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Firm quality and health maintenance☆

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ABSTRACT

We estimate the impact of firm quality – primarily measured by the firm-level wage premium – on the health maintenance of employees. Using linked employer–employee administrative panel data from Hungary, we analyze the dynamics of healthcare use before and after moving to a new firm. We show that moving to a higher-paying firm leads to higher consumption of drugs for cardiovascular conditions and more diagnostic and primary care visits, without evidence of deteriorating physical health, and, among men and older workers, to lower consumption of medications for mental health conditions. The results are robust to using alternative firm quality indicators based on productivity and worker flows, and to controlling for firm size, individual wage, and possible peer effects. The results suggest that higher-paying firms provide beneficial health-related amenities via the detection of previously undiagnosed chronic physical illnesses and improved mental health. Plausible mechanisms include higher-quality occupational health check-ups and less stressful working conditions.

1. Introduction

Workers are willing to accept lower wages for more favorable working conditions – this idea forms the basis of the theory of compensating wage differentials, originating from Rosen (1974, 1986), and having gained empirical support since then (Mas and Pallais, 2017; Wiswall and Zafar, 2018; Maestas et al., 2023, among others). However, despite the intuition behind the theory of compensating wage differentials, the sign of the correlation between wages and amenities is unclear. Following the argument of Sockin (2022), providing "good" amenities is costly for firms, but increases the utility of workers. Workers are willing to trade off wages for amenities, suggesting a negative correlation between wages and amenities. However, more productive firms can offer both higher wages and higher amenities, suggesting a positive correlation between the two. This is also emphasized by Sorkin (2018), who makes a distinction between the "Rosen motive" and the "Mortensen motive" – the first implies that firms can provide better amenities to compensate for lower wages (based on Rosen, 1974, 1986), whereas the second implies that amenities augment variations in pay (based on Mortensen, 2003). Due to these theoretical ambiguities, the sign of the correlation between wages and "good" amenities remains an empirical question, which has important implications for inequality and welfare. In this paper, we focus on health maintenance as one aspect of "good" amenities at the firm and its relation to firm-specific wages.

We use linked employer–employee administrative panel data supplemented with detailed healthcare records from Hungary to analyze the effect of firm quality – primarily measured by firm-level wage premium – on various aspects of healthcare

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utilization of employees. Beyond looking at indicators of primary, diagnostic, specialist outpatient, and inpatient care, we focus on four prescription drug categories: antihypertensive drugs, lipid modifying agents (predominantly statins), antidiabetics, and psychoanaleptics.

Among these drug categories, the first three are treatments of major cardiometabolic conditions (high blood pressure [hypertension], high blood cholesterol [hyperlipidemia] and diabetes), which, if left untreated, lead to cardiovascular and cerebrovascular complications such as heart attack, stroke, heart failure, and kidney injury, among others. Therefore, it is well known and emphasized by professional guidelines (e.g., Arnett et al., 2019) that the appropriate treatment of these chronic conditions substantially reduces the number of deaths from cardiovascular diseases, which comprise the leading cause of morbidity and mortality worldwide.[1] Turning to economic costs and benefits, UK-based studies have shown that the treatment of even uncomplicated mild hypertension is cost-effective for all men and for women above an age threshold (Constanti et al., 2021), and statin therapy is cost-effective for all 40–70 years old people (Mihaylova et al., 2024). Furthermore, there are negative labor market effects of diabetes itself (Pedron et al., 2019; Pinna Pintor et al., 2024) and of acute health shocks associated with the above chronic conditions such as heart attack and stroke (Gordois et al., 2016; Jones et al., 2020). Hence the treatment of hypertension, hyperlipidemia, and diabetes has clear medical and economic benefits in terms of future quality of life, survival, healthcare costs, and labor market outcomes alike, and so their diagnosis and treatment initiation among employees can be regarded as a step towards health maintenance.

This is all the more true because these conditions are highly prevalent but notoriously underdiagnosed. In 2019, the global age-standardized prevalence of hypertension in age group 30–79 was around 33%, of whom only slightly more than half were diagnosed, and less than half were treated. In Hungary, the corresponding prevalence of hypertension was substantially higher (41% for women and 56% for men), with treatment rates of 60% for women and 46% for men (Zhou et al., 2021). Similarly, the worldwide prevalence of diabetes was 8.8% in age group 20–79 in 2019 (IDF, 2017) with comparable rates in Hungary (Kempler et al., 2016), and around half of the cases worldwide (and 39% of cases in Europe) were undiagnosed (IDF, 2017). Also, although the use of lipid modifying agents (predominantly statins) for high blood cholesterol is more controversial due to different treatment guidelines (Mortensen et al., 2022), there is evidence for undertreatment in Central and Eastern Europe, including Hungary (Vrablik et al., 2021).

The fourth examined drug category, psychoanaleptics, mainly covers antidepressants in the working-age population that we analyze.[2] Antidepressants are mainly prescribed for major depressive disorders and anxiety disorders, thus their usage rate is an indicator of the mental health of the population. Compared to Europe on average, the prevalence of depression is higher (Arias-de la Torre et al., 2021) but antidepressant consumption is much lower (OECD, 2019) in Hungary, so undertreatment is likely to be present for depression as well. Similarly to physical health, poor mental health also has negative labor market consequences (Jolivet and Postel-Vinay, 2025).

Focusing on the impact of firm-specific wages on healthcare use, we estimate event study models to analyze the dynamics of healthcare use before and after moving to a new firm. We focus on a relatively healthy population and show that moving to a higher-paying – as opposed to a lower-paying – firm leads almost immediately to a persistently higher consumption of drugs for cardiovascular conditions (antihypertensives and lipid modifying agents) and a larger number of primary care and diagnostic visits, while the number of specialist outpatient visits and inpatient days does not change. In line with these results, moving to a higher-paying firm leads altogether to higher total healthcare spending, entirely driven by increased drug spending. We provide evidence that these patterns are unlikely to be driven by deterioration of physical health. Finally, we find that the consumption of psychoanaleptics (mainly antidepressants) decreases among men and relatively older workers after moving to a higher-paying firm compared to a lower-paying one. Our estimates are robust to using total factor productivity (TFP), the firm-level mean wage, and the poaching index as alternative measures of firm quality. Also, the effect of firm-level wage premium remains significant if we control for firm size, individual wage, or a measure of peer effects.

Overall, taking into account the high rate of latency and the chronic nature of the examined cardiovascular conditions, our results suggest that higher-paying firms have a beneficial effect on the detection of previously undiagnosed chronic physical illnesses and are associated with better access to (preventive) care. When we quantify the importance of these amenities with back-of-the-envelope calculations using calibration parameters from the health technology assessment (HTA) literature, we find that their net monetary value amounts to at most 1%–2% of firm-level net wage differences. At the same time, the decreased use of psychoanaleptics suggests a positive effect of firm quality on the mental health of the employees. Plausible mechanisms include higher-quality occupational health check-ups and less stressful job conditions.

Our paper contributes to the following strands of the literature.

First, as mentioned earlier, we relate to the literature of non-pay characteristics of firms. As Rodrik and Sabel (2022) highlight, "good jobs" may be described by a broad range of characteristics. Health-related job characteristics include the level of workplace hazards (Lavetti, 2020), job stress (French and Dunlap, 1998; Nagler et al., 2023) or access to health insurance (Gruber, 1994; Qin and Chernew, 2014). The maintenance of good health of workers may be a key characteristic of a "good job", and we provide evidence on the important and heterogeneous role of firms in this. Focusing on the relation between firm-specific wages and amenities also links our work to Clark et al. (2009), Lachowska et al. (2022), Sockin (2022) and Bana et al. (2023), who show

[1] For instance, their share among all deaths was 32% in the European Union and even higher, 42% in Hungary in 2021 (Eurostat statistics, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Cardiovascular_diseases_statistics). According to meta-analyses, every 10 Hgmm reduction of systolic blood pressure in hypertension reduces the risk of major cardiovascular disease events, coronary heart disease, stroke and heart failure by 17%–28% and all-cause mortality by 13%, and the proportional risk reduction does not depend on the initial grade of hypertension (Ettehad et al., 2016).

[2] The aggregation level of drug categories in our data does not allow us to analyze antidepressants separately.

that higher-paying firms offer better amenities, captured by worker satisfaction and social insurance take-up. We contribute to this literature by examining health maintenance at firms.

Second, we contribute to the recent literature that decomposes the individual-level variation of healthcare utilization into place-, provider- and patient-specific components by exploiting moves of patients between regions or providers (see Finkelstein et al., 2016 for the origins of this literature and Bíró et al., 2024 for a recent review). Instead, we use mobility of employees between firms, therefore, our work is closely related to the recent paper by Ahammer et al. (2023). Based on administrative data from Austria, Ahammer et al. (2023) show in a mover-identification setting that firms are responsible for nearly 30% of the variation of worker-level healthcare expenditure. We replicate their main result in Appendix B and obtain similar-sized estimates, but otherwise the results of the two papers are not directly comparable because in the main analysis we focus on relatively healthy employees, on outcome variables related to health maintenance, and on specific explanatory variables such as the firm-level wage premium (while also controlling for other variables such as industry and occupation).

Third, our work contributes to understanding the relationship between firm characteristics and employee health (or healthcare utilization). Simple correlations between these variables are misleading due to selection decisions both by the firms and the employees (Rettl et al., 2024). Similar issues arise in the analysis of the health effects of occupation: e.g., Ravesteijn et al. (2018) find that while selection into occupations explains an important part of the correlation between occupation and health, occupations themselves have causal health effects. With our analysis, we contribute to the scarce literature on the health effects of firms, controlling for occupation. Since working conditions influence mental health even within the same occupation (Belloni et al., 2022), our estimated mental health effect of firms may be a consequence of different working conditions.

Finally, our work contributes to the literature on the role of health screening at the workplace. A statement of the American Heart Association claims that "conducting health screenings in the workplace is a promising strategy for early detection of established risk factors" (Arena et al., 2014). Also, there is evidence in the literature that workplace screening programs help identify undiagnosed hypertension and diabetes among employees (Legorreta et al., 2015; Bali et al., 2018). We extend this literature with suggestive evidence on the firm-dependent role of employee health screening in health maintenance based on large-scale administrative linked employer–employee data in the Hungarian context where such screening is mandatory. Importantly, the mandatory nature of the screening avoids self-selection issues such as shown by Jones et al. (2019) in an experimental employer-sponsored wellness program in the US. Nevertheless, our findings (an immediate and persistent level shift in cardiovascular drug consumption) are consistent with the habit-formation patterns seen in that US-based program (Jones et al., 2024).

The rest of this paper proceeds as follows. In Section 2 we provide background on the healthcare system and workplace health check-ups in Hungary. We present our data in Section 3, our analysis sample and empirical methods in Section 4, and our results in Section 5. In Section 6 we discuss our findings and make conclusions.

2. Institutional background

The following overview of the Hungarian healthcare system is based on Gaál et al. (2011). Hungary is a European Union member state with about 10 million inhabitants. Health insurance coverage rate of the population is close to 100%, and private health insurance coverage is very low. Public inpatient and outpatient care services are available free of charge. Each insured person is registered at a primary care physician, who is generally the first point of contact in case of a health problem, although some specialist care services can be accessed without the referral of a primary care physician. Both primary care physicians and specialists can prescribe medications, although the former can make some prescriptions (e.g., of antidepressants) only based on a recommendation of a specialist. On average, there is a slightly larger than 50% copayment on prescribed medications.

In Hungary, employers are responsible for financing occupational health services.[3] Larger employers maintain and run their own services, while smaller employers can contract with occupational health care providers on a private basis. The employer should ensure the services of one occupational physician and one nurse per 1000–2000 workers, depending on the occupational hazards at the workplace. The main roles of occupational physicians are health prevention, and the monitoring of health hazards at the workplace.

When taking up a job at a firm, each new worker has to undergo and pass a health evaluation provided by the occupational physician as a prerequisite for starting to work. In addition, occupational physicians provide regular as well as exceptional health check-ups. By law, regular health screening is only compulsory for certain groups of employees based on age (under 18 and above the statutory retirement age) and occupational hazard, but in practice firms often make annual health screening compulsory for all workers. In 2017, 2.2 million employees were served by 2543 occupational physicians, who performed 2.2 million health evaluations (of which 610,000 were for new workers and 1.35 million regular evaluations) (Hungarian Central Statistical Office, 2024). The failure rate during these evaluations was less than 1% (Nagy et al., 2022).

Employee health screening is comprised of an eye test, audiometry test and blood pressure measurement, but, based on the agreement between the firm and the occupational physician, may include further elements as well. As the main role of occupational physicians is prevention, if they detect a health problem, they may contact the primary care physician of the patient and provide health advice. However, occupational physicians cannot put a worker on sick leave and cannot provide referrals to social security-funded specialist care, which are the responsibilities of primary care physicians and/or specialists. Finally, although occupational physicians are allowed to give prescriptions, the management of chronic conditions (including the provision of regular prescriptions) is generally not part of their tasks.

[3] Occupational medicine is regulated by the Act XCIII of 1993 on Occupational Safety, 89/1995. (VII. 14.) Government Decree and by the 33/1998. (VI. 24.) Decree of the Ministry for National Economy.

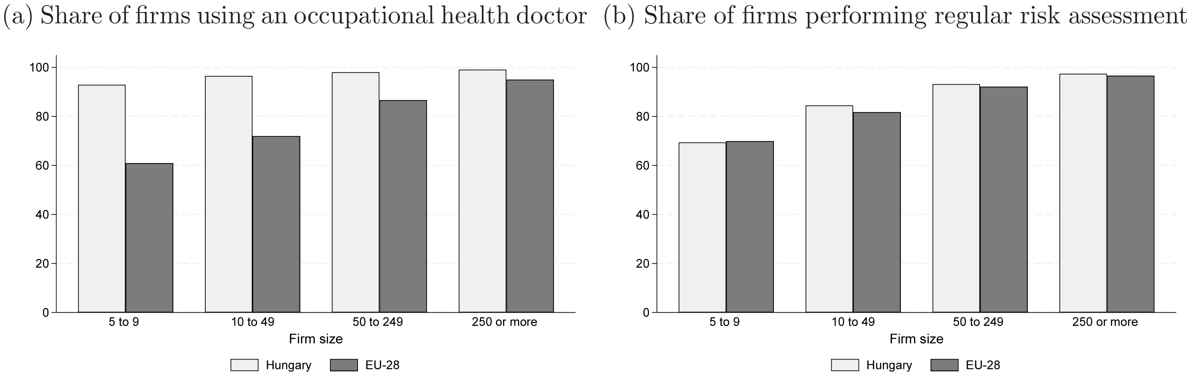

Fig. 1. Occupation safety and health management statistics in Hungary and the EU.
Notes: Figure shows statistics from the 2014 EU-OSHA's European Survey of Enterprises on New and Emerging Risks (ESENER) (https://osha.europa.eu/en/facts-and-figures/esener) by firm size. Panel (a) shows the share of firms using an occupational health doctor either in-house or contracted externally. Panel (b) shows the share of firms carrying out workplace risk assessments on a regular basis.

Regular health screening of workers is common practice in many countries (Steel et al., 2022), such as in the US, where the Occupational Safety and Health Administration (OSHA) requires medical surveillance for numerous hazardous substances,[4] or in the European Union, where workers' participation in health surveillance is mandatory in most member states (Colosio et al., 2017). According to the EU-OSHA's 2014 European Survey of Enterprises on New and Emerging Risks,[5] 77% of establishments (and 97% of large firms) in the EU arrange regular medical examinations to monitor the health of employees. Based on the same survey, Fig. 1 displays statistics on occupation and health management in Hungary and the EU-28. Panel (a) indicates that the share of firms using an occupational health doctor increases with firm size both in Hungary and the EU. The share is above 90% in each firm size category in Hungary and exceeds 85% in firms with at most 50 employees in the EU. Panel (b) shows that the share of firms performing regular risk assessment also increases with firm size, and these shares are very similar in Hungary and the EU. These heterogeneities by firm size suggest that firm characteristics are related to the role of workplace health screening.

3. Data

We use linked employer–employee administrative data, complemented with health-related information, for a 50% random sample of the entire population of Hungary on the monthly level for years 2009–2017.[6]

Demographic and labor force variables. We observe sex, age, living area (district), employment status, employment type (private sector employee, public sector employee, self-employed) for each person in each month. For employees, we observe their wage, occupation (International Classification of Occupations, ISCO codes), firm, and industry.

Firm quality indicators. For double-bookkeeping firms, we have yearly data on firm size, revenue, costs, and value of capital from the tax records of the firm. We define firm quality indicators in the following way.

First, we perform an Abowd-Kramarz-Margolis (AKM) style decomposition of logarithmic wages (Abowd et al., 1999) and compute worker-level and firm-level wage premia (fixed effects, FE) by exploiting moves between firms. That is, on the largest connected set of the employers and employees, we regress log wages on individual and firm fixed effects, controlling for year effects, age squared, age cubed (in line with, e.g., Card et al., 2013). We take the estimated firm fixed effects and call them the firm-level wage premium or "AKM firm FE".

Second, as a simple wage-related firm quality indicator, we use firm-specific logarithmic mean wage.

Third, we estimate the value-added-based total factor productivity (TFP) of firms using the *prodest* Stata module of Rovigatti and Mollisi (2020) and applying the estimation procedure of Wooldridge (2009). In a system GMM (generalized method of moments) framework, we regress the logarithm of value added (gross revenue minus the cost of goods sold) on year effects, the logarithm of firm size (variable input) and the logarithm of subscribed capital (state variable). Unobserved productivity is assumed to be a function of the state variable and proxy variables (material and service costs), and follows a first-order Markov chain. The TFP is the residual estimated from this regression. Finally, we take the firm-specific average of the TFP measure.

[4] https://www.osha.gov/medical-surveillance.

[5] https://osha.europa.eu/en/facts-and-figures/esener.

