



# Do green jobs differ from non-green jobs in terms of skills and human capital?



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## ABSTRACT

This paper elaborates an empirical analysis of labour force characteristics that emerge as a response to the growing importance of environmental sustainability. Using data on the United States we compare green and non-green occupations to detect differences in terms of skill content and of human capital. Our empirical profiling reveals that green jobs use more intensively high-level cognitive and interpersonal skills compared to non-green jobs. Green occupations also exhibit higher levels of standard dimensions of human capital such as formal education, work experience and on-the-job training. While preliminary, our exploratory exercise seeks to call attention to an underdeveloped theme, namely the labour market implications associated with the transition towards green growth.

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## 1. Introduction

This paper elaborates an empirical analysis of green employment, and focuses on the salient labour force characteristics that emerge, or change, as a result of commitment towards environmental sustainability. The transition to greener forms of production, distribution and consumption is commonly touted as a source of long-term benefits in the form of reduced environmental damage but, also, of new opportunities for economic development (Porter and van der Linde, 1995). Previous literature has explored the effects of environmental regulation on a variety of dimensions such as innovation, firm performance and net employment effects but has neglected other issues, such as what kind of occupations make up 'green jobs', and whether and how these differ from non-green

jobs. The present paper fills this gap by providing empirical evidence on these important aspects of structural change that several economies are already experiencing, or are about to, as they adapt to new criteria of environmental sustainability.

Our belief is that grasping the labour market implications of green growth requires a clear understanding of the qualitative transformations in the organisation and the content of work activities. To put matters in context, the spectrum of actions for tackling environmental issues includes alternatives as diverse as reducing greenhouse gas emission by developing renewable energy source; or increasing the efficiency of energy usage in transport, building and industrial productions; or recycling and reusing materials; etc. Such a variety of options implies that environmental sustainability has the potential to modify the status quo of established industries but, also, to stimulate the emergence of new ones (OECD, 2010; Cedefop, 2010; Cambridge Econometrics, 2011). Either way, the implications for the workforce are manifold, and encompass the appearance of new professional categories, the disappearance of old occupations, or simply changes in the job content for continuing ones (Dierdorff et al., 2009; Vona and Consoli, 2015).

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Following on this, the present paper identifies and analyzes the defining characteristics of green jobs. We opt for a broad approach that encompasses complementary dimensions of human labour such as job task, formal education requirements and the professional pathways through which employees acquire and carry know-how – namely on-the-job training and work experience. While the latter are rather standard items in human capital theory (see, e.g. Becker, 1962; Mincer, 1962), the direct analysis of skills and tasks is a recent addition to the battery of existing indicators on how workers' know-how matches job tasks (Autor et al., 2003; Levy and Murnane, 2004). Against this backdrop, the main goal of the paper is to profile the key occupational characteristics of green jobs in the United States (US). In so doing we address two questions:

1. Are occupation-specific levels of formal education, work experience and on-the-job training higher for green jobs compared to non-green ones?
2. Is the task profile of green jobs different from that of non-green ones?

Our analysis builds on cross-sectional data on 905 occupations based on the O\*NET (Occupational Information Network) repository of occupation-specific information. The empirical strategy consists of two steps. First, using the O\*NET taxonomy we identify two subsets, one of green occupations and one of non-green occupations, that exhibit similar occupational characteristics. Subsequently, we compare these in relation to (i) standard measures of human capital (educational level, on-the-job training and work experience); (ii) the task content of jobs based on the taxonomy of Autor et al. (2003); and (iii) occupational exposure to various indicators of technology built upon data on investments, patents and R&D expenditure.

The main finding is that compared to non-green jobs, green occupations exhibit a stronger intensity of high-level cognitive skills. Also, occupations that are changing qualitatively, i.e. in terms of their skill content, have on average more formal education, more work experience and more on-the-job training relative to non-green jobs. Interestingly, on-the-job training is a distinctive feature only of the new occupations that are emerging as a consequence of higher demand for environmental specific skills. While preliminary, our empirical exercise highlights important shortcomings of the binary logic of 'green versus brown' jobs that dominates the scholarly and the policy debates. Indeed, this exploratory analysis seeks to indicate a promising route for understanding the labour market implications of the transition towards green growth.

