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Within- and Cross-Firm Mobility and Earnings Growth

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ABSTRACT

Within- and Cross-Firm Mobility and Earnings Growth*

While it is well established that both promotions within firms and mobility across firms lead to significant earnings progression, little is known about the interaction between these types of mobility. Exploiting a large Danish panel data set and controlling for unobserved individual heterogeneity, we show that cross-firm moves at the non-executive level provide sizeable short-run gains (similar to the effect of a promotion), consistent with the existing literature. These gains, however, appear modest when compared with the persistent impact on earnings growth of promotions (either within or across firms) and subsequent mobility at a higher hierarchy level.

NON-TECHNICAL SUMMARY

What is better for your salary – getting promoted or switching employers? A dataset from Denmark that follows the entire population over more than a decade allows us to address this question. We use a statistical procedure that accounts for the fact that people may differ at the individual level in their earnings capacities. Our findings suggest that moving to a new employer gives a similar boost to short-run earnings growth than a promotion to an executive-level job with the current employer. Jobs further up in the hierarchy, however, provide a steeper growth path for earnings. For longer-term earnings growth it therefore seems more important to move up in the hierarchy than to land jobs with other employers.

JEL Classification: C33, J6, M51

Keywords: earnings growth, promotions, dynamic panel data models, matched employer-employee data

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1 Introduction

It is well established that mobility across firms is an important contributor to the growth in wages that employees experience over their career. Yet, using different data sets, the Personnel Economics literature also documents the importance of promotions for earnings progression. Little is known about the interaction between these types of mobility. This paper helps fill that gap by estimating the effects of within- and between-firm mobility on earnings growth in a joint framework. For this purpose we exploit a rich Danish panel data set that provides information both on employer-employee matches and on broad hierarchy levels. The impact of cross-firm mobility on earnings and earnings growth is the subject of a substantial literature. In an influential paper, Topel and Ward (1992) find that the wage increases employees experience when moving to new employers account for more than one third of the wage growth during the first decade of the working life of white men in the U.S.; a period during which labor force attachment is still tenuous.[1] The role of position changes within firms is the subject of a different strand of the literature, mostly based on data covering individual firms or particular occupations. It shows that promotions are an important source of earnings growth.[2] Baker, Gibbs and Holmström (1994a, 1994b) established that immediate wage increases at promotion account only for part of the average wage difference across hierarchy levels. This often-replicated finding suggests that much of the gain from promotions comes in the form of faster compensation growth at higher levels in the hierarchy.

To our knowledge, only two studies use the same data to estimate the effects of within- and between-firm mobility on earnings. McCue (1996) computes from average real wage changes in the PSID that around 10 percent of the wage growth that an individual experiences over the first decade in the labor market can be attributed to promotions. Around 24 percent of the 10-year wage growth is linked to cross-firm moves. Dias da Silva and Van der Klaauw (2010) use Portuguese matched employer-employee data and control for individual unobserved heterogeneity. They find substantial returns to promotions and cross-firm transitions, each of which provide an immediate wage increase of around 5 percent.

Our results show that it is important to allow for the additional detail that some cross-firm moves are in fact promotions or demotions, and that lateral moves occur at different hierarchy levels. Paying attention to these details helps clarify the relative contributions that different types of between-job mobility make to long-run earnings progression. In our data,

[1]Other contributions are, for example, Antel (1986, 1991), Altonji and Shakotko (1987), Altonji and Williams (2005), Bartel and Borjas (1981), Buchinsky *et al.* (2010), Dustmann and Meghir (2005), Keith and McWilliams (1999), Mincer (1986), and Topel (1991).

[2]For example, Belzil and Bognanno (2008), Booth, Francesconi and Frank (2003), Chiappori, Salanie and Valentin (1999), Dohmen *et al.* (2004), Gibbs and Hendricks (2004), Lazear (1992), Medoff and Abraham (1980, 1981), Seltzer and Merrett (2000) and Treble *et al.* (2001).

cross-firm moves provide sizeable short-run gains. Switching employers at the non-executive level (which constitutes over 90 percent of our sample) is comparable to receiving a within-firm promotion to an executive-level job. The one-off gain from a cross-firm move, however, is relatively modest in comparison with the persistent impact that promotions, either within or across firms, and subsequent mobility at the executive level have on earnings growth. If one uses our estimates to compute 10-year log growth rates for a university graduate who switches employers or receives a promotion early on in his or her career, 12-17 percent of total growth can be attributed to the promotion. Only 2-7 percent stem from the earnings gain that the employee experiences when switching employers. Furthermore, the returns to vertical transitions across firms exhibit an interaction effect: the short-run gain from a cross-firm promotion exceeds the sum of the premia for a (within-firm) promotion and a (lateral) cross-firm move, and this gain is only partly reversed for a cross-firm demotion.

The primary contribution of our paper thus is to help understand the role that interactions between cross-firm mobility and hierarchical transitions play for earnings growth, while at the same time accounting for unobserved individual heterogeneity. We use register-based linked employer-employee data from Denmark. Denmark has a flexible labor market with high cross-firm mobility, and is in these respects similar to the U.K. and the U.S. (for example, Jolivet *et al.* 2006). Our data allow us to trace employee mobility both within and between firms and provide information on compensation as well as a large set of background variables. In the spirit of the earnings dynamics literature,[3] we analyze these data by employing econometric techniques that pay careful attention to the importance of permanent and transitory shocks to the income process.

Our results are based on male employees in the private-sector, who have stable labor force attachment. We replicate these findings for a comparable sample of female employees. While there is a gender wage gap, relative returns to mobility are remarkably similar for men and women. One may interpret this to mean that men and women face similar incentives to look for alternative employment or to compete for a promotion. But the likelihood of a cross-firm move or a promotion, which are the two types of flows associated with sizeable earnings gains, is lower for women. This implies that between-firm mobility and hierarchical transitions, despite similar relative returns for men and women conditional on a move, tend to increase gender differences in earnings.

The paper is organized as follows. Next, we describe the data and then lay out our econometric strategy in Section 3. Section 4 contains the results on mobility and income growth. Section 5 follows up with robustness checks and Section 6 concludes the paper.

[3]For example, Abowd and Card (1989), Altonji *et al.* (2009), Baker (1997), Browning *et al.* (2006), Lillard and Weiss (1979), Lillard and Willis (1978), MaCurdy (1982), Meghir and Pistaferri (2004).

2 The Data

Our study uses register-based information on all establishments and residents in Denmark from Statistics Denmark's Integrated Database for Labor Market Research (IDA).[4] The data base provides detailed information on mobility across firms: unique identifiers allow us to follow individuals and establishments over time (matches are recorded once a year in November). Further, the data permit us to construct a measure of hierarchical placement. Using the first digit of the Danish International Standard Classification of Occupations (DISCO) codes, we can distinguish "executives" – employees who manage organizations or departments (major group 1, comprising corporate managers and general managers) – from "non-executives" (subsuming all other major groups).[5] Our hierarchical placement variable has the advantage of providing a clean measure of an employee's promotion that involves an actual change in position. Such a shift in the employee's production technology is central to prominent theoretical models of wage and promotion dynamics (for example, Bernhardt 1995, Gibbons and Waldman 1999, 2006). Furthermore, our measure has a consistent interpretation across the wide spectrum of firms covered by our data. This helps us avoid some of the problems encountered with promotion measures based on organizational charts, occupational classifications, and self-reports from employees or employers. Their firm- or industry-specific nature complicates comparisons. First, members of an organization often do not perceive as a promotion what the classification identifies as a change in hierarchical level. Dias da Silva and Van der Klaauw (2010), for instance, report that more than 70 percent of all moves classified as a change in hierarchical level in their data are not considered to be a promotion by the employer. Second, it is hard to distinguish self-reported promotions that involve no position change from other elements of pay-for-performance. For example, 40-50 percent of self- or employer-reported promotions involve no change in job description in Pergamit and Veum (1999) and Dias da Silva and Van der Klaauw (2010).[6]

Our aim is to shed light on how mobility affects earnings growth for those with stable employment. Therefore we analyze earnings patterns for *core* employees in private-sector establishments. Specifically, we follow employees who were continuously in full-time employment between 1994 and 2005 in private sector establishments with at least 25 employees, and who were between 30 and 45 years of age at the start of the panel in 1994.[7] With this

[4]The Danish name for the database is *Integreret Database for Arbejdsmarkedsforskning (IDA)*. It is documented at http://www.dst.dk/TilSalg/Forskningsservice/Databaser/IDA.aspx.

[5]The DISCO codes follow the international definitions from the International Labor Organization (ILO), documented at http://www.ilo.org/public/english/bureau/stat/isco/.

[6]Pergamit and Veum (1999) exploit questions about promotion receipt in the 1990 wave of the *National Longitudinal Survey of Youth*. Dias da Silva and Van der Klaauw (2010) use employer-reported promotions in the Portuguese *Quadros de Pessoal*.

[7]While we know employment status from social security records on a monthly basis, employer-employee matches are recorded only once a year in November. So shorter employment periods (and associated flows),

selection, the age range in the panel is 30 to 56 years, so education and retirement choices play no significant role. Our earnings measure is annual labor income (comprising both base pay and variable pay components) converted to year-2000 prices using Statistics Denmark's consumer price index.

We analyze separate samples for men and women, each giving a balanced panel where every individual has a complete 11-year employment history. Table 1 presents descriptive statistics. The male sample consists of 58,860 unique individuals with 706,320 person-year observations, and the female sample consists of 26,506 unique individuals with 318,072 person-year observations. At the start of the panel, the average employee in both samples is 38 years old. Some noticeable gender differences emerge: men work in smaller firms than women, tend to be more educated than women, and earn about 30 percent more than women. The average man earns DKK 340,367 (in year-2000 prices, corresponding to around 41,000 U.S. dollars); the average woman earns DKK 262,310 (around 31,000 U.S. dollars).

The flows in this paper are based on a comparison for each person of their primary employment relationships in November of consecutive years, when employer-employee matches are recorded. Table 2 shows the patterns for all the eight different types of cross-firm and within-firm moves.

