Qualitative Mismatches

Qualitative Mismatches

Michael Sattinger

University at Albany
Albany, NY 12222
USA
m.sattinger@albany.edu

now
the essence of knowledge

Boston – Delft

Foundations and Trends® in Microeconomics

Published, sold and distributed by:
now Publishers Inc.
PO Box 1024
Hanover, MA 02339
USA
Tel. +1-781-985-4510
www.nowpublishers.com
sales@nowpublishers.com

Outside North America:
now Publishers Inc.
PO Box 179
2600 AD Delft
The Netherlands
Tel. +31-6-51115274

The preferred citation for this publication is M. Sattinger, Qualitative Mismatches, Foundation and Trends® in Microeconomics, vol 8, nos 1–2, pp 1–168, 2012

ISBN: 978-1-60198-624-5

Foundations and Trends® in Microeconomics
Volume 8 Issues 1–2, 2012

Editorial Board

Editorial Scope

Foundations and Trends® in Microeconomics will publish survey and tutorial articles in the following topics:

- Environmental Economics
  - Contingent Valuation
  - Environmental Health Risks
  - Climate Change
  - Endangered Species
  - Market-based Policy Instruments
- Health Economics
  - Moral Hazard
  - Medical Care Markets
  - Medical Malpractice
  - Insurance economics
- Industrial Organization
  - Theory of the Firm
  - Regulatory Economics
  - Market Structure
  - Auctions
  - Monopolies and Antitrust
  - Transaction Cost Economics
- Labor Economics
  - Labor Supply
  - Labor Demand
  - Labor Market Institutions
  - Search Theory
  - Wage Structure
  - Income Distribution
  - Race and Gender
- Law and Economics
  - Models of Litigation
  - Crime
  - Torts, Contracts and Property
  - Constitutional Law
- Public Economics
  - Public Goods
  - Environmental Taxation
  - Social Insurance
  - Public Finance
  - International Taxation

Information for Librarians
Foundations and Trends® in Microeconomics, 2012, Volume 8, 4 issues. ISSN paper version 1547-9846. ISSN online version 1547-9854. Also available as a combined paper and online subscription.

Foundations and Trends® in
Microeconomics
Vol. 8, Nos. 1–2 (2012) 1–168

DOI: 10.1561/0700000052

now
the essence of knowledge

Qualitative Mismatches

Michael Sattinger

Department of Economics, University at Albany, Albany, NY 12222, USA
m.sattinger@albany.edu

Abstract

Qualitative mismatches arise when the qualifications or skills of workers, individually or in the aggregate, are different from the qualifications or skills required or specified for their jobs. This review provides an introduction to the subject as well as a survey for social scientists conducting research on incidence, causes and consequences of qualitative mismatches. The review distinguishes between short run mismatches occurring between workers and jobs and long run aggregate mismatches that arise from shifts in supplies and demands for workers. Incidence of qualitative mismatches is related to regression toward the mean and wage consequences are explained by assignment models with Nash bargaining, among other theories. The review considers explanations of current long run qualitative mismatches provided by Goldin and Katz as well as others, and describes the differences between the U.S. and other countries in the evolution of the imbalance. A primary source for the difference in outcomes is that private costs of higher education are significantly higher in the U.S. The review considers policy implications of qualitative mismatches and contrasts educational approaches in the U.S. and European countries. Open questions in qualitative mismatches are considered including the determinants of wage consequences, how

qualitative mismatches change with the business cycle, the relevance of qualitative mismatches for search and matching models of the aggregate labor market, the reduced supply response of higher education in the U.S. in spite of greater educational differentials, causes of increasing inequality, and optimal policies in the short and long run to reduce qualitative mismatches.

Keywords: Optimal matching; labor market; search theory; job assignment theory.

JEL Codes: J2, J3, J64, J124

Contents

Editors Intro: Sattinger "Qualitative Mismatches"

The press release for the 2012 Nobel Prize in Economic Sciences notes that the prize was given to Alvin Roth and Lloyd Shapley to honor them "for the theory of stable allocations ..." The announcement further notes that "This year's Prize concerns a central economic problem: how to match different agents as well as possible." Roth's work was singled out further for demonstrating "that stability is the key to understanding the success of particular market institutions."

The 2012 Nobel Prize makes it particularly timely that we are able to present a closely related contribution by Michael Sattinger, "Qualitative Mismatches." In his piece Professor Sattinger explores the causes and consequences of situations where workers' skill sets are not the optimal ones for their job situations. His work complements the efficiency issues cited by the Nobel committee via examining conditions underlying when markets can have suboptimal (economically inefficient) assignments of workers to jobs. Professor Sattinger's research is additionally important and timely because it extensively analyzes the possible enduring economic losses from recessions, such as the recent one of 2008–2009 in the United States, that can

end with some workers re-employed sub-optimally. He then shows how such recession based mismatch produced losses can be further exacerbated by mismatch consequences of unavoidable long-run changes in the structure of the economy and notes optimal government policy to offset mismatches.

1

Introduction

Qualitative mismatches arise when the qualifications or skills of workers, individually or in the aggregate, are different from the qualifications or skills required for their jobs. Qualitative mismatches cause losses to individual workers in reduced wages, career interruptions, and reduced job satisfaction. They cause losses to firms in reduced productivity, and to economies in restricted growth potential. As a result of these serious consequences, major research institutions have conducted studies to understand future skill needs and mismatches. For example, the Organization for Economic Cooperation and Development (OECD, 2011c, Chapter 4; see also Quintini, 2011b), the European Expert Networks on Economics of Education (2008), the National Research Council (2008), and the European Centre for the Development of Vocational Training (CEDEFOP, 2010b, 2010c) have undertaken major efforts to analyze qualitative mismatches. In addition to direct consequences, qualitative mismatches are related to significant ongoing empirical labor market phenomena, including increasing inequality, technological change that favors more skilled workers, organizational change, computerization, job polarization, and globalization. Furthermore, the explanation of qualitative mismatches involves central

elements of modern labor market theory, including search theory, assignment theory, human capital, and unemployment. There has been wide-ranging empirical analysis of issues related to qualitative mismatches, future skill needs, and educational and training policies, generating an extensive relevant literature.

The approach taken in this review differs from previous work by developing the distinction between short run qualitative mismatches for individual workers and employers and long run aggregate qualitative mismatches arising from changes in the quantity demanded or supplied in a category of the labor market. These two forms of qualitative mismatches are conceptually distinct and proceed from different causes and processes. Without the distinction between the two forms, a measurement of one could be mistaken for the other. The methods and data used to examine the two forms of qualitative mismatches also differ.

Short run qualitative mismatches arise as a consequence of extensive job and worker variety combined with imperfect information and frictions in the labor market that require workers and employers to engage in search to establish employment. "Search" refers to the study of how workers go about finding a job, and how firms recruit workers. When looking for a job, a worker does not know which firms would be willing to hire him or her. When the worker gets an offer from a possible employer, the worker needs to decide whether to accept the offer or continue looking. Search theory describes the optimal strategy for a worker looking for a job, and has been extended to describe how firms look for workers. Since the wage offer that a worker could get at different employers varies according to the relation between the worker's characteristics and the characteristics of the job, continued search by the worker can generate a higher wage. However, since search is costly, the worker at some point will decide to stop searching and accept a job that pays less than the maximum attainable wage. Similarly, the productivity of a worker at a particular job varies depending on the worker's characteristics, but the employer fills the job before finding the ideal worker because it would be costly to leave the job vacant for so long. As a consequence of this search, the characteristics of the worker and firm are not perfectly matched compared to the best assignment determined with perfect and costless information.

