



# A SOVEREIGN RATINGS MODEL: RATING AGENCIES REMAIN CONSERVATIVE ON A GLOBAL LEVEL

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ECONOMIC RESEARCH & INVESTMENT STRATEGY

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- SELECTED RATINGS PROJECTIONS
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## ΕΙΣΑΓΩΓΗ | ΟΙ ΟΙΚΟΙ ΑΞΙΟΛΟΓΗΣΗΣ ΠΑΡΑΜΕΝΟΥΝ «ΣΥΝΤΗΡΗΤΙΚΟΙ» ΣΕ ΠΑΓΚΟΣΜΙΟ ΕΠΙΠΕΔΟ

- Οι πρόσφατες οικονομικές και όχι μόνο περιπέτειες της ελληνικής οικονομίας είχαν ως παράπλευρο αποτέλεσμα την κατανόηση από όλους – ειδικούς και μη – της σημασίας της αξιολόγησης των ομολόγων του ελληνικού δημοσίου από τους διεθνείς οίκους πιστοληπτικής αξιολόγησης.
- Στα θετικά νέα είναι ότι κατά τους προηγούμενους μήνες έχουμε γίνει μάρτυρες της θετικής ανταπόκρισης των οίκων πιστοληπτικής αξιολόγησης στις προσπάθειες που έχουν καταβάλλει διαδοχικές κυβερνήσεις και οικονομικά επιτελεία για δημοσιονομική εξυγίανση και οικονομική ανάκαμψη.
- Ωστόσο το ερώτημα σχετικά με το εάν οι τρέχουσες αξιολογήσεις αντανακλούν πλήρως τη βελτίωση των θεμελιωδών μεγεθών της ελληνικής οικονομίας και συνεπακόλουθα το ποιες είναι οι προοπτικές για την πορεία των αξιολογήσεων των ελληνικών ομολόγων σε μεσοπρόθεσμο ορίζοντα παραμένει περισσότερο επίκαιρο από ποτέ.
- Προκειμένου να απαντήσουμε στο ερώτημα αυτό έχουμε εκπονήσει ένα ευρύτερο στατιστικό υπόδειγμα όπου συσχετίζουμε τις αξιολογήσεις του οίκου Moody's με τα θεμελιώδη μακροοικονομικά στοιχεία και δεδομένα πολιτικού ρίσκου και οικονομικής διακυβέρνησης σε ένα πλήθος 123 ανεπτυγμένων και αναδυόμενων αγορών.
- Τα γενικότερα συμπεράσματα από την εκτίμηση του υποδείγματος αυτού είναι καταρχάς ότι οι αξιολογήσεις του οίκου Moody's παραμένουν εξαιρετικά συντηρητικές καθώς υπολογίζουμε ότι **μόνο 22 αξιολογήσεις της Moody's συμπίπτουν με τα αποτελέσματα του μοντέλου μας**. Από τις υπόλοιπες **39 αξιολογήσεις** της Moody's είναι **ανώτερες από τις δικές μας εκτιμήσεις**, ενώ σε **62 περιπτώσεις η Moody's είναι πιο συντηρητική** αξιολογώντας τις οικονομίες αυτές χαμηλότερα από το δικό μας υπόδειγμα. Πριν περάσουμε στα «ελληνικά αποτελέσματα» έχει ενδιαφέρον να σταθούμε στις περιπτώσεις των ΗΠΑ και του Ηνωμένου Βασιλείου. Και στις δύο περιπτώσεις η Moody's αξιολογεί τις δύο οικονομίες υψηλότερα από το υπόδειγμα μας, ενδεικτικό του ότι το μέγεθος, η παράδοση και το βάθος κάποιων οικονομιών προσφέρουν σημαντική στήριξη στην πιστοληπτική αξιολόγηση πέρα από κάθε μακροοικονομική επίδοση.
- Αντίθετα εστιάζοντας στην **ελληνική οικονομία** διαπιστώνουμε ότι παρά την πρόσφατη αναβάθμιση από πλευράς Moody's της αξιολογήσής μας κατά 2 βαθμίδες από Ba3 σε Ba1, η **αξιολόγηση του διεθνούς οίκου παραμένει συντηρητική** καθώς σύμφωνα με τις εκτιμήσεις μας η Ελλάδα έχει «κατακτήσει» την επενδυτική βαθμίδα Baa3 ήδη από το 2020. Παράλληλα, αναλύοντας τις επιμέρους διαστάσεις της ελληνικής οικονομίας στους πυλώνες της οικονομίας, δημοσιονομικής διαχείρισης και θεσμικής αξιολόγησης καταγράφεται βελτίωση. Μόνο στη διάσταση του ιδιοσυγκρασιακού κινδύνου καταγράφεται μια επιδείνωση η οποία ωστόσο είναι κοινή με την πλειοψηφία των οικονομιών που εξετάζουμε.



## INTRODUCTION | RATING AGENCIES REMAIN CONSERVATIVE ON A GLOBAL LEVEL

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- The recent economic ‘adventures’ of the Greek economy had the side effect of both experts and non-experts understanding the importance of the evaluation of Greek government bonds by international credit rating agencies.
- The optimistic news is that over the past few months, we have witnessed the positive response of credit rating agencies to the efforts made by successive governments and economic staff for fiscal consolidation and economic recovery.
- However, the question of whether current ratings fully reflect improvements in the fundamentals of the Greek economy and, consequently, what the prospects are for the course of Greek sovereign ratings in the medium term remains more relevant than ever.
- To answer this question, we have developed a broader statistical model that correlates Moody’s ratings with macroeconomic fundamentals, political risk and economic governance data across a set of 123 developed and emerging markets.
- The general conclusion from the evaluation of our model is that Moody’s ratings remain **extremely conservative**. We estimated that **only 22 of its ratings coincide** with the results of our model. Of those remaining, **39 of Moody’s ratings are higher than our estimates**, while in **62 countries, Moody’s assigns a more conservative rating** than our model. Before moving on to the ‘Greek results’, it is interesting to consider the cases of the USA and the United Kingdom. Moody’s rates the two economies higher than our model, indicating that the size, tradition and depth of some economies provide certain advantages.
- On the contrary, when focused on the **Greek economy**, we found that despite the recent upgrade of its rating from Ba3 to Ba1, Moody’s **rating remains conservative**, as (according to our estimates) Greece has ‘conquered’ the Baa3 investment grade since 2020. Examining Greece’s four pillars (i.e. economic, fiscal and institutional strength and event risk), the only deterioration is recorded in event risk, which is common to the majority of the economies we examined.



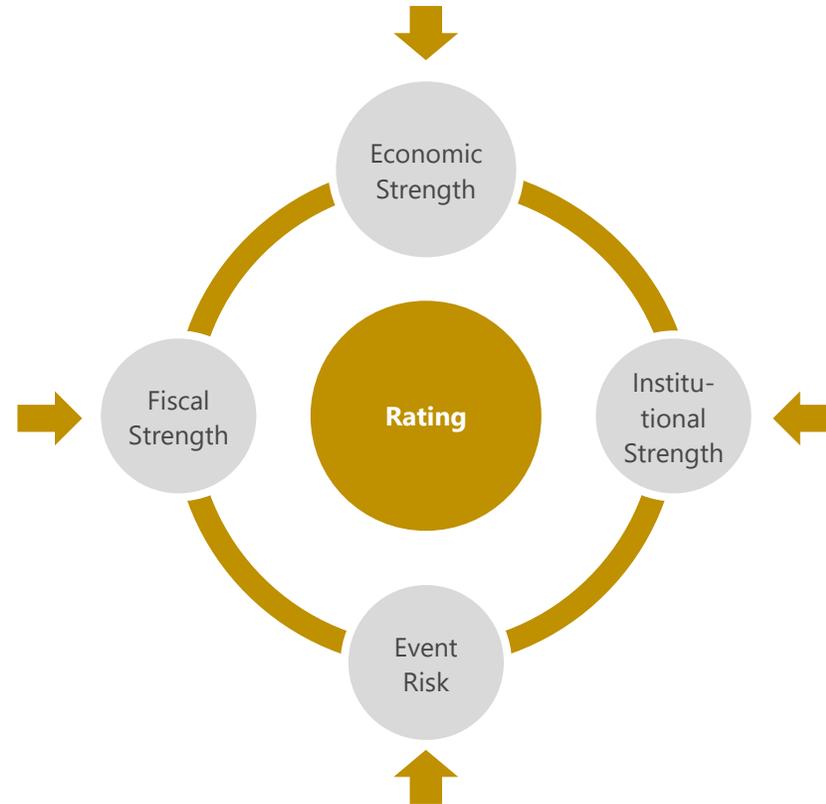
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# THE FOUR-FACTOR MODEL

Growth Dynamics	Average Real GDP Growth, Volatility of Real GDP Growth
Scale of Economy	Nominal GDP (\$bn)
National Income	GDP/Capita (PPP,\$)

Debt Burden	General Govt. Debt to GDP, General Govt. Debt to Revenues
Debt Affordability	General Govt. Interest Payments to Revenues, General Govt. Interest Payments to GDP
Adjustment Factor	Increase in General Government Debt/GDP ppts, General Govt. Foreign Currency Debt/General Govt. Debt

