LABOR MARKET EFFECTS OF INTERNATIONAL TRADE WHEN MOBILITY IS COSTLY

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ABSTRACT. I build and estimate a dynamic structural model of sectoral choices with heterogeneous workers accumulating sector specific human capital. Utility costs of switching sectors provides an additional barrier to mobility. Estimating the utility costs by Simulated Minimum Distance on administrative data covering the population of Danish workers and firms, costs are found to be in the range of 1.2 to 2.4 times average annual wages, providing a significant barrier to mobility. By conducting counterfactual policy experiments, it is shown that the utility costs are instrumental in explaining the slow adjustment of the labor market following globalisation.

Keywords: Globalisation, adjustment costs, worker heterogeneity
JEL: E24, F13, F16

1. INTRODUCTION

Developed countries have experienced increasing foreign competition, particularly from low wage countries, since the early 1990s. This has been coupled with a shift in production away from the manufacturing sector towards non-traded goods and services. The reallocation process has naturally involved decline of some industries and the expansion of others. While the public debate on globalisation often focuses on the destruction of jobs rather than the gains, economists and policy makers insist that the gains from trade outweigh the losses, at least in the long run as resources are allocated towards comparative advantage industries. But focusing only on long term gains does not address questions on the sluggishness and costs of the reallocation process. As globalisation continues, this tension between workers concerned by short term outcomes and policy makers focused on aggregate long term outcomes is bound to increase, making estimation of the adjustment costs following globalisation an ever more present concern.

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This paper attempts to do just that for Denmark. Among Continental European countries Denmark is special as the flexibility of the Danish labor market is very high, comparable even to the United States.[1] With weak employment protection and high unemployment insurance (UI) benefits being two of three pillars of the 'flexicurity' system (active labor market policies is the third) firms are relatively free to hire and lay off workers as they desire. Workers, on the other hand, pay the price of this flexibility: They may experience spells of unemployment, they might lose part of their sector specific human capital, or they may have a distaste for switching sectors for other reasons. The main purpose of this paper is to quantify these reallocation costs following globalisation.

To this end I build and estimate a dynamic structural model of the Danish economy, where heterogeneous workers of overlapping generations accumulate human capital specific to the sector in which they are employed. In every period of time, workers receive wage offers from all sectors of the economy after which they choose to work in the sector that maximises expected lifetime utility. The choice takes into account the possibility of becoming unemployed and receiving unemployment benefits. If the worker wishes to switch sectors from one year to the next, he faces different costs. First, he may not be able to offer the same amount of human capital to all sectors as part of his human capital is sector specific. Second, the worker faces a utility cost of switching sectors that depends on characteristics such as gender, education and age. The production side of the model is characterised by perfect competition, where sectoral representative firms demand human and physical capital in order to produce output according to a Cobb-Douglas production function.

The structural parameters of the model are estimated using Simulated Minimum Distance (SMD) on a matched worker-firm dataset covering the population of Danish workers and the universe of firms from 1996 to 2008. Employing SMD on this dataset, I fit a set of Auxiliary Parameters (AP) that provide a detailed description of the data. The SMD estimator finds the set of structural parameters such that the distance between APs estimated on actual data and APs estimated on data simulated from the model is minimised.

The main estimation result is that the mobility cost of switching sectors for the median worker is between 1.2 and 2.4 times average annual wages, providing a significant

[1] See Botero, Djankov, La Porta, Lopez-De-Silanes, and Shleifer (2004) for a cross country comparison of labor market flexibility.

barrier to inter-sectoral mobility. The median mobility cost covers substantial heterogeneity over the population of workers: Female, less-educated, and in particular older workers face higher mobility costs.

Once the model parameters are estimated, I use it to explore the dynamic adjustment processes following a globalisation shock to the economy. While globalisation manifests itself in numerous ways, this paper focuses on two of these. First, by causing some sectors to expand and others to contract, globalisation can increase the probability of becoming unemployed for workers in the contracting sectors, particularly if workers are unable to reallocate immediately. The second way that this paper considers that globalisation affects the economy is through trade liberalisation, which lowers the output price of the liberalising sector.

Consider increased globalisation of the manufacturing sector. Then, the globalisation shock consists of two separate shocks: i) An unemployment shock increasing the probability of becoming unemployed for workers employed in the manufacturing sector; ii) A trade liberalisation episode lowering the output price of the manufacturing sector. First, the unemployment and trade liberalisation shocks are studied in isolation before turning to the impact of a joint shock. In the simulations, I find that: i) The labor market reallocation process is sluggish, so that only 50% of the reallocation is completed after 7 years in case of the unemployment shock, and 49% after 9 years in case of the trade liberalisation; ii) The unemployment shock leaves human capital prices unchanged since physical capital is free to flow in and out of the sectors; iii) Trade liberalisation lowers human capital prices in the affected sectors.

Recent empirical papers have studied how international trade affects domestic labor markets. In an influential paper, Autor, Dorn, and Hanson (2013) find that increasing import competition from China increases unemployment in local labor markets: For every $1,000 increase in imports per worker, the share of employed manufacturing workers falls by 0.7 percentage points. Examples of other reduced form studies are the papers by Autor, Dorn, Hanson, and Song (2012), and Ebenstein, Harrison, McMillan, and Phillips (forthcoming). Recently, efforts have been made to estimate the transition costs of labor reallocation in structural models, e.g. Artuç, Chaudhuri, and McLaren (2010), Artuç and McLaren (2012), Coşar (2013), Coşar, Guner, and Tybout (2011). The paper closest to mine in the structural literature is Dix-Carneiro (2014), who estimates a similar model on Brazilian worker data. He is focused on the distributional effects of trade liberalisation on high and low skilled workers. In contrast, although my model allows workers to be highly educated, this affects only the *amount* of human capital they can offer, not the *type*. In addition, the key feature of my model is the formal modeling of the institutional setting facing unemployed workers in Denmark, a feature we know from the theoretical literature on labor markets and international trade to be crucial.[2]

The remainder of the paper is organised as follows. The next section presents a dynamic structural model of the labor market allowing for observed and unobserved heterogeneity on the worker side. Section 3 describes the matched worker-firm data and the aggregate data used for estimation. Section 4 gives an overview of the estimation procedure and presents the results. Section 5 examines the dynamic adjustments following different shocks to the economy and conducts policy experiments. Finally, Section 6 concludes.

2. Empirical Model

The objective is to design and estimate a general equilibrium model of the labor market that allows for an assessment of the transition costs of labor reallocation across sectors while allowing workers to be unemployed. Building on the framework developed in Keane and Wolpin (1994), Lee (2005), Lee and Wolpin (2006), and Dix-Carneiro (2014), the strategy is to estimate a dynamic Roy (1951) model.[3]

At each period of time the economy is populated by overlapping generations of workers aged 30 to 65. Workers supply their human capital to one of five sectors: (1) Agruculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation /Communication, or (5) Services. Workers have different levels of human capital to offer different sectors as a worker might be an able economist whilst being a less able construction worker. To capture this, workers accumulate work experience, part of which is transferable to other sectors. Changing sectors from one period to the next is costly for the worker for two reasons: First, not all experience is transferable across sectors, and second, the worker faces a utility cost of switching. In addition to the five productive sectors there is an unproductive unemployment sector (0) where workers

[2]A growing body of theoretical papers studies the effect of international trade on unemployment. In Davidson, Martin, and Matusz (1999), Helpman and Itskhoki (2010), Helpman, Itskhoki, and Redding (2010), and Helpman, Itskhoki, and Redding (2011), the equilibrium unemployment rate may rise following trade liberalisation.

[3]See Heckman and Sedlacek (1985, 1990), and Heckman and Honoré (1990).

sit idle, receiving unemployment insurance benefits or welfare assistance. Workers cannot choose the unemployment sector as unemployment arrives with individual specific probability. Thus, all unemployment is involuntary.

In the following I describe the production and worker sides of the model before discussing how the model is solved and estimated.

2.1. **Sectoral Production.** Representative firms in each sector demand the human capital supplied by workers in order to produce output. The production technology is assumed to be of a Cobb-Douglas form so that the value added of sector s becomes

$$Y_t^s = p_t^s A_t^s (S_t^s)^{\alpha_t^s} (K_t^s)^{1-\alpha_t^s}, \tag{1}$$

where p_t^s is the output price, A_t^s is productivity, S_t^s is the human capital employed in the sector, and K_t^s is physical capital. Notice that α_t^s is allowed to vary over time, and that the aggregate human capital, S_t^s, is not observed.

Given the production technology, the unit prices of human capital and physical capital are

$$\begin{aligned} r_t^s &= \alpha_t^s \frac{Y_t^s}{S_t^s}, \\ r_t^{s,K} &= (1-\alpha_t^s)\frac{Y_t^s}{K_t^s}. \end{aligned} \tag{2}$$

2.2. **Workers.** At every period of time, a worker chooses to work in the sector that maximises the present value of lifetime utility. He must consume his entire contemporaneous income in the current period as there is no saving. If the worker, previously employed in sector s_{t-1}, chooses to work in $s \neq s_{t-1}$, he incurs a utility cost. However, regardless of the sectoral choice, the worker with a set of characteristics Ω_{iat} faces unemployment probability $\delta(\Omega_{iat})$. Unemployed workers receive either unemployment insurance benefits or welfare assistance.

Let $\mathbf{V}_{at}(\Omega_{iat})$ be the value function of a worker. This value function represents the maximum expected present value of lifetime utility in year t over the choice alternatives. The Bellman equations of worker i of age a in year t are

$$\mathbf{V}_{at}\left(\Omega_{iat}\right) = \max_s \left\{\mathbf{V}_{at}^s\left(\Omega_{iat}\right)\right\}, \tag{3}$$

with alternative-specific value functions

(4)

$$\mathbf{V}_{at}^{s}(\Omega_{iat}) = \begin{cases} (1-\delta(\Omega_{iat}))\left[w^{s}(\Omega_{iat}) + \rho \mathbb{E}\mathbf{V}_{a+1,t+1}(\Omega_{i,a+1,t+1}|\Omega_{iat}, d_{it}=s)\right] + \\ \delta(\Omega_{iat})\left[w^{0}(\Omega_{iat}) + \rho \mathbb{E}\mathbf{V}_{a+1,t+1}(\Omega_{i,a+1,t+1}|\Omega_{iat}, d_{it}=0)\right] + & \text{if } a < 65 \\ \eta_{it}^{s} - \mathbf{C}^{s_{t-1},s}(\Omega_{iat}) \\ \\ (1-\delta(\Omega_{iat}))w^{s}(\Omega_{iat}) + \delta(\Omega_{iat})\, w^{0}(\Omega_{iat}) + \eta_{it}^{s} - \mathbf{C}^{s_{t-1},s}(\Omega_{iat}) & \text{if } a = 65 \end{cases}$$

In the value functions of Equation (4), $w^{s}(\Omega_{iat})$ is the real wage offer in sector s, $w^{0}(\Omega_{iat})$ is the unemployment benefit, η_{it}^{s} is a zero mean random sectoral preference shock, $\mathbf{C}^{s_{t-1},s}(\Omega_{iat})$ is a utility cost incurred by a worker switching from sector s_{t-1} to sector s, and ρ is the discount factor.

The state space, Ω_{iat}, is given by all variables that are relevant for the determination of the real wage the worker would get in any sector and any other variables relevant for the formation of expectations.

$$\Omega_{iat} = \left\{\text{Female}_{i}, \text{Educ}_{i}, \text{Elig}_{it}, \text{Exper}_{it}, \{\mathbf{r}_{t+\tau}\}_{\tau=0}^{65-a}, s_{t-1}, w_{t-\tau}, \boldsymbol{\eta}_{it}, \boldsymbol{\varepsilon}_{it}\right\}. \tag{5}$$

These include gender, level of education, eligibility for UI benefits, experience, the sequence of future human capital prices, previous sector including unemployment, wage in last employment, and current idiosyncratic shocks. In the following I describe each of the components of the value function.