[6] The sample was drawn in 2003 and the same people were followed until 2017. The health-related variables are available only from 2009. The administrative database used in this paper is owned by the National Health Insurance Fund Administration, the Central Administration of National Pension Insurance, the National Tax and Customs Administration, the National Employment Service and the Educational Authority of Hungary. The data was processed by the Databank of the HUN-REN Centre for Economic and Regional Studies.

Fourth, following Bagger and Lentz (2019), we also calculate the poaching index, the share of new hires coming from other firms (and not from unemployment). We define this index based on all hires between 2009–2017 for each firm that had at least 10 hires in our sample in this period.

Healthcare use indicators. The data covers a wide array of healthcare use indicators on the monthly level. In our empirical analysis, we aggregate the variables by six-month periods because some categories of regular healthcare use (such as prescription drug purchases) might take place only once every couple of months. Within outpatient care, we examine primary care visits, diagnostic visits, and specialist visits. The number of diagnostic visits is defined as the sum of (outpatient) laboratory, X-ray, and ultrasound visits, while our definition of specialist visits includes all outpatient visits apart from primary care visits and diagnostic visits. We also examine diagnostic and specialist visits by outpatient specialty. Inpatient care use is measured by the number of days spent in hospital.

Within pharmaceutical consumption, our main variables of interest are the binary indicators of consumption of four major prescription drug categories, defined by Anatomical Therapeutic Chemical (ATC) codes at the level of aggregation available in our data: antihypertensives (C02–C09), lipid modifying agents (C10, predominantly statins), antidiabetics (A10, including insulin and oral medications) and psychoanaleptics (N06, mostly containing antidepressants in the age group of our interest).[7] Beyond the analysis of these four major prescription drug categories, we also examine 1st level ATC categories separately.

Within healthcare spending categories, we look at social security spending on outpatient care and inpatient care, social security plus out-of-pocket spending on prescription drugs, and the sum of these three spending categories ("total healthcare spending"), all on the six-monthly level. As an additional indicator, we look at the six-monthly number of sick pay days.

Data on outpatient and inpatient care cover public healthcare only. Data on prescription drugs cover prescriptions provided in public and private outpatient care as well, but do not contain non-prescription drugs, or medications received during inpatient stays. A limitation of our data is that we do not observe medical procedures such as cancer screening or vaccination.

4. Methods

4.1. Analysis sample

Throughout the analysis, we focus on private sector employees who move between firms. For each employee, we identify the first month in the period 2011–2015 when the employee works at a different firm than in the month before (if such a month exists).[8] We include only those persons whose origin and destination firm at the time of the move had at least 50 workers,[9] and the firm-level wage premium measure is observed both for the origin and destination firm. We focus on moves in 2011–2015 to ensure that at least two pre-transition and two post-transition years are observed in the data, as our data ranges from 2009 to 2017. The month of the move, the three preceding months, and the two subsequent months are defined as the six-monthly event time 0. We make this choice because healthcare use a few months before the move might be affected by the foreseen move, therefore, we consider event time 0 as the transition period. We follow employees through six-monthly event time −4 to 4, i.e., for a period spanning four and a half years, which we call the *event time window*.

We examine individuals aged 30–55 at the time of the move, as we focus on ages when healthcare use becomes more frequent but retirement is still distant (the majority of individuals retired after age 60 in this period). We exclude employees who were hospitalized at least once within the two-year period before the move, as our aim is to analyze a relatively healthy population without major pre-move health deterioration to ensure that the transition between firms is not driven by health problems. We also exclude from the sample those women who ever had (in the 2009–2017 period) an inpatient or outpatient diagnosis code referring to pregnancy, childbirth, and the puerperium (ICD10 [International Classification of Diseases] "O"). After these restrictions, we have a sample of 58,485 individuals.

We further restrict the sample to persons who were continuously employed in the private sector throughout the event time window (more precisely, who have non-missing occupation and industry records) and remain at the destination firm after the move until the end of the event time window.[10] Imposing these restrictions leads to a balanced analysis sample of 24,302 individuals. 91% of them remain in the same broad occupation category (white-collar or blue-collar) after the move; 57% of them remain in the same one-digit industry category.[11]

We define as a comparison group the sample of workers who remain occupied at the same firm for a period spanning four and a half years around a randomly selected event date in 2011–2015, and the firm has at least 50 employees at this pseudo-event. For this non-mover comparison group, we also require the no-hospitalization condition before the pseudo-event, leading to a balanced sample of 217,314 individuals. Note that in our main analysis, we include only the sample of workers moving between firms and use the comparison group of stayers only in descriptive analyses and in a robustness check in Section 5.2.

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[7] Within ATC N06, antidepressants (N06 A) and "psychostimulants, agents used for ADHD and nootropics" (N06B) are the two substantial categories. The latter mainly covers vinpocetine, a drug used in the treatment of dementia and some other neurological disorders, hence it is rarely prescribed in the age group of our interest.

[8] To make sure that a change of the firm identifier does not lead to a false move we apply the worker-flow method of detecting firm identifier changes as in Saygin et al. (2021).

[9] We make the firm size restriction because the estimated firm quality indicators are noisy and often missing for smaller firms. A robustness check including firms with at least 20 workers is shown in Fig. A.6.

[10] A robustness check including workers who remain employed but may move to a further firm is shown in Fig. A.7.

[11] In the analysis sample, 24% of the moves between firms occur after a mass lay-off at the original firm, defined as a reduction in the workforce by at least 50% based on annual average workforce size.

4.2. Empirical specifications

We analyze the effect of moving to a firm with a different firm-level wage premium on health-related outcomes by estimating the following event study model on the sample of movers:

$$H_{it} = \sum_{j=-4}^{4} \beta_j \mathbb{1}[e_{it} = j]\Delta_i + \sum_{j=-4}^{4} \alpha_j \mathbb{1}[e_{it} = j] + X_{it}\gamma + \tau_t + \mu_i + \varepsilon_{it}, \quad (1)$$

where i indexes individuals, t indexes calendar time, H_{it} is a health-related dependent variable, e_{it} indicates event time in six-month periods, $\mathbb{1}[e_{it} = j]$ is the event time dummy for event time j, τ_t denotes monthly date fixed effects (measured at the first month in the event time period), μ_i denotes person fixed effects, X_{it} includes sex-specific quadratic functions of age, one-digit industry dummies, and two-digit occupation dummies. Δ_i is the difference between the firm-level wage premium (AKM firm FE) in the post- vs. pre-move firm. The coefficients of interest are the β_j, capturing the effect of the post-move firm's wage premium relative to the pre-move firm's wage premium on the health-related outcome over time. We make the normalization $\sum_{j=-4}^{-1} \beta_j = 0$.

The identification of the effect hinges on the assumption that Δ_i is not related to changes in the health of workers. If, for example, workers with deteriorating health were more likely to move to lower-paying than to higher-paying firms, then we would observe higher healthcare use at lower-paying than at higher-paying firms after the move, irrespective of the true effects of the firms on healthcare use. We provide three pieces of suggestive evidence that the difference between the firm-level wage premium in the post- vs. pre-move firm is not related to changes in worker health: (1) the relation between healthcare use and Δ_i is flat preceding the move between firms (i.e., parallel trend holds before the move); (2) capturing health status with hospitalization and with non-diagnostic specialist outpatient care use, we do not see evidence that the difference in firm-level wage premium would be related to major changes in worker health; (3) any potential health effect of firm quality would likely be gradual, whereas most of our estimated changes in healthcare use (e.g., in the use of antihypertensives and diagnostic care) are sudden around the time of the transition between firms.

Next, we estimate the effect of the change of firm- and individual-level indicators on health-related outcomes in a difference-in-differences (DiD) type specification:

$$H_{it} = \tilde{\boldsymbol{\beta}} E_{it} \tilde{\boldsymbol{\Delta}}_i + \alpha E_{it} + X_{it}\gamma + \tau_t + \mu_i + \varepsilon_{it}, \quad (2)$$

where we use the same notation as in Eq. (1), and E_{it} is a binary indicator of the post-move period, i.e., it equals one for event times 1 to 4 and zero for event times −1 to −4 (omitting the six-month transition period, event time 0, from the model). In various specifications, $\tilde{\boldsymbol{\Delta}}_i$ denotes the difference of a single firm quality measure (AKM firm FE, log mean wage, log TFP, or the poaching index) in the post- vs. pre-move firm or a vector of differenced indicators, such as the difference of firm-level wage premium, log firm size and log individual wage in the same model. We measure time-varying firm characteristics and individual wage at event times 1 (at the post-move firm) and −1 (at the pre-move firm). The parameter (vector) of interest is $\tilde{\boldsymbol{\beta}}$, which shows the effect of the change in firm-level parameters or log individual wage on healthcare use.

On the methodological side, when estimating versions of Eq. (2), we directly regress individual-level healthcare use on the change in firm quality measures while potentially controlling for the change in other firm characteristics such as industry or firm size. As discussed in Agha et al. (2019) in a mover-based setting, this is equivalent to first decomposing healthcare use into worker and firm effects and then regressing the estimated firm fixed effects on firm-level indicators as done in Ahammer et al. (2023), similarly to most of the mover-based literature. Our aim here is not to examine in detail the correlates of the firm effects but to show that taking into account other firm characteristics does not cancel the estimated effects of the firm quality measures such as the firm-level wage premium. Strictly speaking, the estimated parameter of, e.g., the firm-level wage premium shows the effect of *moving to* a firm with a different wage premium while controlling for changes in individual and firm characteristics (e.g., industry, firm size, occupation, individual wage). The parameter shows the effect of the wage premium itself only if there are no other confounding variables.

To analyze heterogeneity in the relationship between healthcare use and firm quality, we estimate event studies (1) and DiD-type Eqs. (2) separately on subgroups defined by age group, sex, location of residence, and pre-move occupation category.[12] In all regressions, we estimate standard errors clustered at the person and firm level.

5. Results

5.1. Descriptive analysis

Table 1 displays descriptive statistics at event time −1, i.e., in the six-month period before moving between firms, separately for individuals for whom the firm-level wage premium decreased vs. increased at the time of the move.[13] For comparison, we show descriptive statistics of workers staying at the same firm for the whole observation period. We weight the sample of stayers to match the age and sex composition of movers.

According to Table 1, individuals for whom the change in firm-level wage premium is positive are less likely to be males, are slightly younger, have a lower average initial wage but a higher wage change, and are more likely to work in the service industry

[12] The occupation categories refer to the first month of event time −1, i.e., the six-month period before the move between firms.

[13] Fig. A.1 shows that the change in firm-level wage premium upon the move has a roughly symmetric distribution with a slightly positive mean.

Table 1
Descriptive statistics by the change of firm-level wage premium.

	(1): Movers, neg. diff. AKM firm FE		(2): Movers, pos. diff. AKM firm FE		(3): Stayers		Standardized mean difference		
	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	(2)-(1)	(3)-(1)	(3)-(2)
Male	0.731	0.443	0.633	0.482	0.678	0.467	−0.21	−0.12	0.09
Age	41.277	7.324	39.362	7.206	40.242	7.316	−0.26	−0.14	0.12
County seat (incl. Budapest)	0.422	0.494	0.425	0.494	0.414	0.493	0.01	−0.02	−0.02
Log individual wage	12.408	0.583	12.169	0.605	12.339	0.565	−0.40	−0.12	0.29
Change in log individual wage	−0.003	0.297	0.214	0.333	0.043	0.16	0.69	0.19	−0.65
White-collar worker	0.377	0.485	0.396	0.489	0.451	0.498	0.04	0.15	0.11
Healthcare use (six-monthly)									
Antihypertensives (binary)	0.197	0.398	0.153	0.36	0.175	0.38	−0.12	−0.06	0.06
Lipid mod. agents (binary)	0.058	0.234	0.039	0.192	0.049	0.217	−0.09	−0.04	0.05
Antidiabetics (binary)	0.025	0.156	0.019	0.137	0.023	0.149	−0.04	−0.01	0.03
Psychoanaleptics (binary)	0.019	0.135	0.02	0.138	0.02	0.139	0.01	0.01	0.00
Diagnostic visits	0.577	1.282	0.526	1.217	0.562	1.266	−0.04	−0.01	0.03
Primary care visits	2.269	2.916	2.213	2.824	2.033	2.798	−0.02	−0.08	−0.06
Specialist visits	1.326	3.261	1.334	4.074	1.325	3.481	0.00	0.00	0.00
Hospital days	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Total healthcare spending (euro)	38.117	78.356	33.691	71.361	37.529	79.397	−0.06	−0.01	0.05
Drug spending (euro)	24.544	56.969	20.914	51.644	24.078	57.472	−0.07	−0.01	0.06
Outpatient spending (euro)	11.973	24.952	11.456	24.064	11.688	24.735	−0.02	−0.01	0.01
Inpatient spending (euro)	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00
Employer characteristics									
AKM firm FE	0.284	0.189	0.114	0.218	0.19	0.244	−0.83	−0.43	0.33
Change in AKM firm FE	−0.136	0.146	0.206	0.175	0	0	2.12	1.32	−1.66
Log TFP	2.384	0.126	2.331	0.122	2.38	0.126	−0.43	−0.03	0.40
Change in log TFP	−0.02	0.127	0.065	0.12	0	0.01	0.69	0.22	−0.76
Log mean firm-level wage	12.54	0.459	12.191	0.47	12.41	0.463	−0.75	−0.28	0.47
Change in log mean firm-level wage	−0.172	0.334	0.402	0.38	0.004	0.028	1.60	0.74	−1.48
Poaching index	0.476	0.187	0.37	0.175	0.403	0.197	−0.59	−0.38	0.18
Change in poaching index	0.075	0.213	0.182	0.236	0	0	0.48	−0.50	−1.09
Firm size	2291	3376	2219	4898	3470	6972	−0.02	0.22	0.21
Industry									
Manufacturing	0.319	0.466	0.274	0.446	0.366	0.482	−0.10	0.10	0.20
Trade	0.135	0.342	0.12	0.326	0.108	0.311	−0.04	−0.08	−0.04
Services	0.185	0.388	0.405	0.491	0.274	0.446	0.50	0.21	−0.28
Other	0.361	0.48	0.201	0.401	0.251	0.434	−0.36	−0.24	0.12
Individuals	11,030		13,272		217,314				

Notes: Table displays mean values measured in the six-month period before moving between firms (or before the placebo event dates in the case of stayers). Sample is as described in Section 4.1, the sample of movers is split by the sign of the change in AKM firm FE. Standardized mean difference is the difference of means divided by the square root of the average of the variances of the two groups.

before the transition. The change in log TFP, log mean firm-level wage and the poaching index are – as expected – higher for those moving to a higher-paying firm. The six-monthly indicators of healthcare use are similar in the two groups of movers, although movers with decreasing firm-level wage premium use slightly more antihypertensives than those with increasing firm-level wage premium.[14]

The average characteristics of stayers are generally between the two groups of movers, although stayers are more likely to be white-collar workers, to work in the manufacturing industry, and to be employed at larger firms than movers.

Fig. A.2 displays the time patterns of healthcare variables of movers with negative and positive change in the firm-level wage premium, as well as of the non-mover (stayer) comparison group with placebo event times. The figure suggests that the trends before the moves are roughly parallel and the mean healthcare use of stayers is close to that of movers. According to the figure, the use of lipid modifying agents and the number of specialist visits (panels (b) and (g)) decrease slightly and temporarily just after a move to a lower-paying firm. The patterns suggest that for some healthcare services, the transition between firms may imply a temporary disruption in care. More importantly for our analysis, the use of antihypertensives, lipid modifying agents, antidiabetics and diagnostic care (panels (a) to (c) and (e)) increases more among workers moving to a higher-paying firm than in the opposite direction. The use of psychoanaleptics increases only among the stayers and those who move to a lower-paying firm (panel (d)). The increase in hospital days (panel (h)) stems from the construction of our sample, i.e., no hospital stays in the two-year period before transition.

[14] Here we regard a difference as substantial if the standardized mean difference, i.e., the difference of means divided by a measure of the standard deviation, is greater than 0.1 in absolute value.

Table 2
Effect of various firm quality measures on healthcare spending.

Indicator	Total healthcare spending (euro)	Drug spending (euro)	Outpatient spending (euro)	Inpatient spending (euro)
Separate model for each firm characteristic				
Diff AKM firm FE	3.652**	2.495***	0.212	0.711
{Std.dev. 0.228}	[1.735]	[0.850]	[0.523]	[0.638]
Diff log TFP	6.847*	2.419	1.414	1.397
{Std.dev. 0.124}	[3.901]	[1.956]	[1.082]	[1.386]
Diff log mean wage	1.384	1.102**	−0.006	0.210
{Std.dev. 0.451}	[0.968]	[0.470]	[0.268]	[0.339]
Diff poaching index	5.010***	3.192***	1.454***	0.272
{Std.dev. 0.231}	[1.929]	[0.926]	[0.702]	[0.753]
Mean outcome at event time −1	33.9	21.3	11.1	0.0

Notes: Table shows estimated β parameters and standard errors clustered at the person and firm level (in brackets) from Eq. (2), using the variables indicated in the first column of the table in separate models. Standard deviations of the differenced variables are also shown. Sample is as described in Section 4.1. Number of individuals in the four panels, respectively: 24,302; 19,986; 24,340; 24,054.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Fig. A.3 displays analogous descriptive plots for healthcare spending categories.[15] According to the figure, the trends are parallel before the move, and drug spending (therefore also total healthcare spending) increases slightly more after a move to a higher-paying firm than after a move to a lower-paying firm.

Importantly, in our empirical analysis, we include person fixed effects to ensure that any differential time patterns in healthcare use are not driven by time-constant differences between individuals moving to higher- or lower-paying firms, and we also control for the (possibly time-varying) occupation and industry categories.