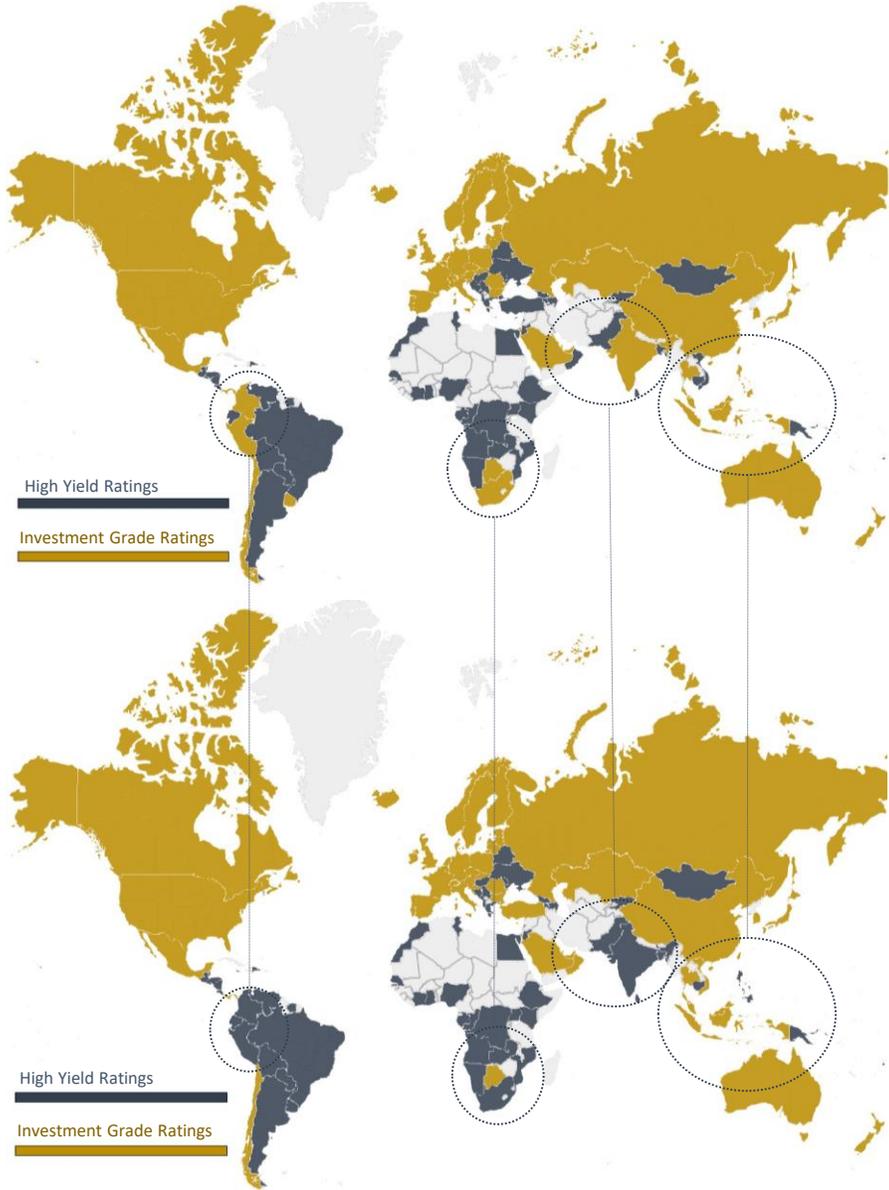


Quality of Institutions	Government Effectiveness, Rule of Law, Control of Corruption
Policy Effectiveness	Fiscal Policy Effectiveness, Monetary & Macroeconomic Policy Effectiveness

Political Risk	Domestic Political Risk (Voice & Accountability, GDP per capita)
Government Liquidity Risk	Fundamental Metrics (Government External Debt to Government Debt)
External Vulnerability Risk	(Current Account Balance & FDI) to GDP, External Vulnerability Indicator, Net International Investment Position to GDP



# THE GLOBAL BIRD'S-EYE VIEW | Is there a mismatch between realized ratings and implied ratings model?



2023	Same Rating	Underrated	Overrated
# countries	22	62	39
% of total	17.9	50.4	31.7

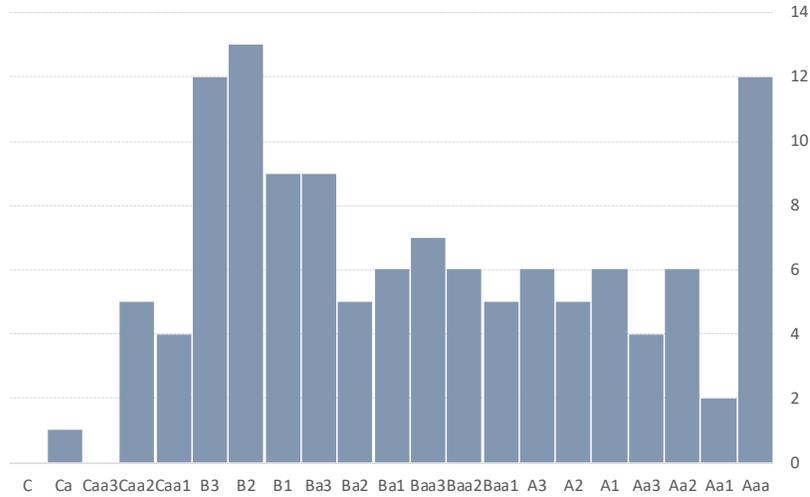
Based on our results, out of a total sample of 123 countries, 22 had the 'correct' rating (in the sense that our model matched Moody's ratings), 39 were rated 'premium' by Moody's vs. our fundamental rating and 62 were rated more conservative than what their fundamentals imply.

Our implied ratings signal a moderate shift towards the Investment Grade (IG) Ratings in 2024 compared to 2019, prior to the global pandemic outbreak and current geopolitical instability.