2.2.1. *Wages.* As is common in the literature, the wage offer a worker receives in a sector is the product of the unit price of human capital in that sector and the amount of sector specific human capital that the worker possesses.[4] The sector specific human capital of a worker can be decomposed into a deterministic part and an idiosyncratic shock. The deterministic part depends on worker characteristics such as gender, education, and experience. The wage offer in sector s is given by

$$\begin{aligned} w^{s}(\Omega_{iat}) = r_{t}^{s} \cdot \exp\Big[&\beta_{1}^{s}\text{Female}_{i} + \beta_{2}^{s}\text{Educ}_{i} + \beta_{3}^{s}\text{Exper}_{it} + \beta_{4}^{s}\left(\text{Exper}_{it}\right)^{2} + \\ &\beta_{5}^{s}\text{Exper}_{it} \cdot \mathbf{1}\{s_{t-1} \neq s\} + \varepsilon_{it}^{s}\Big], \end{aligned} \tag{6}$$

where r_{t}^{s} is the unit price of human capital, Female_{i} indicates whether the worker is a woman, Educ_{i} indicates if the worker has completed college education, and ε_{it}^{s} is the

[4] See e.g. Dix-Carneiro (2014), Heckman and Sedlacek (1985), Lee (2005), and Lee and Wolpin (2006)

idiosyncratic human capital shock. Work experience, Exper_{it}, is gained for each year of employment. This means that Exper_{it} and its square term capture the component of experience that is transferable across productive sectors. However, if the worker chooses to switch sectors, not all experience is transfered. This is captured by the interaction term between Exper_{it} and $\mathbf{1}\{s_{t-1} \neq s\}$, an indicator for switching.

2.2.2. *Unemployment.* Workers become unemployed with individual specific probability, $\delta(\Omega_{iat})$. These probabilities are allowed to vary with gender, education level, age, and previous sector of employment, meaning that workers for whom these attributes are identical face the same probability of becoming unemployed. The probabilities are set to the empirical frequencies as observed in the data.

During spells of unemployment, the worker receives unemployment benefits, the size of which depends on whether the worker is eligible for UI benefits or has to rely on welfare assistance:

$$w^0\left(\Omega_{iat}\right) = \begin{cases} \min\left\{\gamma \cdot w_{t-\tau}, \overline{\text{UI}}\right\} & \text{if } \text{Elig}_{it} = 1, \\ \text{WA} & \text{if } \text{Elig}_{it} = 0, \end{cases} \tag{7}$$

where γ is the degree of compensation for the insured, $w_{t-\tau}$ is the wage received in the most recent employment, $\overline{\text{UI}}$ is the maximum UI benefits, Elig_{it} is an indicator of whether the worker is eligible for UI benefits, and WA is the welfare assistance. $\overline{\text{UI}}$, WA, and γ are set to values that matches what unemployed Danish workers are facing.[5] Eligibility for UI benefits depends on two criteria. First, the worker must be member of a UI fund. Second, the worker must not have received UI benefits for more than 4 years.

2.2.3. *Mobility Costs.* The utility cost that a worker switching sectors faces depends on gender, education, and age and is given by

$$\mathbf{C}^{s_{t-1},s}(\Omega_{iat}) = \exp\left[\xi^{s_{t-1}} + \kappa_1 \text{Female}_i + \kappa_2 \text{Educ}_i + \kappa_3(a-30) + \kappa_4(a-30)^2\right], \tag{8}$$

where $\xi^{s_{t-1}}$ is a parameter depending on the previous sector. The costs are only incurred if the worker switches productive sectors from one year to the next, meaning that $\mathbf{C}^{s_{t-1},s}(\Omega_{iat}) = 0$ if $s_{t-1} = s$ or $s = 0$. Since all unemployment is involuntary it is not possible to identify mobility costs from switching to and from unemployment. The mobility costs represent workers' distaste for switching to a new sector, that may arise for any number of reasons, e.g. due to the existence of search costs. This paper remains

[5] Appendix A describes the institutional setting facing unemployed workers in Denmark in some detail.

agnostic as to the exact source of the mobility costs, and leaves exploring this important issue to future research.

2.2.4. *Expectations of Future Human Capital Prices.* For a worker to be able to decide in which sector to work at a given point in time, he must compute what wage offers he expects to receive in the future. These wage offers depend not only on the idiosyncratic sector specific shocks to his human capital $\boldsymbol{\varepsilon}_{i\tau}$, which is unknown to him at time $t < \tau$, but also on the unit price of human capital in all sectors, $\mathbf{r}_\tau$. Following Lee (2005), it is assumed that workers have perfect foresight with respect to the future sequence of human capital prices, a sequence that is computed endogenously when the model is solved.

2.2.5. *Idiosyncratic Shocks.* The vectors of idiosyncratic shocks, $\boldsymbol{\varepsilon}_{it}$ and $\boldsymbol{\eta}_{it}$, comprise the components of the state space that are unobserved by the researcher. In order to solve the model, assumptions on their distributions are necessary. It is assumed that they are independent and drawn from a normal distribution and the Extreme Value Type I distribution, respectively:

$$\begin{aligned} \varepsilon_{it}^{s} &\overset{\text{iid}}{\sim} \mathcal{N}\left(0, \sigma^{s}\right), \\ \eta_{it}^{s} &\overset{\text{iid}}{\sim} \text{Extreme Value Type I.} \end{aligned} \tag{9}$$

The iid extreme value assumption on the preference shocks yields a convenient closed for solution when taking the expectation, contributing to computational tractability. Given these distributional assumptions, it is possible to solve the model.

2.3. **Model Equilibrium.** At age a and time t, each worker solves his optimisation problem given by Equations (3) and (4) in order to decide what sector to work in. Once all workers have made their choices, the total supply of human capital to sector s is

$$S_t^{s,sup}\left(\{\mathbf{r}_{t+\tau}\}_{\tau=0}^{35}\right) = \sum_{a=30}^{65}\sum_{i=1}^{n_{at}} S^s\left(\Omega_{iat}\right)\cdot \mathbf{1}\left\{d_{iat} = s\right\}, \tag{10}$$

where $S^s(\Omega_{iat})$ is the individual sector specific human capital of worker i at age a, $\mathbf{1}\{d_{iat} = s\}$ is an indicator function for sectoral choice s, and n_{at} is the number of workers of age a at time t. The current aggregate supply of human capital in sector s, $S_t^{s,sup}$, is a function of the entire sequence of human capital prices in all sectors, $\{\mathbf{r}_{t+\tau}\}_{\tau=0}^{35}$.

In equilibrium, sectoral supply of human capital, from Equation (10), equals sectoral demand, which is found from Equation (2) to be

$$S_t^{s,dem} = \alpha_t^s \frac{Y_t^s}{r_t^s}.$$

Combining the aggregate supply and demand for human capital yields the equilibrium condition for sector s

$$S_t^{s,sup}\left(\{\mathbf{r}^*_{t+\tau}\}_{\tau=0}^{35}\right) = \alpha_t^s \frac{Y_t^s}{r_t^{s,*}}, \tag{11}$$

whose solution determines the equilibrium human capital prices. As my sample period is finite, I am able to impose perfect foresight only between the initial and final sample years. Therefore it is assumed that workers have static expectations from the the final year onwards. Thus, when deciding where to work in, say, the final sample year, a worker of age 30, who forms expectations on the future sequence of human capital prices from now until he retires at age 65, assumes that future human capital prices remain at their contemporaneous level.

As the aggregate sectoral value added series, Y_t^s, and wage bill series, $\alpha_t^s Y_t^s$, are observed in the data, I impose these during estimation. This entirely removes the need to make assumptions on the evolution of physical capital.

2.4. **Solving the Model.** The set of structural model parameters consists of the discount factor, ρ, the full set of 30 wage offer function parameters for all sectors, $\{\boldsymbol{\beta}^s\}_{s=1}^5$ and $\{\sigma^s\}_{s=1}^5$, the 9 mobility cost parameters, $\{\boldsymbol{\xi}^s\}_{s=1}^5$ and $\boldsymbol{\kappa}$, the 3 unemployment benefit parameters, γ, $\overline{\mathrm{UI}}$, and WA, and finally the 864 unemployment probability parameters, δ.

Solving the model for a given set of structural parameters involves computing the expected values in the Bellman equations (3) and (4), which presents several computational challenges. First, taking the expectation involves integrating over the distributions of η_{it}^s and ε_{it}^s. The distributional assumptions on these in (9), means that the integral over η_{it}^s has a convenient closed form solution (Rust, 1994). The integral over ε_{it}^s does not have a closed form, and therefore has to be numerically approximated. Here the integration is done by Monte Carlo methods.[6] The second difficulty concerns the "curse of dimensionality". The state space in (5) is large and contains continuous variables ($\{\mathbf{r}_{t+\tau}\}_{\tau=0}^{65-a}$ and $w_{t-\tau}$). To address this issue, I employ the Keane and Wolpin (1994) method of computing the expectations only at a subset of the state space and then

[6]Other integration methods can be used such as Gauss-Hermite quadrature (Judd, 1998), but these methods are computationally expensive for high-dimensional problems. Although the dimensionality problem can be somewhat alleviated by sparse grid or monomial methods, this comes at the cost of precision.

inter- and extrapolating over this subset by regression. Here, that is done by second order polynomial regression. To obtain the equilibrium sequence of of human capital prices, I use the perfect foresight algorithm developed by Lee (2005).

Define

$$\begin{aligned}&\text{Emax}_{at}\left(g, ed, el, s_{t-1}, \text{Exper}, \mathbf{r}, \{\mathbf{r}^*_{t+\tau}\}_{\tau=1}^{65-a}, w_{t-\tau}\right) = \\ &\mathbb{E}_{\boldsymbol{\varepsilon},\boldsymbol{\eta}}\mathbf{V}_{at}\left(g, ed, el, \text{Exper}, \mathbf{r}, \{\mathbf{r}^*_{t+\tau}\}_{\tau=1}^{65-a}, w_{t-\tau}, \boldsymbol{\varepsilon}, \boldsymbol{\eta} \mid d_{t-1} = s_{t-1}\right)\end{aligned}$$

to be the expected value, prior to drawing contemporaneous shocks of $\boldsymbol{\varepsilon}$ and $\boldsymbol{\eta}$, of a worker of age a at time t, who were in sector s_{t-1} in the last period, where s_{t-1} can also be 0, in which case the worker was unemployed. Here, g is gender, ed education, el eligibility for UI benefits, $\mathbf{r}$ is the current human capital prices, and $\{\mathbf{r}^*_{t+\tau}\}_{\tau=1}^{65-a}$ are the future human capital prices. Now, let

$$\Delta = \{(\text{Exper}, \mathbf{r}, w_{t-\tau}) \mid \text{Exper} \le 35;\ \underline{r} \le r^s \le \bar{r};\ \underline{w} \le w_{t-\tau} \le \overline{w}\},$$

where $\underline{r}$, $\bar{r}$, $\underline{w}$, and $\overline{w}$ are lower and upper bounds for human capital prices and wage in previous employment, respectively. $\text{Emax}_{at}(g, ed, el, s_{t-1}, \{\mathbf{r}^*_{t+\tau}\}_{\tau=1}^{65-a}, .)$ is approximated for all $g \in \{\text{Male}, \text{Female}\}$, $ed \in \{0,1\}$, $el \in \{0,1\}$, and $s_{t-1} \in \{0,1,2,3,4,5\}$ by the backward recursion algorithm:

(1) Start at the final period $t = T$ and the final age $a = A = 65$. Draw $N = 1500$ random values of $\{\mathbf{d}^n = (\text{Exper}^n, \mathbf{r}^n, w^n_{T-\tau})\}_{n=1}^N \in \Delta$.
(2) For each n draw $\boldsymbol{\varepsilon}$ and integrate over $\boldsymbol{\eta}$. Then integrate over the $\boldsymbol{\varepsilon}$ draws to get an approximation of $\text{Emax}_{AT}(g, ed, el, s_{T-1}, \mathbf{d}^n)$.
(3) Approximate $\text{Emax}_{AT}(g, ed, el, s_{T-1}, .)$ by a second order polynomial regression of
$\text{Emax}_{AT}(g, ed, el, s_{T-1}, \mathbf{d}^n)_{n=1}^N$ on $\{1, \text{Exper}^n, \mathbf{r}^n, w^n_{T-\tau}\}_{n=1}^N$. This polynomial regression gives a very good fit, as for all a, t, g, ed, el, and s_{t-1} I have $R^2 > 0.96$.
(4) Repeat steps 1 to 3 recursively for $a = 64$ through $a = 31$ to get an approximation for $\text{Emax}_{aT}(g, ed, el, s_{T-1}, .)$. Since this is the final period workers have static expectations over the future human capital prices.
(5) Repeat steps 1 to 4 for periods $t = T - 1$ to $t = 1$ using equilibrium skill prices such that $\mathbf{r}_t = \mathbf{r}^*_t$.

