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Are all automation-resistant skills rewarded? Linguistic skills in the US labour market

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Abstract

Skills that are difficult to automate are expected to increase in demand and reward according to skill-biased technological change advocates, who have identified high rewards for cognitive and social skills. However, such broad skill categories involve numerous essential competencies that can be differentially rewarded or go simply unrewarded. Using US data, this article analyses the demand for and payment of linguistic competency, a cross-cutting kind of skill that is basic for both cognitive and social work in the new economy and is one of the human capacities that is most difficult to automate. While human capital theory predicts an increase in wages as the demand for linguistic skills rises, from cultural/institutional perspectives, it can be theorised that communicative abilities and foreign-language knowledge are socially undervalued because of their association with feminised activities, ethnicity, and low-status service jobs. We analyse the demand and reward for linguistic skills through a two-step analysis of occupational and individual data derived from two sources: the Occupational Information Network and the Current Population Survey. Results show that while 'hard' verbal-reasoning skills are associated with high average salaries, as is predicted by neoclassical theory, the potentially undervalued linguistic skills – interactive and multilingual skills – are unrewarded and even penalised. This evidence requires further political attention, given its implications for large number of workers, especially in feminised, low-status service jobs.

JEL Codes: J01, J23, J24, J31, J38

Keywords

Cognitive, interactive, language, occupations, skill-biased technological change, skills, undervaluation, wages

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Introduction

In the context of the 'new economy', the labour market demand for skilled language use is greater than ever before, owing to processes signified by the terms informationalisation, globalisation and tertiarisation. The first of these terms refers to the symbolic work characteristic of post-industrial societies, where mastery of language is required to produce and manage information and knowledge (Castells, 2000; Dhir, 2005). The internationalisation of markets has generated a greater need to work in several languages (Heller, 2010; New American Economy, 2017), just as the expansion of the interactive service-sector requires more effective communication skills (Boutet, 2001; Gatta et al., 2009). Occupations with relatively higher rates of employment growth are those involving significant cognitive and social or interpersonal work. This growth has been attributed to the difficulties of automating such tasks through computers or robots (Autor, 2015). Linguistic competency, defined in this article as the collection of skills, abilities and knowledge that basically involve mastery of language(s), is an important component of these higher order constructs and one of the human capacities that is most difficult to automate. Despite rapid progress in new technologies, the capacities to understand and produce complex messages, communicate in persuasive ways and manage the interplay between several linguistic codes are still largely dependent on the human ability to process language in specific contexts (Levy and Murnane, 2005).

Given the potential role of linguistic skills in the new economy, both in terms of productivity and employability, the question arises as to how such skills are rewarded. From an economic point of view, language is a kind of human capital because it enhances productivity and should therefore be rewarded as such. This argument is taken for granted among advocates of 'skill-biased technological change' (SBTC), who have furnished evidence of higher rewards for automation-resistant skills such as the cognitive and social ones (Deming and Kahn, 2018). However, according to some critical labour researchers, despite the need for language in labour processes, the application of linguistic skills at work may go unrewarded because of the effects of institutionalised ideologies on employers' skill perceptions. Communicative abilities (listening, speaking, etc.) are theorised by some writers as devalued skills, because of their association with femininity (England et al., 2001; Steinberg, 1990) as well as failure to recognise competencies in interactive service work (Hampson and Junor, 2015; Korczynski, 2005). Along the same lines, foreign-language knowledge (bilingualism/multilingualism) may be regarded by employers as an innate talent or non-technical skill to which no compensable value is attached, especially when associated with non-dominant ethnicity (Alarcón et al., 2014; Alarcón and Heyman, 2013).

The present article aims to confront two hypotheses. On one hand, it tests the view that occupational rewards increase with the requirement for linguistic skills, based on human capital and SBTC theories. For neoliberal economists, this reasoning has the clear political implication that no intervention is required: indeed, the achievement of a meritocratic and flourishing labour market requires free-market policies. On the other hand, the alternative hypothesis is that communicative ability and foreign-language knowledge are undervalued, based on cultural approaches to the labour market. Critical labour researchers argue that political intervention is necessary to overcome the devaluation of workers' new skills on the threshold of the fourth industrial revolution.

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To date, however, little direct evidence has been assembled of the extent of the demand for linguistic skills and of the payment employees receive for their use at work. Whereas some major studies have focused on social and interpersonal skills or the more general category of soft skills (Balcar, 2016; Steinberg et al., 1986), these studies subsume linguistic skills into broader and higher order categories. The studies that make multidimensional measurements of skill (Deming and Kahn, 2018; Green, 2012; Liu and Grusky, 2013) do not clearly distinguish linguistic skills from other social skills, scattering them across broad categories or the tangle of skills, roles and tasks in 'new economy' jobs. And works that explicitly measure linguistic skills usually focus on one type, multilingualism or foreign-language knowledge, and disregard the rest (Fry and Lowell, 2003; Stöhr, 2015). If we want to understand the payoff for skills in the new economy, we should identify the essential ones by using much finer-grained measurements. This article aims to provide a more accurate definition and complete measurement of linguistic skill so that demand and reward can be analysed, because different theories predict different valuation for each of its dimensions. Specifically, we undertake a complex measurement of occupational skills from the United States Occupational Information Network database (O*NET, 2019) in order to separate linguistic skills from other non-manual, cognitive skills. These occupational requirements are then linked to data on person-year earnings from the Current Population Survey (CPS; United States Bureau of Labor Statistics, 2019). Finally, a regression analysis is carried out to estimate the net rewards for linguistic skills by removing the influence of individual and occupational potential confounders.

This article is organised as follows. First, the literature is reviewed, where the importance of studying linguistic competences in the context of the new economy is justified and the two competing theories on skill rewards are presented. Next, the methodological strategy is described: that is, the collection and combination of multi-level data (individual-occupation), the measurement of skills and other relevant variables, and the subsequent regression analysis. Finally, the results are provided and the article concludes with a discussion of the main findings on the payoff for linguistic skills and the implications for fairness in the labour market.