In Fig. 2 we show binned scatter plots that relate the difference of the firm-level wage premium in the post- vs. pre-move firm to the change of the person-specific mean healthcare use in the post- vs. pre-move firm. These plots reinforce the positive relationship of firm-level wage premium with the use of antihypertensives and lipid modifying agents, and also indicate a statistically significant positive relationship with the number of primary care visits.

5.2. Baseline results

We turn to the β_j event study parameters estimated from Eq. (1), showing the dynamic effect of the difference of the post- vs. pre-move firm-level wage premium on healthcare use. We display the results for the entire estimation sample in Fig. 3, and separately for age groups 30–42 and 43–55 at the time of the transition between firms in Fig. A.4.[16] The parameter estimates are summarized in single difference-in-differences type results in the top row of Table 3, which shows the estimated $\tilde{\boldsymbol{\beta}}$ parameter of Eq. (2) when $\tilde{\boldsymbol{\Delta}}_i$ only contains the difference of the post- vs. pre-move firm-level wage premium. The DiD-type estimates for the two age groups are included in Fig. 6.

Prescription drug consumption. Panel (a) of Fig. 3 and the first column of Table 3 indicate that a one standard deviation (0.23 log point, i.e., 26%) higher firm-level wage premium implies an around 0.4%point higher (half-yearly) probability of antihypertensive use after the transition, which is 2.4% of the average rate of antihypertensive use in our sample. The firm-level wage premium is also positively related to the use of lipid modifying agents (panel (b) of Fig. 3 and second column of Table 3), with a one standard deviation higher firm-level wage premium implying an around 0.2%point higher (in relative terms, 3.9% higher) probability of consumption. On average, firm-level wage premium does not affect the use of antidiabetics and psychoanaleptics.

Looking at the two age groups separately, Figs. 6 and A.4 indicate that the effects on the use of antihypertensive medications and lipid modifying agents are larger for relatively older than for younger workers. The probability of the use of psychoanaleptics decreases with firm-level wage premium among the 43–55 years old employees: a one standard deviation higher firm-level wage premium implies an around 0.2%point reduction (statistically significant at the 10% level), which roughly equals 10% of the average consumption ratio in this age group.

[15] Being financed on a capitation basis, primary care spending does not depend on utilization, hence it is not included in the graphs.

[16] Compared to the baseline estimates, Fig. A.6 shows results for the sample of firms with at least 20 workers (instead of at least 50 workers as in the baseline sample), Fig. A.7 displays results for the sample that includes workers who remain employed but may move to a further firm, and Fig. A.8 shows estimates from a specification that includes the non-mover comparison group (with placebo event dates) as well. The results are generally robust to these alternative specifications.

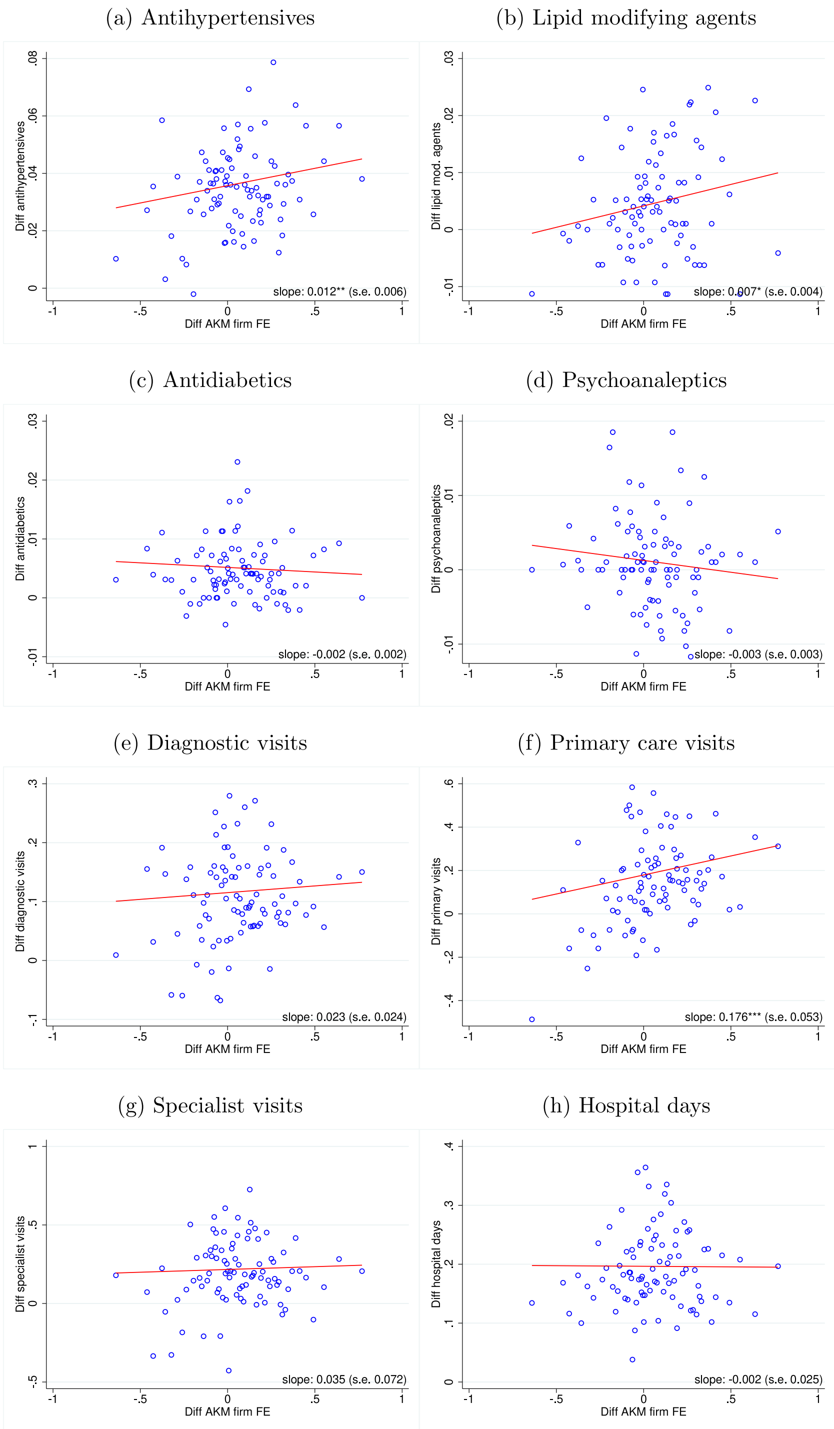

Fig. 2. Relation between change in firm-level wage premium and healthcare use.
Notes: Figure shows binned scatter plots for the relation of the difference between AKM firm FE in the post- vs. pre-move firm to the difference between the person-specific mean healthcare use in the post- vs. pre-move firm. The distribution of differenced AKM firm FE is split to 100 equally sized bins.

The upper panel of Table A.1 shows for each 1st level ATC category the effect of firm-level wage premium on prescription drug use, while Fig. A.5 displays event studies for 1st level ATC categories with a non-negligible (at least 5%) six-monthly consumption ratio. We estimate statistically significant – and positive – effects on three categories: drugs for cardiovascular, respiratory, and musculoskeletal diseases, and the event studies show immediate jumps in consumption after the move at least for the first two

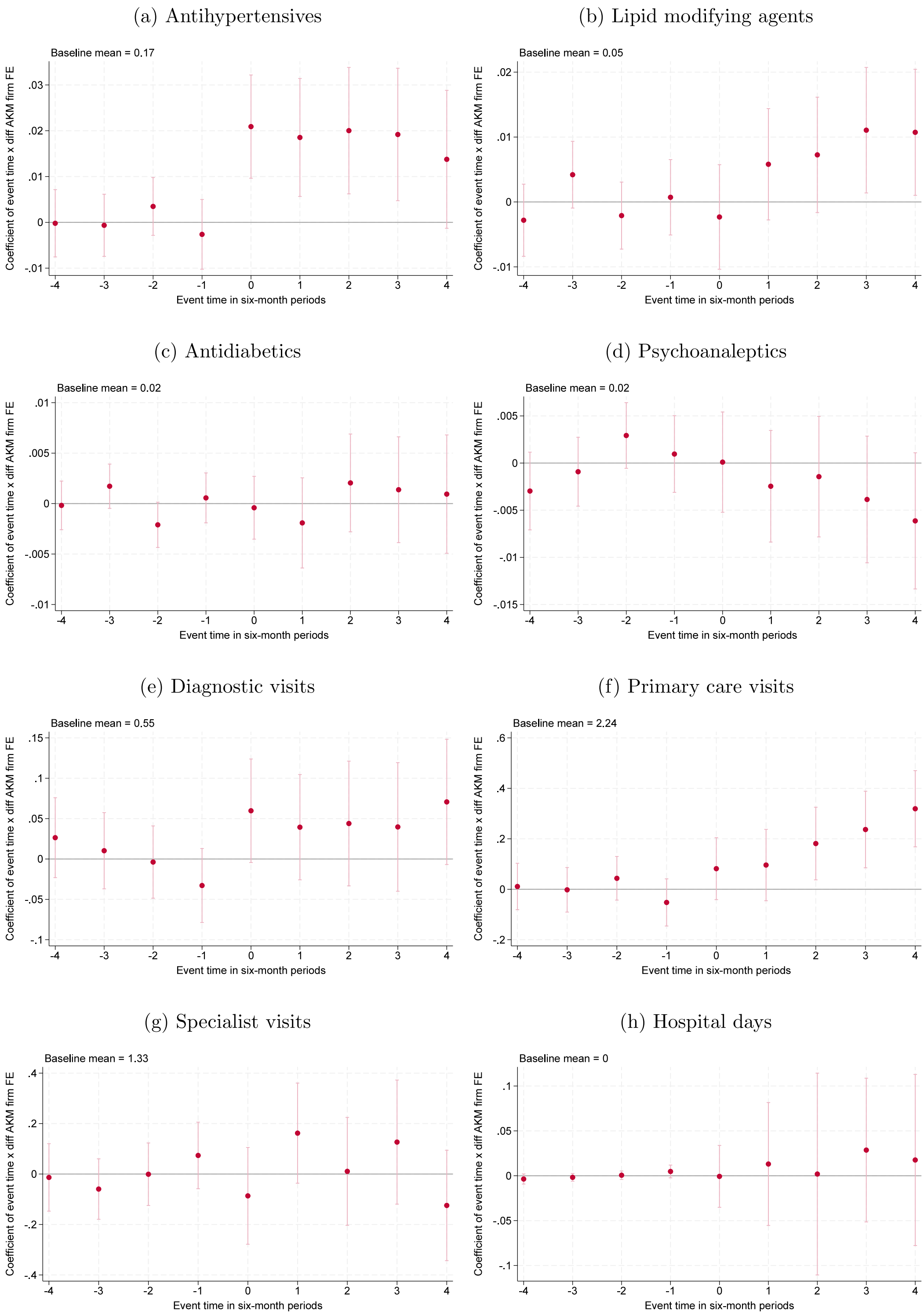

Fig. 3. Event studies for healthcare use, effect of firm-level wage premium.
Notes: Figure shows estimated β_j parameters (coefficients of event time × difference between post- vs. pre-move AKM firm FE) with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1. Event time 0 corresponds to the month of the move between firms. The mean outcome measured at event time −1 is displayed at the top of each panel. Number of individuals: 24,302.

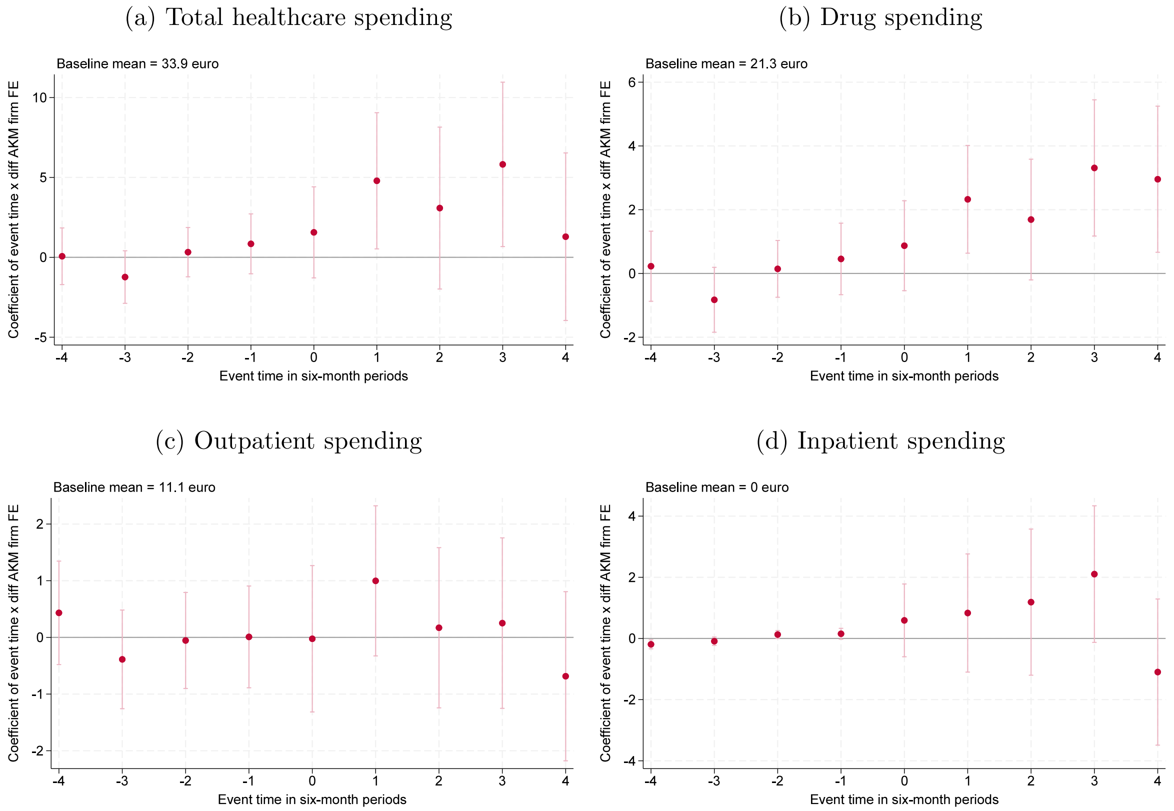

Fig. 4. Event studies for healthcare spending, effect of firm-level wage premium.
Notes: Figure shows estimated β_j parameters (coefficients of event time × difference between post- vs. pre-move AKM firm FE) with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1. Event time 0 corresponds to the month of the move between firms. The mean outcome measured at event time −1 is displayed at the top of each panel. The spending values are deflated to 2011 and converted to euro using the mean exchange rate of 2011 (1 euro = 279.4 Hungarian Forints). Number of individuals: 24,302.

Table 3
Effect of various firm quality measures on healthcare use.

Indicator	Anti-hypertens.	Lipid mod. agents	Anti-diabetics	Psycho-analeptics	Diagnostic visits	Primary care visits	Specialist visits	Hosp. days
Separate model for each firm characteristic								
Diff AKM firm FE	0.018***	0.008**	0.001	−0.003	0.050*	0.212***	0.047	0.013
{Std.dev. 0.228}	[0.006]	[0.004]	[0.002]	[0.003]	[0.027]	[0.057]	[0.078]	[0.027]
Diff log TFP	0.037***	0.022***	−0.001	−0.002	0.104*	0.368***	0.403**	0.021
{Std.dev. 0.124}	[0.013]	[0.008]	[0.005]	[0.006]	[0.056]	[0.125]	[0.173]	[0.059]
Diff log mean wage	0.007**	0.006***	0.001	−0.003*	0.017	0.097***	0.007	0.011
{Std.dev. 0.451}	[0.003]	[0.002]	[0.001]	[0.001]	[0.016]	[0.030]	[0.042]	[0.015]
Diff poaching index	0.016***	0.007*	0.002	−0.002	0.073**	0.271***	0.185**	0.042
{Std.dev. 0.231}	[0.006]	[0.004]	[0.003]	[0.003]	[0.032]	[0.064]	[0.078]	[0.028]
Mean outcome at event time −1	0.174	0.047	0.022	0.019	0.550	2.240	1.332	0.000

Notes: Table shows estimated β parameters and standard errors clustered at the person and firm level (in brackets) from Eq. (2), using the variables indicated in the first column of the table as heterogeneity indicators. Separate model is estimated for each firm characteristic, and standard deviations of the differenced variables are also shown. Sample is as described in Section 4.1. Number of individuals in the four rows, respectively: 24,302; 19,986; 24,340; 24,054.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