Once the model is solved, it can be estimated. The paper proceeds with a section describing the dataset used for estimation before turning to estimation strategy and results.

3. DATA

Estimating the empirical model from above puts certain requirements on the data. It necessitates the use of panel data on the worker side, including observations of outcomes for the unemployed. It also requires panel data on sectoral real value added and income shares for the factors of production. Both such datasets are available from Statistics Denmark for the period 1996 to 2008. This section documents each of the sources of these data, and gives some descriptive statistics.

3.1. **Worker Data.** For each year in the sample period, the worker data is taken from the administrative register "Integrated Database for Labor Market Research" (IDA), which covers the entire Danish population aged 15-74. At birth, or when becoming a permanent resident, every individual is given a unique personal identification number, used by the local and central government to record a variety of individual level information. Likewise, the universe of Danish firms, each with a unique identifier, are recorded in the "Firm Statistics Register" (FirmStat), whose information allows me to assign each firm to the five productive sectors that are defined in accordance with the NACE Rev. 2 statistical classification of economic activities in the European Union. Workers and firms can then be matched using the "Firm-Integrated Database for Labor Market Research" (FIDA) database.

From this matched worker-firm dataset I extract data on age, sex, labor market status (employed or unemployed), UI fund membership, work experience, firm tenure, sector tenure, and hourly wages for workers aged 30 to 65. The entry age of 30 is chosen since almost all workers have completed their education at this age. For workers who are employed I observe hourly wage rates, while for the unemployed I observe unemployment benefits, which can be decomposed into UI benefits for those eligible and welfare assistance for others. It is possible to match workers with firms only from 1995 onwards, so I use the 1995 data to construct initial conditions for estimating the model.

The dataset allows me to track individual workers over the sample period, which makes it possible to construct sectoral transition rates as well as transitions to and from unemployment. Table 3.1 shows average yearly transition rates between the five productive sectors as well as the unemployment sector. Several features are worth noting. First, a key feature of the data that the model must be able to replicate is the high degree of persistence in sectoral choices: The diagonal elements of the transition

TABLE 3.1. Average Yearly Transition Rates

From ↓ , To →	(0)	(1)	(2)	(3)	(4)	(5)
(0)	0.4794	0.0141	0.1053	0.0436	0.1046	0.2531
(1)	0.0409	0.8447	0.0281	0.0228	0.0265	0.0370
(2)	0.0294	0.0017	0.9090	0.0080	0.0249	0.0271
(3)	0.0290	0.0042	0.0208	0.9009	0.0191	0.0261
(4)	0.0227	0.0016	0.0226	0.0063	0.9144	0.0324
(5)	0.0182	0.0009	0.0075	0.0026	0.0111	0.9596

Sectors: (0) Unemployment, (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

matrix are all much larger than the off-diagonals, which may be the result of workers being unable to arbitrage wage differentials. Second, although there is persistence in unemployment, the persistence is smaller than that of the productive sectors. Third, workers initially unemployed are less likely to find a job in the agriculture/mining sector and the construction sector than they are of finding a job in the other sectors, with the service sector being the most likely employer. Moreover, workers initially employed in agriculture/mining are those most likely to become unemployed, while those from the service sector are least likely.

A final observation is timely here. The transition rates to unemployment from any sector can be further decomposed into rates as a function of worker characteristics such as age, gender, and education level. This decomposition gives exactly the unemployment probabilities, $\delta(\Omega_{iat})$, from Section 2, which is then fixed throughout the estimation procedure.

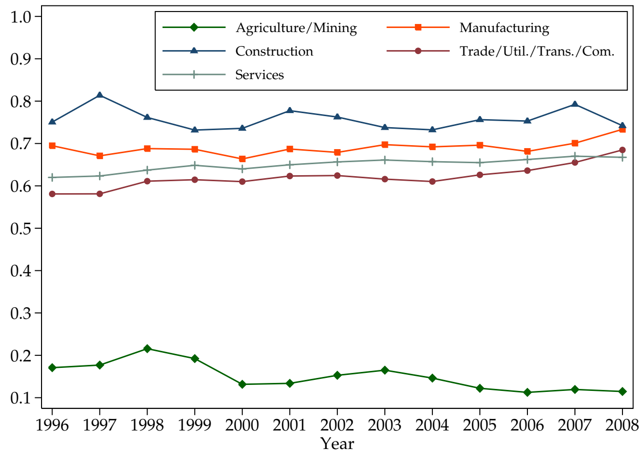
3.2. **Aggregate Series.** The aggregate series used for estimation and simulation are taken from the online databases of Statistics Denmark.[7] From the PRIS8 database I extract the Consumer Price Index (CPI) and set the base year to 2000. Gross value added series on the sectoral level are obtained from NATE101, while income shares for human capital and physical capital, also on the sectoral level, are constructed from data from NATE102 as

$$\alpha_t^s = \frac{(\text{Wage bill})_t^s}{(\text{Gross value added})_t^s - (\text{Production taxes})_t^s},$$

[7] Statistikbanken (http://statistikbanken.dk)

with the physical capital share being $1 - \alpha_t^s$. Figure 3.1 shows the evolution of human capital income shares.

FIGURE 3.1. Evolution of Labor Income Shares



From NAT09N I extract data on sectoral capital stocks, which together with income shares of capital allows me to compute the return to capital in sector s as

$$r_t^{s,K} = (1 - \alpha_t^s)\,\frac{Y_t^s}{K_t^s} = \frac{(\text{Gross surplus from production})_t^s}{(\text{Capital stock})_t^s}.$$

Finally, using Input-Output tables for the Danish economy in 2008, I construct expenditure shares as

$$\mu^s = \frac{(\text{Total uses})^s}{\sum_{k=1}^{5} (\text{Total uses})^k},$$

shown in Table 3.2.

TABLE 3.2. Expenditure Shares

	μ^s
Agriculture/Mining	0.0114
Manufacturing	0.1757
Construction	0.0610
Trade/Util./Trans./Com.	0.2748
Services	0.4770

4. Estimation Strategy and Results

The structural parameters of the model, θ, are estimated using Simulated Minimum Distance (SMD), also known as Indirect Inference (see Hall and Rust (2002) and Gourieroux and Monfort (1996) for details). As the name suggests, this is a simulation based estimation technique that minimises the distance between a set of simulated and sample moments, known as Auxiliary Parameters (APs). The sample APs are calculated once and for all, and stored in a vector, α^D. Then, for a trial value of θ, the APs are calculated on data from one or more simulations of the model, and stored in $\alpha^S(\theta)$. The SMD estimator of θ is the vector that minimises a quadratic form of distance between the two sets of APs:

$$\widehat{\theta}_{SMD} = \arg\min_{\theta} \left[\alpha^S(\theta) - \alpha^D\right]' \mathbf{A} \left[\alpha^S(\theta) - \alpha^D\right],$$

where $\mathbf{A}$ is a positive definite matrix. So long as the APs are well enough specified, $\widehat{\theta}_{SMD}$ is a consistent estimator (asymptotically) of the true structural parameters, even when computing $\alpha^S(\theta)$ using a single simulation. As shown in Appendix C, using a single simulation effectively doubles the asymptotic variance of the SMD estimator compared to a situation where the number of simulations approaches infinity. In the present context, this is a fairly small price to pay when compared to the significant computational gain of simulating data from the model only once.

4.1. Auxiliary Parameters.

The purpose of the APs is to capture statistical relationships that allows for identification of the structural parameters of the model. Therefore, although the researchers choice of APs may seem rather *ad hoc*, the choice should be motivated by identification reasons. As the parameters to be estimated here relate to the human capital production functions and the mobility costs, the APs are simply chosen to be the coefficients of OLS regressions of the form

$$Y_{it} = X_{it}'\zeta + \lambda_t + \eta_{it},$$

where Y_{it} is the outcome, X_{it} is a vector of regressors excluding a constant, ζ is a parameter vector, and λ_t are year fixed effects for each of the years from 1996 to 2008. The regressors X_{it} are the same for all regressions: a female dummy, a tertiary education dummy, age, age squared, experience, and experience times an indicator for sectoral switching.

In order to identify the parameters of the human capital production functions in Equation (6), the first set of regressions are chosen to be log wage regressions for each of the five productive sectors. In addition to recording the coefficients, I also record the standard error of the regressions to help in the identification of the standard error of the shock to human capital. The next set of regressions are linear probability models (LPMs) for sectoral choices (five regressions), and LPMs for transitions between any pair of productive sectors (25 regressions). These regressions are crucial for identifying the mobility cost parameters in Equation (8), but the LPMs for sectoral choices also help identify parameters of the human capital production functions.

The APs are comprised of the ζ's and λ's from the regressions, as well as the root mean squared error of the log wage regressions, making a total of 670 APs. Appendix D shows the results of their estimation on the sample data. The efficient choice of the weighting matrix, **A**, is the inverse covariance matrix of the APs, which I bootstrap also using the matched worker-firm data.

4.2. **Estimation Procedure.** The estimation procedure involves searching over the 39 human capital production function and mobility cost parameters. The remaining parameters (unemployment probabilities, unemployment benefit parameters, and the discount factor) are calibrated. The parameters concerning unemployment benefits are

TABLE 4.1. Calibrated Parameters

Parameter		Equation	Value	USD
Discount factor,	ρ	(4)	0.95	
Compensation rate,	γ	(7)	0.90	
Maximum benefit,	$\overline{\text{UI}}$	(7)	101	\$22.47
Welfare assistance,	WA	(7)	75	\$16.69

The values for $\overline{\text{UI}}$ and WA are hourly real benefits in 2000 DKK, calculated by dividing deflated annual figures by 1,702 work hours per year. The last column shows the benefits in current US dollars using Danish CPI of 1.288 to convert to 2012 DKK and then the exchange rate of 5.79 DKK/\$.

set to mimic the institutional setting faced by Danish workers (see Appendix A).