Theoretical framework

Linguistic skills in the context of the new economy

The interplay between linguistic activity and professional activity has undergone various transformations during the different phases of capitalism (Boutet, 2001). During Taylorism and Fordism, language was outside the world of work. Speaking was forbidden, a distraction from work that was mainly manual and routine. The idea that language can also be a component of work that enhances productivity first started to be entertained during the crisis of Taylorism in the 1980s mainly because of the emergence of the service sector. Nowadays, specific features of the new economy such as the spread of information and communications technology (ICT), the globalisation of markets, the responses to the saturation of markets through symbolic resources and the growth of the service sector all involve an increasing need for language.

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Language is now a basic tool for both managing and producing information and knowledge and can be either the input to, or the output of, labour (Castells, 2000; Dhir, 2005; Harris, 1998). Linguistic skills are necessary inputs to the performance of interactive tasks and to the processing of complex messages. They are fundamental to a wide range of tasks such as teaching, negotiating, counselling, selling and coaching. Linguistic skills can be directly converted into output – that is, the product of work – and, therefore, a final consumer good valued for its own sake. Discourses, speeches, conversations or texts such as reports, books, articles, letters or posts are examples of spoken and written linguistic products. In fact, employers consider that they need more linguistic skills than the workforce can provide (Barrington et al., 2006; National Association of Colleges and Employers (NACE), 2014, 2016). Globalisation has had a direct impact on increasing the demand for language because an interconnected world implies greater cross-border movement of information, goods and people (Heller, 2010; New American Economy, 2017). Transnational markets and international campaigns involve working with several languages (i.e. multilingualism) to manage the diversity of customers and to effectively receive and communicate messages with foreign subsidiaries and external providers (Fidrmuc and Fidrmuc, 2016; Fixman, 1990; Hagen, 2006). To sum up, and following Feely and Harzing (2003), globalisation and informationalism generate three kinds of linguistic needs in business – or linguistic barriers to overcome, which can occur separately or together: diversity, or number of languages necessary; penetration, or communicative requirements across areas and functions; and sophistication, or complexity in processing language.

Of course, many tasks and outputs require not only linguistic but also other cognitive or social skills. While other studies have analysed language as part of these higher order constructs, this article focuses on linguistic skills themselves, considering that their intrinsic features are distinguishable from other competencies. Evidence for this comes from the important research being carried out on human intelligences in parallel to research on cognitive skills. Linguistic intelligence is defined as the capacity to think in words and grammatical structures and to use them to accomplish goals, to study language itself and to learn new languages. Despite the arguments of Visser et al. (2006) that specific abilities or 'intelligences', such as linguistic, mathematical, spatial, interpersonal, and aesthetic, all reflect general intelligence, they are also internally consistent and independent from each other. Thus, in the labour market, the linguistic domain should be analysed separately from, for example, the interpersonal or social domain. While intelligence involves innateness or 'potential', skills are acquired by learning or training. Linguistic competencies can also be distinguished from psychological traits and other predispositions usually called non-cognitive abilities. For example, as Balcar (2016) notes,

> The difference between [cognitive and non-cognitive skills] can be illustrated by the distinction between communicativeness (a predisposition) and the ability to communicate effectively in a work environment (a skill) because even a person with a low degree of communicativeness can be a very good communicator (owing to knowledge of appropriate methods and tools). (p. 454)

Thus, we set out to analyse the demand for linguistic competence, which we define, in line with the reasoning above, in terms of diversity, penetration and complexity. The

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following section discusses what previous research says about the reward for linguistic skills, abilities and knowledge.

How hard and soft linguistic skills are rewarded? Conflicting evidence from labour research

It has been theorised that SBTC is increasing the demand and reward for highly skilled jobs and making routine low-skilled jobs redundant (Autor et al., 2003). The continued innovations in computer power, artificial intelligence and robotics are rapidly expanding the set of work activities that can be automated. However, the scope of automation is limited because many tasks require skills for which computer programmers cannot enunciate the explicit rules or procedures (Autor, 2015). Cognitive and, especially, social or interpersonal activities are difficult to automate, and SBTC advocates would suggest that they are in high demand and therefore well-rewarded (Deming and Kahn, 2018). The limitation of this analysis is that it relies on broad categories of skills that do not allow closer examination of the demand and reward associated with their component elements. This is the case of linguistic skills, which are split up and subsumed into higher order and more generalised constructs. Verbal skills (directly related to literacy) are considered a cognitive skill learned through education (Liu and Grusky, 2013); communicative/interactive abilities are usually treated as a part of the more diffuse and complex concept of 'soft skills' (Balcar, 2016; Klein et al., 2006); and multilingualism or foreign-language knowledge is something in between, a hard skill that can be acquired through learning, but also a soft skill because it is associated with culture or ethnicity (Alarcón and Heyman, 2013).

These different linguistic skills (verbal, interactive and multilingual) can each have their own particular payoff in the labour market, which is not appreciable if they are subsumed into a single broad category. As noted above, two types of research give a possible answer to the question of how linguistic skills are rewarded in the new economy: the neoclassical economic theory of human capital and cultural/institutional theories of labour markets.

According to human capital theory (Becker, 1964), different occupations require different types and levels of competencies, which are assumed in turn, to attract differentiated wage rewards. The differences in the payoff for skills are assumed to be the result of the supply–demand mechanism in the labour market. In a nutshell, the combined effect of a high demand for skill (because skill increases the firm's productivity) and low supply (because skill acquisition requires talent and effort) explains higher wages for skilled workers, and by extension, for occupations. This reasoning is adopted by SBTC advocates, according to whom demand for cognitive and social skills is on the increase because they are difficult to substitute by technology. Thus, according to human capital theory, it can be hypothesised that *The greater the demand for linguistic skills, abilities or knowledge in an occupation, the greater the pay associated with them* (hypothesis 1, H1).

