Longitudinal patterns of financial product ownership: a latent growth approach

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Abstract The main goal of this study is to analyze the dynamic process of financial product ownership of Italian households under the assumption of multiple latent trajectories of growth. Using panel data from the Survey on Income and Wealth conducted by the Bank of Italy, we conclude that the trajectory of Italian households in terms of financial product ownership in the period 2000 to 2008 can be represented by two latent factors describing two specific behaviours: state bonds ownership and all other types of financial assets ownership. We also find that this behaviour is significantly influenced by the area of the country where the family lives and other characteristics of the head of the household, such as labour condition and education.

1 Introduction

Latent growth models (LGM) consider both intra-individual change and inter-individual differences in such change by estimating the amount of variation across individuals in the latent growth factors (random intercept and slope) as well as the average growth (Bollen and Curran, 2006). The assumption of unidimensionality in the growth process – all manifest variables measured by the same latent factor – is not always realistic. If multidimensionality exits and is ignored, statistical results maybe seriously biased. Thus, multidimensional latent growth modelling allows specifying multiple latent trajectories at the same time with varying parameters and inter-relations between the processes.

This paper illustrates the enormous potential of this type of longitudinal latent variable modelling. The application estimates the evolution of financial product ownership at household level in Italy in the period 2000 to 2008. We model the binary

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indicators of ownership (i.e., whether a given household owns a certain type of financial asset) as multiple indicators of a latent process.

2 The latent growth model

Let us define the structure of the data being modelled. Each household i at a given time t may hold or not the financial product j. Thus, y_{ijt} is a binary variable where 0 is the case when the household does not hold the financial product and 1 otherwise – $i = 1,..,n; j = 1,...,J; t=1,...,T$.

Let y_{ijt}^* be a continuous score underlying y_{ijt}, i.e., by defining a threshold ν_{jt} it turns out that $y_{ijt} = 0$, for $y_{ijt}^* \leq \nu_{jt}$, and $y_{ijt} = 1$, otherwise. Let h_{itk} be the latent variable or score of household financial ownership at time t in dimension k. Thus, for each household and time point, it results a k-dimensional factor-item response model for each indicator: $y_{ijt}^* = \lambda_{jtk} h_{itk} + \varepsilon_{ijt}$, where the intercept is omitted, given the threshold, the factor loadings are λ_{jtk}, a latent variable h_{itk}, and a specific residual ε_{ijt}. The growth model requires measurement invariance of the factors across time, i.e., the thresholds and factor loadings of the indicators are equal over time: λ_{jk} and ν_j, respectively. Moreover, for scaling identification, the first loading is set to 1.

The LGM (Meredith and Tisak, 1990) is defined by the latent process $h_{itk} = h_{ik}^I + (t-1)h_{ik}^S + \varepsilon_{itk}$ that gives the trajectory of the household i financial ownership at time t, where h_{ik}^I and h_{ik}^S are the intercept and slope of the process, respectively. ε_{itk} is the error term

For the conditional model, the intercept and the slope of each factor are function of the observed variables contained in the vector $\underline{x}_i$ (Salgueiro et al., 2011): $h_i^I = \alpha_0^I + \underline{\alpha}_1^I \underline{x}_i + \zeta_i^I$; $h_i^S = \alpha_0^S + \underline{\alpha}_1^S \underline{x}_i + \zeta_i^S$, where h_i^I and h_i^S are continuous latent variables, α_0^I and α_0^S are constant, and $\underline{\alpha}_0^S$ and $\underline{\alpha}_1^S$ contain the coefficients of the covariates in the conditional model.

Model parameters are estimated via maximum likelihood using the EM algorithm.

3 The empirical study

The Bank of Italy (BI) has been running the Survey of Household Income and Wealth (SHIW) since 1965. With a few exceptions, the survey was conducted on a two-year basis since then. SHIW provides information on income, savings, consumption expenditure and the real wealth of Italian households, as well as on

household composition and labour force participation. In 1989, BI introduced a longitudinal component in the survey, adopting a peculiar split panel design: at each survey wave, the sample consists of two sections: a panel sub-sample, made up of households who participated in the previous wave; and a fresh cross-sectional sub-sample. In this paper we consider the sub-sample of 1684 households interviewed in the waves from 2000 to 2008 and ownership of 13 different assets[2].