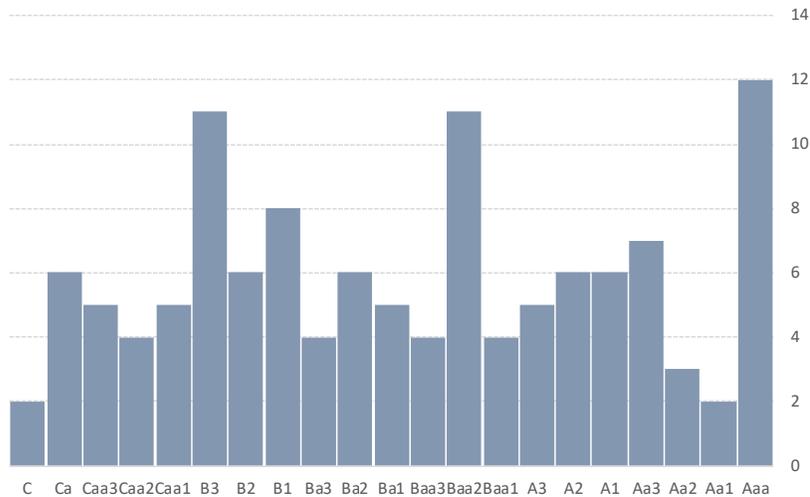


# RATING DISTRIBUTIONS

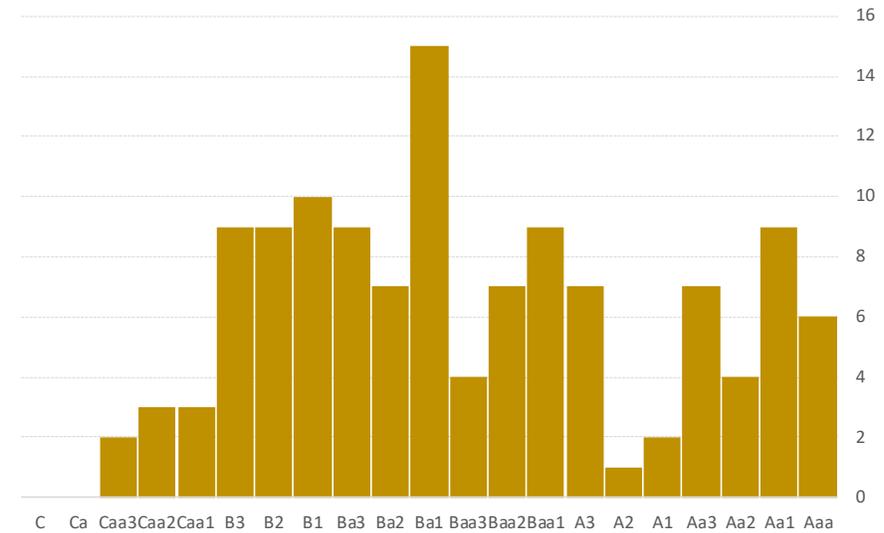
## 2019 Actual Rating Distribution



## 2023 Actual Rating Distribution



## 2024 Implied Rating Distribution





# FACTOR-DRIVEN RATING DECISIONS IN LINE WITH ACTUAL RATINGS | FULL SAMPLE 1/3

Countries	Implied Rating		Actual Rating	Junk Probability	Investment Grade Probability	Confidence	Economic Strength	Institutional Strength	Fiscal Strength	Event Risk
	2024	2023								
						2023				
ALBANIA	Ba2	Ba2	B1	75.3	24.8	21	11.1	11.4	13.5	8.4
ANGOLA	Caa2	Caa2	B3	100	0.1	24.5	19.2	14.5	19.0	13.7
ARGENTINA	Ba2	Ba3	Ca	87.7	12.3	29	8.6	14.8	16.5	11.8
ARMENIA	Ba2	Ba2	Ba3	73.1	26.8	19.7	9.3	12.9	12.7	11.3
AUSTRALIA	Aa2	Aa2	Aaa	0.1	100	34.9	4.2	7.6	4.3	3.7
AUSTRIA	Aa1	Aa1	Aa1	0	99.9	52.2	5.7	7.9	5.5	2.9
AZERBAIJAN	Ba3	Ba3	Ba1	82.1	17.8	25.5	11.2	12.9	8.1	17.1
BAHAMAS	Ba3	Ba3	B1	84.4	15.7	27	11.2	9.8	20.5	5.6
BAHRAIN	Ba3	B1	B2	89.8	10.1	30.1	8.0	10.4	23.3	15.0
BANGLADESH	Ba3	Ba3	B1	87.3	12.7	28.9	6.8	16.2	16.6	14.2
BARBADOS	B1	B1	B3	92.9	7.0	30.4	14.3	9.3	18.7	7.3
BELARUS	B1	B1	Ca	94.0	5.9	29.8	11.7	15.7	10.3	16.7
BELGIUM	Aa2	Aa2	Aa3	0.1	99.9	28	6.3	8.7	8.7	3.6
BELIZE	B1	Ba3	Caa2	89.7	10.4	30	14.4	10.5	14.2	7.9
BOLIVIA	B3	B3	Caa1	98.4	1.4	32.2	14.5	13.2	18.3	14.1
BOSNIA HERZEGOVINA	Ba1	Ba1	B3	60.5	39.5	16.4	10.6	11.8	8.3	11.1
BOTSWANA	Baa3	Ba1	A3	53	47.0	18	12.2	12.3	6.3	4.7
BRAZIL	Ba1	Ba1	Ba2	54.7	45.1	17.7	8.0	16.0	14.1	9.6
BULGARIA	Baa2	Baa2	Baa1	26.1	73.8	18.3	8.0	11.7	8.0	6.8
CAMBODIA	B1	B1	B2	91.6	8.3	30.5	13.3	13.1	10.5	13.7
CANADA	Aa2	Aa2	Aaa	0.3	99.7	22.8	4.5	5.7	10.3	3.4
CHILE	Baa2	Baa3	A2	35.9	64.2	19	8.3	10.4	7.8	13.6
CHINA	A3	A3	A1	8.6	91.4	16.2	4.5	10.7	10.4	15.9
COLOMBIA	Ba2	Ba2	Baa2	77.9	22.3	22.6	8.6	14.1	13.7	11.4
CONGO	Caa1	Caa1	B3	99.3	0.5	29.9	17.9	10.2	20.4	14.6
COSTA RICA	Ba2	Ba2	B2	78.2	21.7	22.9	8.8	10.2	18.4	12.5
COTE D'IVOIRE	Ba3	B1	Ba3	92.8	7.1	30.4	9.9	12.4	19.8	13.3
CROATIA	Baa1	Baa1	Baa2	14.1	85.7	16.6	8.1	10.3	5.1	7.1
CYPRUS	Baa1	Baa1	Baa2	14	86.1	16.6	9.4	6.0	6.6	5.1
CZECH REPUBLIC	A3	A3	Aa3	8	91.8	16.2	5.9	10.5	4.7	8.8
DEMOCRATIC REP. OF CONGO	B2	B2	Caa2	98.1	1.9	30.5	15.8	17.6	5.1	18.1
DENMARK	Aa1	Aaa	Aaa	0	100	79.4	6.0	4.9	2.3	2.2
DOMINICAN REP.	Ba2	Ba2	Ba3	78.9	21.1	23.3	7.8	13.8	18.3	7.7
ECUADOR	Ba1	Ba2	Caa3	65.6	34.1	17.9	11.4	8.6	13.5	9.5
EGYPT	B2	B2	Caa1	96.3	3.6	26	5.7	18.1	22.1	17.6
EL SALVADOR	B3	B3	Caa3	98.2	1.8	30.9	14.0	11.5	20.1	14.4
ESTONIA	A3	A3	A1	6.4	93.6	18.7	8.3	9.2	3.0	4.2
ETHIOPIA	B3	B3	Caa3	98.7	1.2	32.5	13.3	15.7	15.5	17.7
FIJI	B1	B2	B1	96.1	3.9	26.8	14.1	10.1	20.2	9.9
FINLAND	Aa1	Aa1	Aa1	0	99.8	58.7	5.7	5.7	6.1	4.5

Where,

- Confidence: denotes the peak of the ratings probability distribution. The higher the return, the more confident the model is about the assigned ratings.
- Economic/Institutional/Fiscal Strength: Higher values indicate higher levels of risk.



# FACTOR-DRIVEN RATING DECISIONS IN LINE WITH ACTUAL RATINGS | FULL SAMPLE 2/3

Countries	Implied Rating		Actual Rating	Junk Probability	Investment Grade Probability	Confidence	Economic Strength	Institutional Strength	Fiscal Strength	Event Risk
	2024	2023								
FRANCE	Aa1	Aa1	Aa2	0	100.1	57.5	5.3	6.9	5.5	4.7
GABON	Ba3	Ba2	Caa1	77.5	22.5	22.4	10.7	9.5	15.5	11.9
GEORGIA	Ba1	Ba1	Ba2	63.4	36.6	17.3	10.7	10.7	10.1	11.5
GERMANY	Aaa	Aaa	Aaa	0	99.9	82.6	3.6	6.9	2.7	2.9
GHANA	B3	B3	Ca	99.2	0.8	32.3	11.2	16.5	26.2	9.0
GREECE	Baa3	Baa3	Ba1	40.4	59.8	19.2	9.3	7.4	11.1	8.2
GUATEMALA	Ba3	Ba3	Ba1	81.6	18.3	25.1	10.0	14.4	11.7	11.6
HONDURAS	B2	B2	B1	95.7	4.1	27.4	13.2	14.6	13.5	12.6
HONG KONG	Aa1	Aa1	Aa3	0	99.9	53.1	4.3	4.5	1.2	8.9
HUNGARY	Ba1	Ba1	Baa2	55.0	45.1	17.7	6.6	12.9	9.3	13.0
ICELAND	A1	A2	A2	2.6	97.4	27.6	8.4	9.0	6.5	9.3
INDIA	Ba1	Ba1	Baa3	58.1	42.0	17	7.9	15.2	15.7	10.5
INDONESIA	Baa2	Baa2	Baa2	20	79.7	18.2	6.0	9.3	11.6	10.1
IRELAND	Aa3	Aa3	Aa3	0.6	99.3	24.4	2.6	4.7	4.0	5.3
ISRAEL	Aa3	Aa2	A1	0.3	99.8	22.1	4.5	5.9	6.4	10.1
ITALY	Baa2	Baa2	Baa3	19.1	80.9	18	5.9	8.9	12.7	4.1
JAMAICA	B2	B2	B2	96.0	3.7	26.6	14.4	11.0	19.7	7.8
JAPAN	Aa1	Aa1	A1	0	99.9	57.5	2.5	5.7	6.0	2.8
JORDAN	Ba2	Ba2	B1	68.5	31.3	18.7	10.3	9.5	13.5	12.2
KAZAKHSTAN	Baa2	Baa3	Baa2	34.6	65.6	18.9	6.7	14.3	5.2	13.2
KENYA	B2	B2	B3	96.9	3.0	26.1	9.9	16.1	19.8	13.4
KOREA	Aa1	Aa1	Aa2	0	99.8	52.5	1.8	4.6	6.5	8.7
KUWAIT	Aa3	Aa3	A1	0.9	99.2	26.9	10.4	7.2	0.9	10.2
KYRGYZ REPUBLIC	B2	B2	B3	97.7	2.1	29.3	15.8	15.5	10.7	12.1
LATVIA	A3	A3	A3	9.3	90.6	16	8.0	10.7	3.2	5.2
LEBANON	Caa3	Caa3	C	99.9	0	48.5	16.7	21.3	18.9	17.3
LITHUANIA	A3	A3	A2	4.9	95.1	21.8	7.0	10.0	3.0	3.8
LUXEMBOURG	Aaa	Aaa	Aaa	0	99.9	88.8	4.7	4.5	1.9	1.6
MALAYSIA	Baa1	Baa1	A3	14.8	85.3	16.9	5.9	7.6	12.7	9.0
MALTA	Baa1	Baa1	A2	13.4	86.6	16.5	8.6	8.4	6.0	2.9
MAURITIUS	Ba1	Ba1	Baa3	62.3	37.8	17	11.4	11.7	11.3	4.4
MEXICO	A3	A3	Baa2	7.3	92.7	17	7.2	14.0	10.0	11.1
MONGOLIA	B1	B2	B3	95.5	4.3	27.8	12.4	13.4	14.2	16.4
MONTENEGRO	B1	B1	B1	91.9	8.1	30.5	11.9	13.5	12.8	14.2
MOROCCO	Ba1	Ba1	Ba1	55.4	44.7	17.6	11.3	11.6	9.8	12.0
MOZAMBIQUE	Caa1	Caa1	Caa2	99.7	0.3	24.4	15.2	15.8	21.1	14.5
NAMIBIA	B1	B1	B1	91.5	8.3	30.5	14.6	12.2	12.6	8.3
NETHERLANDS	Aaa	Aaa	Aaa	0	100	85.1	3.3	6.4	3.5	2.5
NEW ZEALAND	Aa3	Aa3	Aaa	0.6	99.3	23.4	5.9	7.9	5.8	7.0
NICARAGUA	B2	B3	B3	98.2	1.8	30.9	15.1	15.5	12.2	14.3
NIGERIA	B3	B3	Caa1	98.4	1.5	32.1	13.5	17.4	12.7	16.4

Where,

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- Economic/Institutional/Fiscal Strength: Higher values indicate higher levels of risk.