However, in the human capital and SBTC framework, empirical evidence regarding the return on linguistic skills is mixed. Cognitive competencies, of which verbal skills are an important part, are usually well paid. There is more controversy regarding

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interpersonal or social skills, for which linguistic skills are central. Balcar (2016) found that almost three-quarters of the variability of a set of soft skills are accounted for by effective communication. And the whole combination of soft skills appears to have a positive impact on wages that is comparable to that of hard skills. Deming and Kahn (2018) found large positive correlations between wages and whether a job vacancy requires cognitive and social skills. In their research, job advertisements were classified into 10 skill categories, with keywords such as 'communication', 'negotiation' or 'collaboration' being grouped under the category of social skills. By contrast, focusing on task intensity rather than skills, the research of Green (2012) reveals that not all kinds of linguistically demanding activities are rewarded. While activities named 'influence communication' are positively associated with wages, those categorised as 'external communication' are not significantly rewarded (or are penalised in some models). However, the role of linguistic competencies in this research is unclear because these categories include a variety of different activities. While teaching, persuading and active listening belong to the category of influence communication, selling, counselling and advising are assigned to the latter (Green, 2012: 43). Finally, this literature also shows contradictory results about language diversity. Whereas Fry and Lowell (2003), Pendakur and Pendakur (2002) and Morris et al. (2015) found no reward for foreign-language knowledge, Saiz and Zoido (2005) and Ginsburgh and Prieto-Rodriguez (2011) found positive rewards. The rewards may vary according to the foreign language in question. In Germany, Stöhr (2015) concluded that occupational wages increase with knowledge of English, but not with requirements for other foreign languages.

As summarised in the following, many labour researchers consider that cultural and institutionalised ideologies influence the recognition of skills and the returns they give. Studies in this line of reasoning provide a framework for understanding the contradictory results of economic literature on the payoff for linguistic skills. Three arguments explain why interactive and bilingual/multilingual competencies are likely to be unrewarded and even penalised.

Devaluation of women's work. There is considerable evidence to suggest that some activities associated with femininity are devalued (England et al., 2001; Steinberg, 1990). The studies of this question focus on what has been called 'interactive service work', jobs that involve face-to-face interaction with clients or customers. This work pays less than other work with comparable requirements for education, training and skills (Junor et al., 2008). Steinberg et al. (1986: 152) found that jobs involving communication with the public and group facilitation paid less than other jobs, regardless of other skill demands. Kilbourne et al. (1994) developed a scale to measure nurturant work that not only involves dealing with people but also requires talking and listening. Their results show a wage penalty for both male and female workers.

Unrecognised skills in service jobs. Low-status service jobs mainly require emotional work, caring labour and interpersonal tasks, for which linguistic skills are crucial to effective communication (Gatta et al., 2009). However, the lack of objectification in qualifications regarding soft skills and the requirement of personal traits that usually accompany these skills make that they are unrecognised (Hampson and Junor, 2015; Korczynski, 2005).

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The low union representation in this type of job allows employers to exploit the skills of their employees without rewarding them appropriately. The lack of recognition can be extended to professional jobs in which other competencies are more important and used as a mechanism of closure, so that communicative skills remain undervalued because of their association with low-paid service jobs.

Naturalised competence. Naturalisation refers to the consideration that certain competencies are a natural capacity that is embodied in the worker. From an employer's perspective, these naturalised competencies are not considered dimensions of human capital because they do not require training and are therefore regarded as not requiring reward. Linguistic skills are especially susceptible to being regarded as such. Alarcón and Heyman (2013) show how foreign-language skills are used by employers but not valued as a technical competency. Bilingualism, in the context of the US border, is used by employers as a sign of cheap and flexible labour rather than as an economically and socially valued skill. A similar conclusion can be derived from Duchêne (2009), who found no extra benefits for multilingual workers in call centres. Employers recruit multilingual workers hoping to benefit from such skill at specific times. Studies based on large-scale surveys also report null returns for language knowledge, mainly in the case of immigrants (Alarcón et al., 2014; Robinson-Cimpian, 2014; Shin and Alba, 2009).

According to these studies, employers undervalue some linguistic skills because of cultural devaluation or predominant ideologies in society. Thus, it can be hypothesised that while the rewards for 'hard' verbal skills (literacy) increase with demand, *interactive abilities and foreign-language competencies are undervalued and thus have either no return or a negative return* (hypothesis 2, H2).

Methodology

The conflicting evidence from the reviewed literature gives rise to two hypotheses (see Figure 1): one derived from human capital theory (H1) and the other from explanations of the undervaluation of skill (H2). The methodological design presented in this section has focused on testing these hypotheses, which have not previously been formally compared from a quantitative point of view.

Data

Two public databases from the United States were used to study the rewards for linguistic skills. They supply information on wages and individual control variables, as well as on the linguistic requirements and controls at the occupational level. The first database – the Earner Study Sample of the 2013–2018 March CPS (United States Bureau of Labor Statistics, 2019) – provides information for a model of individual earnings,[1] focused on the civilian work force aged between 16 and 65 years. A second database from the Occupational Information Network (O*NET (version 20.1), 2019) was used to measure linguistic and other skill demands. Developed by the US Department of Labor, it provides ratings of more than one thousand occupations in the US labour market on several occupational aspects (i.e. skills, abilities, knowledge).