Ninety-three percent of all employees in the male sample are in the non-executive layer. Most remain at that level, with 87 percent of them staying with the same firm (*stayer*) and 11 percent moving laterally between firms (*CF*). A bit more than 1 percent are promoted to the executive layer within the same firm (*PWF*); promotions across firm boundaries (*PCF*) account for 0.3 percent. Similarly, executives (who make up 7 percent of male employees) typically remain in that level; but there is less persistence than for non-executives: 78 percent stay with the same firm (*ExecStayer*) and 8 percent move laterally across firms (*ExecCF*). Almost 12 percent of executives are demoted to non-executive positions within the firm (*DWF*) and slightly less than 3 percent cross firm boundaries and continue at the non-executive level (*DCF*). Downward moves hence are not uncommon; but promotions (both within- and cross-firm) are about 1.3 times more frequent than demotions. Our data thus add to a number of studies which show that demotions are by no means exceptional, including Belzil and Bognanno's (2008) study of U.S. executives (with a promotions/demotions ratio of 1.1 or 5.1, depending on the definition of hierarchical levels), Lluis's (2005) analysis of German household panel data (ratio 2.6 or 1.1 after a wage-growth-based reclassification), Hamilton and MacKinnon's (2001) study of the Canadian Pacific Railway (ratio 1.7), and Seltzer and Merrett's (2000) work on the 19th-century Union Bank of Australia (ratio 2.1).

Women are slightly less likely to make cross-firm moves than men (10 percent vs. 11

for instance lasting from March to September of a particular year, cannot be picked up with our data. Given our focus on core employees with continuous employment histories, however, this does not seem problematic for our purposes.

percent for men). Only 2.3 percent are employed at the executive level (vs. 7.3 percent for men). This is in part explained by a lower probability of promotion (0.5 percent vs. 1.5 percent for men) and a higher probability of demotion (17 percent vs. 15 percent for men).

Overall, the cross-firm mobility patterns are similar to those reported by McCue (1996) for the U.S. (men 11 percent/women 12 percent; using the PSID 1976-88), and higher than those reported by Lluis (2005) for Germany (6 percent both for men and women; GSOEP 1985-96). Indeed, in a cross-country comparison by Jolivet *et al.* (2006) based on the European Community Household Panel (1994-2001) and the PSID (1993-96), Denmark belongs to the group with high job-to-job transition rates (15-20 percent over a three-year window) along with Ireland, the U.K. and the U.S. The middle range is covered by Germany and the Netherlands, whereas rates well below 10 percent are found in Belgium, France, Italy, Portugal, and Spain.[8] In the previously mentioned study by Dias da Silva and Van der Klaauw (2010) that uses Portuguese data, fewer than 20 percent of those in the sample have *more* than 9 years of schooling and their average annual earnings are approximately 9,000 U.S. dollars (in year-2000 prices). In comparison, in our sample around 80 percent have more than the 9 years of compulsory schooling and average annual earnings are around 30,000 U.S. dollars (in year-2000 prices). Our data thus come from a more flexible labor market with a much more highly educated labor force and higher income levels, which in these respects is more similar to labor markets in the U.K. and the U.S.

3 The Econometric Strategy

3.1 The Empirical Model

Given earnings $C_{i,t}$ for individual i at date t, log earnings growth is modeled as

$$\Delta \ln (C_{i,t}) \equiv \ln(C_{i,t}) - \ln(C_{i,t-1}) = \alpha_i + \sum_{j=1}^{J} \mu_j \, M_{j,i,t} + X'_{i,t} \, \beta + u_{i,t}. \tag{1}$$

The right-hand side of equation (1) consists of a fixed effect (α_i), J mobility dummies $M_{j,i,t}$, a vector of control variables ($X_{i,t}$), and a residual ($u_{i,t}$). The mobility dummies correspond to the flows CF, PWF, PCF, $ExecStayer$, $ExecCF$, DWF, DCF presented above. The reference group is *Stayer* – non-executive employees staying at that level in the same firm. Our control variables include a quadratic in age as well as education, sector, and year fixed effects.

There are three important econometric issues that must be addressed. The first is the covariance structure of the residual. The second is the econometric treatment of mobility.

[8] For further details on job-to-job mobility in Denmark see Frederiksen (2008). Other studies investigating issues related to mobility and earnings using Danish registry data are Aagard *et al.* (2009), Bagger *et al.* (2009), and Smeets (2006).

The third is the possibility of a fixed effect in earnings growth.

The covariance structure of the residual

The covariance structure of the residual in equation (1) warrants attention as it will contain both permanent and transitory components. Accordingly, we have that

$$u_{i,t} = \upsilon_{i,t} + \Delta\varepsilon_{i,t},$$

where $\upsilon_{i,t}$ is an *iid* permanent income shock and $\varepsilon_{i,t}$ is a transitory shock that follows an MA(q) process. This implies that $u_{i,t}$ will have non-zero autocorrelations up to order $q+1$. Studies of individual earnings dynamics typically find a low-order MA structure, suggesting that q should be around 2 (for example, Abowd and Card 1989 and Meghir and Pistaferri 2004).

To purge the model of serial correlation in the residual, we project $\Delta\varepsilon_{i,t}$ onto lagged earnings growth:

$$\Delta\varepsilon_{i,t} = \sum_{s=1}^{S} \gamma_s \, \Delta \ln (C_{i,t-s}) + \xi_{i,t}.$$

Substituting, we obtain

$$\Delta \ln (C_{i,t}) = \alpha_i + \sum_{s=1}^{S} \gamma_s \, \Delta \ln (C_{i,t-s}) + \sum_{j=1}^{J} \mu_j \, M_{j,i,t} + X'_{i,t} \beta + e_{i,t}, \tag{2}$$

where $e_{i,t} \equiv \xi_{i,t} + \upsilon_{i,t}$. The parameters γ_s reflect the correlation between lagged earnings growth and transitory earnings shocks.[9] The lag length S is chosen so that the $e_{i,t}$ exhibit no serial correlation. In this sense, our specification is consistent with Abowd and Card (1989), Topel and Ward (1992), and Meghir and Pistaferri (2004), who model earnings as an ARMA process with a unit root.

While the inclusion of lagged earnings growth in equation (2) serves the purpose of eliminating serial correlation in $u_{i,t}$, it also lends itself to a structural interpretation. Specifically, it implies that the premium associated with a given type of mobility, captured by μ_j, will affect the dynamics of future earnings. Without the $\gamma_s \, \Delta \ln (C_{i,t-s})$ terms, mobility would behave exactly like a permanent innovation to earnings. But theories of hierarchical assignment suggest that matters are more complicated. Consider, for example a promotion. If performance is the sum of both permanent and transitory components, a promotion may occur because of a high permanent component or because of a lucky draw for the transitory component. Those who meet the promotion standard hence are a selected sample, in that they have above-average expected transitory components. Because of regression to the mean in the transitory component, post-promotion output will decline on average (Lazear 2004).

[9] Note that the permanent shock, $\upsilon_{i,t}$, will be uncorrelated with the lagged mobility variables embedded in lagged earnings growth because of a predeterminedness assumption that we invoke below in this section.

To the extent that bonus pay (which is a component of $C_{i,t}$ in our data) reflects this, there will be some degree of mean reversion in the earnings process. This would be captured by negative coefficients on lagged earnings growth in equation (2). In that case, it would also be incorrect to interpret the premium embedded in μ_j as a permanent innovation to earnings. We explicitly take these dynamic effects into consideration below when interpreting the consequences of mobility.

The econometric treatment of mobility

We impose the following moment conditions

$$E\left[e_{i,t}\, M_{j,i,s}\right] = 0 \; for \; t \geq s \; and \; \forall j.$$

These conditions amount to assuming that mobility is predetermined, as the residual in equation (2) at time t is orthogonal to all mobility dated t and prior. This implies that the permanent income innovation embedded in $e_{i,t}$ is allowed to affect mobility at $t+1$ and beyond. As discussed in Arellano and Honoré (2001), our predeterminedness assumption restricts the serial correlation in $e_{i,t}$. This further emphasizes the importance of choosing the lag length S so that the residuals are serially uncorrelated. In other words, if we did not include enough lags of earnings growth to remove the serial correlation stemming from the transitory shocks in equation (2), OLS would be inconsistent.

With our econometric treatment of mobility we follow important previous contributions in this literature (for example, Topel and Ward 1992). While our procedure does control for unobserved individual heterogeneity, the predeterminedness assumption is not innocuous. It is, however, the best assumption we can invoke, given our aim to distinguish whether within- or across-firm flows are upward, downward, or lateral moves in the hierarchy. (And our results show that this attention to detail is indeed crucial for a better understanding of the returns to cross-firm mobility.) Invoking an endogeneity assumption in the spirit of the dynamic panel literature – which would use lagged mobility as instruments for contemporaneous mobility – is not a viable alternative: in our case, lagged variables do not provide strong instruments because the number of flows we consider and the nature of our hierarchical placement measure limit the amount of variation in these variables. Alternative IV strategies, that look for exogenous events such as plant closures, are not viable either – we simply do not have valid and strong instruments at hand for *all* eight types of mobility that we consider.

Is there a fixed effect in earnings growth?

Our choice of estimation method depends on whether we need to account for a fixed effect in earnings growth or not. In the presence of a fixed effect (i.e., $Var(\alpha_i) > 0$), we need to work with the model in first differences:

$$\Delta\Delta \ln(C_{i,t}) = \sum_{s=1}^{S} \gamma_s \, \Delta\Delta \ln(C_{i,t-s}) + \sum_{j=1}^{J} \mu_j \, \Delta M_{j,i,t} + \Delta X'_{i,t}\beta + \Delta e_{i,t}. \tag{3}$$

The *double* difference of log earnings then serves as the dependent variable and one can use the level of the mobility variables dated $t-1$ and earlier as instruments for $\Delta M_{j,i,t}$ in a GMM estimation (see Arellano and Bond 1991). For instance, Belzil and Bognanno (2008) use this procedure. If, however, $Var(\alpha_i) = 0$ one can directly estimate equation (2) using OLS. Note that if $Var(\alpha_i) > 0$, earnings growth will exhibit non-zero autocorrelations at arbitrarily long leads and lags. A test for this will guide our choice of empirical model.

3.2 Specification Tests

The initial step in our analysis is to select between a GMM procedure à la Arellano and Bond (1991) and using OLS. As discussed above, our choice will be guided by a test whether or not $Var(\alpha_i) > 0$. Employing a procedure common in the earnings dynamics literature, our test is based on the autocorrelations of earnings growth (for example, Abowd and Card 1989 and Meghir and Pistaferri 2004). In the presence of a fixed effect in earnings growth, autocorrelations should be positive and significant at all leads and lags.