# FACTOR-DRIVEN RATING DECISIONS IN LINE WITH ACTUAL RATINGS | FULL SAMPLE 3/3

Countries	Implied Rating		Actual Rating	Junk Probability	Investment Grade Probability	Confidence	Economic Strength	Institutional Strength	Fiscal Strength	Event Risk
	2024	2023								
NORWAY	Aa1	Aa1	Aaa	0	99.9	75.3	3.8	9.0	2.7	1.8
OMAN	Baa2	Baa3	Ba2	39.4	60.7	19.2	8.8	8.2	12.3	11.0
PAKISTAN	B3	B3	Caa3	99.0	1.1	32.6	9.9	17.8	21.4	17.0
PANAMA	Baa3	Baa3	Baa2	40.6	59.5	19.2	7.9	8.4	16.8	6.7
PAPUA NEW GUINEA	B3	B3	B2	98.8	1.2	32.6	16.0	15.5	14.8	10.7
PARAGUAY	Ba3	Ba3	Ba1	83.7	16.4	26.4	10.6	14.3	12.9	9.0
PERU	Ba1	Ba1	Baa1	54.6	45.2	17.7	9.6	12.0	9.5	9.7
PHILIPPINES	Ba1	Ba2	Baa2	68.1	31.6	18.6	8.5	12.7	12.6	12.2
POLAND	Baa1	A3	A2	8.9	91.1	16.1	3.6	12.0	6.0	7.2
PORTUGAL	Baa1	Baa1	A3	10.2	89.7	16.1	6.6	6.7	9.2	5.4
QATAR	Aa3	Aa3	Aa3	0.5	99.4	23.4	7.3	4.0	9.4	10.2
REPUBLIC OF MOLDOVA	Ba3	Ba3	B3	86.6	13.3	28.4	12.2	14.7	9.8	9.9
ROMANIA	Baa3	Baa3	Baa3	35.5	64.7	19	4.9	13.8	10.7	12.1
RUSSIAN FEDERATION	Baa1	Baa1	WR	16.1	83.9	17.3	7.0	14.7	4.4	14.3
SAUDI ARABIA	Aa3	Aa3	A1	0.7	99.2	26	4.8	9.1	5.5	16.2
SENEGAL	B1	B1	Ba3	93.9	5.9	29.8	11.8	12.7	19.1	8.9
SERBIA	Ba1	Ba1	Ba2	54.6	45.1	17.7	8.3	13.0	10.6	9.8
SINGAPORE	Aa2	Aa2	Aaa	0.1	99.8	31.2	2.4	6.3	10.0	5.4
SLOVAKIA	A3	A3	A2	7.1	92.9	17.4	6.5	10.6	4.5	5.7
SLOVENIA	A2	A2	A3	3.3	96.8	25.8	7.5	5.9	5.3	4.0
SOLOMON ISLANDS	B2	B1	Caa1	94.1	5.9	29.8	18.4	11.5	9.1	6.1
SOUTH AFRICA	Ba1	Ba1	Ba2	53.7	46.2	17.9	10.2	12.8	14.2	8.8
SPAIN	Baa1	Baa1	Baa1	17.3	82.5	17.6	6.5	8.5	10.6	5.1
SRI LANKA	Caa2	Caa1	Ca	99.6	0.3	21.9	13.8	17.0	22.8	15.5
ST. VINCENT	B1	B1	B3	91.4	8.8	30.5	13.9	8.2	18.1	10.5
SURINAME	Caa1	Caa1	Caa3	99.4	0.7	30.6	16.0	16.3	19.7	6.8
SWEDEN	Aaa	Aaa	Aaa	0	100	88.4	3.5	5.9	2.4	1.9
SWITZERLAND	Aaa	Aaa	Aaa	0	100	82.4	0.0	2.6	1.6	1.7
TAIWAN	Aaa	Aaa	Aa3	0	100	77.8	2.5	3.6	3.1	3.5
THAILAND	Baa2	Baa2	Baa1	20.3	79.8	18.2	6.9	8.2	9.6	13.0
TRINIDAD & TOBAGO	Ba1	Ba1	Ba2	57.0	43.2	17.3	11.9	10.9	8.7	6.5
TUNISIA	B3	B3	Caa2	99.0	0.9	32.5	13.7	14.8	18.0	17.2
TURKEY	Baa3	Baa3	B3	42.6	57.4	19.1	3.3	15.8	11.2	14.9
UGANDA	B2	B2	B2	97.9	2	30.2	12.4	15.3	17.6	14.0
UKRAINE	B3	B3	Ca	98.6	1.5	32	14.3	14.9	17.1	12.1
UNITED ARAB EMIRATES	Aa1	Aa2	Aa2	0.1	100.1	35.8	5.1	3.5	7.1	10.6
UNITED KINGDOM	A1	A2	Aa3	2.2	98.0	28.7	6.7	7.5	13.4	5.2
UNITED STATES	Aa3	Aa3	Aaa	0.6	99.4	24	2.4	10.3	10.5	6.3
URUGUAY	Ba1	Ba1	Baa2	53.7	46.2	17.9	9.5	9.8	12.3	10.1
VENEZUELA	Caa3	Caa3	C	100	0	64.6	17.1	21.4	20.3	20.0
VIETNAM	Baa1	Baa1	Ba2	16.7	83.3	17.5	5.0	11.1	7.9	13.2
ZAMBIA	Caa2	Caa2	Ca	99.8	0.1	27.7	16.8	18.0	20.7	13.3

Where,

- Confidence: denotes the peak of the ratings probability distribution. The higher the return, the more confident the model is about the assigned ratings.
- Economic/Institutional/Fiscal Strength: Higher values indicate higher levels of risk.



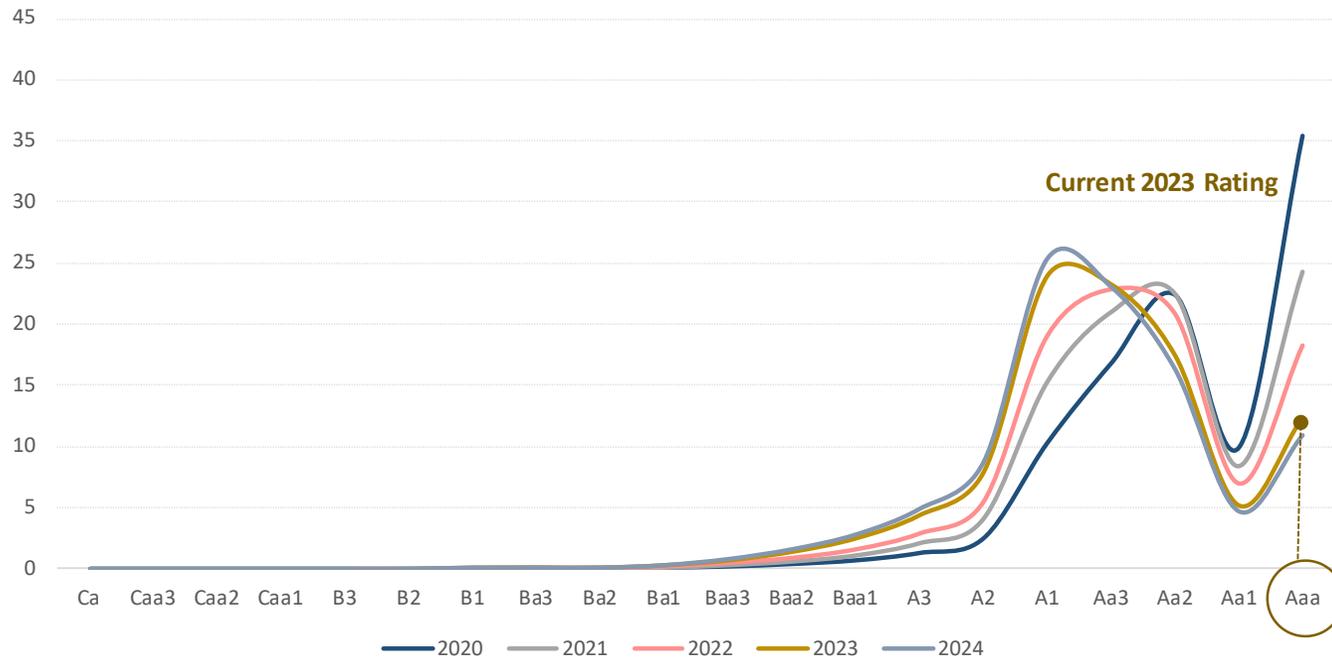
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Piraeus Bank Implied Rating Probability



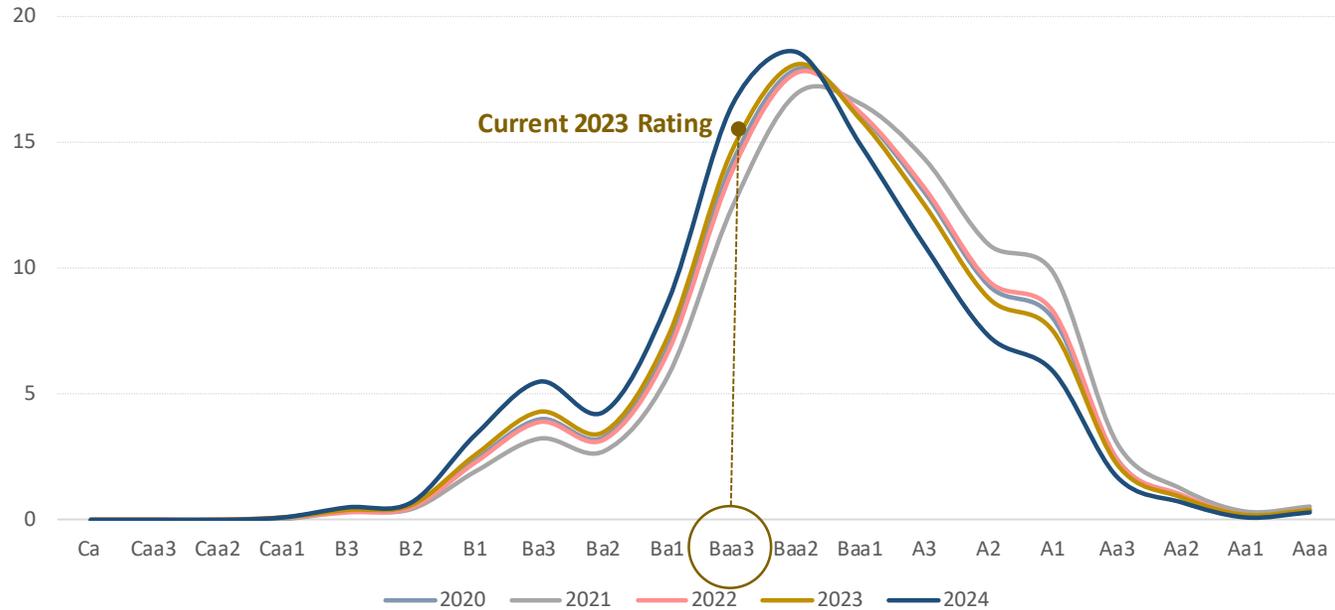
- Our model-implied rating for the US is significantly lower (by three notches) compared to Moody's Aaa rating. According to our results, the ratings probability distribution has been constantly shifting lower since 2021.
- The shift to lower ratings is caused by the significant deterioration of the institutional and fiscal factors. This deterioration is a direct consequence of the political dysfunctionality and fiscal expansion recorded in the US in recent years.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	2.1	7.0	7.9	6.4
2021	2.4	9.2	7.3	6.5
2022	2.3	10.1	8.1	6.5
2023	2.4	10.3	10.5	6.3
2024	2.5	10.4	10.9	6.3

