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ARTICLE

What is the Impact of Financial Difficulties on Reaching Happiness?

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ARTICLE INFO

Article history
Received: 13 February 2019
Accepted: 25 February 2019
Published: 1 March 2019

Keywords:
Happiness frontier
Stochastic frontier analysis
Financial difficulties

JEL: I31, R15

ABSTRACT

This paper provides a framework to reveal a measure of happiness based on British Household Panel Survey. Thereafter we focus on what is the impact of financial difficulties faced by individuals in the survey on reaching the frontier. By doing so, we also explore the underlying causality threads between happiness and financial difficulties. Our methodology follows a stochastic frontier analysis framework to estimate the happiness frontier, while we employ a flexible panel VAR for the underlying responses to shocks and estimating variance decompositions.

1. Introduction

The economics of happiness does not purport to replace income-based measures of welfare, but instead to complement them with broader measures of well-being. The field has grown substantially since the late 20th century, for example by the development of methods, surveys and indices to measure happiness and related concepts. The utilization of resources in support of improved individual happiness, including an individual's social, human, hedonic, and financial capital, has become a popular activity, a cridecoeur for a growing international movement amongst organizational leaders, consultants who advise them, and a core governmental concern.

The examination of happiness has gathered momentum since McCrae and Costa (1991) and several studies report plethora of findings (Diener and Seligman, 2002; Hayes and Joseph, 2003; Steel et al., 2008; Weber and Huebner, 2015)[1]. Alas, there is little evidence of the nexus between happiness and financial difficulties. This paper provides the missing link between happiness and financial difficulties. Moreover, building on Rayo and Becker (2007) we also estimate a happiness frontier function by introducing a parametric measured based on stochastic frontier analysis.

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1 Some studies show that greater extraversion and lower neuroticism positively affect happiness (Cheng and Furnham, 2003; Diener and Seligman, 2002; McCrae and Costa, 1991). Openness appears to embrace a mixed influence (Hayes and Joseph, 2003). There are also two additional personalities: agreeableness and conscientiousness that could nest the three main ones (McCrae and Costa, 1991).

 DOI: https://doi.org/10.30564/mmpp.v1i1.533

2. Empirical Methodology and Results

Our data set comprises the British Household Panel Survey for the period 1996-2018. Following Rayo and Becker (2007) theoretical model, we build on the concept of a happiness function that takes the form:

$$H_{it} = f(X_{it}, Z_{it}) + v_{it} + u_{it} \quad (1)$$

where Hit denotes observed individual's life satisfaction (i.e. happiness, on a scale from 1 to 7) for individual i at year t; Xit is a vector of inputs such as annual household income, health, and education; and Z_{it} is a vector of control variables.[2] Z_{it} counts for age, number of children, marital status, employment status, gender, region and year dummies, vit corresponds to random fluctuations, while uit accounts for individual's happiness frontier that may raise individual's gain in terms of happiness.

To empirically implement the above model of happiness function, we assume that individuals have an underlying happiness frontier that model (1) would reveal. To do so, we opt for the following translog specification of the happiness function:

$$\begin{aligned}
\ln H_i = {} & \alpha_0 + \sum_i a_i \ln P_i + \sum_i \beta_i \ln Y_i + \\
& \tfrac{1}{2}\sum_i \sum_j a_{ij} \ln P_i \ln Pj + \\
& \tfrac{1}{2}\sum_i \sum_j \beta_{ij} \ln Y_i \ln Y_j + \\
& \sum_i \sum_j \delta_{ij} \ln P_i \ln Y_j + \sum_i \varphi_i \ln N_i + \\
& \tfrac{1}{2}\sum_i \sum_j \varphi_{ij} \ln N_i \ln N_j + \\
& \sum_i \sum_j \xi_{ij} \ln P_i \ln N_j + \theta_1 t + \\
& \tfrac{1}{2}\theta_2 t^2 \sum_i \mu_i t \ln P_i + \sum_i \kappa_i t \ln Y_i + \\
& \sum_i \nu_i t \ln N_i + kD_i + \sum_i \xi_i Z_i + u_i + v_i
\end{aligned} \quad (2)$$

Standard symmetry restrictions in all quadratic terms are imposed in accordance with theory, while we also include dummies to capture any differences across specific groups (clusters) of individuals and time effects.

