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ANÁLISIS DE DATOS FINANCIEROS

AMADEUS

amaDEUS

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1. Abstract

In this project, I carry out a study on the financial data of Amadeus with the aim of evaluating the variations of its premium and comparing it to the market it is listed in, the IBEX35. The main asset analyzed will be the stock premium for Amadeus.

Given that the risk of the premium can be justified by a variety of factors, I propose in this paper different reflections aimed at trying to scope out the essential market influences. Starting with the Capital Asset Pricing Model, evaluating each factor from a statistical point of view and improving on the model by adding relevant variables.

The focus will be on empirical and theoretical concepts to justify market trends and conclude the reason for variations within the period from which the company became public in 2010 until the last available financial report, 2019.

Specifically, the sectorial analysis of the Global Distribution Systems will be assessed in relation to each competitor's market evolution. Furthermore, the impact of technology, mergers & acquisitions in juncture with specific events in the history of Amadeus and European market trends will be the main variables contributing to the relationship between the Amadeus' performance and its stock premium variation.

2. Amadeus

2.1 General Company Description

Amadeus IT Group S.A., commonly known as Amadeus, is a company that processes transactions for the travel and tourism industry on a global scale through its Computer Reservation System (CRS). The company is one of the few to act as a Global Distribution System (GDS), providing distribution, technology and payment solutions for the global travel and tourism industry. Amadeus' mission statement is the following: *“To connect travel providers' with travel agencies in real time”*.

It was incorporated and registered in the Mercantile Registry on February 4, 2005. On July 31, 2006 WAM Portfolio S.A. took over Amadeus IT Group and adopted its name. After this event, on August 1, 2016 Amadeus IT Holding S.A. (Absorbing Company) merged with Amadeus IT Group S.A. (Absorbed Company) and adopted the name of the absorbed company, creating the Amadeus we know today.

The chairman of the board of directors is José Antonio Tazón García and the current managing director since 2011 is José Luis Maroto. Its corporate headquarters are in Madrid. Its legal form is a stock division company and its stock symbol is BME:AMS and it is listed on the IBEX35. Amadeus' area of operations is the information and technology area focused on the tourism sector. Amadeus introduced its initial public offering (IPO) in 1999 entering the IBEX35 shortly after, but dropped the out in 2005 returning to private investment due to a leveraged buyout by Cinven and BC Partners. It officially went back to trading thanks to a successful IPO in 2010, entering the IBEX35 once again in on January 1, 2011.

In accordance with the company bylaws¹, the corporate purpose of the company, in summary, is as follows:

- (a) Transmission of data through computer systems mainly related to the transport and tourism industry.
- (b) Provision of services related to distribution via IT (software and hardware).
- (c) Participation as a shareholder in other associations, companies, entities and enterprises operating in the same business area.
- (d) Carrying out financial studies of mergers and acquisitions with companies in the sector.
- (e) Acting as a holding company, with the possibility of participating in other companies not necessarily having the same corporate purpose.

2.2 History and Geographic Location

It was founded in 1987 through a strategic alliance, or joint venture, between Air France, Lufthansa, Iberia and SAS AB (Scandinavian Airlines) to establish a standardized system connecting airlines with travel agencies. They are currently the world's leading suppliers of information services and reservation systems in the travel industry.

¹ BYLAWS OF AMADEUS IT GROUP, S.A. (2019)

Since the 1990s Amadeus has the most advanced global travel distribution system in the world. In 2000 Amadeus pioneered the development of its revolutionary booking technology for airlines and travel agencies and has since diversified its portfolio into other applications.

Since its foundation Amadeus has extended its portfolio to travel revenue and expense management, travel intelligence and merchandising by capitalizing on the potential of cloud data storage, mobile and macro data technology. Investment in research and development has become an integral part of its growth. Having invested €900 million in R&D in 2018, €6.6 billion since 2004.

The company's main offices are located in:

- Madrid, Spain: corporate headquarters and marketing
- Nice, France: main research and development headquarters used for product and development, including a technology park in Sophia Antipolis.
- Erding, Germany: a data logistics center used for operations and data processing.

