Voiceless: The Economic Consequences of a Stammering Population

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In this paper Jeff Dwan O'Reilly looks at the effects of speech impediments on an individual's career progression. The paper serves to highlight the complexity of attempting to perform any sort of regression involving income; though a statistically significant effect is found, in that speech impediments reduce income, the paper highlights the need for further research. Some extensions that are required are indeed noted in due course, but the paper serves as an excellent explainer of the issues these people may face.

Introduction

Speech disorders in individuals are not an unusual occurrence in our society, yet still the scope of their consequential effects on individual's well-being, society and the economy, remain largely under analysed from an econometric perspective. This study thus attempts to add to the existing literature on the subject by primarily examining the effects of having a speech disorder on an individual's potential earnings. This question is important not only for the well-being of people with speech disorders - hereafter PWSD's - but potentially society as a whole. Thus, evidence of lower incomes for PWSD's may compel governments to consider providing state funded therapy or treatment supports to help boost their individual productivity, benefiting the entire economy.

Logic and Literature Review

According to The National Institute on Deafness and Other Communication Disorders (NIDCD, 2016) over three million people in the U.S alone

stutter, an estimated 1% of the adult population (Blumgart et al., 2010) making it by far the most prevalent speech disorder. Craig et al. (2009) succinctly describe a stammers physical manifestation as follows;

> involuntary disruptions to the fluency of speech, consisting largely of syllable repetitions, prolongations, blocking of sounds, substitutions and avoidance of words and situations. (p.61).

Considering the description above it is of little surprise that PWSD are much more likely to experience Social Phobia (SP) – an extreme form of anticipatory anxiety which can ultimately lead an individual to a poorer quality of life as they refrain from engaging in possible interactions, where they may be required to communicate with others (Blumgart et al., 2010). This anxiety is a direct result of a chronic fear of embarrassment and being perceived as foolish or incompetent. Often these anxiety effects endure even if the stammer is controlled later in life (Blumgart et al., 2010). This strategy of social avoidance eventually pervades into an individual's employment reasoning and career decisions, as noted by McAllister et al. (2012). They noted that although contrary to previous literature (O'Brien et al. 2011) having a stammer did not significantly impact on an individual's level of educational attainment but rather, stammerers were more likely to be in a lower-socio-economic class than those of the same age without a stammer because of their chosen occupation. Occupations of a high socio-economic status such as professional or managerial posts which command, on average, higher wages often require excellent verbal communication skills especially in a service-based economy. As a result, PWSD's tend to avoid these sorts of jobs, fearing employer rejection or that their speech dysfluency will prevent them from fulfilling the role effectively. Consequently, many PWSD's are underemployed in skilled manual jobs given their potential because of a lack of confidence in their communicative abilities (Craig and Calver, 1991). This conclusion is not without academic support. Klein and Hood (2004), following interviews with PWSD's finding that they tend to, "perceive their stuttering as a major handicap in the pursuit of their true vocation" (p.266). They also found that 70% stammerers believed that their speech disorder decreased their chances of promotion or being hired. 20% even rejected job offers because of their own perceived lack of personal communication competency. Severity of the stammer also played a significant role in individual's employability perceptions with those with severe stammers reporting the most difficultly. However, unsurprisingly, this was not statistically different from mild stammerers, given the severe negative psychological effects of the condition (Klein and Hood, 2004). These negative self-perceptions about employability are

not unfounded with Hurst and Coopers (1983) extensive U.S employer interview surveys revealing that 85% of employers agree that stammering reduced an individual's employability to some degree. They also find that only 9% of employers would choose a stammerer over a non-stammerer for a promotion all else being equal between the candidates. According to Ruben (2000), society has dramatically changed in the last century from a manual labour driven industry to a communication dependent one, where the "fittest" person will be defined by their communication ability. This change may not only reduce PWSD's mean income because of reduced job opportunities but also render many unemployable.