The estimation procedure follows the steps:

(1) From the data, obtain series for real value added, Y_t^s, and human capital income shares, α_t^s. These are imposed throughout the estimation procedure.
(2) Obtain the 670 sample auxiliary parameters, α^D, and get their covariance matrix by a bootstrap procedure.

(3) Solve the structural model and simulate sectoral choice paths that resembles those observed in the data with respect to e.g. age, gender and education profiles. Obtain simulated auxiliary parameters, $\alpha^S(\theta)$, using the simulated data.
(4) Search for the structural parameter vector, $\widehat{\theta}_{SMD}$, that minimises the quadratic distance between the simulated and sample auxiliary parameters using the bootstrapped covariance matrix as the weighting matrix.

Once the structural model parameters are estimated, the covariance matrix is computed at their optimised values. As shown in Appendix C, the covariance matrix for the estimated parameters is computed using the bootstrapped covariance matrix of the sample auxiliary parameters. Thus, the precision of the structural estimates are a function of the precision of the auxiliary estimates.

4.3. **Estimation Results.** Table 4.2 gives the results of simulated minimum distance estimation of the human capital production function parameters. As expected, human

TABLE 4.2. Human Capital Production Functions

	(1)	(2)	(3)	(4)	(5)
Female	-0.2628	-0.1747	-0.2361	-0.2150	-0.1667
	(0.0003)	(0.0001)	(0.0003)	(0.0003)	(0.0002)
Educ	0.1454	0.3180	0.1710	0.2361	0.2533
	(0.0001)	(0.0005)	(0.0002)	(0.0003)	(0.0003)
Exper	0.0254	0.0220	0.0337	0.0263	0.0229
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper^2	-0.0004	-0.0002	-0.0004	-0.0001	-0.0003
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper($s_{t-1} \neq s$)	-0.0007	-0.0250	-0.0425	-0.0336	-0.0214
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
σ^s	0.2721	0.2735	0.2816	0.3360	0.2875
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)

Standard errors in parenthesis. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

capital grows with work experience. However, experience is generally not completely transferable across sectors, as seen from the negative coefficients on Exper($s_{t-1} \neq s$). The transferability of experience varies over the sector of entry with experience being almost entirely transferable to the agriculture/mining sector and least transferable to construction.

That barriers to mobility are potentially large is clear from Table 4.3, which also shows that mobility costs are heterogeneous over worker characteristics with women, older, and less educated workers facing higher costs.

TABLE 4.3. Mobility Costs

	(1)	(2)	(3)	(4)	(5)
ξ	7.0009	5.3759	6.2341	4.7008	6.0461
	(0.0747)	(0.0178)	(0.0350)	(0.0201)	(0.0120)
	Female	Educ	Age	Age^2	
κ	0.2117	-0.1987	0.0696	-0.0003	
	(0.0008)	(0.0002)	(0.0000)	(0.0000)	

Standard errors in parenthesis. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

To interpret the mobility cost estimates, Table 4.4 computes (counterfactual) median mobility costs for all workers in terms of average annual wages. The trade/util./tran./com. sector is most costly to enter with a median cost of 2.4 times average annual wages, while the services sector is least costly to enter at 1.2 times annual wages. These estimates are very much in line with those found by Dix-Carneiro (2014), and much smaller than the mobility costs of around 6 times annual average wages as found by Artuç, Chaudhuri, and McLaren (2010) using CPS data from the United States.[8] When restricting focus to the workers who switch sectors, the median mobility costs are much lower at between 0.4 and 0.9 times average annual wages.

Figure 4.1 shows the non-parametric density of the counterfactual mobility costs of entering each sector. These densities differ because of the different demographic characteristics of workers employed in the sectors.

4.4. **Goodness of Fit.** To asses the goodness of fit of my model, I plot the auxiliary parameters from the data against auxiliary parameters simulated from the model. A perfect fit would result in all point lying on the plotted 45 degree line. Though all points are not on the 45 degree line, the estimated model does a sensible job of matching the moments from the observed data.

[8]See Dix-Carneiro (2014) for a discussion of the methodological source of this difference.

TABLE 4.4. Mobility Costs in Terms of Wages

	All workers	Conditional on switching
Agriculture/Mining	1.9262	0.4895
Manufacturing	2.1938	0.4235
Construction	1.9005	0.4985
Trade/Util./Tran./Com.	2.4494	0.9016
Services	1.1686	0.5609

Median costs of entry to the indicated sector is computed as $\mathbf{C}^{ss'}(X_i)/\hat{w}(X_i)$, where $\hat{w}(X_i)$ is an estimate of the average annual wage of a worker with characteristics X_i.

FIGURE 4.1. Kernel Densities of Mobility Costs

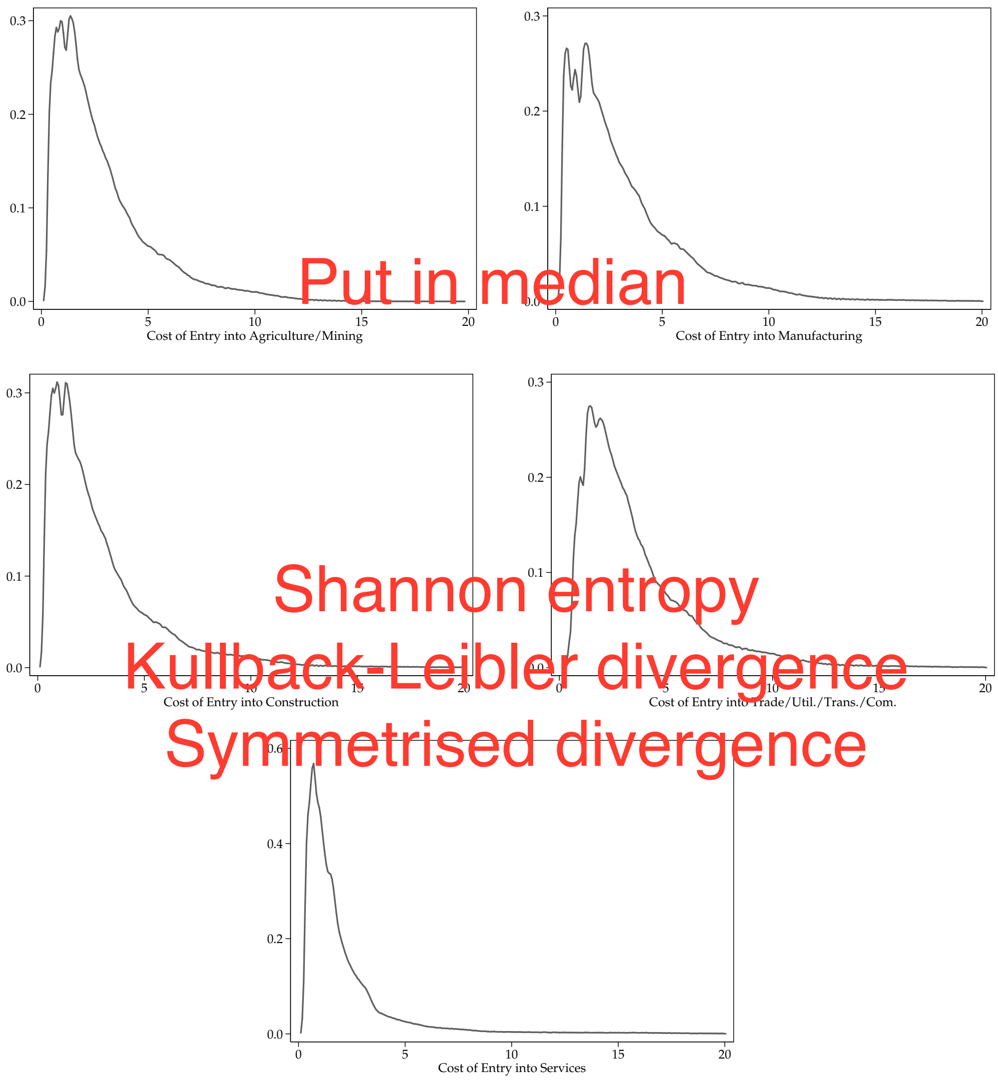


FIGURE 4.2. Goodness of Fit – Scatter over 45 degree line

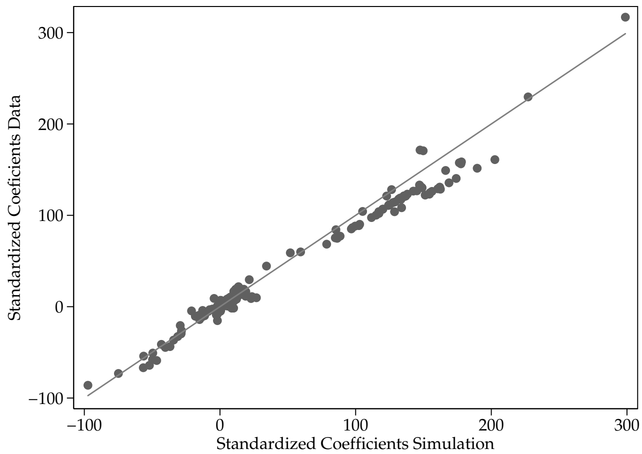


Table 4.5 shows average sectoral choices in actual and simulated data. The model is able to match sectoral choices remarkably well.

TABLE 4.5. Average Sectoral Choices

	Actual Data	Simulated Data
Unemployment	0.0397	0.0438
Agriculture/Mining	0.0132	0.0227
Manufacturing	0.1861	0.1817
Construction	0.0591	0.0624
Trade/Util./Tran./Com.	0.1948	0.2122
Services	0.5071	0.4772

5. SIMULATIONS

Now that the parameters of the model are estimated, it can be used to evaluate the effects of counter-factual structural changes in the model economy. The focus here is to study the dynamics following a globalisation shock to the manufacturing sector that both increases the probability of becoming unemployed for workers there and, at the same time, reduces the output price of the sector. Before doing that, however, it will be useful to consider the shocks in isolation in order to compare the differential way in which they affect the economy. This section therefore considers the dynamics following three shocks: (i) Unemployment shock only, (ii) Trade Liberalisation shock only, and

(iii) Globalisation (both unemployment and trade liberalisation shocks). All shocks occur to the manufacturing sector. A maintained assumption through all simulations is that only the outputs of the agriculture/mining sector and the manufacturing sector are traded globally at exogenous world market prices. The output prices of the remaining non-traded sectors are endogenously determined by the model.

The unemployment shock is modeled as a permanent unanticipated doubling of the unemployment probability for workers employed in manufacturing, such that a worker previously facing a one percent probability of becoming unemployed now faces a two percent unemployment probability. Trade liberalisation is modeled as a permanent 30% decline in the output price of the manufacturing sector.

5.1. **Additional Assumptions.** In estimating the model in Section 4, no assumptions were made on the accumulation of physical capital. All that was needed was the sectoral real value added series and income shares, both of which were observed.[9] When simulating the model this no longer suffices: Further assumptions are necessary in order to endogenise output prices for the non-traded sectors. I assume that the sectoral returns to physical capital, which are observed in the sample period (see Section 3), remain fixed at their 2008 level. This has two consequences: (i) Physical capital cannot flow across sectors, so physical capital is sector specific, and (ii) Sectoral physical capital levels adjust freely in order for physical capital returns to remain constant.

The instantaneous utility from consuming is given by the Cobb-Douglas function

$$u(\mathbf{C}) = \prod_{s=1}^{5} C_s^{\mu^s},$$

where the expenditure shares, $\boldsymbol{\mu}$, are those from Table 3.2. The indirect utility of a worker with nominal wage w_t is then $w_t / \prod_{s=1}^{5} (p_t^s)^{\mu^s}$. The real income of capital owners is $\sum_{s=1}^{5} r_t^{s,K} K_t^s$.