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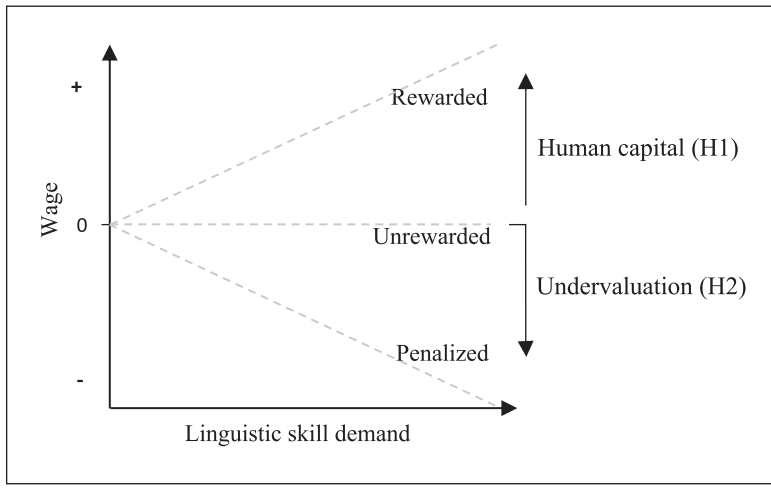

Figure 1. Graphical representation of the hypotheses.
Human capital theory (H1) establishes that the greater the demand for linguistic competency across occupations, the higher the rewards will be. On the contrary, undervaluation (H2) means that increasing demand for linguistic skills has no rewards or even negative rewards (penalty).

These ratings come from questionnaire responses by sampled workers and occupational experts and are reported in the O*NET database as averages of the value placed by all informants on the various occupational aspects being rated. Information from both data sources was analysed through a two-step procedure: A complex measurement of occupational skills from the O*NET database was first undertaken in order to separate linguistic skills from other non-manual, cognitive skills. These occupational requirements were then linked to data on person-year earnings from the CPS, thanks to the Standard Occupational Classification (SOC) codes available in both data sets. The total unified sample with non-missing wage values was 37,080 observations (18,540 workers) linked to 470 census occupation codes.[2]

Measures

Wages. Earnings were measured as hourly wages. The hourly wages for non-hourly workers were computed by dividing the weekly wage by the number of hours worked per week. The wages were adjusted for inflation using the Consumer Price Index and expressed in US$2018. The wages of highly paid workers are truncated by the Bureau of Labor Statistics to maintain confidentiality. We multiply such wages by 1.4, one of the best solutions suggested by Card and DiNardo (2002) to address 'top coding' (pp. 744–745). Finally, the logarithmic transformation was applied to reduce the positive asymmetry of the variable.

Linguistic skill requirements. Linguistic competence is defined as the *collection of skills, abilities and knowledge, of which the mastery of linguistic code is the essential part*. The

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term 'linguistic' refers to the use of natural language.[3] This is made up of signs or a collection of abstract symbols codified to carry out complex communication. Of the long list of skills in the O*NET database, all those that fitted this definition were selected, either in terms of complexity, penetration or diversity (the three criteria identified from the literature review): reading and writing abilities, speaking and active listening skills, as well as knowledge of English and other languages. Compound skills such as 'negotiation' or 'instructing' were not included in the measurement, because although they have an important linguistic component, they also require other essential competencies. Linguistic skills were factorialised together with a list of competencies from Liu and Grusky's (2013) model, one of the most complete models of cognitive demand in post-industrial labour markets.[4] Both *importance* (5-point scale) and *level* (7-point scale) items were considered, normalised to range between 0 and 1.[5] Principal component analysis (PCA) was applied to reduce the dimensionality of all items to a limited number of dimensions according to the patterns of correlation between them.

The result was nine factors with similar variances and a structure comparable to that of Liu and Grusky's (2013) work but enhanced in terms of linguistic competencies (Table 1). The first factor expresses the demand for scientific and engineering knowledge and the second factor for numerical and quantitative competencies. The third factor is a collection of competencies which could be called verbal reasoning. This third group includes deductive and inductive reasoning skills and the ability to identify and solve complex problems. Linguistic ability relating to the level of written comprehension and expression is also relevant to this factor. The fourth factor expresses the demand for verbal interactive abilities, with important loads for items related to face-to-face or voice-to-voice efficient communication such as clarity of speech, active listening and public speaking. The fifth factor focuses on creative abilities; the sixth factor on electronic and computer skills and the seventh on managerial skills; the eighth clearly expresses knowledge of foreign languages; and the ninth is nurturing skills. These factors provide information about occupational cognitive skill requirements, the main variables to be analysed in relation with individual earnings. The factor variables were included in the CPS data base as scores of the occupation at which workers belong.

Control variables. Adjusted log wages were modelled according to the following worker variables: years of schooling, experience and its square, civil status, region, urbanicity, industry, sector, type of contract and union membership (see descriptive statistics in Appendix 1).

At the occupational level, three types of control variable were included: competency-based, compositional and institutional (Carbonaro, 2005). The first refers to demands for cognitive work, indispensable control variables for estimating the effects of linguistic skills. The measurement of this demand using the factorialisation of the O*NET items was described in the previous section. The demand for knowledge of English was also included within this collection of variables but not in the factor analysis as it is basic knowledge in the US context, a requirement for any job and, therefore, correlated with all linguistic demands. There is also evidence that the autonomy to make decisions is as important as many other skills, or even more important, so an O*NET item was included about the 'degree of freedom to make decisions without supervision'.

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Table 1. Cognitive skill requirements with PCA rotated factor loadings ($r > 0.5$).

Item	Loading	Item	Loading	Item	Loading
S&E knowledge		Deductive reasoning	0.54	Innovation	0.61
Engineering	0.85	Inductive reasoning	0.61	Operations analysis	0.60
Design	0.74	Critical thinking	0.58	*Computer skills and knowledge*	
Mechanical	0.87	Active learning	0.57	Programming	0.70
Physics	0.91	Information ordering	0.50	Electronics	0.80
Chemistry	0.80	*Interactive abilities*		Computers interact.	0.77
Numerical skills		Oral comprehension	0.63	*Managerial skills*	
Numerical reasoning	0.82	Oral expression	0.67	Financial Resources	0.69
Number facility	0.85	Speech clarity	0.63	Personnel Resources	0.70
Mathematics	0.85	Active listening	0.61	Management	0.83
Verbal-reasoning skills		Speaking	0.64	*FL knowledge*	
Written comprehension	0.51	*Creative abilities*		Foreign languages	0.94
Written expression	0.50	Fluency of ideas	0.59	*Nurturing skills*	
Problem sensitivity	0.60	Originality	0.64	Service orientation	0.67
Problem solving	0.51	Thinking creatively	0.77	Assisting and caring	0.92

FL: foreign languages. S&E: Science and Engineering
Data are from O*NET (version 20.1; $N = 470$ SOC occupations). The number of factors with eigenvalues higher than 1 was retained and the factor loadings were reported using an *orthogonal equamax* rotation. For ease of exposition, the table shows which items primarily loaded on the 9 factors. Moreover, considering that most 'level' and 'importance' scales load on the same factor, only the higher load between the two is reported. The complete factor loading matrix can be requested from the authors.

