Is Personality Related to the Risk of Technology-Induced Job Loss?

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Automation and robotization is likely to reduce the need for specific job tasks and displace substantial shares of current occupations. To minimize the negative impact of automation on the labour markets, it is important to identify who works in the occupations that will most likely be affected. Most existing research has focused on factors such as formal competences, educational and current work. It is important to consider other individual traits that may have social and health related consequences, and which may help our understanding of the likely economic and labour market implications of automation. We know less about how personality traits relate to technologically induced job loss risk, for example. Understanding this relationship is important for developing more appropriate policies and initiatives for how individuals can adapt in terms of retraining or finding other jobs, which in turn may reduce the risks of financial hardship and adverse health impacts. To do this, we combine data on personality from a large-scale Norwegian health survey (HUNT) with register-based information on occupations. Our findings show that individuals low in extraversion and high in neuroticism are more likely to have jobs that are in risk of disappearing due to robotization. The neuroticism effect is partially, but not fully, explained by the fact that neuroticism is also correlated with low levels of education.

Job loss risk and technological change

Automation and technology induced job loss risks are substantial and can substantially upend labour demand in the years ahead. It is likely to affect low-skilled and routine workers disproportionately; jobs that involve repetitive, routine tasks are more prone to automation (Acemoglu and Restrepo 2018, Lewandowski, Park et al. 2022). These can span both blue-collar jobs, like assembly-line workers, and white-collar jobs, such as data entry clerks or basic customer service roles. New technologies, especially robotics and artificial intelligence, can handle repetitive routine-based tasks with efficiency and consistency, often at lower costs.

Many industry jobs especially lower-level jobs in manufacturing and assembly line work, and clerical jobs, like secretaries, accountants and administrative assistants, fall under this category. Advanced robotics and AI-driven software can perform also complex tasks that were previously seen as likely to remain the domain of human workers. Examples include collaborative robots in factories and digital assistants that can schedule appointments, set up contracts, analyse X-ray images or set up budgets. This includes certain roles in finance, such as stock trading, and even aspects of healthcare, like radiology. Having said this, job loss risk is greater for those who are already financially and in terms of health more vulnerable (Bratsberg, Rogeberg et al. 2021).

Occupations more threatened by technological change

Workers in occupations where a higher share of tasks that can be performed by robots or technology face a higher risk of losing their jobs (Frank, Autor et al. 2019). In their "task model", Autor et al. (Autor, Levy et al. 2003) distinguish labour inputs into routine and non-routine workers, where the latter is less likely to be automized. Non-routine tasks are likely to have a lower probability of automation, especially when they require higher levels of creativity, manual dexterity or social intelligence (David, Dorn et al. 2017). The Routine Task Intensity (RTI) index can serve as a barometer for the susceptibility of specific occupations to automation, outsourcing and lower labour demand. Derived from a combination of job characteristics, the RTI index is an amalgamation of scores from both the routine cognitive and manual task scales, with scores from three non-routine task scales (manual, analytical, and interpersonal) subtracted. In essence, the RTI encapsulates the dominance of routine, potentially automatable, tasks

within a particular occupation. For ease of interpretation and inter-study comparisons, the scores have been standardized. The lower the RTI score, the more an occupation is tilted towards cognitively demanding, problem-solving non-routine tasks. Occupations with a reduced RTI are less prone to obsolescence and encompass a higher content of tasks requiring intricate cognitive skills. Furthermore, the RTI score's implications extend beyond mere occupational stability. Research indicates that professions with a higher RTI, symbolizing a predominance of routine tasks, correlate with shorter lifespans, earlier retirements and greater risk of job loss (Bratsberg, Rogeberg et al. 2021). Conversely, occupations with a lower RTI, indicating more complex cognitive requirements, can be viewed as cognitive stimuli, which may influence health outcomes positively.

Personality and risk of job loss

Personality traits have wide-ranging consequences for individual lives, including affecting their mental and somatic health and lifestyles (Allen and Walter 2018, Luchetti, Sutin et al. 2018, Turiano, Hill et al. 2018), whether they partner and have children (Jokela, Alvergne et al. 2011, Skirbekk and Blekesaune 2013), as well as their education and economic outcomes (Komarraju, Karau et al. 2011, Spurk and Abele 2011). The effect of personality on wages can be heterogeneous across occupations (Nandi and Nicoletti 2014), which may suggest that there is some occupational sorting according to personality. To the extent that individuals tend to choose jobs that match their personalities (Roberts et al. 2007), and a good match helps keeping the job (McCarthy et al. 2022), it is reasonable to assume that there are individual differences in terms of risk of job loss.

