COULD THE BASS MODEL BE APPLIED TO ITALIAN EMIGRATION?

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1. The new Italian emigration

In recent years, the outward Italian emigration had considerably grown compared to the 80s and 90s, when the phenomenon was indeed ongoing, yet at a smaller scale. Current emigration presents specific peculiarities, configuring a situation different from the past, which in literature is known as "the new Italian emigration". Among the novelties of the new outcoming flow, there is an increased share of women and well-educated individuals leaving the country (Colucci, 2018; Strozza and Tucci, 2018; Fondazione Migrantes, 2020).

Furthermore, although the Southern regions continue, as in the past, to contribute to the outgoing movements, recently the more advanced northern Italy has become the main outflow area, recording since 2007 more consistent negative migratory balances than in other regions of the country (Bonifazi, 2018; Strozza and Tucci, 2018). This could imply that the financial crisis that occurred in 2007-2008 and the worst economic situation in the rest of Italy have pushed the Northerners to move abroad (De Rose and Strozza, 2015). In addition, this could suggest that the geographical proximity to the other European countries and the greater dynamics of the northerners compared to the southern Italians in catching the new opportunities offered by the EU integration process could have acted as a further push factor for the individuals living in the North.

Another relevant feature is that the destinations that Italian migrants choose mainly converge to the EU and EFTA countries, such as United Kingdom, Germany, Switzerland, and France (Bonifazi, 2018). One plausible explanation of this trend is that the economic crisis could have boosted the EU unification process aimed at ease European mobility and integrate the labour market (Livi Bacci, 2014; De Rose and Strozza, 2015; Pugliese, 2018).

Finally, the new Italian emigration appears to be paired with a change in attitude towards international migration. The availability of new communication and transport technologies could have overcome several of the previous barriers hindering movements in the past, allowing Italians, especially the youngsters, to approach international mobility in a novel and more confident way (Tirabassi, 2018).

Roughly speaking, the technological advancements had empowered the Italian citizens with new means to shorten both the physical and psychological distance from their homeland.

Overall, the interaction among the global economic downturn, the EU integration process, and the change in attitude towards outward mobility appear to have shaped a new migration behaviour that has diffused across Italy. The spreading of new practices and ideas among the individuals of a given population usually pertains to the diffusionist theory, a well-established framework in the theoretical area of sociology and demography (Casterline, 2001). Our objective here is to propose an interpretation of the new Italian emigration in the light of diffusionism. The specific tool we have implemented to analyse the Italian phenomenon is the Bass model (Bass, 1969), a typical model extensively implemented in literature to study the diffusion of new ideas and behaviours.

Note that our proposal is that of a "toy model", i.e., a simplistic model used to provide insights into whether some mechanism might explain complex real-world phenomena. Toy models are extremely simplified, representing only a small number of causal or explanatory factors; typical examples are the Lotka–Volterra model in population ecology and the Schelling model of segregation in the social sciences. Toy models usually do not perform well in prediction and empirical adequacy; they serve other epistemic goals.

The diffusionist theory and the Bass model will be introduced in the next section. The third section will outline data and methods. The fourth section will discuss the empirical results, and the fifth one will synthetically point out some conclusions and limitations of this work.

2. The diffusionist perspective and the Bass model

The diffusionist paradigm finds its roots in the field of social sciences. It has gained progressive theoretical structure through time to explain the diffusion of new ideas and practices (also called "innovations") among the members of a specific community (Rogers, 1962; Strang and Meyer, 1993). The basic idea of diffusionism is that the interplay of social influence mechanisms, as interpersonal information exchange, social norms, and emulative processes, shape individual action. The ground diffusionist considerations deal with the sociological concepts of "collective behaviour", "social contagion", and "contagious beliefs" (Coleman, 1994, pp.197-240). The "Ready, Willing, and Able" paradigm, initially proposed by Coale (1973) and successively operationalized by Lesthaeghe and Vanderhoeft (2001), conceptualizes the preconditions that should be satisfied to ensure the spread of a new demographically relevant behaviour, while the mechanisms of social influence

determine the success and timing of the diffusion process (Montgomery and Casterline, 1996).

Many social phenomena have been analysed through the lens of diffusionism, such as the emergence of protest movements (McAdam and Rucht, 1993; Chabot and Duyvendak, 2002; Soule, 2004; Rane and Salem, 2012) and the spread of violence (Myers, 2000; Garcia and Wimpy, 2016).