\* The higher value the riskier



Piraeus Bank Implied Rating Probability



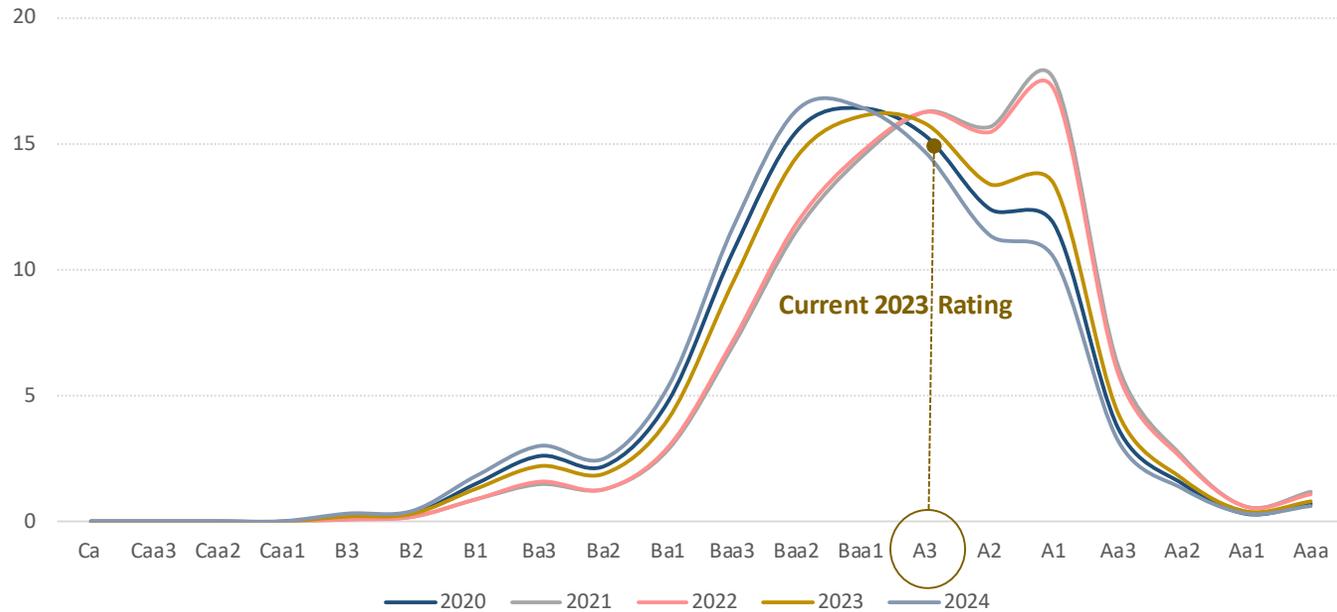
- Our model-implied rating for Italy (in a somewhat counter intuitive way) is one notch above the current Baa3 rating assigned to Italy by Moody's. Nevertheless, in reviewing the ratings' probability distribution shifts since 2020, we document a continuous deterioration in the ratings profile for the Italian economy.
- The fiscal risk factor is stable but at very elevated levels, while the main element of deterioration is within the institutional risk factor.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	5.9	7.7	13.6	4.6
2021	5.9	6.8	13.6	4.1
2022	5.9	8.0	13.1	4.1
2023	5.9	8.9	12.7	4.1
2024	5.8	9.9	12.9	4.1

\* The higher value the riskier



Piraeus Bank Implied Rating Probability



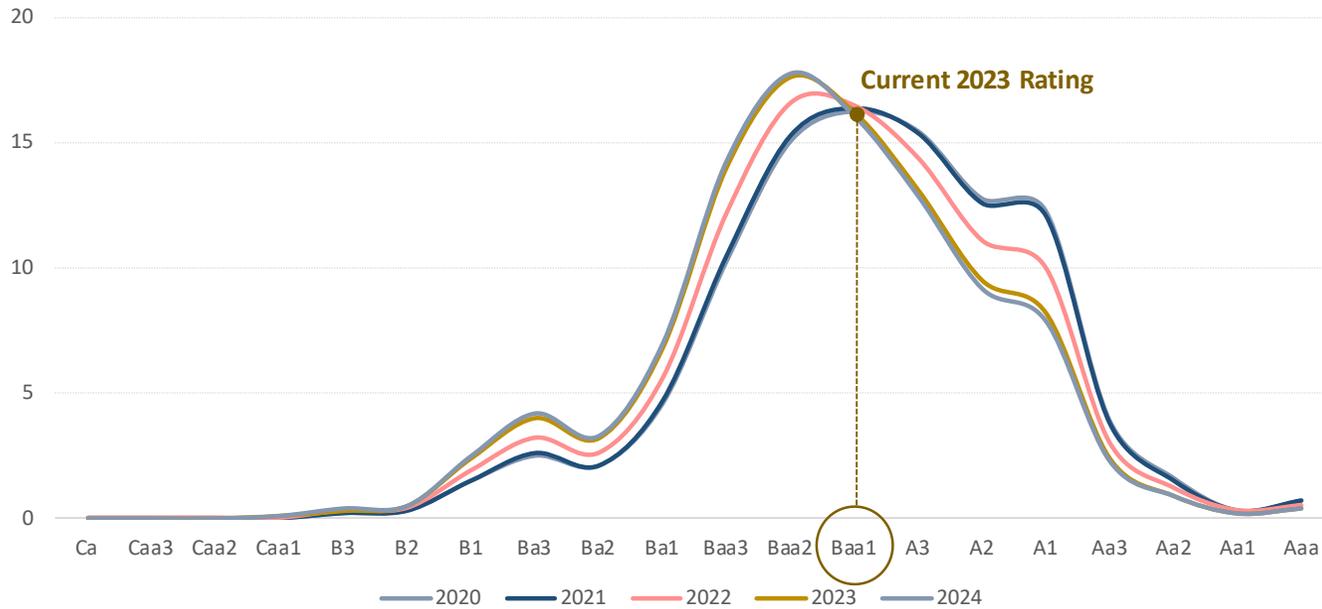
- The ratings distribution for Portugal exhibits substantial volatility. For example, it significantly improved during the pandemic years of 2021 and 2022 but has deteriorated since then. However, Moody's upgraded the rating by two notches in November to A3, which is marginally more optimistic than our model in view of 2023's developments and 2024's forecasts.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	7.1	5.7	11.1	4.8
2021	6.8	4.5	10.0	4.7
2022	6.7	5.6	9.0	4.4
2023	6.6	6.7	9.2	5.4
2024	6.6	7.7	9.7	5.4

\* The higher value the riskier



Piraeus Bank Implied Rating Probability



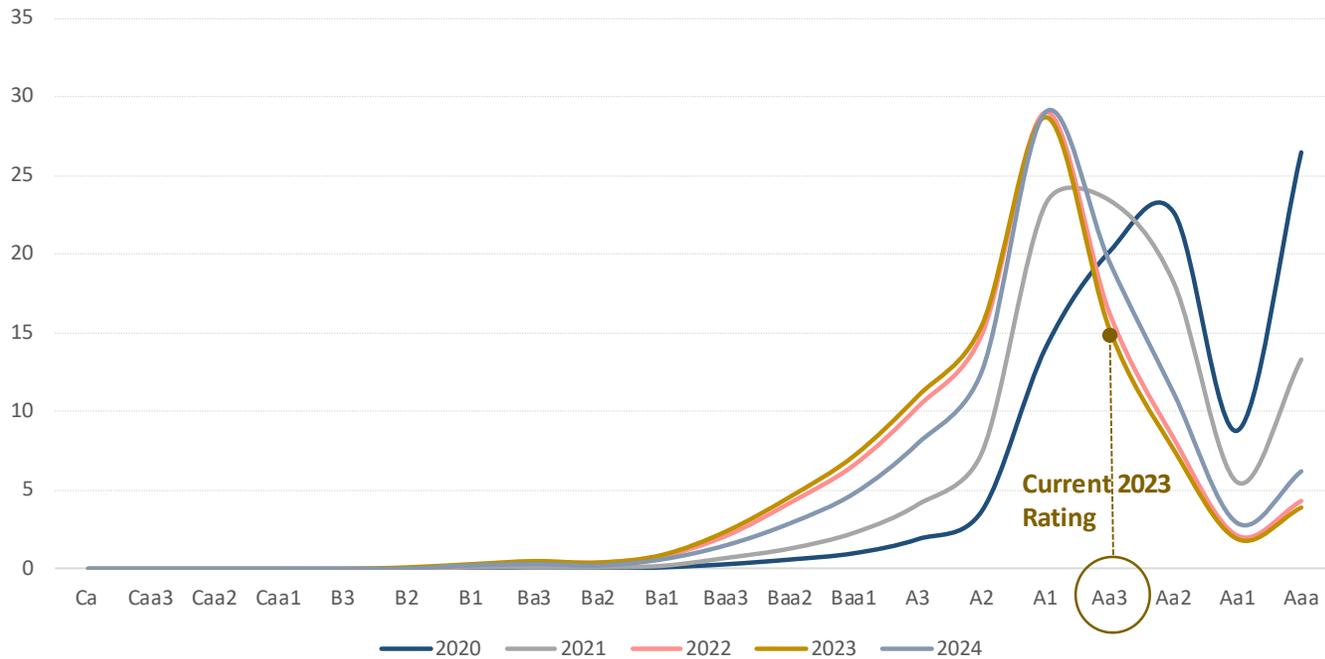
- In Spain, a persistent historical and forecasted deterioration in the rating probability distribution is documented by a constant shift to lower ratings.
- Negative developments in the institutional risk factor appear to be the culprit of the downgrade risk.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	6.9	5.5	10.8	5.8
2021	6.7	6.4	10.4	5.0
2022	6.5	7.5	10.5	5.2
2023	6.5	8.5	10.6	5.1
2024	6.6	9.2	9.6	5.1

