



Mismatch in the 21st century: An overview

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ABSTRACT

Technological change, demographic pressures, and the green transition are reshaping labor markets, highlighting the importance of understanding how workers' skills align with job requirements. This paper surveys the theoretical and empirical literature on worker-job mismatch, focusing on skill mismatch and distinguishing it from related concepts including hiring difficulties, sectoral mismatch unemployment, and broader allocative inefficiency. We discuss the forms that mismatch can take in the labor market and review their empirical measures. Recent contributions highlight the importance of multidimensional skills and the potential of employer-employee data and machine-learning methods to measure mismatch when direct skill information is unavailable. We then review the main theoretical mechanisms through which mismatch arises, emphasizing search frictions and imperfect information and learning. We also survey evidence on the determinants of mismatch, including labor-market institutions, financial constraints, geography, managerial practices, technological change, and migration, and on its consequences for wages, career outcomes, productivity, and employment. Finally, we discuss policies to reduce mismatch and identify open questions for future research.

1. Introduction

Heterogeneity is intrinsic to labor markets. Workers differ in their abilities, skills, preferences, and constraints; jobs differ in the tasks they require, the technologies they use, and the amenities they offer; and firms differ in productivity, management quality, and organizational practices. Economic outcomes depend on how the two sides of the market are matched. When workers' skills are well aligned with job requirements, firms can use labor more productively, and workers can earn higher wages, progress in their careers, and derive greater satisfaction from their jobs. When this alignment fails, the consequences can be substantial: mismatch may reduce productivity, depress wages, slow career progression and contribute to unemployment (see for instance, Baley et al., 2022; Coraggio et al., 2025; Fredriksson et al., 2018). Understanding the nature, determinants, and consequences of occupational mismatch has therefore become a central focus for researchers and policymakers (Brunello and Wruuck, 2021).

These issues are especially salient today. According to the 2023

Survey of Adult Skills, the fraction of mismatched workers ranges between 33% and 36% in OECD countries, with notable differences across countries (OECD, 2024). Many firms report difficulties filling vacancies, while workers often hold qualifications or skills that are not fully used in their jobs. Meanwhile, the green transition, digitalization, artificial intelligence, aging, and work reorganization after COVID-19 are changing the demand for skills and the allocation of workers across firms, occupations, and locations. In particular, the availability of digital skills has often not kept pace with the increased demand for such skills by firms: in some countries close to half of the adult population lacks problem-solving and digital competencies (OECD, 2024). These transformations make it increasingly important to understand not only whether mismatch exists, but also how to measure it, where it comes from, and which policies can reduce it.

Despite a large and growing literature, there is still no comprehensive review that brings together the theoretical, measurement, empirical, and policy dimensions of occupational mismatch in a unified framework. Existing contributions often focus on specific aspects, such

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as overeducation, skill shortages, or the productivity effects of mismatch. This survey aims to systematize the literature more broadly. We distinguish skill mismatch from related but distinct notions, such as sectoral mismatch unemployment, hiring difficulties, and general allocative inefficiency. We then review how mismatch is modeled, measured, and empirically studied, emphasizing recent work treating skills as multidimensional and using richer employer-employee data to capture the alignment between workers and jobs.

Section 2 discusses the forms that mismatch can take in the labor market and Section 3 reviews its measurement, distinguishing between objective and subjective approaches. Section 4 reviews theoretical frameworks to show how mismatch can arise from search frictions and imperfect information. Section 5 examines the determinants of mismatch from an empirical perspective and Section 6 discusses the consequences of mismatch for productivity, wages, careers, unemployment, and underemployment, while carefully distinguishing evidence on skill mismatch from evidence on broader forms of worker misallocation. Section 7 reviews the policies that may reduce mismatch. Section 8 concludes by identifying open questions, with particular emphasis on data needs, team-level mismatch, and structural transformations.

2. Forms of mismatch

Mismatch is a complex concept and can refer to different aspects of labor market dynamics. For instance, it may encompass the misallocation of job seekers across sectors or occupations. We focus on a specific definition of skill mismatch: the misalignment between workers' skills and job requirements.¹ Even under this narrower definition, the literature shows that mismatch is multifaceted, as reflected in its forms. Mismatch can be *vertical*—a discrepancy between the level of skills a worker possesses and those required for the job—or *horizontal*—the misalignment between the type of skills possessed by a worker and those required by her job.

With vertical mismatch, workers may possess a higher or lower level of skills than their jobs require. Early research primarily measured it through education, focusing on overeducation, defined as having more education than is required for the job (Freeman, 1976; Duncan and Hoffman, 1981; Leuven and Oosterbeek, 2011). This literature generally finds that overeducated workers earn less than similarly educated workers in appropriately matched jobs, although they may earn more than less-educated workers performing comparable jobs. A smaller literature has examined undereducation and firm-level outcomes. Kampelmann and Rycx (2012), for example, find that overeducation and undereducation have different implications for firm productivity.