The diffusionist view has found extensive application also in the demographic studies. In particular, the need to find a plausible explanation for the decline in marital fertility across Europe that occurred during the past decades has brought to the initial application of the diffusionist concepts in the area of demography. In the 80s, the Princeton European Fertility Project and the World Fertility Survey were the two seminal works suggesting that a demographic phenomenon such as the fertility decline could have been influenced by the spread of new birth control practices and new ideas of family among people (Coale and Watkins, 1986; Tolnay, 1995; Cleland, 2001). After that, the diffusionist vision has found wide application, especially in the study of fertility choices and family planning (Lesthaeghe, 2010; Alvergne *et al.*, 2011; Bengtsson and Dribe, 2014; Vitali *et al.*, 2015). The diffusionist paradigm has also been applied to other demographically and health-related studies, such as the promotion of public health campaigns aimed at combatting the spread of diseases like HIV-AIDS, and of health-damaging behaviours as smoking, alcohol, and drug abuse (Rogers, 1995; Backer and Rogers, 1998; Svenkerud *et al.*, 1998; Rogers, 2002; Barker, 2004; Bertrand, 2004; Haider and Kreps, 2004; Abraham and Roman, 2010; Ramseyer Winter, 2013). After all, as stated by Vitali and Billari (2017), "The diffusionist perspective can be applied in general to demographic change. In particular, diffusion mechanisms can be in place whenever there is an innovation in demographic behaviours". In our work, we attempt to conceptually and empirically find a diffusionist interpretation to the novel emigration flow involving Italy lately.

The Bass diffusion model (Bass, 1969) has been extensively applied in economics and market research to study and forecast the diffusion of innovative behaviours, products, and ideas in a social system. The model represents a first attempt to provide a mathematical framework to the ideas of the sociological driving forces of adoption proposed by Rogers in his seminal work (Rogers, 1962). The Bass model consists of a simple first-order differential equation

$$Y'(t) = \left(p + \frac{q}{m}Y(t)\right)\left(m - Y(t)\right) = p\left(m - Y(t)\right) + q\frac{Y(t)}{m}\left(m - Y(t)\right) \quad (1)$$

where the variation of adoption $Y'(t)$ over time is proportional to the residual susceptible population $\left(m - Y(t)\right)$, with m being the constant overall susceptible population, and $Y(t)$ the cumulative adoptions at time t. Rearranging the left-hand

side equation (1) it is possible to notice that the instantaneous adoptions $Y'(t)$ is the result of the sum between two components, the *external* one governed by parameter p and the *internal* one modulated by q. Parameter p is the so-called coefficient of innovation, representing the effect of the external influence to adopt, that includes mass media communications and public campaigns, e.g. awareness and prevention health campaigns. Parameter q is the coefficient of imitation and reflects the inter-personal influence individuals can exert on each other to adopt. So, two categories of adopters emerge: the innovators, i.e., those engaging in the new behaviour because of their ability to keep up-to-date, and the *imitators*, i.e., those who are mainly guided by interpersonal communication. While the diffusion process depends on the external component alone at the very early stages, later innovators, by activating the internal source of influence, may trigger an avalanche effect. The proposed closed-form solution of the Bass model is the following:

$$Y(t) = \text{m} \frac{1 - e^{-(p+q)t}}{1 + \frac{q}{p} e^{-(p+q)t}} \tag{2}$$

The basic Bass model and its extensions have found empirical applications not only in market studies but also in the demographic and epidemiological fields: e.g. to analyse the diffusion of oral contraception (Sharif and Ramanathan, 1981), to clarify the dynamics in vaccination propensity and address public health policy (Onofrio, Manfredi, and Poletti, 2012; Kahana and Yamin, 2021), and to study the diffusion of disease-related information during an epidemic outbreak (Gündüç, 2019).