All output from the non-traded sectors must be consumed domestically, which identifies the output prices of these sectors:

$$\begin{aligned} \mu^s \sum_{k=1}^{5} Y_t^k = Y_t^s \quad &\Longleftrightarrow \\ p_t^s = \frac{\mu^s}{1-\mu^s} \left[\frac{\left(\sum_{k=1}^{5} Y_t^k\right) - Y_t^s}{A_t^s \left(S_t^s\right)^{\alpha_t^s} \left(K_t^s\right)^{1-\alpha_t^s}} \right] \quad &\text{for } s = 3,4,5. \end{aligned}$$

[9]This is an implicit assumption that capital is allocated efficiently during the estimation procedure.

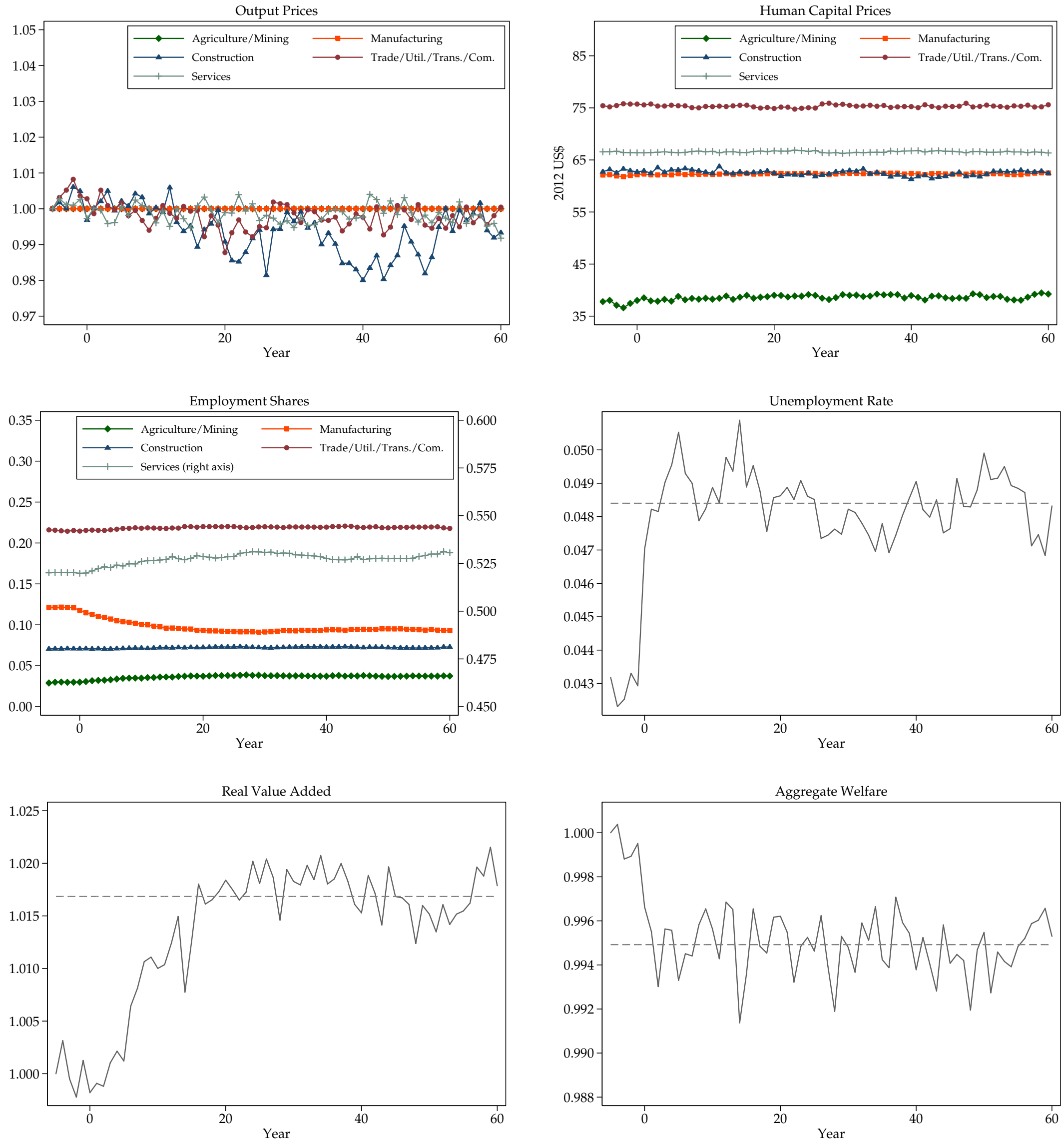
Finally, the unemployed are compensated by lump-sum transfers from employed workers and capital owners. With these assumptions, the dynamics following counterfactual shocks to unemployment and to the output price of the manufacturing sector can now be examined.

5.2. **Unemployment Shock.** Consider the effect of a permanent shock to the probability of becoming unemployed for workers in the manufacturing sector. The share of manufacturing workers who become unemployed increases, leading to a higher unemployment rate. The manufacturing sector is now less attractive, which leads workers to seek out opportunities in other sectors, lowering the share of the workforce employed in manufacturing. Due to the reallocation cost, however, the adjustment process is sluggish: 50% of the reallocation is completed after 7 years, and 90% after 17 years. The employment share of manufacturing drops by 25% compared to the initial steady state. However, this adjustment in the labor market leaves both output prices and human capital prices virtually unaffected. As manufacturing workers are reallocated elsewhere, production drops, putting downward pressure on wages. But, as the price of physical capital is assumed to be fixed, the physical capital level drops proportionally to human capital in order to hold constant the rental price of physical capital. As the ratio of physical to human capital remains unchanged, so do the human capital prices.

In the new steady state, the real value added of the economy has increased by 1.7%. The gradual labor market adjustment is clear: After 10 years real value added is adjusted by only 59% of new steady state level. Despite the increase in real value added, aggregate welfare is 0.005% lower in the new steady state. The reason for this drop in welfare is that the new equilibrium unemployment rate is higher, meaning greater transfers from the employed to the unemployed.

5.3. **Trade Liberalisation.** Now consider the effects of a 30% decrease in the output price of the manufacturing sector due to trade liberalisation. The output price of the agriculture/mining sector remains constant as it is assumed that its output is traded internationally. The output prices of the remaining non-traded sectors adjust endogenously. Human capital prices in the manufacturing sector drop with the output price shock. The manufacturing sector all but disappears as workers reallocate towards the other sectors. 49% of the reallocation is complete after 9 years, while 91% is complete only after 24 years.

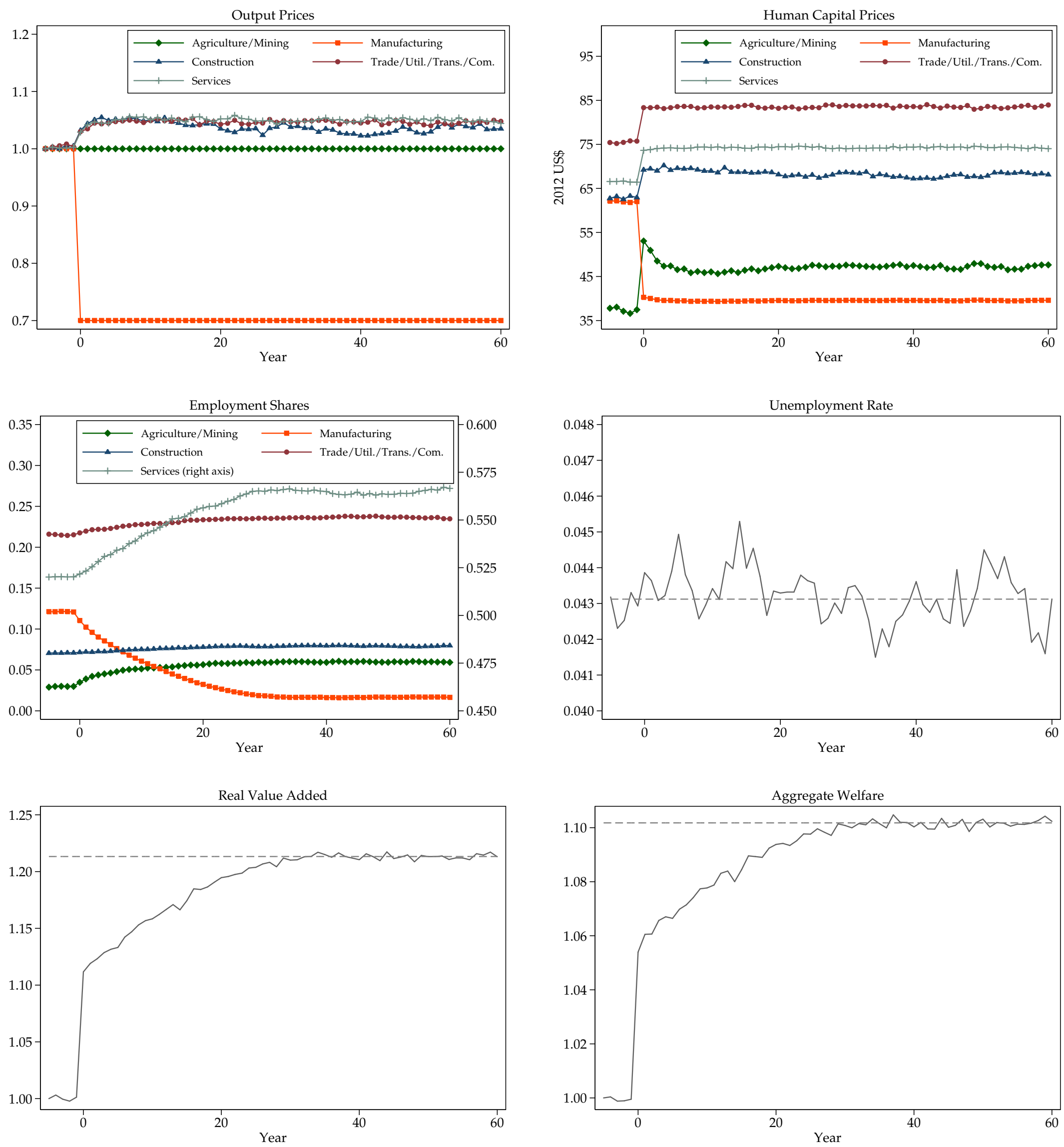
FIGURE 5.1. Simulation – Unemployment Shock



Human capital prices are affected by trade liberalisation for two reasons. First, lowering output prices reduces the marginal product of human capital, putting downward pressure on human capital prices. Second, in order to keep the physical capital return fixed, the ratio of physical to human capital drops, further lowering human capital prices. When the economy reaches the new steady state, real value added has increased by 21%, albeit gradually: After 10 years 74% of the adjustment is complete. The welfare gains are smaller at 10%, due to the presence of unemployment.