These short run qualitative mismatches are an inevitable consequence of the operation of the labor market in the presence of costly information obtained through search. Although inevitable, the short run qualitative mismatches cause losses to both workers and firms. Workers lose because they spend time unemployed, are paid less than they could potentially earn, and must perhaps engage in on-the-job search to obtain further advancement in their careers. Employers lose because a job may remain vacant until they can find someone to fill it, they may get less production from the worker than they could hope for, and the worker may leave for a better job, generating a costly separation. The extent of the losses from qualitative mismatches in the short run depends on policies that promote efficient matching. Labor market intermediaries and temporary help agencies can reduce short run qualitative mismatches by placing workers in jobs more efficiently than the rest of the labor market. Short run qualitative mismatches would arise even in the absence of the long run aggregate qualitative mismatches that are described next, and would not disappear as a result of long run adjustments in the labor market. Short run qualitative mismatches are studied by examining how the labor market assigns workers to jobs through search by workers and employers, and how qualitative mismatches arise as a consequence of the strategies of workers and employers in the presence of costly search.

In contrast, long run aggregate qualitative mismatches arise when the economy changes in a way that alters the mix of job characteristics, or the incentives for individuals to obtain education and training change in a way that alters the mix of worker characteristics. For job characteristics, the causes could be technological change, capital investments, globalization, or organizational change. For worker characteristics, the causes could be subsidies to different levels of education, quality of preparation at earlier educational levels, or private costs of education. To understand the nature of a long run aggregate qualitative mismatch, it is convenient to consider a single labor market for jobs with a particular combination of characteristics and a corresponding group of workers. A long run qualitative mismatch should be understood as a situation in which a shift in demand in this market is not balanced by a shift in supply over a longer period of time, perhaps because the

changes are not fully anticipated. To the extent that the labor market responds to these imbalances through wage and other changes, long run qualitative mismatches may not show up in comparisons between individual workers and their jobs. Long run qualitative mismatches would respond to policies that anticipated changes on the demand side and promoted changes in the educational and training system that balanced the shifts in demands for skills with shifts in supplies. Long run qualitative mismatches are studied by examining the consequences of trends in economies and societies that generate shifts in demands and supplies, including technology, globalization, organization of work, and educational institutions.

As an example of the differences between short run and long run qualitative mismatches, evidence of workers overeducated for their jobs is regularly observed, while at the same time analysts conclude that there is no aggregate overeducation (Teichler and Schomburg, 2007; Machin and McNally, 2006).

Differences between short run and long run qualitative mismatches are summarized in Table 1.1.

Table 1.1. Short run and long run qualitative mismatches.

	Short run	Long run
Causes	Costs of searching by worker or firm prevent best matches	Unbalanced shifts in supply and demand
Methods of observation and measurement	Differences in individual job and worker characteristics	Forecasts of aggregate differences in supply and demand for labor categories
Methods of analysis	Study how workers search for jobs and how firms recruit workers	Examine consequences of trends in technological and organizational change, globalization, ICT, education
Consequences	Costly search for workers and firms, losses in worker wages and lower firm output	Lost returns to worker investments in education and training, inadequate labor force for firm expansion and growth
Policies that address mismatches	Labor institutions that encourage more efficient matches, reduction in search	Adapt educational policies to anticipated changes

The relation between short run and long run qualitative mismatches can be understood using Richard Freeman's book, "The Overeducated American" (1976). In this book, Freeman describes the long run qualitative mismatch that arose in the U.S. in the 1970s as a result of the supply of college educated labor increasing more rapidly than the demand. One consequence of this long run qualitative mismatch was that many individuals with higher levels of education were unable to find jobs that required their educational preparation. That is, the long run qualitative mismatch contributed to a short run qualitative mismatch in the form of overeducation for many individuals. Nevertheless, even in the absence of any long run qualitative mismatches, short run qualitative mismatches would continue to exist because of the difficulty of finding a job without mismatches in a reasonable amount of time.

One may believe that a competitive labor market would be able to handle any qualitative mismatches, whether in the short run or in the long run.[1] In the short run, individuals may eventually resolve qualitative mismatches by changing jobs. But not all mismatches get eliminated by individuals, and there are always new entrants who begin their labor careers with mismatches. Consideration of short run qualitative mismatches suggests changes in institutions that could reduce the levels of short run qualitative mismatches occurring at any point in time. In the long run, workers and employers that accurately foresee labor market developments would be able to avoid imbalances between supplies and demands. However, in the current episode of a long run qualitative mismatch, discussed later in this review, the increase in relative wages for U.S. college graduates did not generate a sufficient increase in enrollment and graduation rates to avoid the mismatch. Market forces by themselves cannot be relied upon to eliminate qualitative mismatches in either the short run or the long run.

Labor market qualitative mismatches play a central role in current debates regarding macroeconomic policy. Diamond (2011, p. 1064)

[1] Market failures in acquiring skills are examined in Booth and Snower (1996). See also Pallais (2010) for inefficiencies in entry-level labor markets.

reacts to the following statement by Kocherlakota (2010, p. 6), President of the Federal Reserve Bank of Minneapolis:

> "What does this change in the relationship between job openings and unemployment connote? In a word, mismatch. Firms have jobs, but can't find appropriate workers. The workers want to work, but can't find appropriate jobs. There are many possible sources of mismatch — geography, skills, demography — and they are probably all at work. Whatever the source, though, it is hard to see how the Fed can do much to cure this problem. Monetary stimulus has provided conditions so that manufacturing plants want to hire new workers. But the Fed does not have a means to transform construction workers into manufacturing workers."

Diamond argues against the conclusion that structural mismatches are generating a higher level of unemployment that would not be affected by aggregate demand policies. He cites evidence (Dickens, 2010; Elsby et al., 2010) that most of the shift in the unemployment-vacancy relation in the current recession arises from fewer hires instead of mismatches. The next section, on short run disaggregated qualitative mismatches, is concerned with mismatches generated by the business cycle as well as ongoing mismatches generated by continuing frictions and inefficiencies in the labor market (see CEDEFOP, 2010b, Chapter 5, for a discussion of skill mismatches over the business cycle).

In this study, mismatches at a point in time can be regarded as arising from three sources. First, there is a level that arises from the search procedures that workers use to find jobs and employers use to find workers. This level would arise even if there were no other sources of mismatches. Second, there is a level of mismatch that arises over the course of a business cycle as a result of workers with high education and skill levels taking jobs at which they are overqualified during high unemployment, or firms hiring workers that do not meet their requirements during low unemployment. Third, there are additional mismatches that could arise if there are imbalances between supplies and demands from

long run aggregate qualitative mismatches. It is possible that overqualification at one level could cancel out some underqualification at another level, so that the three levels are not simply added together.

Qualitative mismatches lie in the background of current unemployment and business cycle theory. Whether or not these theories explain unemployment and business cycles, they do not explain much about qualitative mismatches. Qualitative mismatches impose serious costs on workers, firms and economies. Economic theory would be more useful if it moves in the direction of explaining unemployment and mismatches as they evolve together.

As a subdiscipline of labor economics, qualitative mismatches present a large array of empirical phenomena with policy implications. Nevertheless, the analytical background for qualitative mismatches has several deficiencies. By including both supply and demand factors, assignment theories are often cited as providing a better basis for qualitative mismatches than human capital or job competition theories. However, assignment theory needs to be combined with job search theory to explain how qualitative mismatches arise, and with other theories to explain how wages are determined. This survey seeks to advance qualitative mismatches as a subdiscipline by posing the relevant disciplinary questions and contributing to its analytical basis and structure.

References

3s Management Consultancy (2009), *European Dictionary of Skills and Competences*. www.disco-tools.eu.

Acemoglu, D. (2002), 'Technical change, inequality, and the labor market'. *Journal of Economic Literature* **XL**(1), 7–72.