HYPOTHESES AND DESCRIPTION OF THE DATA SET[1]

The primary objective of this study is to determine and interpret, using econometric cross-sectional analysis, the effects of ever having a speech disorder on an individual's reported income. Given the sensitivity of the topic combined with its relative infrequency among the population, sources of appropriate data are notoriously difficult to attain (Palasik et al., 2010). However, for this study individual data was available from the Integrated Public Use Microdata Series website (IPUMS) which contained data relating to the U.S National Health Interview Survey (NHIS). This was an online survey collecting information on the health, health care access, and health behaviours of the civilian population of the U.S.A. Each respondent in the NHIS was automatically assigned a unique identification number which IPUMS uses to match responses to individuals. As a result, those who failed to answer speech related questions, or others regarding their demographics or earnings, could easily be omitted from the analysis without risk of compromising the data ordering.

TEST HYPOTHESIS

H_0:Having ever had a speech disorder does not have any impact on level of current earnings.

H_A:Having ever had a speech disorder does have an impact on level of current earnings.

The overall sample size of the data set was 108,000 but due to missing data entries likely due to oversight or perceived irrelevance on behalf of some respondents in relation to certain key variables to do with speech disorders, the sample size was generally much lower, n=13,618. The sample consisted solely of adults.

The dependent variable of the examination was reported 'Earnings' from the previous calendar year provided they were currently in employment.

1 For summary statistics of data see Appendix table 3.

Earnings ranged from $1 to $75,000+ and were organised in bands of $5000 intervals up to $25000 and bands of $10,000 up to $75,000 with values 1 through 11. For the sake interpretation, these bands were revalued as the means of their respective bands to make earnings a continuous variable, 'Earnings2'. Earnings were further transformed into the log of earnings to estimate percentage changes in earnings.

The independent variables represent a range of explanatory individual characterises with relation to earnings. Native citizen, age, sex, region of residence, were readily available in the data set as were the number of years employed at a job and the number of hours worked per day to a large extent. The variable type for current occupation was extremely broad with over 80 groups. These were reclassified under nine subgroups in line with the Major Occupation Groupings (MOG's) of the U.S National Bureau for Labour Statistics (2001); further detailed below.

With regards the key independent variables of interest used to test Hypothesis 1 of this study it was decided that, given the sample sizes restraints of some variables, a new encompassing dummy variable be generated to maximise the sample size. Thus, the binary variable, ever-had-a-speech-problem (evspeechprobl) was created. [2]

TABLE1: VARIABLE DESCRIPTIONS

Name	Description
evspeechprobl	Has ever suffered from a speech disorder
earnings	Earnings from previous calendar year
log_earnings2	Log of earnings previous calendar year
educ	Educational attainment to the highest level
age	Current age
sex	Male or Female
citizen	Born in the U.S or not.
region	Region of residence in the U.S
yearsonjob	Years on main or longest
hourswrk	Total hours worked last week or usually
secondjob	Have more than one job or business
mog_a	Professional and Technical Occupations
mog_b	Executive, Administrative, And Managerial Occupations
mog_c	Sales Occupations
mog_d	Administrative Support Occupations (Including Clerical)
mog_e	Precision Production, Craft, And Repair Occupations
mog_f	Machine Operators, Assemblers, And Inspectors
mog_g	Transportation and Material Moving Occupations
mog_h	Handlers, Equipment Cleaners, Helpers, And Labourers
mog_k	Service Occupations, Except Private Households

2 EVSPEECHPROBL WAS CREATED FROM OBSERVATIONS FROM A RANGE OF OTHER SPEECH DISORDER RELATED QUESTIONS WHERE IT COULD BE RELIABLY INFERRED THAT, IF ANSWERED IN THE AFFIRMATIVE, THE RESPONDENT HAD, OR STILL CURRENTLY HAS, A SPEECH DISORDER WHICH THEY HAD EITHER BEEN MEDICALLY DIAGNOSED WITH OR SELF-REPORTED..

Empirical Approach

To answer this question we firstly, run a fully specified OLS multiple linear regression model to determine the effect of ever having had a speech disorder on earnings (eq.1). This broad model attempts to control for a variety of other explanatory variables and capture the net effects of each of these independent variables, on log of earnings, thereby reducing the likelihood of omitted variable bias (OVB). From this we will assess the overall explanatory power of the model.

Following this, we conduct and briefly outline the results of a variety of diagnostic, statistical and robustness tests on the model before discussing the results.