The proportions of women, Black and qualified workers within each occupational category were included as compositional variables. The most feminised occupations typically have lower salaries than those dominated by men, and the same occurs in occupations with greater proportions of Black workers. The percentage of qualified employees was also included. Unlike the two previous variables, salaries tend to increase with the level of credentialism. Of the institutional variables, the rate of unemployment and the degree of unionisation are key. The first reflects the relationship between work supply and demand. The occupations with the greatest rates of unemployment (more supply than demand) tend to offer low salaries. However, the occupations with more unionisation tend to provide higher salaries because of the defensive role trade unions perform in wage negotiations. All these variables were obtained from aggregations of data from the March CPS 2013-18 whole sample (see Table 2).

Regression analysis

Regression allows a statistical test of whether there is a wage compensation or a devaluation for language skills. In the regression equation, the dependent variable was adjusted log wages, and the key independent variables are linguistic skills. In greater detail, the net rewards for linguistic competencies were estimated by a 'first difference' estimation that took advantage of two waves of the CPS to remove individual skills variability and other individual traits. The influence of competency-based, compositional and institutional

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Table 2. Descriptive statistics and correlations of occupational variables.

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. S&E	2.61	1.44	1														
2. Numerical	7.33	1.79	−0.13	1													
3. Verbal reasoning	9.29	1.80	0.02	−0.06	1												
4. Interactive	9.13	1.82	−0.06	0.03	−0.02	1											
5. Creative	7.61	1.82	0.02	−0.04	*0.15*	0.07	1										
6. Informatic	8.21	1.88	−0.07	−0.06	0.01	0.00	0.02	1									
7. Managerial	8.49	1.81	0.04	*0.15*	*0.21*	0.06	0.06	−0.05	1								
8. Foreign language	7.59	1.40	0.09	*−0.18*	0.07	−0.08	−0.07	0.02	0.00	1							
9. Nurturing	6.88	1.23	−0.09	−0.06	0.07	0.03	0.07	0.01	*−0.11*	−0.04	1						
10. Prop. female	0.48	0.29	*−0.58*	0.02	−0.06	*0.20*	−0.09	*0.13*	*−0.24*	*0.13*	*0.50*	1					
11. Prop. non-white	0.18	0.07	*−0.29*	0.01	*−0.13*	*−0.30*	−0.08	0.07	*−0.36*	−0.03	*0.23*	*0.26*	1				
12. Prop. qualified	0.35	0.29	*−0.12*	*0.12*	*0.58*	*0.30*	*0.42*	*0.34*	*0.23*	*0.34*	0.09	*0.18*	*−0.16*	1			
13. Unionisation	0.12	0.13	*0.19*	*−0.29*	*0.17*	−0.05	−0.04	0.06	*−0.19*	*0.22*	*0.14*	−0.02	−0.06	*0.16*	1		
14. Unemployment	5.23	3.53	0.09	*−0.19*	*−0.47*	*−0.31*	*−0.33*	*−0.29*	*−0.27*	−0.07	*−0.28*	*−0.21*	*0.13*	*−0.67*	*−0.17*	1	
15. Log hourly wage	2.90	0.38	*0.12*	*0.14*	*0.62*	*0.24*	*0.42*	*0.34*	*0.47*	*0.19*	−0.05	*−0.18*	*−0.32*	*0.83*	*0.10*	*−0.69*	1

SD: standard deviation.
Data are from CPS, 2013–2018 and O*NET (version 20.1). $N = 470$ (weighted by occupation size). The coefficients in italics are significant at $p < 0.05$.

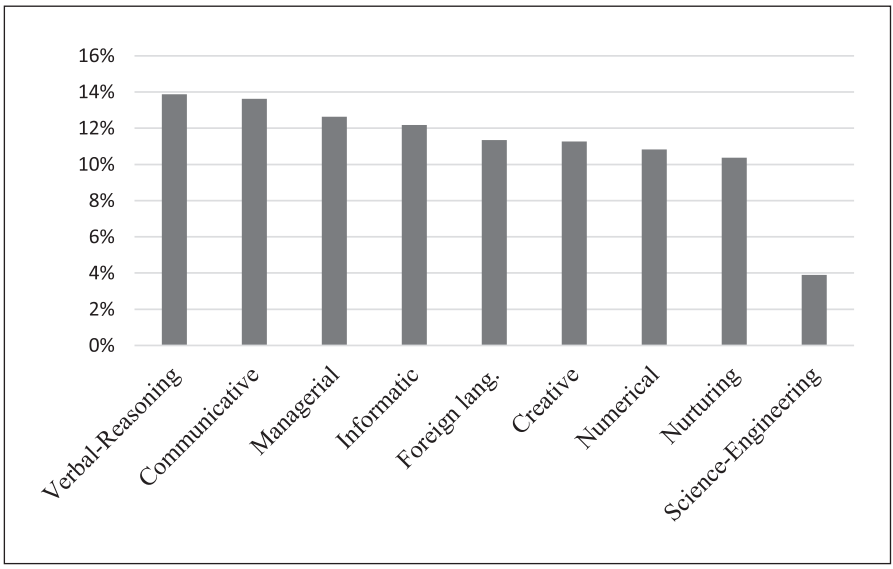

Figure 2. Average demand or requirement for cognitive skills.
Data are from O*NET (version 20.1; $N = 470$ SOC occupations). To get average skill requirements, factor loadings were first used to compute the total cognitive skill load of the 470 occupations. Then, the sum of each kind of skill in occupations was divided by this total cognitive load. Finally, the average skill load for the nine kind of skills across the 470 occupations was computed.

occupation level variables was also taken into account (see Appendix 2 for greater detail on the regression analysis). Although the hypotheses of this study present two conflicting, general claims about rewards for linguistic skills, specific, not controlled occupational characteristics may reduce or intensify the main effects of these skills. For this reason, extended models with interactions between linguistic demand variables and major occupational groups were also estimated.

