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Well-Paid Nurses are Good Nurses

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Abstract

Some recent articles suggest that increasing wage in the nursing market with the aim of reducing shortage may yield a negative effect on the average ability and motivation of applicants attracted and, in turn, on the average quality of care. This finding is at odds with empirical evidence and has been criticized on the grounds that nurses' motivation is modeled in an overly simplistic way. The present paper provides a novel theoretical framework where the orientation of nurses' motivation - intrinsic versus extrinsic - is taken into account, and the precise distinction between intrinsic and extrinsic motivation is delineated on the basis of self-determination and person-environment fit theories. Findings show that high wages attract able and motivated individuals, thus maximizing the average quality of care. This result reconciles theory with evidence.

Keywords: Nurses' wage, nurses' ability, nurses' motivation, quality of care, self-determination and person-environment fit theories.

JEL Codes: I11, J32, A12.

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1 Introduction

The present paper investigates how the nursing wage level affects the number of registered nurses and nursing assistants that will be potentially available in the future - the long-run supply of nurses - and the quality of care provided by future nurses.

This research question is non-trivial because many countries around the world are concerned about nursing shortage. In 2012 the US Bureau of Labor Statistics listed registered nursing and nursing assistance among the top-twelve occupations in terms of projected job openings due both to growth and replacement needs in the United States, as reported in Table I.

[Table I here]

Table II shows that a similar scenario concerning nurses and caregivers occurs in another aging developed country, namely Italy.

[Table II here]

The above evidence suggests that the goal of a sustainable recruitment and retention of nurses should be in the political agenda of aging industrialized countries. This is why a recent literature has begun to study how the level of wage affects the long-run supply of nurses. Chiha and Link (2003) find a significant and positive effect of registered nurses' wage on the number of people who enter first-degree nursing programs in the US. A similar conclusion is drawn by Buhr (2009), who shows that earnings have a positive effect in attracting persons who are not currently working as nurses in Canada, and Buchan and Black (2011), who report on some case study countries where a significant pay raise was awarded to nurses.

A second stream of literature (Heyes 2005; Taylor 2007; Barigozzi and Turati 2012; henceforth HTBT) theoretically investigates self-selection into nursing and confirms that an increasing flat wage, together with additional undergraduate places at universities, helps mitigate the shortage problem by attracting more applicants to the nursing career. Nevertheless, Heyes (2005) shows such a recipe might entail an undesirable side-effect. In his setup, potential applicants are endowed with a dichotomous characteristic, that is, motivation: poorly motivated potential applicants (henceforth non-motivated) provide lower quality of care than highly motivated (henceforth motivated) individuals. The key assumption is that motivated potential applicants require a *lower* minimum wage to choose nursing instead of an alternative job (i.e., a lower reservation wage) because they enjoy a non-pecuniary "motivational" premium. Following a pay raise, non-motivated potential applicants are likely to choose nursing, thus reducing the average motivation of applicants attracted and the average quality of care. The existence of this mechanism, referred to as *inefficiency wage* by Heyes, is confirmed by Taylor (2007) who, yet, finds conditions under

which pay affects positively the utilitarian welfare. Barigozzi and Turati (2012) extend Heyes (2005) by allowing for a second dichotomous characteristic of potential applicants, that is, ability. They derive conditions under which pay has an adverse effect on both the average ability and the average motivation of applicants attracted. On these theoretical grounds, Heyes (2005) and Barigozzi and Turati (2012) conclude that a pay raise might not be an appropriate solution to the issue of nursing shortage because it can attract the wrong sort of potential applicants.

Unfortunately, this theoretical prediction seems at odds with evidence on how pay affects workers' selection in jobs such as nursing, teaching, politics and, more generally, public sector jobs, where both ability and motivation of workers may matter for quality. Nickell and Quintini (2002) report that the relative pay of many public sector workers in the United Kingdom declined sharply after the mid-1970s. Using general and mathematics tests' score percentile positions as an indicator of workers' ability, they find that men entering public sector occupations such as civil servants, doctors, teachers, and nurses, in the early 1990s had a lower test score position than those entering in the late 1970s. Ferraz and Finan (2009) study salaries of local legislators across Brazil's municipal governments and find that higher wages improve the quality of politicians, as measured by education, type of previous profession, and political experience in office. Gagliarducci and Nannicini (2013) use data on Italian municipal governments from 1993 to 2001 and conclude that higher wage attracts more educated candidates.¹ After observing that regulated pay for nurses is almost flat across the UK, Propper and Van Reenen (2010) show that lower outside wages, i.e., higher relative pay of nursing, attract better nurses and enhance hospital quality as measured by hospital deaths for emergency heart attacks. Dal Bó et al. (2013) focus on a recruitment process for public sector positions in Mexico. They find that higher wages attract more able applicants, as measured by their intelligence quotient, and more motivated applicants, as measured by their proclivity toward public sector work. Remarkably, the second aspect is evidence of advantageous rather than adverse selection effects on motivation.

The inefficiency wage mechanism has been criticized on the basis that nurses' motivation is modeled in an overly simplistic way, its only effect being a reduction of the reservation wage. In particular, the non-technical articles by Nelson and Folbre (2006) and Adams and Nelson (2009) remark that HTBT overlook the so-called motivational crowding-in effect (Frey 1997), i.e., the positive impact of a pay raise on nurses' motivation when the pay raise is perceived as acknowledging nurses' efforts. This is a legitimate criticism, yet focused on the quantity and quality of care supplied by currently existing nurses - the short-run supply of nurses - whereas the result in HTBT relates to the

¹In the political economy literature, an exception is Fisman et al. (2013). Relying on the 2009 base pay harmonization for the Members of the European Parliament (MEPs), they find that the huge pay raise (200% per national delegation on average) lowered the ability of elected MEPs, measured by the selectivity of their undergraduate institutions.

recruitment of future nurses - the long-run supply.

