



Offshoring and the onshore composition of tasks and skills[☆]



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ABSTRACT

We analyze the relationship between offshoring and the onshore workforce composition in German multinational enterprises (MNEs), using plant data that allow us to discern tasks, occupations, and workforce skills. Offshoring is associated with a statistically significant shift towards more non-routine and more interactive tasks, and with a shift towards highly educated workers. The shift towards highly educated workers is in excess of what is implied by changes in either the task or the occupational composition. Offshoring to low-income countries—with the exception of Central and Eastern European countries—is associated with stronger onshore responses. We find offshoring to predict between 10 and 15% of observed changes in wage-bill shares of highly educated workers and measures of non-routine and interactive tasks.

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1. Introduction

There is considerable agreement among economists that fragmentation of production, and offshoring of production stages, likely affect

employment and wages across countries. Disagreement remains over the expected direction of these effects. If offshoring mainly involves tasks carried out by low-skilled labor, the relative demand for low skill would decline and contribute to a widening wage gap between skilled and unskilled labor (Feenstra and Hanson, 1996, 1999). Since offshoring is likely to be associated with cost reductions, which put downward pressure on wages, low-skilled workers may nevertheless benefit from an increase in their real wages. Moreover, if the associated cost reductions are particularly strong in industries employing low-skilled labor intensively, offshoring might reduce the wage gap between skilled and unskilled labor as resources are reallocated towards low-skill intensive industries (Jones and Kierzkowski, 1990) and cost savings from trade in tasks may accrue to skill groups that are relatively susceptible to offshoring (Grossman and Rossi-Hansberg, 2008).¹

Recent research points to the nature of tasks as a more relevant characteristic for a job's propensity to be offshored than the skill level of the worker (see e.g. Leamer and Storper, 2001; Markusen, 2006;

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¹ See also the treatments in Baldwin and Robert-Nicoud (2010) and Kohler (2009).

Jensen and Kletzer, 2006; Blinder, 2006). This is of particular importance for labor-market consequences if offshoring involves relatively many tasks that high-skilled workers carry out so that low-skilled workers are less affected. Interpreting computer-tomography images or X-rays, for instance, typically requires higher education, but can easily move offshore.² Maintenance work, on the other hand, need not require higher education, but can typically not relocate because proximity to the maintained facilities is required. Several task characteristics are potentially relevant for offshorability: the prevalence of codifiable rather than tacit information to perform the job (Leamer and Storper, 2001); the prevalence of routine tasks, especially if they can be summarized in deductive rules (Levy and Murnane, 2004); or the job's lacking requirement of face-to-face contact and geographic proximity (Blinder, 2006). Whereas the nature of tasks could be strongly correlated with the skill-intensity of the occupation, there is no a priori reason for this to be the case.

To examine the relationship between offshoring and the composition of skills and tasks in the home economy, we build a data set based on German multinational enterprises (MNEs) and their offshore employment (*OE*). MNEs conduct an important part of world-wide offshoring.³ We then combine the MNE data with plant-level information on workforce skills and occupations over the period 1998–2001, during which German MNEs strongly expanded foreign operations. In a final data construction step, we link the occupations with survey information on task components by occupation. We follow Autor et al. (2003), and related research by Spitz-Oener (2006), in that we match occupations to the involved share of routine versus non-routine tasks. To identify tasks according to the non-routine/routine and interactive/non-interactive dichotomies, we newly codify information from a German work survey on workplace tool use.⁴

Our data choice has three main benefits: the detailed German occupational classification offers refined task-to-occupation matches; our task measures are based on observed job activities from an economy-wide worker survey; and actual tool uses provide palpable insight into the nature of tasks. To mitigate potential codification errors in our mapping from tool uses to task content, we adopt two alternative mappings that handle ambiguities differently. Subsequent results are qualitatively close under either codification. We adopt dichotomous definitions of tasks (non-routine/routine and interactive/non-interactive), worker skills (high education/low education) and occupations (white-collar/blue-collar) for comparability to cost function estimation in related research (Slaughter, 2000; Hanson et al., 2005; Harrison and McMillan, 2011). The combined data allow us to query whether non-routine tasks and interactive tasks are less offshorable and to assess skill-demand implications.