Looking from the demand side of the labour market, a very recent study shows that employers value personality as much as educational qualifications judging from the similar number of jobs ads that make references to each of those characteristics (Brenčič and McGee 2023).

We use measures of two central personality measures: Neuroticism and Extroversion. "Neuroticism is one of the most widely studied traits in the entire field of psychology" (Caspi et al. 2005, p. 457). The importance of Neuroticism and Extraversion in predicting work-behaviour is well-established (Clark and DeYoung 2014, Tackett and Lahey 2017, Ward, Graham et al. 2018, Furnham 2012), and some argue that Neuroticism is likely to be the most powerful Big-Five personality trait predictor of work success (Cheng and Furnham 2012) – and mental well-being (Turiano, Hill et al. 2018). Neuroticism is the opposite of emotional stability. High scorers tend to be anxious, vulnerable to stress, guilt-prone, lacking in confidence, moody, angry, easily frustrated, and insecure in relationships (Caspi et al. 2005). Extraversion is mainly characterised by sociability, along with three other order low order traits: social inhibition or shyness, dominance, and energy/activity level (Caspi et al. 2005). Extraverts tend to be sociable, talkative and assertive as opposed to reserved and quiet.

Personality traits and occupations

One literature review, based on 97 published meta-analyses reporting relations of extraversion to 165 distinct work relevant variables, finds that across four career domains—education, job application, on the job outcomes, and career development —and five conceptual categories: motivations, values, and interests; attitudes and well-being; interpersonal relations; job performance; and counterproductivity, extraversion shows effects in a desirable direction for 90% of the outcomes (Wilmot, Wanberg et al. 2019). Since extraverts often seek novel social stimuli and excitement, Extraversion can be negatively correlated to tolerance to routine tasks because extraverts may get bored with these kinds of tasks (Furnham 2012). Therefore, it could be reasonable to expect to find fewer extraverts in occupations where the routine task intensity, and consequently the risk of job loss, are high.

Conversely, as low autonomy is one of the facets of Neuroticism, it is likely that a more emotionally instable individual, who has more conventional interests, i.e., "prefers structured verbal and numerical activities and subordinate roles; is conforming; (...) is effective in well-structured tasks; (...) Bank tellers, secretaries, bookkeepers and file clerks resemble this type" (Holland 1963, p. 549). In other words, it is likely for a more emotionally instable individual to prefer routine and predictability in her/his job.

A quantitative review of meta-analytic studies on personality and job performance by Barrick et al. 2001 finds that Neuroticism can be a generalizable predictor of overall performance. Low Neuroticism is associated with several leadership and managerial skills, such as resilience under pressure (Pendleton et al., 2021). Conversely, an emotionally instable individual would be a particularly poor choice for a managing director operating high stakes

operation or as an air traffic controller position in a busy airport, for example. It has indeed been shown that effect of personality traits on pay vary by occupation. Individuals who score higher on Neuroticism earn less in all occupations, but especially those in personal service, sales and customer service (Nandi and Nicoletti 2014) – suggesting that is a particularly poor match, and one could expect relatively fewer individuals scoring high on Neuroticism in those occupations.

Unlike Neuroticism, Extraversion tends to benefit job performance – and extraverts tend to be particularly successful in jobs that demand interpersonal skills (including both training and mentoring) (Barrick et al. 2001). Extraverts tend to have more enterprising and social interests (Ackerman and Heggestad 1997, Larson et al. 2002) i.e. they have verbal and interpersonal skills for leading other people. "Salesmen, politicians, managers, promoters and business executives resemble this type" (Holland 1963, p. 549). Therefore, it could be reasonable to assume that extraverts are less likely to choose high routine jobs. Extraversion is also negatively correlated with risk aversion i.e., due to their excitement-seeking behaviour extraverts are more willing to take risks, which in turn can be associated with education and occupational choice. Conversely, individuals scoring high on Neuroticism tend to be more risk averse.

Occupational careers over the life course

Occupations depend to some extent on type and level of education. However, individuals also change occupations throughout their working lives, often moving into more senior, higher paid and more secure positions over their careers (Tomlinson et al., 2018). The ability to do so may depend on personality traits. Given their more enterprising and social personality, extravert individuals can be better placed to take advantage of opportunities offered in employment. Somewhat similarly, the fact that individuals low in neuroticism tend to hold leadership and managerial skills could indicate that neurotic individuals are less able to take advantage of progressing to more prestigious positions. For these reasons, individuals high in extraversion and low in neuroticism are expected to be more able to navigate into occupations that are low in the risk of technologically induced job loss over the course of working years (i.e., 20–65 years).