Interestingly, the present analysis shows that the inefficiency wage result can be reversed even when the focus is on the long-run supply. To this aim, an adverse selection framework à la HTBT, rather than a moral hazard one à la Frey, is developed where: (i) the quality of care depends on nurses' ability and motivation; (ii) for any given level of motivation, able potential applicants require a higher reservation wage than non-able ones due to larger opportunity costs; (iii) the effect of pay on motivation holds at the level of the aggregate nursing supply, and not at the level of the individual potential nurse, whose degree of (ability and) motivation is given; in other words, the crowding-in effect is disregarded.

The inefficiency wage mechanism is shown to be driven by the two following intertwined shortcomings. HTBT (i) do not provide a rigorous conceptual definition of nurses' motivation and (ii) disregard the determinants of such motivation. Drawing upon self-determination and person-environment fit theories, this paper aims to fill this twofold gap. Support is provided for the idea that the motivation of potential nurses is mainly a state of autonomous extrinsic motivation, whose main determinant is the compatibility between potential nurses and the mission of hospitals in terms of value congruence. On this ground, the assumption that, for any given level of ability, motivated potential applicants ask for a lower reservation wage than non-motivated ones turns out to be incorrect. As a corollary, setting a relatively high pay can be effective in mitigating the problem of nursing shortage because not only more but also better - more able and more motivated - applicants are attracted: *well-paid* nurses turn out to be *good* nurses. This *efficiency wage* result provides a theoretical rationale for the aforementioned empirical evidence.

In conclusion, it is worth justifying the focus of the present analysis on self-selection rather than moral hazard. Financial incentives to improve quality of care may not only have a positive impact but also a negative one on nurses' motivation, the latter crowding-out effect occurring when incentives are perceived as a means of controlling nurses' efforts; for instance, incentive schemes like pay for performance are believed to crowd out workers' motivation (Frey 1997). Even ignoring motivational issues, financial incentives might not be effective because quality of care is difficult to measure (Carroll 2014) and the correct implementation of incentive schemes is not simple (Maynard and Bloor 2010). Accordingly, attracting able and motivated individuals is extremely important to deliver high care quality.²

The rest of the paper is organized as follows. Section 2 introduces self-determination and person-environment fit theories, applies them to nursing with the aim of investigating the orientation and the determinants of nurses' motivation, and spells out the contribution

²A similar reasoning is developed by Besley (2005: 45) in the context of politics: "[...] political selection is important [...]. If the control of politicians through elections is limited, then improving the quality of government requires an increase in the honesty, integrity or competence of those who are elected."

of the paper to the literature. The theoretical model along with the main findings are laid out in Section 3. Section 4 concludes. Formal proofs of the results are in the Appendix.

2 Nurses' Motivation

Self-determination and person-environment fit theories. Self-determination Theory (SDT) is an influential psychology theory of human motivation (Deci and Ryan 1985). SDT investigates the degree to which an individual's choice to perform an activity is autonomous. More autonomous motivation reflects less external control and more self-determination and implies better quality of engagement. Ryan and Deci (2000) distinguish between *intrinsic motivation* - the most autonomous form of motivation, according to which an activity is done because it is inherently interesting or enjoyable - and *extrinsic motivation* - doing something for some separable consequence. In turn, four different forms of extrinsic motivation exist depending on their degree of autonomy.³

- (i) The least autonomous form is called *external regulation*, i.e., doing something to obtain an externally imposed reward or to satisfy an external demand (e.g., nurses that do their job to get the salary).
- (ii) *Introjected regulation* is more autonomous and refers to activities done to avoid guilt or anxiety or to attain ego-enhancements or pride (e.g., nurses that refrain from shirking to avoid peer pressure in the workplace or enhance self-esteem).
- (iii) In case of *identified or integrated regulation*, an activity is consciously valued by an individual because it helps reaching a "good" goal, good for the society and also for the individual (e.g., nurses that go beyond the call of duty to help people in need). There is just a quantitative difference between identified and integrated regulation, the latter being more autonomous in that the good goal is still a separable consequence but more or fully assimilated to the self.

In light of this categorization, the dichotomous classification of potential nurses into non-motivated and motivated can be described as follows. Non-motivated potential nurses do the bare minimum and can be thought of as being moved only by external regulation. By contrast, motivated potential nurses go beyond the call of duty because they are stimulated by more autonomous forms of motivation. As will be made clear, their motivation is likely to be a state of extrinsic motivation in the form of identified/integrated regulation, rather than pure intrinsic motivation.

To pinpoint the factors that influence the orientation of motivated workers - intrinsic vs. autonomous extrinsic motivation - it is useful to consider SDT and person-environment

³For the sake of precision, the different forms of extrinsic motivation are introduced by a subtheory of SDT, called Organismic Integration Theory.

fit theories together; as argued by Greguras et al. (2014), they have several common key components. Ryan and Deci (2000: 56) state: "Intrinsic motivation exists in the relation between individuals and activities. People are intrinsically motivated for some activities and not others, and not everyone is intrinsically motivated for any particular task." Intrinsic work motivation is thus affected by both workers' and job characteristics (DeVaro and Brookshire 2007). This gives scope to the notion of *person-job fit*, henceforth P-J fit, which is defined as the match between the needs/desires of a person and what is provided by a job (Edwards 1991). The best possible person-job match can be considered the main determinant of intrinsic motivation.

