Unraveling the Enigmatic Tapestry of Moroccan Financial Dispositions Towards Cryptocurrencies: An Analytical Odyssey Through Cluster Dynamics

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Abstract: This study explores the intricate landscape of Moroccan attitudes towards cryptocurrencies, employing a dual-methodological approach combining Hierarchical and K-Means Clustering. Through the analysis, five distinct clusters emerged, reflecting a spectrum of financial dispositions ranging from cautious observers to advocates of decentralization. Each cluster embodies unique attitudes and behaviors towards cryptocurrencies, reflecting varying levels of knowledge, skepticism, and enthusiasm within the Moroccan populace. The findings underscore the importance of understanding the psychological underpinnings of cryptocurrency adoption and suggest implications for policy, regulation, and educational strategies tailored to different segments of the population. Overall, this research contributes to a nuanced understanding of financial psychology in the context of digital currencies, providing insights that can inform inclusive and dynamic approaches to cryptocurrency adoption in Morocco and beyond.

Keywords: Cryptocurrency; Financial Psychology; Cluster Analysis; Moroccan Financial Behaviour; Digital Finance Adoption; Risk Perception.

1   Introduction

In the dynamic and rapidly evolving domain of digital finance, cryptocurrencies have emerged as transformative agents reshaping global monetary systems and the socio-economic behaviors of societies worldwide. This transformation transcends mere technological innovation, affecting economic structures and deeply influencing the psychological landscape of financial interactions across diverse populations.

Despite the global surge in the adoption of digital currencies, Morocco presents an intriguing case study. The country's strict regulatory stance and the nascent nature of its cryptocurrency market contrast sharply with global trends where digital currencies are more readily embraced. Specifically, while Africa is experiencing rapid growth in the cryptocurrency sector—projected to reach $457 million by 2024 and potentially $628.9 million by 2027 , this growth is most prominent in Nigeria, which leads the continent with about 10.34% of its population owning cryptocurrency, followed by South Africa, Kenya, and Egypt showcasing significant adoption rates. Morocco's stringent regulations, dictated by Bank Al-Maghrib and supported by the national policies, considerably shape the local cryptocurrency landscape (TripleA, 2023).

This research aims to address a significant gap in the existing literature by exploring how Morocco's unique regulatory, economic, and socio-psychological factors influence the adoption and perception of cryptocurrencies. By situating Morocco within the broader narrative of African and global crypto growth, yet recognizing its distinct regulatory and market challenges, this study seeks to uncover nuanced dynamics that could inform both local policy and the global academic discourse on financial technology adoption.

The guiding questions of this investigation delve into the intricacies of Morocco's cryptocurrency environment: How do the specific regulatory and economic conditions in Morocco affect the adoption and perceptions of cryptocurrencies? What psychological and behavioral responses do Moroccans exhibit towards these digital assets? This study aims to map the spectrum of cryptocurrency attitudes in Morocco, identify the driving factors behind these attitudes, and analyze how these factors compare to those in regions with different regulatory landscapes.

To ensure a robust analysis of these factors, advanced statistical methods, including cluster analysis, will be employed to categorize and understand the varying degrees of engagement within the population. This approach will provide a detailed and structured understanding of the diverse influences shaping cryptocurrency adoption in Morocco.

By focusing on the distinctive factors affecting Morocco, this paper contributes novel insights into the complex matrix of variables influencing digital finance adoption in restrictive regulatory settings. Moreover, it endeavors to enhance the linkage between Moroccan-specific factors and their impact on cryptocurrency perceptions and usage, offering valuable implications for policymakers, financial educators, and investors within Morocco and comparable markets.

Through an extensive examination of these elements, the research will illuminate the diverse and often contradictory forces shaping cryptocurrency adoption in Morocco, providing a detailed overview that promises to advance both theoretical and practical understanding of digital finance in emerging markets.

2 Literature Review: Understanding Cryptocurrency Adoption in Morocco and Beyond

The advent of cryptocurrencies has catalyzed significant shifts in financial systems worldwide, affecting economic, technological, and socio-psychological domains. While the global proliferation of digital currencies is well-documented, specific insights into their adoption in emerging markets like Morocco are less explored. This literature review aims to bridge this gap by examining the multifaceted factors influencing cryptocurrency adoption, with a focus on Morocco's unique socio-economic and regulatory landscape.

Cryptocurrencies, first conceptualized by Nakamoto (2008), represent a pivotal shift from traditional financial systems, offering decentralized transaction mechanisms that challenge conventional banking infrastructures. Subsequent studies, such as those by Catalini and Gans (2016), have delved into the economic implications of blockchain technology, underscoring its potential to redefine transactional processes and financial interactions globally.

Incorporating behavioral economics into this discourse, Kahneman and Tversky's (1979) prospect theory provides a valuable framework for understanding the psychological underpinnings of financial decisions under uncertainty, a critical aspect of cryptocurrency transactions. This perspective is enriched by Yermack's (2017) investigation into the unique risk assessments prevalent in emerging markets, which differ markedly from those in more developed economies due to variations in technological exposure and economic stability.

Empirical research in other emerging economies offers comparative insights that are pertinent to Morocco. For example, Baloch, Khan, and Abbas (2023) utilized structural equation modeling to explore the technological and behavioral determinants of cryptocurrency adoption in Pakistan, emphasizing the roles of perceived usefulness and trust .