The remainder of the paper is organised as follows. Section 2 presents an overview of existing research on green employment and green skills. Section 3 outlines the data and the empirical methodology. Section 4 elaborates the empirical analysis. The last section concludes and summarises.

## 2. Green employment vs. green skills

This section provides an overview of the relevant literature. First, we focus on studies that gauge the employment effect of environmental regulation and of innovation. It will be argued that this research disregards important qualitative dimensions concerning the adaptation of work activities to environmental criteria. Subsequently we evaluate the merits and the shortcomings of different methodologies that have been used to identify green employment. Finally, we propose an alternative roadmap based on literature that focuses on the human capital and the skill content of occupations.

### 2.1. Net employment effects of environmental regulation and innovation

The pursuit of environmentally sustainable growth is more than ever at the top of the global policy agenda. Ad-hoc interventions such as Europe's 2020 strategy (European Commission, 2010) or the Green Jobs Act in the US are instances of the kind of public commitment in support of smart, sustainable and inclusive economic growth. Unsurprisingly the effectiveness, and even the desirability, of government intervention in this remit is a divisive issue (see, e.g. Jaffe et al., 1995; Bowen, 2012) and even when there is consensus about active government involvement, how this should be implemented is equally controversial. The spectrum of possible actions is wide and encompasses options such as pigouvian taxes, cap-and-trade schemes, R&D subsidies and command-and-control regulation, as well as a variety of routes for implementation (Aghion et al., 2009; Mowery et al., 2010). Moreover, as the OECD (2007) remarks, the existing instruments are usually embedded within a policy mix that aims at multiple, at times contrasting, goals.

Turning to the labour market, the empirical evidence on the effects of environmental policy and regulation is mixed. Some scholars deem it either cost-ineffective (Michaels and Murphy, 2009; Hughes, 2011) or conducive to job destruction (Álvarez, 2009; Morriss et al., 2009). This contrasts with optimistic views based on the expectation that policy has the potential to induce the expansion of markets for environmental goods and services that are normally labour intensive (Engel and Kammen, 2009; Selwyn and Leverett, 2006; UNEP, 2008). Further evidence is available from studies on direct interventions such as the enforcement of emission criteria which in the US, for example, is enacted by the federal government via mandates to implement plant-specific interventions such as the installation of state-of-the-art technology.<sup>1</sup> The evidence on this is also mixed. A recent review of empirical studies by Dechezleprêtre and Sato (2014) concludes that environmental regulation yields negative employment effects in pollution intensive sectors. Some scholars ascribe the employment effects of environmental regulation to industry specificities (e.g. Morgenstern et al., 2002; Belova et al., 2013), plant characteristics (e.g. Becker, 2005; Becker et al., 2013) or type of pollutant (e.g. Greenstone, 2004). Accordingly, some report job losses (e.g. Henderson, 1996; Greenstone, 2002; Walker, 2013), others find no significant impact (e.g. Berman and Bui, 2001; Morgenstern et al., 2002; Cole and Elliott, 2007) while some (i.e. Bezdek et al., 2008) observe job creation due to environmental regulation. More recently Mulatu and Wossink (2014) and Kahn and Mansur (2013) find that energy-intensive and polluting industries tend to relocate and, hence, to destroy jobs as a consequence to ER respectively in European countries and US states. Yet another strand of studies argues that employment effects are irrelevant to the debate on green policy (Jaffe et al., 1995; Portney, 1994; Goodstein, 1996). In a similar vein, a comprehensive study on environmental products manufacturers at establishment-level by Becker and Shadbegian (2009) concludes that there is nothing unique about the green industry in terms of performance, wage premia or job creation.

Another strand of literature focuses more specifically on the effects of environmental technological change on employment (see Yi, 2014 for a review). From a theoretical point of view product

<sup>1</sup> In the US a national organisation, the Environmental Protection Agency (EPA), and individual states have a prominent role in enforcing compliance with emission standards. For instance, state regulation programmes must undergo EPA approval in order to ensure balance in regulatory intensity across states. If a county is not in attainment, the state must submit local intervention plans or fine non-compliers. In turn, non-compliance on the part of a state entails loss of federal funding (Becker and Henderson, 2000).

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