By contrast, in case of identified/integrated regulation, a job is valued by a worker not because it is inherently interesting or enjoyable, rather because it helps satisfying a social value like, e.g., helping people in need; this represents a separable consequence, which has been partially or fully internalized by the worker. In this case, the worker is not stimulated by the enjoyment in doing the work itself, but, rather, by the organizational mission. Consequently, identified/integrated work motivation is affected by *person-organization fit*, henceforth P-O fit, defined as the compatibility between workers and organizations in terms of value congruence (Tom 1971). Lauver and Kristof-Brown (2001: 455) add: "P-O fit pertains to how an individual matches an organization's values, goals, and mission." The idea that the person-organization fit is a crucial determinant of work motivation is not new in economics (Akerlof and Kranton 2005; Tonin 2015). In particular, Besley and Ghatak (2005) show that motivation of workers is positively affected by the extent to which they agree with the organizational mission.

The conceptual difference between P-J fit and P-O fit can be summed up as follows. P-J fit is related to an individual's compatibility with a specific job: the individual loves that job. P-O fit is not necessarily related to a specific job, but, rather, to organizations that match the individual's main social values.

Nurses' Motivation. Ryan and Deci (2000) observe that most of the activities people do after childhood are not intrinsically motivating. This may be particularly true when the activity at stake is the nursing job. For instance, in everyday practice, nurses have to perform several tasks that involve physical proximity and touch, such as (Adams and Nelson, 2009: 12): "piercing skin with needles [...], changing dressings on messy wounds, assisting patients with activities such as eating or toileting, and/or other activities saturated with touch and smell." It is hard to believe that many people would accomplish these tasks out of enjoyment. Motivated nurses are more likely stimulated by some separable, though internalized, consequence (Toode, 2015). This is confirmed by, e.g., Folbre and Nelson (2000: 132), who refer to care workers' motivation as regard for the well-being of care recipients.

Empirical support for this view comes, to a certain extent, from the few existing analyses that measure not only intrinsic but also extrinsic motivation of nurses. Toode et al. (2015) investigate motivation of registered nurses in Estonia through electronically self-reported questionnaire. They find that the three main reasons that motivate registered nurses are, "I enjoy this work very much", "I have fun doing my job", "this job fits my personal values", in descending order; the first two reasons are related to intrinsic motivation, the third one, instead, to identified/integrated regulation. Similar results are found by Battistelli et al. (2013), who investigate a sample of Italian nurses. Interestingly, the youngest generation of nurses in the Estonian sample has the highest scores of compatibility with the organizational values, which is the main determinant of identified/integrated regulation. Overall, both intrinsic motivation and identified/integrated regulation are relevant in this sample, the latter being more relevant for young nurses and probably for future nurses, that are mostly young and whose self-selection choices are the focus of this paper. Using data from Chinese nurses and physicians, van Beek et al. (2012) report that the sample is characterized by moderate intrinsic motivation, while displaying higher scores in identified regulation.

These contributions, mainly focused on registered nurses, support the idea that identified/integrated regulation is a considerable part of nurses' motivation. This is likely to be even more true for young future nurses, as mentioned, and for nursing assistants, whose tasks require lower skills and therefore may be considered hardly interesting or enjoyable.

Contribution to the literature. Bruno Frey was the first scholar to bring SDT into economics. In this process, the terms intrinsic and extrinsic motivation undergo a substantial alteration. Frey (1997: 14) distinguishes activities which individuals do "because they are induced to do so by monetary payment or by command," which he refers to as extrinsically motivated, from activities whose motivations are more autonomous, referred to as intrinsically motivated. In other words, Frey equates extrinsic motivation with external regulation and categorizes intrinsic motivation as the residual set, containing intrinsic motivation in the SDT sense plus introjected, identified, and integrated regulation. Interestingly, HTBT rely on Frey's approach; in particular, Heyes (2005) uses the term "vocation" to define nurses' motivation and takes vocation to be a state of both intrinsic motivation and identified/integrated regulation.⁴ Frey's alternative categorization perfectly fits his purpose to investigate the behavioral effect of external regulation on workers' autonomous motivation, the aforementioned crowding-in and crowding-out effects. Nevertheless, Frey (1997: 14) acknowledges that his approach is looser than that of SDT: "It may well be

⁴Heyes (2005: 561-562) first defines persons with a vocation for nursing as those doing the job "because they like doing it". This is a state of intrinsic motivation. He then quotes the Longman's Dictionary definition, according to which vocation is "a job you do because you have a strong feeling that doing this job is a purpose of your life, especially because you want to help other people." This is a state of identified/integrated regulation because "helping other people" is a separable, though internalized, consequence.

that the precise distinction (between intrinsic and extrinsic motivation) is important for psychology."

This paper adds that a rigorous distinction is also important for the study of self-selection into nursing. The reason is as follows. When motivation of potential nurses is taken to be mainly intrinsic in the SDT sense, an inefficiency wage mechanism à la HTBT arises. By contrast, the present analysis finds the opposite result because motivation of potential nurses is mainly considered a state of identified/integrated regulation.

To see this point, suppose for a moment that motivated potential applicants are stimulated by intrinsic motivation in the SDT sense. As discussed above, individuals find nursing inherently interesting or enjoyable when they perceive the best possible match between their psychological needs and the nursing job. By definition, such match is necessarily worse when they dedicate to a different job. In other words, an individual can be intrinsically motivated for only one sort of work; this idea is supported by the literature (see, e.g., the discussion on caring relationships and the market in Bruni and Sugden 2008 and Nelson 2009). From a modelling point of view, this amounts to assume that the non-pecuniary premium enjoyed by motivated potential applicants when they enter nursing is larger than that enjoyed when they choose an alternative job. The inefficiency wage result follows because, *ceteris paribus*, motivated individuals ask for a lower reservation wage than non-motivated ones, who get zero premium both from nursing and the alternative job.

