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# The Scarring Effects of Initial Labor Market Conditions on South Korean Nurses

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Using a longitudinal dataset spanning the period 2000-2020, and an identification strategy based on instrumental variables, we examine the existence of scarring in the context of the Korean nursing profession. We find that the prevailing unemployment rate at time of graduation has negative effects on nurses' wages that remain highly significant up to 6 years after joining the labor market, while working hours are positively scarred for up to 10 years. We also estimate a series of happiness equations to understand nurses' experiences after joining the labor market, and find that a higher unemployment rate at time of graduation is associated with feelings of worse financial conditions, less happy lives, and lower income satisfaction.

*Keywords:* Human capital; Persistence; Scarring; School-to-work transition; Unemployment
*JEL Classification*: E24, I11, I24, J24, J28, J64

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## I. Introduction

How does a good or bad career start affect employees' working lives in the long term? This critical question has been subject to numerous theoretical suppositions on the part of human resource researchers and labor economists. However, there is a distinct scarcity of empirical studies which examine this question on an occupational level, in spite of the importance of such evidence for informing theory and building a better understanding of the mechanisms driving any potential persistence of early career conditions (von Wachter, 2020). In this existing sparse empirical literature, Oyer (2006) examined PhD Economists in the US and found that those who joined the academic job market during a macroeconomic downturn were less likely to hold a top research job in the future. In another study, Oyer (2008) found that stock market conditions at time of graduation have long term effects on the earnings and careers of MBA graduates.

Intuitively, it is not difficult to see that the early stage of a career is a key phase in a worker's life. It is a period typically characterized by high productivity, during which an average worker goes through faster wage growth than they will ever experience. It is a period when workers learn many of the skills that will shape their long-term working lives, compiling a stock of human capital that will be used throughout their careers. This capital may be acquired in many different ways such as through performing particular tasks, interacting with certain types of colleagues, or via training and working under particular organizational settings. It follows that a worker going through an unlucky career start such as undergoing a spell of unemployment, working for a "bad employer", or experiencing a skill mismatch, is likely to suffer a long-lasting disadvantage compared to another worker who has begun their career developing the rights skills, doing the right tasks, surrounded by the right people, in the right workplace. This persistence phenomenon, also known as scarring, may manifest itself across numerous outcomes such as wages, workplace relations, or career progression (Guo, 2022; Schmillen and Umkehrer, 2018).

In this context, the nature of the macroeconomic environment should be considered as it directly affects one's chances of getting a job, let alone a "good job". It is therefore envisaged that graduating at a time where an economy is contracting will have negative effects on a number of working outcomes that persist for a long time after joining

the labor market (Kawaguchi and Murao, 2014; Raaum and Roed, 2006). Empirically, studies have shown that macroeconomic conditions at labor market entry carry scarring effects on income, employment, consumption, health, wellbeing and a number of other outcomes (Borland, 2020). Naturally, such studies have clear implications for policy, but also for theory as labor market frictions enter a wide array of economic models (Card, 2019). It is thus essential to advance our understanding of the long-term effects of an undesired start to working life, and the channels via which such effects persist.

In view of the above, this paper makes a distinct contribution to the literature on persistence by examining the short- and long-term effects of initial labor market conditions on three different outcomes; wages, workhours, and perceived condition. As such, our work focuses on South Korean nurses who graduated between 2000 and 2010, a period when macroeconomic conditions and the unemployment rate varied considerably. We choose South Korean nurses for our empirical work for a number of reasons. Firstly, nurses are critical to the smooth operation of any national healthcare system, yet the nursing profession is globally characterized by a major shortage of workers and a worryingly high turnover rate (Lee, 2019). This is particularly true in the South Korean case (Hong and Cho, 2017). Indeed, Kim and Kim (2021b) find that newly hired nurses in South Korea have a turnover rate of 26.4% in their first year of work, with almost a fifth of nurses resigning in their first six months of tenure. This motivates us to join the literature exploring the root-causes of this phenomenon to inform policy, scarring being one potential culprit. Secondly, the nursing profession is characterized by relatively less heterogeneity in terms of education level compared to other professions, which limits potential bias stemming from differences in initial skills. Moreover, the choice of South Korean nurses in particular is made because practicing nursing in South Korea requires the passing of an official examination, the Korean Nursing Licensing Examination (KNLE) which further helps ensuring a certain level of skill and human capital homogeneity within our sample. Additionally, in an effort to increase the homogeneous nature of our dataset, we work with a sample consisting only of Female nurses who were born and raised in South Korea. This means we can proceed with our analysis without worrying about any potential effect stemming from gender or ethnic differences. This also limits the possibility of having been exposed to beneficial/harmful experiences in

another country which might have affected human capital (Spetz, 2016; Walani, 2013). The data we utilize is longitudinal and comes from the Korean Labor and Income Panel Survey (KLIPS), which runs on a yearly basis since 1998.

In line with the literature, initial labor market conditions are proxied by the unemployment rate, which we specify at both the national and local level. Our findings provide evidence that a higher unemployment rate at time of joining the labor market has significant and persistent effects on wages, work hours, and perceived condition. Indeed, a higher unemployment rate when joining the labor market is found to depress wages and negatively impact life happiness, financial condition and income satisfaction, and so for a number of years after graduating. However, our results show that a higher initial unemployment rate increases weekly work hours, which contradicts previous empirical works such as Speer (2016) and Schwandt and von Wachter (2019). All of these effects dissipate with each additional year of potential experience.

This paper makes a number of contributions to different strands of literature. Firstly, it offers novel evidence to the body of work on scarring which needs more occupation-specific studies as previously mentioned. Secondly, our paper provides insights that help further our understanding of the potential long-term costs of business cycles and market shocks. Finally, our results can inform healthcare policy aimed at improving nurses' work conditions and provide recommendations which could potentially be generalized across countries.