Table 3 reports autocovariances along with their bootstrapped standard errors and shows significant autocorrelations up to order 2. This suggests that there is no fixed effect in earnings growth and that we can directly estimate equation (2) under the assumption that the transitory earnings shocks are MA(1).[10]

A caveat is that the test for the absence of a fixed effect in earnings growth in Table 3 can have low power. Baker (1997) illustrates this with an extract from the PSID that has approximately 500 individuals. But since we have over 58,000 individuals we do not believe that this is an issue in our sample. To explore the robustness of our findings we nevertheless also estimate specification (3) using GMM (see Section 5.3). In addition, our balanced panel structure helps us avoid another potential problem that studies with panel data face: in unbalanced panels higher-order covariances are estimated with less data than lower-order ones, which can result in a failure to reject a false null of a zero autocovariance at high orders.

4 Mobility and Earnings Growth: Estimation Results

4.1 Preliminaries

As a matter of data description, let us start with OLS estimation of the model in equation (1). Note that this model does not properly account for the covariance structure of earnings

[10]Results are robust to assuming an MA process of higher order (available from the authors).

growth because it does not include lagged earnings growth. Nevertheless, conducting this exercise will help explain the role that transitory shocks play for the relationship between mobility and earnings progression in our main specification.

Moving to a new employer is associated with about 1 percent higher labor income growth for both men and women, as reported in columns (1) and (4) of Table 4. Columns (2) and (5) consider hierarchical transitions on their own. An upward move accelerates earnings growth by around 1 percent, whereas a downward move has no significant effect.

Refining the set of moves shows the interactions between within- or cross-firm moves and hierarchical transitions in columns (3) and (6), respectively. Switching firms at the non-executive level (*CF*) yields around 1 percent higher growth relative to staying with the same employer at that level. A within-firm promotion yields roughly the same coefficient as *CF* for men, but halves it for women. The biggest return is for a cross-firm upward move, with around 5 percent higher growth for men and 4 percent for women. Our estimates suggest that executive-level jobs are associated with a steeper earnings profile: earnings increase 0.6 percent faster than for non-executive stayers. Furthermore, cross-firm mobility pays off more at the executive level, yielding around 3 percent higher growth for men relative to *ExecStayers* and around 1 percent for women. Finally, demotions appear to reset the growth of an executives earnings at the rate of a non-executive *Stayer*. So even though demotees do not suffer negative earnings growth in the year of their demotion, they do lose out on the higher pay progression they would have enjoyed if they had remained executives. Overall, the first impression is that lateral cross-firm mobility seems to count roughly as much as a within-firm promotion, and that moving to a new firm tends to enhance the returns to vertical mobility.

We now turn to the role that transitory earnings shocks play. Our first-pass estimation results are biased because they fail to properly account for transitory earnings shocks. To understand this, start with a projection of the change in the transitory earnings shock onto the vector of mobility dummies:

$$\Delta \varepsilon_{i,t} = \sum_{j=1}^{J} \theta_j \, M_{j,i,t} + \omega_{i,t}. \tag{4}$$

Employing the decomposition $u_{i,t} = \upsilon_{i,t} + \Delta \varepsilon_{i,t}$ and substituting into equation (1), we then obtain

$$\Delta \ln \left(C_{i,t} \right) = \alpha_i + \sum_{j=1}^{J} \left(\mu_j + \theta_j \right) M_{j,i,t} + X_{i,t}' \beta + \upsilon_{i,t} + \omega_{i,t}.$$

This exercise reveals that the estimates in Table 4 are of $\mu_j + \theta_j$ rather than of μ_j. Technically, the bias θ_j can be understood in terms of equation (4) as the coefficient in a regression of the change in the transitory shocks onto the set of mobility dummies. But the source of bias can be understood more intuitively by drawing on Lazear's (2004) mean-regression model discussed above. While the expectation of the transitory component is zero when taken over the population, those employees who are promoted are non-randomly selected out of the population. In the year of their promotion, they tend to have experienced larger (positive) shocks than those not promoted. Regression to the mean in the transitory component hence should reduce earnings growth somewhat in the year following a promotion – suggesting that $\theta_j < 0$ for the cases of PWF and PCF. The next section shows that one indeed obtains larger coefficients on the promotion variables if one includes lagged earnings growth in the model.

This discussion also has important implications for our predeterminedness assumption. If the main source of bias associated with that assumption stems from the components of the transitory shocks that are not fully purged by including lagged earnings growth in the model, then estimates of the effects of promotions on earnings growth will be biased downward. Analogously, estimates of the effects of demotions will be biased upward. What this suggests then is that – if indeed there remains an unaccounted-for influence of transitory earnings shocks – the use of the predetermined assumption yields estimates that are lower bounds for the true effects of promotions.

4.2 Accounting for Transitory Shocks

Our main specification, based on equation (2), yields the estimates reported in columns (2) and (4) of Table 5 for men and women, respectively. Columns (1) and (3) allow for comparison with the previous estimates.

Consistent with our covariogram-based specification tests (see Section 3.2), the Cochrane-Orcutt test suggests that one lag of the dependent variable is sufficient to eliminate autocorrelation in the errors.[11] Lagged compensation growth has a negative effect on current compensation growth – a common finding in the income dynamics literature (for example, Abowd and Card 1989, Topel and Ward 1992, and Meghir and Pistaferri 2004). The negative serial correlation reflects the effects of transitory shocks. To the extent that high (low) income growth in the past period is driven by transitory productivity shocks and pay-for-performance, there will be a tendency for regression to the mean and lower (higher) earnings growth in the current period. In line with this explanation, Belzil and Bognanno (2008) can attribute the negative serial correlation in their estimates for overall earnings growth of U.S. executives to variable pay components.

Comparing our estimates with the biased specifications in columns (1) and (3), the most striking change is that upward mobility and cross-firm moves at the executive level have higher returns, whereas there is no change in the effect of cross-firm mobility at the non-executive level (CF), and the demotion coefficients remain insignificant. Both the male and female samples exhibit this pattern. Note, in particular, that the stronger growth premia

[11]Results are robust to including further lags, though (available from the authors).

for promotions are consistent with our explanation in the previous section, that failure to account for transitory shocks will bias these estimates downward.

Our results reveal an asymmetry between the effect of a promotion and a demotion on wage growth: both men and women gain more from moving up to an executive-level position than they lose when stepping down from such a position. The impact of demotions on wage growth has received little attention, except from Belzil and Bognanno (2008). Their study focuses on reporting levels *within* the executive tier at 600 large U.S. firms from 1981 to 1988 and finds that demotions have a stronger (negative) effect on compensation growth than promotions.

Exploiting the unique feature of our data that allows us to follow individuals across firm boundaries, we show that there is a great deal of heterogeneity in returns to cross-firm moves. A cross-firm promotion leads to 4-5 percent faster growth than a within-firm promotion (men gain more than women do). A within-firm promotion, in turn, yields roughly the same as a move across firm boundaries within the non-executive layer, both adding around 1 percentage point to earnings growth. At the executive level there is a bigger gender difference; women gain around 1 percentage point from switching employers, whereas men gain around 3 percentage points.[12] Finally, a cross-firm demotion lowers earnings growth to the level of a Stayer at the non-executive level.

Overall, we find sizeable short-run gains from cross-firm moves, even after controlling for unobserved individual heterogeneity, in line with previous research on between-job earnings growth (for example, Topel and Ward 1992). For example, the immediate growth premium associated with a lateral move across firms at the non-executive level is comparable to that from being promoted within the firm. Our novel contribution is to show that interaction effects with the hierarchical dimension account for a great deal of heterogeneity in returns to cross-firm mobility: gains from vertical moves in the hierarchy tend to be bigger if they are across firm boundaries than if they are within-firm. In the next section we elaborate on the implications that our estimates have for earnings growth dynamics.

[12] The log growth increment for a male non-executive from a cross-firm move in t is

$$\ln\left(\frac{\frac{C_t}{C_{t-1}}^{CF_t}}{\frac{C_t}{C_{t-1}}^{Stayer_t}}\right) = \ln\left(\frac{C_t}{C_{t-1}}^{CF_t}\right) - \ln\left(\frac{C_t}{C_{t-1}}^{Stayer_t}\right) = 0.009.$$

The log growth increment for an executive moving cross-firm in t is

$$\ln\left(\frac{\frac{C_t}{C_{t-1}}^{ExecCF_t}}{\frac{C_t}{C_{t-1}}^{ExecStayer_t}}\right) = \ln\left(\frac{\frac{C_t}{C_{t-1}}^{ExecCF_t}}{\frac{C_t}{C_{t-1}}^{Stayer_t}}\right) - \ln\left(\frac{\frac{C_t}{C_{t-1}}^{ExecStayer_t}}{\frac{C_t}{C_{t-1}}^{Stayer_t}}\right) = 0.038 - 0.009 = 0.028.$$

4.3 Implications for Earnings Growth Dynamics

What do our estimates imply for earnings growth after different employment histories? The answer is not straightforward from the mobility coefficients in Table 5, because they paint only the short-run picture. These growth premia partially reflect transitory earnings effects that eventually dissipate, as captured by the coefficients on lagged income growth.

To gauge the medium-run effects implied by our estimates, we compute cumulative growth rates for different employment history scenarios from columns (2) and (4) of Table 5. All scenarios are based on the career of a university graduate (17 years of education) starting employment at age 30. We compare a benchmark no-move scenario with employment histories that involve a within-firm promotion or some type of cross-firm move (in our sample relatively few switch employers repeatedly in a 10-year window). Figure 1 illustrates the resulting earnings paths and gives the quickest overview of the patterns that emerge; black lines refer to men and gray lines to women. Tables 6 and 7 provide a detailed bootstrap analysis of log growth patterns for men and women, respectively (see Appendix A for details).