By contrast, and unlike previous contributions, the present paper draws a clear line between intrinsic motivation and identified/integrated regulation and between the different determinants of these two types of motivations. Doing so, it provides support for the idea that motivated potential nurses are characterized by identified/integrated regulation, whose source is P-O fit, rather than intrinsic motivation, whose source is P-J fit. In other words, motivated potential nurses value the nursing job not only because they like it intrinsically, but especially because they can work in a hospital which matches their social value of helping people in need. If this is the case, motivated potential nurses could seek a different career in an alternative organization which enables them to help people in need. Possible examples are: social worker (e.g., personnel manager in a work integration social enterprise), school counselor, substance abuse counselor, adult literacy teacher, etc. The idea that potential caregivers may be motivated for a number of types of work is supported by, e.g., Nelson (2009). As a result, the motivational premium enjoyed when the outside job option is chosen is non-lower than the nursing motivational premium, with the effect that, for any given level of ability, motivated potential applicants require a *non-lower* reservation wage than non-motivated ones; the best, both able and motivated, potential nurses are attracted only when a relatively high pay is offered. This efficiency wage result is the novel contribution of the present paper.

3 The Setup

Consider a nursing market where potential applicants are endowed with two dichotomous characteristics: ability, whose level is measured by parameter $\alpha_i \in \{\alpha_L, \alpha_H\}$, with $\alpha_H > \alpha_L > 0$, and motivation, whose level is represented by parameter $\mu_j \in \{\mu_l, \mu_h\}$, with $\mu_h > \mu_l > 0$. The following four types of individuals thus exist: type- Hh , endowed with parameters α_H and μ_h and referred to as able and motivated; type- Hl , able and non-motivated; type- Lh , non-able and motivated; type- Ll , non-able and non-motivated. The proportion of type- ij individuals in the economy is $\sigma_{ij} > 0$, with $ij = \{L, H\} \times \{l, h\}$ and $\sum_{ij} \sigma_{ij} = 1$.

The following two-period model is investigated.

- Before the first period, Nature determines the types of individuals. Each individual privately observes her/his own type.
- In the first period, all individuals decide whether to work as a nurse or to choose an alternative job in a different labor market, after observing the level of nursing wage, $w \geq 0$, and the level of the outside job wage, $w_O \geq 0$.
- In the second period, each nurse selects an effort level e to provide the care service. Similarly, each individual opting for the outside option exerts an effort level a to accomplish the job.

3.1 The Second-period Optimal Effort Levels

This subsection calculates the effort levels e and a chosen by individuals in the second period.

First, suppose that a type- ij individual decided to work as a nurse in the first period. In this case, her/his utility function takes the following form:

$$w + \mu_j f(e) - c(e, \alpha_i). \quad (1)$$

The nursing wage w is assumed to be independent of the individuals' type because the type is private information. Function $f(e)$, $f' > 0 > f''$, denotes the observable but non-contractible quality of care as a function of the effort exerted. The motivation parameter μ_j measures how much nurses are concerned with quality of care; since $\mu_h > \mu_l$ motivated nurses are more concerned and go beyond the call of duty, while non-motivated nurses do the bare minimum. Finally, $c(e, \alpha_i)$ is the effort disutility function, with $c_e > 0$ and $c_{ee} > 0$ denoting first and second derivatives with respect to e ; higher ability is hypothesized to reduce both the effort disutility and the marginal effort disutility, in symbols, $c(e, \alpha_H) < c(e, \alpha_L)$ and $c_e(e, \alpha_H) < c_e(e, \alpha_L)$, for any given e .

Each nurse selects e to maximize the utility function (1). Solving the first order condition (FOC) $\mu_j f'(e) - c_e(e, \alpha_i) = 0$ by e yields the optimal effort levels e_{ij}^* , which

are assumed to be positive and finite. Applying the implicit function theorem to FOC yields $\frac{\partial e}{\partial \mu} = -\frac{f'}{\mu_j f'' - c_{ee}}$ and $\frac{\partial e}{\partial \alpha} = \frac{c_{e\alpha}}{\mu_j f'' - c_{ee}}$. These two expressions are strictly positive by assumption. Accordingly, for any given ability level, motivated nurses exert higher optimal effort than non-motivated colleagues, $e_{ih}^* > e_{il}^* (> 0)$, because they care more about quality of care. Similarly, for any given motivation level, able nurses exert higher optimal effort than non-able nurses, $e_{Hj}^* > e_{Lj}^* (> 0)$, because they incur less effort disutility.

Overall, the lowest (highest) quality of care is provided by non-able and non-motivated (able and motivated) nurses, while the intermediate levels are offered by able and non-motivated and non-able and motivated nurses. In symbols,

$$\begin{aligned} f(e_{Ll}^*) < f(e_{Lh}^*) < f(e_{Hl}^*) < f(e_{Hh}^*) & \text{ when } f(e_{Lh}^*) < f(e_{Hl}^*), & (a) \\ f(e_{Ll}^*) < f(e_{Hl}^*) < f(e_{Lh}^*) < f(e_{Hh}^*) & \text{ when } f(e_{Hl}^*) < f(e_{Lh}^*). & (b) \end{aligned} \quad (2)$$

Let $U_{ij} = \mu_j f(e_{ij}^*) - c(e_{ij}^*, \alpha_i) > 0$ denotes a type- ij nurse optimal utility net of wage w . For any given level of ability, U_{ij} is increasing in motivation, i.e., $U_{ih} - U_{il} > 0$. Indeed, inequality $\mu_h f(e_{ih}^*) - c(e_{ih}^*, \alpha_i) > \mu_h f(e_{il}^*) - c(e_{il}^*, \alpha_i)$ holds true by definition of (unique) optimal effort and inequality $\mu_h f(e_{il}^*) - c(e_{il}^*, \alpha_i) > \mu_l f(e_{il}^*) - c(e_{il}^*, \alpha_i)$ holds true because $\mu_h > \mu_l$. The difference $U_{ih} - U_{il}$ is referred to as the nursing motivational premium, for any given level of ability, due to greater concern for quality. A similar argument can be invoked to show that, for any given level of motivation, U_{ij} is increasing in ability, i.e., $U_{Hj} - U_{Lj} > 0$. This positive difference is referred to as the nursing ability premium, for any given level of motivation, due to lower effort disutility.