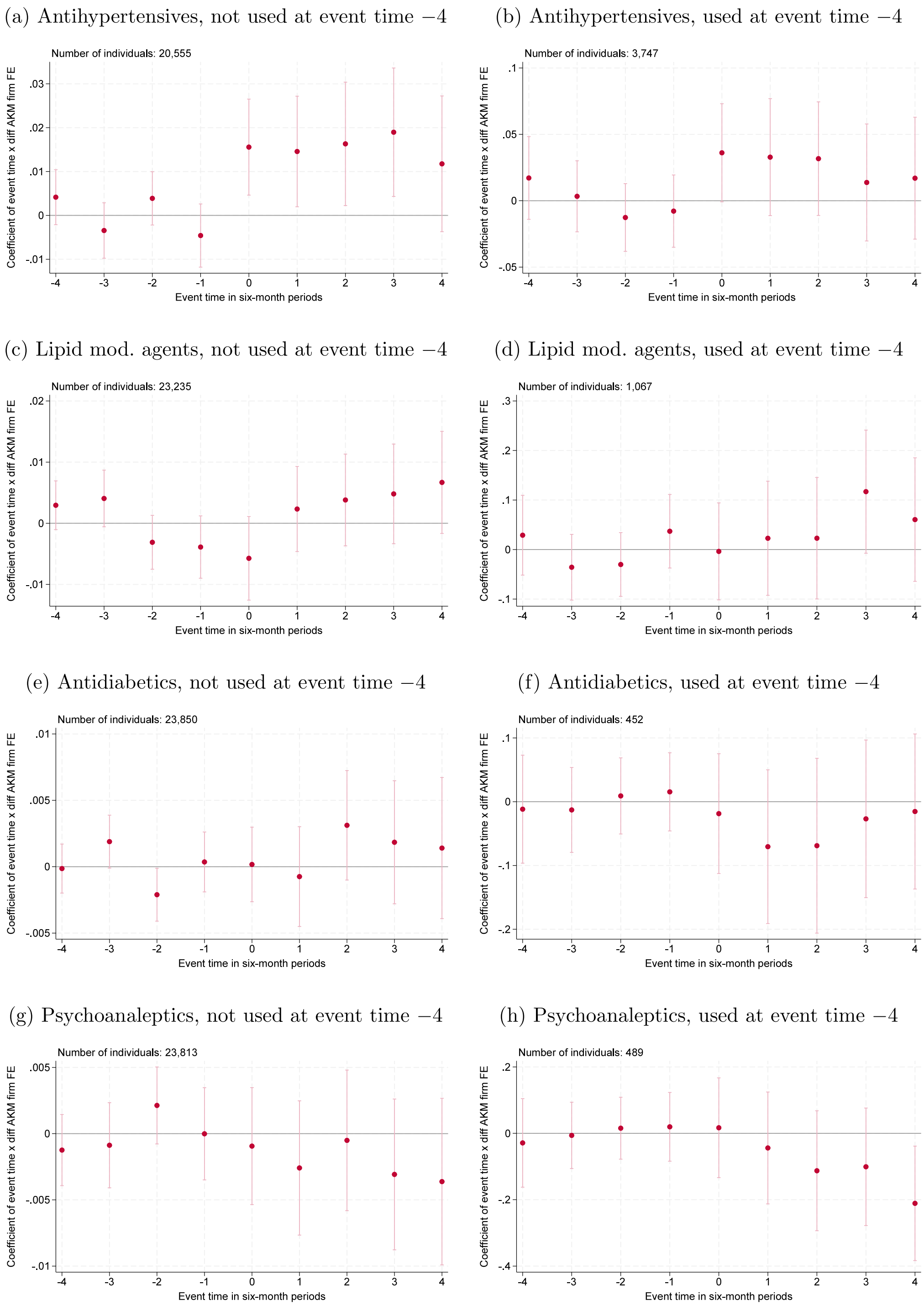

Fig. 5. Event studies for initiation and continuation of prescription drug consumption, effect of firm-level wage premium.
Notes: Figure shows estimated β_j parameters with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1, split by having used the specific drug category at event time −4. Event time 0 corresponds to the month of the move between firms, the two months after, and the three months before. Number of individuals is indicated at the top of each panel.

categories. This suggests that beyond the already discussed case of cardiovascular drugs (that mainly cover antihypertensives and lipid modifying agents), the consumption of some other drug categories is also affected by firm quality, which may further support health maintenance. However, it is beyond the scope of this paper to interpret these additional results because, for instance, drugs

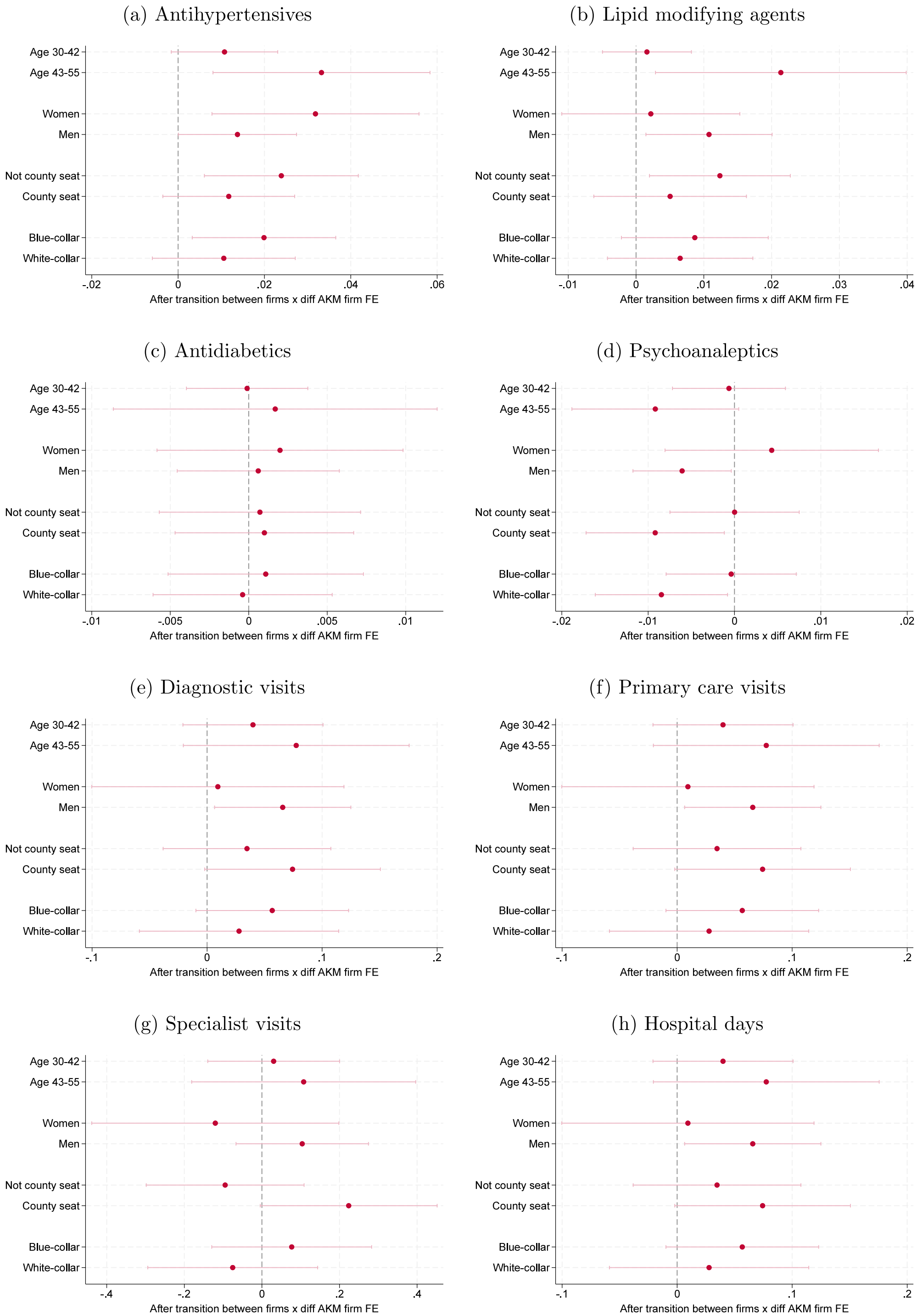

Fig. 6. Effect of firm-level wage premium on healthcare use, results by sub-samples.
Notes: Figure shows estimated β parameters with 95% confidence intervals from Eq. (2), using the difference between post- vs. pre-move AKM firm FE as the main explanatory variable. Sample is as described in Section 4.1. Total number of individuals: 24,302.

for musculoskeletal diseases contain a wide variety of individual medications such as prescription non-steroidal anti-inflammatory drugs.

Table 4
Effect of firm-level wage premium on healthcare use, controlling for firm size and individual wage.

Indicator	Anti-hypertens.	Lipid mod. agents	Anti-diabetics	Psycho-analeptics	Diagnostic visits	Primary care visits	Specialist visits	Hosp. days
AKM firm FE, firm size, and individual wage in same model								
Diff AKM firm FE	0.019***	0.007*	−0.002	−0.006*	0.078**	0.299***	0.109	0.025
	[0.007]	[0.004]	[0.002]	[0.003]	[0.031]	[0.063]	[0.088]	[0.029]
Diff log size	0.002**	0.000	0.000	0.000	0.006*	0.036***	0.034***	0.005
	[0.001]	[0.000]	[0.000]	[0.000]	[0.004]	[0.008]	[0.011]	[0.004]
Diff log ind. wage	−0.003	0.002	0.003**	0.003	−0.046**	−0.163***	−0.125**	−0.025
	[0.005]	[0.003]	[0.002]	[0.002]	[0.021]	[0.043]	[0.063]	[0.022]
Mean outcome at event time −1	0.174	0.047	0.022	0.019	0.550	2.240	1.332	0.000

Notes: Table shows estimated β parameters and standard errors clustered at the person and firm level (in brackets) from Eq. (2), using the variables indicated in the first column of the table as heterogeneity indicators. The listed three heterogeneity indicators are included in the same model. Sample is as described in Section 4.1. Number of individuals: 24,271.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Initiation and continuation of prescription drug consumption. To better understand the dynamics of prescription drug consumption around the transition between firms, for each analyzed prescription drug category, we split the sample by whether the individual used the specific drug at event time −4 (i.e., around two years before the move between firms). Subsamples without prior drug use can provide indicative evidence on new diagnoses, while subsamples with prior drug use allow the examination of treatment continuity.

The left-hand side panels of Fig. 5 show the β_j parameters from Eq. (1) estimated on subsamples without drug use at event time −4. According to panel (a), for antihypertensives, there is an around 0.3%point increase in the six-monthly probability of new prescriptions if someone moves to a firm with a one standard deviation (i.e., 26%) higher wage premium (and there was no consumption of antihypertensives in the six-monthly period two years before the move). We also see some, but less precisely estimated evidence for a positive effect on the initiation of lipid modifying agents. These results are in line with the hypothesis that health screening upon entering a new firm and regular screening afterwards have a larger role in the diagnosis of hypertension and high blood cholesterol at higher-paying than at lower-paying firms. The event study estimates for the initiation of antidiabetics and psychoanaleptics are noisier.

The right-hand side panels of Fig. 5 show the β_j parameters estimated on subsamples with drug use at event time −4. Although the estimates are noisy, panel (b) suggests a positive relation of the firm-level wage premium with the continued use of antihypertensives, while panel (h) suggests a slightly negative relation with the continued use of psychoanaleptics, especially in the medium term after the move.

Outpatient and inpatient care use. Panels (e), (f), and (g) of Fig. 3 show the estimated β_j from Eq. (1) for diagnostic outpatient care, primary care and (non-diagnostic) specialist outpatient care visits (the DiD-type results are shown in Table 3). According to the estimates, a one standard deviation (i.e., by 26%) higher firm-level wage premium is associated with around 0.01 more diagnostic and 0.05 more primary care visits on the six-monthly level (both about 2% in relative terms). As primary care physicians have a key role in general health maintenance (via prescription of drugs and diagnosis of diseases), the positive effect on this outcome – together with the effect on diagnostic services – suggests more effective health maintenance at higher-paying firms. The relation between firm-level wage premium and (non-diagnostic) specialist outpatient care use is negligible and statistically insignificant.

Looking at outpatient specialties separately, the lower panel of Table A.1 shows that the effect of the firm-level wage premium is positive and statistically significant at the 10% level for X-ray diagnostics, orthopedics, and cardiology, and significantly negative for psychiatry. The result on cardiology may reflect a higher awareness of cardiological conditions such as hypertension. The decreased use of psychiatric services at higher-paying firms is in line with our previous results on antidepressant consumption, and may indicate lower need but also a possible deterioration of access to mental health care.[17]

Importantly, panel (h) of Fig. 3 and the last column of Table 3 reveal that a higher firm-level wage premium does not imply a higher number of hospital days. This result, together with the essentially zero effect on specialist outpatient care use, suggests that the higher use of antihypertensives, lipid modifying agents, primary care, and diagnostic care is not likely to be the consequence of worsening health of individuals moving to better-paying firms.[18] Furthermore, panel (b) of Fig. A.9 shows that working hours are not related significantly to the firm-level wage premium, therefore, the estimated impacts on healthcare use are likely not driven by changes in the time available for health maintenance.

[17] Note that the sum of the estimated effects on specialist care categories in Table A.1 adds up to the total effect on specialist care visits as reported in the main text.

[18] We report event study results for sickness absence days in panel (a) of Fig. A.9, which shows that two years after the move, there is a slight increase in the six-monthly number of sick pay days if someone moves to a higher-paying firm. The interpretation of this result is not straightforward as the increase is also consistent with a more permissive sick leave policy (i.e., with a higher probability of sickness absence given the same health status), not just with a deterioration in health.

Healthcare spending. Finally, Fig. 4 shows the estimated β_j from Eq. (1) for total healthcare spending and its components (drug, outpatient and inpatient spending), while the DiD-type results are shown in Table 2. In line with the results above, a one standard deviation higher firm-level wage premium is associated with 0.83 euro (2.5%) higher six-monthly total healthcare spending and in particular with 0.57 euro (2.7%) higher six-monthly drug spending, while the association with outpatient and inpatient spending is small and statistically insignificant.

5.3. Heterogeneities

Subgroup analysis. Now, we estimate Eq. (2) across worker subgroups, where $\tilde{\boldsymbol{\Delta}}_i$ is defined again as the difference between the AKM firm FE in the post- vs. pre-move firm. Fig. 6 shows the estimation results on our sample split by age group, sex, living area (county seat vs. not), and occupation category (blue- vs. white-collar). We analyze the heterogeneity in our results along these characteristics for multiple reasons. Healthcare needs and in particular the prevalence of undiagnosed conditions vary strongly with age and, to a lesser extent, with the other characteristics as well. For instance, work-related health risks are less prevalent among white-collar than among blue-collar workers. Health consciousness likely varies both with sex and with occupation. Specifically, white-collar workers are on average more educated, which may imply better health-consciousness. Finally, access to regular healthcare is better in county seats. Therefore, occupational health check-ups may have a smaller role in county seats where workers can more easily access primary and secondary care. On the other hand, if, as a result of an occupational health check-up, further healthcare use (e.g., diagnostic or other specialist care) is recommended, then that may have a stronger impact in county seats where such care types are more easily accessible.

According to Fig. 6, as already discussed, the positive relation between firm-level wage premium and the use of antihypertensives and lipid modifying agents, and the negative relation between firm-level wage premium and the use of psychoanaleptics are stronger (or only present) for the relatively older workers, whose baseline usage rates and chronic disease latency rates are already larger, than for the younger workers. Heterogeneities by the other variables are less pronounced but a few differences are worth mentioning. The positive effect of firm-level wage premium is stronger among women than among men in the case of antihypertensives. For psychoanaleptics, the negative effects are only significant among men, among those living in county seats and among white-collar workers (and not among the complementary groups). Finally, men and those living in county seats react more strongly in the number of specialist visits after moving to a higher-paying firm. We conclude that in general it is not the case that specific groups would drive the results (apart from, possibly, the case of psychoanaleptics).

Heterogeneity by the size of the change of the firm-level wage premium. Next, we check heterogeneities by the size of the change of the firm-level wage premium in Table A.2, where we group changes into four quartiles according to their magnitude.[19] The top panel of the table shows estimated coefficients from a modified version of Eq. (2), in which we replace the continuous indicator of the change in firm-level wage premium with categorical variables indicating the quartiles of the change. Compared to moving to a substantially lower-paying firm (where the change is in the lowest quartile, i.e., less than −0.08 log point), moving to a substantially higher-paying firm (where the change is in the top quartile, i.e., more than 0.19 log point) has a significantly positive effect on the use of antihypertensives, lipid modifying agents, diagnostic care and primary care, and a significantly negative effect on the use of psychoanaleptics. A move in the middle (i.e., in the second and third quartile) generally implies a similar change in the above healthcare variables than a move in the top quartile, although the estimates are noisy, therefore, possible nonlinearities cannot be proven statistically.

The negative estimated parameters of the single dummy variable after the move are conditional on the other regressors in the model, including quadratic age and time effects. Therefore, these negative parameters do not imply that the healthcare variables would decrease after a move in the lowest quartile: indeed, the middle panel of the table shows that, except for psychoanaleptics, all examined healthcare use variables increase over time in each quartile of firm-level wage premium change – as this should happen because of the aging of the employees. Finally, differences in the baseline mean healthcare use across quartiles (reported in the bottom panel of the table) might also contribute to nonlinearities in the effect of the firm-level wage premium.

5.4. Alternative firm quality measures

To examine the robustness of our results to using firm TFP, firm-specific mean wage, and the poaching index instead of firm-level wage premium as an indicator of firm quality, we estimate Eq. (2) with these choices for $\tilde{\boldsymbol{\Delta}}_i$. Table 3 shows that the use of antihypertensives, lipid modifying agents, and primary care increases with firm quality statistically significantly at least at the 10% level irrespective of the firm quality measure used. In fact, even the magnitudes are similar: a one standard deviation change in each of the four firm quality measures is associated, in relative terms, with a 2%–3% change in the use of antihypertensives and primary care visits, and with a 3%–6% change in the use of lipid modifying agents.

According to Tables 2–3, reassuringly, none of the quality measures has a significant relation with hospital days and inpatient spending. For psychoanaleptics, diagnostic visits, specialist visits, total healthcare spending, and drug spending, the parameters have the same sign but different levels of significance depending on the choice of the quality indicator. For antidiabetics, none of the estimates are statistically significant at the 10% level. In a sense, the stability of the results is not surprising because higher-paying firms are consistently better than lower-paying firms in these other aspects, too, as shown in Table A.3.

[19] Similar, although statistically imprecise patterns arise if only two groups are formed, for instance, according to the sign of the change of the firm-level wage premium.

5.5. Possible mechanisms

To investigate potential mechanisms that can explain the relationship between firm-level wage premium and healthcare use, we estimate Eq. (2) with including different control variables in $\tilde{\boldsymbol{\Delta}}_i$ beyond the difference of post- vs. pre-move AKM firm FE.

