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| **CV date** | 03/11/2021 |

**Part A. PERSONAL INFORMATION**

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| --- | --- |
| First and Family name | Morán, Manuel |
| Social Security, Passport, ID number | 50404893W | Age | 69 |
| Researcher numbers | Researcher ID (WoS) |  R-5859-2018 |
| Orcid code |  0000-0001-8162-4971 |
| Scopus | 7403143473 |

**A.1. Current position**

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| --- | --- |
| Name of University/Institution | Complutense University of Madrid  |
| Department | Economic Analysis  |
| Address and Country | Economic and Business Administration Faculty. Campus of Somosaguas. 28223 Madrid. Spain |
| Phone number |  34913942407 |
| Email: | mmoranca@ucm.es |
| Current position | Retired full profesor (in 2017) Honorific professor (from 2017) |

**A.2. Education**

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| --- | --- | --- |
| PhD | University | Year |
| Mathematics | Complutense of Madrid | 1988 |

**A.3. JCR articles, h Index, thesis supervised…**

* 2 thesis supervised (José Manuel Rey and José María Maroto)
* 4 sexenios (the last one in 2012)
* 32 articles in JCR journals, 14 Q1 (5 D1), 14 Q2, 3 Q3 and 1 Q1
* 1 article in a SJCR journal (Q3)
* Chapters of books: 10
* Books: 6
* Metrics (Scopus/WoS/Google Scholar): publications 34/35/84, cites 236/238/489; h-index: 9/9/14.

**Part B.**

**CV SUMMARY**

My research started in 1985, when I met Miguel de Guzman, in the PhD program of the Universidad Complutense of Madrid (UCM). Miguel posed there a geometrical conjecture by Schoenberg that I solved using iterative dynamical methods. Miguel then proposed to me a problem on dynamics of polygonal billiards as my PhD research topic. At the same time he invited me to participate in his seminar on an emerging topic, Fractal Geometry, and I took part in my first research project leaded by him. Three years later I completed my PhD and got a position in the Faculty of Economics of the UCM where I became interested in the quests derived from the potential applications of Dynamical Systems to Economic Theory and Environmental Economics.

 At that time computers entered on stage. This irruption fuelled a true scientific and philosophical revolution, starred by Chaotic Dynamics and Fractal Geometry. My own previous inclinations and my postgraduate training in Miguel's team made possible to me to participate enthusiastically in these advances. In a chapter of my PhD I discovered a new family of fractals, Fractal Series, and I got my first publication in the journal Mathematika, that reached a year later the fourth position in the area "Mathematics" of the JCR.

 In 1992 the public entity Puertos de España entrusted me a research program on the height of waves. María Eugenia Mera and Jose Manuel Rey Simó, PhD students at that time, joined the team. María Eugenia Mera contributed with her knowledge on Mathematical Optimization and Informatics and received her PhD at the Faculty of Mathematics of the UCM in 1995. I became the Advisor of Jose Manuel Rey's PhD. Jose Manuel read his dissertation in the Faculty of Mathematics of the UCM in 1995 and he won the extraordinary PhD award of the Faculty in that year. These were the first steps of my research team.

 We started to get financial support from the Ministry of Sciences in 1995 (at a time when there was true will to help young starting researchers). Jose María Maroto, from the PhD program of the Faculty of Economics of the UCM, entered our team in 2000, and got his PhD under my advise, in 2004. Marta Llorente Comí, PhD by the University of Helsinki, joined our team in 2004 and Victor Ruiz Morcillo joined our team also in 2004 and he got his PhD in 2006.

 Our focus has stayed ever since on Time Series Analysis, Dynamical Systems and Fractal Geometry José María Maroto turned our attention on a new research topic, Economic Fisheries. We had to acquire expertise in the use of Dynamic Optimization techniques required therein. Later on Jose Manuel Rey shifted his own interest to Psychological Mathematics, so we became a research group on applications of Mathematics to Social Sciences.

