology Indicators and Economic Growth in the European Area: Some Empirical Evidence. In: B. van Ark and N.F.R. Crafts (eds.), *Quantitative Aspects of Post-war European Economic Growth*, CEPR/Cambridge UP, pp.215-243.
- Vogelsang, T. (1994), Wald-Type Tests for Detecting Shifts in the Trend Function of a Dynamic Time Series. Working Paper Cornell, Ithaca, New York.
- Ward, M. and J.J. Devereux (2003), Measuring British Decline: Direct Versus Long-Span Income Measures. *Journal of Economic History* 63:3, pp.826-851.
- Ward, M. and J.J. Devereux (2004), Relative UK/US Output Reconsidered: A Reply to Professor Broadberry. *Journal of Economic History* 64:3, pp.879-891.
- Williamson, O.E. (2000), The New Institutional Economics: Taking Stock, Looking Ahead. *Journal of Economic Literature* 38:2, pp. 595-613.
- WIPO (1983), 100 Years Protection of Industrial Property. Synoptic Tables on Patents, Trademarks, Designs, Utility Models and Plant Varieties, 1883-1982, WIPO, Geneva.
- Wolff, E.N. (1991), Capital Formation and Productivity Convergence Over the Long Term. *American Economic Review* 81:3, pp.565-579.
- Wolff, E.N. and M.I. Nadiri (1993), Spillover Effects, Linkage Structure, and Research and Development. *Structural Change and Economic Dynamics* 4:2, pp.315-331.
- Wright, G. (1990), The Origins of American Industrial Success, 1879-1940. *American Economic Review* 80:4, pp.651-668.
- Wrigley, J. (1986), Technical Education and Industry in the Nineteenth C. In: B. Elbaum and W.A. Lazonick (eds.), *The Decline of the British Economy*. Clarendon Press, Oxford, pp.162-188.
- Young, A. (1993a), Invention and Bounded Learning by Doing. *Journal of Political Economy* 101:3, pp.443-472.
- Young, A. (1993b), Substitution and Complementarity in Endogenous Innovation. *Quarterly Journal of Economics* 108:3, pp.775-807.
- Zivot, E. and D.W.K. Andrews (1992), Further Evidence on the Great Crash, the Oil Price Shock, and the Unit Root Hypothesis. *Journal of Business and Economic Statistics* 10, pp.251-270.