The most striking feature is that implied earnings outcomes after 10 years split neatly into the two categories "never promoted" and "promoted." Cross-firm mobility has a secondary effect only. Start with the lowest placed black line in Figure 1. It represents the reference group – a male employee who makes neither a vertical nor a cross-firm move (Scenario 5). And the second-lowest line represents an employee who switches employers after the third employment year but who is never promoted (Scenario 4). The distance between the two bottom lines hence reflects the return to cross-firm mobility at the non-executive level. The top three lines represent career histories involving a promotion (Scenarios 1-3). Comparing these lines shows that the gain from moving up to the executive level by far exceeds the gain from just switching employers. Within the group of "promoted" we see that cross-firm mobility at the executive level provides sizeable extra income growth (Scenarios 1 and 2 vs. 3), but contributes less than the initial change in hierarchy levels.

The same pattern of relative growth rates also emerges from the separate estimation for the female sample (gray lines). There is a gender difference, however, for average starting salary and absolute growth rates. The latter can be seen more easily in Figure 2. It plots income indices for men and women that reflect how income grows relative to the level at the start of the career (normalized to be 100). For our purposes, the important message is that the two separate samples yield a consistent picture; namely, that cross-firm mobility offers more modest gains than vertical mobility. Given the differences between men and women (for example, labor force participation and fertility considerations), the robustness of our findings across samples is quite remarkable.

Tables 6 and 7 quantify the effects and tell us that the differential growth rates are indeed statistically significant. The top part of the table shows how much the real income of a 30-year old university graduate is predicted to grow over a 5-year and 10-year horizon, respectively. For example, a male employee who is promoted after 3 years but never switches employers (Scenario 3) has predicted real income growth of around 61 percent over 10 years ($exp(0.477) \approx 1.61$), whereas someone who switches employers after 3 years but is never promoted (Scenario 4) sees growth of around 53 percent ($exp(0.426) \approx 1.53$). Earnings growth is lower than estimates for the U.S. that control for individual fixed effects. For example, Schönberg (2007) reports a 10-year growth rate of around 80 percent for university graduates, and Topel and Ward (1992) find that earnings roughly double. It should, however, be noted that these figure are hard to compare because the U.S. studies look at early stages of the career and include individuals with weaker labor force attachment than in our sample.

The bottom part of the table compares real income growth across career histories. Continuing with our example, consider the gray shaded area containing the comparisons of scenarios involving a promotion and those that do not. We see that the 10-year income under Scenario 3 is about 5 percent higher than it would have been under Scenario 4 ($exp(0.051) \approx 1.05$).[13] A comparison of the 10-year log growth rates and their components suggests that 12-17 percent of total growth can be attributed to promotions and only 2-7 percent can be attributed to gains from cross-firm mobility.[14]

The overall picture is that all promotion versus no promotion scenarios yield greater differences in 10-year cumulative growth rates than the within-group comparisons (gray shaded cells versus the cells with no shading). At the 5-year horizon, transitory effects from the mobility after the third employment year still lead to different short-run income growth rates. At the 10-year horizon, those promoted (Scenarios 1, 2, and 3) now are all on a significantly steeper growth path than those never promoted (Scenarios 4 and 5): earnings grow 0.7 percent faster as shown in the the last column in the gray shaded area. This is in line with learning models such as Gibbons and Waldman (1999, 2006), where assignment to a higher-level job entails a steeper earnings growth path.

[13]Using the 10-year log growth rates from the top part of Table 6:

$$\ln\left(\frac{C_{10}^{Scenario\,3}}{C_0}\bigg/\frac{C_{10}^{Scenario\,4}}{C_0}\right) = \ln\left(\frac{C_{10}^{Scenario\,3}}{C_0}\right) - \ln\left(\frac{C_{10}^{Scenario\,4}}{C_0}\right) = 0.477 - 0.426 = 0.051.$$

The 10-year income under Scenario 3 ($C_{10}^{Scenario\,3}$) is 1.61 times the starting income (C_0), whereas under Scenario 4 it is 1.53 times the starting income. Now, $C_{10}^{Scenario\,3} \Big/ C_{10}^{Scenario\,4} \approx \frac{1.61}{1.53} \approx 1.05$.

[14]Of the total earnings growth in Scenario 1 in the male sample, 0.511, a comparison with Scenario 4 shows that 0.085 log points (17 percent) can be attributed to the promotion. Comparing Scenarios 1 and 3 shows that 0.034 log points (7 percent) can be attributed to the cross-firm move. Similarly, comparisons of Scenarios 2 and 3 and of Scenarios 4 and 5 attribute 2-4 percent of the 10-year earnings growth to cross-firm mobility. And a comparison of Scenarios 3 and 5 attributes 12 percent to promotions. Figures for the female sample are obtained in similar fashion.

5 Robustness Checks

In this section we show that our findings are robust to estimating on subsamples with different education levels, allowing for individual-level trends in earnings growth and that they are not sensitive to the firm size restriction used to obtain our core sample.

5.1 Estimations on Subsamples With Different Education Levels

Our main estimation results control for differences in education using dummies that distinguish four categories. The group with 9 years of education completed just the compulsory schooling (omitted category, 18.26 percent of the sample). Those with 12 years of schooling have a high school degree (56.19 percent of the sample). The group with 15 years of schooling includes those with a Bachelor's degree, or who have completed an apprenticeship or some other form of post-secondary professional training (18.55 percent of the sample). The final category with 17 years or more of schooling includes those with a postgraduate university education, i.e. who hold a Master's degree or doctorate (7.00 percent of the sample).

While our main estimation allows for different growth rates across education categories, it restricts the returns to mobility to be the same for all education levels. Tables 8 and 9 show the estimation results when this assumption is relaxed and the respective subsamples are analyzed separately.

Overall, the results for men in Table 8 show that all point-estimates on the mobility dummies are increasing in the education level and Figure 3 illustrates this pattern very clearly. Employees with a university degree (panel d) have higher returns to mobility than those with post-secondary professional training (panel c), who in turn gain more than those with a high school degree (panel b) or less education (panel a). But in all cases, we again observe a divide between the "promoted" versus "never promoted" scenarios, as in our main estimates.

A closer look at Table 8 indicates that a move to a new firm at the non-executive level and a within-firm promotion offer more or less equal short-term gains for employees with at least 15 years of education. But both cross-firm promotions and cross-firm mobility at the executive level remain the most lucrative types of mobility. For employees with a high school degree a promotion boosts growth at almost twice the rate associated with cross-firm mobility at the non-executive level. As for the highly educated employees, the returns from cross-firm promotions and mobility at the executive level are the highest ones. For the lowest education group coefficients are less precisely estimated because some flows have few observations.

For women the above patterns are similar (but less pronounced); these estimates are reported in Table 9. Overall, the qualitative results are in line with those for the full sample. Splitting the sample by education, however, does reveal additional details. Our main specification captures differences in overall earnings growth across education groups through education dummies. Estimating subsample by subsample, differences in growth rates across the education groups show up in the regression constants. The different slopes of earnings growth in Figure 3 reflect this. Growth rates clearly increase with the level of education. For instance, the 10-year income growth for the base scenario (Scenario 5) for employees with no high school degree reveals pay progression of around 10 percent whereas university graduates more than double their earnings.

5.2 Evaluating the Importance of the Firm Size Restriction

In our main analysis we focus on a sample of core employees who work continuously in firms with at least 25 employees. To explore whether the gains from mobility are sensitive to the size restriction, we re-estimate our model using different criteria for inclusion in the sample. Tables 10 and 11 present the results. The first column restates the original results with a minimum firm size of 25, the second and third columns use size restriction 50 and 100, respectively. Even though the sample size is reduced by up to 33 percent for men and 25 percent for women, the estimates are remarkably similar across samples. From this we conclude that our results are not driven by the firm size criterion.

5.3 Allowing for a Fixed Effect in Earnings Growth

Our choice of estimation procedure was guided by the fact that the autocorrelation in income growth dies off quickly and becomes insignificant after a few lags, which is at odds with a fixed effect in income growth (see Section 3.2). Nevertheless, as a robustness check we relax this assumption and allow for unobserved, persistent individual heterogeneity in earnings growth. Table 12 reports the corresponding GMM estimates. Consistency of the Arellano-Bond estimator relies on residuals (in first differences) to be serially uncorrelated from the second lag on. For the reported specifications this requires adding two lags of the dependent variable as regressors, as the test for autocorrelation developed by Arellano and Bond (1991) shows.

Figure 4 illustrates the GMM results. It plots the evolution of real labor income implied by the estimates for a university graduate starting his career at age 30. It should be compared with Figure 1 that is based on our preferred specification. Again the evolution of earnings depends mostly on whether a person manages to move up in the hierarchy, and to a lesser extent only on cross-firm mobility. With the GMM estimation, the divide between the two categories "never promoted" and "promoted" even becomes larger.

6 Conclusion

We explored the effects of within- and cross-firm mobility on earnings growth using Danish matched employer-employee panel data. Our results revealed sizeable short-run gains for cross-firm mobility at the non-executive level. Yet the bulk of longer-term earnings growth we observe appears to be driven by promotions either within or across firms, or is a consequence of cross-firm mobility at the executive level. We also established substantial heterogeneity in pay progression between executives and non-executives, which is consistent with models of job assignment where a promoted employee is placed in a position with a steeper income growth trajectory (for example, Bernhardt 1995, Gibbons and Waldman 1999, 2006). Our results show that in order to understand the way mobility influences earnings progression, it is important to consider both cross-firm mobility and hierarchical transitions and to pay close attention to the interaction effects between these types of flows.

A Appendix A: Details on the Bootstrap Procedure

To calculate the standard errors in Tables 6 and 7 we use a block bootstrap procedure. We treat each individual as a sampling unit, to account for correlation in observations across time within individuals. Our procedure re-samples the data 100 times. Each re-sample is drawn with replacement, and the re-sampled data has the same sample size as the original data set (N = 588,600 for men and N = 265,060 for women). For each re-sampled data set, we first estimate our main specification based on equation (2). Using the estimated coefficients, we then compute the implied log growth rates for each scenario and employment year (where index i captures the characteristics associated with the scenario):

$$\Delta \widehat{\ln(C_{i,t})} = \hat{\alpha}_i + \hat{\gamma}\, \Delta \widehat{\ln(C_{i,t-1})} + \sum_{j=1}^{J} \hat{\mu}_j\, M_{j,i,t} + X'_{i,t}\,\hat{\beta}, \tag{5}$$

setting the initial value $\Delta \widehat{\ln(C_{i,0})} = 0$. In a final step, we record separately the implied differences across scenarios. For instance, the comparison of 10-year cumulative growth rates across Scenarios 1 and 5 is obtained as follows:

$$\sum_{t=1}^{10} \Delta \widehat{\ln(C_{1,t})} - \sum_{t=1}^{10} \Delta \widehat{\ln(C_{5,t})}.$$

The standard errors reported in the tables are the standard deviation of the relevant object over all 100 re-sampled data sets. Significance levels are based on the normal distribution.