\* The higher value the riskier



## Piraeus Bank Implied Rating Probability



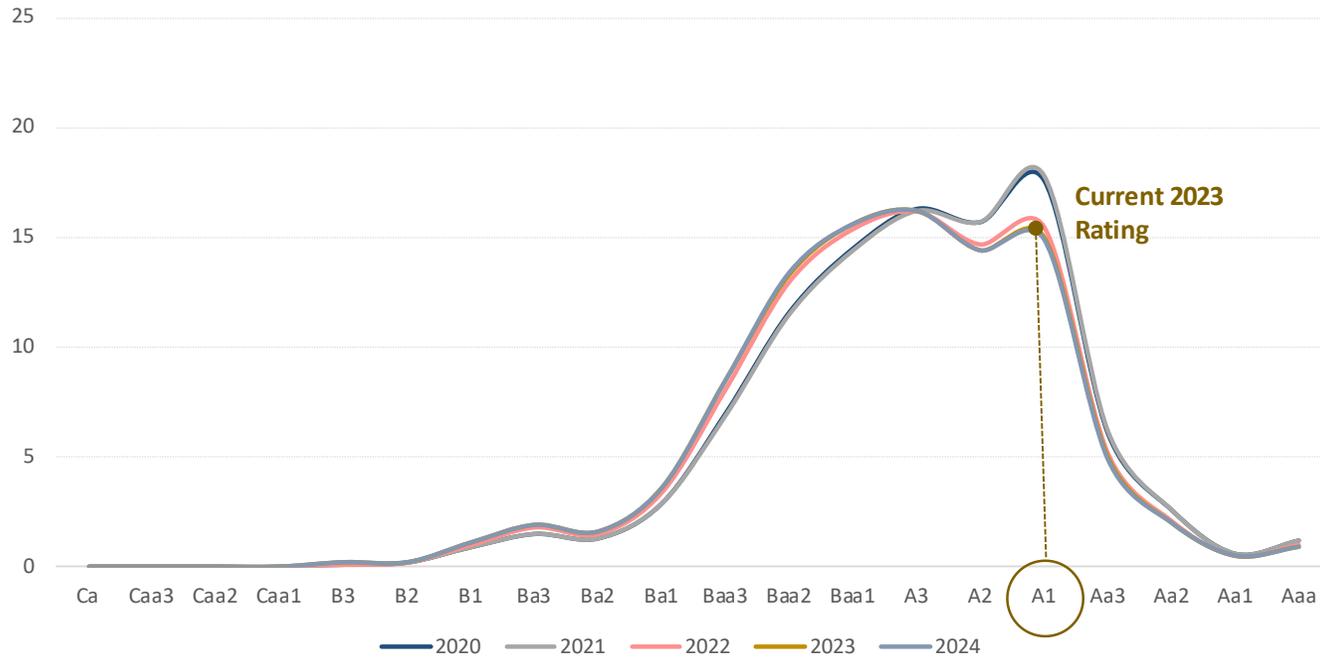
- The UK is on a path to downgrade, given the dramatic shift in its rating distribution. Moody's actual rating in 2023 is one notch above our estimates, but further deterioration cannot be ruled out in the future.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	6.7	3.6	7.0	4.0
2021	6.6	5.6	8.0	6.1
2022	6.7	7.2	12.9	5.8
2023	6.7	7.5	13.4	5.2
2024	6.8	7.9	9.7	5.4

\* The higher value the riskier



Piraeus Bank Implied Rating Probability



- China is fairly rated, with both implied and realised ratings coinciding.
- The event risk factor is more volatile, imposing a higher risk for the rating.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	4.7	10.1	9.6	15.5
2021	4.4	10.3	9.6	15.9
2022	4.6	10.5	10.2	15.9
2023	4.5	10.7	10.4	15.9
2024	4.4	10.7	10.7	15.9

\* The higher value the riskier



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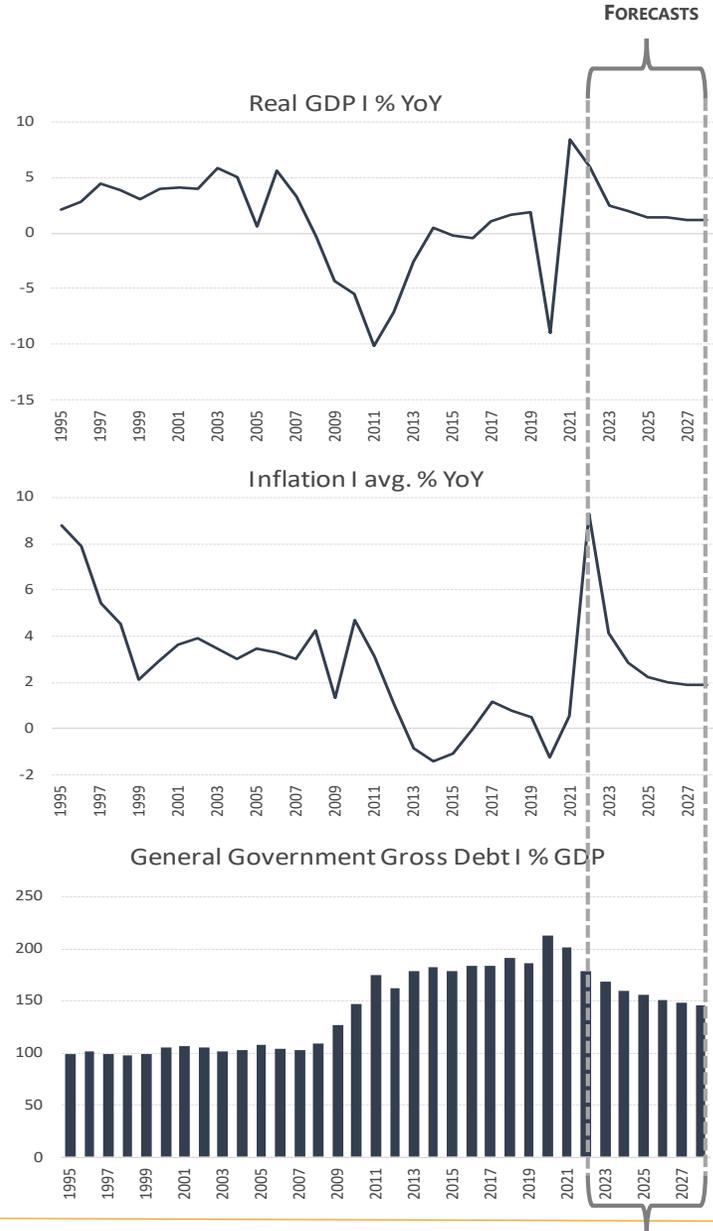
## GREECE SOVEREIGN RATING PROJECTIONS

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- Our analysis of the Greek sovereign rating outlook has two distinct stages:
    - First** we compare our current model-implied rating with Moody's actual rating.
    - Second** we use our ratings-model to forecast the evolution of Greek sovereign ratings in 2024.
  - In the **first stage** we utilise either actual data for the period of interest or data that we could deduce with a high level of conviction as inputs and compare the model outcome with Moody's rating.
  - Ex-post, we can see that based on our 2022 analysis, Greece's sovereign debt should have been rated investment grade status by 2023, a fact that has been 'confirmed' by Moody's September 2023 two-notch upgrade, which is just one before IG status. Additionally, our estimates signal a further upgrade in 2024 by at least one notch.
  - In the **second stage**, we assume that the global rating distribution remains constant and use macro-forecasts for Greece to project the baseline macro-scenario on future ratings.
- Based on that comparison (and up-until September 2023), Moody's was assigning an extremely conservative rating for Greece (Ba3) vis-à-vis the "theoretical" ratings that Greece should have been based purely on the values of its fundamentals.



# GREECE SOVEREIGN RATING PROJECTIONS | THE MACRO-FORECAST INPUTS



	Real GDP (% YoY)	Inflation (avg. %YoY)	General Government Gross Debt (% GDP)
2022	5.9	9.3	178.1
2023	2.5	4.1	170.0
2024	2.0	2.8	160.2
2025	1.4	2.2	155.7

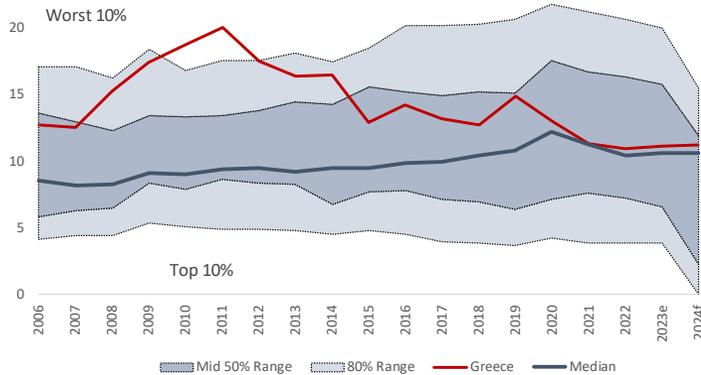
Source: IMF, Moody's

- Even though real GDP in 2021 returned back close to 2019 levels, economic activity in Greece is projected to slow down in the next three years, starting in 2023, albeit recording positive growth rates. In particular, it is expected that the real GDP will not grow by more than 2.5% per annum over the next three years.
- Persistent inflation dynamics indicate a high reading (though lower compared to the previous year) for 2023 at 4.3%, driven by high energy prices, geopolitical risks and supply bottlenecks abroad.
- High inflation and robust economic activity pushed nominal GDP significantly higher. However, a more moderate GDP growth and a cooling down of prices in the coming years, as well as a more prudent fiscal policy and higher interest rates, are expected to post debt levels down to 150% of the GDP by 2025.