Firm size and individual wage. First, we investigate if heterogeneities by firm-level wage premium remain significant after controlling for firm size and for individual wage. According to Table 4, the relation between the analyzed healthcare use indicators and firm-level wage premium is robust to the inclusion of these variables in the model, suggesting that firm quality captured by firm-level wage premium influences prescription drug use and physician visits beyond the impact of firm size and individual wage. Note that under this extended specification, the relation between the use of psychoanaleptics and firm quality is statistically significant at the 10% level for the whole sample, not just for certain subgroups such as the relatively older, more responsive employees as in the baseline specification of Fig. 6.

Despite the 50% average co-payment rate for prescription drugs, except for the use of antidiabetics, individual wages do not affect drug consumption significantly, therefore, individual wage effects seem not to play a key role in the relation between firm-level wage premium and prescription drug use. A likely explanation for this finding is that the analyzed drugs are relatively cheap. The median six-monthly total (social security plus out-of-pocket) cost of the analyzed four drug categories, conditional on non-zero spending, was 24–25 euro for antihypertensives, lipid modifying agents, and psychoanaleptics, and 48 euro for antidiabetics, which are not substantial compared to the median gross six-monthly wage of 4437 euro (corresponding to 1.240 million Hungarian forint) and the median net six-monthly wage of 2950 euro in our sample.

Peer effects. In principle, the relation between firm-level wage premium and healthcare use may be driven by peer effects if, for example, co-workers are more health conscientious at better-paying firms and they influence their peers' healthcare use Pruckner et al. (2020). As an indicative test of this mechanism, we estimate Eq. (2) by including the difference in the mean of the five-year age group – sex – one-digit occupation specific healthcare use of peers at the post- vs. pre-move firm as an additional control variable. If peer effects are important, we expect a positive coefficient for this indicator (β parameter of Eq. (2)). Note, however, that our estimation is subject to the well-known reflection problem (Manski, 1993), therefore, our focus here is not on peer effects themselves but on the sensitivity of the estimated relation between healthcare use and firm-level wage premium to the inclusion of this – imperfect – control variable. It turns out that the peer-effect-controlled estimates of the parameter of the firm-level wage premium as reported in Panel A of Table A.4 are similar to the baseline estimates reported in Table 3, therefore the relation between the healthcare variables and firm-level wage premium is unlikely to be driven by peer effects. In fact, the controlled estimates for the use of antihypertensives, lipid modifying agents, and primary care all remain significant.

Occupational medicine. Although we do not observe occupational medicine in our data, we know that by law, each worker entering a new firm has to undergo a health check-up, provided by the new employer. The result that new treatment of cardiovascular diseases is more likely to commence after arriving at a higher-paying firm can be explained by multiple possible mechanisms: (1) higher-paying firms take the health check-up upon hiring a new worker more seriously (they contract with the occupational physician to provide more thorough health check-up); (2) higher-paying firms can afford (or are more willing) to provide regular health check-ups via the occupational physician to their workers — this mechanism is suggested by the increasing difference by firm quality over time in some healthcare use categories; (3) occupational physicians at higher-paying firms can devote more time to their (sick) patients as workers are on average in better health and therefore have lower healthcare needs; (4) people moving to higher-paying firms take the recommendations of the occupational physician more seriously, partly because they are more motivated to maintain their capacity to work.

The understanding of the exact mechanism behind our results remains for future research, which necessitates detailed data on occupational medicine. Now, the only occupational-medicine-related heterogeneity we can check in our data makes use of a specific Hungarian regulation defining occupational health categories. This regulation determines the minimal frequency of occupational health check-ups and the minimal ratio of occupational physicians per employee based on occupational health risks. The categorization applies mainly to blue-collar workers[20] and is determined by the two-digit industry code of the employer. We check in Panel B of Table A.4 whether moving to an employer in a different risk category has an effect on healthcare use after controlling for firm-level wage premium. Here, risk level is coded as zero for the low-risk and one for the high-risk industry-specific risk categories, and we take the difference of this risk level in the destination versus origin firm.[21] The estimated effect of this variable is essentially zero and the firm-level wage premium parameters remain close to the baseline estimates, which suggests that the impact of firm-level wage premium is not driven by the above peculiarities of the Hungarian occupational health regulations.

[20] White-collar workers employed in a similar environment in most of their working hours are also covered but we cannot define them in the administrative data.

[21] Before the move, 25% of the blue-collar workers in our sample work in a high-risk industry. The mean difference in the risk level indicator in the destination vs. origin firm is 0.18 with a standard deviation of 0.58.

5.6. The monetary value of the health-maintenance amenities

Finally, to get a sense of the relative magnitude of the examined health maintenance amenities offered by the firms, we approximate the net monetary value of the associated health gains with back-of-the-envelope calculations and relate it to the variation of net wages. We use two approaches: an "aggregate" and a "bottom-up" approach.

According to the aggregate approach, we exploit the fact that, for instance, a 10% (0.1 log point) change in the firm-level wage premium is associated with a 0.37 euro change in six-monthly healthcare spending (Table 2). Taking into account that the average net monthly wage in our sample was 570 euro, a 10% change in firm-level wage premium means approximately 340 euro change in six months, implying that the increase in health expenditure is around 0.11% of the change in net wage premium. Although we do not know the rate of return on this particular mixture of health-maintenance investments, it is likely to be vastly positive. For instance, the median return on investment (ROI) of public health interventions surveyed in the systematic review of Masters et al. (2017) was 14.3 (but individual ROI values were in the range 0.7–221 even in the specializations closest to our interest, i.e., health protection, health promotion and healthcare public health). Taking this estimate at face value suggests that the health-maintenance amenity may be worth about 1%–2% of the firm-level net wage premium, with a very large uncertainty.

In the bottom-up approach, we specifically approximate the value of the increased use of lipid-modifying and antihypertensive medications at higher-paying firms. We focus on these two investments because they have well-measured long-run benefits (see the health literature cited in Section 1) and their monetary values can be approximated reasonably well using calibrated parameters, e.g., on the quality-adjusted life year (QALY) gain of the therapy.[22] According to the calculations given in Appendix C, our best – although highly imprecise – estimate for the net monetary value of these two therapies is around 0.22% of firm-level net wage differences. Given that around one-quarter of the change in total healthcare spending after moving to a different firm comes from the change in spending on these two medication categories,[23] a mechanical extrapolation would yield 0.8% as the relative net monetary value of the health-maintenance amenities. Note, however, that the benefits of the treatments may be underestimated as our focus is on a relatively young population, among whom the primary aim may be to prevent the development of high-risk conditions at older ages (Mancia et al., 2007).

Altogether, both the "aggregate" and "bottom-up" calculations suggest that the net value of the health gains is probably not greater than 1%–2% of the differences in the firm-level net wage premium. It may be larger in specific groups such as among the relatively older (43–55 years old) workers, for whom the effect of the wage premium on the treatment rate is substantially larger (see Fig. 6).

6. Discussion and conclusion

Using workers' transitions between firms, we analyzed how the firm-level wage premium is related to healthcare use. We focused on a population without hospitalization before moving to a different firm, to ensure that the transition is not driven by health deterioration. We found no evidence of major changes in health status after the move between firms. However, moving to a better-paying firm implies almost immediately a persistently higher use of antihypertensives, lipid modifying agents, diagnostic outpatient care, and primary care. At the same time, the consumption of psychoanaleptics of male workers and workers aged 43–55 decreases with firm productivity.

As the other categories of healthcare use do not decrease, the decline in the consumption of drugs for mental health conditions is unlikely to be the consequence of reduced access to care. Therefore, we conclude that mental health tends to improve with firm quality proxied by firm-level wage premium among men and relatively older workers, and this may be driven by better working conditions. If mental illnesses are better diagnosed at higher-paying firms then our results may underestimate the beneficial effects of firm-level wage premium on mental health.

Our main results suggest that moving to a higher-paying firm is accompanied by a higher awareness of diagnostic services and a higher probability of the diagnosis and treatment of existing cardiovascular diseases such as hypertension and high blood cholesterol, which have a large latency rate. The estimates are robust to using the total factor productivity, firm-level average wage, and the poaching index as a firm quality indicator, and to netting out the influence of peer effects, changes in the industry-specific formal risk category, firm size and individual wages. The latter robustness check implies that income effects are unlikely to drive the results. Although people moving to higher-paying firms achieve on average higher wage growth, this does not have a major role because most outpatient and hospital services are free of charge and the analyzed drug categories have low out-of-pocket costs. Due to data limitations, we cannot analyze to what extent lifestyle changes associated with the quality of the employer play a role in the estimated effect of firm quality on healthcare use — this channel may be one of the underlying mechanisms.

Based on the health literature cited in Section 1, the long-run benefits of the increased lipid-modifying and antihypertensive therapy include a smaller number of cardiovascular and cerebrovascular complications such as heart attack and stroke, the corresponding reduction of labor productivity loss and disability benefit applications, and ultimately a better quality of life and longer life expectancy. Although a full cost–benefit analysis of the higher treatment rate and the higher use of diagnostic and

[22] In contrast, the increased use of diagnostic and primary care visits may include a wide range of services, hence determining their monetary value is less straightforward.

[23] According to Table C.1, the sum of the DiD-parameters of spending on the two medication categories is 1.0 euro, which can be compared with the parameter of total spending (3.7).

primary care services at higher-paying firms is beyond the scope of this paper, our back-of-the envelope calculations suggest that their net monetary value amounts to at most 1%–2% of firm-level net wage differences.

In sum, we conclude that higher-paying firms provide better health-related amenities, amplifying inequalities between firms. Beyond their beneficial effects on mental health, higher-paying firms contribute to the maintenance of the health of their workers through the prevention channel if there is health screening at the workplace. By providing amenities (in our case, health maintenance services), firms can not only increase the productivity of their workers but can also decrease worker turnover and vacancy rate (Sockin, 2022; Mas, 2025). Based on the related health literature (see Section 1), there is ample evidence that the prevention and/or treatment of cardiovascular conditions and depression are productivity-enhancing, while also improve worker well-being. In the case of productivity-boosting amenities that do not decrease worker utility, profit-maximizing firms provide such amenities up to an optimal solution (Mas, 2025).

Our results on the positive relation between firm-level wages and health-related amenities are based on an institutional setting with universal health insurance coverage provided by the social security system, therefore our findings are not affected by incentives inherent in employer-based health insurance. Our results are relevant to other institutional settings with some employee health screening, such as in the European Union (based on the Directive 89/391/EEC), and in the US (based on the Occupational Safety and Health Act).

CRediT authorship contribution statement

Anikó Bíró: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Péter Elek:** Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Additional figures and tables

See Figs. A.1–A.9 and Tables A.1–A.4.

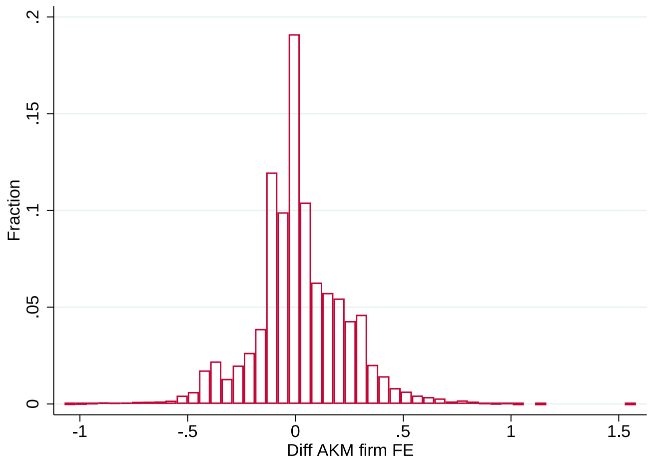

Fig. A.1. Distribution of the change in firm-level wage premium upon transition.
Notes: Figure shows the distribution of the difference between the AKM firm FE in the post- vs. pre-move firm.

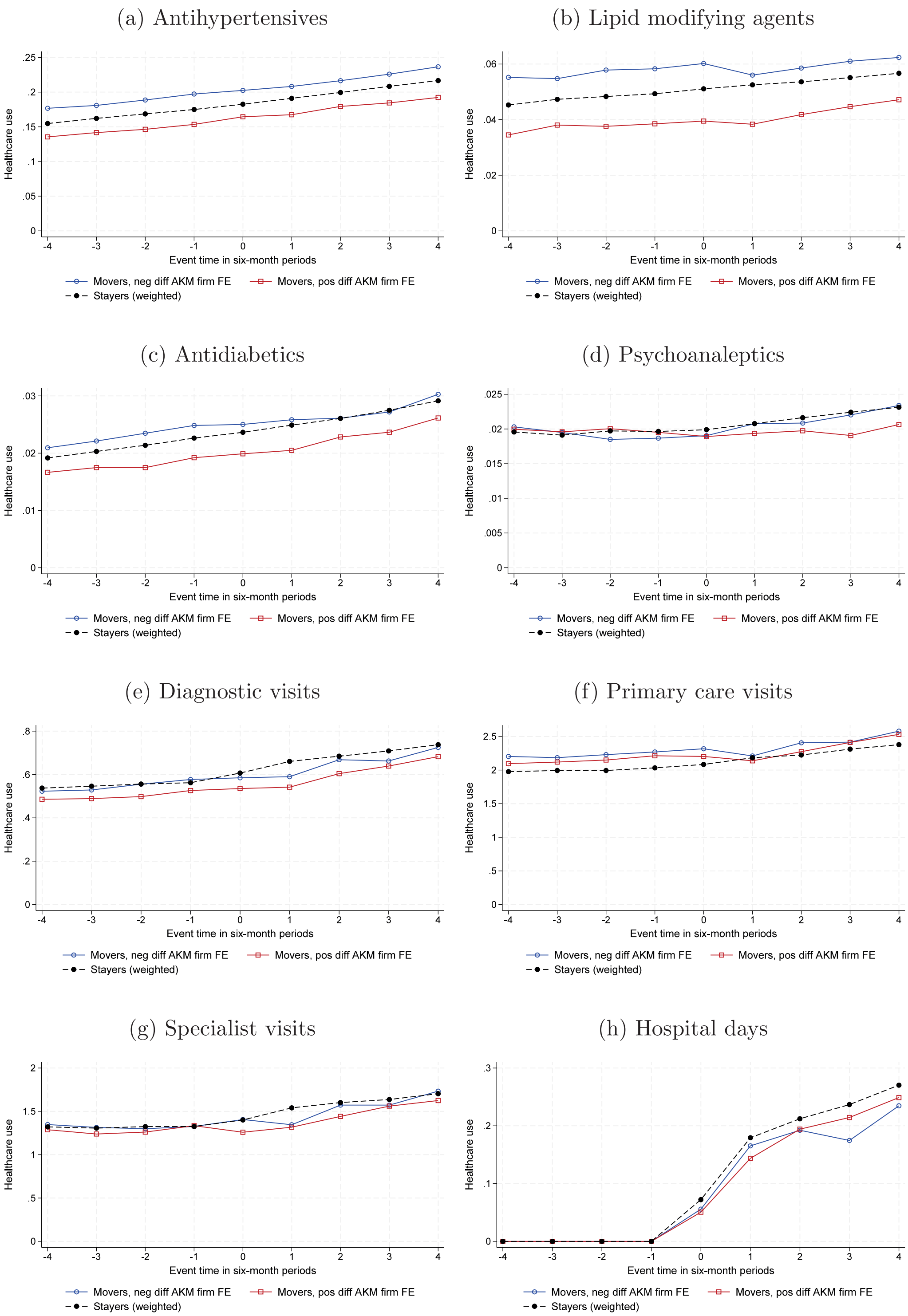

Fig. A.2. Healthcare use around job-to-job transition by change in firm-level wage premium.
Notes: Figure shows the evolution of six-monthly healthcare use indicators split by the sign of the change in AKM firm FE for movers. Sample is as described in Section 4.1, extended with workers not moving between firms. The sample of individuals not moving between firms ("stayers") is weighted to match the age and sex composition of the mover sample. Event time 0 corresponds to the month of the move between firms (or a random event date for those who do not move), the two months after, and the three months before. Number of individuals: 24,302 movers (11,030 with negative diff AKM firm FE; 13,272 with positive diff AKM firm FE); 217,314 stayers.

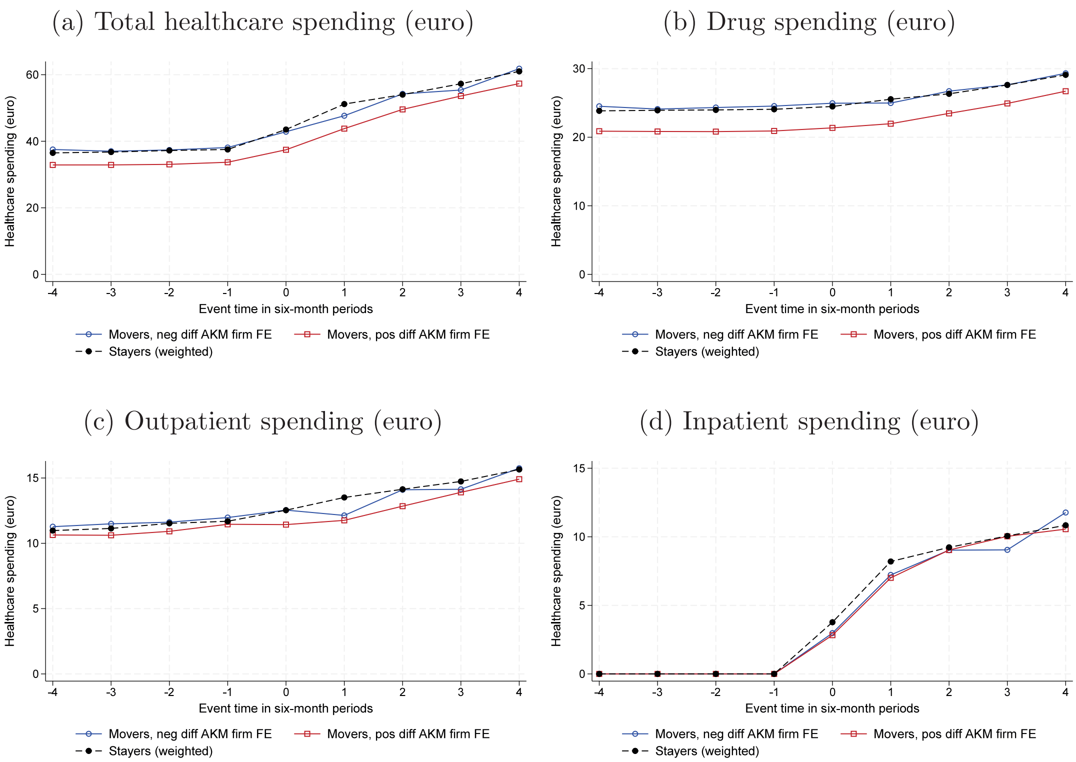

Fig. A.3. Healthcare spending around job-to-job transition by change in firm-level wage premium.
Notes: Figure shows the evolution of six-monthly healthcare use indicators split by the sign of the change in AKM firm FE for movers. Sample is as described in Section 4.1, extended with workers not moving between firms. The sample of individuals not moving between firms ("stayers") is weighted to match the age and sex composition of the mover sample. Event time 0 corresponds to the month of the move between firms (or a random event date for those who do not move), the two months after, and the three months before. Number of individuals: 24,302 movers (11,030 with negative diff AKM firm FE; 13,272 with positive diff AKM firm FE); 217,314 stayers.