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Tables and Figures

Table 1: Descriptive statistics (at the start of the panel in 1994)

	Men	**Women**
Age[a]	37.63	38.04
	(4.53)	(4.48)
9 years (less than high school)	18.26%	22.42%
12 years (high school)	56.19%	60.44%
15 years (Bachelor or post-secondary professional training)	18.55%	13.44%
17 years (Master's degree)	7.00%	3.70%
Real labor income[a,b]	340,367	262,310
	(118,874)	(81,082)
Firm size[a] (number of employees, employee weighted average)	2,259	3,473
	(3,524)	(4,541)
Unique individuals	58,860	26,506
Person-year observations (1994 - 2005)	706,320	318,072

Notes: Panel of men/women aged 30 to 45 in 1994, continuously employed between 1994 and 2005 in private firms with at least 25 employees. [a] Mean (standard deviation).
[b] Danish kroner, DKK 100 = 12 U.S. dollars (all in year-2000 levels).

Table 2: Mobility patterns

	Men[a]		**Women**[b]	
	percent	**transition prob.**[c]	**percent**	**transition prob.**[c]
All transitions	**100**	**100**	**100**	**100**
within-firm moves		88.56		89.87
cross-firm moves		11.44		10.13
Non-executive level	**92.73**	**100**	**97.68**	**100**
$\textbf{\textit{Non-executive}}_{t-1} \rightarrow \textbf{\textit{Non-executive}}_t$				
no move (Stayer)	80.94	87.28	87.37	89.44
lateral move, cross-firm (CF)	10.43	11.25	9.82	10.05
$\textbf{\textit{Non-executive}}_{t-1} \rightarrow \textbf{\textit{Executive}}_t$				
promotion, within-firm (PWF)	1.12	1.20	0.41	0.42
promotion, cross-firm (PCF)	0.25	0.27	0.08	0.08
Executive level	**7.27**	**100**	**2.32**	**100**
$\textbf{\textit{Executive}}_{t-1} \rightarrow \textbf{\textit{Executive}}_t$				
no move (ExecStayer)	5.65	77.72	1.77	76.27
lateral move, cross-firm (ExecCF)	0.56	7.72	0.16	6.91
$\textbf{\textit{Executive}}_{t-1} \rightarrow \textbf{\textit{Non-executive}}_t$				
demotion, within-firm (DWF)	0.86	11.78	0.32	13.78
demotion, cross-firm (DCF)	0.20	2.78	0.07	3.03

Notes: [a] Men: 647,460 person-year observations 1995-2005 (58,860 unique individuals).
[b] Women: 291,566 person-year observations 1995-2005 (26,506 unique individuals).
[c] Annual transition probability (percent of group).

Table 3: The autocovariances of income growth

	Autocovariance (std. error[a]**)**				
Order	**0**	**1**	**2**	**3**	**4**
Men	**0.01892*****	**-0.00575*****	**-0.00117*****	0.00001	-0.00004
	(0.00217)	(0.00108)	(0.00048)	(0.00010)	(0.00008)
Women	**0.01643*****	**-0.00378*****	-0.00145**	-0.00030*	0.00002
	(0.00277)	(0.00097)	(0.00086)	(0.00023)	(0.00004)

Notes: Significance levels: *** **1 percent**, ** 5 percent, * 10 percent.
[a] Bootstrap standard errors (100 replications).

Table 4: Income growth and career mobility (OLS, ignoring transitory shocks)

	Men[a]			Women[b]		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Cross-firm move	**0.010*****			**0.012*****		
	(0.001)			(0.001)		
Upward move		**0.014*****			**0.010*****	
(PWF or PCF)		(0.002)			(0.004)	
Downward move		-0.003			-0.007	
(DWF or DCF)		(0.003)			(0.005)	
Non-executive lateral move, within-firm			–			–
(Stayer)						
Non-executive lateral move, cross-firm			**0.009*****			**0.012*****
(CF)			(0.001)			(0.001)
Promotion, within-firm (PWF)			**0.008*****			0.006*
			(0.002)			(0.004)
Promotion, cross-firm (PCF)			**0.049*****			**0.038*****
			(0.006)			(0.010)
Executive stayer (ExecStayer)			**0.006*****			**0.006*****
			(0.001)			(0.001)
Executive lateral move, cross-firm			**0.033*****			0.014**
(ExecCF)			(0.003)			(0.006)
Demotion, within-firm (DWF)			-0.001			-0.004
			(0.003)			(0.005)
Demotion, cross-firm (DCF)			-0.000			-0.014
			(0.007)			(0.017)
Age/10	**-0.033*****	**-0.034*****	**-0.034*****	-0.005	-0.006	-0.005
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.005)
$Age^2/100$	**0.002*****	**0.002*****	**0.002*****	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
constant	**0.114*****	**0.117*****	**0.118*****	**0.039*****	**0.041*****	**0.040*****
	(0.007)	(0.007)	(0.007)	(0.011)	(0.011)	(0.011)
R^2	0.0069	0.0065	0.0074	0.0039	0.0031	0.0040
Observations	647,460	647,460	647,460	291,566	291,566	291,566

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

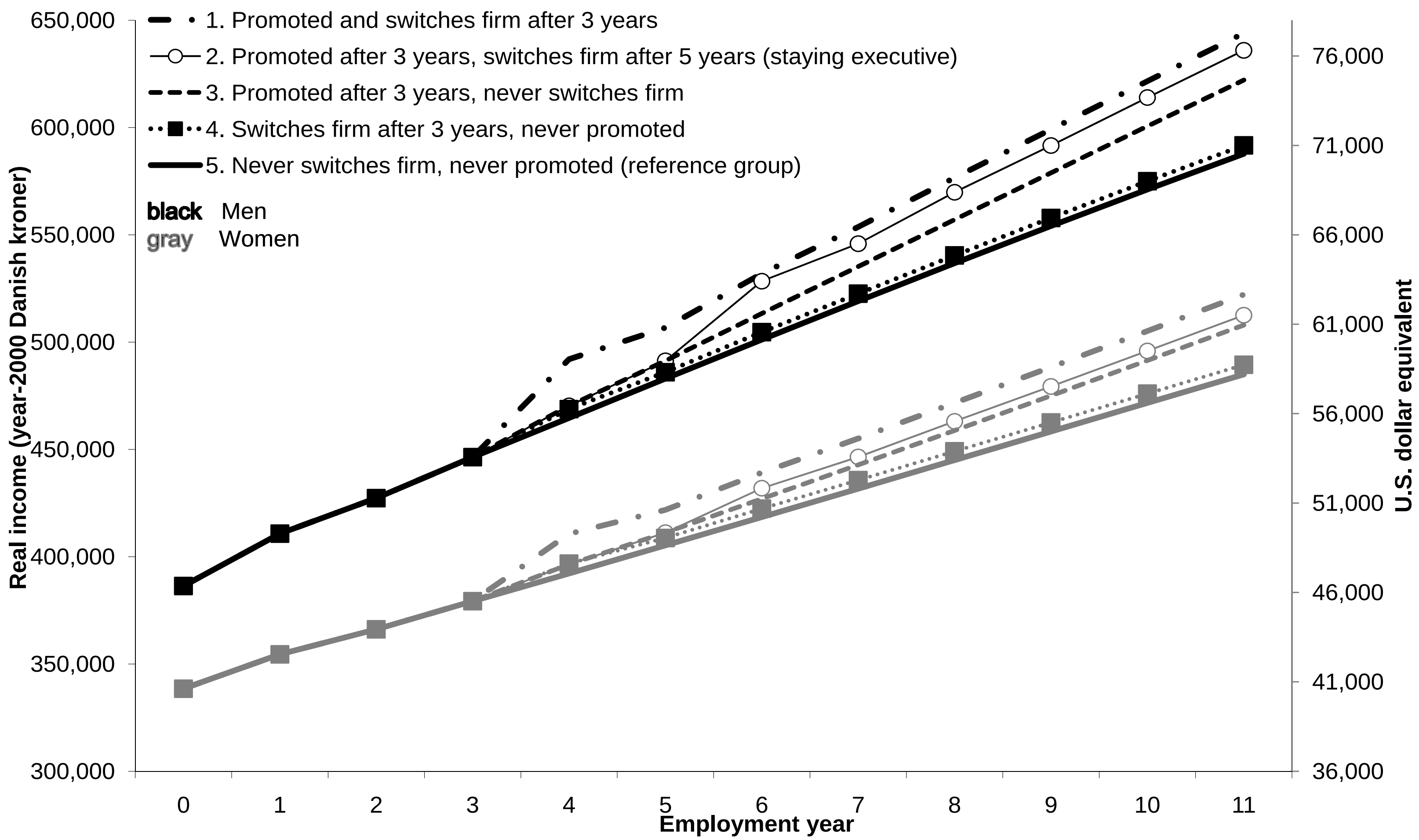
Notes: All regressions include education, sector, and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent.