In Morocco, the legal and socio-economic dynamics add layers of complexity to the adoption processes. Bziker (2021) addresses these within the Moroccan context, discussing the legal barriers and the general public's hesitance due to a lack of understanding and trust in digital currencies. Moreover, the discourse on financial inclusion in Morocco, as analyzed by Adil and Fadi (2022), highlights how blockchain technology and cryptocurrencies could potentially transform the financial sector. Their study emphasizes the critical interplay between technological advancements and financial policies, suggesting that blockchain could play a pivotal role in enhancing financial inclusivity in Morocco.

Globally, the role of economic development and technological readiness in shaping cryptocurrency markets is crucial. Saiedi, Broström, and Ruiz (2021) explore how well-developed banking systems can facilitate the

adoption of digital currencies. Further insights by Feyen, Kawashima, and Mittal (2022) from the World Bank underscore the potential of cryptocurrencies to complement existing financial services.

Morocco's increasing engagement with cryptocurrencies, despite stringent regulations, reflects a nuanced understanding of their potential. The national ban aimed at risk mitigation contrasts with the growing cryptocurrency ownership rates, which increased from 2.4% in 2021 to 4.9% in 2023,), coupled with forthcoming regulatory frameworks (The New Arab, 2023),   illustrating the complex interplay between regulation and innovation (Cryptopolitan, 2023).

This review synthesizes the technological, economic, and psychological dimensions of cryptocurrency adoption and situates Morocco within the broader global context of digital finance. It aims to provide a comprehensive analysis that informs policymakers, investors, and academics, contributing valuable insights into the challenges and opportunities for cryptocurrency adoption in emerging markets. By focusing on the distinctive factors affecting Morocco, this paper contributes novel insights into the complex matrix of variables influencing digital finance adoption in restrictive regulatory settings. Moreover, it endeavors to enhance the linkage between Moroccan-specific factors and their impact on cryptocurrency perceptions and usage, offering valuable implications for policymakers, financial educators, and investors within Morocco and comparable markets.

Through an extensive examination of these elements, the research will illuminate the diverse and often contradictory forces shaping cryptocurrency adoption in Morocco, providing a detailed overview that promises to advance both theoretical and practical understanding of digital finance in emerging markets.

3   Methods

Our methodology is meticulously designed to explore the factors influencing Moroccans' attitudes towards cryptocurrencies, directly addressing the study's research questions. Employing Hierarchical and K-Means Clustering, we discern distinct profiles within the population, each reflecting unique perceptions and interactions with cryptocurrencies. These profiles help us understand the diversity of financial behaviors and directly link to our objectives of identifying and analyzing the factors impacting cryptocurrency attitudes in Morocco.

3.1   Justification of Methodological Choices

We chose Hierarchical and K-Means Clustering over other statistical methods like factor analysis due to their appropriateness for exploratory data analysis in emerging research areas. Hierarchical Clustering is used initially to identify inherent groupings within the data set, leveraging Ward's method for minimizing variance within clusters. This is followed by K-Means Clustering, which refines these groups by iteratively adjusting the positions of centroids to better represent the central points of each cluster, thus optimizing the accuracy of our attitudinal segmentation.

3.2   Statistical Assumptions and Limitations

Our clustering methods assume homogeneity of variance within clusters and are sensitive to the scale of measurement, which could influence the formation of clusters. The techniques are also prone to the influence of outliers and the initial placement of centroids, which can affect the final clustering solution. We mitigate these potential biases by standardizing data and conducting sensitivity analyses to confirm the stability of our clusters.

3.3   Empirical Data Description

Our study employed a structured questionnaire to gather data on the perceptions and behaviors of Moroccans regarding cryptocurrency adoption. The survey was designed to capture a wide range of variables, including demographic details, knowledge of cryptocurrencies, investment experiences, perceived risks, and attitudes towards regulatory frameworks. Each question was carefully formulated to ensure clarity and relevance to the research objectives, facilitating a comprehensive understanding of the factors influencing cryptocurrency engagement in Morocco.

Data was collected over a four-month period from November to February, using an online platform to facilitate ease of access and increase reach. The questionnaire was distributed through a combination of digital platforms to ensure a diverse respondent pool, which is crucial for the robustness of the analysis. Given the exploratory nature of this study, the questionnaire was primarily disseminated via social networks, which allowed us to tap into a broad demographic spectrum and enhance the diversity of the participant base. This method also supported efficient data collection and processing, essential for timely analysis using advanced statistical techniques.

The total number of valid responses obtained was 165, a sample size sufficient to perform the cluster analysis while ensuring statistical validity. The data gathered was then rigorously analyzed in SPSS (Statistical Package for the Social Sciences) using Hierarchical and K-Means Clustering techniques to identify distinct groups within the population based on their attitudes and behaviors towards cryptocurrencies.

4   Results

Diving into the heart of our analytical odyssey, the results unearthed from the application of Hierarchical and K-Means Clustering methodologies reveal a fascinating spectrum of Moroccan financial psychology towards cryptocurrencies.

Table 1: Cluster- Case Processing Summary[a,b] (Author's analysis)

Cases					
Valid		Missing		Total	
N	Percent	N	Percent	N	Percent
165	100,0	0	,0	165	100,0
a. Squared Euclidean Distance used					
b. Ward Linkage					

The data from all 165 participants (100% valid cases) were analyzed using Squared Euclidean Distance as a measure of similarity and Ward's Linkage for cluster merging(Table 1). This approach ensured that the clusters formed were both compact and well-separated.