## II. Theoretical considerations

It is well established in the empirical literature that young new workers pay a high price for adverse macroeconomic conditions (Abel *et al.*, 2014; Elsby *et al.*, 2016). They have less work opportunities, face more competition for one same vacancy, and are more pressured to accept the first jobs offered to them, which are often unsuitable for them (Abel and Deitz, 2017). This kind of pressure poses a number of issues. It lowers the match quality between the worker's skills and those demanded by firms (De Fontenay *et al.*, 2020; Bae and Kim, 2023). It can also push young adults towards smaller, lower quality, lower paying employers, or pressure them to accept irregular forms of employment, which has punitive effects on their human capital and earnings (Borland

and Coelli, 2021; Leonard et al., 2016; Oreopoulos *et al.*, 2012). Matters are often worse for the less advantaged groups in the labor market who have been shown to face even higher and longer unemployment (Fernández-Kranz and Rodríguez-Planas, 2018; Schwandt and van Wachter, 2019). As such, the disproportionate impact experienced by different groups of people leads to increasing inequality and polarization (Burgess *et al.*, 2003; Altonji *et al.*, 2016; Ralston *et al.*, 2016).

*A. Search and matching*

Existing theoretical approaches provide alternative explanations as to how a thin initial labor market can precipitate persistent scarring effects on workers. More specifically, *search theory* postulates that job shopping is key to improving working conditions (Topel and Ward, 1992; Neal, 1999). In a context of high mobility, where finding a job and moving to better workplace is easy and frequent, the adverse effects of graduating during an economic downturn are easily correctable (Mortensen, 1986). Unemployment spells would be shorter, and mismatches between firms and workers would be less persistent. However, the story becomes different once labor market frictions set in. Indeed, the presence of search frictions, limited mobility, and imperfect information can make correcting an unfortunate start an onerous task for prospective workers, trapping them in undesirable jobs.

A key aspect of this explanation lies in the assumption that some firms are better than others (Krause and Lubik, 2006; von Wachter and Bender, 2006). Good employers pay, train, and promote better, and they look well on a resume which further increases one's ability to be mobile if ever needed. For example, Stewart (2007) shows that an early career low-wage job has long-term adverse consequences for one's employment prospects, which is not the case for those with a good job. Kondo (2007) finds that Japanese graduates who fail to obtain a regular fulltime job upon graduation are less likely to have a regular fulltime job in the latter stages of their careers. Under such an explanatory arc, the catch-up process that occurs after the initial loss takes place over a period of time. Individuals change jobs and move to higher quality employers, and improvements in their working conditions are concentrated at job changes rather than accruing on the job (Burdett, 1978; Neumark, 2002). Building on the above, a first hypothesis is proposed:

*Hypothesis 1: A higher initial level of unemployment scars nurses' outcomes by matching them with "bad employers".*

This hypothesis states that nurses graduating when unemployment is increasing may be pushed to work for a hospital with less favorable working conditions, such as lower wages, longer working hours, less socializing with colleagues, among others. Should it be easy to change employers and move to a hospital with better conditions, then little persistence is expected to emerge from estimation results. We know that throughout South Korea, nurses tend to complain about bad working environments (Min *et al.*, 2022). Nevertheless, it is reasonable to assume that different hospitals offer more/less favorable working conditions to their nursing staff. If this difference in working conditions is not reflected by different wages and working hours between establishments, then we may find it by looking at nurses' own perceived condition. Thus, under this hypothesis, we can expect to find persistence across one or all of wages, working hours, and perceived condition.

*B. Human capital*

Another way to look at scarring is via the lens of human capital. From this perspective, scarring is manifested through the long-term negative consequences on individuals' skills following the experience of certain events earlier in their careers. These adverse circumstances can impair an individual's ability to acquire and apply knowledge and skills, thereby limiting their future opportunities and potential for success. A case in point is the skill atrophy or deskilling that takes place when someone experiences a spell of joblessness (Mincer, 1974; Mincer and Ofek, 1982; Albrecht *et al.*, 1999). Given the importance of on-the-job skill accumulation in progressing to a better work position, a negative shock to the foundations of that skilling process could put workers on a worse human capital accumulation path, with effects that persist in time (Blanchard and Summers, 1986; de Grip and van Loo, 2002; Luijkx and Wolbers, 2009; Pissarides, 1992).

Edin and Gustavsson (2008) in an empirical study find that each year spent out of work is equivalent to a five-percentile average drop in the skill distribution. Similarly, being out-of-job has been suggested to trigger a loss in social capital by distancing individuals from their surroundings, further lowering the likelihood of getting re-employed

(Gallie and Paugam, 2000). However, these explanations alone are not enough, as they do not prove useful when looking at short spells of unemployment which are typical of young adults. Indeed, Böheim and Taylor (2002) and Doiron and Georgens (2008) show that the incidence of an unemployment spell, and not its duration, is the major culprit for the subsequent effects of being out of work.

An alternative explanation which also builds on human capital, is that graduates during economic downturns are more likely to end up in a mismatch, developing the wrong type of human capital at the wrong firm, making them less productive in the long term. Indeed, employees recruited when the market is in doldrums are seen to be allocated less important tasks in lower-level jobs, and their skills are under-utilized (Huckfeldt, 2022; Allen and Van Der Velden, 2001; Baert et al., 2013; Mavromaras *et al.*, 2015). Additionally, the lack of correct training at an early stage, which is the case in a mismatch, also carries punitive effects on future outcomes (Gardecki and Neumark, 1998).