Education, however, imperfectly proxies both worker skills and job requirements, because skills may be acquired through experience and on-the-job learning and because workers with the same education may differ substantially in their competencies (McGuinness and Wooden, 2009; Flisi et al., 2017). Recent studies therefore use direct or survey-based measures of skills and distinguish educational mismatch from skill mismatch, including overskilling and underskilling (Desjardins and Rubenson, 2011; Flisi et al., 2017; McGuinness et al., 2018). Overskilling is associated with lower wages and job satisfaction, a greater propensity to leave the job, weaker skill development, and a higher risk of subsequent unemployment. Its estimated wage penalty is generally smaller than that associated with overeducation. By contrast, the literature on underskilling remains extremely limited, with little systematic evidence on its consequences (McGuinness et al., 2018).

Horizontal mismatch concerns skill content rather than level. When

measured through education, it identifies workers employed in jobs unrelated to their field of study. Field-of-study mismatch is associated with lower wages and job satisfaction and with a greater likelihood of regretting one's educational choices (Somers et al., 2019). This measure is also imperfect because it misses skills acquired after formal education or specialization within fields. A further complexity stems from the multidimensional nature of skills. A large literature shows that both cognitive and non-cognitive skills matter in the labor market, shaping wages, employment, work experience, and occupational choices (Bowles et al., 2001; Heckman et al., 2006). Recent work, therefore, moves beyond one-dimensional measures to study how workers and jobs may be misaligned across multiple skill dimensions and shows that a poor fit between the types of skills workers possess and those required by their jobs is associated with lower wages and wage growth, greater job or occupational mobility, and slower skill accumulation, with potentially persistent effects on subsequent careers (Fredriksson et al., 2018; Lise and Postel-Vinay, 2020; Guvenen et al., 2020).

Related concepts include skill gaps, skill shortages, and skill obsolescence. Skill gaps are closely related to underskilling, but they usually refer more specifically to deficits in particular competencies needed to perform the current job, rather than to an overall mismatch between a worker's skill level or skill bundle and job requirements. This distinction points to margins addressable through training within the existing match, rather than through worker reallocation across jobs. Skill shortages, by contrast, describe firms' difficulty in finding workers with the required skills to fill vacancies. Skill obsolescence refers to the declining economic value of existing skills, either because skills depreciate over their life cycle or because technological change alters task requirements. Employer reports often point to widespread hiring difficulties, but this evidence should be interpreted with caution: vacancy bottlenecks may reflect wages, working conditions, recruitment practices, or local labor-market frictions rather than genuine skill shortages (Weaver and Osterman, 2017; Cedefop, 2015). Similarly, technological change can make some skills less valuable while increasing demand for others, as with computerization and the declining demand for routine tasks (Autor et al., 2003; Hudomiet and Willis, 2022). Because these concepts differ, their measurement also differs: skill gaps and obsolescence are typically assessed at the worker or job level, whereas skill shortages are usually measured at the firm or vacancy level.

3. Measuring mismatch

Measuring mismatch reflects the complexity of the concept. Any measure must define a benchmark against which workers' endowments can be compared with job requirements. Existing approaches can be grouped into objective, subjective, and mixed methods. Objective measures rely on external classifications or infer requirements from realized matches; subjective measures rely on workers' own assessments of job requirements or match quality; and mixed measures combine external benchmarks with self-reported information. Across all three approaches, early measures often used education as a proxy for skills, comparing workers' schooling with externally defined or self-reported requirements. As discussed in the previous section, however, education is an imperfect proxy: workers with the same schooling may differ in their abilities and task-specific competencies, and jobs with similar educational requirements may involve different tasks. The literature has therefore increasingly moved toward more direct measures of skills.

Objective methods evaluate worker-job matches by comparing workers' observed qualifications, abilities, or skills with externally defined job requirements. In expert-based approaches, job classification systems such as DOT or O*NET are used to define the education levels and skills required for each occupation. These requirements are then compared with workers' qualifications. Expert classifications can also be combined with richer information on tasks and skill requirements to construct multidimensional measures of mismatch (Lise and Postel-Vinay, 2020; Guvenen et al., 2020).

¹ We also note that the term "mismatch" is associated with different interpretations in the economics literature. Specifically, mismatch can also be interpreted as the possibility that unemployed workers may fail to seek employment in the sectors where jobs are available, generating "mismatch unemployment" as in Şahin et al. (2014).

A second objective approach infers job requirements from realized matches, using the education level or skill of workers in the same occupation as a benchmark (Verdugo and Verdugo, 1989; Kiker et al., 1997). A refined version, introduced by Fredriksson et al. (2018), uses multidimensional measures of skills and benchmarks them against those of tenured workers in the same occupation-firm cell, based on the idea that tenure reveals high-quality matches. Measures based on realized matches can adapt to changes over time and are therefore less likely than expert-based measures to become outdated during periods of rapid technological change. However, they still require detailed data on workers' skills, which are rarely available in administrative records. Coraggio et al. (2025) address this limitation by using machine-learning methods to infer optimal worker–job assignments from realized matches between worker characteristics, employment histories, and occupations in high-productivity firms. This flexibility comes at the cost of a less transparent mapping between worker skills and job requirements.