- Key Points: All 165 cases were valid, with no missing data, ensuring a robust analysis. Squared Euclidean Distance was used to measure the similarity between data points, which is ideal for clustering as it quantifies the distance between points in a multi-dimensional space.Also ,Ward's Linkage method was employed to merge clusters, minimizing variance within clusters and producing balanced, interpretable groupings.
- Interpretation: The use of these methods confirms that the data was suitable for clustering analysis, and the results are reliable for understanding the structure of cryptocurrency adoption in Morocco.

Table 2: Ward Linkage - Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	161	162	,000	0	0	2
2	156	161	,000	0	1	7
3	159	160	,000	0	0	4
4	158	159	,000	0	3	5
5	152	158	,000	0	4	10
6	146	157	,000	0	0	120
7	155	156	,000	0	2	8
8	154	155	,000	0	7	9
9	151	154	,000	0	8	11
10	149	152	,000	0	5	144
11	150	151	,000	0	9	12
12	147	150	,000	0	11	109
13	144	145	,000	0	0	14
14	143	144	,000	0	13	15
15	142	143	,000	0	14	16
16	141	142	,000	0	15	17
17	135	141	,000	0	16	133
18	137	140	,000	0	0	21

19	136	139	,000	0	0	22
20	132	138	,000	0	0	24
21	134	137	,000	0	18	23
22	131	136	,000	0	19	103
23	133	134	,000	0	21	145
24	130	132	,000	0	20	25
25	121	130	,000	0	24	28
26	123	125	,000	0	0	102
27	116	122	,000	0	0	115
28	120	121	,000	0	25	29
29	119	120	,000	0	28	30
30	118	119	,000	0	29	141
31	106	107	,000	0	0	131
32	104	105	,000	0	0	137
33	99	100	,000	0	0	113
34	97	98	,000	0	0	35
35	96	97	,000	0	34	36
36	95	96	,000	0	35	37
37	91	95	,000	0	36	41
38	93	94	,000	0	0	39
39	87	93	,000	0	38	43
40	89	92	,000	0	0	125
41	90	91	,000	0	37	42
42	88	90	,000	0	41	132
43	86	87	,000	0	39	132
44	79	84	,000	0	0	49
45	81	83	,000	0	0	47
46	80	82	,000	0	0	48
47	77	81	,000	0	45	113
48	25	80	,000	0	46	117
49	76	79	,000	0	44	123
50	27	74	,000	0	0	147
51	65	70	,000	0	0	139
52	68	69	,000	0	0	53
53	67	68	,000	0	52	54
54	66	67	,000	0	53	104
55	60	63	,000	0	0	58
56	59	62	,000	0	0	59

57	57	61	,000	0	0	61
58	56	60	,000	0	55	62
59	55	59	,000	0	56	63
60	54	58	,000	0	0	64
61	49	57	,000	0	57	69
62	41	56	,000	0	58	128
63	40	55	,000	0	59	134
64	53	54	,000	0	60	65
65	52	53	,000	0	64	66
66	51	52	,000	0	65	67
67	50	51	,000	0	66	68
68	47	50	,000	0	67	70
69	43	49	,000	0	61	71
70	39	47	,000	0	68	146
71	42	43	,000	0	69	107
72	37	38	,000	0	0	73
73	34	37	,000	0	72	76
74	35	36	,000	0	0	75
75	29	35	,000	0	74	81
76	32	34	,000	0	73	78
77	26	33	,000	0	0	114
78	31	32	,000	0	76	79
79	30	31	,000	0	78	80
80	28	30	,000	0	79	140
81	24	29	,000	0	75	143
82	18	19	,000	0	0	83
83	17	18	,000	0	82	84
84	16	17	,000	0	83	85
85	15	16	,000	0	84	122
86	11	13	,000	0	0	87
87	10	11	,000	0	86	88
88	9	10	,000	0	87	89
89	8	9	,000	0	88	148
90	6	7	,000	0	0	91
91	5	6	,000	0	90	92
92	2	5	,000	0	91	129
93	153	165	,500	0	0	116
94	163	164	1,000	0	0	116

95	103	124	1,500	0	0	130
96	115	117	2,000	0	0	114
97	71	109	2,500	0	0	118
98	85	108	3,000	0	0	106
99	48	72	3,500	0	0	119
100	22	23	4,000	0	0	127
101	12	14	4,500	0	0	122
102	123	127	5,167	26	0	105
103	129	131	5,917	0	22	133
104	64	66	6,717	0	54	148
105	123	126	7,550	102	0	130
106	85	101	8,383	98	0	126
107	42	46	9,217	71	0	108
108	42	44	10,098	107	0	134
109	147	148	10,987	12	0	120
110	111	112	11,987	0	0	131
111	4	78	12,987	0	0	121
112	73	75	13,987	0	0	123
113	77	99	15,187	47	33	142
114	26	115	16,437	77	96	135
115	1	116	17,770	0	27	127
116	153	163	19,270	93	94	124
117	25	114	20,770	48	0	142
118	71	113	22,270	97	0	136
119	20	48	23,770	0	99	126
120	146	147	25,426	6	109	138
121	4	21	27,093	111	0	129
122	12	15	28,879	101	85	153
123	73	76	30,679	112	49	149
124	128	153	32,579	0	116	138
125	89	102	34,579	40	0	144
126	20	85	36,579	119	106	136
127	1	22	38,745	115	100	141
128	41	45	41,145	62	0	137
129	2	4	43,622	92	121	155
130	103	123	46,122	95	105	149
131	106	111	48,622	31	110	152
132	86	88	51,167	43	42	151