Acemoglu, D. and D. Autor (2011), 'Skills, tasks and technologies: Implications for employment and earnings'. In: O. Ashenfelter and D. Card (eds.): *Handbook of Labor Economics,* vol. 4. Elsevier.

Acemoglu, D. and D. Autor (2012). 'What does human capital do?' *A review of Goldin and Katz's 'The Race between Education and Technology'* **L**(2), 426–463.

Aitchison, J. and J. A. C. Brown (1957), *The Lognormal Distribution*. U.K.: Cambridge University Press.

Alba-Ramirez, A. and M. Blazquez (2003), 'Types of job match, overeducation and labour mobility in Spain'. In: F. Buchel, A. De Grip, and A. Mertens (eds.): *Overeducation in Europe: Current Issues in Theory and Policy*. Edward Elgar, pp. 65–92.

Albaek, K. and H. Hansen (2004), 'The rise in Danish unemployment: Reallocation or mismatch?'. *Oxford Bulletin of Economics and Statistics* **66**(4), 515–536.

Albrecht, J. (2011), 'Search theory: The 2010 Nobel Memorial Prize in Economic Sciences'. *Scandinavian Journal of Economics* **113**(2), 237–259.

Albrecht, J. and S. Vroman (2002), 'A matching model with endogenous skill requirements'. *International Economic Review* **43**, 283–305.

Allen, J. and A. De Grip (2007), 'Skill obsolescence, lifelong learning and labor market participation'. ROA research memorandum ROA-RM-2007/6. Maastricht: Research Centre for Education and the Labour Market.

Allen, J. and E. de Weert (2007), 'What do educational mismatches tell us about skill mismatches? A cross-country analysis'. *European Journal of Education* **42**(1), 59–73.

Allen, J. and R. van der Velden (2001), 'Educational mismatches versus skill mismatches: Effects on wages, job satisfaction, and on-the-job search'. *Oxford Economic Papers* **3**, 434–452.

Allen, J. and R. van der Velden (2002), 'When do skills become obsolete, and when does it matter?'. In: A. De Grip, J. Van Loo, and K. Mayhew (eds.): *The Economics of Skills Obsolescence: Theoretical Innovations and Empirical Applications,* vol. 21 *Research in Labor Economics*. JAI Press, pp. 27–50.

AMS Sweden, the Swedish Public Employment Service (2008), 'Taxonomy_DB'.

Ananiadou, K. and M. Claro (2009), '21st century skills and competences for new millennium learners in OECD countries'. OECD Education Working Papers, No. 41, OECD Publishing.

Archibald, R. B. and D. H. Feldman (2011), *Why Does College Cost So Much?* New York: Oxford University Press.

Asian Development Bank (2008), *Education and Skills: Strategies for Accelerated Development in Asia and the Pacific*.

Atkinson, A. B. (2007), 'The distribution of earnings in OECD countries'. *International Labour Review* **146**, 41–60.

Autor, D. and D. Dorn (2010), 'The growth of low skill service jobs and the polarization of the U.S. labor market'. MIT.

Autor, D. and M. J. Handel (2009), 'Putting tasks to the test: Human capital, job tasks and wages'. NBER Working Paper 15116.

Autor, D., F. Levy, and R. J. Murnane (2003), 'The skill content of recent technological change: An empirical exploration'. *Quarterly Journal of Economics* **CXVIII**(4), 1279–1333.

Barlevy, G. (2011), 'Evaluating the role of labor market mismatch in rising unemployment'. *Economic Perspectives* **3Q**.

Bassanini, A., A. Booth, G. Brunello, M. De Paola, and E. Leuven (2007), 'Workplace training in Europe'. In: G. Brunello, P. Garibaldi, and E. Wasmer (eds.): *Education and Training in Europe*. New York: Oxford University Press. Part II.

Battu, H., C. R. Belfield, and P. J. Sloane (2000), 'How well can we measure graduate overeducation and its effects?'. *National Institute Economic Review* **171**, 82–93.

Bauer, T. K. and S. Bender (2004), 'Technological change, organizational change, and job turnover'. *Labour Economics* **11**, 265–291.

Baumol, W. J. and W. G. Bowen (1966), *Performing Arts: The Economic Dilemma*. New York: Twentieth Century Fund.

Béduwé, C. and J.-F. Giret (2011), 'Mismatch of vocational graduates: What penalty on French labour market?'. *Journal of Vocational Behavior* **78**, 68–79.

Behaghel, L., E. Caroli, and M. Roger (2011), 'Age biased technical and organizational change, training and employment prospects of older workers'. IZA Working Paper No. 5544.

Bennett, J. and S. McGuinness (2009), 'Assessing the impact of skill shortages on the productivity performance of high-tech firms in Northern Ireland'. *Applied Economics* **41**, 727–737.

Berkhout, E., M. Sattinger, J. Theeuwes, and M. Volkerink (2012), *Into the Gap; Exploring Gaps and Mismatches*. Amsterdam: SEO Economic Research and Randstad.

Berkhout, E., E. van den Berg, S. Bekker, G. Schmid, and T. Wilthagen (2010a), *Bridging the Gap; International Database on Employment and Adaptable Labor*. SEO Economic Research and Randstad.

Berkhout, E., S. Van der Werff, and A. Heyma (2010b), 'Het verdiende loon? Loonontwikkeling overheidswerknemers vergeleken met de markt sector'. SEO Economisch Onderzoek: Amsterdam.

Berman, E., J. Bound, and S. Machin (1998), 'Implications of skill-biased technological change: International evidence'. *Quarterly Journal of Economics* **113**, 1245–1280.

Bewley, T. (1999), *Why Wages Don't Fall During a Recession*. Cambridge: Harvard University Press.

Birchenall, J. A. (2011), 'A competitive theory of mismatch'. Unpublished paper.

Blinder, A. S. (2009), 'Offshoring: Big deal, or business as usual?'. In: B. M. Friedman (ed.): *Offshoring of American Jobs: What Response from U.S. Economic Policy?* Alan Blinder and Jagdish Bhagwati. Cambridge: MIT Press.

Blinder, A. S. and A. B. Krueger (2009), 'Alternative measures of offshorability: A survey approach'. NBER Working Paper No. 15287.

Bluestone, B. and B. Harrison (1988), 'The growth of low-wage employment: 1963–1986'. *American Economic Review* **78**(2), 124–128.

Booth, A. and D. Snower (1996), *Acquiring Skills; Market Failures, Their Symptoms and Policy Responses*. Cambridge: Cambridge University Press.

Borghans, L. and A. De Grip (2000), 'Skills and low pay: Upgrading or over education?'. In: M. Gregory, W. Salverda, and S. Bazen (eds.): *Labor Market Inequalities: Problems and Policies of Low-Wage Employment in International Perspective*. Oxford: Oxford University Press, pp. 198–223.

Borghans, L. and B. ter Weel (2002), 'Do older workers have more trouble using a computer than younger workers?'. In: A. De Grip, J. Van Loo, and K. Mayhew (eds.): *The Economics of Skills Obsolescence: Theoretical Innovations and Empirical Applications*, vol. 21 *Research in Labor Economics*. JAI Press, pp. 139–173.

Borghans, L. and B. ter Weel (2006), 'The division of labour, worker organisation, and technological change'. *Economic Journal* **116**, F45–F72.

Bound, J. and G. Johnson (1992), 'Changes in the structure of wages in the 1980's: an evaluation of alternative explanations'. *American Economic Review* **82**, 371–392.

Bowlus, A. J. (1995), 'Matching workers and jobs: Cyclical fluctuations in match quality'. *Journal of Labor Economics* **13**(2), 335–350.