Table 5: Income growth and career mobility

	Men		Women	
	(1)	**(2)**	**(3)**	**(4)**
Labor income growth (t-1)		**-0.315**		**-0.275**
		(0.018)		(0.043)
Non-executive lateral move, within-firm (Stayer)	–	–	–	–
Non-executive lateral move, cross-firm (CF)	**0.009*****	**0.009*****	**0.012*****	**0.012*****
	(0.001)	(0.001)	(0.001)	(0.001)
Promotion, within-firm (PWF)	**0.008*****	**0.012*****	0.006*	**0.011*****
	(0.002)	(0.002)	(0.004)	(0.004)
Promotion, cross-firm (PCF)	**0.049*****	**0.057*****	**0.038*****	**0.046*****
	(0.006)	(0.006)	(0.010)	(0.010)
Executive stayer (ExecStayer)	**0.006*****	**0.009*****	**0.006*****	**0.007*****
	(0.001)	(0.001)	(0.001)	(0.002)
Executive lateral move, cross-firm (ExecCF)	**0.033*****	**0.038*****	**0.014*****	**0.018*****
	(0.003)	(0.003)	(0.006)	(0.007)
Demotion, within-firm (DWF)	-0.001	-0.001	-0.004	-0.008*
	(0.003)	(0.003)	(0.005)	(0.004)
Demotion, cross-firm (DCF)	0.000	0.002	-0.014	-0.023
	(0.007)	(0.007)	(0.017)	(0.018)
Age/10	**-0.034*****	**-0.043*****	-0.005	-0.008
	(0.003)	(0.004)	(0.005)	(0.006)
$Age^2/100$	**0.002*****	**0.003*****	-0.000	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)
constant	**0.118*****	**0.148*****	**0.040*****	**0.059*****
	(0.007)	(0.009)	(0.011)	(0.014)
R^2	0.0074	0.1014	0.0040	0.0669
Observations	647,460	588,600	291,566	265,060
Cochran-Orcutt (H_0: *zero autocorrelation in errors*)	-0.313	-0.067	-0.274	-0.058
(p-value)	(< 0.001)	(0.126)	(< 0.001)	(0.406)

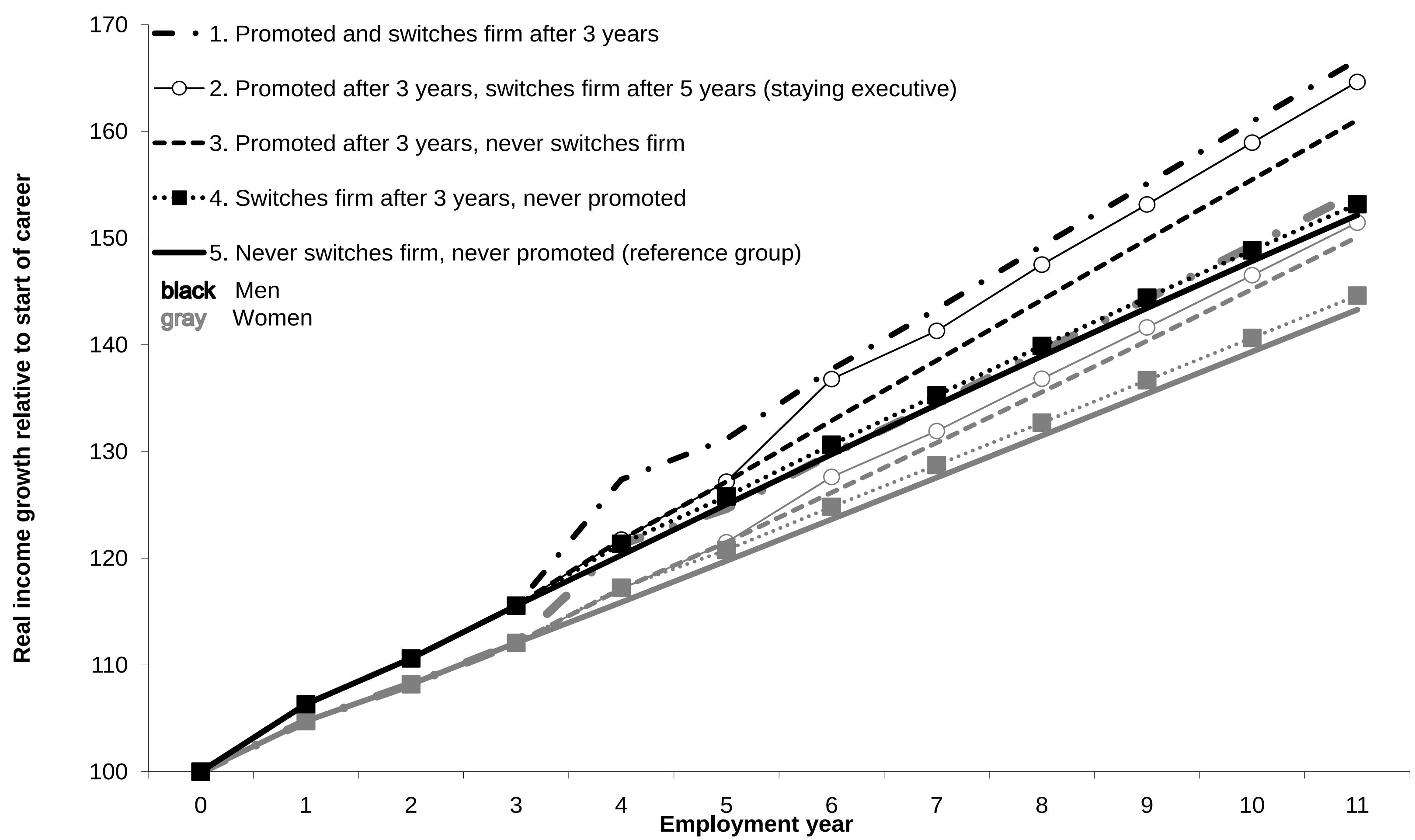
Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

Notes: All regressions include education, sector, and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent.



Notes: Evolution of real labor income implied by specifications (2) and (4) in Table 5 for a university graduate (edu=17) starting his/her career at age 30.

Figure 1: Comparison of real income growth men vs. women.



Notes: Evolution of real labor income implied by specifications (2) and (4) in Table 5 for a university graduate (edu=17) starting his/her career at age 30.

Figure 2: Comparison of relative income growth men vs. women.

Table 6: Income growth dynamics (men)

Career scenarios		Cumulative log income growth after	
		year 5	year 10
1.	Promoted and switches firm after 3 years	0.320	0.511
2.	Promoted after 3 years, switches firm after 5 years (staying executive)	0.313	0.498
3.	Promoted after 3 years, never switches firm	0.284	0.477
4.	Switches firm after 3 years, never promoted	0.267	0.426
5.	Never switches firm, never promoted (reference group)	0.260	0.420

Comparison	Year-5 difference in cumulative log income growth	Year-5 difference in current log income growth	Year-10 difference in cumulative log income growth	Year-10 difference in current log income growth	
1 vs. 5	**0.059*****	**0.012*****	**0.092*****	**0.007*****	
	(0.005)	(0.001)	(0.007)	(0.001)	
2 vs. 5	**0.053*****	**0.036*****	**0.079*****	**0.007*****	
	(0.003)	(0.003)	(0.005)	(0.001)	
3 vs. 5	**0.024*****	**0.007*****	**0.057*****	**0.007*****	**promoted**
	(0.002)	(0.001)	(0.005)	(0.001)	**vs**
1 vs. 4	**0.052*****	**0.011*****	**0.085*****	**0.007*****	**never promoted**
	(0.005)	(0.001)	(0.007)	(0.001)	
2 vs. 4	**0.046*****	**0.035*****	**0.073*****	**0.007*****	
	(0.003)	(0.003)	(0.005)	(0.001)	
3 vs y4	**0.017*****	**0.006*****	**0.051*****	**0.007*****	
	(0.002)	(0.001)	(0.005)	(0.001)	
1 vs. 3	**0.035*****	**0.004*****	**0.034*****	**0.000*****	
	(0.004)	(0.001)	(0.005)	(0.000)	
1 vs. 2	0.006	**-0.025*****	0.013**	**0.000*****	**within group**
	(0.005)	(0.003)	(0.006)	(0.000)	**of promoted**
2 vs. 3	**0.029*****	**0.029*****	**0.022*****	**0.000*****	
	(0.003)	(0.003)	(0.002)	(0.000)	
4 vs. 5	**0.007*****	**0.001*****	**0.007*****	0.0000	**within group**
	(0.001)	(0.000)	(0.000)	(0.000)	**of never promoted**

Notes: Predictions are based on column (2) in Table 5 and assume a starting age of 30 and edu=17. Bootstrap standard errors in parentheses (100 replications). Significance levels: *** **1 percent**, ** 5 percent, * 10 percent. Gray shaded cells compare promotion vs. no-promotion scenarios.

Table 7: Income growth dynamics (women)

Career scenarios		**Cumulative log income growth after**	
		year 5	**year 10**
1.	Promoted and switches firm after 3 years	0.261	0.434
2.	Promoted after 3 years, switches firm after 5 years (staying executive)	0.244	0.415
3.	Promoted after 3 years, never switches firm	0.232	0.406
4.	Switches firm after 3 years, never promoted	0.222	0.369
5.	Never switches firm, never promoted (reference group)	0.212	0.360

Comparison	**Year-5 difference in**		**Year-10 difference in**		
	cumulative log income growth	**current log income growth**	**cumulative log income growth**	**current log income growth**	
1 vs. 5	**0.049*****	**0.009*****	**0.075*****	**0.005*****	
	(0.010)	(0.002)	(0.013)	(0.001)	
2 vs. 5	**0.032*****	**0.017*****	**0.055*****	**0.005*****	
	(0.008)	(0.006)	(0.010)	(0.001)	
3 vs. 5	**0.020*****	**0.006*****	**0.047*****	**0.005*****	**promoted**
	(0.004)	(0.001)	(0.010)	(0.001)	**vs**
1 vs. 4	**0.040*****	**0.008*****	**0.065*****	**0.005*****	**never promoted**
	(0.010)	(0.001)	(0.013)	(0.001)	
2 vs. 4	**0.022*****	**0.016*****	**0.046*****	**0.005*****	
	(0.008)	(0.006)	(0.010)	(0.001)	
3 vs. 4	**0.011*****	**0.005*****	**0.037*****	**0.005*****	
	(0.004)	(0.001)	(0.010)	(0.001)	
1 vs. 3	**0.029*****	**0.003*****	**0.028*****	**0.000*****	
	(0.010)	(0.001)	(0.010)	(0.000)	
1 vs. 2	0.017	-0.008	0.019**	0.000	**within group**
	(0.013)	(0.007)	(0.012)	(0.000)	**of promoted**
2 vs. 3	0.011*	0.011*	0.009	0.000	
	(0.006)	(0.006)	(0.005)	(0.000)	
4 vs. 5	**0.009*****	**0.001*****	**0.009*****	0.000	**within group**
	(0.001)	(0.000)	(0.001)	(0.000)	**of never promoted**

Notes: Predictions are based on column (2) in Table 5 and assume a starting age of 30 and edu=17. Bootstrap standard errors in parentheses (100 replications). Significance levels: *** **1 percent**, ** 5 percent, * 10 percent. Gray shaded cells compare promotion vs. no-promotion scenarios.