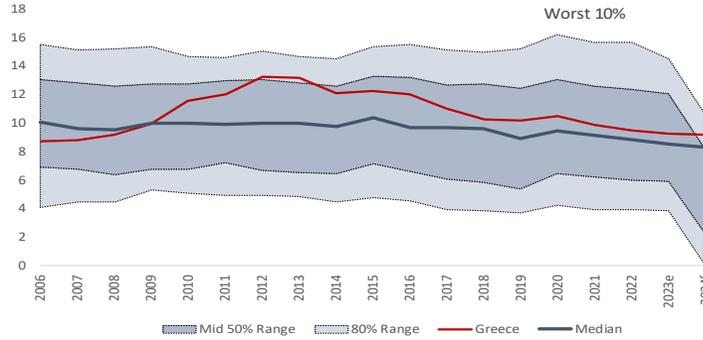


# GREECE HISTORIC FACTOR EVOLUTION

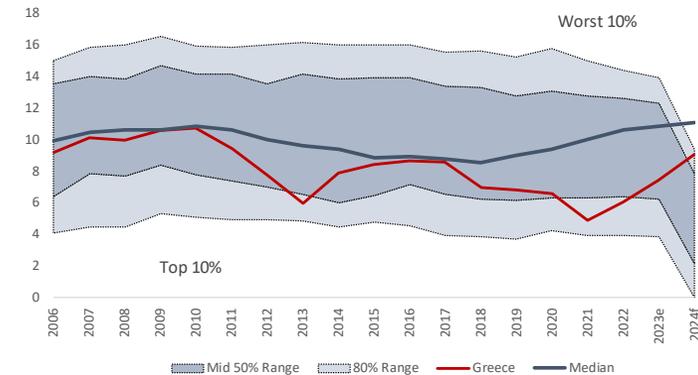
**Fiscal Strength** recovered from a peak in 2011 through an eight-year fiscal consolidation process, returning to the best-performing range of factor distribution across countries in our sample.



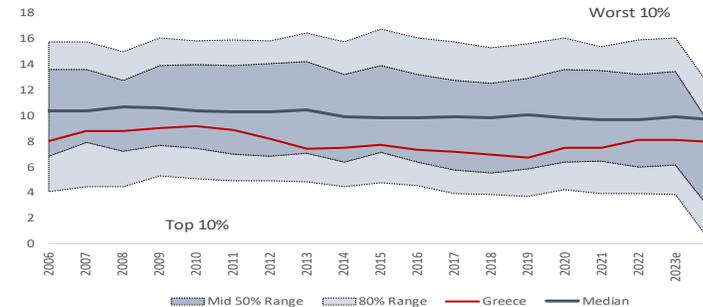
**Event Risk** was at normal levels, which were commonly found in the middle range of the sample's distribution.



**Economic Strength** has remained firm and has improved since 2012 but remains the median across all other economies.

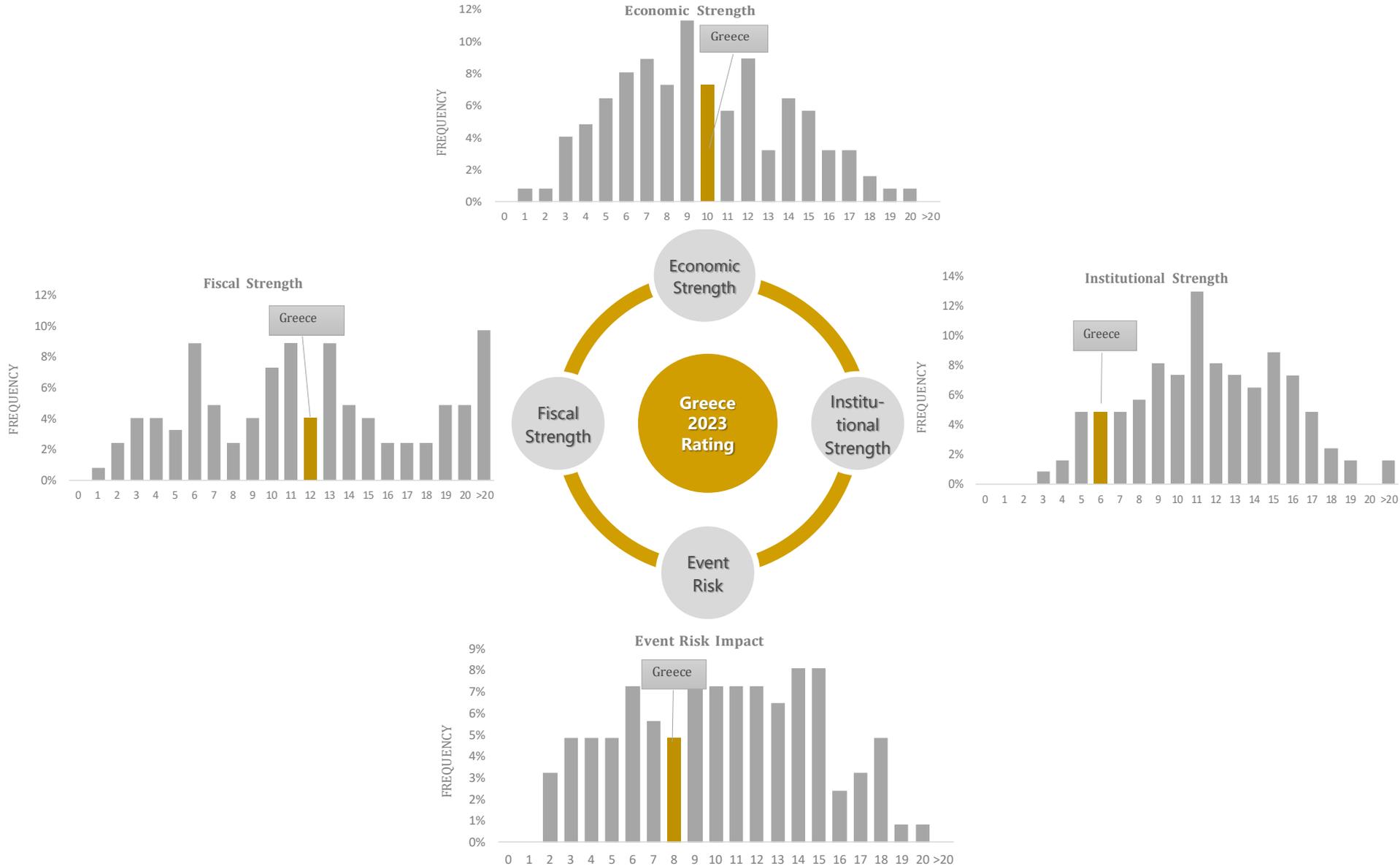


**Institutional Strength** substantially better than the other three factors, fairs much better than the sample median.



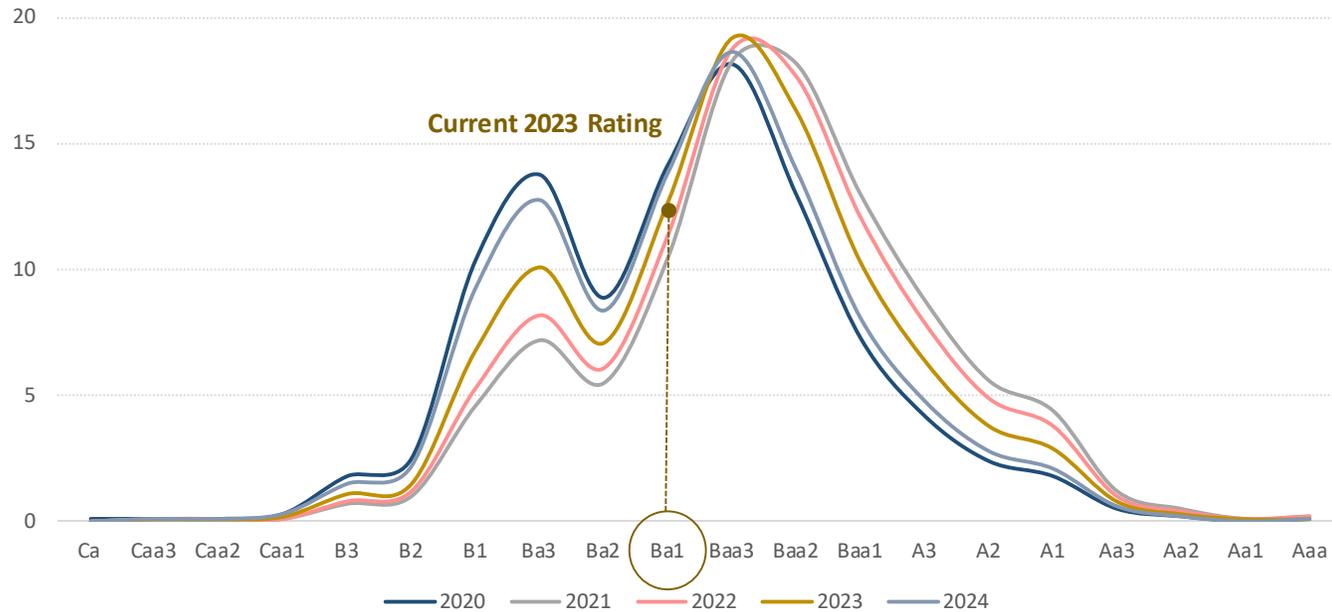


# MACRO FACTORS | GREECE'S RELATIVE POSITION VS 122 SOVEREIGNS





Piraeus Bank Implied Rating Probability



- Our implied ratings for Greece exhibit a sharp bias towards investment grade after 2021. However, our implied rating estimates rating it one notch higher in 2024.
- Clearly, the institutional factor that is based on world governance indicators recorded the best performance, while the fiscal factor continues to present the highest risk despite its recent improvement.
- In 2024, the institutional factor risk will likely increase.