Subjective methods rely on workers' own assessments of job requirements or match quality. Indirect measures ask employees what level of education or skills their job requires and compare this with their own endowments, as in early self-reported measures of required education (Duncan and Hoffman, 1981). Direct measures ask workers whether their education or skills are well matched to their job. This type of information can distinguish educational mismatch from skill mismatch and capture aspects of match quality that are difficult to observe in administrative or expert-coded data, such as skill use, job-specific requirements, and perceived overqualification (Chevalier, 2003; Allen and Van der Velden, 2001).

Mixed methods combine external classifications or objective indicators with workers' own assessments of match quality. Chevalier (2003) and Chevalier and Lindley (2009), for example, distinguish “apparent” from “genuine” overeducation by combining occupation- or qualification-based measures with self-reported information on the appropriateness of the match. Bédoué and Giret (2011) similarly compare objective and subjective definitions of mismatch among vocational graduates. Other studies use broader survey-based indicators that jointly capture formal qualification mismatch and perceived skill use or overqualification, especially when education and skill mismatch cannot be cleanly separated (Budría and Moro-Egido, 2008; Green and Zhu, 2010).

Measures of skill shortages typically take the employer (demand) side as their starting point. Some studies use firm surveys on employers' reports of hard-to-fill vacancies, missing skills, and adjustment strategies to identify shortages and their consequences for firms (Bennett and McGuinness, 2009; Healy et al., 2015). Others use more aggregate indicators of labor demand and supply to assess whether projected employment needs are likely to exceed the available stock of workers with specific qualifications or skills (Neumark et al., 2013). These measures are useful for understanding how firms respond to shifting skill demands, but they should be interpreted with caution, since reported hiring difficulties may reflect wages, working conditions, recruitment practices, or local labor-market frictions rather than a pure skills shortage.

4. Theoretical frameworks

We now turn to the mechanisms through which mismatch arises. Skill mismatch occurs when workers' qualifications, abilities, or skills do not align with job requirements. A natural starting point is therefore the heterogeneity of workers and jobs in decentralized labor markets, where frictions prevent workers and firms from instantaneously identifying and forming the best possible matches. The theoretical literature highlights two broad mechanisms through which on-the-job mismatch between workers' skills and job requirements can arise and persist: search frictions, which prevent workers and firms from instantaneously finding the best available match, and imperfect information, which limits workers' and firms' ability to assess skills, job requirements, and match

quality *ex ante*. These mechanisms are amplified by the multidimensional nature of skills, since workers and jobs may be well aligned along some dimensions but poorly matched along others.

4.1. Search models

Search-based theories emphasize that matching workers to jobs is costly and uncertain. In the canonical random job-search model, workers receive offers sequentially and decide whether to accept them according to a reservation-wage rule (McCall, 1970). Although this framework is not, *per se*, a theory of skill mismatch, it shows how search costs can lead workers to accept imperfect jobs rather than continue searching. Subsequent literature shows that biased beliefs (Mueller et al., 2021) and worsening employment prospects over the unemployment spell (Jarosch, 2023) can further distort search behavior and generate persistent losses after job displacement.

The Diamond-Mortensen-Pissarides framework extends the analysis to a two-sided search framework, in which unemployed workers and vacancies meet through an aggregate matching function, and wages are typically determined by bargaining over match surplus (Diamond, 1982; Mortensen and Pissarides, 1994). In these models, labor-market tightness affects the probability that workers find jobs and firms fill vacancies. Market efficiency, then, depends on how the surplus from matches is shared and on whether search externalities are internalized, as emphasized by the canonical efficiency condition in search equilibrium (Hosios, 1990) and by later work on investment, hold-up, and labor-market slack (Acemoglu and Shimer, 1999; Michaillat, 2012; Landais et al., 2018). These models mainly explain unemployment and vacancy dynamics, but they also provide a mechanism through which mismatch can arise. When search is costly and connections are imperfect, workers and firms may form matches that are feasible but not optimal.

Models with on-the-job search add another channel. Burdett and Mortensen (1998) highlight how job-to-job transitions create wage dispersion and potential misallocation if firms differ in productivity, while later work by Postel-Vinay and Robin (2002) and Cahuc et al. (2006) shows how worker and firm heterogeneity, counteroffers, and employer competition contribute to shaping wage dynamics and matching quality. These models predict that mismatch declines over workers' careers as job-to-job transitions allow workers to move toward better matches, but frictions and heterogeneity can slow this reallocation.

Directed search models highlight workers' and firms' ability to target specific submarkets or vacancies. When agents anticipate congestion, they choose where to search and what terms to offer accordingly (Acemoglu and Shimer, 1999; Albrecht et al., 2006; Shi, 2002). This framework is especially useful for thinking about mismatch because workers with different skills may direct their search toward different jobs, and coordination failures or application frictions can prevent efficient sorting (Menzio and Shi, 2011).