Alternatively, suppose a type- ij individual opted for the outside job in the first period, in which case her/his utility function takes the following form:

$$w_O + \mu_j g(a) - s(a, \alpha_i). \quad (3)$$

Consistently with the above notation, the outside job wage w_O is independent of the individuals' type; $g(a)$, $g' > 0 > g''$, denotes the observable but non-contractible quality of the outside job output as a function of the effort exerted; the motivation parameter μ_j measures how much individuals care about the quality of output; finally, $s(a, \alpha_i)$ is the effort disutility function, with $s_a > 0$, $s_{aa} > 0$, and, for any given a , $s(a, \alpha_H) < s(a, \alpha_L)$ and $s_a(e, \alpha_H) < s_a(e, \alpha_L)$.

Individuals who opted for the outside option selects a to maximize the utility function (3). Solving the first order condition (FOC) $\mu_j g'(a) - s_a(a, \alpha_i) = 0$ by a yields the optimal effort levels a_{ij}^* , which are assumed to be positive and finite. As above, one can easily check that both ability and motivation impact positively on a_{ij}^* . In symbols, the outside job output quality ranking is

$$g(a_{Ll}^*) < \min \{g(a_{Hl}^*), g(a_{Lh}^*)\} < \max \{g(a_{Hl}^*), g(a_{Lh}^*)\} < g(a_{Hh}^*). \quad (4)$$

Denoting with $V_{ij} = \mu_j g(a_{ij}^*) - s(a_{ij}^*, \alpha_i)$ a type- ij worker optimal utility net of wage w_O , one can easily check that $V_{ih} - V_{il} > 0$ and $V_{Hj} - V_{Lj} > 0$, which are referred to as

the outside motivational premium, for any given level of ability, and the outside ability premium, for any given level of motivation.

3.2 The Reservation Wage

In this subsection, the attention is turned to the first-period choice between the nursing career and the outside job option. Such a choice is driven by the nursing reservation wage, defined as the nursing wage level for which individuals are indifferent as to whether to accept the nursing job or the outside option. To calculate the values of type- ij individuals' reservation wages, denoted by \underline{w}_{ij} , it is sufficient to solve equality (1) = (3) at the optimum by w :

$$\underline{w}_{ij} = w_O + V_{ij} - U_{ij}. \quad (5)$$

By definition of reservation wage, a type- ij individual chooses either nursing if $w \geq \underline{w}_{ij}$ or the alternative job if $w < \underline{w}_{ij}$. Note that the reservation wages are increasing in the outside job optimal utility, $w_O + V_{ij}$, which represents the opportunity cost of becoming a nurse, and decreasing in the nursing optimal utility net of wage w , U_{ij} , that mitigates the opportunity cost of becoming a nurse.

To rank the reservation wages of the four types of potential applicants, the impact of both ability and motivation is specified as follows. First, the reservation wages are supposed to be an increasing function of individuals' ability, for any given level of motivation. This is a standard assumption in the literature on selection into labor markets (e.g., Malcomson 1981) and, more specifically, in the case of nursing market (Barigozzi and Turati 2012). The usual justification is that more able individuals generally incur larger opportunity costs. In symbols,

$$\underline{w}_{Hj} > \underline{w}_{Lj}, \quad (6)$$

which in the current framework is equivalent to $V_{Hj} - V_{Lj} > U_{Hj} - U_{Lj}$. This inequality states that, for any given level of motivation, the outside ability premium, $V_{Hj} - V_{Lj}$, is larger than the nursing ability premium, $U_{Hj} - U_{Lj}$.

Second, the impact of motivation on the reservation wages is assumed to be non-negative. This hypothesis is based on the analysis of nurses' motivation in Section 2. Type- ih potential nurses go beyond the call of duty because they have extrinsic motivation in the form of identified/integrated regulation, i.e., they value the nursing job especially because they can work in a hospital which matches their social value of helping people in need. Accordingly, the outside motivational premium is not lower than the nursing motivational premium, as long as the alternative job in a different organization enables motivated individuals to help people in need. In symbols, $V_{ih} - V_{il} \geq U_{ih} - U_{il}$. As a result, for any given level of ability, motivated potential nurses have a non-lower reservation wage

than non-motivated potential colleagues,

$$\underline{w}_{ih} \geq \underline{w}_{il}. \quad (7)$$

On the grounds of (6) and (7), non-able and non-motivated individuals ask for the lowest reservation wage, while able and motivated individuals demand the highest reservation wage. The overall ranking of the reservation wages is as follows:

$$\begin{aligned} \underline{w}_{Ll} \leq \underline{w}_{Lh} < \underline{w}_{Hl} \leq \underline{w}_{Hh} & \quad \text{when } \underline{w}_{Lh} < \underline{w}_{Hl} & (a) \\ \underline{w}_{Ll} < \underline{w}_{Hl} < \underline{w}_{Lh} < \underline{w}_{Hh} & \quad \text{when } \underline{w}_{Hl} < \underline{w}_{Lh} & (b) \end{aligned} \quad (8)$$

3.3 The Quality of Nursing Care

The last step of the analysis consists of studying how the level of w , set in the first period, affects the average quality of care provided by applicants attracted through their self-selection choices. Since the aim is to provide a comparative statics analysis, rather than to investigate how the level of w is selected, introducing a wage-maker agent is not necessary. Yet, one might think of a public supplier of health care that is not subject to a binding budget constraint and sets w to maximize the quality of care.

