Extended Abstract
The aggregate (country-level) gains from trade liberalization have been convincingly argued, both theoretically and empirically. At the same time, it is clear that trade liberalization may cause a reallocation of workers (and other factors of production) across firms, industries and occupations, and can result in heterogeneous earnings losses for displaced workers, corresponding to the type of displacement and the nature of human capital possessed by the worker. Indeed, the issue of workers displacement and related labor market impacts of trade liberalization have been central concerns in the debate over globalization.

The theoretical literature in international trade has variously explored the mechanisms through which an economy might adjust to greater trade openness through factor reallocation. On the one hand, neoclassical trade theory suggests that lowering trade barriers will lead to inter-sectoral shifts in production factors, with workers moving from the contracting import-competing sectors to expanding exporting sectors (as in the standard neo-classical frameworks of the Ricardian model, the Hecksher-Ohlin model or the Ricardo-Viner model). On the other hand, we may also see a movement of workers across firms within the industry – as some firms within the industry shrink or exit, while others expand (as in Melitz (2003)). Correspondingly, following trade openness, workers may be reallocated across or within industries. The actual mode of adjustment, however, has significant implications for how we view the displacement costs of trade exposure, especially if the returns to industry-specific human capital possessed by workers are small in relation to returns to firm- and occupation-specific human capital. If, for instance, worker wages are largely determined by their ability in their occupations and in performing particular tasks (as emphasized by Grossman and Rossi-Hansberg (2006)), the extent of their occupation-specific human capital is key, and the question of whether workers are reallocated across industries or stay within industries may become secondary to the question of whether they shift occupations or not. Furthermore, in the event of occupational shifts, since the tasks required in prior occupations may (or may not) be similar to those in the new occupation, the extent of wage changes with displacement will depend upon the similarity between the workers occupation history prior to and after the displacement.
Equally important is the question of whether outcomes with trade-related displacements differ from worker displacements in general. This may happen if trade shocks imply a lower likelihood of workers finding a new job within the same industry, or even within occupations with similar task requirements, following job displacement. We expect that the wage outcomes for workers following displacement will be determined by the complex interplay between the effects of trade openness on output, the corresponding labor market adjustment and the nature of human capital possessed by workers.

In this paper, we use a combination of rich and unique data sets from Germany (described in detail below) with longitudinally matched employer-employee data to study labor market outcomes for workers subsequent to job displacement and to study the interplay of these outcomes with human capital and the trade exposure of the industries in which the workers are employed. Our exercise takes a detailed consideration of worker human capital, allowing for workers to accumulate both general and specific human capital as part of their labor market experience. Specifically, we measure different dimensions of the specific human capital that workers may possess: in particular, industry-, occupation- and task-specific human capital in the form of industry tenure, occupational tenure and task tenure respectively. As noted earlier, wage changes following changes in jobs will be determined by the extent of the transferability of human capital across jobs- the extent of this transferability is a function of both the jobs that workers move across and the nature and extent of human capital that they possess.

Considerable nuance is essential when thinking of the transferability of human capital across jobs. Suppose a worker switches to a new occupation at a new firm in the same industry between time $t$ and $t+1$ – at the end of $t+1$ experience and industry tenure will increase by 1 year. Both firm and occupation tenure will be zero at the beginning of $t+1$ – i.e., all occupational and firm specific human capital is lost. But while some skills accumulated in an occupation are specific to that particular occupation (occupation-specific skills) and will be lost when the worker moves to a different occupation, other skills acquired by performing tasks in a given occupation can also be valuable in other occupations that require skills similar to the current one.

To take this into account, we begin by mapping occupations to the tasks performed in them by defining occupations as a $n$-dimensional vector of task intensity, $T_I$, where each component denotes the intensities of the corresponding task used in any given occupation $o$. For our baseline measure we map occupations to three tasks: manual (M), interactive (I) and analytical (A), so that the task
intensity in occupation \( \theta \) is given by \( TI_\theta = (MI_\theta, II_\theta, AI_\theta) \).\(^1\) Observing worker occupations (and any changes in these occupations over time) allows us to generate a 3-dimensional vector of task capital, corresponding to the three tasks performed in each occupation. Thus given a worker \( w \)'s occupational history until time \( t \), we can construct the task capital vector (also called the task tenure vector):

\[
T_{wt} = (M_{wt}, I_{wt}, A_{wt}),
\]

where, for instance, \( M_{wt} \) denotes the accumulation of experience (time) in performing manual tasks by worker \( w \) until time \( t \), which is itself calculated by cumulating the time spent by the worker in various occupations prior to \( t \), weighted by the intensity with which manual tasks are utilized in these occupations. See Gathmann and Schoenberg (2010) for a similar measure.