Bowlus, A. J. and C. Robinson (2011), 'Human capital prices, productivity and growth'. Canadian Labour Market and Skills Researcher Network Working Paper No. 89.

Bresnahan, T., Brynjolfsson, and L. M. Hitt (2002), 'Information technology, workplace organization, and the demand for skilled labor: Firm level evidence'. *Quarterly Journal of Economics* **117**(1), 339–376.

Büchel, F. (2002), 'The effects of overeducation on productivity in Germany-the firms' viewpoint'. *Economics of Education Review* **21**, 263–275.

Burdett, K. and D. Mortensen (1998), 'Wage differentials, employer size, and unemployment'. *International Economic Review* **39**, 273.

Card, D. and T. Lemieux (2001), 'Can falling supply explain the rising return to college for younger men? A cohort-based analysis'. *Quarterly Journal of Economics* **116**(2), 705–746.

Carneiro, P. and J. J. Heckman (2003), 'Human capital policy'. In: J. J. Heckman and A. B. Kreuger (eds.): *Inequality in America; What Role for Human Capital Policies?* Chapter 2, Cambridge: MIT Press, pp. 77–239.

Caroli, E. and J. van Reenen (2001), 'Skill biased organizational change? Evidence from a panel of British and French establishments'. *Quarterly Journal of Economics* **116**(4), 1449–1492.

Casselman, B. (2011), 'The long haul'. Wall Street Journal. November 26.

CEDEFOP (European Centre for the Development of Vocational Training) (2009), 'Skill mismatch: Identifying priorities for future research'. Working Paper No. 3, Publications Office of the European Union, Luxembourg.

CEDEFOP (European Centre for the Development of Vocational Training) (2010a), *The Right Skills for Silver Workers: An Empirical Analysis*. Luxembourg: Publications Office of the European Union.

CEDEFOP (European Centre for the Development of Vocational Training) (2010b), *The Skill Matching Challenge: Analyzing Skill Mismatch and Policy Applications*. Luxembourg: Publications Office of the European Union.

CEDEFOP (European Centre for the Development of Vocational Training) (2010c), *Skills Supply and Demand in Europe: Medium Term Forecast up to 2020*. Luxembourg: Publications Office of the European Union.

CEDEFOP (European Centre for the Development of Vocational Training) (2012), 'Skill mismatch: The role of the enterprise'. Research Paper No. 21, Publications Office of the European Union, Luxembourg.

Chevalier, A. (2003), 'Measuring overeducation'. *Economica* **70**, 509–531.

Costinot, A. (2009), 'An elementary theory of comparative advantage'. *Econometrica* **77**(4), 1165–1192.

Costinot, A. and J. Vogel (2010), 'Matching and inequality in the world economy'. *Journal of Political Economy* **118**(4), 747–786.

Costrell, R. M. and G. C. Loury (2004), 'Distribution of ability and earnings in a hierarchical job assignment model'. *Journal of Political Economy* **112**(6), 1322–1363.

Daly, M. C., F. Büchel, and G. J. Duncan (2000), 'Premiums and penalties for surplus and deficit education: Evidence from the United States and Germany'. *Economics of Education Review* **19**, 169–178.

Daly, M. C., B. Jobijn, A. Şahin, and R. G. Valletta (2012), 'A search and matching approach to labor markets: Did the natural rate of unemployment rise?'. *Journal of Economic Perspectives* **26**(3), 3–26.

De Grip, A., H. Bosma, D. Willems, and M. van Boxtel (2008), 'Job-worker mismatch and cognitive decline'. *Oxford Economic Papers* **60**, 237–253.

De Grip, A. and J. Van Loo (2002), 'The economics of skills obsolescence: A review'. In: A. De Grip, J. Van Loo, and K. Mayhew (eds.): *The Economics of Skills Obsolescence: Theoretical Innovations and Empirical Applications,* vol. 21 *Research in Labor Economics*. JAI Press, pp. 1–26.

Dekker, R., A. De Grip, and H. Heijke (2002), 'The effects of training and overeducation on career mobility in a segmented labour market'. *International Journal of Manpower* **23**(2), 106–125.

Delamare Le Deist, F. and J. Winterton (2005), 'What Is competence?'. *Human Resource Development International* **8**(1), 27–46.

Derry, T. K. and T. I. Williams (1960), *A Short History of Technology: From the Earliest Times to A.D. 1900*. New York: Dover Publications.

Deutsch, J., A. Fusco, and J. Silber (2012), 'The BIP trilogy (bipolarization, inequality and polarization): One saga but three different stories'. *Economics* **2012–49**.

Diamond, P. (1971), 'A model of price adjustment'. *Journal of Economic Theory* **3**, 156–168.

Diamond, P. (2011), 'Unemployment, vacancies, wages'. *American Economic Review* **101**(4), 1045–1072.

Dickens, W. T. (2010), 'Has the recession increased the NAIRU?'. Paper presented to the academic advisory meeting of the Federal Reserve Board of Governors, October 12.

Dolado, J. J., M. Jansen, and J. F. Jimeno (2009), 'On-the-job search in a matching model with heterogeneous jobs and workers'. *Economic Journal* **119**, 200–228.

Dolton, P. and O. Marcenaro-Gutierrez (2009), 'Overeducation across Europe'. In: P. Dolton, R. Asplund, and E. Barth (eds.): *Education and Inequality Across Europe*. Cheltenham: Cheltenham: Edward Elgar.

Dolton, P. and M. Silles (2003), 'The determinants and consequences of graduate overeducation'. In: F. Büchel, A. Mertens, and A. Grip (eds.): *Overeducation in Europe*. Cheltenham: Edward Elgar, pp. 189–216.

Dolton, P. and A. Vignoles (2000), 'The incidence and effects of overeducation in the UK graduate labour market'. *Economics of Education Review* **19**, 179–198.

Duncan, G. and S. Hoffman (1981), 'The incidence and wage effects of overeducation'. *Economics of Education Review* **1**(1), 75–86.

Dupuy, A. (2008), 'The assignment of workers to tasks, wage distribution, and technical change: A critical review'. *Journal of Income Distribution* **17**(3–4), 12–36.

Dupuy, A. and P. S. Marey (2008), 'Shifts and twists in the relative productivity of skilled labor'. *Journal of Macroeconomics* **30**, 718–733.

Eeckhout, J. and P. Kircher (2010), 'Sorting and decentralized price competition'. *Econometrica* **78**(2), 539–574.

Eeckhout, J. and P. Kircher (2011a), 'Identifying sorting-in theory'. *Review of Economic Studies* **78**(3), 872–906.

Eeckhout, J. and P. Kircher (2011b), 'Sorting in macroeconomic models'. *The EconomicDynamics Newsletter* **13**(1).

Ehrenberg, R. G. (2012), 'American higher education in transition'. *Journal of Economic Perspectives* **26**(1), 193–216.

Elliott, S. (2007), 'Projecting the impact of computers on work in 2030'. paper prepared for the National Academies Workshop on Research Evidence Related to Future Skill Demands.

Elsby, M., B. Hobijn, and A. Şahin (2010), 'The labor market in the Great Recession'. *Brookings Papers on Economic Activity* pp. 1–48.

Epstein, B. (2012), 'Heterogeneous workers, optimal job seeking, and aggregate labor market dynamics'. Board of Governors of the Federal Reserve System International Finance Discussion Papers No. 1053.

EURES (2012), 'European Job Mobility Portal'. http://ec.europa.eu/eures/home.jsp?lang=en.

European Commission (2008), *Explaining the European Qualifications Framework for Lifelong Learning. Key Questions and Answers.* Brussels: European Commission.

European Commission (2010), *Europe 2020: A Strategy for a Smart, Sustainable and Inclusive Growth.* Brussels: European Commission.