Models of job assignment with task specific skills can also provide an explanation for the persistent effects of graduating during a downturn (Prendergast, 1993; Hayes *et al.*, 2006; Lazear, 2009). Such models would imply that initial labor market conditions affect the future outcomes of workers depending on who they begin working with and the tasks they accomplish as part of their everyday duties. In the case of nurses, under favorable circumstances, those hired by reputable hospitals may be allocated to shifts with more important tasks, or asked to work with more skillful doctors, which helps them develop "task-specific human capital" (Gibbons and Waldman, 2004; Gibbons and Waldman, 2006). Bartel *et al.* (2014) have shown this in the context of nurses, and found that such capital is important for the wellbeing of patients. In a more general context, Gathmann and Schönberg (2010) find that task-specific human capital is responsible almost half of lifetime wage growth. Moreover, an early "good exposure" also helps in developing the right social skills which are becoming increasingly valuable in the modern labor markets, especially in Healthcare (Deming, 2017). From this presented line of argumentation, we can hypothesize:

> *Hypothesis 2: A higher initial level of unemployment scars nurses' outcomes by means of impacting their knowledge and/or skills.*

Indeed, nurses whose careers begin with performing less important

tasks and being less exposed to quality learning experiences might see their skills stagnate, which may slow the promotion process within the same hospital thus impact wages, work hours, and perceived condition (Arellano-Bover, 2022). Similarly, should nurses opt to improve their conditions by taking matters into their own hands and moving to a better employer, the earlier bad start is likely to hinder that process since their skills would now be lower than what is expected. In fact, Modestino *et al.* (2016) and Modestino *et al.* (2020) suggest that skill requirement increases (decreases) with higher (lower) unemployment. Thus, whether within the organization or on an industry level, starting a career performing lower tasks may carry persistent negative effects nurses' outcomes.

*C. Other theoretical explanations for scarring*

In the extant literature, initial job placement is considered to be a potential indicator for skills endowment by recruiters (Lockwood, 1991; Kroft *et al.*, 2013). As recruiters are unable to assess applicants' productivity, they may use previous employment records to screen applicants, which may provoke stigma towards those with previous unemployment spells or job spells at small or unknown firms (Bratberg and Nilsen, 2000). In all likelihood this would limit the possibility of transitioning to a more suitable employer and better job in the future, because of the failure to account for the effects of initial market conditions (Gibbons and Katz, 1991). In this context, Lupi and Ordine (2002) examined the role of stigma attached to joblessness in the case of Italy and found a significant link between stigma and post-unemployment labor market outcomes. Additional evidence shows that unemployed jobseekers are less likely to be invited for interviews compared to employed applicants as recruiters allocate importance to spells of unemployment when assessing job applications (Atkinson *et al.* 1996; Manning, 2000). Some implications of this were suggested by Gregg and Wadsworth (2000) who found that out-of-work job applicants are those who mostly take on "bad jobs". Furthermore, stigma has been shown to have scarring effects on labor market outcomes by means of lowering people's confidence levels hence tarnishing their trust in their abilities to perform adequately (Mortensen, 1977; Gonzalez and Shi, 2010). Finally, it is possible that an initial job placement in conjunction with initial job market conditions can trigger a long-term impact on

human capital, productivity, and earnings by acting on the workers' job preferences and aspirations, thus their future career decisions (Cotofan *et al.*, 2021; Genicot and Ray, 2020; Oyer 2006; Rayo and Becker, 2007). Thus, a third hypothesis emerges:

> *Hypothesis 3: A higher initial level of unemployment scars nurses' outcomes by means of stigma or changes in individual preferences.*

In view of the above theoretical arguments, it can be clearly established that there are different channels though which scarring effects of adverse economic conditions can be transmitted. However, there are obvious limitations when it comes to accurately assessing the persistence of such effects. Most importantly there is a clear gap in the extant empirical literature, as scarring effects in specific occupations have not been adequately examined.

Having laid out the various theoretical strands underpinning the literature on scarring, we are now able to empirically explore and address our hypotheses on whether initial economic conditions carry persistent effects on labor market outcomes in the context of the nursing profession.

## III. Data

We exploit data from South Korea's only labor market panel survey, the Korean Labor and Income Panel Survey (KLIPS) which has been tracking the activities of urban households and their members on an annual basis since 1998. From this survey, we use data spanning the years 2000 to 2020. Our subjects of interest are nurses who have finished their university education between 2000 and 2010 (Table 1). We observe the first ten years of potential experience of these nurses, potential experience meaning years since graduation (in contrast with "actual experience" which does not consider time spent out of employment). All of our subjects are females who were born, raised, and completed all levels of schooling in South Korea. The rationale behind our choice of working with a one gender sample is as follows. Firstly, the vast majority of nurses surveyed in KLIPS are women. Secondly, ensuring maximum homogeneity within our sample helps to elevate the quality of our analysis and makes our findings more informative. Thirdly, South Korea is notorious for its military service which is

**Table 1**
Sample description

| | N |
|---|---|
| Observations | 842 |
| Nurses | 203 |
| who graduated in_ | |
| 2000 | 27 |
| 2001 | 10 |
| 2002 | 26 |
| 2003 | 21 |
| 2004 | 24 |
| 2005 | 22 |
| 2006 | 20 |
| 2007 | 12 |
| 2008 | 14 |
| 2009 | 17 |
| 2010 | 10 |

Notes: All nurses in the sample are females, born and schooled in South Korea. The data is sourced from KLIPS, waves 3 to 21.

mandatory for men and voluntarily open to women. Since timing of graduation is an integral part of our empirical work, including men who semi-randomly join and leave military service at different stages of their youth would add an unnecessary layer of complication to our study.

The key explanatory variables in our analysis are the unemployment rate at time of graduation (GUR), and its interaction with the number of years since graduation (GUR*POTEXP). The coefficient in front of the prior informs us on the initial effect of the graduation unemployment rate, while the coefficient in front of the interaction gauges the persistence of this effect as years since graduation accumulate. KLIPS

**Table 2**
Descriptive statistics

| | Mean | S.D. | Min. | Max. |
|---|---|---|---|---|
| Potential Experience | 6.92 | 5.284 | 0 | 20 |
| Work Hours, weekly | 43.773 | 5.81 | 24 | 69 |
| Log Wage, monthly | 5.125 | 0.487 | 3.638 | 6.31 |
| GUR_province (%) | 4.325 | 1.169 | 1.8 | 7.9 |
| GUR_country (%) | 4.366 | 0.74 | 3.3 | 5.7 |
| GUR_female (%) | 3.862 | 0.614 | 2.8 | 4.8 |

Notes: Potential Experience is the number of years since graduation. In KLIPS, the wage is the monthly aftertax wage in 10,000 Korean Wons. GUR_province is the quarterly province-level unemployment rate at time of graduation. GUR_country is the monthly country-level unemployment rate at time of graduation. GUR_female is the monthly national female unemployment rate at time of graduation. Data is sourced from KLIPS and KOSIS.

provides us with the timing and location of graduation. We obtain the unemployment rate from the statistical database of the Korean Statistical Information Service (KOSIS), and estimate models at both the national and local levels. Note that, for the local estimations, our unit of analysis is provinces, or Major Cities. Descriptive statistics are presented in Table 2.