Hypotheses

Based on the evidence above we hypothesize that

H1: Individuals who score higher on neuroticism face higher job risk loss

H2: Individuals who score higher on extraversion face lower job risk loss

H3: Both effects (H1 and H2) increase with age

Data and variables

Our data analysis combines survey data on personality from a large-scale health survey (HUNT) where all residents in the Nord-Trøndelag County of Norway were invited to participate[1]. In round 3 collected from 2006 to 2008, personality was investigated as extraversion and neuroticism. Based on both scales, of 6 binary items each[2], we constructed 0 to 6 scales using the number of positive answers (yes coded 1, no coded 0). On average respondents scored fairly high on extraversion and relatively low on neuroticism, with mean values of 3.9 and 1.6 respectively (N=18,770). For illustrative purposes we will compare the results from the regression models using a four-step change in each personality trait, corresponding to a 2.2 standard deviations gap in extraversion and a 2.3 standard deviations gap in neuroticism.

We study the risk of job loss using a Routine Task Intensity (RTI) index estimated for 4-digit ISCO-type occupational codes from the O*NET Database. This is intended to capture the extent to which an occupation can potentially be

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[1] https://www.ntnu.edu/hunt/databank

[2] An introductory text asked: "Describe yourself as you are most of the time, and then presenting the 6 extraversion items ("Are you able to gain momentum in a social setting?" … "Do you usually take the initiative to make new friends?", for e.g.) followed by the 6 neuroticism items ("Do you often worry" … "Are you worried that terrible things might happen?", for e.g.).

automated or outsourced (see Mihaylov and Tijdens 2019 for details). The index is computed as the sum of the occupation's scores on the routine manual and routine cognitive task scales and subtracts the scores on three non-routine task scales (manual, analytical and interpersonal). To facilitate interpretation, we standardise the index to have mean 0 and standard deviation of 1 in our HUNT sample.

All analyses include age from 20 to 65 as these are the ages with relatively high employment levels.

Before passing on to the results, one word about possible selection issues. Since we are looking at risk of job loss, we are necessarily looking at individuals who are employed to begin with i.e. in a relatively advantaged position. An initial analysis reveals that the individuals we analyse, for whom we have the RTI, are probably not the most neurotic or the least extravert as these are more likely to be unemployed.

As the two personality traits (extraversion and neuroticism) are negatively correlated in the data (r = -0.15), their correlations with RTI are slightly smaller when using both traits in the analysis. In the regression models we also control for gender (male dummy) and age, using two linear slopes from 20 to 40 and from 40 to 65 years, in years divided by 10 in the regression models). Model 2 also controls for education level calculated, as years beyond compulsory education normally required to acquire the highest level (0–10 for compulsory to a doctoral degree). A final analysis also investigates interactions between age and the two personality traits.

The age slopes become inflated when also controlling for education level. This is due to the higher educational level of younger cohorts (ages) relatively to older cohorts (ages). Hence, the interactions between age and personality traits are estimated with no control for education level to get more realistic estimates of how the combinations of personality traits and age affect the probability of RTI affected occupations.

Results

Extravert individuals were less likely to work in high RTI occupations than non-extrovert individuals, and neurotic individuals were more likely to work in high RTI occupations. The two effects are of seemingly of similar magnitude (model 1). Moving four steps on either trait (just above 2 standard deviations) reduces (for extraversion) or increases (for neuroticism) the RTI score in about 0.15 standard deviations (model 1). Whereas the beneficial extraversion effect is unrelated to level of education, the detrimental effect of neuroticism is reduced to a mere quarter when also controlling for education (model 2). Still, even this modest slope is significant at the 5% level.

Table 1: RTI related extraversion and neuroticism

	Model 1		Model 2	
	Coeff.	SE	Coeff.	SE
Extraversion (0–6)	−0.040**	(.004)	−0.043**	(.004)
Neuroticism (0–6)	0.038**	(.004)	0.009*	(.004)
Sex (men=1, women=0)	0.474**	(.015)	0.429**	(.013)
Age 20–40 (in years/10)	−0.119**	(.016)	−0.266**	(.015)
Age 40–65 (in years/10)	0.039**	(.011)	0.067**	(.010)
Education (years, 0–10)			−0.200**	(.003)
Constant	0.298**	(.063)	1.720**	(.060)
R squared	0.065		0.257	

Men are much more likely to work in high RTI occupations than women, and the probability to work in high RTI occupations was highest for the youngest adults, and lowest for people in their 40-ies, when not controlling for level of education (which disturbed this comparison).