Results

According to the PCA results, demand for linguistic skills can be analysed through three basic components: verbal-reasoning skills for processing complex messages (basically read or written), the ability to effectively communicate (face to face or voice to voice interaction), and knowledge of foreign languages. These three kinds of linguistic skills that can be identified from several skill requirements line up with the three kinds of linguistic barriers identified in business research relative to complexity, penetration and diversity. What, however, is the level of demand for these skills? Figure 2 shows the average skill load for the nine kinds of skills across the 470 occupations (weighted by the total number of workers). In general, all cognitive skills were similarly demanded across occupations. Focusing on the linguistic ones, verbal-reasoning and interactive abilities were the most required in the labour market (averages of 13.9% and 13.6%), and foreign-language knowledge occupied the fifth position (11.3%).

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Table 2 shows the means and standard deviations of occupational variables (competency-based, compositional, institutional and average salary) as well as the correlation between them. The mean values for skill requirements had a similar distribution to the one derived from the average skill load showed in the graphic. The means of the compositional and institutional variables were close to those of the official statistics (United States Bureau of Labor Statistics, 2019). The correlations between competency-based variables were practically non-existent, given that they were derived from a factor analysis producing independent components. Compositionally, there was a gender bias in skill requirements. Occupations with a greater demand for interactive and foreign-language competence, but especially nurturing, are most feminised; conversely, men are overrepresented in technical occupations (the exception is informatic skills, probably because of interaction with computers in office jobs). Non-white workers are notably less present in occupations which demand both managerial and interactive competencies, whereas they are significantly linked with nurturing skills. The correlation with the proportion of highly qualified workers was highest for verbal reasoning and negative with nurturing skills. Of the institutional variables, unionisation most strongly correlated with foreign-language knowledge, whereas unemployment negatively correlated with verbal analytic skills, indicating more demand than supply. Finally, the correlations with mean log wage showed a strong association between the demand for verbal reasoning and managerial skills, whereas the correlation between nurturing and managerial competencies was the lowest.

In Table 3, the results of three regression models estimated with 'first-differences' are presented. Coefficients are only shown for the occupational variables, given that they are the focus of the article (nevertheless, year fixed effects as well as individual variables have been incorporated in all models). Model 1 (first column) shows the estimates of occupational control variables. As in previous studies, feminisation of occupations had a negative association with wages, whereas credentialism impacted wages positively. Unionisation and unemployment both had a significant impact but with a different sign. Model 2 shows the estimates of competency-based variables, including the linguistic ones (all of them expressed as standardised factor scores). All the regression coefficients of skill requirements were significant with the exception of interactive abilities and nurturing skills. Model 3 (third column) presents the full model with all the occupational variables. Although at different levels of importance, most of the competency-based variables were statistically significant. The exceptions were foreign-language knowledge, which became non-significant, and nurturing skills, already non-significant in the previous model: thus, their rewards were found to be not different from zero at any level. On the other hand, interactive abilities became significant but with a negative effect. A one standard deviation increase in communicative abilities reduced wages by nearly 1.7%. In contrast, verbal-reasoning demand was the best paid of all competencies, with an increase in wages of nearly 2.5% for each standard deviation. It is worth noting that all compositional and institutional variables were non-significant in the full model, including the proportion of woman and qualified workers, which showed an important effect in a model without occupational skill requirements.

Table 4 answers the question of whether the payoff for linguistic competencies varies across the 10 major occupational groups with highest employment. This question was

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Table 3. Within regression (first-differences) estimates of the effect of occupational variables on logged wages.

Variables	Model 1	Model 2	Model 3
Verbal reasoning		**0.038*** **	**0.025*** **
		(0.006)	**(0.008)**
Interactive		**−0.003**	**−0.017** **
		(0.006)	**(0.008)**
Foreign languages		**0.022**	**0.003**
		(0.006)	**(0.009)**
Science and engineering		0.010*	0.014*
		(0.006)	(0.008)
Numerical		0.020***	0.016**
		(0.006)	(0.007)
Creative		0.032***	0.023***
		(0.006)	(0.008)
Informatics		0.028***	0.015*
		(0.006)	(0.008)
Managerial		0.024***	0.017**
		(0.005)	(0.006)
Nurturing		0.001	−0.001
		(0.006)	(0.007)
Proportion female	−0.065**		0.007
	(0.026)		(0.033)
Proportion non-white	−0.051		−0.054
	(0.084)		(0.091)
Proportion qualified	0.163***		0.067
	(0.032)		(0.042)
Unionisation	0.002		0.073
	(0.054)		(0.059)
Unemployment	−0.003		0.002
	(0.002)		(0.002)
English	0.174***		0.186**
	(0.067)		(0.083)
Autonomy	0.004		0.000
	(0.013)		(0.014)

CPS, 2013–18 and O*NET (version 20.1). Sample size is 37,080 (18,540 workers). Dependent variable: Log-adjusted hourly wages. All regression models include years of schooling, experience, experience^2, marital status, region, urbanicity, industry, sector, type of contract, membership of trade unions and year fixed effects. Linguistic variables and their coefficients are highlighted in bold.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

answered by adding interactions to model 3. This analysis tested for the existence of other specific occupational features that can produce the payoff for linguistic skills rather than the cultural explanation for undervaluation. The analysis of rewards for linguistic skills by major occupations was also used to identify whether the results observed were caused for any group with particularly different effects (e.g. serving occupations). The results show

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Table 4. Estimated effects of linguistic competences on logged wages, by major occupational groups (those 10 with higher employment in 2018).