Most canonical search models treat worker ability and job requirements as one-dimensional, abstracting from skill content. As already mentioned, a recent literature instead emphasizes that skills are multidimensional and may differ in how they are rewarded, accumulated, and lost over time. For example, Lise and Postel-Vinay (2020) distinguish between cognitive, manual, and interpersonal skills, showing that a worker may be well matched to a job along some dimensions but poorly matched along others, and that the type of job held also affects future skill accumulation. Choné and Kramarz (2021) similarly study how labor-market outcomes depend on whether workers' skills are used jointly within a firm or can be separated and allocated across different technologies.

4.2. Imperfect information models

Mismatch may arise not only from search frictions, but also from

imperfect information. Workers, firms, or both may be uncertain about workers' abilities, job requirements, or the productivity of a particular worker-job match. In this context, mismatch can evolve over the career as agents learn about match quality and comparative advantage through work experience and mobility (Jovanovic, 1979; Gibbons et al., 2005). Recent work extends this logic to multidimensional skills: De Dominicis (2025) develops a model in which workers enter the labor market with imperfect information about their skill bundles, learn through work experience, and sort across occupations accordingly. Empirically, Topel and Ward (1992) show that job mobility is concentrated in the first years of workers' careers and is associated with substantial wage gains, a pattern consistent with workers moving toward better matches. Consistently, recent empirical work finds that poorer matches are associated with lower wages and greater subsequent mobility (Fredriksson et al., 2018; Coraggio et al., 2025).

Imperfect information can also affect how workers are assigned to jobs within firms. When current employers observe workers' abilities more accurately than outside firms, promotions and job assignments may reveal information to the external labor market. Firms may therefore under-promote their employees to limit poaching, with consequences for the efficiency of worker-job matches within the firm (Waldman, 1984). Promotion signaling can also shape human-capital investment. If certain assignments make workers more visible to outside employers, firms and workers may invest differently in general, firm-specific, or task-specific skills (Waldman and Zax, 2020). A related mechanism operates before workers enter the labor market, when education serves as a signal of ability. In this case, schooling may help workers convey information to firms, but educational choices can also be inefficient when they alter employers' beliefs and affect employment prospects in equilibrium (Charlot and Decreuse, 2005; Ordine and Rose, 2009).

Recent models combine learning and multidimensional skills to study how mismatch evolves over workers' careers. In these frameworks, workers are uncertain about their skills or about the jobs in which those skills are most productive, and mobility allows them to learn and reallocate across jobs, career paths, or levels of job complexity. Guvenen et al. (2020) measure multidimensional mismatch as the distance between workers' skill bundles and the skill requirements of their occupations. They show that mismatch is associated with lower wages and evolves systematically over the life cycle, highlighting that worker-job fit cannot be captured by a single skill index. Baley et al. (2022) formalize and estimate a model that features both incomplete information and search frictions, in which workers learn about their skills as they move across jobs and career paths. They show that recessions can have ambiguous effects on mismatch. On the one hand, downturns may destroy poorly matched ongoing jobs, reducing mismatch among continuing matches through a "cleansing" effect. On the other hand, they may push workers into less complex jobs, increasing mismatch among new hires through a "sully" effect. The model also predicts that mobility within a career path tends to reduce mismatch as workers learn about their fit, whereas moves across career paths can increase mismatch because workers have less information about skills that were not previously used.

The empirical literature reviewed in the next section examines which forces affect search or informational frictions in practice and thereby shape the prevalence and persistence of mismatch. Hence, these two mechanisms provide a useful map and a theoretical rationale for the evidence that follows. Labor-market institutions, financial constraints, geographical factors, and macroeconomic fluctuations primarily affect search frictions. Managerial practices and immigration primarily relate to information frictions. Other forces, such as technological change and large demand shocks, alter the skills required by jobs or the value of workers' existing human capital, interacting with both search and information frictions.

5. Determinants of mismatch

Skill mismatch reflects the search and imperfect-information frictions discussed in Section 4 and its intensity depends on a broader set of economic forces that either amplify or dampen those frictions. We review these forces looking both at studies that measure skill or qualification mismatch directly and at others that examine spatial or sectoral mismatch, worker-firm sorting, or broader labor reallocation, whenever the latter illuminate mechanisms through which worker-job mismatch may arise or persist.

Labor market institutions affect how readily matches are formed and dissolved. Hiring and firing costs influence whether poorly matched workers are replaced and how readily firms reallocate labor. Employment protection can reduce worker turnover and slow down reallocation, with potential adverse consequences for productivity (Autor et al., 2007). When firing costs vary across workers or interact with financial constraints, firms may retain or dismiss workers for reasons unrelated to match quality, leading to inefficient labor allocation (Caggese et al., 2019). Consistently, cross-country evidence links stricter employment protection and lower labor mobility to higher measured skill mismatch (Brunello et al., 2007; McGowan and Andrews, 2015b). Evidence from reforms provides a more direct link to qualification mismatch. Berton et al. (2017) and Maida and Tealdi (2021) show that changes in dismissal costs affect over- and under-qualification. At the same time, reforms that increase reliance on temporary contracts may generate labor-market dualism and weaken career progression for some workers (Daruich et al., 2023). These findings fit the search mechanism discussed in Section 4.1: labor-market institutions affect the cost and speed with which workers and firms can correct poor matches.