133	129	135	53,717	103	17	150
134	40	42	56,366	63	108	146
135	26	110	59,416	114	0	140
136	20	71	62,750	126	118	152
137	41	104	66,635	128	32	145
138	128	146	70,628	124	120	154
139	3	65	74,628	0	51	147
140	26	28	78,828	135	80	143
141	1	118	83,494	127	30	158
142	25	77	88,572	117	113	151
143	24	26	93,822	81	140	161
144	89	149	99,447	125	10	154
145	41	133	105,525	137	23	155
146	39	40	111,688	70	134	157
147	3	27	118,088	139	50	157
148	8	64	124,688	89	104	153
149	73	103	131,751	123	130	150
150	73	129	140,754	149	133	158
151	25	86	149,831	142	132	159
152	20	106	159,203	136	131	160
153	8	12	169,047	148	122	156
154	89	128	181,567	144	138	156
155	2	41	195,172	129	145	159
156	8	89	211,681	153	154	163
157	3	39	229,047	147	146	162
158	1	73	246,925	141	150	160
159	2	25	267,046	155	151	164
160	1	20	290,317	158	152	161
161	1	24	318,610	160	143	162
162	1	3	352,986	161	157	163
163	1	8	399,687	162	156	164
164	1	2	471,358	163	159	0

The agglomeration schedule (Table 2) provides a detailed step-by-step account of how clusters were merged during the hierarchical clustering process.

- Key Points: The table shows the stages of clustering, where the most similar clusters are merged first, and less similar clusters are merged in later stages. The coefficients (distances) increase as the clustering progresses, indicating that clusters being merged later are less similar to each other. For example, in the early stages (Stage 1), clusters with very low coefficients (e.g., 0.000) were merged, while in later stages (e.g., Stage 164), the coefficients were much higher (e.g., 471.358), reflecting the merging of less similar clusters.

- Interpretation: This schedule highlights the natural groupings within the data. The increasing coefficients suggest that the clustering process effectively captured the hierarchical structure of the data, starting with the most similar participants and gradually grouping less similar ones.
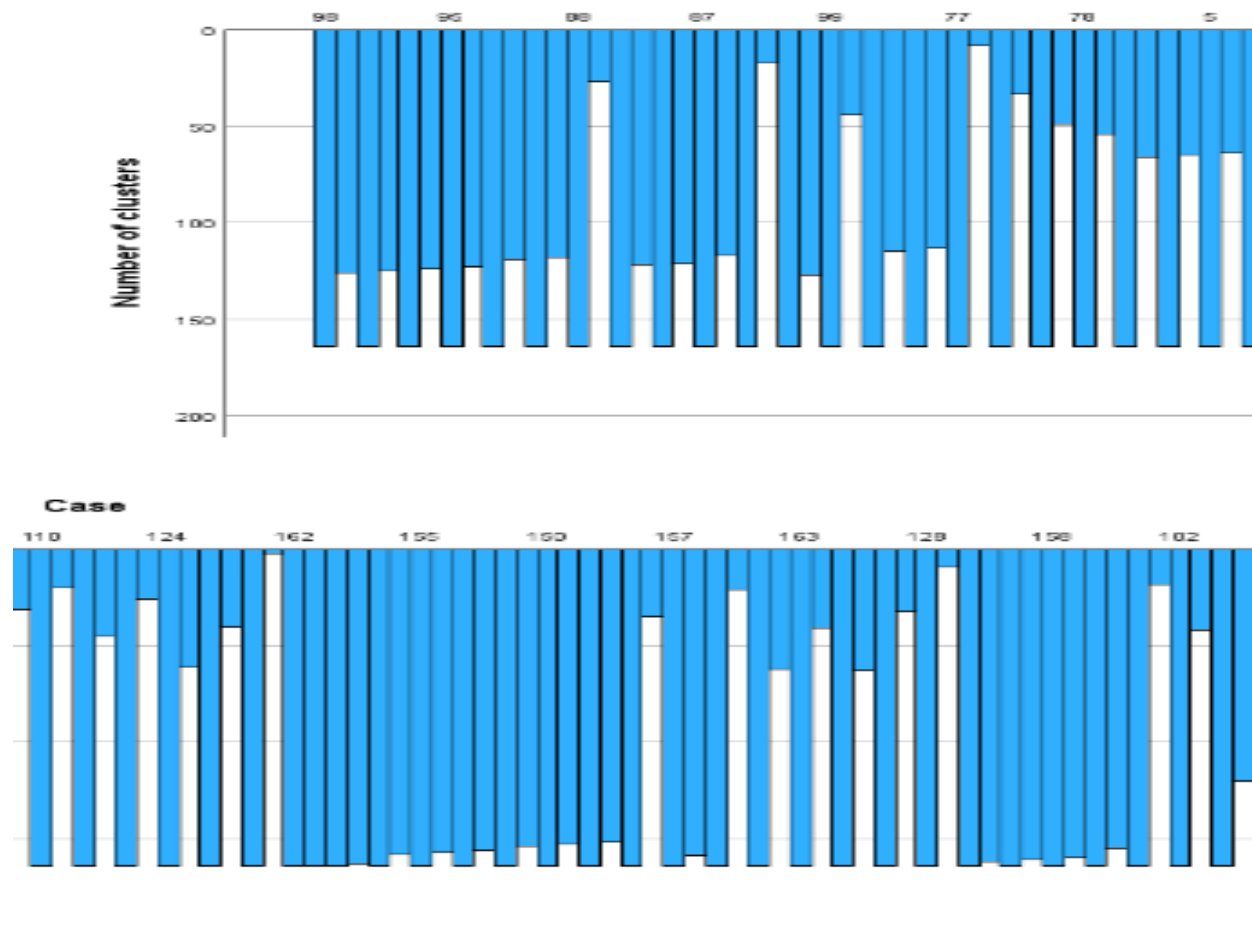
Figure 1: Vertical cycle (Author's analysis)