## IV. Empirical specification

*A. The model*

In the extant empirical literature, the persistent effects of initial labor market conditions on subsequent outcomes are usually estimated by interacting the unemployment rate at time of graduation with the number of years since graduating, also referred to as potential experience. Indeed, such a specification offers insights into both the initial and persistent effects of the graduation unemployment rate on the outcome of interest. As such, we estimate the effects of initial labor market conditions, approximated by the unemployment rate, on a set of labor market outcomes (wages, workhours, and perceived condition) and observe their persistence up over ten years of potential experience. Across the different versions of our estimation, the following augmented Mincer earnings function is adopted:

$$\begin{aligned} y_{it} = {} & \beta_0 + \beta_1 GUR_i + \beta_2 GUR_i * POTEXP_{it} + \beta_3 POTEXP_{it} \\ & + \beta_4 POTEXP_{it}^2 + \beta_5 UR_t + \beta_6 \gamma_t + \beta_7 \omega_{yit} + u_{it} \end{aligned} \tag{1}$$

$y_{it}$ is the dependent variable and denotes the labor market outcome of interest, *i.e.*, wages, workhours, or the perceived condition measure. GUR is the unemployment rate at time of graduation, which can be at the local or national level depending on the estimation. Similar to Kahn (2010), *POTEXP* refers to potential years of experience, or years since finishing education. In order to isolate the effects of the initial unemployment rate *GUR*, we control for the unemployment rate when the observation was recorded, *UR*. $\gamma$ captures both year and city fixed effects. $\omega$ is a vector of control variables that vary given the specification of the respective models. For each estimation, the relevant control variables are listed in the table presenting the results. The

coefficients of interest in equation (1) are $\beta_1$ and $\beta_2$. $\beta_1$ informs us of the initial effect of the graduation unemployment rate whilst the coefficient in front of the interaction term between the graduation unemployment rate and potential experience, $\beta_2$, shows us how persistent this effect is as years since graduation increase.

*B. Identification strategy*

A concern with the estimation of such models is that we should consider potential endogeneity which may affect the robustness of our results, mainly issues of omitted variables. Firstly, a high unemployment rate at time of studying could incite students to delay graduation or migrate to another location with more favorable economic conditions. As we do not have sufficient information to address this issue, we follow convention and instrument for the Graduation Unemployment Rate (*GUR*) with the unemployment rate at age 22 in the state of residence at age 14 (or the national unemployment rate when aged 22 in the case of national estimations). Indeed, 22 is the mean age of graduation in our sample, and it is unlikely that someone has a say in where they reside at age 14 (Kahn, 2010). This instrument is thereafter referred to as $GUR_{proxy}$.

We must also address endogeneity stemming from potential experience. Indeed, if graduation could be delayed as explained above, then the number of years of potential experience is also affected. Thus, similar to Kahn (2010), we instrument for the quadratic on potential experience with a quadratic on age. Finally, since both the graduation unemployment rate (*GUR*) and potential experience (*POTEXP*) may suffer from endogeneity issues as just explained, then a similar concern applies to the interaction term between these two variables (*GUR*∗*POTEXP*). Thus, to instrument for this interaction term, we interact the unemployment rate proxy $GUR_{proxy}$ with a novel instrument, the ratio of age to potential experience which we refer to as $EXP_{proxy}$. Indeed, although age is conventionally used as an instrument for potential experience, we find that this proxy performs better when instrumenting for the interaction term. The quadratic on age remains part of the first stages of our estimations.

*C. Estimation procedure*

Our models are estimated using the 2SLS technique which is

**TABLE 3**
FIRST STAGE OF IV REGRESSIONS

| | COUNTRY | | | | PROVINCE | | | |
|---|---|---|---|---|---|---|---|---|
| | GUR | GUR*POTEXP | POTEXP | POTEXP2 | GUR | GUR*POTEXP | POTEXP | POTEXP2 |
| GUR_PROXY | 0.425 | | | | 0.256 | | | |
| | [0.067]*** | | | | [0.036]*** | | | |
| GUR_PROXY | | -0.373 | | | | -0.465 | | |
| *EXP_PROXY | | [0.123]*** | | | | [0.087]*** | | |
| EXP_PROXY | | | -0.125 | | | | -0.16 | |
| | | | [0.063]** | | | | (0.04)*** | |
| AGE | | | -0.372 | | | | -0.384 | |
| | | | [0.148]** | | | | [0.143]*** | |
| AGE2 | | | | 0.718 | | | | 0.706 |
| | | | | [0.052]*** | | | | [0.049]*** |
| F statistic | 13.52 | 63.91 | 187.37 | 124.4 | 40.99 | 59.58 | 189.49 | 127.05 |
| R squared | 0.522 | 0.838 | 0.938 | 0.902 | 0.77 | 0.83 | 0.939 | 0.912 |

Notes: *** and ** indicate statistical significance at the 1% and 5% level respectively. Standard errors are given in square brackets; Regressions include year and city fixed effects and the unemployment rate at the time of observation. GUR_PROXY is the unemployment rate (quarterly) at age 22 in the state of residence at age 14 for the city-level models, and the national unemployment rate (monthly) at age 22 for the country-level models. EXP_PROXY is the ratio of Age to Years since Graduation.

appropriate for the estimation of identified equations and ensures that endogeneity stemming from the original model specification is appropriately dealt with. We must first make sure that the instruments used as part of our identification strategy are valid. We can determine whether our instruments are appropriate by looking at the results of the first stage estimations, which are shown in Table 3. We can see that our chosen instruments are significant predictors of the respective endogenous variables. Additionally, the lowest F-statistic we obtain is of the size of 13.52, thus higher than 10, which enables us to set aside any concern of having weak instruments.