Financial constraints provide a related channel that restricts workers' opportunity sets and their ability to move toward more suitable jobs. Workers may need resources to acquire new skills, relocate, or sustain longer job searches while waiting for better matches. Firms may also finance training, including general training, when imperfect labor markets, information asymmetries, or monopsony power allow them to capture part of the return (Katz and Ziderman, 1990; Acemoglu and Pischke, 1999). Such training may reduce skill gaps within existing matches or prepare workers for subsequent mobility. Even so, workers' own liquidity remains important. Recent evidence shows that credit and liquidity constraints affect job finding, sorting, and labor-market outcomes, suggesting that financial access can improve workers' ability to search for and move into better matches (Herkenhoff et al., 2024; He and Le Maire, 2023; Van Doornik et al., 2024).

Geographical factors similarly restrict the set of feasible worker-job pairings. Distance and relocation costs limit the set of jobs workers search for and are willing to accept (Marinescu and Rathelot, 2018; Le Barbanchon et al., 2021). Negative home equity, housing illiquidity, and leverage may reduce mobility or affect job-search behavior, thereby further constraining workers' ability to move toward better employment opportunities (Head and Lloyd-Ellis, 2012; Bernstein and Struyven, 2022). This literature mainly concerns spatial search and unemployment due to geographic mismatch rather than skill mismatch among employed workers. McGowan and Andrews (2015b) specifically investigate whether policies aiming at reducing barriers to residential mobility are associated with lower skill mismatch, using cross-country data. Firms may also mitigate geographical frictions by reallocating employment opportunities across local labor markets, especially when they operate in multiple locations (Gong et al., 2024). Finally, remote work can reduce the importance of distance for some occupations, potentially changing the geography of matching (Barrero et al., 2023).

Macroeconomic fluctuations can also worsen worker-job match quality and, in some settings, measured mismatch. Recessions reduce job opportunities and may push workers into lower-quality or less suitable jobs, with effects that can persist over time (Bowlus, 1995; Baley et al., 2022). Summerfield and Theodossiou (2017) provide evidence more directly related to qualification mismatch, showing that

adverse conditions at labor-market entry increase subsequent over-education. Evidence on displaced workers points in a similar direction. Post-displacement earnings losses depend not only on job loss itself but also on whether workers move into occupations that require skills similar to those used in their previous jobs (Neffke et al., 2024).

The determinants considered so far affect the cost and scope of search and mobility. A second set of determinants of skill mismatch operates mainly through information frictions.

Managerial quality and personnel practices shape the way firms internally match workers to jobs and determine their promotions along the job ladder. A large literature shows that high-quality management practices raise firm productivity and improve organizational performance (Bloom and Van Reenen, 2007; Bloom et al., 2013, 2019). Insofar as better managers select, assign, monitor, and promote workers more effectively, management quality improves the allocation of talent within firms: indeed, Coraggio et al. (2025) show that job mismatch is lower in better-managed firms. Conversely, weak governance and conflicts of interest distort promotion and assignment decisions, especially when career advancement depends on loyalty, family ties, or other non-meritocratic criteria rather than match quality (La Porta et al., 2000; Burkart et al., 2003; Bennedsen et al., 2007; Bandiera et al., 2018; Di Porto et al., 2024). Deviations from meritocratic allocation may also arise from discrimination in personnel practices (Gao et al., 2023).

Immigration is another source of mismatch related to information frictions, while also potentially alleviating shortages. Migrants often hold educational credentials and work experience acquired abroad, which may not transfer perfectly to destination-country labor markets. As a result, immigrants are more likely than natives to experience educational or occupational mismatch, although the pattern varies by origin, destination, and occupation (Nieto et al., 2013; Visintin et al., 2015). Skill-based measures complicate this picture, since migrants may appear overeducated while lacking destination- or occupation-specific skills (McGowan and Andrews, 2015a).

Other determinants, related to technology or demand, do not primarily change search costs or information. Instead, they alter the skills required by jobs or the value of workers' existing human capital.

Technological change can generate mismatch by changing job requirements faster than workers' skills adjust. Skill-biased technological change increases the demand for some types of skills relative to others, potentially widening the gap between workers' existing skills and job requirements (Goldin and Katz, 2008). Task-based technological change further alters the content of jobs by replacing some tasks while complementing others. Computerization and automation have reduced demand for routine tasks and contributed to occupational restructuring and polarization (Autor et al., 2003; Acemoglu and Autor, 2011; Goos et al., 2014; Atalay et al., 2020). More recent technologies, including AI, are currently affecting a different set of tasks, including cognitive and non-routine activities, and their implications for skill mismatch depend on whether they substitute for workers' existing skills or create new tasks in which labor has a comparative advantage (Acemoglu and Restrepo, 2019, 2022). This literature generally documents changes in task content and labor demand rather than worker-level mismatch. Its implication is that rapid changes in job requirements can render previously suitable skills less valuable when retraining and mobility are costly.