Table 8: Education subsamples (men)

	Full sample	**Edu=9**	**Edu=12**	**Edu=15**	**Edu=17**
Labor income growth (t-1)	**-0.315*****	**-0.345*****	**-0.294*****	**-0.340*****	**-0.282*****
	(0.018)	(0.041)	(0.021)	(0.034)	(0.066)
Non-executive lateral move, within-firm (Stayer)	–	–	–	–	–
Non-executive lateral move, cross-firm (CF)	**0.009*****	0.003**	**0.006*****	**0.018*****	**0.020*****
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Promotion, within-firm (PWF)	**0.012*****	-0.005	**0.011*****	**0.017*****	**0.020*****
	(0.002)	(0.005)	(0.002)	(0.003)	(0.005)
Promotion, cross-firm (PCF)	**0.057*****	**0.034*****	**0.051*****	**0.065*****	**0.063*****
	(0.006)	(0.011)	(0.008)	(0.010)	(0.019)
Executive stayer (ExecStayer)	**0.009*****	**0.009*****	**0.008*****	**0.011*****	**0.013*****
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Executive lateral move, cross-firm (ExecCF)	**0.038*****	0.020	**0.026*****	**0.052*****	**0.044*****
	(0.003)	(0.012)	(0.004)	(0.005)	(0.008)
Demotion, within-firm (DWF)	-0.001	-0.011	0.006	-0.002	-0.005
	(0.003)	(0.010)	(0.005)	(0.004)	(0.006)
Demotion, cross-firm (DCF)	0.002	-0.011	-0.013	0.017	0.011
	(0.007)	(0.018)	(0.010)	(0.010)	(0.029)
Age/10	**-0.043*****	0.022**	**-0.035*****	**-0.053*****	**-0.114*****
	(0.004)	(0.010)	(0.005)	(0.010)	(0.020)
$\text{Age}^2/100$	**0.003*****	**-0.003*****	**0.002*****	**0.003*****	**0.009*****
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
Education=9	–	–	–	–	–
Education=12	**0.003*****				
	(0.000)				
Education=15	**0.009*****				
	(0.000)				
Education=17	**0.016*****				
	(0.001)				
constant	**0.148*****	-0.016	**0.117*****	**0.207*****	**0.378*****
	(0.009)	(0.022)	(0.010)	(0.023)	(0.047)
R^2	0.1014	0.1203	0.0929	0.1169	0.0793
Observations	588,600	105,041	330,475	111,176	41,908
Unique individuals[a]	58,860	10,688	33,367	11,407	4,249
Cochran-Orcutt (H_0: *zero autocorrelation in errors*)	-0.067	-0.069	-0.055	-0.084	-0.071
(p-value)	(0.126)	(0.523)	(0.337)	(0.346)	(0.586)

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

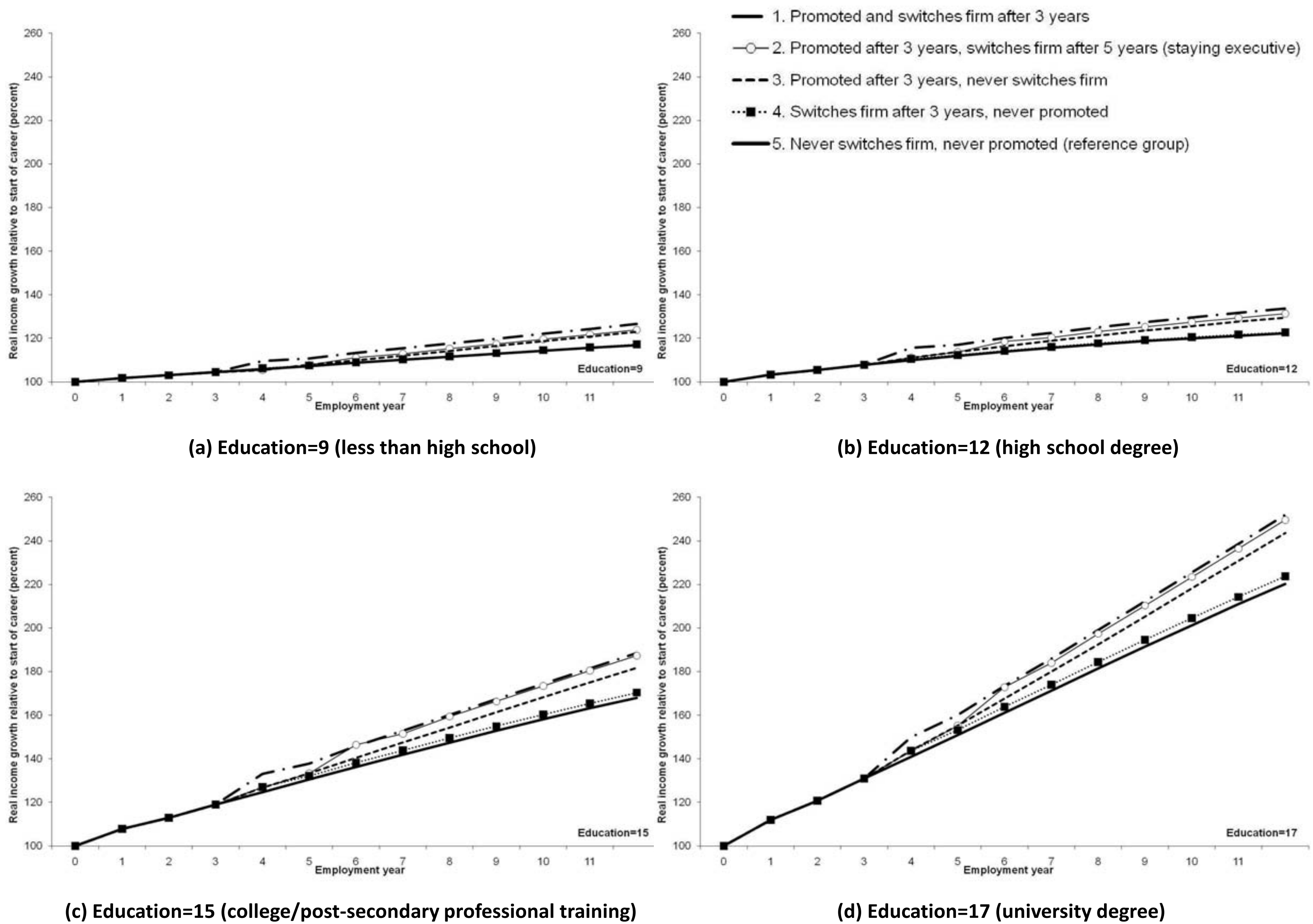
Notes: All regressions include sector and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent. [a] Sum in subsamples >58,860 as a few increase education and appear in different regressions for subperiods of their career.

Table 9: Education subsamples (women)

	Full sample	**Edu=9**	**Edu=12**	**Edu=15**	**Edu=17**
Labor income growth (t-1)	**-0.275*****	**-0.292*****	**-0.261*****	**-0.235*****	**-0.336*****
	(0.043)	(0.093)	(0.070)	(0.024)	(0.039)
Non-executive lateral move, within-firm	–	–	–	–	–
(Stayer)					
Non-executive lateral move, cross-firm	**0.012*****	**0.009*****	**0.013*****	**0.009*****	**0.017*****
(CF)	(0.001)	(0.002)	(0.001)	(0.002)	(0.005)
Promotion, within-firm (PWF)	**0.011*****	-0.003	0.013**	0.014**	0.019**
	(0.004)	(0.014)	(0.006)	(0.007)	(0.009)
Promotion, cross-firm (PCF)	**0.046*****	0.037	0.034**	0.032	**0.089*****
	(0.010)	(0.028)	(0.014)	(0.026)	(0.020)
Executive stayer (ExecStayer)	**0.007*****	0.004	0.003	0.008**	**0.025*****
	(0.002)	(0.004)	(0.002)	(0.004)	(0.005)
Executive lateral move, cross-firm	**0.018*****	-0.015	0.014*	**0.048*****	0.036**
(ExecCF)	(0.007)	(0.016)	(0.008)	(0.016)	(0.016)
Demotion, within-firm (DWF)	-0.008*	-0.023**	-0.009*	-0.006	0.015
	(0.004)	(0.010)	(0.005)	(0.011)	(0.014)
Demotion, cross-firm (DCF)	-0.023	-0.053	-0.020	-0.010	-0.018
	(0.018)	(0.043)	(0.027)	(0.040)	(0.040)
Age/10	-0.008	0.006	0.003	-0.008	-0.084**
	(0.006)	(0.012)	(0.008)	(0.014)	(0.035)
$Age^2/100$	0.000	-0.002	-0.002*	-0.001	0.006
	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)
Education=9	–	–	–	–	–
Education=12	**0.002*****				
	(0.000)				
Education=15	**0.005*****				
	(0.001)				
Education=17	**0.013*****				
	(0.001)				
constant	**0.059*****	0.021	0.022	**0.082*****	**0.285*****
	(0.014)	(0.029)	(0.018)	(0.031)	(0.077)
R^2	0.0669	0.0751	0.0566	0.0589	0.1154
Observations	265,060	58,671	159,156	37,129	10,104
Unique individuals[a]	26,506	5,928	16,061	3,980	1,028
Cochran-Orcutt (H_0: *zero autocorrelation in errors*)	-0.058	-0.102	-0.047	-0.031	-0.035
(p-value)	(0.406)	(0.533)	(0.580)	(0.433)	(0.897)

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

Notes: All regressions include sector and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent. [a] Sum in subsamples >26,506 as a few increase education and appear in different regressions for subperiods of their career.



(a) Education=9 (less than high school)

(b) Education=12 (high school degree)

(c) Education=15 (college/post-secondary professional training)

(d) Education=17 (university degree)

Notes: Evolution of real labor income implied by Table 8 for a man starting his career at age 30.

Figure 3: Relative growth in real income (men, by education).