Our prior expectation regarding our key explanatory variable, evspeechprobl was that considering the negative physical and enduring psychological effects caused by speech disorders as described in the literature review, we expect that having ever had a speech disorder would likely have a significant negative impact on an individual's current earnings.

Empirical Analysis

We begin our empirical analysis with our final OLS multiple linear regression model with robust errors to describing the relationship between the log of individual earnings and a multitude of independent variables (equation 1).

Equation 1

1. $log\_earnings2 = \beta_0 + \beta_1 evspeechprobl + \beta_2 sex + \beta_3 (evspeechprobl * sex) + \beta_4 educ + \beta_5 age + \beta_6 region + \beta_7 citizen + \beta_8 yearsonjob + \beta_9 secondjob + \beta_{10} hourswrk + \beta_{11} occupation + u.$

Table 2: Primary Regression of independent variables on log_earnings2 with robust standard errors

Dependent Variable	*log_earnings2* Coefficient
Ever had a Speech Disorder =1	-0.169***
	(0.0498)
Sex =1, Female	-0.218***
	(0.0119)
(Evspeechprobl=1 * Sex=1, Female)	0.0293
	(0.0755)
Highest level of Educational Attainment	
Grade 1	-0.331
	(0.218)
Grade 2	-0.425**
	(0.173)
From Grade 3 until leaving college without degree yielded insignificant results.	
AA degree: technical/vocational/occupational	0.256***
	(0.0893)
Bachelor's degree (BA, AB, BS, BBA)	0.422***
	(0.0883)
Master's degree (MA, MS, Meng, Med, MBA)	0.538***
	(0.0891)

Doctoral degree (PhD, EdD)	0.630***
	(0.0942)
U.S. citizenship =1, Yes, U.S. citizen	0.145***
	(0.0204)
Age	0.000192
	(0.000535)
Years on main or longest or last job	0.0158***
	(0.000744)
Region of residence	
North Central/Midwest	-0.117***
	(0.0168)
South	-0.0700***
	(0.0149)
West	-0.0322**
	(0.0163)
Total weekly hours usually worked	0.0221***
	(0.000607)
Have more than one job or business =1, Yes	-0.137***
	(0.0187)
Occupation	
MOG_A (Professionals)	0.360***
	(0.0220)
MOG_B (Managers)	0.338***
	(0.0237)
MOG_C (Sales)	0.132***
	(0.0302)
MOG_D (Administration)	0.284***
	(0.0234)
MOG_E (Precision Production/Craft)	0.215***
	(0.0299)
MOG_F (Machine Operators)	0.289***
	(0.0262)
MOG_G (Transportation)	0.188***
	(0.0294)
MOG_H (Cleaners and Labourers)	-0.0760**
	(0.0314)
Constant	8.903***
	(0.0950)
Observations	13,618
R-squared	0.397
Adjusted R-squared (non-robust standard errors)	0.395

Robust standard errors in parentheses
***p<0.01, **p<0.05, *p<0.1

DISCUSSION OF COEFFICIENTS

Our primary variable of interest, ever-having-a-speech-disorder, is proven to be significant at the 1% level and with a negative coefficient of -0.169. This is both in line with the literature prediction and our test hypothesis, H_A. Thus, we can reject H_0 – and confidently conclude that having, or to have ever had a speech disorder does have a negative impact on an individual's earnings. These results are most likely due to decreased employability in today's communication driven society and individual's specific career avoidance (McAllister et al., 2012). The coefficients predict that controlling for the effects of other variables in the model, those who have or have ever had a speech disorder earn approximately 17% less (-.169) than those who have not.

Both sex and citizen yielded results consistent with our predictions and both at the 1% level of significance. Women earned approx. 22% less than their male counterparts all else being equal and native U.S citizens earned 14.5% more relative to non-native-citizens, who are more likely to suffer from employer discrimination. Although not the focus of this paper, the disparity in earnings between men and women in particular, in this relatively large sample, is socially a troubling result although consistent with the literature (Blau and Kahn, 2017).