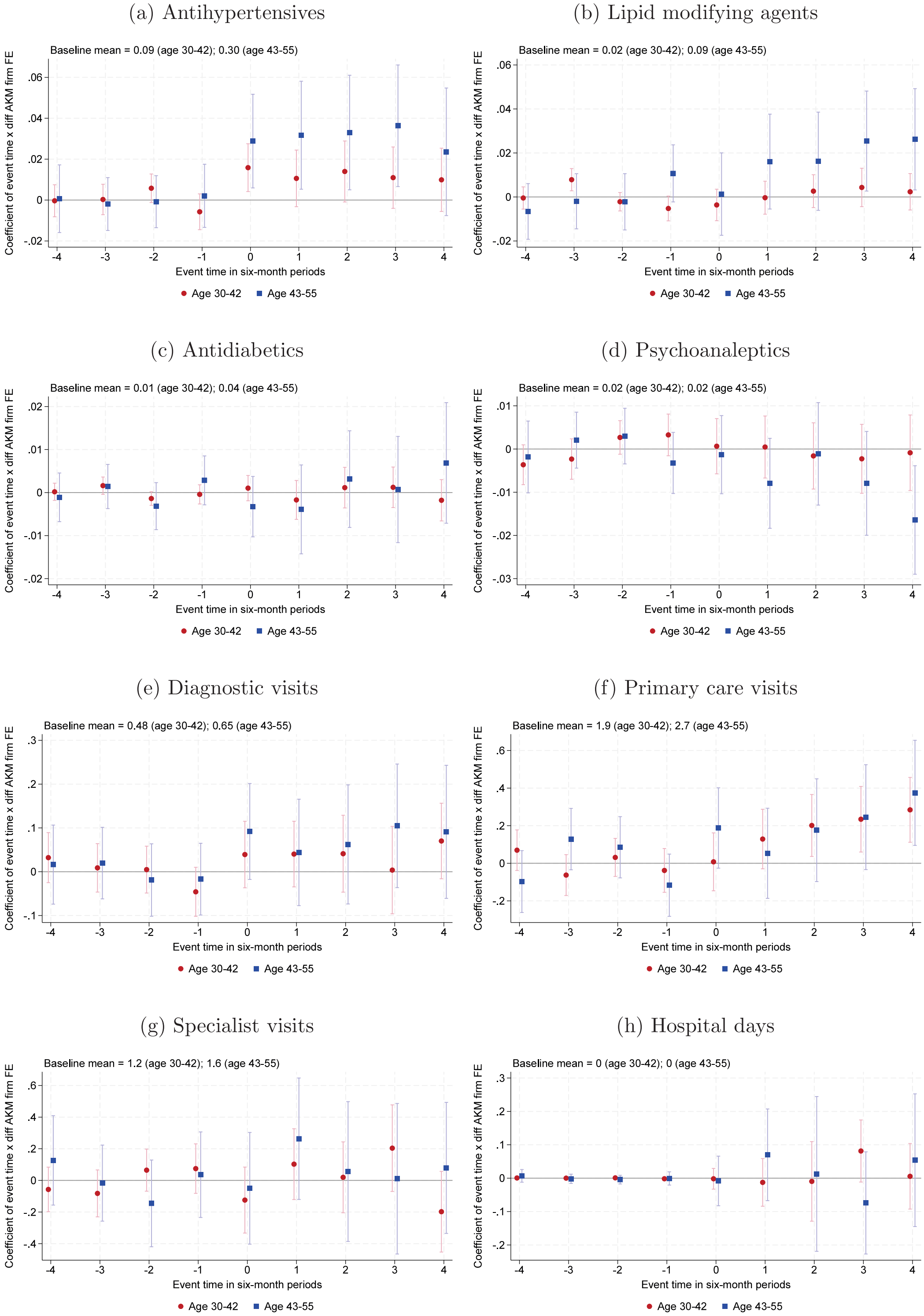

Fig. A.4. Event studies for healthcare use, effect of firm-level wage premium, in age groups 30–42 and 43–55 at the time of the move.
Notes: Figure shows estimated β_j parameters with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. The sample is as described in Section 4.1, split to individuals aged 30–42 vs. 43–55 at the time of the move between firms. Event time 0 corresponds to the month of the move between firms, the two months after, and the three months before. The mean outcome measured at event time −1 is displayed at the top of each panel. Number of individuals: 14,301 (aged 30–42 at the move); 10,001 (aged 43–55 at the move).

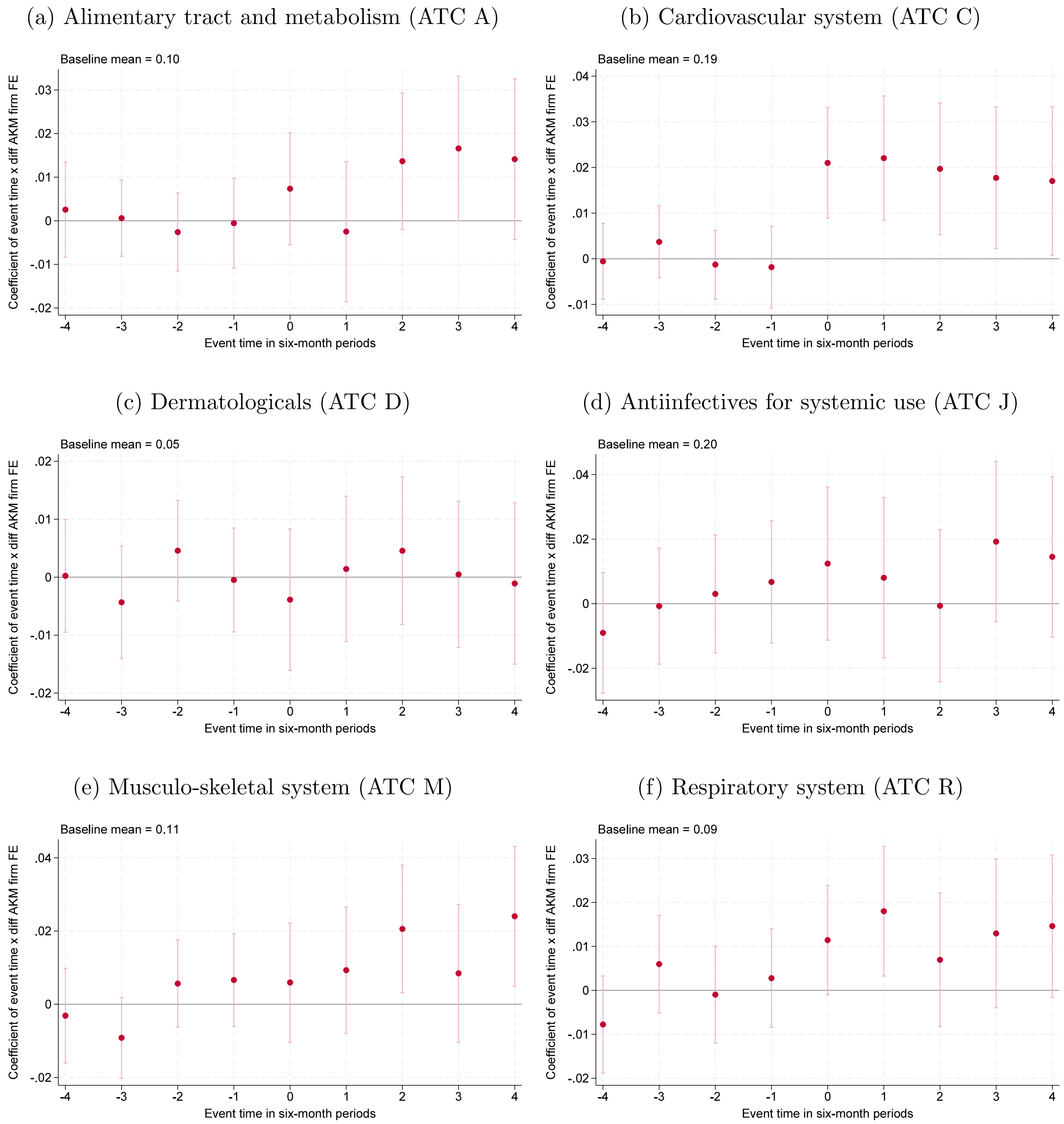

Fig. A.5. Event studies for drugs by 1st level ATC categories, effect of firm-level wage premium.
Notes: Figure shows estimated β_j parameters (coefficients of event time × difference between post- vs. pre-move AKM firm FE) with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1. Event time 0 corresponds to the month of the move between firms. The mean outcome measured at event time −1 is displayed at the top of each panel. Number of individuals: 24,302.

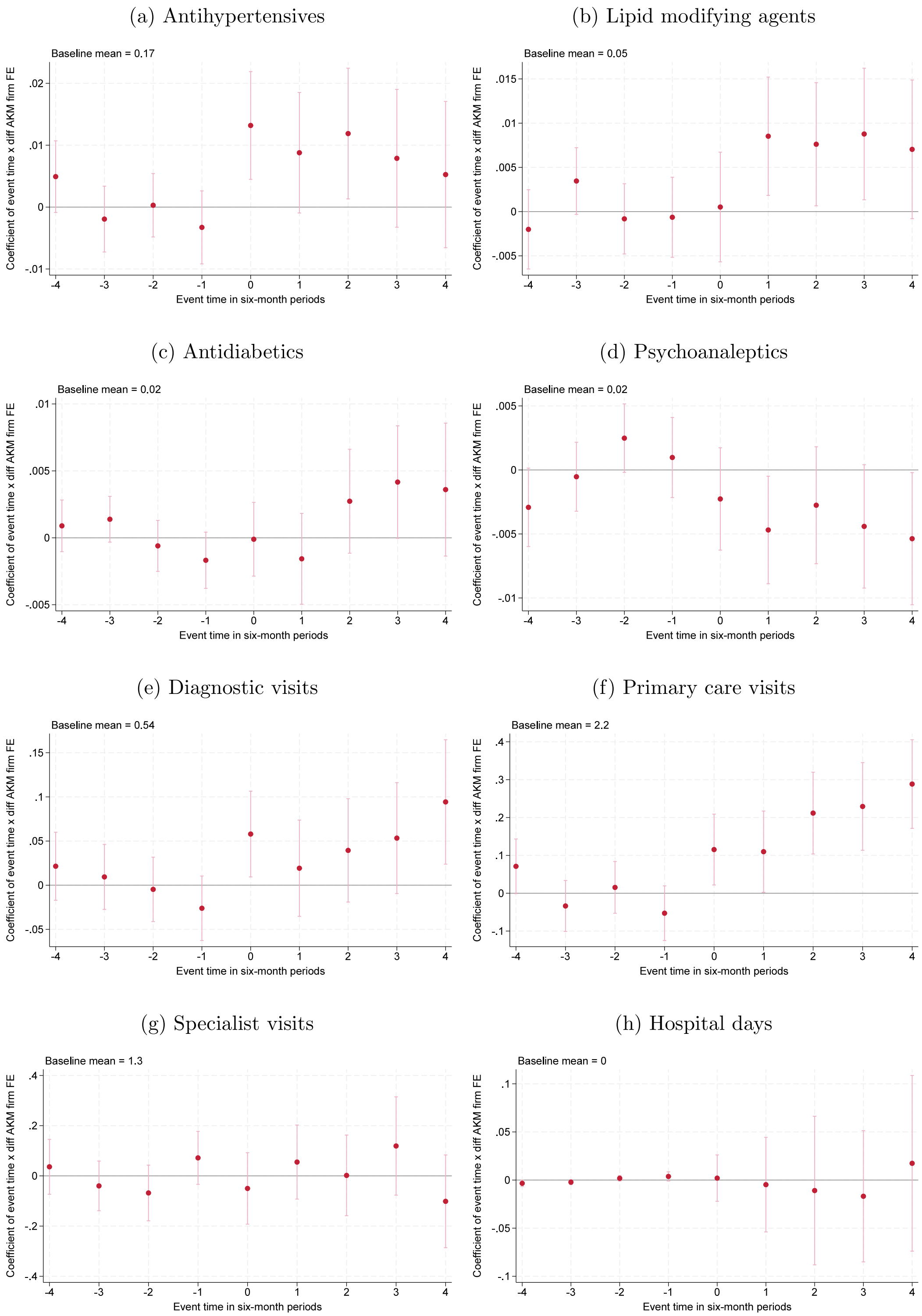

Fig. A.6. Event studies for healthcare use, effect of firm-level wage premium, including smaller firms in sample.
Notes: Figure shows estimated β_j parameters with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1, extended to individuals working at firms with at least 20 workers (instead of the baseline sample of at least 50 workers). Event time 0 corresponds to the month of the move between firms, the two months after, and the three months before. The mean outcome measured at event time −1 is displayed at the top of each panel. Number of individuals: 32,082.

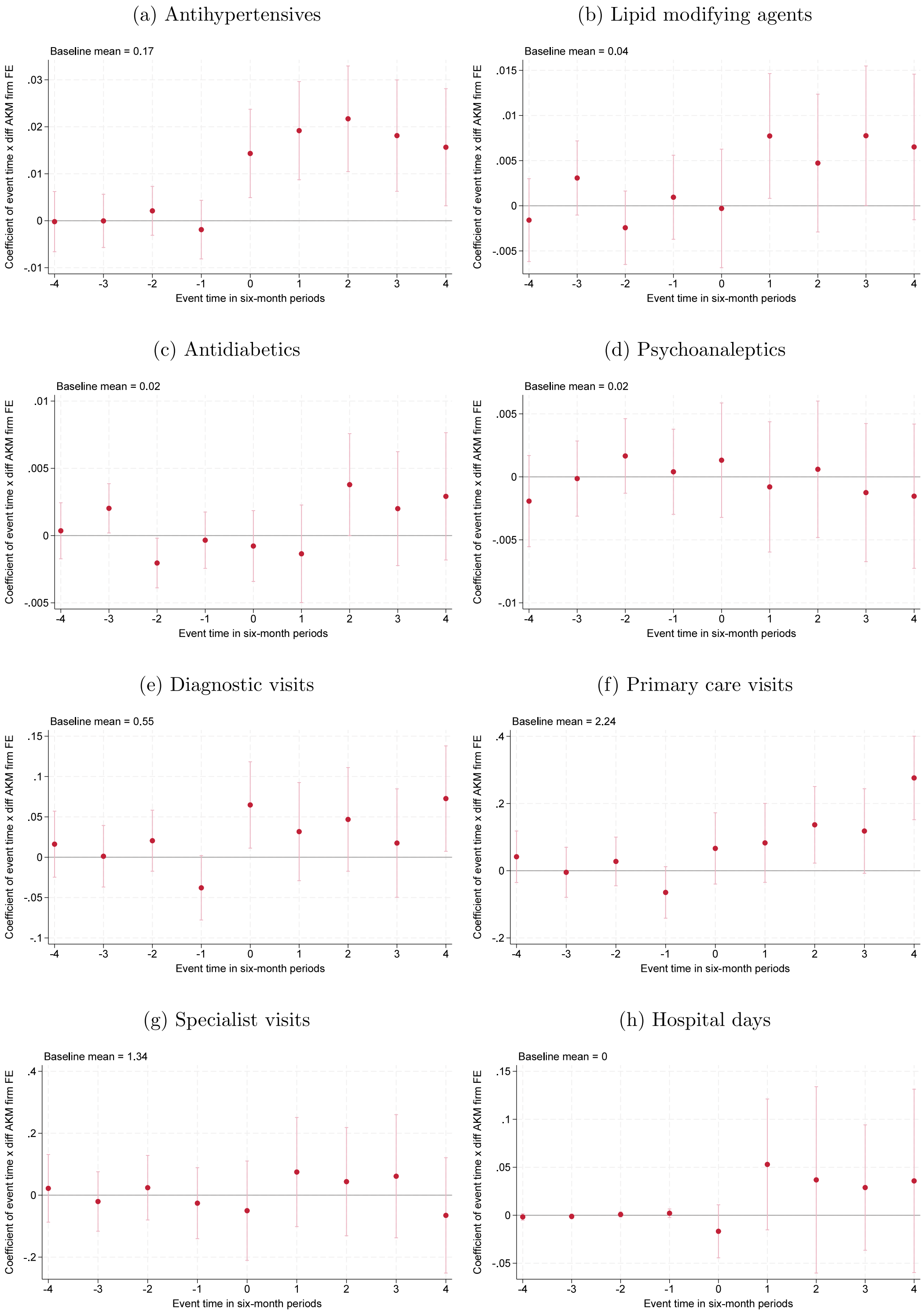

Fig. A.7. Event studies for healthcare use, effect of firm-level wage premium, broader sample of workers.
Notes: Figure shows estimated β_j parameters (coefficients of event time × difference between post- vs. pre-move AKM firm FE) with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1, but also includes workers who may move to a further firm in the event time window. Event time 0 corresponds to the month of the move between firms. The mean outcome measured at event time −1 is displayed at the top of each panel. Number of individuals: 33,762.