To streamline the exposition, the reservation wages are arranged in ascending order and the equality conditions in (8-*a*) are disregarded, so that (8) can be rewritten as

$$\underline{w}_1 = \underline{w}_{Ll} < \underline{w}_2 = \min\{\underline{w}_{Lh}, \underline{w}_{Hl}\} < \underline{w}_3 = \max\{\underline{w}_{Lh}, \underline{w}_{Hl}\} < \underline{w}_4 = \underline{w}_{Hh}. \quad (9)$$

In other words, w_n , $n = 1, 2, 3, 4$, denotes the reservation wage asked for by the n -th “cheapest” potential applicants, which are referred to as type- n potential applicants. In addition, the optimal levels of care quality are rewritten as

$$f_1 = f(e_{Ll}^*), f_2 = \min\{f(e_{Lh}^*), f(e_{Hl}^*)\}, f_3 = \max\{f(e_{Lh}^*), f(e_{Hl}^*)\}, f_4 = f(e_{Hh}^*), \quad (10)$$

so that f_n denotes the quality of care provided by the n -th cheapest nurses. Finally, the trivial case where no individual chooses nursing as a career is disregarded, that is, the focus is on interval $w \geq \max\{0, \underline{w}_1\}$; at the same time, \underline{w}_2 is supposed to be strictly positive to have a comprehensive analysis.

Before proceeding, it is useful to recall that two alternative orderings of both the quality of care and the reservation wages may arise according to (2) and (8); four different combinations must therefore be taken into account. More precisely, when the orderings are given either by (2-*a*) and (8-*a*) or by (2-*b*) and (8-*b*), less and less cheap potential applicants (i.e., those requiring an increasing minimum wage to enter nursing) ensure better and better quality of care. In symbols,

$$f_1 < f_2 < f_3 < f_4. \quad (11)$$

By contrast, when the orderings are given either by (2-a) and (8-b) or by (2-b) and (8-a), the second cheapest potential applicants, type-2, offer higher quality of care than the third cheapest ones, type-3,

$$f_1 < f_3 < f_2 < f_4. \quad (12)$$

The two alternative rankings of care quality, (11) and (12), are summed up in Table III and referred to as Scenario (i) and (ii).

[Table III here]

Given the above premises, potential applicants' self-selection choices as a function of the nursing wage level w are characterized as follows.

1. If $\max\{0, \underline{w}_1\} \leq w < \underline{w}_2$, only type-1 - the cheapest - individuals enter the nursing market. As a result, the level of quality of care is

$$E_1(f) = f_1. \quad (13)$$

2. If $\underline{w}_2 \leq w < \underline{w}_3$ type-1 and type-2 individuals choose nursing. The average level of quality of care is

$$E_2(f) = \frac{\sigma_1}{\sigma_1 + \sigma_2} f_1 + \frac{\sigma_2}{\sigma_1 + \sigma_2} f_2, \quad (14)$$

where $\frac{\sigma_1}{\sigma_1 + \sigma_2}$ ($\frac{\sigma_2}{\sigma_1 + \sigma_2}$) is the positive proportion of type-1 (type-2) applicants attracted.

3. If $\underline{w}_3 \leq w < \underline{w}_4$ type-1, -2, and -3 individuals, i.e., all potential applicants but the most expensive ones, choose nursing. The average level of quality of care is

$$E_3(f) = \frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3} f_1 + \frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3} f_2 + \frac{\sigma_3}{\sigma_1 + \sigma_2 + \sigma_3} f_3, \quad (15)$$

where $\frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3}$, $\frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}$, and $\frac{\sigma_3}{\sigma_1 + \sigma_2 + \sigma_3}$ are the positive proportions of type-1, type-2, and type-3 applicants attracted.

4. Finally, if $w \geq \underline{w}_4$ also type-4 - the most expensive - individuals are attracted to nursing. All individuals choose the nursing job and the average level of quality of care is

$$E_4(f) = \sigma_1 f_1 + \sigma_2 f_2 + \sigma_3 f_3 + \sigma_4 f_4, \quad (16)$$

where $\sigma_1, \sigma_2, \sigma_3, \sigma_4$ are the positive proportions of type-1, type-2, type-3, and type-4 applicants attracted.

First note that more applicants are attracted as w rises, i.e., the long-run supply of nurses increases with the wage. As for the quality of care, an interesting result arises. The scenarios of Table III have two common features. (i) f_1 is the minimum level of care quality. This means that the cheapest potential applicants are the “worst” ones. As a

result, the quality of care is at its minimum when the nursing wage w is minimum, i.e., such that only the cheapest individuals are attracted, $\{0, \underline{w}_1\} \leq w < \underline{w}_2$. (ii) f_4 is the maximum level of care quality. This means that the most expensive potential applicants are the “best” ones. As shown in Appendix A.1, this implies that $E_4(f)$ is the maximum average level of care quality. One can conclude that the average quality of care is at its maximum when the nursing wage w is maximum, i.e., such that all potential applicants choose nursing; in symbols, when $w \geq \underline{w}_4$. The above findings are summarized in the following Proposition.

Proposition 1 (a) *The long-run supply of nurses is increasing in the wage.* (b) *The average quality of care provided by applicants attracted is at its minimum when the nursing wage is minimum, i.e., such that only the cheapest individuals enter nursing.* (c) *The average quality of care is at its maximum when the nursing wage is maximum, i.e., such that all individuals enter nursing.*

Another interesting result stems from the above analysis. Appendix A.2 shows that the average quality of care provided by applicants attracted is monotonically increasing in the nursing wage w , i.e., $E_n(f) < E_{n+1}(f)$ for any $n = 1, 2, 3$, if and only if

$$E_n(f) < f_{n+1}. \quad (17)$$

Taking into account that $E_n(f)$ is a strictly convex combination of values f_n , condition (17) has an intuitive explanation. The average quality of care increases with the nursing wage if and only if the quality of care provided by the new type of potential applicants entering as w rises, f_{n+1} , is higher than the average quality of care before their entry, $E_n(f)$. Inequality (17) is fulfilled when (11) holds true, i.e., when better and better individuals enter nursing as the wage w rises. This means that the average quality of care is monotonically increasing in the nursing wage w under Scenario (i).