Interestingly the interaction variable between evspeechprobl and sex (female) yielded an insignificant result indicating that having a speech disorder did not adversely affect the earning potential of women compared to similarly speech-affected male counterparts. In other words, it seems from the model, that having a speech disorder affects the earning potential of both men and women to the same degree.

As regards education, although statistical significance is lacking for the middle levels of education range it is clear that, higher levels of education yield higher earnings with the top levels such as PhD and master's degrees yielding economically significant positive coefficients statistically significant at the 1% level. Holding all else constant those with doctoral degree's are likely to have earning 63% above average (0.630).

Against initial intuition, age yields an insignificant result. However, given that it surveys only adults this could be due to the rise of educational attainment of younger generations which allows them to earn as high salaries as older generations but at a younger age.

Having more than one job, according to the table, seems to indicate a lower level of earnings which may seem counterintuitive. However, this statistically significant result could be born out of a necessity to work more than desire, as individuals struggle to provide for themselves and others by working multiple low-paying jobs.

Occupation categories also yield some interesting results. As expected, those who occupy professional or managerial executive roles are significantly more likely to earn higher wages than others, given the competency and intelligence they require to perform; 36% and 34% respectively. Although only significant at the 5% level cleaners and labourers were shown to earn less on average.

Region also seems to be a relatively important factor in determining income in the U.S., most obviously those in middle and northern regions where incomes are estimated to be almost 12% lower all else being held equal (0.117).

This could be the hypothetically be explained poorer given its declining economy due to lack of industry and predominantly rural economy.

DISCUSSION OF R-SQUARED AND FURTHER TESTS

An acceptable adjusted R^2 value of 0.395 was obtained in the model indicating that 39.5% of the variation in log of earnings can be explained by the model. Although not high enough to definitively prove a strong relationship it is still a reasonable result. A test for OVB was conducted and did find that despite the multitude of variables contained in fully specified model, it continued to suffer from this effect indicating that some explanatory variables are missing from the model. This is unsurprising however given the size of our models R^2. Earnings are a notoriously difficult variable to explain given the variety of factors that can affect it. Thus, it is important to note the dataset used in this study was originally collected by researchers with the purpose of conducting medical research. Therefore, the number of variables available that were perceived to be relevant in explaining individual's earnings were significantly limited. The inclusion of variables regarding race, level of parental educational attainment, proficiency in the English language and number of children for example, as well as more interactions between variables could well significantly add to the explanatory power of the model. Furthermore, there are some variables that would indeed be extremely useful to include to add to the explanatory power of the model, such as innate talent or intelligence as well as work ethic, but are extremely difficult to control for or find appropriate instruments.

To test for multicollinearity a pairwise correlation table was constructed . With respect to our variable of interest evspeechprobl there was little evidence of multicollinearity with other variables, suggesting as we would expect, that its occurrence and variance is independent of other external factors. The presence of Heteroskedasticity was confirmed using the Breusch-Pagan test – recommend by Baum (2006) and was subsequently corrected to mitigate its effects before presenting the results in the table 2 above.

POLICY IMPLICATIONS AND FURTHER RESEARCH.

Considering the significant results of the regression above we would conclude that there is surely an impetus to provide social and employment support to those who stammer and suffer from social phobia (Blumgart, 2010). Such an existence is not beneficial to society as those individuals with severe speech disabilities are more likely to be unemployed or of a lower socio-economic class than people unafflicted. According to Ruben (2000), communication disorders may

cost the United States between $150 and $186 billion per annum in unfulfilled potential and welfare costs. Furthermore, given the research of Hurst and Cooper (1983) uncovering latent employer attitude towards those with disabilities, there must be more equal and transparent employment policies implemented in the workplace so those with speech disorders, as well as other disabilities, are not discriminated against when it comes to employment and promotion. Allowing those with speech disorders to fulfil their career potential and thereby allowing them to earn higher wages benefits the entire economy as they become more engaged both socially and economically.