The translog happiness function is flexible and also non-linear and as such it would serve as a good fit to otherwise unobservable happiness frontier. We estimate the stochastic frontier model (2) via a maximum likelihood procedure parameterized in terms of the variance parameters $\sigma_\varepsilon^2 = \sigma_u^2 + \sigma_v^2$ and $\lambda = \sigma_u / \sigma_\varepsilon$.

The maximum likelihood procedure is an efficient estimation method and it fits the underlying data generating process of our sample. Note that as our sample refers to British Household Survey it includes a plethora of individuals who vary considerably. In the estimation of our stochastic frontier model we employ panel regressions where variability is important to obtain identification of the happiness frontier. Maximum likelihood estimation considers the above and provides accuracy in our estimations.

Figure 1 provides the histogram of the happiness frontier across the whole spectrum of individuals in the survey. At the outset it appears that the distribution of happiness frontier follows a bell shape that could resemble the normal distribution. In some detail, results show that the average happiness frontier for UK individuals over the period 1996-2018 is 0.4383 (see Figure 1 for the histogram and also Table 1 for the descriptive statistics). What does this imply? With given resources, an average individual is achieving 43.83% efficiency in transforming these resources to reach the optimal happiness frontier.[3] These findings highlight that there could be significant margins for improving happiness frontier with the existing resources by just employing these resources more efficiently.

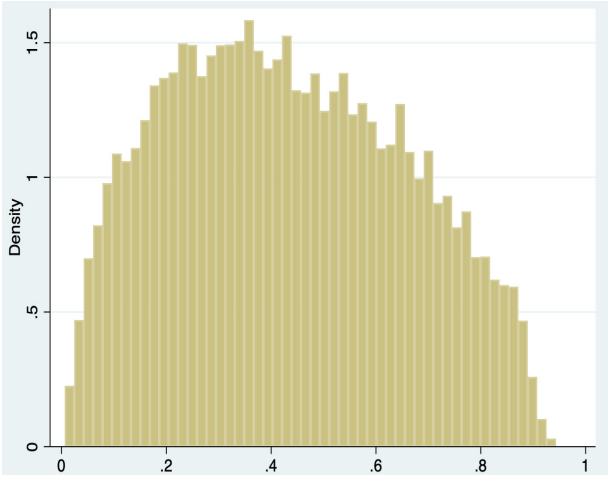

Figure 1. Histogram of Happiness Frontier

Notes: This Histogram illustrates average time-varying happiness frontier obtained from the Stochastic Frontier Analysis.

2 Binder and Broekel (2011) opt for a non-parametric production function with similar inputs to estimate happiness efficiency.

3 Using the order-m nonparametric approach, Binder and Broekel (2011) find that 49.88% of UK individuals in the sample (in 2005) can be considered efficient.

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Table 1. Detailed descriptive statistics of the happiness frontier

	Obs	Mean	Std. Dev.	Min	Max
Happiness Frontier	166,381	0.4317336	0.2244773	0.0062445	0.943563
	Percentiles		Smallest		
1%	0.0370763		0.0062445		
5%	0.0888921		0.0062445		
10%	0.1351326		0.0062445	Obs	166,381
25%	0.2479982		0.0062445	Sum of Wgt.	166,381
50%	0.4180616			Mean	0.4317336
				Std. Dev.	0.2244773
	Percentiles		Largest		
75%	0.6085216		0.943563		
90%	0.749859		0.943563	Variance	0.05039
95%	0.8148197		0.943563	Skewness	0.1697354
99%	0.8835488		0.943563	Kurtosis	2.054267

Notes: This Table reports the descriptive statistics in much detail of the happiness frontier as depicted by the histogram in Figure 1.

Table 1 reports parameters descriptive statistics for happiness frontier. It is worth noting that we cover a longs sample with over 166.000 observations and we estimate the frontier of happiness to vary for the different percentiles quite considerable, from 0.03 in 1% to 0.88 in 99% (being at 0.42 in 50%). These results do not come as a surprise, since significant variability is expected given that the underlying data generating process refers to individuals that would differ considerably. The challenge is then to proceed with an inference of what explain the happiness frontier.