	Model 3.1	Model 3.2	Model 3.3
	Verbal reasoning	Interactive	Foreign languages
Management	−0.037	−0.013	−0.019
	(0.025)	(0.032)	(0.025)
Office and administration	−0.021	−0.008	0.008
	(0.022)	(0.019)	(0.019)
Sales	0.035	−0.048**	0.029
	(0.023)	(0.019)	(0.046)
Transportation	−0.049*	−0.037	−0.002
	(0.029)	(0.025)	(0.029)
Healthcare practitioners	0.007	0.055	0.002
	(0.031)	(0.059)	(0.036)
Education and library	−0.083**	−0.163**	−0.030
	(0.042)	(0.071)	(0.021)
Production	−0.022	−0.053	−0.002
	(0.026)	(0.032)	(0.032)
Construction and extraction	0.057	−0.032	−0.015
	(0.039)	(0.034)	(0.02)
Serving and food preparation	0.010	−0.078***	−0.064***
	(0.032)	(0.026)	(0.031)
Business and finance	−0.034	−0.046	0.028
	(0.029)	(0.03)	(0.027)

CPS, 2013–2018 and O*NET (version 20.1). Sample size is 37,080 observations (18,540 workers). The regression model includes years of schooling, experience, experience^2, marital status, region, urbanicity, industry, sector, type of contract, membership of trade unions, year fixed effects and all the occupation variables (see Table 3).
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

that there was consistency across occupational groups, with reduced, generally non-significant coefficients for interactions. However, there were some exceptions. The penalty for interactive abilities was found to increase in sales, serving, and, specially, education and library occupations. Foreign-language knowledge, which overall had a null effect on salaries, was found to be penalised in the case of serving occupations.

Discussion and conclusion

Labour research has made a great effort to measure skills. However, the measurements made are usually of broad constructs or categorisations such as cognitive, social or soft skills and of tasks as proxies for clusters of skills. A closer examination of essential skills' payoff is necessary to better understand inter-occupation wage inequality. This article has focused on linguistic skills, which are basic to a wide range of tasks. They are of particular relevance in the context of the new economy, because informationalism, globalisation and tertiarisation give language a major role in labour processes. However,

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labour research has paid little attention to exploring the demand and, especially, the payoff, for language-related skills in the new economy.

By selecting purely linguistic items from the O*NET data base, three kinds of linguistic skills were obtained through a multivariate analysis with other kinds of cognitive, non-manual competencies: (1) verbal-reasoning skills, (2) oral communication or interactive abilities and (3) foreign-language knowledge. The measurement of these skills, although still very abstract, represents three kinds of linguistic need identified in business research relative to complexity, penetration and diversity. Hence, this measurement makes it possible to analyse linguistic demands and rewards in the labour market in more detail than in previous research. Descriptive results show that language-related competencies represent more than a third of the total cognitive load of occupations. Verbal-reasoning skills and interactive abilities are in particular demand by the labour market. Foreign-language knowledge is placed in the fifth position among the nine cognitive skills identified. Bivariate correlations barely showed any compositional pattern among linguistic skills. However, it should be mentioned that interactive abilities correlate with feminised, white occupations and foreign-language knowledge do it only modestly with feminised occupations. Verbal analytical skills strongly correlate with the proportion of qualified workers, but not with other compositional variables.

Advocates of SBTC argue that it is difficult to substitute cognitive and social skills with technology. In line with human capital theory, SBTC researchers have showed that cognitive and social skills – of which language is a part – are heavily rewarded. However, there are also signals indicating an undervaluation of interactive and multilingual skills. It can be argued that such skills are culturally undervalued because of their relation to women's work, their predominance in low-status service-sector jobs or their naturalisation (association with ethnicity). Our language-enhanced cognitive skill model sheds light on this issue. The results show that almost all cognitive skills have a positive impact on wages, except for those of caring and linguistic competencies. As far as the latter are concerned, a distinction should however be made, however, between the effect of verbal-reasoning skills requirement and the effect of interactive abilities and second-language knowledge requirements. The first has a strong positive effect on wages, as predicted by neoclassical theory. The other two have a negative and null effect, respectively, which supports the hypothesis of undervaluation. Thus, in contrast to the other competency-based demands that have been analysed, they are unrewarded and even penalised. In line with previous literature, only nurturing skills have also shown a null reward (although not a penalty). It should be pointed out that the argument here refers only to the undervaluation of skills. The effect of this process is independent of the effect of individual or occupational characteristics. The regression model used in this article controlled for individual traits such as race and sex as well as for occupational variables, such as feminisation or work autonomy. Hence, undervaluation of competencies is independent of other inequality-producing processes like gender/race discrimination or workplace deskilling. Moreover, we have seen that the coefficients obtained barely change across occupational groups. Non-significant interactive effects suggest that the valuation of skills depends on institutionalised ideologies rather than occupational specificities. Linguistic undervaluation similarly affects all occupations, although it is aggravated in the case of service and education sectors (probably due to the three reasons explained before). This is of course

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a problem for those occupations in which interactive or foreign-language knowledge predominate. To illustrate this with an example from our data, 76% of the cognitive skill load of telemarketers corresponds to oral communicative abilities, and the wage in this occupation is less than half of the occupational mean. The opposite is true for verbal-reasoning skills, which appear in the results as the best-paid kind of skill.

