



Personality, financial knowledge and credit performance: the USA and the UK comparison

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Outline

- Motivation and objectives
- Brief literature review
- Data description
- Descriptive and summary statistics
- Zero-inflated regression

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Motivation

- A great interest in the use of ‘alternative’ data for credit assessment to help ‘thin credit file’ borrowers.
- Personality is one of alternative types of data that may be useful for thin file augmentation.
- Seems plausible that personality is at least partially responsible for credit repayment behaviour.
- Traditionally ‘Character’ has been considered an important aspect in credit risk management.
- A number of authors noted the importance of financial literacy for credit behaviour.
- Little exploration of the relationship between financial literacy and personality.
- No exploration of cross-country differences.



Personality and credit

Significant positive (+) or negative (-) association with default or poor credit history:

- 'Big Five'
 - Conscientiousness: Bernerth, 2012 (-), Rustichini et al. , 2012 (+), Klinger et al, 2013 (-)
 - Extraversion: Rustichini et al. , 2012 (+)
 - Agreeableness: Bernerth, 2012 (+)
 - Neuroticism: anxiousness in Stockham & Hesseldenz, 1979 (-), Rustichini et al. , 2012 (+), Klinger et al, 2013 (-)
 - Openness: For general risk-taking behaviour Anic, 2007 (+), Amichai-Hamburger and Vinitzky, 2010 (+).



Financial knowledge

- Finance theory suggests that consumers are debt averse and want to pay off debt, especially if they realise the consequences of non-payment (Prelec & Loewenstein, 1998).
- Financial knowledge is seen as a cornerstone of savvy financial behaviour (Lusardi & Mitchell, 2014)
- A general level of financial literacy is found to be low (Lusardi, 2008)
- A related concept is confidence in applying the knowledge or efficacy (awareness), which has been shown to be important in explaining financial outcomes (Farrell et al, 2016; Lown, 2011; Tang and Baker, 2016).



Data USA

On-line responses from M-Turk respondent pool

Measure/Block of Questions	# non-missing	Mean	St dev
Self-reported # missed payments	242	1.05	1.44
Financial knowledge - test	241	0.6	0.14
Financial awareness	168	0.75	0.11
Agreeableness	243	3.98	0.88
Neuroticism	243	2.46	1.05
Conscientiousness	243	3.91	0.87
Openness	243	3.90	0.96
Extraversion	243	2.46	1.16
Age	243	38.48	11.66
Gender (Female=1)	243	0.48	0.4997
Income	243	50473	29768



Data UK

On-line responses from Qualtrics respondent pool

Measure/Block of Questions	# non-missing	Mean	St dev
Self-reported # missed payments	559	1.04	1.65
Financial knowledge - test	559	0.54	0.17
Financial awareness	559	0.59	0.16
Agreeableness	559	3.58	0.61
Neuroticism	559	3.13	0.78
Conscientiousness	559	3.44	0.63
Openness	559	3.57	0.56
Extraversion	559	3.16	0.74
Age	305	23.97	3.79
Gender (Female=1)	305	0.55	0.497



missed payments



	Frequency	Percent
Never	127	52.48
Once	55	22.73
Twice	18	7.44
Three times	4	1.65
Four or more	38	15.70



	Frequency	Percent
Never	239	65.48
Once	56	15.34
Twice	44	12.05
Three times	17	4.66
Four or more	9	2.47