Table 2 reports estimated results from equation (1) for key Xit and Zit variables. Most of the coefficients are statistically significant. Among the inputs, income and excellent health condition show a positive effect on happiness, in line with Clark et al. (2009). On the other hand, medium and high educational statuses appear to lessen happiness, which could be explained by the anxiety related at times to education. In addition, individuals tend to be less happy when getting older, having more children, being unemployed, and not in a married relationship.

Personality types appear to statistically significantly affect happiness frontier, as extraversion and openness are positively related to happiness, in line with McCrae and Costa (1991). The opposite result is reported for the impact of neuroticism on frontier similarly to Diener and Seligman (2002). Neuroticism, in particular, appears to dominate other types of personality in its interaction with FS, which is reported to significantly reduce happiness frontier.

Table 2. Parameter estimates of the happiness function

Variables	Coefficient	Standard error
Income	0.00087***	0.0001
Excellent health	0.22445***	0.0070
Fairly/Very poor health	-0.38484***	0.0073
High education	-0.15230***	0.0119
Medium education	-0.13151***	0.0114
Age	-0.02332***	0.0016
Age-squared	0.00031***	0.0000
Number of children	-0.04149***	0.0045
Marital status-separated	-0.34646***	0.0218
Marital status-divorced	-0.19301***	0.0147
Marital status-widowed	-0.23643***	0.0183
Marital status-never married	-0.12973***	0.0128

Notes: This Table reports main parameters (due to space limitation) of the happiness function (1), estimated using the Stochastic Frontier Analysis. Output: happiness; Inputs: health (excellent, good, fairly/very poor), income, education (high, medium, other). Control variables: age, age-squared, number of child, personality, financial shock, financial shock-personality interactions, and dummies of marital status, employment status, gender, region, and time. *, **, ***: significant at 10%, 5%, 1% level, respectively.

Having derived the happiness frontier, next we examine what are the underlying factors that could shape the frontier. Unequivocally, financial conditions that individuals

 DOI: https://doi.org/10.30564/mmpp.v1i1.533

in the Survey face could play a role in their quest to reach the happiness frontier. Alas, we remain agnostic about the possible impact of a shock in financial conditions on individual's happiness.

We explore next the nexus between happiness frontier and individual's financial conditions as measured by the Survey data set. Moreover, the survey records individuals who state that they face either quite difficult or very difficult financial conditions. From the survey also, we employ the financial indebtedness of the individuals.

Next, we explore, as a first step, the impact of a shock in individual's indebtedness on happiness frontier. To this end, we follow a 2x2 panel VAR model. The value of the Panel-VAR analysis lies primarily on the error terms that are used to calculate impulse responses rather than on individual parameter estimates of the system of equations (Love and Zicchino, 2006). We solve the model and obtain the moving average (MA) representations. This is done by recursive elimination of lagged independent covariates.

The MA representation shows how the endogenous variables depend on the lagged residuals from the reduced form. The MA representation equates Happiness frontier Hit and both life and individual's indebtedness Dit on present and past residuals e1 and e2 from the Panel-VAR estimation:

$$H_{it} = a_{10} + \sum_{j=1}^{\infty} b_{11j} e_{1it-j} + \sum_{j=1}^{\infty} b_{12j} e_{2it-j}$$
$$D_{it} = a_{20} + \sum_{j=1}^{\infty} b_{21} j e_{1it-j} + \sum_{j=1}^{\infty} b_{22j} e_{2it-j} \quad (3)$$

Under the endogeneity assumption the residuals will be correlated and therefore the coefficients of the MA representation are not interpretable. As a result, the residuals must be orthogonal. We orthogonalize the residuals by multiplying the MA representation with the Cholesky decomposition of the covariance matrix of the residuals. The orthogonalized, or structural, MA representation is:

$$H_{it} = \alpha_{10} + \sum_{j=1}^{\infty} \beta_{11j} \varepsilon_{1it-j} + \sum_{j=1}^{\infty} \beta_{12j} \varepsilon_{2it-j}$$
$$D_{it} = \alpha_{20} + \sum_{j=1}^{\infty} \beta_{21j} \varepsilon_{1it-j} + \sum_{j=1}^{\infty} \beta_{22j} \varepsilon_{2it-j} \quad (4)$$

and:

$$\begin{pmatrix} \beta_{11j}\beta_{12j} \\ \beta_{21j}\beta_{22j} \end{pmatrix} = \begin{pmatrix} b_{11j}b_{12j} \\ b_{21j}b_{22j} \end{pmatrix} P \begin{pmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \end{pmatrix} = P^{-1} \begin{pmatrix} e_{1it} \\ e_{2it} \end{pmatrix}$$

where P is the Cholesky decomposition of the covariance matrix of the residuals:

$$\begin{pmatrix} Cov(e_{1it}, e_{1it}) Cov(e_{1it}, e_{2it}) \\ Cov(e_{1it}, e_{2it}) Cov(e_{2it}, e_{2it}) \end{pmatrix} = PP^{-1} \quad (5)$$