In shift-share analysis, we compare MNEs and their offshore employment evolution to non-MNEs (sometimes also called national enterprises) with no in-house *OE*. We find a marked employment shift both towards highly educated workers and towards non-routine and interactive tasks at MNEs, irrespective of whether MNEs expand or shrink their *OE*. Non-MNEs shift employment out of high-end tasks, but also towards more highly educated workforces. Dichotomous definitions allow us to collapse the relative labor demands for onshore tasks, skills and occupations into a reduced-form estimation equation. Regression analysis shows that tasks have a statistically significant relationship to offshoring in the direction that theory leads us to expect: onshore workers perform more non-routine and more interactive tasks at MNEs with more offshoring. We also find that offshoring is consistently associated with

higher workforce education. This is the case even when we control for the changing composition of tasks at the plant level.

Our MNE data include plants from all sectors of the economy. We find onshore labor-demand responses to be qualitatively similar across all sectors, adding to earlier evidence on services offshoring (e.g. Crinò, 2010a,b). A limitation of our analysis is the restriction to offshoring within the same firm, in contrast to offshore outsourcing to independent suppliers. An advantage of MNE data is, however, that we can directly relate the onshore workforce composition to observed *OE* at the MNE. Importantly, offshore activity at MNEs includes production for the local host market, services-with-goods bundling such as after-sales services related to both local production and exports from the home economy, and local procurement, back-office and sales activities attached to home-country exports. We do not discern between horizontal or vertical FDI as such but the data provide information on the location of offshore activity, which we combine into four country groupings: two groupings of lower-income countries and two groupings of countries at a similar level of income as Germany. Estimated effects of offshoring on the task and educational composition are strongest for *OE* in low-income countries outside Europe, whereas *OE* in low-income countries in Central and Eastern Europe does not exert statistically significant responses in Germany.

Our findings are consistent with the traditional view that offshored tasks tend to be carried out by low-skilled rather than high-skilled workers, in contrast with recent conjectures. The predicted economic effect of offshoring on the educational composition of onshore workforces at MNEs is modest, however. Our estimates translate into a contribution of offshoring to changes in the wage-bill share of highly educated workers in the order of 10–15%—a moderate effect compared to the 15–40% contribution of offshoring measured as imports of intermediate inputs to the change in the wage-bill share of non-production workers in the United States (Feenstra and Hanson, 1999).

Few papers to date have studied the empirical nature of tasks and the extent to which task offshoring involves high-skilled or low-skilled labor.⁵ Blinder (2009) uses occupational codes to construct task indexes based on a binary proximity criterion whether work can be carried out remotely or whether the job must be performed on site. According to these indexes, around a quarter of U.S. jobs are potentially offshorable but Blinder finds little or no correlation between an occupation's offshorability and the skill level of workers. For services jobs, Jensen and Kletzer (2010) construct two arguably less subjective measures of offshorability. The first measure is based on the geographic concentration of industries and occupations within the United States and motivated by the idea that tradable activities are localized in few places and then traded both nationally and internationally.⁶ The second one is based on the occupational requirements classification of work activities in the Occupational Network Database, from which Jensen and Kletzer pick eleven job-content measures to construct an index of offshorability. Jensen and Kletzer document that their two measures are positively correlated and find that occupations with a greater share of college-educated workers are more offshorable. In contrast, we find that relative demand for highly educated workers increases at MNEs with large offshore employment.

A separate line of recent research investigates the effect of technical change on relative skill demand with an emphasis on the relation between tasks and information technology. Autor et al. (2003) classify tasks into skill-related categories and find that information technology displaces routine and non-cognitive tasks between 1970 and 1988. In

² This business practice has become known as *tele-radiology*. U.S. or EU trained doctors living in South Asia or Australia perform tele-radiology for the United States and Europe.

³ The estimated share of value added at MNE affiliates in world output was 10.1% in 2005, up from 6.7% in 1990 (UNCTAD, 2006). Intra-firm trade accounts for around one-third of goods exports from Japan and the United States, a similar proportion of all U.S. goods imports, and one-quarter of all Japanese goods imports (OECD, 2002).

⁴ Nilsson Hakkala et al. (2008) and Baumgarten et al. (2010) have meanwhile adopted our task codification from Table A.1 in the appendix for related research.

⁵ Mankiw and Swagel (2006) review the literature on U.S. MNEs and conclude that offshoring to date has at most modest labor market consequences. Crinò (2009) and Feenstra (2010) survey the broader empirical literature on offshore outsourcing and report relevant economic effects on relative earnings. A related literature investigates the effect of intermediate inputs on technology transfers and productivity outcomes (e.g. Amiti and Wei, 2009; Hijzen et al., 2010).

⁶ Jensen and Kletzer (2010) adjust the earlier Jensen and Kletzer (2006) concentration measure for downstream demand concentration.

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