 We have concatenated, under my direction, six research projects of the National Research Plan, from 1995 until 2012, when there was a sharp cut of financing. Since then until my retirement, in 2017, we have continued our research without any national public financing. More than 60 articles, 38 of which with my participation, have been generated by the members of this research team. These papers have contributed in the areas of Time Series Analysis, Fisheries Economics, Economic Dynamics, Chaotic Dynamics, Fractal Geometry, Dynamic Optimization and Psychological Mathematics. I consider my role in the birth and continued work of this team along these years my greatest scientific achievement.

 I have contributed with similar intensity both on primary scientific knowledge and in applied sciences.

 My contribution on the first area above comprises 10 papers, three of them in the first quartile (Q1) in JCR, four in Q2 and three in Q3, with a total number of 205 citations (Google Scholar). They address basic problems of Fractal Geometry, area which was initiated during the two last decades of the past century and it is still nowadays in full development. Through these publications we have participated in the construction of this new branch, rich in practical applications. This has given to me and my team international projection, and it has allowed us to collaborate with distinguished international leaders in the field, as Pertti Mattila (University of Helsinki) or David Preiss (University College of London) and with national teams, leaded by Miguel Reyes (Facultad de Informática UPM) and Miguel Ángel Martin (ETSI de Agrónomos, UPM) and the organization of an international Congress (International Meeting on Fractal, Chaos and Ergodic Theory, Las Palmas de Gran Canaria 1995). I have given seminars in the Universities of Oulu, Jyvaskyka and Helsinki and many Spanish Universities and I have given invited lectures in international Congresses (Fractals and Stochastics III and IV, Germany).

 My contribution on applied sciences may be broadly classified into three groups

 The first one deals with issues of computability on Fractal Geometry. Comprises 6 papers, 3 in Q1 and 3 in Q2, with a total number of 45 citations (GS). These papers are a contribution by our teams completely novel in the literature. They show how the current quantities that serve to measure fractal objects, based on awkward theoretical definitions, can be tamed through computer algorithms, able to assess numerical values, to these quantities with completely unknown until now..

 The second one deals with problems of numerical analysis of time series. Could a complex quantity, as IBEX 35 or GNP of a country, can be explained by the interaction of a reduced set of basic variables linked through simple but nonlinear relationships?. Given a complex quantity that, seemingly, evolves in a random way, does there exist a deterministic core, buried into a truly random noise, deterministic core that could explain a significative part of the signal? Can a variable observed with a big measurement noise be cleaned and separated from the noise? To what extent a forecast, based on past observations, is trustable? Such are the issues addressed in this group, rooted in the novel field of nonlinear and stochastic dynamics. My contribution comprises 8 papers, 2 of them in the first decile, 2 more in the first quartile and the remaining four in Q2, with a total number of 52 citations (GS). These contributions have allowed us to interact with international leaders of the field, as Eckmann, one of the fathers of the theory of Chaos, Y. Pesin or Itamar Procaccia. We have organized an International Seminar, "Structure of Hyperbolic measures", Madrid 1999. I have been invited to give the opening lecture of academic year the Faculty of Sciences of the Universidad Autónoma de Madrid on the subject "Chaos and Determinism"

 The third one, more recent for our team, is the group of works on Economic Fisheries Why, in contrast with the forecasts of Economic Theory, so many fisheries arrive to the castastrophic, from an economic and biologic point of view, situation of severe collapse? What are the market failures behind this fact? Are the population dynamics of the resources correctly estimated and understood? What are the biological safe minimal populations, below which the resource is at risk of collapse or extinction? What are the optimal policies that maximize economic benefit along the time while maintaining sound stocks?. The finest techniques on data analysis, as the Kalman Filter, and the most recent mathematical tools as stochastics models of populations dynamics or dynamical optimization programs in stochastic settings are urgently needed here. My contribution in this field comprises 7 papers, three in the first decile and four in the second one, with a total number of 55 publications. We have received European financing (Gant NIL Council, 2014-15). We regularly collaborate and publish with a team, leaded by Leif Sandal, from the Norwegian School of Economics, Bergen, and we have participated, together with research groups in the University of Vigo and Universidad Vasca, in a research project of the National Research Plan.

 I insert here a paragraph took from the presentation of our web page that summarizes the goals of our team.

“When scarcity brings pain and a large part of the world population survives only through the exploitation of threatened natural resources, there are not neat answers about the danger of collapse of such resources and which are the management rules that best express a fair balance between the interest of the present and future generation. The economic and environmental crisis reveal the insufficiency of our capability of analysis and evaluation about the future risks, in an uncertain environment.