Table 10: Robustness: firm size (men)

	Main sample	Firm size	
	(size$\geq$ 25**)**	$\geq$**50**	$\geq$**100**
Labor income growth (t-1)	**-0.315*****	**-0.315*****	**-0.321*****
	(0.018)	(0.021)	(0.021)
Labor income growth (t-2)			
Non-executive lateral move, within-firm (Stayer)	–	–	–
Non-executive lateral move, cross-firm (CF)	**0.009*****	**0.008*****	**0.006*****
	(0.001)	(0.001)	(0.001)
Promotion, within-firm (PWF)	**0.012*****	**0.013*****	**0.013*****
	(0.002)	(0.002)	(0.002)
Promotion, cross-firm (PCF)	**0.057*****	**0.057*****	**0.053*****
	(0.006)	(0.006)	(0.008)
Executive stayer (ExecStayer)	**0.009*****	**0.009*****	**0.010*****
	(0.001)	(0.001)	(0.001)
Executive lateral move, cross-firm	**0.038*****	**0.041*****	**0.040*****
(ExecCF)	(0.003)	(0.003)	(0.004)
Demotion, within-firm (DWF)	-0.001	0.001	0.003
	(0.003)	(0.003)	(0.004)
Demotion, cross-firm (DCF)	0.002	0.003	0.006
	(0.007)	(0.008)	(0.011)
Age/10	**-0.043*****	**-0.045*****	**-0.040*****
	(0.004)	(0.004)	(0.005)
Age^2/100	**0.003*****	**0.003*****	**0.002*****
	(0.000)	(0.000)	(0.001)
constant	**0.148*****	**0.154*****	**0.141*****
	(0.009)	(0.010)	(0.011)
R^2	0.1014	0.1004	0.1078
Observations	588,600	485,780	394,150
Unique individuals	58,860	48,578	39,415
Cochran-Orcutt (H_0: *zero autocorrelation in errors*)	-0.067	-0.073	-0.066
(p-value)	(0.126)	(0.153)	(0.264)

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

Notes: All regressions include education, sector, and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent.

Table 11: Robustness: firm size (women)

	Main sample	**Firm size**	
	(size$\geq$ 25)	**$\geq$50**	**$\geq$100**
Labor income growth (t-1)	**-0.275*****	**-0.275*****	**-0.316*****
	(0.043)	0.053	(0.059)
Labor income growth (t-2)			
Non-executive lateral move, within-firm	–	–	–
(Stayer)			
Non-executive lateral move, cross-firm	**0.012*****	**0.011*****	**0.008*****
(CF)	(0.001)	(0.001)	(0.001)
Promotion, within-firm (PWF)	**0.011*****	**0.014*****	**0.015*****
	(0.004)	(0.004)	(0.005)
Promotion, cross-firm (PCF)	**0.046*****	**0.049*****	**0.049*****
	(0.010)	(0.011)	(0.013)
Executive stayer (ExecStayer)	**0.007*****	**0.007*****	**0.007*****
	(0.002)	(0.002)	(0.002)
Executive lateral move, cross-firm	**0.018*****	0.012	0.012
(ExecCF)	(0.007)	(0.007)	(0.008)
Demotion, within-firm (DWF)	-0.008*	-0.006	-0.001
	(0.004)	(0.004)	(0.005)
Demotion, cross-firm (DCF)	-0.023	-0.012	-0.004
	(0.018)	(0.020)	(0.022)
Age/10	-0.008	-0.005	-0.002
	(0.006)	(0.007)	(0.007)
Age^2/100	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
constant	**0.059*****	**0.055*****	**0.051*****
	(0.014)	(0.015)	(0.017)
R^2	0.0669	0.0637	0.0873
Observations	265,060	230,660	198,500
Unique individuals	26,506	23,066	19,850
Cochran-Orcutt (H_0: *zero autocorrelation in errors*)	-0.058	-0.064	-0.045
(p-value)	(0.406)	(0.393)	(0.597)

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

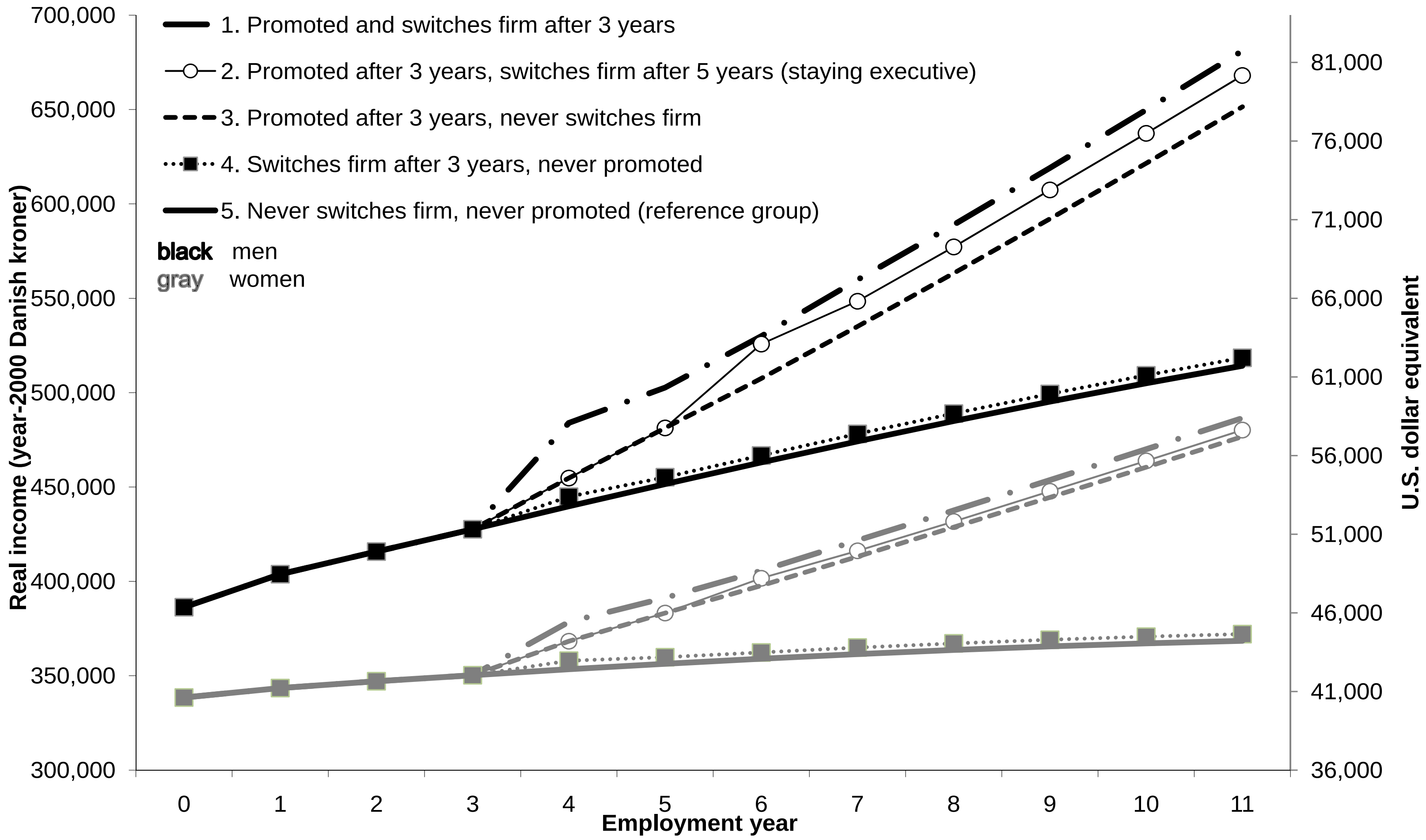
Notes: All regressions include education, sector, and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent.

Table 12: Labor income growth and career mobility (GMM)

	Men		Women	
	OLS	**GMM**	**OLS**	**GMM**
Labor income growth (t-1)	**-0.315*****	**-0.301*****	**-0.275*****	**-0.240*****
	(0.018)	(0.017)	(0.043)	(0.036)
Labor income growth (t-2)		**-0.097*****		**-0.099*****
		(0.008)		(0.018)
Non-executive lateral move, within-firm (Stayer)	–	–	–	–
Non-executive lateral move, cross-firm (CF)	**0.009***** (0.001)	**0.012***** (0.001)	**0.012***** (0.001)	**0.013***** (0.002)
Promotion, within-firm (PWF)	**0.012*****	**0.034*****	**0.011*****	**0.041*****
	(0.002)	(0.004)	(0.004)	(0.009)
Promotion, cross-firm (PCF)	**0.057*****	**0.096*****	**0.046*****	**0.069*****
	(0.006)	(0.008)	(0.010)	(0.016)
Executive stayer (ExecStayer)	**0.009*****	**0.040*****	**0.007*****	**0.041*****
	(0.001)	(0.004)	(0.002)	(0.009)
Executive lateral move, cross-firm (ExecCF)	**0.038***** (0.003)	**0.076***** (0.006)	**0.018***** (0.007)	**0.051***** (0.012)
Demotion, within-firm (DWF)	-0.001	**0.009*****	*-0.008****	0.005
	(0.003)	(0.003)	(0.004)	(0.007)
Demotion, cross-firm (DCF)	0.002	**0.032*****	-0.023	0.006
	(0.007)	(0.009)	(0.018)	(0.030)
Age/10	**-0.043*****		-0.008	
	(0.004)		(0.006)	
$Age^2/100$	**0.003*****	**-0.003*****	0.000	**-0.001*****
	(0.000)	(0.000)	(0.001)	(0.000)
constant	**0.148*****	**0.068*****	**0.059*****	0.027
	(0.009)	(0.017)	(0.014)	(0.051)
Observations	588,600	529,740	265,060	238,554
Number of instruments	–	372	–	372
Arellano-Bond test (H_0: *zero autocorrelation in first-differenced errors*)				
m_1		-6.864		-3.610
(p-value)		(< 0.001)		(< 0.001)
m_2		-0.605		-0.185
(p-value)		(0.545)		(0.853)

Dependent variable: Change in real log labor income $ln(I_t) - ln(I_{t-1})$.

Notes: OLS regression includes education, sector, and year dummies. Clustered standard errors are reported in parentheses. Significance levels: *** **1 percent**, ** 5 percent, * 10 percent.



Notes: Evolution of real labor income implied by the GMM estimates in Table 12 for a university graduate (edu=17) starting his/her career at age 30.

Figure 4: Illustration of real income growth for men/women (GMM estimates).