There are interaction effects between age and personality in the analysis of RTI. For both personality traits, there are only small differences in RTI-position among the youngest adults. but the gap grows with age. At 60 years old, the RTI-gap is about 0.16 standard deviations when moving up 4 steps on the 0–6 on other personality traits, estimated at 2 and 5 for extroversion and 1 and 4 for neuroticism in fig. 1, while keeping the other personality trait at median level (extraversion 4 and neuroticism 1), which may be compared to a gap of about 0.05 standard deviations on the RTI-score at age 25.
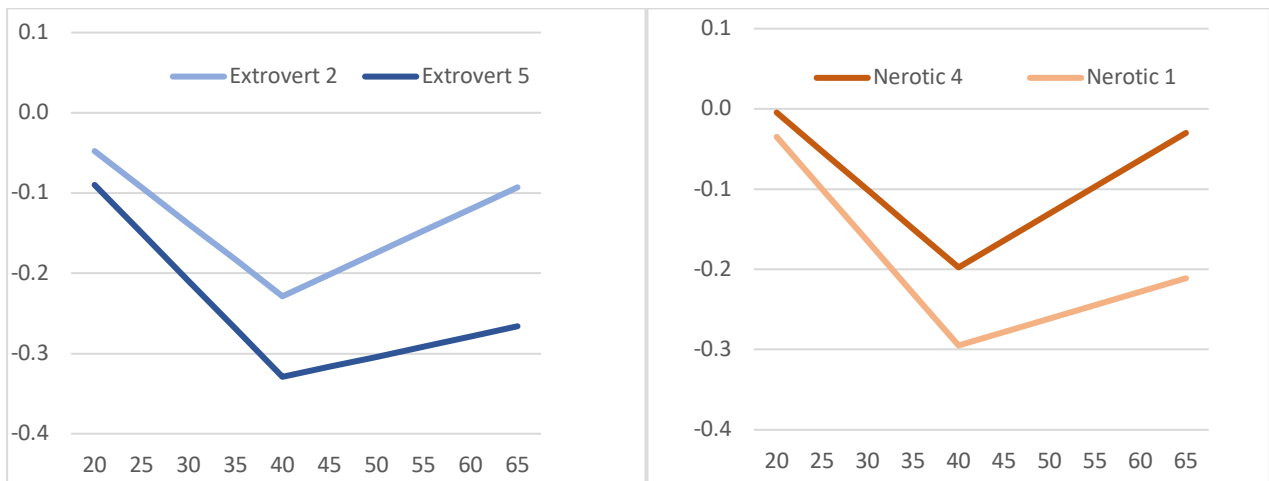
Figure 1: Interactions between extroversion (left) and neuroticism (right), predictions for RTI score for a woman with compulsory education.

Discussion and Conclusions

Using data from a large-scale Norwegian health survey and register-based occupational information to calculate the Routine Task Intensity (RTI) score, which indicates the risk of job loss due to outsourcing and technology, this study shows that individuals with low extraversion and high neuroticism are more likely to face a higher risk of losing their jobs due to automation. This could be due to the fact that they are more likely to be employed in manufacturing, where the degree of automation is probably higher. It could also be that people who are high in neuroticism and low in extraversion are more likely to experience job loss when their employers automate tasks. This may be the case given that these individuals may experience more difficulty adapting to the changes in their job duties and work environment. Since the individuals high in neuroticism and low in extraversion we analyse are the ones who do have a job, our results are likely to be on the conservative side in terms of their 'effect' of these personality traits on labour market outcomes.

In terms of risk mitigation several measures could be implemented to reduce the risk of robot-induced job loss and to improve adaptation to possibly job loss risks based on personality assessments. One is to develop skills that are less likely to be automated. This could include skills in areas such as creativity, problem-solving, and social intelligence. Another is to implement effective life-learning programs that allow workers to keep up-to-date on the latest technologies and trends in their field. This will help them to identify new opportunities and to adapt to changes in the workplace. Finally, it is important for individuals to understand the value of building a strong network of contacts, i.e., invest in social capital. This can help them to find new jobs and to stay connected to the latest developments in their field. Although not all individuals are not born extraverts, it is possible to gain acquire some relevant social skills. Since high neuroticism is associated with a greater risk of job loss due to automation, mental health support could be provided to these individuals to help them cope with potential job loss and its consequences.