European Commission (2011), *Supporting Growth and Jobs-an Agenda for the Modernization of Europe's Higher Education System.* Brussels: European Commission.

European Commission (2012), *Joint Report of the Council and the Commission on the Implementation of the Strategic Framework for European Cooperation in Education and Training (ET 2020).* Official Journal of the European Union.

European Expert Network on Economics of Education (2008), 'Origins and consequences of changes in labour market skill needs'. Analytical report for the European Commission written by Martin Schlotter with contributions by Giorgio Brunello, Stephen Machin, Daniel Münich and George Psacharopoulos.

Falcone, P. (2002), *The Hiring and Firing Question and Answer Book.* New York: American Management Association.

Fallon, P. and P. Layard (1975), 'Capital-skill complementarity, income distribution, and output accounting'. *Journal of Political Economy* **83**, 279–301.

Felstead, A., D. Gallie, and F. Green (2002), *Work Skills in Britain 1986–2001*. Department for Education and Skills, Sheffield: Centre for Skills, Knowledge and Organizational Performance.

Freeman, R. B. (1976), *The Overeducated American*. Academic Press.

Friedberg, L. (2003), 'The impact of technological change on older workers: Evidence from data on computers'. *Industrial and Labor Relations Review* **56**(3), 511–529.

Gabaix, X. and A. Landier (2008), 'Why has CEO pay increased so much?'. *The Quarterly Journal of Economics* **123**(1), 49–100.

Garicano, L. and E. Rossi-Hansberg (2004), 'Inequality and the organization of knowledge'. *American Economic Review* **94**(2), 197–202.

Gautier, P. A. and C. Teulings (2011), 'Sorting and the output loss due to search frictions'. CEPR Working paper 8257.

Gautier, P. A., C. N. Teulings, and A. Van Vuuren (2010), 'On-the-job search, mismatch and efficiency'. *Review of Economic Studies* **77**, 245–272.

Giret, J.-F. (2007), 'A changing labour market for graduates in France'. Centre d'Etudes et de Recherche sur les Qualifications (Céreq), presentation for OECD.

Goldin, C. and L. F. Katz (2008), *The Race Between Education and Technology*. New York: Harvard University Press.

Goos, M. and A. Manning (2007), 'Lousy and lovely jobs: The rising polarization of work in Britain'. *Review of Economics and Statistics* **89**, 118–133.

Goos, M., A. Manning, and A. Salomons (2010), 'Explaining job polarization in Europe: the roles of technology, globalization and institutions'. CEP Discussion Paper No. 1026.

Gottschalk, P. and M. Hansen (2003), 'Is the proportion of college workers in 'non-college' jobs increasing?'. *Journal of Labor Economics* **21**(2), 449–472.

Green, F. (2012), 'Employee involvement, technology and evolution in job skills: A task-based analysis'. *Industrial and Labor Relations Review* **65**(1), 36–67.

Green, F. (2013), *Skilled Work: An Economic and Social Analysis*. Oxford University Press.

Green, F., D. Ashton, B. Burchell, B. Davies, and A. Felstead (2000), 'Are British workers becoming more skilled?'. In: L. Borghans and A. De Grip (eds.): *The Overeducated Worker? The Economics of Skill Utilization*. Cheltenham: Edward Elgar, pp. 77–106.

Green, F., A. Felstead, and D. Gallie (2003), 'Computers and the changing skill-intensity of jobs'. *Applied Economics* **35**, 1561–1576.

Green, F. and S. McIntosh (2007), 'Is there a genuine underutilization of skills amongst the over-qualified?'. *Applied Economics* **39**, 427–439.

Green, F. and Y. Zhu (2010), 'Overqualification, job dissatisfaction, and increasing dispersion in the returns to graduate education'. *Oxford Economic Papers* **62**(4), 740–763.

Griffin, P., B. McGaw, and E. Care (2011), *Assessment and Teaching of 21st Century Skills*. Springer.

Griliches, Z. (1969), 'Capital-skill complementarity'. *Review of Economics and Statistics* **51**(4), 465–468.

Groeneveld, S. and J. Hartog (2004), 'Overeducation, wages and promotions within the firm'. *Labour Economics* **11**, 701–714.

Groot, W. and H. M. van den Brink (2000), 'Overeducation in the labor market: A meta-analysis'. *European Economic Review* **19**, 149–158.

Groot, W. and H. M. van den Brink (2003), 'The dynamics of skill mismatches in the Dutch labor market'. In: F. Büchel, A. Mertens, and A. De Grip (eds.): *Overeducation in Europe*. Cheltenham: Edward Elgar, pp. 49–63.

Groot, W. and H. M. van den Brink (2007), 'Overeducation in the labour market'. In: J. Hartog and H. M. van den Brink (eds.): *Human Capital: Advances in Theory and Evidence*. Cambridge: Cambridge University Press, pp. 101–112.

Guy, F. and P. Skott (2008), 'Information and communications technologies, coordination and control, and the distribution of income'. *Journal of Income Distribution* **17**(3–4), 71–92.

Handel, M. J. (2007), 'A new survey of workplace skills, technology, and management practices (STAMP); background and descriptive

statistics'. paper prepared for the National Academies Workshop on Research Evidence Related to Future Skill Demands.

Hanushek, E. A. and L. Woessmann (2009), 'Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation'. NBER Working Paper 14633.

Hanushek, E. A. and L. Woessmann (2010), 'The cost of low educational achievement in the European Union'. Analytical Report for the European Commission.

Hanushek, E. A. and L. Woessmann (2012), 'The economic benefit of educational reform in the European Union'. *CESifo Economic Studies* **58**, 73–109.

Harrod, R. F. (1956), *Towards a Dynamic Economics*. London: Macmillan.

Hartog, J. (1977), 'On the multicapability theory of income distribution'. *European Economic Review* **10**(2), 157–171.

Hartog, J. (1981), *Personal Income Distribution: A Multicapability Theory*. Boston: Martinus Nijhoff.

Hartog, J. (1992), *Capabilities, Allocation and Earnings*. Boston: Kluwer.

Hartog, J. (2000), 'Over-education and earnings: Where are we, where should we go?'. *Economics of Education Review* **19**, 131–147.

Harvard School of Business (2002), *Hiring and Keeping the Best People*. Boston: Harvard Business School Press.

Haskel, J. and C. Martin (1998), 'Skill shortages, productivity growth and wage inflation'. In: A. L. Booth and D. Snower (eds.): *Acquiring Skills*. Chapter 8, Cambridge: Cambridge University Press.

Haskel, J. and C. Martin (2001), 'Technology, wages and skill shortages: Evidence from UK micro data'. *Oxford Economic Papers* **53**, 642–658.

Haveman, R. H. (1977), 'Jan Tinbergen's 'Income Distribution: Analysis and Policies': A review article'. *De Economist* **125**(2), 161–173.

Healy, J., K. Mavromaras, and P. J. Sloane (2012), *Skill Shortages: Prevalence, Causes, Remedies and Consequences for Australian Businesses*. Adelaide: National Vocational Education and Training Research and Evaluation Program.

Heckman, J. J. and B. Honoré (1990), 'The empirical content of the Roy model'. *Econometrica* **58**(5), 1121–1149.

Heckman, J. J., L. Lochner, and C. Taber (1998), 'Explaining rising wage inequality: Explorations with a dynamic general equilibrium model of labor earnings with heterogeneous agents'. *Review of Economic Dynamics* **1**, 1–58.

Heckman, J. J. and D. V. Masterov (2007), 'The productivity argument for investing in young children'. NBER Working Paper 13016.