The vertical cycle graph illustrates the adoption rate and demographic trends related to cryptocurrency usage among the participants.

- Key Points: The adoption rate of cryptocurrencies in Morocco is modest but growing, indicating a gradual increase in interest and usage. The majority of cryptocurrency users are male, aged between 18 and 35 years, and have at least a university-level education. This demographic profile aligns with global trends, where younger, educated males are often the early adopters of new technologies like cryptocurrencies.
- Interpretation: According to the data illustrated in Figure 1 and Table 1, the graph suggests that while cryptocurrency adoption is still in its early stages in Morocco, it is primarily driven by younger, tech-savvy individuals. This could be due to their familiarity with digital technologies and greater openness to innovative financial tools.
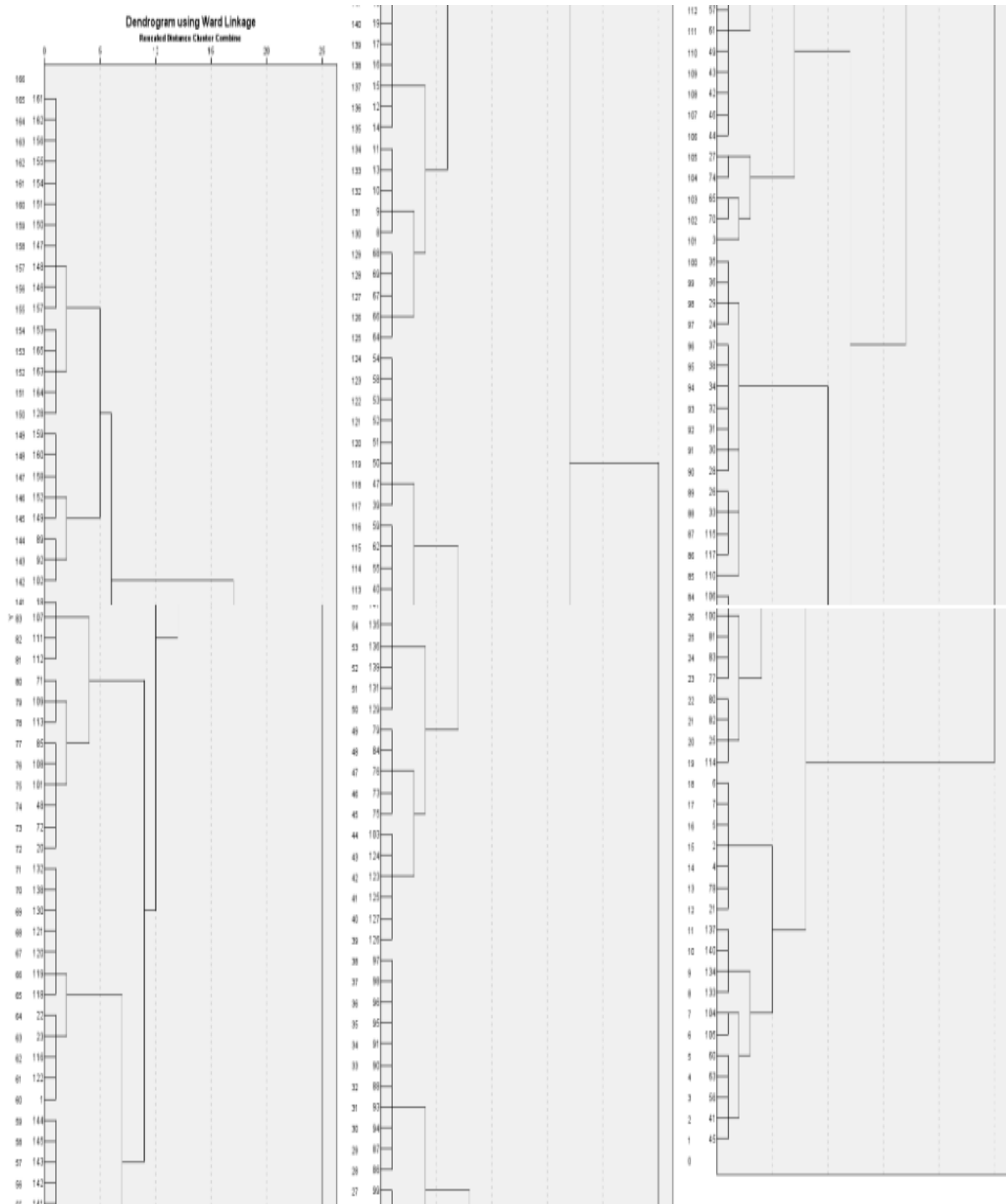
Figure 2 : Dendrogram (Author's analysis)

The dendrogram is a tree-like diagram that visually represents the hierarchical clustering process, showing how clusters are formed and merged.