5.4. **Globalisation Shock.** Focus now on the dynamics following a joint shock; that is, both a doubling of the unemployment probabilities facing manufacturing workers, and

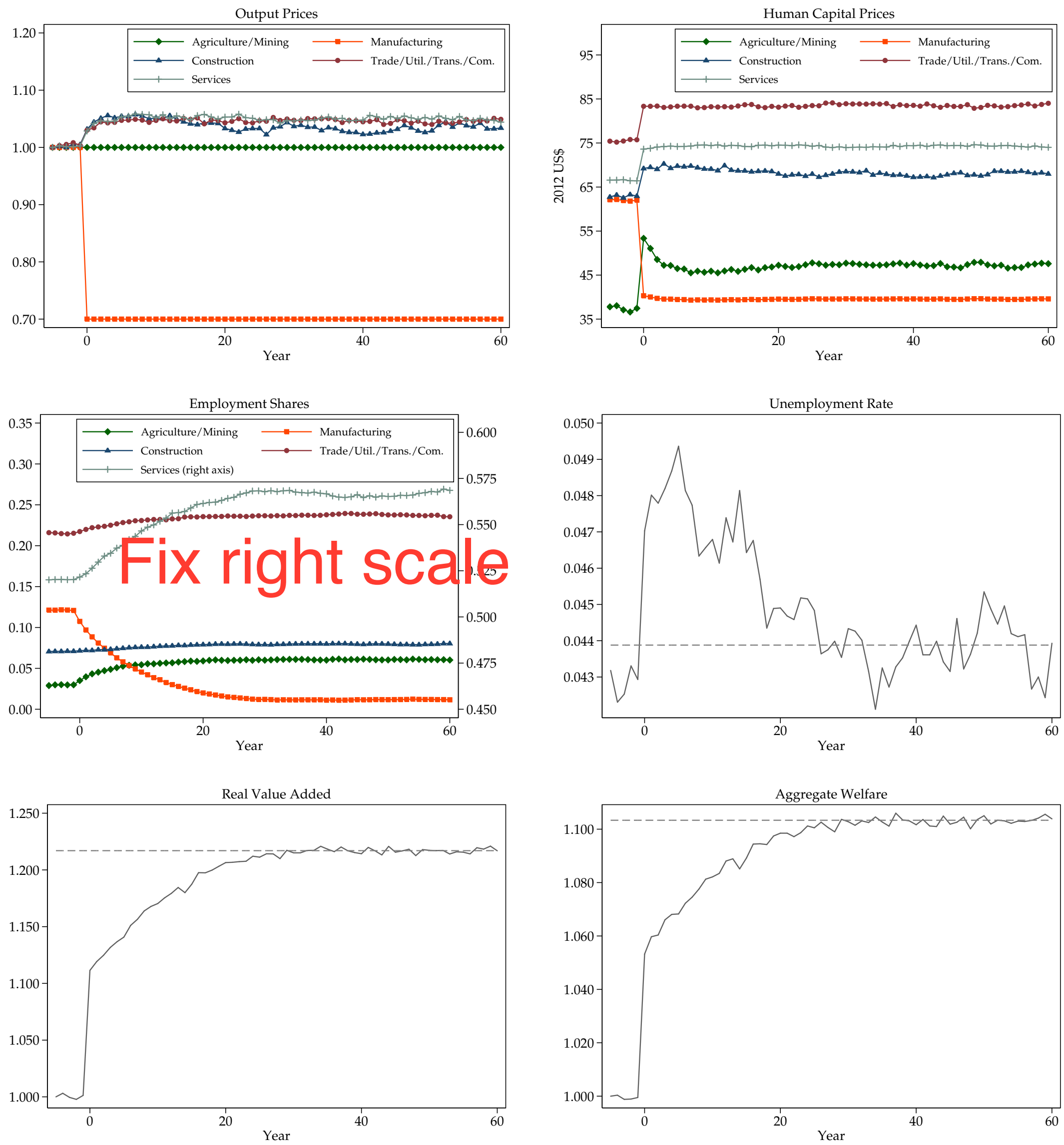
FIGURE 5.2. Simulation – Trade Liberalisation



a 30% decrease in the manufacturing output price. Again, the output price of the agriculture/mining sector remains constant while the prices of the remaining non-traded sectors adjust endogenously. Human capital prices in the manufacturing sector drop with the output price shock and workers reallocate towards other industries.

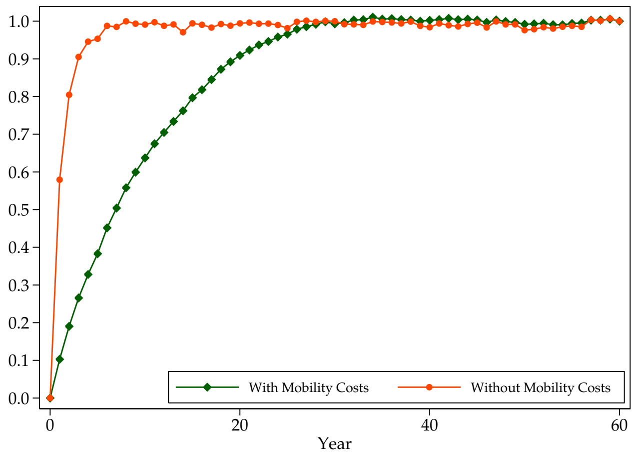
The unemployment rate initially jumps as it is now more likely for manufacturing workers to become unemployed. However, as the labor market adjusts, the unemployment rate gradually drops towards its initial level. This drop happens even though the rise in unemployment probability for manufacturing workers was assumed to be permanent. But as the manufacturing employment share declines from about 12% of the workforce to less than 2%, the number of workers affected by the increase in unemployment probabilities is dramatically reduced.

FIGURE 5.3. Simulation – Globalisation Shock



5.5. **The Role of the Mobility Costs.** In order to examine how the mobility costs affect the dynamic adjustment process, it is useful to consider a situation in which the utility cost of switching sectors is zero. Figure 5.4 plots the cumulated labor market reallocation as a percent of the final year for the globalisation shock. This is done for two scenarios: One where the mobility cost is set to zero for all workers, and one where the mobility cost is the one estimated above.

FIGURE 5.4. Speed of Labor Reallocation Following Globalisation Shock



The green line in the figure shows the reallocation process described in the simulation above where mobility costs are estimated. The reallocation process is very sluggish and takes several years to complete: One year after the shock 10% of the reallocation process is completed and 90% completion is reached only after 20 years. In absence of the mobility costs, the reallocation is much faster: 58% of the reallocation is completed by the end of the first year and 90% completion is done during the fourth year. The reallocation is not immediate when the mobility costs are zero. This is due to the fact that the existence of sector specific human capital makes it costly to switch sectors even when mobility costs are zero. Also note that the reallocation process is much more volatile when the mobility costs are zero as workers become much more likely to switch sectors from one year to the next.

This would suggest that, in so far as policy makers wish to minimise the length of the reallocation period, focus should be on policies that minimise the mobility costs. One such policy may be educating workers through job training programs, as the estimation results show that more educated workers face smaller mobility costs. Modeling and assessing the impact of such policies is important and left for future research.

6. CONCLUSION

This paper built and estimated a dynamic structural model of the Danish labor market in order to compare the different adjustment mechanism in force when the economy is respectively hit by an unemployment shock and a trade liberalisation episode, both to the manufacturing sector. The unemployment shock lead workers to reallocate away from manufacturing towards more productive sectors. Although this reallocation increased the real value added of the economy, aggregate welfare dropped as the new steady state unemployment rate increased. The labor market adjustment left human capital prices unaffected as physical capital levels adjusted in order to keep the ratio of physical to human capital constant. Trade liberalisation also lead to reallocation of manufacturing workers. Unlike the unemployment shock, both real value added and aggregate welfare increased in the new equilibrium, and the price of human capital in the manufacturing sector dropped, both due to the lower output price and due to a lower equilibrium ratio of physical to human capital.

In both cases, the labor market adjustment process was sluggish: After 10 years real value added had adjusted by 59% when hit by the unemployment shock, and 74% when exposed to trade liberalisation. There are two explanations for the sluggishness. First, as part of the human capital of a worker is specific to the sector in which he works, human capital is not entirely transferable across sectors. This means that it takes time for reallocated workers to build up human capital in the new sectors. Secondly, workers face substantial mobility costs when switching sectors, resulting in postponement of reallocation. The estimation shows that the mobility costs are large and provide a substantial barrier to reallocation with median costs in the range of 1.2 to 2.4 times average annual wages.

In case of the unemployment shock, it is important to bear in mind that the only source of gains is from a more efficient allocation of resources. If the unemployment shock proxies a trade shock such as offshoring, additional gains, such as productivity increases or lower intermediate input prices, may exist. These are not modeled here, and the estimating gains from these sources is left for future work.

The mobility costs turn out to be crucial in understanding the slow adjustment following globalisation shocks. When these costs are absent, the labor market reallocates to the new steady state within 2 to 3 years. As more educated workers face smaller mobility costs, policy makers wishing to minimise the adjustment period could focus on implementing policies such as job training for workers. Assessing the efficiency of such policies is important, but lies outside the scope of the current paper, which is focused on estimating the reallocation costs.

The paper can be seen as an attempt to take seriously some arguments often encountered in the public debate on globalisation, which often focuses the costs rather than the gains. By measuring the costs and showing that they are potentially large, the paper is able to illustrate the trade offs faced by individual workers worried by the prospect of reallocating to new sectors, and those faced by policy makers focused on attaining aggregate gains. As the process of globalisation continues, this conflict is bound to become ever more present.

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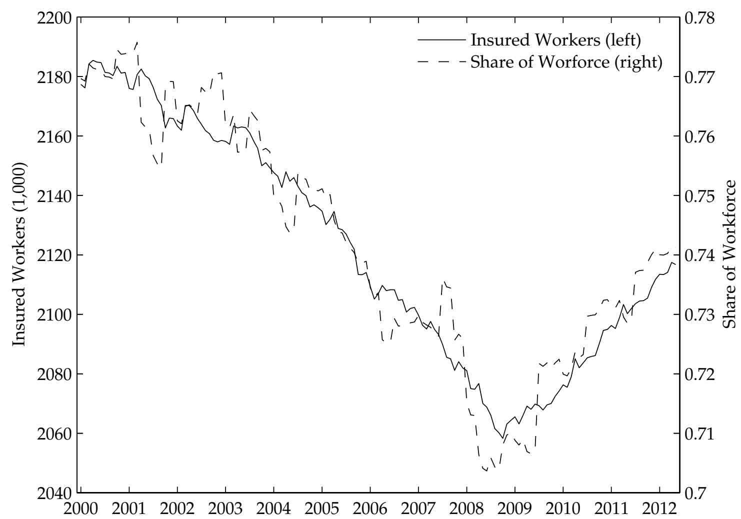
APPENDICES NOT FOR PUBLICATION

APPENDIX A. UNEMPLOYMENT BENEFITS IN DENMARK

This section describes the institutional setting for the unemployed in Denmark as applicable to the period from 1996 to 2008. The structural model in Section 2 includes a model of the institutional setting presented here.

All unemployed workers who wish to receive benefits must be registered as "seeking employment" at local job-centers run by the government. Then there are two separate systems: One for members of unemployment insurance (UI) fund, and one for those who are not.

FIGURE A.1. Insured Workers



The figure shows that the vast majority of the workforce are members of a UI fund; the membership rate is about 70-77 percent in the period shown.

A.1. **Benefits for the Insured.** The UI system is administered by government approved UI funds ("A-kasser"). In order to be eligible for UI benefits, a worker must satisfy certain criteria. The worker must

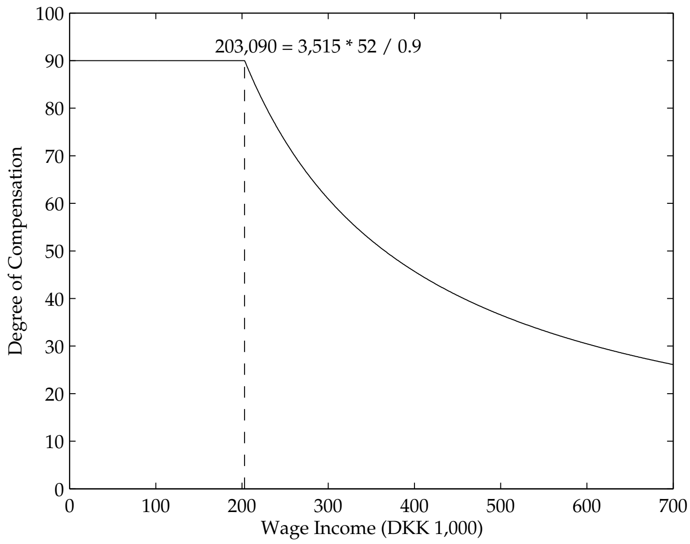
(1) have been member of an UI fund for at least one year,
(2) satisfy the employment criterion,
(3) satisfy the availability criteria,
(4) not be unemployed by self-infliction.