Heckman, J. J. and G. L. Sedlacek (1985), 'Heterogeneity, aggregation and market wage functions: An empirical model of self-selection in the labor market'. *Journal of Political Economy* **93**(6), 1077–1125.

Hersch, J. (1995), 'Optimal 'mismatch' and promotions'. *Economic Inquiry* **33**, 611–624.

Hicks, J. (1932), *The Theory of Wages*. London: Macmillan.

Holzer, H. and D. S. Nightingale (2007), 'Introduction'. In: H. Holzer and D. S. Nightingale (eds.): *Reshaping the American Workforce in a Changing Economy*. Washington: The Urban Institute Press, pp. xi–xxxii.

Ingram, B. and G. Neumann (2006), 'The returns to skill'. *Labour Economics* **13**(1), 35–59.

International Labour Organization (2008), *Skills for Improved Productivity, Employment Growth and Development*. Geneva: International Labour Office.

Jackman, R. and S. Roper (1987), 'Structural unemployment'. *Oxford Bulletin of Economics and Statistics* **49**(1), 9–36.

Jones, J. B. and F. Yang (2012), 'Skill-biased technical change and the cost of higher education'. University at Albany.

Jovanovic, B. (1979), 'Job matching and the theory of turnover'. *Journal of Political Economy* **87**, 972–989.

Juhn, C., K. Murphy, and B. Pierce (1993), 'Wage inequality and the rise in returns to skill'. *Journal of Political Economy* **101**(3), 410–442.

Kahn, L. (2010), 'The long-term labor market consequences of graduating from college in a bad economy'. Yale School of Management.

Kampelmann, S. and F. Rycx (2012), 'The impact of educational mismatch on firm productivity: Evidence from linked panel data'. *Economics of Education Review* **31**, 918–931.

Katz, L. and D. Autor (1999), 'Changes in the wage structure and earnings inequality'. In: O. Ashenfelter and D. Card (eds.): *Handbook of Labor Economics,* vol. 3A. Amsterdam: North Holland.

Kletzer, L. G. (2009), 'Comment'. In: B. M. Friedman (ed.): *Offshoring of American Jobs: What Response from U.S. Economic Policy?* Alan Blinder and Jagdish Bhagwati. Cambridge: MIT Press.

Kocherlakota, N. (2010), 'Inside the FOMC'. Speech August 17, 2010, Marquette, Michigan.

Koopmans, T. and M. Beckmann (1957), 'Assignment problems and the location of economic activities'. *Econometrica* **25**(1), 53–76.

Korpi, T. and M. Tåhlin (2009), 'Educational mismatch, wages and wage growth: overeducation in Sweden, 1974–2000'. *Labour Economics* **16**, 183–193.

Koucky, J., C. Meng, and R. Van der Velden (2007), 'Reflex Country Study'. Maastricht: Research Centre for Education and the Labour Market/REFLEX.

Krugman, P. (1994), 'Past and prospective causes of high unemployment'. In: *Reducing Unemployment: Current Issues and Policy Options*. Federal Reserve Bank of Kansas City.

Krugman, P. (1999), *The Accidental Theorist*. New York: W.W. Norton.

Krusell, P., L. E. Ohanian, J.-V. Ríos-Rull, and G. L. Violante (2000), 'Capital-skill complementarity and inequality: A macroeconomic analysis'. *Econometrica* **68**(5), 1029–1053.

Layard, R., S. Nickell, and R. Jackman (1991), *Unemployment; Macroeconomic Performance and the Labour Market*. Oxford: Oxford University Press.

Lazear, E. P. and J. R. Spletzer (2012), 'The United States labor market: Status quo or a new normal?'. NBER Working Paper No. 18386.

Leitch, L. S. (2006), *Leitch review of skills. Prosperity for all in the world economy-world class skills. Final report*. Her Majesty's Treasury.

Lemieux, T. (2006), 'Increasing residual wage inequality: Composition effects, noisy data, or rising demand for skill?'. *American Economic Review* **96**(3), 461–498.

Lentz, R. and D. Mortensen (2005), 'Productivity growth and worker reallocation'. *International Economic Review* **46**, 731–751.

Lentz, R. and D. Mortensen (2010), 'Labor market models of worker and firm heterogeneity'. *Annual Review of Economics* pp. 577–602.

Lerman, R. I. (2008), 'Are skills the problem? Reforming the education and training system in the United States'. In: T. Bartik and S. Houseman (eds.): *A Future of Good Jobs? America's Challenge in the Global Economy*. Kalamazoo, Michigan: W.E. Upjohn Institute.

Leuven, E. and H. Oosterbeek (2011), 'Overeducation and mismatch in the labor market'. IZA Discussion Paper 5523.

Levy, F. (2010), 'How technology changes demands for human skills'. OECD Education Working Papers, No. 45, OECD Publishing.

Levy, F. and R. Murnane (1992), 'U.S. earnings levels and earnings inequality: A review of recent trends and proposed explanations'. *Journal of Economic Literature* **30**, 1333–1381.

Levy, F. and R. Murnane (2005), *The New Division of Labor: How Computers are Creating the Next Job Market*. Princeton: Princeton University Press.

Levy, F. and K.-H. Yu (2006), 'Offshoring of professional services: Radiology services from India'. MIT Working paper.

Lilien, D. (1982), 'Sectoral shifts and cyclical unemployment'. *Journal of Political Economy* **92**, 777–793.

Lindbeck, A. and D. Snower (1996), 'Reorganization of firms and labor-market inequality'. *American Economic Review* **86**(2), 315–321.

Liu, K., K. G. Salvanes, and E. Ø. Sørensen (2012), 'Good skills in bad times: Cyclical skill mismatch and the long-term effects of graduating in a recession'. Norwegian School of Economics Discussion Paper 2012.

Lochner, L. J. and A. Monge-Naranjo (2011), 'The nature of credit constraints and human capital'. *American Economic Review* **101**(6), 2487–2529.

Lydall, H. (1968), *The Structure of Earnings*. London: Oxford University Press.

Machin, S. and S. McNally (2006), 'Tertiary education systems and labour markets'. Report prepared for the OECD.

Machin, S. and J. V. Reenan (1998), 'Technology and changes in skill structure: Evidence from seven OECD countries'. *Quarterly Journal of Economics* **113**(4), 1215–1244.

Manacorda, M. and B. Petrongolo (1999), 'Skill mismatch and unemployment in OECD countries'. *Economica* **66**(262), 181–207.

Manpower Group (2011), 'Talent shortage survey results'.

Marimon, R. and F. Zilibotti (1999), 'Unemployment vs. mismatch of talents: Reconsidering unemployment benefits'. *Economic Journal* **109**, 266–291.

Markowitsch, J. and C. Plaimauer (2009), 'Descriptors for competence: Towards an international standard classification for skills and competences'. *Journal of European Industrial Training* **33**(8/9), 817–837.

Mason, G. (2012), 'Skill shortages, skill utilization and firm growth in the UK'. Presentation at CEDEFOP/CRESS Workshop, "Skills Mismatch and Firm Dynamics," London.

Mavromaras, K. (2012), 'Mismatch and the employers of mismatched workers'. Presentation at CEDEFOP/CRESS Workshop, "Skills Mismatch and Firm Dynamics," London.

Mavromaras, K., S. Mahutean, P. Sloane, and Z. Wei (2012), *The Persistence of Overskilling and its Effects on Wages*. Adelaide: National Vocational Education and Training Research and Evaluation Program.

Mavromaras, K. and S. McGuinness (2007), 'Education and skill mismatches in the labour market: editors' introduction'. *Australian Economic Review* **40**(3), 279–285.

Mavromaras, K., S. McGuinness, and Y. Fok (2009), 'Overskilling dynamics and education pathways'. IZA Discussion paper 4321.