 Branches and tools, as Stochastic Dynamical Optimization, Stochastic Differential Equations, Fractal Geometry, Nonlinear Dynamics, Mathematical Psychology or Game Theory play here a principal role. I and my team accumulate expertise and motivation enough to make new contributions in order to alleviate the present situation of environmental distress”.

**Part C. RELEVANT MERITS**

**C.1. Publications (JCR articles last 12 years)**

1. Title: Bioeconomical modeling of seasonal fisheries.

Author(s): Kvamsdal, Sturla F., Maroto, José M., Morán, Manuel, Sandal, Leif K.

Source: European Journal of Operational Research, Vol. 281 (2) pages 332-340.

Published: 2020. JCR **Q1** (15/84)

1. Title: On the packing measure of the Sierpinski gasket
 Author(s): Llorente, Marta; Mera, M.E.; Morán, Manuel
 Source: Nonlinearity. Volume: 31 Issue: 6 Pages: 2571-2589

Published: JUN 2018. JCR: **Q1** (33/252), Q2(16/55)

1. Title: A bridge between continuous and discrete-time bioeconomic models: Seasonality in fisheries
 Author(s): Kvamsdal, Sturla; Maroto, Jose M.; Morán, Manuel; Sandal, Leif K.
 Source: Ecological Modelling Volume: 364 Pages: 124-131

 Published: NOV 24 2017. JCR **Q2** (59/158)

1. Title: Rate of convergence: the packing and centered Hausdorff measures of totally disconnected self-similar sets
 Author(s): Llorente, Marta; Mera, M. Eugenia; Morán, Manuel
 Source: Chaos Solitons & Fractals. Vol: 98 Pages: 220-232

Published: MAY 2017 JCR: **Q1**(10/55), Q2(26/103), Q2(26/78)

1. Title: Computability of the packing measure of totally disconnected self-similar sets
 Author(s): Llorente, Marta; Morán, Manuel

Source: Ergodic Theory and Dynamical Systems Volume: 36 Pages 1534-1556 Published: AUG 2016. JCR **Q1**(71/311), Q2(125/255)

1. Title: Detecting the presence of depensation in collapsed fisheries: The case of the Northern cod stock
 Author(s): Maroto, Jose M.; Morán, Manuel
 Source: Ecological Economics Volume: 97 Pages: 101-109

Published: JAN 2014. JCR: **D1** (25/333), D1 (8/100)

1. Title: Error Covariance Matrix Estimation of Noisy and Dynamically Coupled Time Series
 Author(s): Mera, María Eugenia; Morán, Manuel

Source: Journal of Statistical Physics. Volume: 150 Issue: 2 Pages: 375-397.

Published: JAN 2013, JCR **Q2**(26/55)

1. Title: An algorithm for computing the centered Hausdorff measures of self-similar sets
 Author(s): Llorente, Marta; Morán, Manuel

Source: Chaos Solitons & Fractals Volume: 45 Issue: 3 Pages: 246-255.

Published: MAR 2012. JCR **Q1**(10/55), Q2(26/103), Q2(26/78)

1. Title: Potential Collapse in Fisheries with Increasing Returns and Stock-dependent Costs
 Author(s): Maroto, Jose M.; Morán, Manuel; Sandal, Leif K.; Steinshamn, Stein I.
 Source: Marine Resource Economics Volume: 27 Issue: 1 Pages: 43-63

Published: 2012. JCR **Q2** (25/50)

1. Title: The group of isometries of a self-similar set
 Author(s): Morán, Manuel

Source: Journal of Mathematical Analysis and Applications. Volume: 392 (1) Pag: 89-98

Published: AUG 2012. JCR **Q1** (34/296), Q2 (71/247)

1. Title: Noise reduction by recycling dynamically coupled time series
 Author(s): Mera, M.E.; Morán, M.
 Source: Chaos. Volume: 21 Issue: 4 Pages: 1-14.