	Economic Factor	Institutional Factor	Fiscal Factor	Event Risk Factor
2020	10.5	6.6	13.1	7.5
2021	9.9	4.9	11.4	7.5
2022	9.5	6.1	11.0	8.1
2023	9.3	7.4	11.1	8.2
2024	9.2	9.1	11.2	8.0

\* The higher value the riskier



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## DATA DESCRIPTION

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# of Countries	123
# of Years	19 years
Time Span	2006-2023
Outliers	To facilitate the statistical properties of our scoring model we truncate outliers in each of the four factor variables. As a result, we avoid extreme values that distort the statistical analysis. The maximum and minimum values used for truncation purposes are decided on a factor by factor basis and follow the qualitative and judgmental criteria described in Moody's methodology (Updated Version November 25, 2019).
Standardisations	In order to construct the factors on which implied rating scores are based, we follow Moody's standardisation process in which the numeric representation of each sub-factor is based on a 20-level scoring scale that matches sub-factor gauges to numeric scores. As a final step, sub-factors are weighted appropriately under the weighting scheme provided by Moody's to result in the four main factors utilized in the scorecard framework.
Data Sources	Moody's Rating Agency, International Monetary Fund, World Bank, Datastream



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## SOVEREIGN RATINGS | DESCRIPTION

Analytical Rating	Indicates
Aaa	Highest quality with minimal risk.
Aa1	High quality, subject to very low default risk.
Aa2	
Aa3	
A1	Upper-medium grade, subject to low credit risk.
A2	
A3	
Baa1	Medium-grade, moderate credit risk, may have speculative characteristics.
Baa2	
Baa3	
Ba1	Substantial credit risk, have speculative characteristics.
Ba2	
Ba3	
B1	High credit risk, considered speculative.
B2	
B3	
Caa1	Very high credit risk, poor standing.
Caa2	
Caa3	
Ca	Highly speculative. Likely in or very near default with some prospect of recovery of principal or interest.
C	Lowest rated class of bonds. Typically in default with little prospect for recovery of principal or interest.



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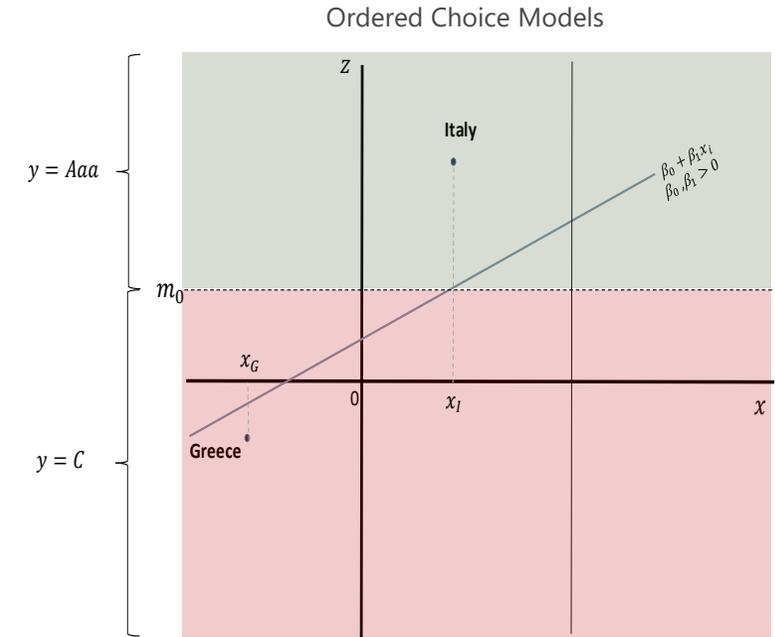
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# FROM DATA TO RATINGS | ORDERED CHOICE MODELS

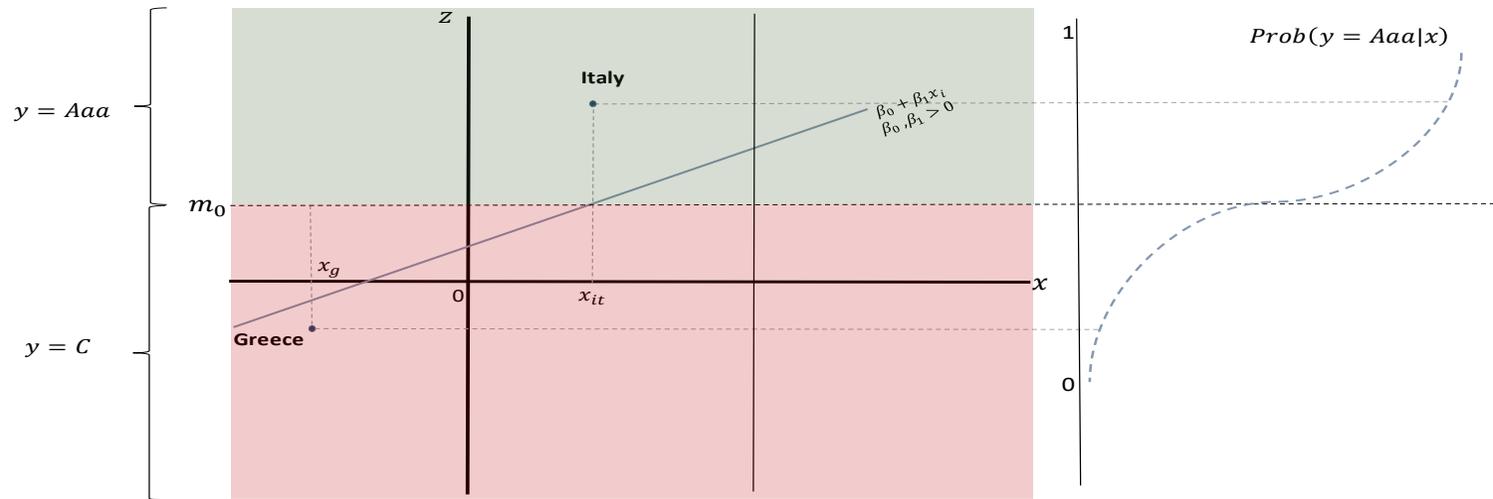
- Rating agency decisions fit naturally with ordered choice models where an individual, i.e. the rating agency in our case, must choose among an ordered set of discrete scores that characterise the capacity of a country to pay off its debt obligations. By ordered set, we mean that the scores follow a natural ordering from low ability (C) to high ability of debt repayment (Aaa). Ordered choice models can be thought of as an indirect regression of the observed rating decisions ( $y$ ) to a set of instrument variables ( $x$ ) that define several economic and qualitative characteristics of a country's debt repayment ability.
- The difference with the standard linear regression framework is that it is not possible to relate discrete rating scores in a linear way to the continuum of values observed in  $x$ . To overcome this problem we assume that the underlying process of choosing a country's discrete rating score is driven by a continuous preference strength random variable ( $z$ ) that indirectly relates the rating decision  $y$  with the economic characteristics of each country  $x$ . In particular, we relate the observed rating decisions  $y$  with the unobserved preference strength  $z$ , which in turn is related to the observed characteristics in  $x$ .
- The notion of ordered choice models can perhaps be better understood in the context of two country-two-rating scores example (binary choice model). For the sake of simplicity let's say that the rating agency must choose between two scores for Greece and Italy, C and Aaa, where the first rating indicates a low ability to repay debt and the second indicates a high ability to repay debt. For each country, the rating agency observes a single characteristic that indicates the country's GDP growth  $x_G$  for Greece and  $x_I$  for Italy. We further assume that the rating agency assigns an Aaa rating to Italy and a C rating to Greece based on the GDP growth and on some other unobserved factors that we cannot measure accurately or that are not available publicly.
- Our goal is to estimate how the rating score outcome is related to the observed characteristics. For this reason, we assume that the rating agency makes decisions according to a preference index  $z$  that is positively related to the observed characteristic (GDP growth) and the unobserved factors. In other words, we assume that as GDP growth increases, the tendency (or preference) of the rating agency to assign an Aaa rating is greater. Additionally, preferences are also affected (positively or negatively) by another unknown factor  $\varepsilon$ , ( $z_i = \beta_0 + \beta_1 * x_i + \varepsilon_i$ ).
- Assume that the values of  $z$  can be partitioned into two areas representing the two observed rating score choices - those that lie above a specific threshold  $m_0$  and those that lie below. For example, since  $z_G < m_0$  then  $y_G = C$  while for Italy  $z_I > m_0$  so  $y_I = Aaa$ .
- To date, we have managed to relate the rating decisions for the two countries with their GDP growth indirectly through the preference strength variable  $z$ . Since  $z$  depends also on the unobserved term  $\varepsilon$  which is random, the next step is to make assumptions on the distribution of this unobserved term.





# FROM DATA TO RATINGS I THE ORDERED LOGIT MODEL

Logit Transformation and Error Distribution



- The suggested model provides a crude description of the mechanism underlying an observed rating decision. The next crucial assumption is that of the distribution of the random error component  $\varepsilon$  (i.e. the country's unobserved or unmeasured features).
- The standard assumption here is that errors are randomly drawn from some theoretical distribution, allowing us to attach probabilities to each rating decision. In other words, by specifying the error distribution in the model, we transform the rating score preferences  $z$  to a probability function of the rating score outcome conditional on  $x, \beta_0, \beta_1$  and  $m_0$ . Intuitively, the conditional probability function works as the preference strength variable that is transformed such that it takes values between zero and one and changes analogously to the economic characteristics of the country. That is, if  $x_G$  increases, then the probability of assigning a higher rating to Greece also increases.
- For each choice of error distribution, we should apply an appropriate transformation. These transformations are usually a non-linear function, and the most common are the probit function (for normally distributed errors) and the logit function (for errors drawn from a logistic distribution). In our study, we prefer to work with the latter S-shaped function, as shown in the figure above.
- Ordered logit or probit models are extensions of this simple binary choice example to a setting in which the rating agency has to choose between more than two rating scores. The parameters that we estimate in the ordered logit model are the  $\beta$  from the linear equation as well as the  $n - 1$  threshold parameters  $m$  that correspond to the  $n$  rating scores.



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