In spite of the envisaged endogeneity issues, we still present the OLS estimates for comparison purposes. Each coefficient is presented in a set of three: the OLS estimate, the 2SLS estimate with no control variables except years and location fixed effects, and the 2SLS estimate with all additional controls which we coin as the augmented model. The

coefficients obtained from the augmented model are our preferred ones. For the perceived condition equations where the dependent variable is a dummy variable, we only present the coefficients obtained from the augmented model.

## V. Findings

*A. The scarring effects on wages*

Table 4 shows the results of the estimations where the log monthly wage is the labor market outcome under consideration. Two models are estimated: the first one, shown in columns (1), (2) and (3), is on a country level, where the key predictor (*GUR*) is the monthly national unemployment rate at time of graduation. The second model, presented in columns (4), (5) and (6), is at the province level, with *GUR* defined as the quarterly unemployment rate at the time of graduation and at the province where education was undertaken. In panel A, we can see the coefficients for the unemployment rate (*GUR*) and its interaction with the number of years since graduation (potential experience, *POTEXP*). We estimate our model using both OLS and the two-stage least squares methods, to check whether our coefficients are robust to dealing with endogeneity. The coefficients of the 2SLS with controls shown in columns (3) and (6) are our preferred ones, considering that the technique deals with potential endogeneity.

All the coefficients in Panel A are significant at the 1% level. Across all specifications, the graduation unemployment rate is shown to have a negative initial effect on wages which dissipates as years after graduation accumulate. Looking first at the OLS results, we can see in column (1) that a one percentage point increase in the initial national unemployment rate triggers a wage loss of 0.153 percent. The coefficient in front of the interaction term (*GUR***POTEXP*) shows that this initial wage loss is followed by a yearly catch up of 0.011 percent. The OLS estimates for the provincial specification tell a similar story: in column (4), we can see that a one percentage point increase in the local unemployment rate as associated with an initial wage loss of 0.096 percent, which dissipates yearly by 0.007 percent.

Looking now at the 2SLS coefficients, we can see that both with and without controls the story is consistent with the one told by the OLS estimates. Indeed, for the national specification, a one percentage point

increase in the graduation unemployment rate is followed by a wage loss of 1.757 and 1.05 percent, without and with controls respectively. In the model without controls, the yearly catchup is of the magnitude of 0.159 percent, whereas it is of 0.099 percent in the augmented model. In the provincial case, a one percentage point increase in the local unemployment rate triggers a 0.715 percent wage loss in the model without controls, and a 0.756 percent wage loss in the augmented model. The respective yearly catchup is 0.034 percent and 0.038 percent.

We notice that the effect of initial unemployment conditions on the log wage is always larger in the national model compared to the province-level one. Indeed, all the left-side Panel A coefficients are larger in magnitude compared to their respective right-side ones. This is in line with the literature on educated workers being less sensitive to local labor markets compared to the whole economy since they can smooth shocks through migration (Wozniak, 2006). This conclusion is robust for all OLS, 2SLS, and augmented 2SLS specifications. Moreover, we can also see that the OLS coefficients are always smaller than the 2SLS ones. We were expecting this as OLS results are biased towards zero.

In Panel B, we present our findings on the degree of persistence for the wage effects of the initial unemployment rate. Similar to Panel A, we estimated the effects of both the national and local graduation unemployment rates. Beginning with the national model, and the OLS results shown in column (1), we can see that the effect of the national unemployment rate decreases with years of experience, and becomes small (-0.047) and insignificant after 7 years of potential experience. The 2SLS estimations tell a similar story as to diminishing magnitude as potential experience years accumulate. However, our augmented model shown in column (3) suggests that the effects remain highly significant even in the 6 to 9 years of potential experience interval. Moving to the provincial specification, we can see that the coefficients tell a similar story. For all OLS, 2SLS, and augmented 2SLS estimations, the effect of the initial local unemployment rate decreases with years of potential experience. The OLS (column (4)) suggests that this effect becomes insignificant after 6 years of potential experience. This is contradicted by the augmented 2SLS result which shows that the effect remains relatively large (-0.402) and highly significant at the end of the period studied.

**TABLE 4**

THE IMPACT ON WAGES

| | COUNTRY | | | PROVINCE | | | ROBUSTNESS |
|---|---|---|---|---|---|---|---|
| | OLS | 2SLS | 2SLS (augmented) | OLS | 2SLS | 2SLS (augmented) | 2SLS (augmented) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **A: Regression Results** | | | | | | | |
| GUR | -0.153 | -1.757 | -1.05 | -0.096 | -0.715 | -0.756 | -1.325 |
| | [0.03]*** | [0.432]*** | [0.389]*** | [0.026]*** | [0.169]*** | [0.175]*** | [0.407]*** |
| GUR*POTEXP | 0.011 | 0.159 | 0.099 | 0.007 | 0.034 | 0.038 | 0.103 |
| | [0.002]*** | [0.043]*** | [0.037]*** | [0.001]*** | [0.11]*** | 0.011]*** | [0.041]** |
| **B: Effects for selected experience years** | | | | | | | |
| Years 0-3 | -0.096 | -0.238 | -0.618 | -0.061 | -0.236 | -0.712 | -0.556 |
| | [0.029]*** | [0.075]*** | [0.146]*** | [0.024]** | [0.071]*** | [0.189]*** | [.179]*** |
| Years 4-6 | -0.068 | -0.124 | -0.36 | -0.038 | -0.14 | -0.404 | -0.536 |
| | [0.028]** | [0.045]*** | [0.083]*** | [0.023]** | [0.046]*** | [0.115]*** | [0.162]*** |
| Years 7-9 | -0.047 | -0.086 | -0.324 | -0.017 | -0.089 | -0.402 | -0.444 |
| | [0.029] | [0.054] | [0.098]*** | [0.023] | [0.049]* | [0.144]*** | [0.17]*** |
| Observations | 737 | 536 | 536 | 736 | 530 | 530 | 536 |
| R-squared | 0.541 | - | - | 0.52 | - | - | - |

Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level respectively. Standard errors are given in square brackets. Estimations control for current local unemployment rate, year fixed effects and location fixed effects. The augmented model, shown in columns (3) and (6), contains the following additional controls: the age, a dummy variable for type of workplace, a dummy variable for whether nurse works overtime, and the number of years of actual experience.