The fit of the Bass model to empirical situations can have a twofold research purpose: the extrapolation objective, typical of marketing studies, to forecast and monitor the future adoption of a product (Massiani and Gohs, 2015; Fan, Che, and Chen, 2017), and the interpretative objective, aimed at explaining the processes under analysis and possibly convey meanings and results of interest (Guidolin and Mortarino, 2010; Furlan, Guidolin, and Guseo, 2016; Bunea *et al.*, 2020). In the present work, we intend to follow the second approach to offer a diffusionist perspective and interpretation of the new Italian emigration process. In Bass terms, we propose to adapt the ideas of external and internal influence to the recent emigration flow to shape the figures of innovative and imitative choices to emigrate. In our thoughts, the Italian stagnation, combined with the spread over media of information about the more favourable labour market and the better living conditions in some EU countries, might have acted as external drivers of influence. On the other end, the information conveyed by actual emigrants about their foreign experience and the possibility to be better-off could have triggered word-of-mouth effects and

emulative behaviours. Holding onto this perspective, we fit the Bass model to the Italian figures in the attempt of shading new lights on the recent out-migration flow.


3. Data and methods

Annual counts of Italian citizens who emigrated from 2001 to 2019 were retrieved from the Italian National Institute of Statistics (Istat) repository. Outgoing counts were available for the five macro-areas of departure (previous residence): Northwest, Northeast, Centre, South, and Isles. Data at hand suffer from some intrinsic issues, which are more noticeable in the Southern areas than in the Northern ones. One significant flaw in data is that, although mandatory, many emigrants miss to enroll in the Register of Italians Resident Abroad (AIRE – *Anagrafe degli Italiani Residenti all'Estero*); this causes an underestimation of the outgoing flows. Eventually, data corrections due to routine surveillance activities lead to peaks in the time series of movements, making model estimations less reliable.

The Bass model has been fitted using NLS estimation, separately for Italy and each of the five macro-regions. Implementing the "BASS.standard" function of the DIMORA package in the R software, we automatically estimated all the model parameters p, $q,$ and m (Zanghi, 2021).

4. Bass model application and discussion

The results of the Bass model fit are displayed in Figure 1. Based on the cumulative emigrations for 2001-2019, we notice a larger and faster outflow from the Northern areas. In particular, the Bass model captures the well-known North-South duality in emigration dynamics. Whereas in the Northern regions, the external component of diffusion has already paved the way to the internal component, the diffusion process is still mostly led by the external component in the South. In Bass terms, the situation in the South is in its early stage, with innovative drivers dominating the diffusion process. Conversely, the Northern areas seem to have entered a more mature phase, dominated by interpersonal communication and imitation. The Central Italy shows an intermediate situation compared to the South and North, having reached the prevalence of the imitative component over the innovative one but later than the northern regions.