Area of the country and education and professional status of the head of the household are added as time constant covariates (observed in 2000), making the modelling of intercept and slope of the latent processes conditional. In 2000, 45.96% of the households were from the North of Italy (NORTH), and 21.28% and 32.76% were from the Centre and the South (SOUTH), respectively. Moreover 16.6% of heads of household were workmen, 15.9% clerks (CLERK), 3.3% managers (MANAGER), 12.2% were self-employed (SELF) and 52.0% not working (NOTWORK). The distribution by education was: 5.5% did not attend school, 28.7% elementary school (ELEM), 29.1% middle school (MED), 28.2% high school (HIGH) and 8.5% university or higher (UNIV).

Estimated loadings (Table 1) for the two latent processes show that all indicators are positively associated with the two factors and lead to interpret factors 1 and 2 as ownership of state bonds and ownership of all other types of financial products, respectively.

Table 1: *Estimated loadings*

	Factor 1			Factor 2	
	Estimate	s.e.		Estimate	s.e.
BOT	1.00	-	SHA	1.00	-
CCT	3.03	0.12	DEP	2.25	0.82
BTP	2.76	0.14	PCD	1.06	0.19
			PCT	1.95	0.30
			BFP	0.56	0.08
			OBB	1.95	0.37
			QFC	2.20	0.44
			PGP	1.24	0.26
			PTE	2.25	0.33
			COO	0.90	0.17

The main focus of the analysis is on the structural part of the model, i.e., the latent trajectories measured by the indicators and explained by the covariates (Table 2).

For factor 1 – ownership of state bonds, we conclude that: (i) the intercept (expected value in 2000 assuming null covariates) is only significantly influenced by SOUTH, i.e., households from the southern area of Italy are expected to have an initial score of 0.35 lower than those living in the central area of the country; (ii) the slope is significantly different for households living in the North (0.08) compared to those living in the Centre; (iii) middle and high school, and university degree

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[2]Ordinary Treasury bills - BOT, repos - CCT, multi-annual Treasury bills - BTP, shares - SHA, deposits - DEP, certificates of deposits - PCD, Treasury credit certificates - PCT postal bonds -POB, bonds - OBB, mutual funds - QFC, assets under management - PGP, foreign securities -PTE, loans to cooperative – COO.

categories have also a significant and positive impact on the slope of the trajectory of owning state bonds compared to the lowest level of education.

For factor 2 – owning all other types of financial products, we conclude that: (i) the expected value in 2000 is significantly higher in the North (0.11), and for high school and university degree; (ii) the slope has a significantly negative constant, but being self-employed has a significant positive impact on this ownership behavior; being from the South reduces even more the slope; (iii) all educational dummy variables in the model increase significantly the slope of the trajectory.

Table 2: *Estimated parameters – structural conditional model*

	Factor 1				Factor 2			
	Intercept		Slope		Intercept		Slope	
	Est.	s.e.	Est.	s.e.	Est.	s.e.	Est.	s.e.
Intercept	0	-	-0.32	0.18	0	-	-0.30	0.09
CLERK	0.12	0.67	0.05	0.20	0.13	0.09	0.03	0.01
MANAGER	0.01	32.91	0.02	0.61	0.08	0.19	0.03	0.07
SELF	0.01	0.65	0.05	0.21	0.19	0.12	0.05	0.02
NOTWORK	0.16	0.61	0.06	0.19	-0.04	0.05	-0.01	0.03
NORTH	0.03	0.05	0.08	0.02	0.11	0.08	0.01	0.02
SOUTH	-0.35	0.08	-0.10	0.07	-0.80	0.36	-0.09	0.01
ELEM	-0.11	0.21	0.05	0.05	0.14	0.12	0.18	0.06
MED	-0.06	0.21	0.12	0.06	0.15	0.09	0.24	0.06
HIGH	0.04	0.29	0.14	0.04	0.39	0.15	0.28	0.07
UNIV	0.31	0.33	0.22	0.06	0.67	0.14	0.28	0.08

4 Conclusions

The paper applies a latent growth model to analyze the recent dynamics of financial product ownership behavior of Italian families. The findings of this study show that one needs two latent factors to summarize this behavior: state bonds ownership and other financial products ownership. These two factors evolve with different trajectories in time and are significantly influenced by family characteristics: area of the country where the family lives and labor condition and education of the head of household.

References

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