Published: 2011. JCR: **D1** (7/245), D1 (7/55)

1. Title: Advantages of the Hausdorff centered measure from the computability point of view.
 Author(s): Llorente, Marta; Morán, Manuel

Source: Mathematica Scandinavica Volume: 17 Issue: 1 Pages: 103-122.

Published 2010. JCR:**Q4** (237/279)

1. Title: Reduction of noise of large amplitude through adaptive neighborhoods
 Author(s): Eugenia Mera, M.; Morán, Manuel
 Source: Physical Review E. Volume: 80 Issue: 1 Pages 1-8.

Published: JUL 2009. JCR: **Q1** (5/47), Q2 (8/28)

1. Title: Increasing marginal returns and the danger of collapse of commercially valuable fish stocks.
 Author(s): Maroto, Jose M.; Morán, Manuel

Source: Ecological Economics. Volume: 68 Issue: 1-2 Pages: 422-428.

Published: Dec 2008. JCR: **Q1** (19/209), Q1 (6/58)

**C.2. Research projects and grants**

**International research projects**

**Title:** Ecosystem-Economic Interactions in the Norwegian Sea: Analysis and Management (EINSAM)

**Funding agency:** Research Council of Norway (NFR), project no. 234238/E40

**Participating institutions:** Norwegian School of Economics (NHH), Institute of Marine Research (Norway), University of Helsinki

**Project period**: 2014-2016

**Funding:** 3000000 NOK (313555€)

**PI:** Sturla Kvamsdal

**Number of participants:**  8

**Title:** Stochastic Bioeconomic and Population Dynamics Modeling of Collapsed Fisheries.

**Funding agency:** NILS Science and Sustainability. European Project (ES07 – EEA Grants) (021-ABEL-CM-2013)

**Participating institutions:** UCM, Norwegian School of Economics (NHH)

**Project period**: 07/04/2014-30/11/2015

**Funding:** 65,300 Euros

**PI:** José María Maroto Fernández

**Number of participants:**  9

**Title:** Bioeconomic Multispecies Analysis of Marine Ecosystem (BMAME)

**Funding agency:** Research Council of Norway (NFR), project no. 196433/S40

**Participating institutions:** Norwegian School of Economics

**Project period**: 01/01/2010-31/12/2013

**Funding:** 8800000 NOK (1173000€)

**PI:** Leif Sandal

**Number of participants:**  6

**Title:** A General Age-structured Model for Ecosystem Management (AGAMEM)

**Funding agency:** Research Council of Norway (NFR), project no. 216571

**Participating institutions:** Norwegian School of Economics

**Project period**: 01/01/2012-01/01/2016

**Funding:** 8450000 NOK (1126000€)

**PI:** Stein Ivar Steinshamn

**Number of participants:** 8

**National research projects**

**Title:** Gestión sostenible de pesquerías: dinámicas de transición y puntos de referencia límite (GSP).Optimality in age-structured bioeconomic models. REF. PR87/1922582

**Funding agency:** Complutense University-Santander.Bank

**Participating institutions:** Complutense University of Madrid (UCM).

**Project period:** 01/01/2020-31/12/2021

**Funding:** 7900 Euros

**PI:** José María Maroto

**Number of participants:** 7

**Title:** Optimality in age-structured bioeconomic models

**Funding agency:** Ministry of Science (MEC): MICINN 2012, ECO2012-39098-C06-00.

**Participating institutions:** Complutense University of Madrid (UCM), University of Vigo, University of the Basque Country, Norwegian University of Science and Technology, University of Helsinki.

**Project period:** 01/02/2013-01/02/2016

**Funding:** 19500 Euros

**PI:** María José Gutiérrez Huerta

**Number of participants:** 7

**Title:** Stochastic calculus with applications to Social Sciences

**Funding agency:** MEC (MTM2009‐12672)

**Participating institutions:** UCM

**Project period:** 01/01/2010-01/01/2013

**Funding:** 48279€ Euros

**PI:** Manuel Morán Cabré

**Number of participants:** 6

**Title:** Nonlinear stochastic equilibria: economic and environmental applications

**Funding agency:** MEC (MTM2006-02372)

**Participating institutions:** UCM

**Project period:** November 2006- November 2009

**Funding:** 54752.59 Euros

**PI:** Manuel Morán Cabré

**Number of participants:** 7