The orthogonal residuals can be interpreted as shocks: ε1it is a shock in the happiness frontier and ε2it is a shock in the individual's indebtedness.

The coefficients in the equations (4) give the current response of the left-hand side variable to shocks occurring j periods ago. The advantage of this reduced form Panel-VAR specification is that we can assess the dynamic interdependencies between happiness frontier and individual's indebtedness with the minimum of restrictions imposed.

Table 3 reports the forecast error variation of the *2x2* panel VAR. It reports 5 and 10 period ahead variance decompositions, where 13.8% and 16.1% respectively of the forecast error variance of the happiness frontier is explained by individual's indebtedness.

Table 3. Variance Decompositions of Happiness Frontier to Financial Shock

Period	Variables	Frontier	Indebtedness
5	Frontier	0.8619565	0.1380435
5	Indebtedness	0.1621471	0.8378529
10	Frontier	0.838778	0.1612221
10	Indebtedness	0.161222	0.838778

Notes: This Table reports the variance decompositions of the panel VAR model for 5 and 10 periods ahead for a system of two variables: happiness frontier *HE*, financial shock FS.

Further to the forecast variance decompositions we provide, next, the Impulse Response Function (IRFs thereafter). Figure 2 reports the corresponding Impulse Response Functions. Results demonstrate the negative response of happiness frontier (*HE*) to a one standard deviation shock on the individual's indebtedness (*indebt*) (see Figure 2, first row, second column). Something that it is also worth noting is that a shock in individual's indebtedness would results to an increase in individual's indebtedness (see Figure 2, first row, first column) with a very high significant level. In other words, individuals who face indebtedness could face a vicious spiral whereby further shocks would cause them to further indebtedness.

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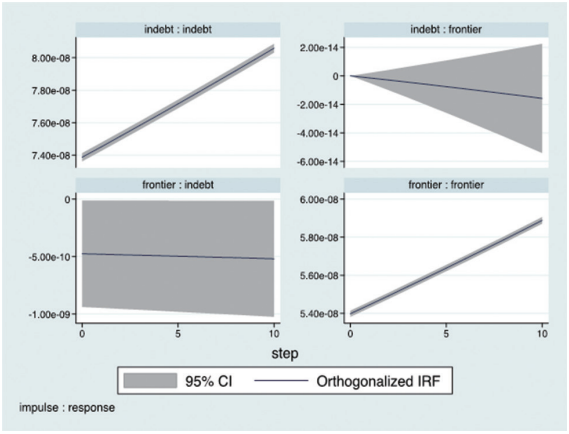

Figure 2. Impulse response functions: the impact of individual's indebtedness on happiness frontier

Notes: This Figure illustrates Impulse Response Functions for 1 lag panel VAR analysis with two variables: happiness frontier HE and the individual's indebtedness (indebt). CI: confidence intervals.

Next, we expand our analysis with a 4x4 panel VAR. The four variables are happiness frontier (HE) obtained from model (1), individual indebtedness, quite difficult financial conditions and very difficult financial conditions.

Table 4 shows that 0.03% of the forecast error variance of happiness frontier is explained by indebtedness. Individuals' happiness frontier is also responding to shocks as measured by individuals who report that they face quite difficult financial conditions (see DIF1) and very difficult financial conditions (see DIF2).