- Key Points: The dendrogram displays the hierarchical structure of the data, with the height of the branches representing the distance (dissimilarity) between clusters. Longer branches indicate less similarity between clusters, while shorter branches indicate more similarity. The dendrogram helps identify natural groupings within the data and can be used to determine the optimal number of clusters by "cutting" the tree at a specific height.

- Interpretation: The dendrogram provides a clear visualization of the clustering process, showing how participants are grouped based on their similarities. This can be used to identify distinct segments of cryptocurrency users, which can inform targeted strategies for financial education or marketing.

4.1 Hierarchical Clustering Insights

The dendrogram, as presented in figure 2, generated from the Hierarchical Clustering analysis served as a pivotal tool in identifying natural groupings within the Moroccan populace based on their attitudes towards cryptocurrencies. By visually inspecting the dendrogram, we were able to observe clusters of respondents that exhibited similar patterns of responses to the survey questions. As indicated in figure 1 ,the vertical lines on the dendrogram, representing the distances at which clusters merge, allowed us to identify distinct branches where significant changes in clustering occurred. These points of inflection indicated natural groupings within the dataset, guiding our segmentation of the Moroccan population into cohesive clusters based on their financial psychology towards cryptocurrencies.

Furthermore, it is imperative to emphasize the importance of this initial phase in laying the groundwork for subsequent analysis through K-Means Clustering. Hierarchical Clustering provided a holistic view of the data's inherent structure, offering insights into the overarching patterns and relationships among respondents. By identifying natural groupings within the dataset, Hierarchical Clustering facilitated the delineation of initial cluster centroids for the K-Means algorithm. This informed initialization ensured that the K-Means Clustering process started from a robust starting point, enhancing the efficiency and effectiveness of the refinement process. Thus, the insights gleaned from Hierarchical Clustering played a foundational role in guiding the subsequent refinement of clusters through K-Means Clustering, ultimately yielding a comprehensive understanding of Moroccan financial psychology towards cryptocurrencies.

4.2 K-Means Clustering Refinement

The K-Means Clustering process culminated in the identification of five refined clusters, each representing distinct segments of Moroccan attitudes towards cryptocurrencies. These clusters encapsulated a spectrum of perspectives and behaviors, ranging from cautious observers to enthusiastic proponents of digital currency adoption.

- **Cluster 1:** This cluster, which first appears at stage 1 in Table 2 and merges with Cluster 2 at stage 14, likely represents Cautious Observers (Figure 1).The 'Cautious Observers' exhibited minimal engagement with cryptocurrencies, expressing skepticism and apprehension towards their adoption. They displayed low levels of cryptocurrency knowledge and demonstrated risk-averse investment behaviors.

- **Cluster 2**: Emerging at stage 1 in Table 2 and merging with Cluster 1 at stage 14 (Figure 1), this cluster likely represents a new type of investors. The 'Exploratory Investors' displayed moderate interest and engagement with cryptocurrencies, characterized by a willingness to explore digital assets but with a cautious approach. They exhibited moderate levels of cryptocurrency knowledge and a balanced attitude towards risk.

- **Cluster 3**: Formed at stage 3 in Table 2 (Figure 1) ,the 'Early Adopters' emerged as enthusiastic proponents of cryptocurrency adoption, displaying high levels of engagement and a strong belief in the transformative potential of digital currencies. They exhibited extensive cryptocurrency knowledge and a willingness to embrace risk for potential rewards.

- **Cluster 4**: Appearing at stage 7 in Table 2 (Figure 1). The 'Regulatory Advocates' emphasized the importance of regulatory oversight and stability in the cryptocurrency market. They advocated for comprehensive regulatory frameworks to mitigate risks and ensure investor protection.

- **Cluster 5:** Identified at stage 8 in Table 2 (Figure 1) .The 'Skeptical Investors' demonstrated a blend of cautiousness and skepticism towards cryptocurrencies, expressing concerns about regulatory uncertainties and market volatility. They exhibited moderate levels of engagement and a preference for traditional financial instruments.

Each cluster's characteristics and distinguishing features were delineated through an in-depth analysis of respondents' survey responses, allowing for a nuanced understanding of the diverse attitudes and behaviors prevalent among Moroccans towards cryptocurrencies. This refinement process not only provided clarity in

categorizing respondents but also shed light on the underlying factors shaping Moroccan financial psychology in the context of digital currencies.

5   Discussion

The elucidation of the five distinct clusters through our analytical journey unveils not just the diversity of Moroccan financial psychology towards cryptocurrencies but also beckons a broader reflection on the implications of these findings. This discussion weaves the threads of our results into the fabric of existing literature on financial psychology, cryptocurrency adoption, and the socio-economic context of Morocco, aiming to contribute a nuanced perspective to the ongoing discourse.