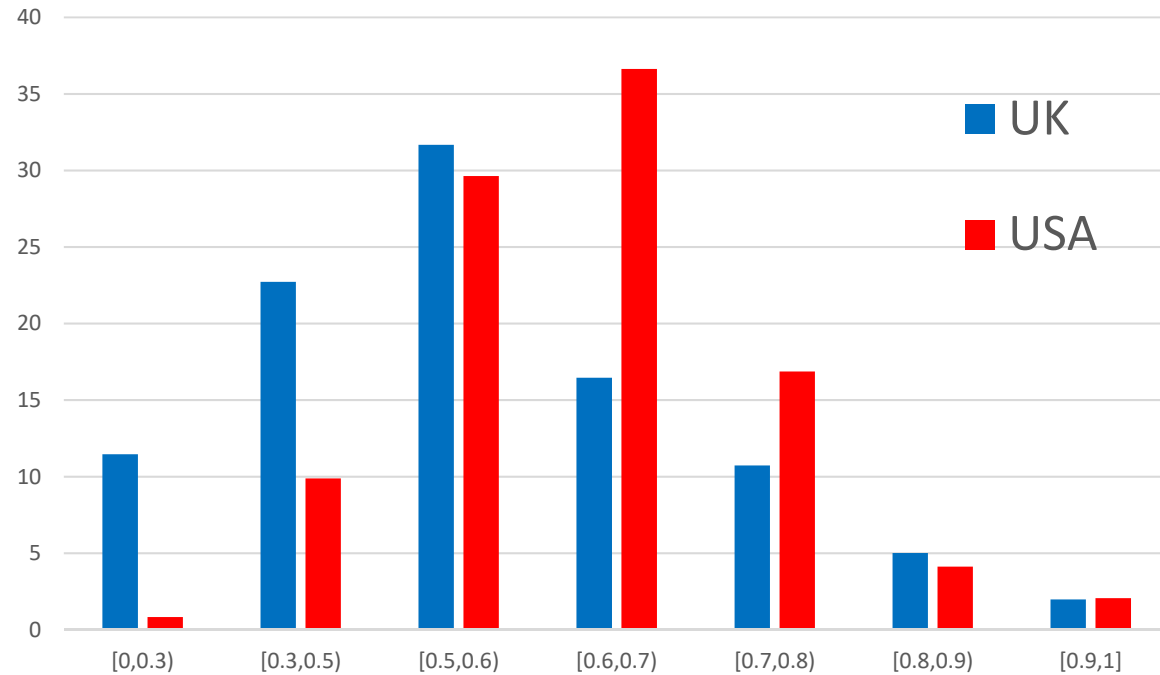
Financial knowledge, % correct answers



Mean	0.599
Median	0.625



Mean	0.534
Median	0.583





Binary logistic, 3+missed payments, P= 'Good'

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	0.8405	2.3851	0.1242	0.7245
Fin knowledge	1	-0.5123	1.5616	0.1076	0.7429
Fin awareness	1	4.1748	1.9985	4.3635	0.0367
Agreeableness	1	0.0818	0.3037	0.0726	0.7877
Neuroticism	1	-0.5655	0.2360	5.7404	0.0166
Conscientiousness	1	0.0608	0.2599	0.0548	0.8150
Openness	1	-0.2528	0.2408	1.1028	0.2936
Extraversion	1	0.2133	0.2286	0.8707	0.3508
Income (ranks)	1	0.4389	0.0950	21.3629	<.0001
Age (ranks)	1	-0.4118	0.0905	20.6925	<.0001
Female	1	0.2253	0.4634	0.2363	0.6269



Binary logistic, 3+missed payments, P='Good'

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	3.7773	2.3284	2.6317	0.1047
Fin knowledge	1	0.2263	1.1114	0.0415	0.8386
Fin awareness/ confidence	1	4.5872	1.3111	12.2414	0.0005
Agreeableness	1	-0.0311	0.0344	0.8165	0.3662
Neuroticism	1	-0.0588	0.0411	2.0468	0.1525
Conscientiousness	1	0.0205	0.0434	0.2223	0.6373
Openness	1	-0.0532	0.0377	1.9917	0.1582
Extraversion	1	-0.0049	0.0352	0.0191	0.8902
Age	1	-0.0423	0.0515	0.6746	0.4115
Female	1	0.2875	0.3976	0.5231	0.4695



Zero-inflated models

Zero-inflated models are used for modelling excess zeros and at the same time correct for overdispersion. The assumption is that there are two possible data generation processes, which the two processes should be used is determined by a Bernoulli experiment. For each observation i , the first process 1 is assigned with probability ϕ_i and the second process - with probability $1 - \phi_i$. The first process is responsible for only zero counts. The second process produces counts from either a negative binomial or a Poisson.

$$y_i \sim \begin{cases} 0 & \text{with probability } \phi_i \\ f(y_i) & \text{with probability } 1 - \phi_i \end{cases}$$

The probability of number of counts taking a particular value $\{Y_i = y_i\}$ is given by

$$P(y_i = 0 | x_i) = \phi_i + (1 - \phi_i) g(0)$$

$$P(y_i | x_i) = (1 - \phi_i) g(y_i), \quad y_i > 0.$$

To link the probability ϕ_i to different characteristics of observation i , ϕ_i is written as a function of $z_i' \beta$, where z_i' is the vector of zero-inflation covariates and β is the vector of zero-inflation coefficients to be estimated. The function that relates the product of $z_i' \beta$, to the probability ϕ_i is called the zero-inflation link function. We used logistic as a link function.