Table 4. Variance decompositions: the impact of financial shock-personality on happiness frontier

Period	Variables	HE	indebt	DIF1	DIF2
5	HE	0.9972808	0.0027191	4.72E-16	1.59E-15
5	indebt	0.0298345	0.9701656	6.34E-14	2.42E-14
5	DIF1	0.0000302	0.0000951	0.9998747	1.24E-14
5	DIF2	0.0001208	0.0000617	0.0000377	0.9997798
10	HE	0.9971379	0.002862	3.28E-15	1.55E-14
10	indebt	0.0297716	0.9702284	9.00E-15	3.55E-15
10	DIF1	0.0000297	0.0001017	0.9998685	3.92E-14
10	DIF2	0.0001327	0.0000685	0.0000377	0.9997611

Notes: This Table reports the variance decompositions of the panel VAR model for 5 and 10 periods ahead for a system of four variables: happiness frontier (HE), individual's indebtedness (indebt), quite difficult financial conditions (DIF1) and very difficult financial conditions (DIF2).

Figure 3 reports the corresponding Impulse Response Functions. Results demonstrate the negative response of HE to a one standard deviation shock on individual's indebtedness (see last row of Figure 3).

Interestingly, we also report results of IRFs that show that there is a negative response of HE to a one standard deviation shock on quite difficult financial conditions (DIF1) and very difficult financial conditions (DIF2) (see last row of Figure 3). These results are of importance as they demonstrate that together with individual's indebtedness the manner individuals perceive their financial constraints also affect negatively reaching for the happiness frontier.

These results shed new light into the individual's adaptation to external shocks (Di Tella et al., 2010), whereby certain types of individuals who consider that they face quite difficult and very difficult financial conditions would diverge from reaching the happiness frontier.

It is also worth noting that that there is a positive response of DIF2 to a one standard deviation shock on DIF1 (see first row of Figure 3), at least in the short run. These results insinuate that individuals who perceive that they face very difficult financial conditions would also respond with a positive sign to a shock in perception that they are facing quite difficult financial conditions.

The above would imply that there might be a feedback loop between the various shocks and responses.

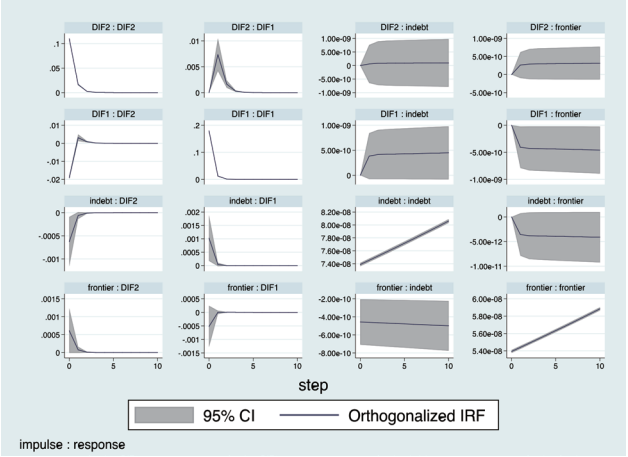

Figure 3. Impulse response functions: the impact of financial shock-personality on happiness frontier

Notes: This Figure illustrates Impulse Response Functions for 1 lag panel VAR analysis with four variables: happiness frontier (HE), individual's indebtedness (indebt), quite difficult financial conditions (DIF1) and very difficult financial conditions (DIF2).

3. Conclusion

The paper provides for the first-time parametric happiness frontier, which highlights that gains could be observed without resorting to further resources. In addition, we show that financial conditions, and in particular the way individuals perceive their financial conditions, would affect their trajectory towards reaching the happiness frontier.

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We show that an average individual as recorded in the British Household survey would underachieve its full happiness potential, as she/he reaches 43.83% of happiness frontier. To this end, there is some 56% of further improvement in transforming these resources to reach the optimal happiness frontier. Our study goes further to explore whether financial conditions would deter individuals from reaching their happiness frontier.

Our results are of interest as they show that individual's response to a one standard deviation shock on the individual's indebtedness is negative. Similar results are reported for the case that individuals perceive that they face quite difficult financial conditions and very difficult financial conditions.

These results could be of interest for policy makers and individuals alike. Policy makers should take every effort to ensure that certain monitoring of individual's indebtedness is in place so as to consider measures to alleviate financial constraints faced by individuals. Alas, it is well known that British households face with high levels of indebtedness and thereby households should consider acting against further debts within their household budgets constraints. The present study has not considered such households budget constraints. Future research should look much more in detail in similar issues.

Acknowledgement: We are grateful to Yannis Geogrellis for providing the dataset and Michael R.M. Abrigo and Inessa Love for the panel VAR's codes.

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DOI: https://doi.org/10.30564/mmpp.v1i1.533