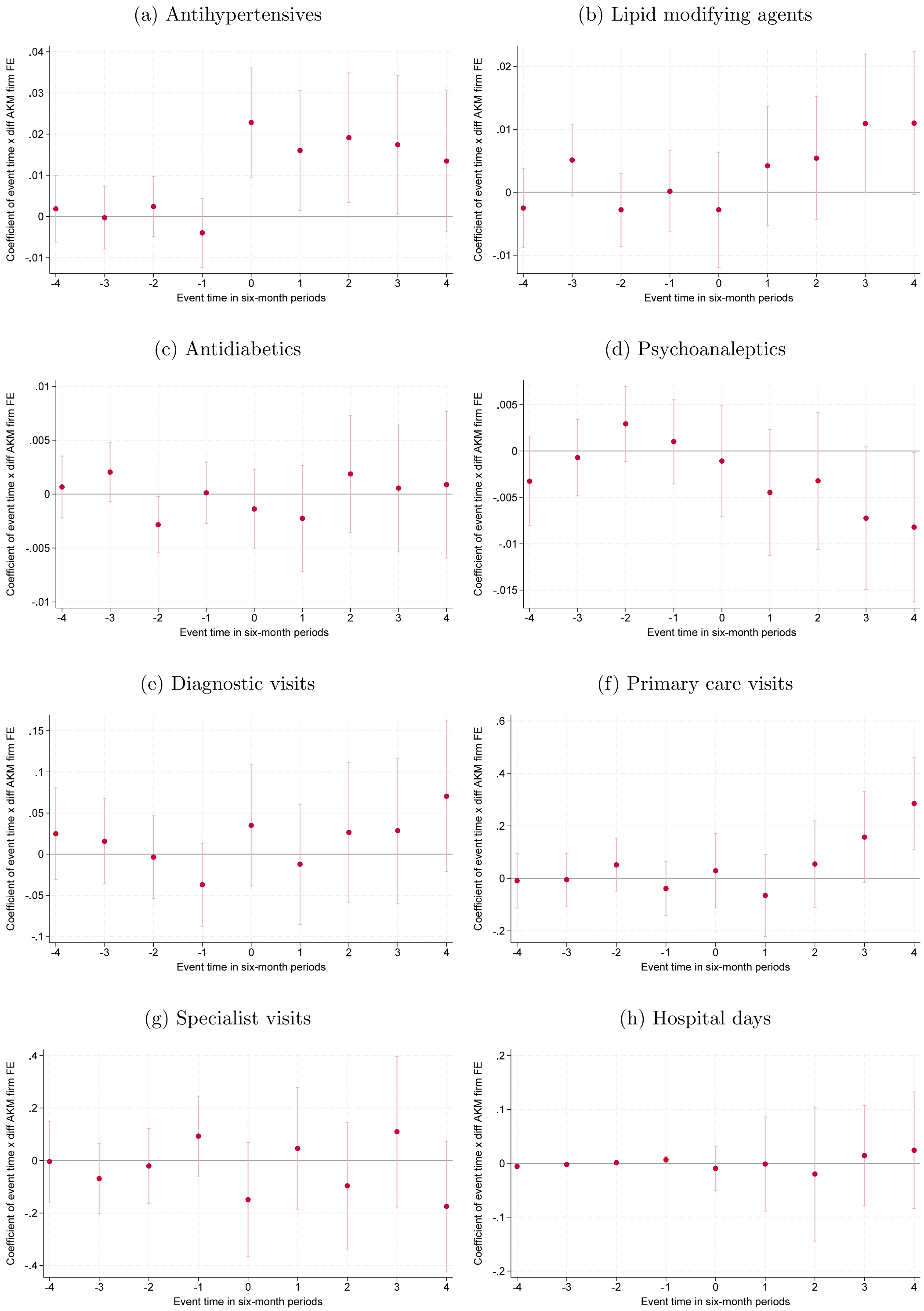

Fig. A.8. Event studies for healthcare use, effect of firm-level wage premium, including stayers in the sample.
Notes: Figure shows estimated β_j parameters (coefficients of event time × difference between post- vs. pre-move AKM firm FE) with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1, extended with workers not moving between firms. The sample of individuals not moving between firms is weighted to match the age and sex composition of the mover sample. Event time 0 corresponds to the month of the move between firms (or the placebo event date), the two months after, and the three months before. Number of individuals: 223,804.

Table A.1
Effect of firm-level wage premium on drug consumption by 1st level ATC categories and on outpatient visits by specialties.

	After × diff AKM firm FE		Mean value at
	Coeff.	SE	event time −1
Binary indicators of six-monthly drug consumption			
Alimentary tract and metabolism (ATC A)	0.009	0.006	0.105
Blood and blood forming organs (ATC B)	0.004	0.004	0.031
Cardiovascular system (ATC C)	0.019***	0.006	0.191
Dermatologicals (ATC D)	0.001	0.005	0.053
Genito-urinary system and sex hormones (ATC G)	−0.004	0.003	0.018
Systemic hormonal preparations (ATC H)	0.000	0.003	0.024
Antiinfectives for systemic use (ATC J)	0.007	0.009	0.204
Antineoplastic and immunomodulating agents (ATC L)	−0.000	0.001	0.003
Musculo-skeletal system (ATC M)	0.016**	0.007	0.108
Nervous system (ATC N)	−0.004	0.004	0.043
Antiparasitic products, insecticides and repellents (ATC P)	−0.002	0.002	0.006
Respiratory system (ATC R)	0.014**	0.006	0.087
Sensory organs (ATC S)	0.004	0.004	0.032
Various (ATC V)	0.000	0.001	0.001
Six-monthly numbers of outpatient visits			
Diagnostic visits			
Laboratory	0.026	0.021	0.358
X-ray	0.020**	0.010	0.136
Ultrasound	0.005	0.005	0.056
Specialist visits			
Internal medicine	−0.006	0.011	0.101
Surgery	0.017	0.013	0.088
Traumatology	0.012	0.019	0.069
Gynaecology	−0.007	0.008	0.074
Otolaryngology	−0.007	0.010	0.084
Ophtalmology	−0.006	0.008	0.072
Dermatology	−0.007	0.010	0.069
Neurology	−0.001	0.005	0.030
Orthopaedics	0.009*	0.005	0.021
Urology	0.011	0.010	0.038
Oncology	−0.004	0.005	0.014
Physiotherapy, rheumatology	0.039	0.055	0.335
Infectology	−0.001	0.002	0.004
Psychiatry	−0.024**	0.012	0.046
Pulmonology	−0.004	0.008	0.151
Rehabilitation	0.008	0.009	0.014
Cardiology	0.013*	0.007	0.036

Notes: Table shows estimated β parameters with standard errors clustered at the person and firm level from Eq. (2), using the difference between post- vs. pre-move AKM firm FE as the main explanatory variable. Outcome variables are binary indicators of six-monthly use of drugs by 1st level ATC categories (upper panel) and the six-monthly numbers of outpatient visits by specialties (lower panel). Sample is as described in Section 4.1. Number of individuals: 24,302.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

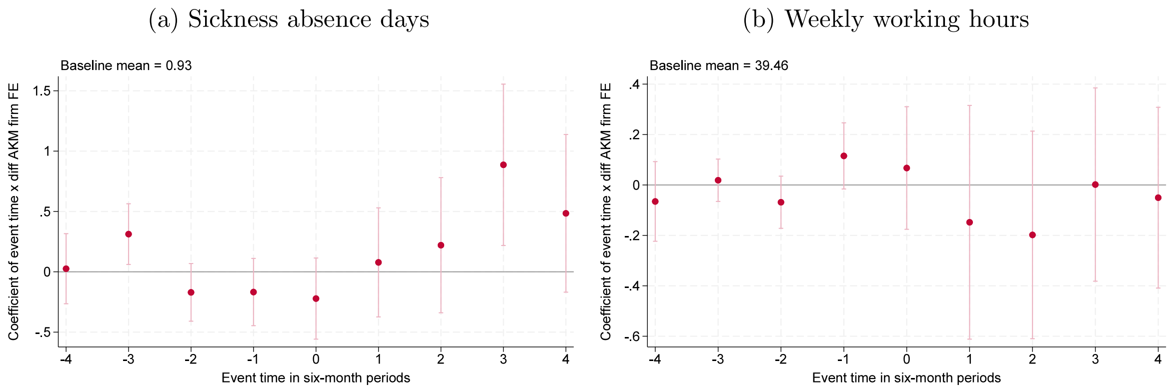

Fig. A.9. Event studies for sickness absence and working hours, effect of firm-level wage premium.
Notes: Figure shows estimated β_j parameters (coefficients of event time × difference between post- vs. pre-move AKM firm FE) with 95% confidence intervals from Eq. (1). Normalization: $\sum_{j=-4}^{-1} \beta_j = 0$. Sample is as described in Section 4.1. The mean outcome measured at event time −1 is displayed at the top of the panel. Number of individuals: 24,302.

Table A.2
Effect of quartiles of firm-level wage premium change on healthcare use.

Indicators	Anti-hypertens.	Lipid mod. agents	Anti-diabetics	Psycho-analeptics	Diagnostic visits	Primary care visits	Specialist visits	Hosp. days
Regression estimates								
After	−0.008**	−0.008***	−0.002**	0.002	−0.085***	−0.288***	−0.146***	0.115***
	[0.003]	[0.002]	[0.001]	[0.002]	[0.016]	[0.042]	[0.053]	[0.018]
After × 2nd quartile	0.008**	0.004	0.001	−0.003*	0.066***	0.084**	0.081	0.013
	[0.004]	[0.003]	[0.001]	[0.002]	[0.020]	[0.041]	[0.057]	[0.018]
After × 3rd quartile	0.008**	0.005*	0.004**	−0.003	0.055***	0.124***	0.107**	0.040**
	[0.004]	[0.002]	[0.002]	[0.002]	[0.018]	[0.041]	[0.053]	[0.020]
After × top quartile	0.010**	0.005**	0.001	−0.004**	0.049***	0.080**	−0.008	0.004
	[0.004]	[0.002]	[0.001]	[0.002]	[0.018]	[0.040]	[0.051]	[0.019]
Mean difference in outcome between after vs. before move								
Bottom quartile	0.031	0.002	0.004	0.003	0.086	0.127	0.168	0.185
2nd quartile	0.041	0.005	0.005	0.001	0.146	0.231	0.275	0.203
3rd quartile	0.036	0.006	0.007	0.001	0.122	0.219	0.273	0.220
Top quartile	0.038	0.006	0.004	−0.000	0.111	0.176	0.157	0.177
Mean outcome at event time −1								
Bottom quartile	0.197	0.058	0.025	0.021	0.584	2.321	1.341	0.000
2nd quartile	0.194	0.059	0.023	0.016	0.573	2.206	1.353	0.000
3rd quartile	0.157	0.037	0.020	0.019	0.567	2.292	1.383	0.000
Top quartile	0.145	0.036	0.019	0.020	0.472	2.135	1.245	0.000

Notes: Table shows estimated β parameters and standard errors clustered at the person and firm level (in brackets) from Eq. (2), using the variables indicated in the first column of the table as heterogeneity indicators. Sample is as described in Section 4.1. The range of the change in AKM firm FE by quartiles is, respectively, −1.37 to −0.08; −0.08 to 0.03; 0.03 to 0.19; 0.19 to 2.08. Number of individuals: 6096 in bottom quartile AKM firm FE change; 6111 in 2nd quartile AKM firm FE change; 6050 in 3rd quartile AKM firm FE change; 6045 in top quartile AKM firm FE change.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table A.3
Correlation between firm quality measures.

	AKM firm FE	Log TFP	Log mean wage	Poaching index
AKM firm FE	1.00			
Log TFP	0.54	1.00		
Log mean wage	0.74	0.56	1.00	
Poaching index	0.32	0.31	0.42	1.00

Notes: Table displays correlation coefficients between firm quality measures in the six-month period before moving between firms. Sample is as described in Section 4.1.

Table A.4
Effect of firm-level wage premium on healthcare use, controlling for measures of peer effects and risk category.

Indicators	Anti-hypertens.	Lipid mod. agents	Anti-diabetics	Psycho-analeptics	Diagnostic visits	Primary care visits	Specialist visits	Hosp. days
Panel A: AKM firm FE and peer effects in same model								
Diff log AKM firm FE	0.019***	0.007*	0.000	−0.003	0.040	0.190***	0.002	0.011
	[0.006]	[0.004]	[0.002]	[0.003]	[0.028]	[0.057]	[0.080]	[0.028]
Diff peer's use	0.159***	0.258***	0.102***	0.210***	1.695***	1.838***	2.989***	4.565***
	[0.014]	[0.029]	[0.030]	[0.038]	[0.118]	[0.096]	[0.226]	[0.937]
Panel B: AKM firm FE and change in risk level of industry in same model								
Diff AKM firm FE	0.021**	0.010	0.002	−0.001	0.059*	0.328***	0.109	−0.009
	[0.009]	[0.006]	[0.003]	[0.004]	[0.036]	[0.086]	[0.114]	[0.042]
Diff risk level	0.002	−0.001	−0.002	−0.001	0.008	−0.007	0.088*	0.007
	[0.004]	[0.002]	[0.002]	[0.002]	[0.017]	[0.040]	[0.048]	[0.018]
Mean outcome at event time −1,								
Panels A	0.174	0.047	0.022	0.019	0.550	2.240	1.332	0.000
Panel B	0.208	0.057	0.026	0.019	0.532	2.545	1.340	0.000

Notes: Table shows estimated β parameters and standard errors clustered at the person and firm level (in brackets) from Eq. (2), using the variables indicated in the first column of the table as heterogeneity indicators. Sample is as described in Section 4.1. In Panel B the sample is restricted to blue-collar workers. In Panel A, peer's use refers to healthcare use in the same 5-year age group – sex – one-digit occupation category. In Panel B, risk level is coded as zero for the low-risk and one for the high-risk industry-specific risk categories. Number of individuals: 23,100 in Panel A; 13,811 in Panel B.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Appendix B. Decomposition of the variation in healthcare spending

In this Appendix, we replicate equation (2) of Ahammer et al. (2023), estimating the firms' contribution to healthcare spending. We restrict the sample to individuals aged 30–55 when moving between firms, who had no hospital stay in the two years before the move, and stay at the same firm over the two-year horizon after the move. Just like in our baseline sample, we require that the destination and origin firms have at least 50 workers immediately before and after the move.

More specifically, we estimate the following model:

$$H_{it} = \sum_{j=-4}^{4} \alpha_j \mathbb{1}[e_{it} = j] + \sum_{j=-4}^{4} \theta_j \mathbb{1}[e_{it} = j]\Gamma_i + \tilde{X}_{it}\gamma + \tau_t + \mu_i + \varepsilon_{it}, \tag{3}$$

where, beyond using the notations of Eq. (1) in this paper, H_{it} is now total healthcare spending (winsorized at the top 99% of its distribution), $\tilde{X}_{it}$ includes sex-specific quadratic function of age, and Γ_i is the difference of average healthcare spending in the post- vs. pre-move firm. The coefficients of interest are θ_j.

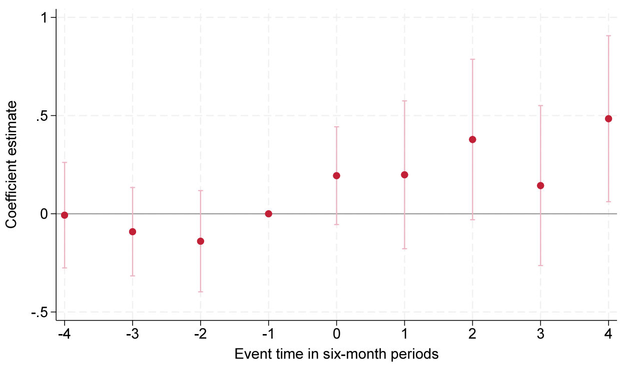

Fig. B.1. Role of firms in the variation of healthcare spending — event study coefficients.
Notes: Figure shows the coefficients of the interaction term between event time and the difference in average healthcare spending in the post- vs. pre-move firm (θ_j parameters) from Eq. (3). Event time 0 corresponds to the month of the move between firms, the two months after, and the three months before. Number of individuals: 23,692.

Fig. B.1 shows that, according to this calculation, the contribution of firms to the variation in worker-level healthcare spending is 36%.[24]

Appendix C. Approximating the monetary value of lipid-modifying and antihypertensive therapy

In the following calculations, we use parameters from the literature on the benefits of the therapies and their value for the patients.

First, an important parameter is the (discounted) QALY (quality-adjusted life year) gain of the marginal patient who starts receiving the medication. For lipid modifying agents, we argue as follows. Before 2014, UK guidelines recommended the use of statins for patients whose ten-year cardiovascular risk was above 20% or who had already suffered from cardiovascular disease (Cooper et al., 2008).[25] According to Supplementary Figure S1 of Mihaylova et al. (2024), the QALY gain of such 50–59 years old patients is between 0.43 and 0.82, the weighted average being around 0.6. According to Supplementary Table S3 of Mihaylova et al. (2024), the discounted QALYs in these age groups are roughly 40% of the undiscounted QALYs, so we calculate with a discounted QALY gain of 0.25 for lipid modifying agents. For antihypertensive medications, we assume that the marginal patient has stage one hypertension and thus, following Table 3 of Constanti et al. (2021), antihypertensive medications increase their discounted QALY by about 0.2.