Unfortunately, however, the analysis of this study has only made a minor excavation into what is a much larger issue. Given the relatively poor quality of the data in this survey (lack of data on other explanatory variables), as well as well as the preliminary level of analysis, a much more rigorous study should be performed including a broader range of interaction between the explanatory variables before any definitive conclusions are drawn. A more detailed set of quantitative microdata should be collected containing more descriptive details of the stammer itself including its severity as well as the economic habits of stammerers, so as to make a more informed case for future policy action. Quantitative research regarding the evaluation of the most effective form of treatment is also crucial if government of businesses are to be persuaded to provide partially-funded therapy or other support to help maximise the potential of their people. Furthermore, a time-series analysis would also be extremely enlightening as to how the effects of a stammer vary in relation to employment and income over time and whether its effects persist even after treatment.

Conclusion

The primary goal of this paper has been to establish whether a significant relationship existed between ever having had a speech disorder on an individual's earnings. It is the hope of the author that this claim has indeed been appropriately vindicated through appropriate econometric methods and analysis despite issues with regard OVB, and heteroskedasticity. The nature of the affliction makes it difficult to accurately quantify, yet even following a series of robustness checks and controlling for a range of variables it remained stubbornly persistent in both its statistical significance and direction of effect. Thus, this paper has emphasized and explained why there is a need for policy-makers to address, not only this issue regarding speech-disorders, but also other disabilities and conditions that result in unfulfilled potential. As demonstrated by Ruben (2000), less than optimal fulfilment of potential can have damaging economic consequences, not only

for those afflicted, but also for the entire economy.

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APPENDIX

Table 3: Variable Summary Statistics

Variable	*Obs*	*Mean*	*Std.Dev.*	*Min*	*Max*
earnings	40405	6.147	3.063	1	11
earnings2	40405	35755.11	23508.64	2500	75000
evspeechpr~l	34483	.04	.197	0	1
hourswrk	47843	39.35	13.195	1	95
educ	99015	13.527	5.227	1	22
yearsonjob	27080	11.625	10.111	1	35
citizen	108000	1.912	.283	0	1
secondjob	19994	1.092	.289	0	1
earnings	40405	6.147	3.063	1	11
age	108000	36.568	22.634	0	85
sex	108000	1.52	.5	0	1
region	108000	2.759	1.038	1	4
MOG_A	32005	.275	.447	0	1
MOG_B	32005	.129	.335	0	1
MOG_C	32005	.075	.263	0	1
MOG_D	32005	.135	.342	0	1
MOG_E	32005	.076	.265	0	1
MOG_F	32005	.087	.281	0	1
MOG_G	32005	.06	.237	0	1
MOG_H	32005	.057	.232	0	1
MOG_K	32005	.106	.308	0	1

Table:4 – Ever had a Speech Disorder – Frequency.

Evspeechprob	Freq.	Percent	Cum.
0 - No	33,094	95.97	95.97
1 - Yes	1,389	4.03	100.00
Total	34,483	100.00	

Table 5: Pairwise Correlations between variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) log_earnings2	1.000									
(2) evspeechprobl		-0.062*	1.000							
		0.000								
(3) hourswrk	0.460*	-0.022*	1.000							
	0.000	0.002								
(4) educ	0.304*	-0.058*	0.092*	1.000						
	0.000	0.000	0.000							
(5) yearsonjob	0.188*	-0.015*	0.056*	-0.004	1.000					
	0.000	0.016	0.000	0.509						
(6) citizen	0.116*	0.039*	0.028*	0.082*	0.150*	1.000				
	0.000	0.000	0.000	0.000	0.000					
(7) secondjob	-0.009	0.007	0.075*	0.072*	-0.014	0.038*	1.000			
	0.271	0.310	0.000	0.000	0.081	0.000				
(8) sex	-0.168*	-0.015*	-0.199*	0.028*	-0.098*	0.008*	0.009	1.000		
	0.000	0.006	0.000	0.000	0.000	0.013	0.221			
(9) MOG_B	0.156*	-0.013*	0.148*	0.093*	0.098*	0.056*	-0.006	-0.074*	1.000	
	0.000	0.018	0.000	0.000	0.000	0.000	0.362	0.000		
(10) MOG_H	-0.150*	0.004	-0.072*	-0.251*	-0.036*	-0.168*	-0.011	-0.020*	0.095*	1.000
	0.000	0.466	0.000	0.000	0.000	0.000	0.131	0.000	0.000	

* shows significance at the .05 level