The employment criterion states that full-time insured must have been employed for at least 52 weeks out of the last 3 years while the part-time insured must have been employed for at least 34 weeks out of the last 3 years in order to be eligible for UI benefits. Some of the availability criteria are that the worker must actively seek any employment opportunities and reside in Denmark.

If the worker is eligible for UI benefits, then the weekly benefit is calculated as 90 percent of the worker's labor income for the past 3 months or 12 weeks, depending on whether the wage was paid on a monthly basis, or weekly of biweekly basis. However, the maximum benefit is DKK 3,515 per week from January 1, 2008. This number is regulated once a year by a factor that takes into account the general development of wages for the employed. The UI benefits are paid out for a maximum of four years after which the benefits expire.

Since the maximum UI benefit is capped at DKK 203,090 a year in 2008, the degree of compensation drops in incomes above this level. The resulting compensation degree is 61 and 46 percent for yearly incomes of DKK 300,000 and DKK 400,000, respectively.

FIGURE A.2. Compensation Rate



A.2. **Benefits for the Uninsured.** The unemployed workers who are either uninsured or ineligible for UI benefits may apply for welfare assistance ("kontanthjælp"). The size of the assistance depends on a number of factors. For workers of age 25 and above that are caretakers of children, the monthly maximum assistance is DKK 13,732 in 2012, while that figure is DKK 10.335 for those without children. For workers under the age of 25 the maximum assistance is DKK 6,660 for caretakers and DKK 5,662 for others.

However, workers are only eligible for assistance if their assets do not exceed a total value of DKK 10,000. Furthermore, spousal income is deducted from the assistance.

APPENDIX B. SECTORS

TABLE B.1. Mapping from NACE Rev. 2 to Sectors

Agriculture/Mining	Agriculture and Horticulture (01); Forestry (02); Fishing (03); Extraction of Oil and Gas (06); Extraction of Gravel and Stone (08); Mining Support Service Activities (09)
Manufacturing	Food Products (10); Beverages (11); Tobacco Products (12); Textiles (13); Wearing Apparel (14); Leather and Related Products (15); Wood and Wood Products (16); Paper and Paper Products (17); Printing and Reproduction of Recorded Media (18); Coke and Refined Petroleum Products (19); Chemicals and Chemical Products (20); Pharmaceuticals (21); Rubber and Plastic Products (22); Other Non-Metallic Mineral Products (23); Basic Metals (24); Fabricated Metal Products (25); Computer, Electronic and Optical Products (26); Electrical Equipment (27); Machinery and Equipment (28); Motor Vehicles (29); Other Transport Equipment (30); Furniture (31); Other Manufacturing (32); Repair and Installation of Machinery and Equipment (33)
Construction	New Buildings (41); Civil Engineering (42); Specialised Construction Activities (43)
Trade/Utilities/ Transportation/Communication	Electricity, Gas, Steam and Air Conditioning Supply (35); Water Collection, Treatment and Supply (36); Sewerage (37); Waste and Recycling (38); Wholesale and Retail Trade and Repair of Motor Vehicles and Motorcycles (45); Wholesale Trade (46); Retail Trade (47); Land Transport and Transport via Pipelines (49); Water Transport (50); Air Transport (51); Support Activities for Transportation (52); Postal and Courier (53); Publishing (58); Motion Picture and TV Program Production (59); Programming and Broadcasting (60); Telecommunications (61); Computer Programming and Consultancy (62); Information Services (63)
Services	Accommodation (55); Food and Beverage Services (56); Financial Services (64); Insurance and Pension Funding (65); Other Financial Activities (66); Real Estate (68); Legal and Accounting (69); Business Consultancy (70); Architecture and Engineering (71); Scientific Research and Development (72); Advertising and Market Research (73); Other Professional, Scientific and Technical Activities (74); Veterinary Activities (75); Renting and Leasing (77); Employment (78); Travel Agency (79); Security and Investigation (80); Services to Buildings and Landscapes (81); Other Business Services (82); Public Administration (84); Education (85); Human Health (86); Residential Care (87); Social Work (88); Creative, Arts and Entertainment (90); Libraries and Museums (91); Gambling and Betting (92); Sports (93); Activities of Membership Organisations (94); Repair of Personal Goods (95); Other Personal Services (96); Activities of Households as Employers of Domestic Personnel (97)

APPENDIX C. ASYMPTOTIC DISTRIBUTION OF THE SMD ESTIMATOR

Define the SMD estimator[10] as

$$\widehat{\theta}_{SMD} = \arg\min_{\theta} \left[\alpha^S(\theta) - \alpha^D\right]' \mathbf{A} \left[\alpha^S(\theta) - \alpha^D\right], \tag{12}$$

where the positive definite weighting matrix $\mathbf{A}$ is assumed to converge to a non-stochastic matrix. If the model is well specified $\alpha^S(\theta)$ converges to α^D. Then, by using $\text{plim}\,\alpha^S(\theta) = \alpha^\infty(\theta)$ and $\text{plim}\,\alpha^D = \alpha^0(\theta)$, we have

$$\text{plim}\,\widehat{\theta}_{SMD} = \theta_0.$$

Let

$$\begin{aligned}\alpha^S(\theta) - \alpha^D &= \alpha^S(\theta) - \alpha^D + \alpha^\infty(\theta_0) - \alpha^\infty(\theta_0) + \alpha^0(\theta_0) - \alpha^0(\theta_0) \\ &= \left[\alpha^S(\theta) - \alpha^\infty(\theta_0)\right] + \left[\alpha^0(\theta_0) - \alpha^D\right] + \left[\alpha^\infty(\theta_0) - \alpha^0(\theta_0)\right],\end{aligned}$$

where the last term cancels out when the model is well specified. Now, apply the Central Limit Theorem and evaluate at $\theta = \theta_0$ to get

$$\sqrt{n}\left[\alpha^S(\theta_0) - \alpha^D\right] = \sqrt{n}\left[\alpha^S(\theta_0) - \alpha^\infty(\theta_0)\right] + \sqrt{n}\left[\alpha^0(\theta_0) - \alpha^D\right],$$

and

$$\sqrt{n}\left[\alpha^S(\theta_0) - \alpha^D\right] \longrightarrow^d \mathcal{N}\left(0, \frac{S+1}{S}\mathbf{V}_0\right). \tag{13}$$

The first order condition of the optimisation problem in (12) is

$$\left[\alpha^S(\theta) - \alpha^D\right]' \mathbf{A}\nabla\alpha^S(\theta) = 0,$$

and a Taylor series expansion around θ_0 gives

$$\alpha^S(\theta) = \alpha^S(\theta_0) + \nabla\alpha^S(\theta_0)\left[\theta - \theta_0\right].$$

Substitute back into the first order condition and solve for $[\theta - \theta_0]$ to get

$$[\theta - \theta_0] = -\left[\nabla\alpha^S(\theta)'\mathbf{A}\nabla\alpha^S(\theta)\right]^{-1} \nabla\alpha^S(\theta)'\mathbf{A}\left[\alpha^S(\theta_0) - \alpha^D\right].$$

Using this and (13) we get

$$\sqrt{n}\left[\widehat{\theta}_{SMD} - \theta_0\right] \longrightarrow^d \mathcal{N}\left(0, \frac{S+1}{S}\mathbf{G}_1^{-1}\mathbf{G}_2\mathbf{G}_1^{-1}\right),$$

where

$$\begin{aligned}\mathbf{G}_1 &= \left[\text{plim}\,\nabla\alpha^S(\theta_0)\right]' \mathbf{A}_\infty \left[\text{plim}\,\nabla\alpha^S(\theta_0)\right], \\ \mathbf{G}_2 &= \left[\text{plim}\,\nabla\alpha^S(\theta_0)\right]' \mathbf{A}_\infty\mathbf{V}_0\mathbf{A}_\infty \left[\text{plim}\,\nabla\alpha^S(\theta_0)\right].\end{aligned}$$

With the optimal weighting matrix $\mathbf{A} = \mathbf{V}_0^{-1}$, the asymptotic distribution of the Simulated Minimum Distance Estimator is

$$\sqrt{n}\left[\widehat{\theta}_{SMD} - \theta_0\right] \longrightarrow^d \mathcal{N}\left(0, \frac{S+1}{S}\mathbf{G}^{-1}\right),$$

where

$$\mathbf{G} = \left[\text{plim}\,\nabla\alpha^S(\theta_0)\right]' \mathbf{V}_0^{-1} \left[\text{plim}\,\nabla\alpha^S(\theta_0)\right].$$

[10] See Hall and Rust (2002), Browning, Ejrnæs, and Alvarez (2010), and Alan (2006).

Appendix D. Auxiliary Parameters

Table D.1. Log-Wage Regressions

	(1)	(2)	(3)	(4)	(5)
Female	-0.225770	-0.169741	-0.166993	-0.198295	-0.209311
	(0.0018)	(0.0003)	(0.0009)	(0.0004)	(0.0002)
Educ	0.160424	0.316571	0.215302	0.290197	0.226375
	(0.0019)	(0.0004)	(0.0008)	(0.0005)	(0.0002)
Age	0.038571	0.013350	0.018009	0.018789	0.012954
	(0.0008)	(0.0002)	(0.0003)	(0.0002)	(0.0001)
Age^2	-0.000445	-0.000184	-0.000225	-0.000266	-0.000172
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	0.004641	0.006850	0.006529	0.008335	0.006877
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper$(s_{t-1} \neq s)$	-0.001951	-0.002840	-0.003274	-0.003691	-0.004709
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	4.217619	4.824655	4.704604	4.738534	4.838578
	(0.0180)	(0.0037)	(0.0067)	(0.0043)	(0.0025)
1997	4.214235	4.814332	4.693450	4.735317	4.827604
	(0.0180)	(0.0037)	(0.0067)	(0.0043)	(0.0025)
1998	4.236790	4.857475	4.716918	4.759405	4.855633
	(0.0180)	(0.0037)	(0.0067)	(0.0043)	(0.0025)
1999	4.230793	4.845266	4.724120	4.760118	4.857312
	(0.0180)	(0.0037)	(0.0067)	(0.0043)	(0.0025)
2000	4.241672	4.851834	4.729479	4.763529	4.863007
	(0.0180)	(0.0037)	(0.0067)	(0.0043)	(0.0025)
2001	4.257276	4.865525	4.749059	4.778822	4.882439
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2002	4.271265	4.869439	4.749296	4.779176	4.880082
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2003	4.235850	4.853705	4.732755	4.756843	4.862623
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2004	4.235780	4.851975	4.731816	4.747835	4.872738
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2005	4.282241	4.894966	4.773812	4.789896	4.909219
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2006	4.310018	4.918123	4.801449	4.810689	4.931857
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2007	4.336668	4.940444	4.825477	4.840149	4.953328
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
2008	4.338527	4.934240	4.815024	4.842222	4.967502
	(0.0180)	(0.0037)	(0.0066)	(0.0043)	(0.0025)
Root MSE	0.373303	0.276544	0.284388	0.336371	0.305798
R^2	0.995	0.997	0.997	0.996	0.997
Observations	268224	3791930	1204452	3968220	10331959