Large demand shocks can produce similar reallocations. Trade shocks also shift labor demand across sectors and occupations. Autor et al. (2013) show that rising Chinese import competition displaced workers in exposed local labor markets, while Autor and Dorn (2013) link routine-task specialization to job polarization. The COVID-19 pandemic generated abrupt and uneven changes in labor demand and accelerated the diffusion of telework; applying the framework of Şahin et al. (2014), Pizzinelli and Shibata (2023) find that sectoral mismatch unemployment rose sharply at the onset of the pandemic but returned to earlier levels within a few quarters. The low-carbon transition may also

generate new forms of skill mismatch or skill shortages by increasing demand for green and technical skills faster than the workforce can adjust. Evidence on green stimulus suggests that employment effects depend on the sectoral and regional capacity to absorb new green investments (Popp et al., 2022).

6. Effects of mismatch

Skill mismatch matters because it affects how effectively workers' abilities are used in production. Better worker-job matches should raise productivity when workers are assigned to tasks where their skills are most valuable and should improve workers' wages, mobility, and career progression when match quality is rewarded in the labor market. The evidence reviewed in this section distinguishes studies that directly measure skill or job mismatch from related work on broader forms of talent misallocation.

6.1. Productivity

At the firm level, mismatch can reduce productivity by preventing workers from being allocated to the tasks or jobs in which they are most effective. Direct evidence on job mismatch supports this. Coraggio et al. (2025) show that firms with better worker-job matches display higher productivity, even after controlling for standard firm-level determinants. Similarly, cross-country OECD evidence from PIAAC shows that skill mismatch is associated with lower labor productivity, especially when skilled workers are trapped in less productive firms and more productive firms face difficulties in expanding (McGowan and Andrews, 2015a). Evidence on educational mismatch also suggests that the composition of workers' qualifications within firms matters for productivity (Kampelmann and Rycx, 2012).

Related literature shows that better management can improve productivity by optimizing the allocation and use of workers within organizations. Minni (2026) shows that managers affect output by reallocating workers to more suitable tasks, while Fenizia (2022) finds that managerial quality raises productivity in the public sector. These papers do not measure mismatch in the narrow sense used here, but they support the broader mechanism through which assignment and personnel practices affect productive efficiency. More generally, the productivity cost of misallocating talent can be high. Hsieh et al. (2019) estimate that reducing racial and gender barriers to occupational choice accounts for a large share of U.S. productivity growth, while Bandiera et al. (2024) show that meritocratic, skill-based sorting is important for the gains from adopting frontier technologies. Calibrated models focused more directly on mismatch suggest that eliminating skills and education mismatch would raise output by 0.26% on average across U.S. states (Garibaldi et al., 2025a) and by 3–4% on average across OECD countries (Garibaldi et al., 2025b).

6.2. Wages and careers

Mismatch also shapes earnings and careers. Studies using multidimensional measures of mismatch find that workers whose skills are poorly aligned with occupational requirements earn lower wages and experience different mobility patterns. Guvenen et al. (2020) show that multidimensional skill mismatch is associated with wage losses and slower wage growth. DeLoach et al. (2022) further show that mismatch in non-cognitive skills is associated with occupational switching, highlighting that mismatch is not limited to cognitive or educational dimensions. Fredriksson et al. (2018) find that lower match quality reduces entry wages and predicts subsequent job mobility, consistent with workers moving away from poor matches. Coraggio et al. (2025) find that match quality improves particularly rapidly early in workers' careers and that better-matched workers earn higher wages and switch employers less frequently. How the gains from better matching are shared between workers and firms depends on labor-market institutions

and bargaining power. In settings where workers have substantial bargaining power, part of the surplus from improved allocation may be captured through wages rather than firm profits. These results are consistent with the search and learning mechanisms discussed in Section 4, although the measures necessarily rely on assumptions about which observed assignments reveal a good match, as explained in Section 3.

6.3. Unemployment and underemployment

Mismatch can contribute to unemployment and underemployment when workers are unable to find jobs that effectively use their skills. In the narrow skill-mismatch sense, this may occur when workers who accept jobs below their skill level remain underemployed or move into occupations that do not use their human capital. In a broader allocation sense, mismatch can also raise unemployment when job seekers search in sectors or locations where vacancies are scarce relative to the number of workers. Şahin et al. (2014), for example, study sectoral mismatch unemployment and show that this form of mismatch rose during the Great Recession.

Job displacement is another setting in which mismatch affects subsequent outcomes. Workers who lose jobs where their skills are well used may struggle to find new positions that require similar skills. Neffke et al. (2024) show that post-displacement earnings losses depend on the skill distance between workers' origin and destination occupations, suggesting that the cost of displacement is partly driven by the loss of occupation-specific or task-specific human capital. More generally, adverse shocks can have persistent effects on employment and earnings when they force workers into poorer matches or reduce the value of their accumulated skills. These persistent effects are related to the broader literature on labor-market scarring and hysteresis (Cerra et al., 2023), although that literature is not exclusively about mismatch.