### *B. The scarring effects on working hours*

One labor outcome that has been relatively neglected by the literature on scarring is the number of working hours. We fill this gap, and Table 5 presents the estimated coefficients when the log of weekly work hours is plugged in as the dependent variable in equation (1). Panel A shows that for both country-level and province-level models, the graduation unemployment rate has a positive initial effect on working hours, which dissipates as experience accumulates. In the national case, the OLS estimation (column 1) suggests that the graduation unemployment rate initially increases weekly workhours by 0.05 percentage points, followed by a yearly catch up of 0.002 percentage points. In the province-level model, the OLS (column 3) tells us that the graduation unemployment rate is associated with a 0.033 percentage points initial increase in

**TABLE 5**

THE IMPACT ON WORKING HOURS

| | COUNTRY | | | PROVINCE | | | ROBUSTNESS |
|---|---|---|---|---|---|---|---|
| | OLS | 2SLS | 2SLS (augmented) | OLS | 2SLS | 2SLS (augmented) | 2SLS (augmented) |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **A: Regression Results** | | | | | | | |
| GUR | 0.05 | 0.294 | 0.296 | 0.033 | 0.234 | 0.213 | 0.266 |
| | [0.01]*** | [0.107]*** | [0.108]*** | [0.01]*** | [0.06]*** | [0.063]*** | [0.123]** |
| GUR*POTEXP | -0.002 | -0.022 | -0.019 | -0.002 | -0.01 | -0.01 | -0.041 |
| | [0.0007]*** | [0.011]** | [0.009]** | [0.0006]*** | [0.004]*** | [0.004]** | [0.026] |
| **B: Effects for selected experience years** | | | | | | | |
| Years 1-3 | 0.043 | 0.153 | 0.149 | 0.027 | 0.183 | 0.198 | 0.265 |
| | [0.01]*** | [0.041]*** | [0.036]*** | [0.01]*** | [0.05]*** | [0.047]*** | [0.107]** |
| Years 4-6 | 0.037 | 0.141 | 0.127 | 0.022 | 0.174 | 0.176 | 0.22 |
| | [0.01]*** | [0.037]*** | [0.033]*** | [0.01]** | [0.046]*** | [0.044]*** | [0.095]** |
| Years 7-9 | 0.031 | 0.123 | 0.098 | 0.018 | 0.156 | 0.171 | 0.175 |
| | [0.01]*** | [0.036]*** | [0.024]*** | [0.01]** | [0.044]*** | [0.042]*** | [0.071]** |
| Observations | 780 | 534 | 534 | 779 | 534 | 534 | 534 |
| R-squared | 0.349 | - | - | 0.294 | - | - | - |

Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level respectively. Standard errors are given in square brackets. Estimations control for current local unemployment rate, year fixed effects and location fixed effects. The augmented model, shown in columns (3) and (6), contains the following additional controls: a dummy variable for type of workplace, and the number of years of actual experience.

weekly workhours, followed by a yearly dissipation of 0.002 percentage points. For both the national and provincial specifications, the 2SLS and the augmented 2SLS tell a similar story to that of the OLS, although the OLS coefficients are smaller.

Panel B in Table 5 shows the long-term nature of these effects over a selection of intervals of potential years of experience. The coefficients show that for all estimations and for up to ten years after graduation, the effect of the graduation unemployment rate is positive, persistent and significant, although decreasing in magnitude. These results suggest that initial labor market conditions play an important role in determining nurses' working hours over the first 10 years of their careers, particularly in the earlier years after graduation.

*C. Robustness*

Although the results for our estimations on the impact of the initial unemployment rate on subsequent wages and weekly working hours are consistent across all our specifications and indicate the existence of persistent effects of initial conditions, we further test how robust our findings are to a third indicator for the unemployment rate: the national female unemployment rate. Indeed, this is valid considering that our sample consists of females only, but also interesting considering that historically, the national female unemployment rate in South Korea has been consistently lower than the country rate.

Columns (7) in both tables 4 and 5 include the results from our robustness estimations. The monthly female national unemployment rate is used in a 2SLS with the relevant controls as discussed in section 3.1.b. Beginning with the log wage, we can see in column (7) panel A that a one percent increase in the national female rate at time of graduation has a highly significant negative initial effect on wages, the size of 1.325 percentage points. As years since graduation accumulate, a catch-up process occurs and we have a yearly dissipation of 0.103 log point, significant at the 5% level. In panel B, we can see that throughout the first ten years of potential experience, the effect of the initial female unemployment rate maintains a highly significant and negative effect on the log wage. Thus, in the case of the log wage, our robustness estimations relay the story presented by our models. It is not surprising to find that the magnitude of the coefficients obtained from our robustness estimations are closer in magnitude to the national models compared to the provincial one, as the female rate we use is the country-level one.

Column (7) of table 5 shows the coefficients for the robustness estimation when the log of weekly working hours is the dependent variable. From panel A, we can see that the initial effect of a one percent increase in the national female unemployment rate at time of graduation is a 0.266 percentage points increase in weekly working hours, significant at the 5% level. The coefficient in front of the interaction term is relatively similar in magnitude to the ones found in our models, and has the same negative sign, but emerges as insignificant. In Panel B, we can see the persistent effects on working hours. Indeed, in line with our previous estimations, column (7) also shows that the effects of the initial unemployment rate remain significant

up to the 7-9 potential experience years interval. In this interval, the initial unemployment rate is associated with a 0.175 percentage points increase in working hours for nurses in our sample.