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

TABLE D.2. LPMs for Sectoral Choices

	(1)	(2)	(3)	(4)	(5)
Female	-0.012603	-0.105754	-0.082464	-0.086120	0.288068
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0002)
Educ	-0.007912	-0.099011	-0.047300	-0.133806	0.316794
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0002)
Age	-0.000378	-0.000129	-0.000754	-0.012433	0.015647
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age^2	0.000005	-0.000035	0.000002	0.000091	-0.000130
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	-0.000394	0.002072	-0.000033	0.002935	0.001086
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper$(s_{t-1} \neq s)$	0.000429	-0.001663	0.000447	-0.000830	-0.008370
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	0.035880	0.311438	0.133809	0.577965	-0.188614
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
1997	0.035511	0.314994	0.134018	0.579744	-0.177914
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
1998	0.035490	0.318760	0.136030	0.583498	-0.173233
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
1999	0.035470	0.316217	0.137536	0.585554	-0.169940
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2000	0.035606	0.316729	0.139924	0.584328	-0.170248
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2001	0.035931	0.315354	0.140495	0.583353	-0.166604
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2002	0.036282	0.312481	0.140331	0.583231	-0.166076
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2003	0.036060	0.306324	0.140641	0.584214	-0.169382
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2004	0.036200	0.301354	0.141749	0.586223	-0.165607
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2005	0.036200	0.298510	0.144899	0.590177	-0.161753
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2006	0.036111	0.299514	0.148197	0.592117	-0.157089
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2007	0.036659	0.300686	0.148819	0.595435	-0.153928
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
2008	0.036267	0.291473	0.146335	0.598015	-0.141547
	(0.0007)	(0.0022)	(0.0013)	(0.0022)	(0.0026)
R^2	0.018	0.220	0.099	0.233	0.604
Observations	20373918	20373918	20373918	20373918	20373918

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

TABLE D.3. LPMs for Transitions from Agriculture/Mining

	(1)	(2)	(3)	(4)	(5)
Female	-0.011452	-0.000318	-0.000435	-0.000230	-0.000107
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Educ	-0.006931	-0.000171	-0.000155	-0.000158	-0.000065
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age	-0.000262	-0.000056	-0.000055	-0.000069	-0.000002
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Age^2	0.000003	0.000000	0.000000	0.000001	0.000000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	-0.000270	-0.000014	-0.000007	-0.000013	-0.000033
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper$(s_{t-1} \neq s)$	-0.000553	0.000196	0.000181	0.000190	0.000262
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	0.028636	0.002369	0.002093	0.002448	0.000990
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
1997	0.029337	0.002132	0.001962	0.002311	0.000795
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
1998	0.029377	0.002360	0.001951	0.002289	0.000781
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
1999	0.029420	0.002138	0.001958	0.002303	0.000769
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2000	0.029531	0.002112	0.001953	0.002271	0.000758
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2001	0.029835	0.002091	0.001935	0.002254	0.000812
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2002	0.029881	0.002123	0.001920	0.002267	0.000730
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2003	0.030211	0.002050	0.002059	0.002230	0.000894
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2004	0.030263	0.002011	0.001995	0.002263	0.000739
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2005	0.030220	0.002117	0.001991	0.002315	0.000854
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2006	0.030045	0.002161	0.002093	0.002387	0.000814
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2007	0.030106	0.002155	0.001998	0.002395	0.000827
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
2008	0.030259	0.002200	0.001903	0.002292	0.001232
	(0.0006)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
R^2	0.016	0.003	0.003	0.003	0.004
Observations	20373918	20373918	20373918	20373918	20373918

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

TABLE D.4. LPMs for Transitions from Manufacturing

	(1)	(2)	(3)	(4)	(5)
Female	-0.000260	-0.101225	-0.001873	-0.001851	0.000190
	(0.0000)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
Educ	-0.000157	-0.096667	-0.000625	-0.000533	0.002204
	(0.0000)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
Age	-0.000045	0.001358	-0.000234	-0.000727	-0.000598
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
Age^2	0.000000	-0.000048	0.000002	0.000005	0.000004
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	-0.000008	0.002640	-0.000008	0.000008	-0.000084
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper$(s_{t-1} \neq s)$	0.000177	-0.008974	0.000939	0.002900	0.003071
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	0.001891	0.244658	0.009520	0.027120	0.021760
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
1997	0.001737	0.254299	0.008510	0.023993	0.018710
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
1998	0.001698	0.257294	0.008650	0.023932	0.018976
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
1999	0.001697	0.258194	0.008668	0.023775	0.019413
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2000	0.001688	0.256321	0.008667	0.023263	0.018974
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2001	0.001712	0.256139	0.008362	0.023710	0.019223
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2002	0.001742	0.255075	0.008277	0.023923	0.018439
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2003	0.001662	0.251187	0.008516	0.023358	0.017925
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2004	0.001656	0.245282	0.008125	0.022984	0.018030
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2005	0.001642	0.240967	0.008515	0.024136	0.018598
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2006	0.001713	0.240073	0.008800	0.023923	0.018686
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2007	0.001708	0.240325	0.008467	0.024170	0.021088
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
2008	0.001638	0.233704	0.008248	0.024198	0.027396
	(0.0001)	(0.0021)	(0.0002)	(0.0004)	(0.0004)
R^2	0.003	0.216	0.017	0.049	0.051
Observations	20373918	20373918	20373918	20373918	20373918

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

TABLE D.5. LPMs for Transitions from Construction

	(1)	(2)	(3)	(4)	(5)
Female	-0.000354	-0.001557	-0.075572	-0.001134	-0.001356
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Educ	-0.000123	-0.000455	-0.044517	-0.000470	0.000060
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Age	-0.000025	-0.000152	-0.000175	-0.000196	-0.000105
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Age^2	0.000000	0.000001	-0.000003	0.000002	0.000001
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	-0.000008	-0.000023	0.000198	-0.000009	-0.000035
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper$(s_{t-1} \neq s)$	0.000148	0.000730	-0.003030	0.000679	0.000907
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	0.001204	0.006806	0.104159	0.007436	0.006387
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
1997	0.001077	0.006198	0.108415	0.006687	0.004672
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
1998	0.001059	0.006245	0.110164	0.006652	0.004638
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
1999	0.001080	0.006078	0.112107	0.006640	0.004470
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2000	0.001060	0.006087	0.113990	0.006565	0.004489
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2001	0.001128	0.006278	0.115385	0.006657	0.004803
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2002	0.001445	0.006204	0.115562	0.006693	0.004743
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2003	0.001079	0.005905	0.115695	0.006658	0.004698
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2004	0.001070	0.005870	0.116647	0.006482	0.004876
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2005	0.001071	0.005847	0.118801	0.006811	0.004683
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2006	0.001133	0.006118	0.121589	0.006855	0.004814
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2007	0.001126	0.006325	0.123313	0.007148	0.005347
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
2008	0.001102	0.006152	0.122501	0.006843	0.005415
	(0.0001)	(0.0002)	(0.0013)	(0.0002)	(0.0002)
R^2	0.003	0.013	0.093	0.012	0.015
Observations	20373918	20373918	20373918	20373918	20373918

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

TABLE D.6. LPMs for Transitions from Trade/Util./Tran./Com.

	(1)	(2)	(3)	(4)	(5)
Female	-0.000221	-0.001902	-0.001185	-0.082729	0.000816
	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)
Educ	-0.000141	-0.000586	-0.000520	-0.130861	0.001058
	(0.0000)	(0.0000)	(0.0000)	(0.0002)	(0.0000)
Age	-0.000049	-0.000773	-0.000223	-0.010165	-0.001235
	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)
Age^2	0.000000	0.000006	0.000002	0.000071	0.000011
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	-0.000009	-0.000007	-0.000002	0.003541	-0.000114
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper$(s_{t-1} \neq s)$	0.000175	0.002670	0.000789	-0.009273	0.003609
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	0.001903	0.027499	0.007959	0.491174	0.038590
	(0.0001)	(0.0004)	(0.0002)	(0.0022)	(0.0004)
1997	0.001642	0.024942	0.007270	0.501879	0.035346
	(0.0001)	(0.0004)	(0.0002)	(0.0022)	(0.0004)
1998	0.001642	0.025297	0.007512	0.504817	0.035580
	(0.0001)	(0.0004)	(0.0002)	(0.0022)	(0.0004)
1999	0.001669	0.024703	0.007363	0.508281	0.035770
	(0.0001)	(0.0004)	(0.0002)	(0.0022)	(0.0004)
2000	0.001729	0.025786	0.007496	0.508207	0.036599
	(0.0001)	(0.0004)	(0.0002)	(0.0022)	(0.0004)
2001	0.001660	0.025113	0.007515	0.507108	0.036498
	(0.0001)	(0.0004)	(0.0002)	(0.0022)	(0.0004)
2002	0.001645	0.024614	0.007319	0.506942	0.035925
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
2003	0.001639	0.023816	0.007096	0.508482	0.035088
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
2004	0.001648	0.023837	0.007170	0.510063	0.035717
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
2005	0.001685	0.024508	0.007490	0.511498	0.035896
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
2006	0.001723	0.025652	0.007931	0.512749	0.038365
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
2007	0.001745	0.026169	0.007620	0.515293	0.038947
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
2008	0.001664	0.025030	0.007239	0.519633	0.038889
	(0.0001)	(0.0004)	(0.0002)	(0.0021)	(0.0004)
R^2	0.003	0.045	0.014	0.228	0.057
Observations	20373918	20373918	20373918	20373918	20373918

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.

TABLE D.7. LPMs for Transitions from Services

	(1)	(2)	(3)	(4)	(5)
Female	-0.000093	0.000126	-0.001010	0.000596	0.282797
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)
Educ	-0.000035	0.001727	-0.000068	0.001076	0.314987
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0002)
Age	-0.000010	-0.000547	-0.000144	-0.001054	0.017336
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Age^2	0.000000	0.000004	0.000001	0.000009	-0.000150
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Exper	-0.000023	-0.000119	-0.000032	-0.000136	0.002675
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$Exper(s_{t-1} \neq s)$	0.000264	0.001990	0.000791	0.003052	-0.019566
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1996	0.000927	0.019755	0.006239	0.034345	-0.271674
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
1997	0.000682	0.017986	0.005207	0.030822	-0.247749
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
1998	0.000713	0.018347	0.005355	0.031371	-0.244333
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
1999	0.000656	0.017863	0.005235	0.031523	-0.238903
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2000	0.000703	0.018477	0.005487	0.031330	-0.238573
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2001	0.000668	0.018481	0.005274	0.031110	-0.236467
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2002	0.000726	0.017819	0.005330	0.031063	-0.232733
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2003	0.000626	0.017207	0.005082	0.031213	-0.235069
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2004	0.000623	0.016953	0.005228	0.030593	-0.235287
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2005	0.000646	0.017595	0.005576	0.031739	-0.231899
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2006	0.000699	0.018459	0.005781	0.032783	-0.228649
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2007	0.001279	0.020078	0.006159	0.034190	-0.227186
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
2008	0.001080	0.019947	0.005471	0.033890	-0.219947
	(0.0001)	(0.0004)	(0.0002)	(0.0004)	(0.0025)
R^2	0.004	0.030	0.013	0.047	0.602
Observations	20373918	20373918	20373918	20373918	20373918

Standard errors in parentheses. Sectors: (1) Agriculture/Mining, (2) Manufacturing, (3) Construction, (4) Trade/Utilities/Transportation/Communication, (5) Services.