Under Scenario (ii), by contrast, the monotonic positive effect of w on the average quality occurs only when $E_2(f) < E_3(f)$ or, equivalently,

$$\frac{\sigma_1}{\sigma_1 + \sigma_2} f_1 + \frac{\sigma_2}{\sigma_1 + \sigma_2} f_2 < f_3. \quad (18)$$

Given (12), this inequality is fulfilled when $\frac{\sigma_2}{\sigma_1 + \sigma_2}$, the proportion of type-2 nurses in case only type-1 and type-2 individuals are attracted, is relatively low, so that the LHS of (18) is relatively close to f_1 . Recalling from (9) that type 1 is Ll , while type 2 can be either Lh (in which case type 3 is Hl) or type Hl (in which case type 3 are Lh), inequality (18) can be rearranged as

$$\frac{\sigma_{Lh}}{\sigma_{Ll}} < \frac{f_{Hl} - f_{Ll}}{f_{Lh} - f_{Hl}} \text{ or } \frac{\sigma_{Hl}}{\sigma_{Ll}} < \frac{f_{Lh} - f_{Ll}}{f_{Hl} - f_{Lh}}. \quad (19)$$

In turn, conditions (19) are more likely to be fulfilled when $\frac{\sigma_{Lh}}{\sigma_{Ll}}$ and $\frac{\sigma_{Hl}}{\sigma_{Ll}}$, are relatively low, i.e., when few motivated and many non-motivated individuals are present in the subset of

non-able potential applicants - $\sigma_{Lh} < \sigma_{Ll}$ - and few able and many non-able individuals are present in the subset of non-motivated potential applicants - $\sigma_{HI} < \sigma_{LI}$. This amounts to say that a positive statistical association between ability and motivation is required, with the effect that a non-able individual is likely to be non-motivated and viceversa. Interestingly, this is the finding of Dal Bó et al. (2013), one of the few papers providing an empirical measure of the correlation between ability and motivation of workers.

The above findings are summarized in the following Proposition.

Proposition 2 *The average quality of care provided by applicants attracted is: (a) monotonically increasing in the nursing wage w under Scenario (i) of Table III; (b) monotonically increasing under Scenario (ii) when (18) is fulfilled; (c) increasing (but not monotonically) under Scenario (ii) when (18) is not fulfilled.*

In conclusion, two figures based on a Cartesian plane are provided to illustrate the results of Propositions 1 and 2. The nursing wage w is on the horizontal axis and the average quality of care $E_n(f)$ is on the vertical axis. Figure 1 describes Scenario (i); Figure 2 describes Scenarios (ii). For ease of exposition, but without loss of generality, \underline{w}_1 is set equal to zero.

[Figure 1 here]

First, note that in both figures $E_1(f)$ is the minimum average level of care quality, while $E_4(f)$ is the maximum one, as stated in Proposition 1. Second, Figure 1 shows that the impact of wage on the average quality of care is monotonically positive; Figure 2, instead, shows that such effect can be either monotonically positive (solid line) or positive but not monotonically (dotted line), as stated in Proposition 2.

[Figure 2 here]

4 Conclusion

Health economists are paying growing attention to the study of nursing labor markets where the quality of care provided by potential applicants is affected not only by ability but also by motivation. The existing theoretical contributions have pointed out an inefficiency wage mechanism, according to which the pay level may impact negatively on the average ability and motivation of applicants. These predictions are at odds with recent empirical evidence on the relationship between pay level and workers' selection in nursing and other public sector occupations where both ability and motivation matter for quality of care. In addition, the inefficiency wage result has been criticized on the grounds that nurses' motivation is modeled in an overly simplistic way.

The present paper has deepened the analysis of nurses' motivation by showing that motivated potential nurses are likely to feel extrinsic motivation in the form of identified/integrated regulation. On this basis, a relatively high pay has been shown to attract not only more but also better - more able and more motivated - applicants. This finding reconciles the previous theoretical contributions with empirical evidence.

A Appendix

A.1 Proposition 1

To prove that $E_4(f)$ is the maximum average level of care quality, one has to check that:

(i) $E_1(f) < E_4(f)$; (ii) $E_2(f) < E_4(f)$; (iii) $E_3(f) < E_4(f)$.

(i) $E_1(f) < E_4(f)$ is obviously fulfilled since $E_1(f) = f_1 < \min\{f_2, f_3, f_4\}$, while $E_4(f)$ is a strictly convex combination of f_1, f_2, f_3 , and f_4 .

(ii) $E_2(f) < E_4(f)$ can be rearranged as

$$f_4 > \left[1 - \frac{\sigma_2(\sigma_3 + \sigma_4)}{\sigma_4(\sigma_1 + \sigma_2)}\right] f_1 + \frac{\sigma_2(\sigma_3 + \sigma_4)}{\sigma_4(\sigma_1 + \sigma_2)} f_2 + \frac{\sigma_3}{\sigma_4} (f_1 - f_3). \quad (20)$$

The above inequality is fulfilled by virtue of (11) and (12). Indeed, f_4 is larger than both f_1 and f_2 , hence it is also larger than the LHS of (20), which is given by a strictly convex combination of f_1 and f_2 - the first two terms - plus a negative term.