*D. The scarring effects on perceived condition*

The coefficients found and presented in Tables 4 and 5 all give support to the occurrence of scarring following a higher unemployment rate at time of labor market entry. However, as shown in the literature review, a range of theoretical arguments could be posited that would enable us to make different interpretations on the mechanisms driving these results. Therefore, it would be useful to explore how nurses view their own condition over the first ten years after graduating, using what are known as happiness equations.

We look at three aspects of nurses' perceived condition: whether they see themselves as being in a bad financial situation, whether they are generally happy in life, and whether they are satisfied with their income level. The fact that our sample consists only of females permits us to study perceived condition without having to worry about differences in values, expectations, stress levels and other sex-differences reported in this strand of literature (Kahneman and Deaton, 2010). Also, a property useful to our discussion is that the way an individual perceives their own condition depends on one's relative condition among peers (Luttmer, 2005; Clark et al., 2008; Layard et al., 2010). Finally, although we are not studying wellbeing in the strict sense of the term, findings from this strand of literature inform us as to what we should expect from our estimations on perceived condition. Indeed, it has been established that unemployment depresses wellbeing, and that income increases it albeit for a short period of time (Blanchflower *et al.*, 2014; Di Tella *et al.*, 2010; Hovi, 2023). Çitçi and Begen (2019) have also shown that entering the workforce in a context of high unemployment is associated with long lasting decreases in job satisfaction.

Table 6 presents the results from estimating a 2SLS of equation (1) with the three perceived condition measures taken as dependent variables. Perceived financial condition of the household is represented by a dummy variable taking the value of 1 if a respondent reports a bad financial situation. Overall life satisfaction is shown by a dummy variable equaling 1 if a respondent reports being happy in life at the time of being surveyed. Income satisfaction is shown by a dummy

**Table 6**

The impact on perceived condition

| | Bad Financial Condition | Happy in Life | Satisfied with Income |
|---|---|---|---|
| | (1) | (2) | (3) |
| **A: Regression Results** | | | |
| GUR | 0.515 | -0.573 | -0.426 |
| | [0.196]*** | [0.241]** | [0.179]** |
| GUR*POTEXP | -0.03 | 0.035 | 0.019 |
| | [0.012]** | [0.015]** | [0.011]* |
| **B: Effects for selected experience years** | | | |
| Years 1-3 | 0.516 | -0.652 | -0.574 |
| | [0.248]** | [0.316]** | [.276]** |
| Years 4-6 | 0.363 | -0.385 | -0.379 |
| | [0.181]** | [0.228]** | [0.196]* |
| Years 7-9 | 0.145 | -0.404 | -0.365 |
| | [0.147] | [0.183]** | [0.144]** |
| Observations | 556 | 556 | 556 |

Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level respectively. Standard errors are given in square brackets; Bad Financial Condition, Happy in Life and Satisfied with Income are dummy variables which take the value of 1 if reported by the observed individual. The model used is the augmented Provincial one (i.e. Quarterly Provincial unemployment rate). The financial condition estimation, presented in column (1), contains as additional controls the log after-tax wage and the household size. The life happiness estimation, presented in column (2), controls for age, marital status, the log after-tax wage, weekly work hours and household size. For the Income Satisfaction estimation presented in column (3), additional controls include the age, log weekly work hours and the log on household average monthly expenses.

variable taking the value of 1 to indicate a respondent who reports being happy with her current income.

Looking first at perceived financial condition in column (1), we can see that nurses who entered the labor market when the unemployment is high are more likely to report being in a bad financial condition. However, this effect dissipates with potential years of experience and becomes insignificant 6 years after graduating.

A similar story is shown in column (2) which presents coefficients

for the Life Satisfaction estimation. Indeed, a higher unemployment rate at time of graduation is associated with an initial decrease in the likelihood of reporting to be currently happy in life. This is followed by a yearly improvement in happiness, but the effect of the graduation unemployment rate remains significant throughout the period studied. Lastly, the model with income satisfaction is estimated and its coefficients are shown in column (3). Following a 1% increase in the graduation rate, an initial drop in income satisfaction occurs, significant at the 5% level. This effect dissipates with years of experience, but we find that even during the 7 to 9 years of experience interval, the effect of the initial unemployment rate remains significant at the 5% level.

## VI. Discussion

In the previous section, we have seen that an increase in the graduation unemployment rate carried scarring effects on income, with coefficients that remained negative and highly significant up to 6 years after joining the labor market. This is in line with the findings of Kahn (2010) but in that paper, the wage effects of the local unemployment rate are shown to be persistent for up to 15 years. Kawaguchi and Kondo (2020) also find effects that are more persistent than ours (up to 18 years). However, both these studies use the National Longitudinal Survey of Youth 1979 (NLSY79), and neither focuses on a particular occupation as we do. Our results are closer to those of Oreopoulos *et al.* (2012) in a study on Canadian college graduates who find wage effects that last for approximately 8 years. Other recent studies which have found negative wage effects to an increasing initial unemployment rate include Genda *et al.* (2010), Hershbein (2012), Brunner and Kuhn (2014), Speer (2015), Altonji *et al.* (2016), Cockx and Ghirelli (2016), Liu *et al.* (2016), Cribb *et al.* (2017), Schwandt and von Wachter (2019), Umkehrer (2019), Andrews *et al.* (2020), Rothstein (2020), and Barsbai *et al.* (2022).

Our estimations on weekly work hours have generated results that show positive effects that dissipate in magnitude but remain highly significant even 10 years after joining the labor market. This means that an increase in the unemployment rate at time of graduation is associated with an increase in the work hours of nurses that slowly fades away. These results are in contradiction to those of Speer (2016) and Schwandt and von Wachter (2019) who find that working hours decreased following adverse initial labor market conditions. However,

the nature of our analysis differs from theirs in terms of studied sample. We focus on a particularly homogeneous group belonging to the same occupation, whereas their studies are conducted on a country level (US).