Figure 1 – *Bass model fitting for the Italian macro-areas and entire Italy.*
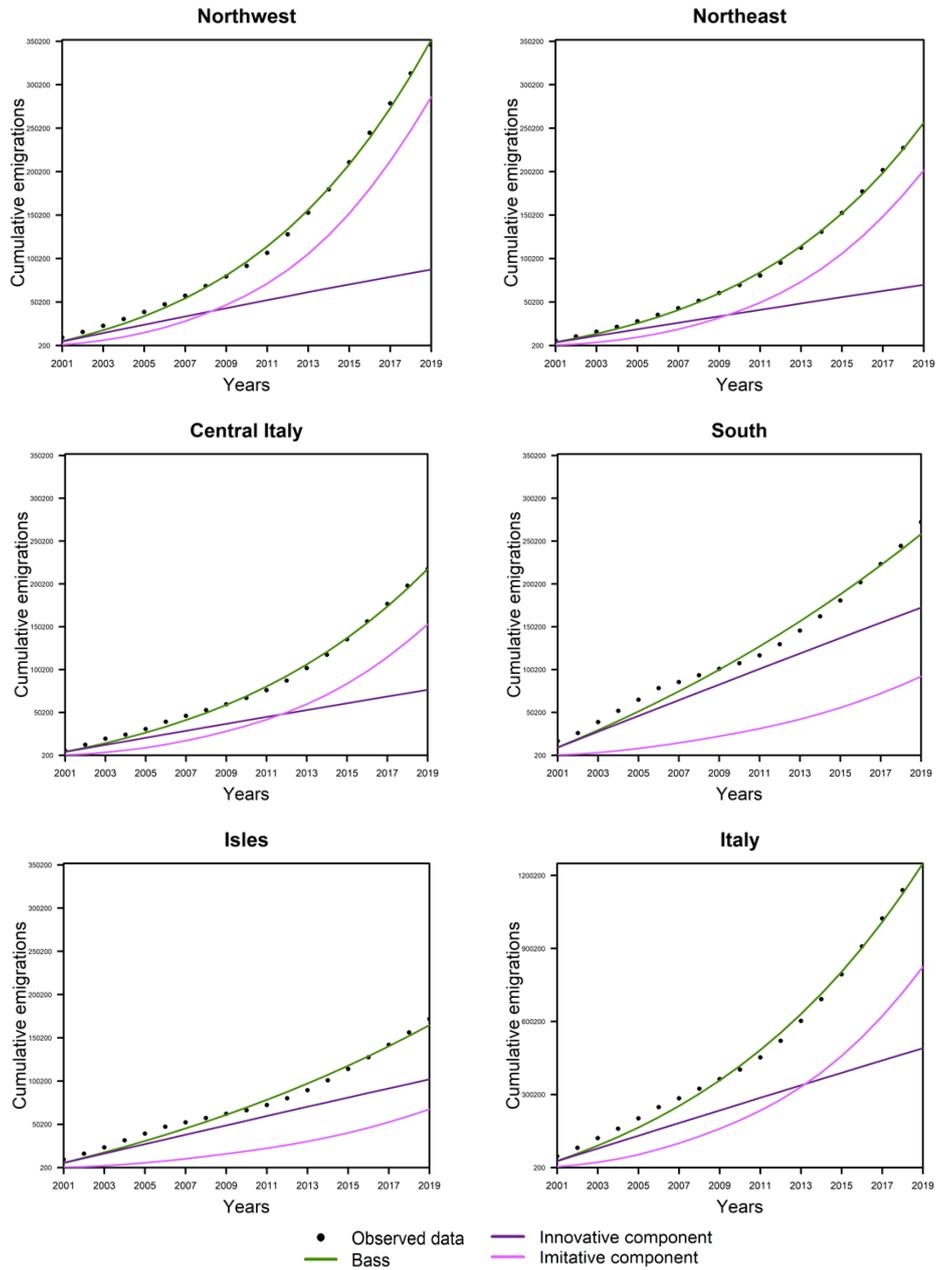
The goodness of fit, shown by the relative MSE in Table 1, exhibits a North-South variation, with higher figures in North and Central Italy than in South Italy and Isles. This result could be the consequence of the flaws in the data mentioned before, which are generally more frequent in the Southern regions.

Table 1 – *Goodness of fit for the Bass model in different Italian macro-areas*

Area	Relative MSE
Northwest	0.28251
Northeast	0.19443
Central Italy	0.32371
South	0.76642
Isles	0.68600
Italy	0.32906

5. Conclusions and limitations

Progresses in the EU integration, technological advances, and the 2007 financial crisis have accelerated the spread of novel and peculiar migratory behaviors in Italy, characterized by an increased attitude towards international mobility. This process started in the Northern regions of Italy and is gradually taking place in the Southern areas also.

We proposed an interpretation of the new trends in Italian out-migration flows within a diffusionist paradigm. The Bass model allowed us to distinguish between the two driving forces of adoption, i.e., an innovative force that dominates diffusion processes at their early stages and an imitative force that leads at later stages.

For the period 2001-2019, the Bass models fitted for the different regions of Italy showed imitative dynamics to be prominent in Northwest, Northeast, and Central areas. In contrast, innovative dynamics are still prevailing in the South and Isles. Higher relative MSE in Bass models fitted for Southern regions revealed higher proportions of Southern migrants delaying or failing to enroll in the register of Italians living abroad.

In addition to the data collection issues, our work presents some other limitations mainly due to the lump sum consideration of the maximum number of emigrants *m* (also called "carrying capacity"). The *m* parameter has been indeed estimated via NLS procedure, instead of being held fixed *a priori*. This could have generated an over estimation of the asymptotic migrant population.

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SUMMARY

Could the bass model be applied to Italian emigration?

Objectives. Our work is a first attempt at verifying whether the diffusionist theory - a framework extensively employed in the demographic literature to interpret the spread of new ideas and practices - can adequately and meaningfully explain migration decisions and related migration data.

Methods. We test whether the Bass model can properly fit the new Italian emigration when working with absolute values. In this sense, we propose interpolation applications for the different Italian macro-areas, separately.

Results. The Bass model detects geographic differences in the underlying dynamics governing the new emigration flows. In Bass terms, the diffusion of the new emigratory behaviour travels at two different speeds in the Northern-Central Italy and in the South. The forces governing the pace of diffusion also reveal a geographic heterogeneity, presenting North-South divergences.

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