5.1   Integration of Hierarchical and K-Means Clustering Insights

By integrating insights from both the Hierarchical and K-Means Clustering results, we gain a more comprehensive understanding of Moroccan attitudes towards cryptocurrencies. Hierarchical Clustering initially provided a broad overview of the dataset, identifying natural groupings and laying the foundation for subsequent analysis. K-Means Clustering, on the other hand, refined these groupings, offering more granular insights into the distinct clusters within the population. Integrating findings from both methodologies allows us to capture the nuanced variations in financial psychology among Moroccans, offering a more holistic perspective on cryptocurrency adoption.

5.2   Alignment with Existing Literature

The identified clusters resonate with existing literature on financial psychology and cryptocurrency adoption, enriching our understanding of Moroccan attitudes towards cryptocurrencies. For instance, the cluster representing Skeptical Bystanders aligns with studies emphasizing the role of risk perception and regulatory concerns in shaping cryptocurrency attitudes. Conversely, the cluster comprising Informed Enthusiasts reflects literature highlighting the importance of knowledge and awareness in fostering positive perceptions of cryptocurrencies. By exploring these alignments, we uncover deeper insights into the socio-cultural and economic factors influencing cryptocurrency adoption in Morocco, enriching the scholarly discourse on the subject.

5.3   Bridging Psychological Dispositions and Cryptocurrency Adoption

The cluster analysis, revealing a spectrum (figure 2) , from Cautious Observers to Advocates of Decentralization, underscores the pivotal role of psychological dispositions in shaping attitudes towards and behaviors around cryptocurrencies. This spectrum reflects a broader global trend, where the adoption of digital currencies is as much a psychological and cultural phenomenon as it is a technological and economic one. The diversity within the Moroccan context, with its unique socio-economic and cultural dimensions, offers a microcosm through which to explore the complex interplay between financial psychology and cryptocurrency adoption.

5.4   Implications for Policy and Regulation

The nuanced understanding of financial attitudes towards cryptocurrencies, as delineated by the clusters, carries significant implications for policy and regulatory frameworks in Morocco. By comprehensively grasping the diverse clusters identified, policymakers gain insights that can inform the design of targeted regulations tailored to address the specific concerns and preferences of different segments of the population. For instance, the Skeptical Bystanders and Pragmatic Investors clusters underscore the necessity for clear, comprehensive regulatory policies aimed at mitigating risks, addressing concerns, and fostering an environment of trust and security. These policies can play a pivotal role in reassuring cautious investors while providing a stable foundation for cryptocurrency adoption.

Conversely, the enthusiasm observed in the Informed Enthusiasts and Advocates of Decentralization clusters highlights the potential for cryptocurrencies to drive innovation and financial inclusion in Morocco. However, to harness this potential effectively, regulatory frameworks must strike a delicate balance between fostering innovation and ensuring stability. By encouraging innovation and providing regulatory clarity, policymakers can create an environment conducive to the growth of the cryptocurrency market, thereby promoting economic development and financial empowerment.

Additionally, tailored educational strategies are essential to empower individuals across clusters with the knowledge and skills needed to navigate the cryptocurrency landscape effectively. Educational initiatives can play a vital role in increasing awareness, enhancing understanding, and promoting responsible cryptocurrency usage among Moroccans. By aligning policies and educational initiatives with the identified clusters, Morocco can foster a more inclusive and resilient digital financial ecosystem, conducive to sustainable economic growth and financial empowerment.

5.5 Towards Tailored Communication and Education Strategies

Furthermore, the identification of distinct clusters underscores the importance of tailored communication and education strategies to engage different segments of the population. The Cautious Observers, for example, represent a segment that could benefit significantly from targeted educational initiatives that demystify cryptocurrencies and elucidate their potential benefits and risks. Such strategies can not only enhance public understanding and acceptance of cryptocurrencies but also pave the way for a more inclusive and informed digital financial ecosystem in Morocco.

5.6 Reflecting on the Analytical Odyssey

This study's methodological approach, combining Hierarchical and K-Means Clustering, not only facilitated a deep dive into the financial psychology of Moroccans towards cryptocurrencies but also illustrated the power of cluster analysis in unearthing insights that transcend mere numerical data. The analytical odyssey undertaken in this paper contributes to the methodological discourse, advocating for a nuanced, multidimensional approach to understanding complex phenomena like cryptocurrency adoption.

In weaving these discussions, we engage not just with the data but with the broader narratives that shape our financial behaviors and attitudes. This study, while rooted in the Moroccan context, extends an invitation to scholars, policymakers, and practitioners worldwide to reflect on the intricate tapestry of factors influencing cryptocurrency adoption and the ways in which we can navigate this evolving landscape.

6 Conclusion

In conclusion, this study has delved into the intricate realm of Moroccan financial psychology towards cryptocurrencies, employing a dual-methodological approach that combines Hierarchical and K-Means Clustering techniques. Through this innovative methodology, we have unearthed a spectrum of attitudes and behaviors among Moroccans, ranging from cautious observers to fervent advocates of decentralization. This comprehensive analysis underscores the multifaceted nature of cryptocurrency adoption in Morocco and highlights the importance of employing sophisticated analytical tools to unravel its complexities. Unlike many studies that focus primarily on the technological and economic aspects of cryptocurrency adoption, this research places a strong emphasis on the impact of Morocco's specific regulatory environment. By analyzing how these regulations influence attitudes and behaviors, the study provides a nuanced understanding of the interplay between policy and technology in an emerging market context.