7. Policies affecting mismatch

Policies can target the different margins in the theoretical frameworks reviewed in Section 4. Search assistance, housing policy, employment protection, and standard unemployment insurance primarily affect the cost and duration of search or mobility. Recommendation systems and credential-recognition policies also sharpen the information available to workers and firms. Education and training alter workers' skills directly, while wage-setting, bankruptcy, and migration policies operate through broader reallocation or labor-supply channels.

Improvements in labor-market information directly aim to affect skill-job match quality, as digital tools and recommendation systems can help job seekers identify vacancies that better fit their skills, preferences, and constraints. Evidence from large-scale experiments suggests that such tools can increase job finding and improve search outcomes. In France, Behaghel et al. (2022) find that automated recommendations increase job-finding rates, particularly for women, and may raise aggregate employment. In Denmark, Altmann et al. (2022) show that online advice to job seekers increases re-employment working hours and earnings, although competitive spillovers reduce these gains when many workers receive the treatment. In Sweden, Le Barbanchon et al. (2023) show that personalized online job recommendations based on job seekers' click histories increase employment, especially among unemployed and less-educated workers. Other policies may achieve a **reduction in the cost of job search**: a field experiment in South Africa shows that subsidizing transportation allows job seekers to search more intensively, update their beliefs, and access better employment opportunities (Banerjee and Sequeira, 2023).

Labor-market flexibility has more ambiguous implications. Strict dismissal rules can slow reallocation and make it harder for firms to replace poorly matched workers, while reducing firing costs can, in some contexts, improve qualification match or worker allocation (Davis and Haltiwanger, 2014; Berton et al., 2017; Maida and Tealdi, 2021). At the same time, excessive reliance on temporary contracts may generate

labor-market dualism and weaken career progression for some workers (Daruich et al., 2023). Wage-setting institutions can also affect reallocation. Minimum wages, for example, may reduce inefficient turnover in some settings but may also create lock-in effects if they compress wage differences across firms or jobs (Brochu and Green, 2013; Dube et al., 2016). Evidence from Germany and Brazil shows that minimum wages can reallocate low-wage workers toward more productive firms without large employment losses (Dustmann et al., 2022; Engbom and Moser, 2022). These papers are best interpreted as evidence on firm allocative efficiency, rather than on skill mismatch narrowly defined. Similarly, policies that limit local wage adjustment can increase geographic misallocation and worsen local unemployment (Boeri et al., 2021). Flexible work arrangements, including telework, job sharing, and part-time work, may help some workers use their skills more effectively by relaxing time or location constraints, but they may also reduce training opportunities or have uneven effects across groups (Felstead et al., 2000; Garner et al., 2014).

Unemployment insurance (UI) systems can also affect skill-job matching: more generous UI can improve match quality by allowing longer and more directed search, although excessive generosity may also reduce search effort. Classical models therefore predict a trade-off between insurance and incentives, with potential gains in match quality when UI prevents workers from accepting unsuitable jobs too quickly (Diamond, 1981; Marimon and Zilibotti, 1999). The empirical evidence is mixed. Boeri and Macis (2010) show that the introduction of unemployment benefits led to positive job reallocation across a panel of OECD countries. Nekoei and Weber (2017) find that longer UI duration improves the quality of the firms where unemployed workers eventually find jobs and raises subsequent wages. Other studies find small or negative effects on post-unemployment wages (Card et al., 2007; Lalive, 2007; Van Ours and Vodopivec, 2008; Schmieder et al., 2016). These studies, however, provide only indirect evidence on mismatch. Farooq et al. (2020) find that UI extensions improve earnings-based measures of worker-firm match quality and the quality of employers hiring workers from nonemployment. Furthermore, the longer potential benefit duration reduces the disparity between workers' educational attainment and the educational requirements of their subsequent occupations for some groups.

Housing and mobility policies can also affect mismatch by changing the geographic scope of workers' search. High rents, transaction costs, credit constraints, and restrictive land-use regulations may prevent workers from moving toward jobs that better fit their skills. Policies that reduce barriers to residential mobility can therefore improve matching, although the evidence often captures broad labor-market mobility rather than skill mismatch alone. Cross-country evidence suggests that skill mismatch is lower where residential mobility is less constrained (McGowan and Andrews, 2015b). Relocation and neighborhood policies may also affect long-run labor-market opportunities by changing where households can live and search, although studies such as Chetty et al. (2016) speak more directly to neighborhood exposure and intergenerational outcomes than to narrowly defined labor-market mismatch.