(iii) $E_3(f) < E_4(f)$ is equivalent to $E_3(f) < f_4$. Indeed,

$$\frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3} f_1 + \frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3} f_2 + \left(1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}\right) f_3 < \quad (21)$$

$$\sigma_1 f_1 + \sigma_2 f_2 + \sigma_3 f_3 + (1 - \sigma_1 - \sigma_2 - \sigma_3) f_4 \Leftrightarrow \quad (22)$$

$$\frac{\frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3} - \sigma_1}{1 - \sigma_1 - \sigma_2 - \sigma_3} f_1 + \frac{\frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3} - \sigma_2}{1 - \sigma_1 - \sigma_2 - \sigma_3} f_2 + \frac{1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3} - \sigma_3}{1 - \sigma_1 - \sigma_2 - \sigma_3} f_3 < f_4 \Leftrightarrow \quad (23)$$

$$\frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3} f_1 + \frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3} f_2 + \left(1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}\right) f_3 < f_4 \Leftrightarrow E_3(f) < f_4. \quad (24)$$

Note that $E_3(f) < f_4$ is fulfilled since $E_3(f)$ is a strictly convex combination of f_1, f_2 , and f_3 ; these three values are all lower than f_4 by virtue of (11) and (12).

A.2 Proposition 2

The equivalence $E_3(f) < E_4(f) \Leftrightarrow E_3(f) < f_4$, which we prove in Appendix A.1, can be easily generalized to show that $E_n(f) < E_{n+1}(f)$ is equivalent to $E_n(f) < f_{n+1}$ for any given $n = 1, 2, 3$.

First one can check that $E_1(f) = f_1 < E_2(f)$ is equivalent to $E_1(f) < f_2$:

$$f_1 < \frac{\sigma_1}{\sigma_1 + \sigma_2} f_1 + \left(1 - \frac{\sigma_1}{\sigma_1 + \sigma_2}\right) f_2 \Leftrightarrow f_1 < f_2 \Leftrightarrow E_1(f) < f_2. \quad (25)$$

Similarly, $E_2(f) < E_3(f)$ is equivalent to $E_2(f) < f_3$:

$$\frac{\sigma_1}{\sigma_1 + \sigma_2} f_1 + \left(1 - \frac{\sigma_1}{\sigma_1 + \sigma_2}\right) f_2 < \frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3} f_1 + \frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3} f_2 + \left(1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}\right) f_3 \Leftrightarrow \quad (26)$$

$$\left(\frac{\sigma_1}{\sigma_1 + \sigma_2} - \frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3}\right) f_1 + \left(1 - \frac{\sigma_1}{\sigma_1 + \sigma_2} - \frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}\right) f_2 < \left(1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}\right) f_3 \Leftrightarrow \quad (27)$$

$$\frac{\frac{\sigma_1}{\sigma_1 + \sigma_2} - \frac{\sigma_1}{\sigma_1 + \sigma_2 + \sigma_3}}{1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}} f_1 + \frac{1 - \frac{\sigma_1}{\sigma_1 + \sigma_2} - \frac{\sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}}{1 - \frac{\sigma_1 + \sigma_2}{\sigma_1 + \sigma_2 + \sigma_3}} f_2 < f_3 \Leftrightarrow \quad (28)$$

$$\frac{\sigma_1}{\sigma_1 + \sigma_2} f_1 + \left(1 - \frac{\sigma_1}{\sigma_1 + \sigma_2}\right) f_2 < f_3 \Leftrightarrow E_2(f) < f_3. \quad (29)$$

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TABLES

TABLE I. PROJECTED NUMBER OF JOB OPENINGS IN NURSING DUE TO GROWTH AND REPLACEMENT NEEDS, 2012 AND PROJECTED 2022, US (Source: the US Department of Labor, Bureau of Labor Statistics)

	Job openings due to growth and replacement needs (2012-2022)
Registered nurses	1,052,600
Nursing assistants	593,600

TABLE II. PROJECTED NUMBER OF JOB OPENINGS IN NURSING AND CAREGIVING DUE TO GROWTH AND REPLACEMENT NEEDS, 2011 AND PROJECTED 2016, ITALY (Source: ISFOL, Istituto per lo sviluppo della formazione professionale dei lavoratori)

	Job openings due to growth and replacement needs (2011-2016)
Nurses (Tecnici della salute)	100,056
Caregivers (Professioni qualificate nei servizi personali ed assimilati)	439,747

TABLE III: ORDERINGS OF CARE QUALITY

Quality of care	Scenarios
$f_1 < f_2 < f_3 < f_4$	Scenario (i)
$f_1 < f_3 < f_2 < f_4$	Scenario (ii)

FIGURES

FIGURE 1: NURSING WAGE AND QUALITY OF CARE I

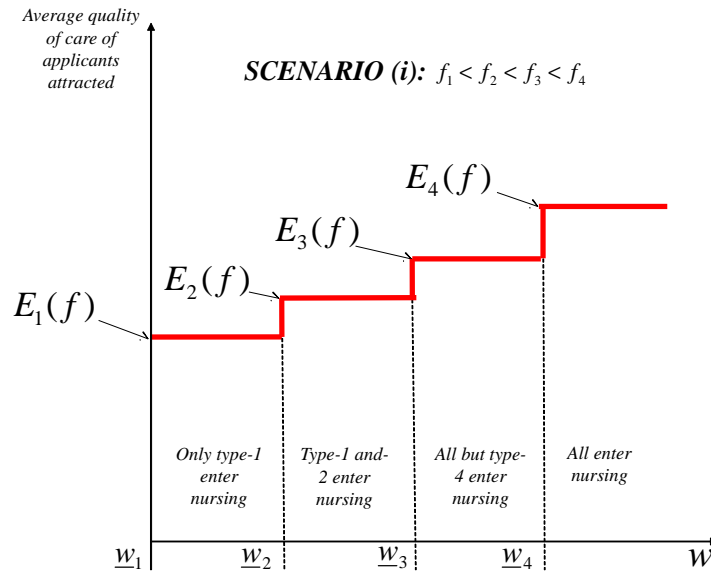


FIGURE 2: NURSING WAGE AND QUALITY OF CARE II