Zero inflated Poisson, P=0

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	6.13067	2.77279	2.21	0.027
Fin knowledge	1	-2.545	2.15828	-1.18	0.2383
Fin awareness	1	-3.8145	3.38339	-1.13	0.2596
Agreeableness	1	0.19074	0.48787	0.39	0.6958
Neuroticism	1	0.09628	0.40862	0.24	0.8137
Conscientiousness	1	0.50839	0.39261	1.29	0.1954
Openness	1	0.15028	0.6848	0.22	0.8263
Extraversion	1	-0.3437	0.33404	-1.03	0.3035
Income (ranks)	1	-0.0519	0.12437	-0.42	0.6765
<i>Age (ranks)</i>	<i>1</i>	<i>-0.7739</i>	<i>0.23624</i>	<i>-3.28</i>	<i>0.0011</i>
Female	1	0.55623	0.66484	0.84	0.4028



Zero inflated Poisson, $P = n$

Analysis of Maximum Likelihood Estimates					
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	2.40333	0.5598	4.29	<.0001
Fin knowledge	1	-0.4804	0.48166	-1	0.3185
Fin awareness	1	-1.7303	0.6234	-2.78	0.0055
Agreeableness	1	0.07134	0.09321	0.77	0.4441
Neuroticism	1	0.16364	0.08198	2	0.0459
Conscientiousness	1	-0.0788	0.07755	-1.02	0.3093
Openness	1	0.17647	0.09323	1.89	0.0584
Extraversion	1	-0.099	0.08099	-1.22	0.2214
Income (ranks)	1	-0.1504	0.02716	-5.54	<.0001
Age (ranks)	1	0.02519	0.02996	0.84	0.4006
Female	1	-0.0623	0.15346	-0.41	0.685



Zero inflated Poisson, P=0

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	0.82101	2.14225	0.38	0.7015
Fin knowledge	1	0.2521	1.00554	0.25	0.802
Fin awareness/ confidence	1	4.21087	1.24116	3.39	0.0007
Agreeableness	1	-0.0479	0.03346	-1.43	0.1525
Neuroticism	1	0.06	0.0372	1.61	0.1068
Conscientiousness	1	0.04397	0.03914	1.12	0.2613
Openness	1	-0.0476	0.03571	-1.33	0.1826
Extraversion	1	-0.0287	0.032	-0.9	0.3692
Age	1	-0.1316	0.04505	-2.92	0.0035
Female	1	0.05019	0.33325	0.15	0.8803



Zero inflated Poisson, $P = n$

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	0.50024	1.01643	0.49	0.6226
Fin knowledge	1	-0.9184	0.41981	-2.19	0.0287
Fin awareness/ confidence	1	-1.5515	0.52086	-2.98	0.0029
Agreeableness	1	0.0049	0.01459	0.34	0.7368
Neuroticism	1	0.01226	0.01452	0.84	0.3982
Conscientiousness	1	0.00019	0.01924	0.01	0.9922
Openness	1	-0.0008	0.01874	-0.04	0.9666
Extraversion	1	0.01589	0.01403	1.13	0.2574
Age	1	0.02459	0.02019	1.22	0.2231
Female	1	-0.1303	0.1447	-0.9	0.3679



Discussion 1

- The analysis provides an initial exploration of the associations between personality, financial knowledge/ awareness and missed credit re-payments.
- Using a standard default definition of 3+ missed payments we observe significant association with Financial Awareness and Neuroticism for the USA; and with Financial Awareness for the UK.
- Yet, the associations may differ depending on the level of the delinquency, therefore models for count data and zero-inflated models are used.
- Zero-inflated models show better fit, suggesting that there might be different types of behaviour: for people never missing a single payment, and people with varying levels of delinquency.



Discussion 2

- For the USA, ‘soft’ variables significantly associated with varying levels of delinquency, include Financial Awareness, Neuroticism, Openness, although there are no notable associations of personality and knowledge (‘soft’ variables) with the probability of never missing a single payment.
- For the UK, there is a significant association of Financial Awareness with the probability of never missing a single payment, and also with varying levels of delinquency, together with Financial Knowledge.
- Further work may explore interactions between predictors, e.g. gender.

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