Second, we use one times the GDP per capita as the value of one QALY for the patient. This is a middle ground as some estimates are lower (for instance, Pichon-Riviere et al., 2023 give 0.52 times the GDP as a Hungarian-specific estimate) and some are larger (a working group in Hungary suggested 1.5–3 times the GDP for the cost-effectiveness threshold of health technologies, more in line with previous WHO recommendations of 1–3 times the GDP, see Kovács et al., 2022).

As far as the effects on the costs of pharmaceutical therapy are concerned, we use results from the DiD-type Eq. (2), estimated on the six-monthly total costs of lipid modifying agents and antihypertensives, respectively. Then, we aggregate these effects for the whole lifetime, assuming 40 years of survival and an annual discount rate of 3.5% (in line with the discount rate used in the above publications determining the QALY gains).

We assume in the calculation of the health gains and costs that the marginal patient receives lifelong lipid-lowering or antihypertensive therapy. We compare these monetary values with three years of discounted net firm-level wage premium difference because an average worker in our sample spends roughly such time at the new firm. (This way, we assume that the prescription practices do not change even after switching to a third firm. Obviously, the results are very sensitive to this assumption.)

According to Table C.1, the net monetary value of the consumption of lipid modifying agents and of antihypertensives both amount to about 0.1% of firm-level net wage differences, with a large uncertainty because of the calibrated parameters.

Table C.1
Monetary value of prescription differences.

	Lipid modifying agents	Anti-hypertensives
Health gain of medication use		
Discounted QALY gain of one patient's lifetime use	0.25	0.20
Discounted value of one patient's lifetime use (euro)	2700	2160
Parameter of diff AKM firm FE on the probability of use	0.008	0.018
Effect of 0.1 change of AKM firm FE on the probability of use	0.0008	0.0018
Discounted lifetime gain of 0.1 change of AKM firm FE (euro)	2.16	3.89
Costs of medication use		
Parameter of diff AKM firm FE on six-monthly total cost (euro)	0.204	0.799
Effect of a 0.1 change of AKM firm FE on six-monthly total cost (euro)	0.02	0.08
Out-of-pocket (OOP) ratio	0.24	0.42
Discounted lifetime OOP costs of 0.1 change of AKM firm FE (euro)	0.21	1.47
Discounted net lifetime value of 0.1 change of AKM firm FE (euro)	1.95	2.42
Three-year discounted net wage difference		
Average monthly net wage	570	
Effect of 0.1 change of AKM firm FE on three-year discounted net wage	1952	
Ratio (net value of medications/net wage)	0.10%	0.12%

Notes: We use the average GDP per capita (10,800 euro) and the average HUF/EUR exchange rate (296 HUF/EUR) for 2009–2017. The value of one QALY is taken as one times the GDP per capita. The out-of-pocket (OOP) ratio was calculated from aggregate sources for the two medication categories. The discounted costs were calculated by assuming lifetime use for a remaining 40 years (i.e. 80 half-years). A 3.5% annual discount rate was used.

[24] Note that the specification slightly differs from that of Ahammer et al. (2023) due to the different sample and the different outcome variable (level instead of logarithm of healthcare spending).

[25] Statin consumption is substantially lower in Hungary than in the UK (Blais et al., 2021), so we do not expect that a wider population is treated in Hungary.

Data availability

Our empirical analysis builds on a linked employer–employee administrative data set from Hungary. This data is available for replication and research purposes from the Databank of the ELTE Centre for Economic and Regional Studies. The access to the data is conditional on the registration of research (or replication) project and upon approval, the data is available on the secure server of the Databank of the ELTE Centre for Economic and Regional Studies.

References

Abowd, J.M., Kramarz, F., Margolis, D.N., 1999. High Wage Workers and High Wage Firms. Econom. 67 (2), 251–333.

Agha, L., Frandsen, B., Rebitzer, J.B., 2019. Fragmented Division of Labor and Healthcare Costs: Evidence From Moves Across Regions. J. Public Econ. 169, 144–159.

Ahammer, A., Packham, A., Smith, J., 2023. Firms and Worker Health. NBER Working Paper 32011.

Arena, R., Arnett, D.K., Terry, P.E., Li, S., Isaac, F., Mosca, L., Braun, L., Roach, J.W.H., Pate, R.R., Sanchez, E., et al., 2014. The Role of Worksite Health Screening: A Policy Statement From the American Heart Association. Circ. 130 (8), 719–734.

Arnett, D.K., Blumenthal, R.S., Albert, M.A., Buroker, A.B., Goldberger, Z.D., Hahn, E.J., Himmelfarb, C.D., Khera, A., Lloyd-Jones, D., McEvoy, J.W., et al., 2019. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease. J. Am. Coll. Cardiol. 74 (10), e177–e232.

Bagger, J., Lentz, R., 2019. An Empirical Model of Wage Dispersion With Sorting. Rev. Econ. Stud. 86 (1), 153–190.

Bali, V., Yermilov, I., Koyama, A., Legorreta, A., 2018. Secondary Prevention of Diabetes Through Workplace Health Screening. Occup. Med. 68 (9), 610–616.

Bana, S., Bedard, K., Rossin-Slater, M., Stearns, J., 2023. Unequal Use of Social Insurance Benefits: The Role of Employers. J. Econometrics 233 (2), 633–660.

Belloni, M., Carrino, L., Meschi, E., 2022. The Impact of Working Conditions on Mental Health: Novel Evidence From the UK. Labour Econ. 76, 102176.

Bíró, A., Elek, P., Kungl, N., 2024. Multi-dimensional Panels in Health Economics with an Application on Antibiotic Consumption. In: Mátyás, L. (Ed.), The Econometrics of Multi-Dimensional Panels: Theory and Applications. Springer International Publishing.

Blais, J.E., Wei, Y., Yap, K.K., Alwafi, H., Ma, T.-T., Brauer, R., Lau, W.C., Man, K.K., Siu, C.W., Tan, K.C., et al., 2021. Trends in Lipid-Modifying Agent Use in 83 Countries. Atherosclerosis 328, 44–51.

Card, D., Heining, J., Kline, P., 2013. Workplace Heterogeneity and the Rise of West German Wage Inequality. Q. J. Econ. 128 (3), 967–1015.

Clark, A.E., Kristensen, N., Westergård-Nielsen, N., 2009. Job Satisfaction and Co-worker Wages: Status or Signal? Econ. J. 119 (536), 430–447.

Colosio, C., Mandic-Rajcevic, S., Godderis, L., van der Laan, G., Hulshof, C., van Dijk, F., 2017. Workers' Health Surveillance: Implementation of the Directive 89/391/EEC in Europe. Occup. Med. 67 (7), 574–578.

Constanti, M., Floyd, C.N., Glover, M., Boffa, R., Wierzbicki, A.S., McManus, R.J., 2021. Cost-Effectiveness of Initiating Pharmacological Treatment in Stage One Hypertension Based on 10-Year Cardiovascular Disease Risk: A Markov Modeling Study. Hypertension 77 (2), 682–691.

Cooper, A., Nherera, L., Calvert, N., O'Flynn, N., Turnbull, N., Robson, J., Camosso-Stefinovic, J., Rule, C., Browne, N., Ritchie, G., et al., 2008. Clinical Guidelines and Evidence Review for Lipid Modification: Cardiovascular Risk Assessment and the Primary and Secondary Prevention of Cardiovascular Disease. London: National Collaborating Centre for Primary Care and Royal College of General Practitioners.

Ettehad, D., Emdin, C., Kiran, A., Anderson, S., Callender, T., Emberson, J., Chalmers, J., Rodgers, A., Rahimi, K., 2016. Blood Pressure Lowering for Prevention of Cardiovascular Disease and Death: A Systematic Review and Meta-analysis. Lancet 387 (10022), 957–967.

Finkelstein, A., Gentzkow, M., Williams, H., 2016. Sources of Geographic Variation in Health Care: Evidence From Patient Migration. Q. J. Econ. 131 (4), 1681–1726.

French, M.T., Dunlap, L.J., 1998. Compensating Wage Differentials for Job Stress. Appl. Econ. 30 (8), 1067–1075.

Gaál, P., Szigeti, S., Csere, M., Gaskins, M., Panteli, D., 2011. Hungary: Health System Review. Heal. Syst. Transit. 13 (5), 1–266.

Gordois, A.L., Toth, P.P., Quek, R.G., Proudfoot, E.M., Paoli, C.J., Gandra, S.R., 2016. Productivity Losses Associated with Cardiovascular Disease: A Systematic Review. Expert. Rev. Pharmacoeconomics & Outcomes Res. 16 (6), 759–769.

Gruber, J., 1994. The Incidence of Mandated Maternity Benefits. Am. Econ. Rev. 84 (3), 622–641.

Hungarian Central Statistical Office, 2024. Foglalkozás-egészségügyi alapszolgálatok (2000–). (Accessed 17 July 2024) https://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_ege0009b.html.

IDF, 2017. IDF Diabetes Atlas, 8th edition. International Diabetes Federation.

Jolivet, G., Postel-Vinay, F., 2025. A Structural Analysis of Mental Health and Labour Market Trajectories. Rev. Econ. Stud. 92 (3), 1920–1954.

Jones, D., Molitor, D., Reif, J., 2019. What Do Workplace Wellness Programs Do? Evidence From the Illinois Workplace Wellness Study. Q. J. Econ. 134 (4), 1747–1791.

Jones, D., Molitor, D., Reif, J., 2024. Incentives and Habit Formation in Health Screenings: Evidence from the Illinois Workplace Wellness Study. NBER Working Paper 32745.

Jones, A.M., Rice, N., Zantomio, F., 2020. Acute Health Shocks and Labour Market Outcomes: Evidence From the Post Crash Era. Econ. Hum. Biology 36, 100811.

Kempler, P., Putz, Z., Kiss, Z., Wittmann, I., Abonyi-Tóth, Z., Rokszin, G., Jermendy, G., 2016. Prevalence and Financial Burden of Type 2 Diabetes Mellitus in Hungary Between 2001–2014 – Results of the Analysis of the National Health Insurance Fund Database (in Hungarian). Diabetol. Hung. 24 (3), 177–188.

Kovács, S., Németh, B., Erdősi, D., Brodszky, V., Boncz, I., Kaló, Z., Zemplényi, A., 2022. Should Hungary Pay More for a QALY Gain than Higher-Income Western European Countries? Appl. Heal. Econ. Heal. Policy 20 (3), 291–303.

Lachowska, M., Sorkin, I., Woodbury, S.A., 2022. Firms and Unemployment Insurance Take-up. NBER Working Paper 30266.

Lavetti, K., 2020. The Estimation of Compensating Wage Differentials: Lessons from the Deadliest Catch. J. Bus. Econom. Statist. 38 (1), 165–182.

Legorreta, A.P., Schaff, S.R., Leibowitz, A.N., van Meijgaard, J., 2015. Measuring the Effects of Screening Programs in Asymptomatic Employees. J. Occup. Environ. Med. 57 (6), 682–686.

Maestas, N., Mullen, K.J., Powell, D., Von Wachter, T., Wenger, J.B., 2023. The Value of Working Conditions in the United States and Implications for the Structure of Wages. Am. Econ. Rev. 113 (7), 2007–2047.

Mancia, G., De Backer, G., Dominiczak, A., Cifkova, R., Fagard, R., Germano, G., Grassi, G., Heagerty, A.M., Kjeldsen, S.E., Laurent, S., et al., 2007. 2007 Guidelines for the Management of Arterial Hypertension: The Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). Eur. Heart J. 28 (12), 1462–1536.

Manski, C.F., 1993. Identification of Endogenous Social Effects: The Reflection Problem. Rev. Econ. Stud. 60 (3), 531–542.

Mas, A., 2025. Non-wage Amenities. NBER Working Paper 33643.

Mas, A., Pallais, A., 2017. Valuing Alternative Work Arrangements. Am. Econ. Rev. 107 (12), 3722–3759.

Masters, R., Anwar, E., Collins, B., Cookson, R., Capewell, S., 2017. Return on Investment of Public Health Interventions: A Systematic Review. J. Epidemiol. Community Health 71 (8), 827–834.

Mihaylova, B., Wu, R., Zhou, J., Williams, C., Schlackow, I., Emberson, J., Reith, C., Keech, A., Robson, J., Parnell, R., et al., 2024. Lifetime Effects and Cost-Effectiveness of Standard and Higher-Intensity Statin Therapy Across Population Categories in the UK: A Microsimulation Modelling Study. Lancet Reg. Heal. - Eur. 40, 100887.

Mortensen, D., 2003. Wage Dispersion: Why Are Similar Workers Paid Differently? MIT Press.

Mortensen, M.B., Tybjærg-Hansen, A., Nordestgaard, B.G., 2022. Statin Eligibility for Primary Prevention of Cardiovascular Disease According to 2021 European Prevention Guidelines Compared With Other International Guidelines. JAMA Cardiol. 7 (8), 836–843.

Nagler, M., Rincke, J., Winkler, E., 2023. High-Pressure, High-Paying Jobs? Rev. Econ. Stat. 1–45.

Nagy, I., Grónai, E., Brunner, P., Nagy, S., Borosné, B.E., Farkas, I., Preiszler, R., 2022. Activity of Occupational Health Services in 2021 in Hungary (in Hungarian). In: Foglalkozás-Egészségügy. 26 (2), 70–85.

OECD, 2019. Pharmaceutical Consumption. In: Health At a Glance 2019: OECD Indicators. OECD Publishing, Paris.

Pedron, S., Emmert-Fees, K., Laxy, M., Schwettmann, L., 2019. The Impact of Diabetes on Labour Market Participation: A Systematic Review of Results and Methods. BMC Public Health 19, 25.

Pichon-Riviere, A., Drummond, M., Palacios, A., Garcia-Marti, S., Augustovski, F., 2023. Determining the Efficiency Path to Universal Health Coverage: Cost-Effectiveness Thresholds for 174 Countries Based on Growth in Life Expectancy and Health Expenditures. Lancet Glob. Heal. 11 (6), e833–e842.

Pinna Pintor, M., Fumagalli, E., Suhrcke, M., 2024. The Impact of Health on Labour Market Outcomes: A Rapid Systematic Review. Heal. Policy 143, 105057.

Pruckner, G.J., Schober, T., Zocher, K., 2020. The Company You Keep: Health Behavior Among Work Peers. Eur. J. Heal. Econ. 21, 251–259.

Qin, P., Chernew, M., 2014. Compensating Wage Differentials and the Impact of Health Insurance in the Public Sector on Wages and Hours. J. Heal. Econ. 38, 77–87.

Ravesteijn, B., Kippersluis, H.v., Doorslaer, E.v., 2018. The Wear and Tear on Health: What is the Role of Occupation? Heal. Econ. 27 (2), e69–e86.

Rettl, D.A., Schandlbauer, A., Trandafir, M., 2024. Employee Health and Firm Performance. 4022672, SSRN.

Rodrik, D., Sabel, C.F., 2022. Building a Good Jobs Economy. In: Allen, D., Benkler, Y., Downey, L., Henderson, R., Simons, J. (Eds.), A Political Economy of Justice. University of Chicago Press, Chicago, pp. 61–95.

Rosen, S., 1974. Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. J. Political Econ. 82 (1), 34–55.

Rosen, S., 1986. The Theory of Equalizing Differences. Handb. Labor Econ. 1 (12), 641–692.

Rovigatti, G., Mollisi, V., 2020. PRODEST: Stata Module for Production Function Estimation Based on the Control Function Approach. Boston Coll. Dep. Econ. S458239.

Saygin, P.O., Weber, A., Weynandt, M.A., 2021. Coworkers, Networks, and Job-Search Outcomes Among Displaced Workers. ILR Rev. 74 (1), 95–130.

Sockin, J., 2022. Show Me the Amenity: Are Higher-Paying Firms Better All Around?. CESifo Working Paper 9842..

Sorkin, I., 2018. Ranking Firms Using Revealed Preference. Q. J. Econ. 133 (3), 1331–1393.

Steel, J.S., Godderis, L., Luyten, J., 2022. Short-Term Effectiveness of Face-To-Face Periodic Occupational Health Screening Versus Electronic Screening With Targeted Follow-Up: Results From a Quasi-Randomized Controlled Trial in Four Belgian Hospitals. Scand. J. Work. Environ. Heal. 48 (3), 220.

Arias-de la Torre, J., Vilagut, G., Ronaldson, A., Serrano-Blanco, A., Martín, V., Peters, M., Valderas, J.M., Dregan, A., Alonso, J., 2021. Prevalence and Variability of Current Depressive Disorder in 27 European Countries: A Population-Based Study. Lancet Public Heal. 6 (10), e729–e738.

Vrablik, M., Seifert, B., Parkhomenko, A., Banach, M., Jozwiak, J., Kiss, R., Gaita, D., Raslova, K., Zachlederova, M., Bray, S., Ray, K., 2021. Lipid-Lowering Therapy Use in Primary and Secondary Care in Central and Eastern Europe: DA VINCI observational study. Atherosclerosis 334, 66–75.

Wiswall, M., Zafar, B., 2018. Preference for the Workplace, Investment in Human Capital, and Gender. Q. J. Econ. 133 (1), 457–507.

Wooldridge, J.M., 2009. On Estimating Firm-Level Production Functions Using Proxy Variables to Control for Unobservables. Econom. Lett. 104 (3), 112–114.

Zhou, B., Carrillo-Larco, R.M., Danaei, G., Riley, L.M., Paciorek, C.J., Stevens, G.A., Gregg, E.W., Bennett, J.E., Solomon, B., Singleton, R.K., et al., 2021. Worldwide Trends in Hypertension Prevalence and Progress in Treatment and Control From 1990 to 2019: A Pooled Analysis of 1201 Population-Representative Studies With 104 Million Participants. Lancet 398 (10304), 957–980.