We use the task capital measure thus constructed in a variety of ways. In one exercise, we study the impact of trade liberalization on the quality of the match between workers and their current occupations. This is done by looking at the “distance” between their task capital vector \( T_{wt} \) and the task intensity vector \( TI_\theta \) (with vector lengths suitably normalized). Specifically, we define the match between the worker \( w \)'s task capital and her occupation \( \theta \) at time \( t \) as the dot product of the normalized task tenure and task intensity vectors (i.e., the angular separation between the two vectors):

\[
\text{Match}_{wot} = \frac{T_{wt} \cdot TI_\theta}{||T_{wt}|| \cdot ||TI_\theta||}
\]

The match is maximized when a worker’s task tenure is completely aligned with the occupational task intensity vector (so there is zero angular separation between the two vectors) as will be the case when the worker’s work experience has been entirely in the same occupation or in occupations with the same task requirements. The match is minimized when the worker’s task tenure is orthogonal to the occupation that she is in.

Changes in the quality of the match between a worker and her occupation between time \( t \) and \( t' \) can be measured as:

\[
\Delta \text{Match}_{wot} = \text{Match}_{wot} - \text{Match}_{wot,t-1}
\]

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\(^1\) We perform robustness checks using the more detailed 17-dimensional task vector.
This measure is used to capture the extent of mismatches between worker skills and occupations following instances of worker displacement. Thus, we compare the change in match quality and wages across samples corresponding to a range of displacement outcomes, for instance, between workers who did not switch occupations, workers who switched occupations but stayed within the same firm, workers who switched occupations and firms and also workers who switched occupations and industries.

Further, labor market outcomes following displacement may vary with the trade exposure of the industry in which the worker is employed. We hypothesize that trade-related displacements may be different from non trade-related displacements, especially if the trade-related displacements are driven by sector- or occupation- level drivers as opposed to idiosyncratic “firm-level” shocks that might cause displacement in non-trade contexts. Such shocks may result in displaced workers having to move out of their sector more frequently to find employment and perhaps move to more distant sectors and occupations.

In our preliminary exploration of the data, we find support for many of the preceding theoretical hypotheses. We find that industry-, firm-, occupation-, and task-specific human capital are all significant determinants of wages. In particular, the match between task tenure and occupation proves to be very important in wage determination. We also find trade-related displacements to be associated with more frequent occupational switches and to a lesser degree more frequent industry switches. Trade-related displacements are costlier for occupation and industry switchers because they move to further jobs – resulting in a greater mismatch between task capital and occupation of employment.

**Data**

Our main dataset is the Sample of Integrated Labor Market Biographies (SIAB) from the Federal Employment Agency in Germany. The dataset consists of a two percent random sample of administrative social security records in Germany. SIAB is particularly suited for our purposes thanks to the detailed information on a very large sample of workers (approximately 1.6 million individuals) over a very long period of time (1975-2008). This confidential dataset contains detailed information on the full labor market experience of workers in the sample. In addition to detailed information on worker characteristics such as gender, age, education level, occupation, nationality etc, SIAB includes
information on each employer of the worker (such as industry, size, average wage and location) throughout the worker’s tenure in the job market. Note that each unit of observation in the dataset (“spell”) represents the employment status for a worker. The worker could be employed or unemployed in any given spell. If the worker is employed, then employment information such as daily wages, firm, occupation, etc is provided for that employment spell. If the worker is unemployed, then benefits information is provided for that unemployment spell. A new spell is recorded if the individual separated from their job, individual experienced a pay change or at the end of each year.

Importantly, from this data, we are able to construct full employment histories of workers including job switches and any unemployment spells starting from the point of entry to the job market. The ability to construct full employment histories and detailed wage and firm-level information for each job is crucial for us to construct measures of industry-, firm-, occupation-, and task-specific human capital for each worker. By allowing us to trace workers over time and across firms and spells, the dataset enables us to cleanly identify job displacements. Our sample covers all workers who entered the labor market during the 1975-2008 period. We drop workers who entered the dataset between 1990-1992 as we cannot identify with certainty whether the worker is actually entering the labor force or entering the dataset from East Germany. This is relevant because we do not have the work histories for workers entering from East Germany, and so cannot calculate their human capital. Also, we restrict our analysis to male workers since male and female workers differ significantly in terms of their non-pecuniary options and opportunity costs outside the labor market. This leads to differences in work attachments and occupational choices, which are outside the scope of our investigation.

We combine SIAB with data on occupational tasks from the German Qualification and Career Surveys, which are repeated cross-sections that track skill requirements and task usage for occupations for random samples of the German labor force. Five waves for the years 1979, 1985, 1991/92, 1998/99, and 2006 cover about 20-30 thousand individuals and 250 occupations in each wave. In the surveys, workers are asked the frequency with which they perform 17 different tasks (such as operating machines, research and development, cleaning/waste disposal, consulting/advising, healing/taking care etc.) in their job. We use this information to code 3- and 17-dimensional task vectors for each occupation and calculate the distance between two occupations (calculated as the distance between the vectors). We then link these measures with the aforementioned worker-level data and use it to construct each worker’s task-based human capital.
We complement these two datasets with publicly available sector level measures of trade exposure for 17 sectors from 1991 onwards from the OECD’s database. Note that in the SIAB worker data, we have information at the 3-digit SIC level, which gives us approximately 220 industries. Since that is more disaggregated than our trade data, we differentiate by referring to the more aggregate trade data as the sector level.

Reference


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2 We are in the process of incorporating into our analysis more disaggregated trade exposure measures from the WIITS that will also allow us to instrument for changes in industry level trade exposure.