To the best of our knowledge this is the first study that treats scarring from a perceived condition perspective as well. Potentially, the closest paper would be Maclean and Hill (2015) who looks at self-esteem and find that leaving school in an economic downturn decreases self-esteem over time. However, there are different strands of literature that share some similar ground with the work we have presented. Indeed, a number of papers have looked at the effects of initial labor market conditions on health behaviour and attitude. For instance, initial labor market conditions have been shown to carry persistent positive effects on divorce, family formation, political beliefs, criminal activities, heart-attack incidences, overdoses, alcohol consumption, obesity, sleep patterns, and smoking (Engdahl *et al.*, 2019; Giuliano and Spilimbergo, 2014; Li and Toll, 2021; Maclean, 2013; Maclean and Hill, 2015; Maclean and Hill, 2017; Cutler *et al.*, 2015, Bell *et al.*, 2018; Schwandt and von Wachter, 2019). These are in line with our findings which show a negative effect of higher unemployment at time of graduation on happiness and income satisfaction. The vast literature linking income to stress is also relevant and supports our results.

Taken together, our results can be reconciled and interpreted with models of human capital accumulation (hypothesis 2). Indeed, our finding that a higher graduation unemployment rate has a negative (positive) effect on wages (work hours) suggests that nurses who join the labor market at a turbulent time can be exploited more easily by employers, as they work longer hours and earn less than their counterparts who graduated in luckier times. However, these effects dissipate as experience is accumulated, which indicates that a certain form of progress is happening year after year. The Gibbons and Waldman (2006) extension of the skill accumulation model suggests that, with experience, nurses may be accumulating either task-specific capital which improves their wages within the same job, or general human capital which promotes them to higher paying jobs in the hospital. Gathmann and Schönberg (2010) is a good illustration of this framework. In this spirit, our finding that the effect on weekly workhours is decreasing in years of experience could indicate that some form of promotion, albeit small one, may be taking place. These

promotions would be to positions with shorter shifts and better pay. Here, we build on the assumption that within the same job, a nurse is assigned to a specific shift-length that does not change.

Unfortunately, we are unable to assess the quality of respondents' first employers nor know more about the particular tasks and interactions of nurses when they first started work. Such information would have enabled us to link our findings to models of job assignments which could inform us on the nature and origin of the skill accumulation taking place (Hayes *et al.*, 2006; Lazear, 2009). Nevertheless, it is possible that nurses who begin work under not-so-favorable conditions are assigned to jobs of lower average quality, and that a catch-up process follows as human capital is accumulated on the job.

## VII. Conclusion and Recommendations

The literature on scarring lacks rigorous occupational level evidence necessary to inform the theoretical arguments on the way such persistence occurs (von Wachter, 2020). This paper fills this gap, and explores the persistent effects of initial labor market conditions on wages, working hours and perceived condition in the case of South Korean nurses. Using an identification strategy based on instrumental variables applied to a rich longitudinal dataset, we found that the unemployment rate at time of graduation has negative effects on nurses' wages that remain highly significant up to 6 years after joining the labor market, and a positive effect on weekly work hours that decreases in magnitude with years of experience but remains highly significant up to 10 years after graduating. We also estimated a series of happiness equations in order to further inform us on nurses' experiences over the first ten years after joining the labor market. We found that a higher unemployment rate at time of graduation is associated with respondents reporting worse financial conditions, less happy lives, and less income satisfaction. Whilst the chronic shortage of nurses in Korea suggests that scarring may differ from those in other occupations more sensitive to demand changes caused by economic fluctuations, our findings reveal that scarring effects on wages and working hours are still significant, albeit potentially different in magnitude compared to previous studies on other groups. Our results are in line with models of skill accumulation, and contribute to the growing body of evidence

linking human capital with the scarring effects of adverse initial labor market conditions.

The chronic shortage of nurses in Korea suggests that the scarring effects observed may differ from those in other occupations more sensitive to demand changes caused by economic fluctuations. Despite this persistent demand, our findings reveal that scarring effects on wages and working hours are still significant, albeit potentially different in magnitude compared to previous studies on other occupational groups. This highlights the vulnerability of nurses entering the labor market during economic downturns. Additionally, the high turnover rate among Korean nurses increases the likelihood of poor job matches across various factors, distinguishing this occupation from others with lower turnover rates. This characteristic suggests that scarring effects may be exacerbated by frequent job changes and instability, potentially leading to more pronounced negative impacts on wages and job satisfaction compared to other occupations.

Building on our findings and linking them to previous empirical works on the matter, a series of policy recommendations tailored to the South Korean nursing market are offered. Firstly, we recommend implementing policies of task rotations whereby nurses would get exposed to a number of learning opportunities and be in contact with a diverse range of specialists (Lazear, 2009). Secondly, strategies to improve and preserve good work environments must be actively pursued as a sound work environment has positive effects on nurses' skill accumulation and wellbeing, hence on the smooth operation of health institutions (Kim and Kim, 2021a; Park and Oh, 2016). Such workplace improvement strategies could take the form of reducing nurses' workload and lowering the nurses-to-patients ratio (Min *et al.*, 2022). Staffing policies should also be addressed, and staffing needs should be calculated based on patients' needs and tasks performed instead of number of patients, since some patients require more care than others (Bartel *et al.*, 2014). Another policy that would alleviate workload problems is ensuring that nurses spend their workhours performing nursing tasks only, and do not have to take on secretary duties, personnel management, and others non-nursing responsibilities (Yun and Yu, 2021). This could start with designing clearly formulated job descriptions and making sure that subordinates' job descriptions are respected by their hierarchical superiors. Finally, training to improve social capital should be offered, particularly at earlier career

stages, as nurses' social capital has been shown to have an important impact on the quality of care offered to patients (Shin and Lee, 2016; Deming, 2017).

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# The scarring effects of initial labor market conditions on South Korean nurses

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