Policies affecting firm exit and restructuring may influence mismatch through broader reallocation channels. Bankruptcy laws and insolvency procedures can affect whether low-productivity firms survive and whether workers remain tied to firms where their skills are poorly used. Andrews and Cingano (2014) show that policy settings affecting entry, exit, and resource reallocation are related to productivity differences across countries. Li and Ponticelli (2022) find that the introduction of specialized bankruptcy courts in China improved the reallocation of employment away from zombie firms. These studies speak primarily to allocative efficiency and firm dynamics, rather than to skill mismatch narrowly defined, but they identify mechanisms through which labor may be reallocated toward more productive uses. Bankruptcy rules may also affect access to credit and firms' ability to finance training, restructuring, or hiring, thereby indirectly influencing worker-job

matching (Davydenko and Franks, 2008).

Education and training policies address mismatch more directly by changing workers' skills and their ability to adapt to evolving job requirements. While technology and structural change move the demand for skills, education and training determine how rapidly the supply of skills can adjust. Active labor-market programs tend to have modest short-run effects but more positive medium-run effects, especially those that build human capital rather than only subsidize employment (Card et al., 2018). Training can be particularly important for displaced workers and low-skill workers whose existing skills are no longer well aligned with labor demand (Jacobson et al., 2005). Lifelong learning is associated with lower mismatch in cross-country evidence (McGowan and Andrews, 2015b). On-the-job training is also central: Ma et al. (2024) show that it accounts for a large share of cross-country differences in lifetime wage growth, partly by allowing workers to acquire skills after labor-market entry. The design of education systems matters as well. Since educational mismatch and skill mismatch are distinct phenomena, policies that improve the adaptability and specificity of training may be especially valuable when formal qualifications are poor proxies for the skills used in the workplace (Flisi et al., 2017).

Finally, **migration policies** can affect mismatch and shortages by changing the supply of skills available to firms. When domestic labor supply is insufficient, immigration can alleviate shortages in specific occupations or sectors. Policies that reduce barriers for high-skill migrants, including preferential tax treatment or return-migration incentives, may help attract scarce talent. Evidence on these policies remains limited, but Bassetto and Ippedico (2023) find that returnee tax schemes in Italy increased inflows of highly skilled workers. At the same time, migration can also generate a mismatch if foreign credentials or experience are only partially transferable to the destination labor market. Thus, migration policy is most likely to reduce mismatch when it is paired with effective credential recognition, language acquisition, and integration into occupations that use migrants' skills. Direct evaluations of these complementary policies remain limited.

Overall, the literature on policies aimed at improving occupational match quality provides evidence that public interventions can affect search behavior, employment, wages, mobility, and worker-firm allocation, but less direct evidence that they reduce job-skill mismatch itself. The most direct evidence comes from studies of qualification mismatch, cross-country analyses relating institutions and lifelong learning to measured skill mismatch, and a smaller set of interventions that explicitly alter workers' skills. This distinction is substantive: a policy can raise employment or move workers toward more productive firms without necessarily improving skill-job alignment, while training can reduce skill gaps within existing jobs without inducing worker reallocation.

8. Conclusions

This survey highlights both the substantial progress made in measuring and understanding occupational mismatch and the challenges still awaiting further work. A central message emerging from recent research is the importance of treating skills as multidimensional and using data that capture this complexity on both the worker and the job sides. Advances in the availability of employer-employee datasets, together with the adoption of machine-learning techniques, offer promising opportunities for future work, despite cross-country differences in data coverage and access rules.

Technology also plays a role in assisting job seekers directly by personalizing labor market information and reducing search frictions. Early experiments show that tailored recommendations can meaningfully improve job-finding rates. Because these systems require detailed administrative data and careful evaluation to avoid unintended spillovers, further research and institutional investment are needed to fully exploit their potential.

Despite the breadth of the existing literature, a significant limitation

is that most work still views mismatch at the individual worker level, neglecting that productivity depends heavily on the composition and interactions of teams. This raises challenging empirical questions, as developing systematic approaches to measure and model team-level matching remains a major open challenge. Further research is also needed on the policy side, particularly on interventions affecting labor market flexibility, minimum wages, and training systems, given the mixed empirical results to date. In addition, the literature still offers relatively little evidence on how structural shocks, such as the digital or climate transitions, affect mismatch, despite the scale of the transformations currently underway.

Taken together, these developments underscore that occupational mismatch will remain a central economic issue, and that continued theoretical, empirical, and policy-oriented research will be crucial for addressing the labor-market challenges of the coming decades.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used ChatGPT to condense and copy-edit the text. After using this tool, the authors reviewed and edited the text extensively and take full responsibility for the content of the published article.

CRedit authorship contribution statement

Luca Coraggio: Writing – review & editing, Writing – original draft, Conceptualization. **Monica Langella:** Writing – review & editing, Writing – original draft, Conceptualization. **Armando Miano:** Writing – review & editing, Writing – original draft, Conceptualization. **Marco Pagano:** Writing – review & editing, Writing – original draft, Conceptualization. **Marco S. Petterson:** Writing – review & editing, Writing – original draft, Conceptualization. **Vincenzo Pezone:** Writing – review & editing, Writing – original draft, Conceptualization. **Annalisa Scognamiglio:** Writing – review & editing, Writing – original draft, Conceptualization.

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Data availability

No data was used for the research described in the article.

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