Mavromaras, K., S. McGuinness, and M. Wooden (2007), 'Overskilling in the Australian labour market'. *Australian Economic Review* **40**(3), 307–312.

McGuinness, S. (2006), 'Overeducation in the labour market'. *Journal of Economic Surveys* **20**(3), 387–418.

McGuinness, S. and L. Ortiz (2012), 'Who should we ask? Employer-employee perceptions of skill gaps within firms'. Presentation at CEDEFOP/CRESS Workshop, "Skills Mismatch and Firm Dynamics," London.

McGuinness, S. and M. Wooden (2007), 'Overskilling, job insecurity and career mobility: Evidence from Australia'. IZA Discussion paper 2938.

Messinis, G. and N. Olekalns (2007a), 'Skill mismatch and returns to training in Australia: Some new evidence'. Working Paper 997, University of Melbourne.

Messinis, G. and N. Olekalns (2007b), 'Skill mismatch and training in Australia: Some implications for policy'. *Australian Economic Review* **40**(3), 300–306.

Michaels, G., A. Natraj, and J. V. Reenen (2010), 'Has ICT polarized skill demand? Evidence from eleven countries over 25 years'. NBER Working Paper 16138.

Milgrom, P. and J. Roberts (1990), 'The economics of modern manufacturing: Technology, strategy and organization'. *American Economic Review* **80**(3), 511–528.

Miller, P. W. (2007), 'Overeducation and Undereducation in Australia'. *Australian Economic Review* **40**(3), 292–299.

Mortensen, D. (2003), *Wage Dispersion; Why Are Similar Workers Paid Differently?* Cambridge: Massachusetts Institute of Technology.

Mortensen, D. (2009), 'Island matching'. *Journal of Economic Theory* **144**, 2336–2353.

Mortensen, D. (2011), 'Markets with search friction and the DMP model'. *American Economic Review* **101**(4), 1073–1091.

Mortensen, D. and C. Pissarides (1999), 'New developments in models of search in the labor market'. In: O. Ashenfelter and D. Card (eds.): *Handbook of Labor Economics,* vol. 3B. Amsterdam: Elsevier, pp. 2567–2624.

Moscarini, G. (2001), 'Excessive worker reallocation'. *Review of Economic Studies* **68**, 593–612.

Murnane, R. (2008), 'Final reflections'. In: *Research on Future Skill Demands: A Workshop Summary.* Margaret Hilton, rapporteur: National Academy of Sciences, pp. 84–91.

National Research Council (2008), *Research on Future Skill Demands: A Workshop Summary.* Margaret Hilton, rapporteur: National Academy of Sciences.

National Research Council (2010), *Exploring the Intersection of Science Education and 21st Century Skills: A Workshop Summary*. Margaret Hilton, rapporteur: National Academy of Sciences.

Neumark, D., H. P. Johnson, and M. C. Mejia (2011), 'Future skill shortages in the U.S. economy?'. NBER Working Paper No. 17213.

Nickell, S., L. Nunziata, W. Ochel, and G. Quintini (2002), 'The Beveridge-curve, unemployment and wages in the OECD from the 1960's to the 1990's'. In: P. Aghion, R. Frydman, J. Stiglitz, and M. Woodford (eds.): *Knowledge, Information, and Expectation in Modern Macroeconomics*. Princeton: Princeton University Press, pp. 394–431.

Ochsen, C. (2009), 'On the measurement of mismatch'. *Applied Economics Letters* **16**, 405–409.

OECD (2007a), *Offshoring and Employment; Trends and Impacts*. Luxembourg: OECD Publishing.

OECD (2007b), *PISA 2006: Science Competencies for Tomorrow's World,* vol. 1, Analysis. Paris: OECD Publishing.

OECD (2010), *Off to a Good Start? Jobs for Youth*. OECD Publishing.

OECD (2011a), *Education at a Glance 2011: Highlights*. OECD Publishing.

OECD (2011b), *Education at a Glance 2011: OECD Indicators*. OECD Publishing.

OECD (2011c), *OECD Employment Outlook 2011*. OECD Publishing.

OECD (2011d), *Towards an OECD Skills Strategy*. OECD Publishing.

Oyer, P. and S. Schaefer (2010), 'Personnel economics: Hiring and incentives'. In: O. Ashenfelter and D. Card (eds.): *Handbook of Labor Economics,* vol. 4. Elsevier.

Pallais, A. (2010), 'Inefficient hiring in entry-level labor markets'. Working paper, MIT.

Petrongolo, B. and C. Pissarides (2001), 'Looking into the black box: A survey of the matching function'. *Journal of Economic Literature* **39**(2), 390–431.

Pissarides, C. (2000), *Equilibrium Unemployment Theory*. Cambridge: The MIT Press, 2nd edition.

Pissarides, C. (2011), 'Equilibrium in the labor market with search frictions'. *American Economic Review* **101**(4), 1092–1105.

Quinn, M. and S. Rubb (2006), 'Mexico's labor market: The importance of education-occupation matching on wages and productivity in developing countries'. *Economics of Education Review* **22**(4), 389–394.

Quintini, G. (2011a), 'Over-qualified or under-skilled: a literature review'. OECD Social, Employment and Migration Working Papers, No. 121, OECD Publishing.

Quintini, G. (2011b), 'Right for the job: over-qualified or under-skilled?'. OECD Social, Employment and Migration Working Papers, No. 120, OECD Publishing.

Quintini, G. and T. Manfredi (2009), 'Going separate ways? School-to-work transitions in the United States and Europe'. OECD Social, Employment and Migration Working Papers, No. 90.

Reder, M. (1955), 'The theory of occupational wage differentials'. *American Economic Review* **45**(5), 833–852.

Robst, J. (2008), 'Overeducation and the college major: Expanding the definition of mismatch between schooling and jobs'. *The Manchester School* **76**(4), 349–368.

Rogerson, R. and R. Shimer (2011), 'Search in macroeconomic models of the labor market'. In: O. Ashenfelter and D. Card (eds.): *Handbook of Labor Economics,* vol. 4. Elsevier.

Rosen, S. (1975), 'Measuring the obsolescence of knowledge'. In: F. T. Juster (ed.): *Education, Income and Human Behavior*. New York: Carnegie Foundation for the Advancement of Teaching and National Bureau of Economic Research, pp. 199–232.

Roy, A. D. (1951), 'Some thoughts on the distribution of earnings'. *Oxford Economic Papers* **3**(2), 135–146.

Rubb, S. (2009), 'Overeducation among older workers: Impact on wages and early retirement decisions'. *Applied Economics Letters* **16**(16), 1621–1626.

Rycx, F. (2010), 'The impact of educational mismatch on firm productivity: Direct evidence from linked panel data'. Université Libre de Bruxelles.

Şahin, A., J. Song, G. Topa, and G. L. Violante (2011), 'Measuring mismatch in the U.S. labor market'.

Saint-Paul, G. (2008), *Innovation and Inequality: How Does Technical Progress Affect Workers?* Princeton University Press.

Sala, G. (2011), 'Approaches to skill mismatch in the labour market: A literature review'. *Revista De Sociologia* **96**(4), 1025–1045.

Sattinger, M. (1975), 'Comparative advantage and the distributions of earnings and abilities'. *Econometrica* **43**, 455–468.

Sattinger, M. (1980), *Capital and the Distribution of Labor Earnings*. Amsterdam: North Holland.

Sattinger, M. (1993), 'Assignment models of the distribution of earnings'. *Journal of Economic Literature* **31**(2), 831–880.

Sattinger, M. (1995), 'Search and the efficient assignment of workers to jobs'. *International Economic Review* **36**(2), 283–302.