This result gives rise to several considerations. First are considerations linked to the study of the labour market and the wage setting. The optimistic view of SBTC supporters requires nuance. Although skills that are difficult to automate are expected to be in higher demand, as is the case of interactive skills, cultural attitudes and ideology influence their remuneration above and beyond the supply–demand dynamic. The results of this article indicate that linguistic competencies with signs of devaluation in the literature are, in effect, unrewarded even though they are in high demand. In this respect, the cognitive and social skills which are believed to be in higher demand should be examined more closely. Thus, to reach an understanding of wage setting and of payment for skills, it is necessary to take into account not only the principles of rational choice (debated in this article from the perspective of the neoclassical theory of human capital) but also cultural understandings and institutionalised ideologies.

A considerable number of the studies which analyse payment for linguistic skills focus on knowledge of foreign languages. It is a sensitive topic given that economic/instrumental motives are the most important for learning and maintaining language. Moreover, rewarding knowledge of different languages can be a key element in the selective acculturation of immigrants in host societies. This argument is especially relevant in the US context, given the high percentages of bilingualism and immigrant population. The academic literature is contradictory on this question: some studies report considerable returns to foreign-language skills, while others report a null effect or penalty. The analytical perspective adopted in this study shows that at an occupational level, there is no reward for foreign-language knowledge use in the US labour market.

The results of this research give rise to a debate related to fairness in the labour market regarding the payment for skill. Skills are social constructions, and their representations or associated ideologies can be modified so that such competencies are fairly paid. Free market mechanisms cannot change cultural structures, so political intervention is required to prevent competencies from being devalued. Political and trade-union actions should focus on promoting a wider and democratic conceptualisation of competences and on measures of comparable worth. Two practical recommendations aimed at this goal arise in the context of this research: A first necessary step is to unpack the broad definitions and measurements of skills. We distinguished several kinds of linguistic skills usually hidden in higher order constructs used in job evaluation systems (e.g. cognitive, interactive, etc.). The second step is to change the valuation of the culturally undervalued skills, providing a clear assessment of their demand and rewards free of gender, class and ethnic biases.

Employment in occupations that require interactive and, specifically, linguistic skills is on the increase on the threshold of the fourth industrial revolution. In the service sector, linguistic skills are the most important for many jobs (and increasingly the only ones demanded because of the robotisation of labour processes). A fair assessment of such skills would allow employers to catch better talents and workers to obtain greater rewards and empowerment, thanks to their skills.

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Notes

1. We used the Integrated Public Use Microdata Series (IPUMS) identifiers to link repeated observations and variables from the Annual Social and Economic (ASEC).
2. Although O*NET provides detailed information about the different occupations of the SOC, it was only possible to match 470 out of 538 census occupations between the two databases. For the codes with various correspondences in the O*NET database, the average of competency-based variables was taken.
3. Natural languages can take different forms, such as speech or signing (but not formal languages such as computing or logic). Natural languages are based on verbal communication and therefore exclude other communication systems (i.e. non-verbal communication).
4. While the sociological and economic literature describes other complex measures of cognitive skills (e.g. Deming and Kahn, 2018; Felstead et al., 2007; Green, 2012), we consider that this is the one which covers the broadest range of competencies. In any case, they usually provide a core set of common factors or groups of skills.
5. The decision to use both scales was made for conceptual and empirical reasons. Importance was considered just as relevant as level. Moreover, both scales are strongly correlated (average inter-item correlation $r = 0.93$).

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Appendix 1

Descriptive statistics

Mean and standard deviation of demographic variables.

Variable	Mean	Standard deviation
Adjusted hourly wage	22.96	16.87
Log hourly wage	2.93	0.67
Female	0.47	0.50
Non-White	0.20	0.40
Married	0.53	0.50
Union membership	0.12	0.33
Years of schooling	13.96	2.59
Potential experience	20.58	13.21
Experience^2/100	5.98	5.86
Full-time worker	0.82	0.38
Private sector	0.85	0.36
Urbanicity	0.87	0.34
Region (omitted = northeast)		
Midwest region	0.22	0.41
South region	0.37	0.48
West region	0.23	0.42
Industry (omitted = other)		
Natural resources and mining	0.02	0.15
Construction	0.07	0.26
Manufacturing	0.10	0.30
Trade and transportation	0.17	0.38
Media	0.02	0.15
Financial activities	0.07	0.25
Professional and business	0.12	0.32
Education and health services	0.23	0.42
Leisure and hospitality	0.10	0.30
Public administration	0.05	0.21

CPS 2013–2018 weighted sample. Civilian labour force aged between 16 and 65 years with valid earning data.

Appendix 2

Model specification

Within (fixed-effects) regressions were carried out to analyse CPS (2013–2018) wage data. We arranged the data in a pooled two-wave panel (workers in the earner study

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interviewed two times in March). By observing occupational change of a large number of individuals, the differences in skill requirements between occupations provide enough variation to identify intra-individual wage differences associated with occupational linguistic skills requirements. The *within* estimator is useful for eliminating omitted-variable bias created by the failure to include controls for unmeasured, unchanging personal characteristics. Workers may have different unmeasured productivity-related factors such as skills and personality traits. These are important in the context of this study, where the effects of linguistic skills on wages can be confounded with those of personality traits (e.g. sociability or communicativeness) and other intellectual skills. After time constant individual heterogeneity had been removed by first-differencing and by including observed time-varying individual variables and year fixed-effects, occupational change in wages was modelled using competency-based, compositional and institutional variables. The model, estimated with the 'first difference' approach, can be summarised with the following equation

$$\Delta \log\left(W\right)_{it} = \Delta L_{it}\beta_1 + \Delta O_{it}\beta_2 + \Delta X_{it}\beta_3 + \Delta\varepsilon_{it} \quad (1)$$

where i indexes individuals at time t. Δ is the first difference operator $(z_t - z_{t-1})$, $\log(W)$ is logged hourly wages, L is the vector of linguistic competencies of the occupation at which workers belong, O is the vector of the other occupational covariates, X is the vector of individual covariates, and ε is the residual.

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