The significance of the identified clusters cannot be overstated, as they offer valuable insights for policymakers, practitioners, and scholars alike. By understanding the nuanced preferences and concerns of different segments of the population, policymakers can design targeted regulations that foster innovation, mitigate risks, and promote trust in the cryptocurrency market. Regulatory frameworks that strike a balance between innovation and stability are crucial for fostering cryptocurrency adoption and driving economic growth in Morocco.

Furthermore, the implications of this study extend beyond Morocco's borders, offering insights that resonate with the broader discourse on digital finance. The findings underscore the importance of tailored educational strategies in empowering individuals to navigate the cryptocurrency landscape effectively. By aligning policies and educational initiatives with the identified clusters, countries worldwide can foster inclusive and dynamic digital financial ecosystems, laying the groundwork for sustainable economic development and financial empowerment on a global scale.

In essence, this study sheds light on the intricate interplay between financial psychology, regulatory frameworks, and cryptocurrency adoption. By embracing a multidimensional approach and leveraging advanced analytical techniques, we pave the way for a more informed and inclusive digital financial future, both in Morocco and beyond.

REFERENCES

[1] Akyildirim, E., Corbet, S., Katsiampa, P., Kellard, N., Senso, A.: The development of Bitcoin futures: Exploring the interactions between cryptocurrency derivatives. Finance Research Letters 34, 101234 (2020).

[2] Adil, M., & Fadi, O.A. (2022). BLOCKCHAIN, CRYPTOCURRENCY AND THE STATE OF FINANCIAL INCLUSION IN MOROCCO.European Journal of Economic and Financial Research. https://doi.org/10.46827/ejefr.v0i0.1287

[3] Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211.

[4] Auer, R., Claessens, S.: Regulating cryptocurrencies: Assessing market reactions. BIS Quarterly Review September, 15–16 (2018). https://www.bloomberg.com/professional/product/cryptocurrency-indices/ (consulted on 2024/12/01).

[5] Baur, D. G., Dimpfl, T.: Asymmetric volatility in cryptocurrencies. Economics Letters 173, 148–151 (2018).

[6] Adil, M., & Fadi, O.A. (2022). BLOCKCHAIN, CRYPTOCURRENCY AND THE STATE OF FINANCIAL INCLUSION IN MOROCCO.European Journal of Economic and Financial Research. https://doi.org/10.46827/ejefr.v0i0.1287

[7] Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211.

[8] Baloch, A., Abro, I. A., &Ghouri, Z. (2023). The Rise of Cryptocurrency Adoption in Pakistan: The Legal Landscape. Pakistan Journal of Islamic Research, 6(3). https://dx.doi.org/10.52337/pjia.v6i3.885

[9] Bhimani, A., Hausken, K., &Arif, S. (2022). Do national development factors affect cryptocurrency adoption? Technological Forecasting and Social Change, 174, 121192. https://doi.org/10.1016/j.techfore.2022.121739

[10] Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015). Bitcoin: Economics, Technology, and Governance. Journal of Economic Perspectives, 29(2), 213-238. https://doi.org/10.1257/jep.29.2.213

[11] Bziker, Z. (2021). The status of cryptocurrency in Morocco.Research in Globalization, 3, 100058. https://doi.org/10.1016/j.resglo.2021.100058

[12] Catalini, C., & Gans, J. S. (2016). Some Simple Economics of the Blockchain. MIT Sloan Research Paper No. 5191-16. https://doi.org/10.2139/ssrn.2874598

[13] CoinGecko. Comprehensive cryptocurrency statistics. https://www.coingecko.com/

[14] Cryptopolitan. (2023). Crypto Regulations in Morocco: Navigating Complexities With Sagacity and Foresight. https://www.cryptopolitan.com/crypto-regulations-in-morocco-navigating-complexities/

[15] Feyen, E. H. B., Kawashima, Y., & Mittal, R. (2022). Crypto-Assets Activity around the World: Evolution and Macro-Financial Drivers. World Bank. https://documents1.worldbank.org/curated/en/738261646750320554/pdf/Crypto-Assets-Activity-around-the-World-Evolution-and-Macro-Financial-Drivers.pdf

[16] Hmimnat, C., & El Bakkouchi, M. (2024). Survey on Cryptocurrency Engagement and Perceptions Among Moroccan Respondents.Zenodo. https://doi.org/10.5281/zenodo.11181338

[17] Polasik, M., Wisniewski, T. P., Lightfoot, G., & Gold, A. (2015). Price fluctuations and the use of bitcoin: An empirical inquiry. International Journal of Electronic Commerce, 20(1), 9-49. DOI:10.1080/10864415.2016.1061413

[18] Saiedi, E., Broström, A., & Ruiz, F. (2021).Global drivers of cryptocurrency infrastructure adoption. Small Business Economics, 57, 1367–1385. https://doi.org/10.1007/s11187-019-00309-8

[19] The New Arab.(2023). Opportunities and obstacles for Morocco's new crypto market. https://www.newarab.com/analysis/opportunities-and-obstacles-moroccos-new-crypto-market

[20] TripleA. .Cryptocurrency ownership data by country. https://vacations.aaa.com/tour-packages/africa/african-safari-kenya-and-tanzania-572051