Sattinger, M. (2001), 'Introduction'. In: M. Sattinger (ed.): *Income Distribution, Description, Measurement, Shape, Dynamics,* vol. I, *The International Library of Critical Writings in Economics*. Northampton: Edward Elgar.

Sattinger, M. (2006), 'Overlapping labour markets'. *Labour Economics* **13**(2), 237–257.

Sattinger, M. (2008), 'Introduction to special issue on technology and labor markets'. *Journal of Income Distribution* **17**(3–4), 4–11.

Scarpetta, S., G. Quintini, and T. Manfredi (2010), 'A scarred generation: Leaving school when recession hits'. OECD Social, Employment and Migration Working Papers.

Schweri, J., J. Hartog, and S. C. Wolter (2011), 'Do students expect compensation for wage risk?'. *Economics of Education Review* **30**(2), 215–227.

Scottish Government (2007), *Skills for Scotland; A Lifelong Skills Strategy*. Edinburgh: Scottish Government.

Searle, R. (2003), *Selection and Recruitment: A Critical Text*. Palgrave Macmillan.

Searle, R. (2009), 'Recruitment and Selection'. In: D. G. Collings and G. Wood (eds.): *Human Resource Management, A Critical Approach*. Chapter 9, London: Routledge, pp. 151–168.

Shapiro, H., J. R. K. Lauritzen, and P. Irving (2011), 'Emerging skills and competences-a transatlantic study'. Danish Technological Institute and GHK Consultants.

Shimer, R. (2005), 'The assignment of workers to jobs in an economy with coordination frictions'. *Journal of Political Economy* **113**(5), 996–1025.

Shimer, R. (2007), 'Mismatch'. *American Economic Review* **97**(4), 1074–1101.

Shimer, R. and L. Smith (2000), 'Assortative matching and search'. *Econometrica* **68**, 343–370.

Sicherman, N. and O. Galor (1990), 'A theory of career mobility'. *Journal of Political Economy* **98**(1), 169–192.

Skott, P. (2006), 'Wage inequality and overeducation in a model with efficiency wages'. *Canadian Journal of Economics* **39**(1), 94–123.

Sloane, P., H. Battu, and P. Seaman (1999), 'Overeducation, undereducation and the British labour market'. *Applied Economics* **31**, 1437–1453.

Sloane, P. J. (2003), 'Much ado about nothing? What does the overeducation literature really tell us?'. In: F. Büchel, A. De Grip, and A. Mertens (eds.): *Overeducation in Europe; Current Issues in Theory and Policy*. Cheltenham: Edward Elgar, pp. 11–45.

Slonimczyk, F. (2009), 'Skill Mismatch and Wage Inequality in the U.S.'. University of Massachusetts, Amherst.

Slonimczyk, F. (2012), 'Earnings inequality and skill mismatch in the U.S.'. *Journal of Income Inequality*. forthcoming.

Slonimczyk, F. and P. Skott (2012), 'Employment and distribution effects of the minimum wage'.

Sohn, K. (2010), 'The role of cognitive and noncognitive skills in overeducation'. *Journal of Labor Research* **31**(2), 124–145.

Spitz-Oener, A. (2006), 'Technical change, job tasks, and rising educational demands: Looking outside the wage structure'. *Journal of Labor Economics* **24**(2), 235–270.

Srinivas, S. and M. Sattinger (2007), 'The employment-productivity relationship with employment criteria'. In: S. Polachek and O. Bargain (eds.): *Aspects of Worker Well-Being,* vol. 26 *Research in Labor Economics*. Elsevier, pp. 447–466.

Stiglitz, J. (2012), *The Price of Inequality: How Today's Divided Society Endangers Our Future*. W.W. Norton.

Suen, W. (2007), 'The comparative statics of differential rents in two-sided matching markets'. *Journal of Economic Inequality* **5**, 149–158.

Teichler, U. and H. Schomburg (2007), 'Neither overeducation nor mismatch-recent trends for HE graduates'. Presentation at the OECD Expert Meeting "How might the changing labour market transform higher education," Paris.

Terviö, M. (2008), 'The difference that CEO's make: An assignment model approach'. *American Economic Review* **98**(3), 642–668.

Teulings, C. N. (1995), 'The wage distribution in a model of the assignment of skills to jobs'. *Journal of Political Economy* **103**, 280–315.

Teulings, C. N. (2005), 'Comparative advantage, relative wages, and the accumulation of human capital'. *Journal of Political Economy* **113**(20), 425–461.

Teulings, C. N. and P. A. Gautier (2004), 'The right man for the job'. *Review of Economic Studies* **71**(2), 553–580.

Thisse, J.-F. and Y. Zenou (2000), 'Skill mismatch and unemployment'. *Economics Letters* **69**, 415–420.

Thurow, L. (1975), *Generating Inequality*. New York: Basic Books.

Tinbergen, J. (1951), 'Some remarks on the distribution of labour incomes'. In: A. Peacock et al. (ed.): *International Economic Papers, Translations Prepared for the International Economic Association,* vol. 1. London: Macmillan, pp. 195–207.

Tinbergen, J. (1956), 'On the theory of income distribution'. *Weltwirtschaftliches Archiv* **77**, 156–175.

Tinbergen, J. (1974), 'Substitution of graduate by other labour'. *Kyklos* **27**(2), 217–226.

Tinbergen, J. (1975), *Income Distribution: Analysis and Policies*. Amsterdam: North Holland.

Tolbert, C. and M. Sizer (1996), 'U.S. commuting zones and labor market areas: A 1990 update'. Economic Research Service Staff Paper No. 9614.

Tsacoumis, S. (2007), 'The feasibility of using O*NET to study skill changes'. Paper prepared for the National Academies Workshop on Research Evidence Related to Future Skill Demands.

United States Department of Labor (2012), 'National Center for O*Net Development'. www.onetonline.org.

Valsecchi, I. (2000), 'Job assignment and promotion'. *Journal of Economic Surveys* **14**(1), 31–51.

Van den Berg, G. and A. van Vuuren (2010), 'The effect of search frictions on wages'. *Labour Economics* **17**(6), 875–885.

van Loo, J. and J. Semeijn (2004), 'Defining and measuring competences: An application to graduate surveys'. *Quality & Quantity* **38**, 331–334.

Verhaest, D. and E. Omey (2006), 'The impact of overeducation and its measurement'. *Social Indicators Research* **77**, 419–448.

Vugt, G. V. (2012), 'Inevitably unemployable: An enquiry into the nature of skill demand and supply'. University College Utrecht, Utrecht University.

Wasmer, E., P. Fredriksson, A. Lamo, J. Messina, and G. Peri (2007), 'The macroeconomics of education. Report prepared for the Seventh European Conference of the Fondazione Rodolfo Debenedetti, Venice'. In: G. Brunello, P. Garibaldi, and E. Wasmer (eds.): *Education and Training in Europe*. Chapter I, New York: Oxford University Press.

Weigel, T., M. Mulder, and K. Collins (2007), 'The concept of competence in the development of vocational education and training in selected EU member states'. *Journal of Vocational Education and Training* **59**(1), 51–64.

Weightman, G. (2007), *The Industrial Revolutionaries; The Making of the Modern World, 1776–1914*. Grove Press.

Weinberg, B. (2004), 'Experience and technology adoption'. IZA Discussion Paper No. 1051.

Willis, R. J. and S. Rosen (1979), 'Education and self-selection'. *Journal of Political Economy* **87, Part 2**(5), S7–S36.

Winterton, J., F. Delamare Le Deist, and E. Stringfellow (2005), 'Typology of knowledge, skills and competences: Clarification of the concept and prototype'. Centre for European Research on Employment and Human Resources Groupe ESC Toulouse, Research report elaborated on behalf of CEDEFOP/Thessaloniki.