Its other regional offices are in Argentina, the United States, Thailand and the United Arab Emirates. Amadeus IT operates in 195 countries with Europe representing 43% of its revenues. The rest of its revenues comes from Asia-Pacific (12%), the Middle East and Africa (12%), North America (11%), Latin America (8%) and Central, Eastern and Southern Europe (7%). Amadeus' staff currently exceeds 19,000 employees of 146 different nationalities.

2.3 Business Structure

The company uses information technology (IT) to simultaneously connect a large number of travel suppliers with travel agents. Amadeus IT Group, connects airlines, hotels, railways, cruise ships and other travel suppliers with agents who sell products or product packages to corporate clients and consumer clients. It allows travel players, that is, travel sellers, travel providers and travelers, to manage their operations more efficiently and provide a better service during every stage of travel process.

Amadeus divides its business lines into three blocks: Distribution, Technological Solutions and Diversification into new business lines.

- Distribution: Amadeus provides a connected and collaborative platform that offers real-time pricing, booking, ticketing and processing solutions that facilitate trade and transactions between travel suppliers, travel vendors and travelers worldwide.
- IT Solutions and Diversification: Amadeus offers a broad set of specialized technology solutions that improve a variety of core travel business operations such as sales, analytics, inventory, revenue management, departure control and payments. It focuses on diversity of service offerings through mergers and acquisitions which can improve on the existing offers.

The Distribution area accounts for 70% of sales while its IT Solutions area is responsible for the remaining 30% of sales. The Distribution area is the interface between suppliers and agents while IT Solutions includes the Altéa Suite and New Skies systems used by airlines for reservation management, ticket sales, inventory management and departure control. Amadeus has 132 airlines that use Altéa products and another 120 that operate completely under the Altéa Suite system. Contracts with airlines that require the Altéa system are long term and usually last between 10 and 15 years.

In 2015, it had 40% of the world's reservations market and 28% of the world's technological solutions market. The company's main competitors are Sabre and Travelport. In 2006 -together with Sabre- they reached an agreement with the multinational electronic payment intermediation company to create a reservation tracking system called the Worldwide Commission Management System (WCMS).

In terms of operations, the company connects clients with reservation services from 484 airlines, more than 40,000 car rental services, 17 cruise lines, 33 ferry services and 90 rail operators. In addition to this it is associated with 233 tour operators and 421 thousand hotel owners, connecting in total more than 310 hotel chains. Another additional service of Amadeus is travel insurance having 16 providers. Amadeus processed more than 580 million in bookings in 2018.

2.4 Share Capital

Amadeus IT Group share capital amounts to a total of €4,312,684.36 million represented by 431,268,436 shares of €0.01 nominal value each. The company's share capital is fully subscribed and paid in and the number of voting rights is equal to the number of shares.

Free float shares represent a 99.81% of share capital. In terms of voting rights, the major investors as of October 18, 2019, are as follows: MFS Investment possesses 5.017% of voting rights, Capital Research and Management possesses 5.020%, Blackrock Inc. possesses 5.271%, Europacific Growth Fund possesses 3.009% and Invesco has 1.359%. From the mentioned companies, only MFS Investments voting rights are direct, the rest are indirect voting rights obtained through mutual funds and/or exchange traded funds (ETF's) therefore having limited decision making power.

Amadeus shares are listed on the Stock Exchanges of Madrid, Barcelona, Bilbao and Valencia and are traded through the Automated Quotation System (a computerized system that provides up-to-the-minute price quotations on about 5,000 of the more actively traded over-the-counter stocks), also known as the Continuous Market. The shares, represented by book entries, are accounted and recorded by the Sociedad de Gestión de los Sistemas de Registro, Compensación y Liquidación de Valores S.A. (Iberclear) and its associate entities.

2.5 Main Financial Events

In conclusion to this segment of my research I would like to summarize the main financial events that Amadeus has gone through from 2010 until 2020. As I mentioned before, Amadeus went public after a successful IPO on the Spanish stock market in 2010. It also was the first company in history to comply with the Electronic Miscellaneous Document (EMD) standard from the International Air Transport Association (IATA). The IATA EDM standard enables the tracking and payment of services booked through travel agencies through global distribution systems, such as the ones provided by Amadeus, or the airlines Central Reservation System (CRS). This ensures a seamless process that will cut financial distress for airlines that were struggling to track additional costs assigned to e-tickets.

The problem with e-tickets in the 2000's is that they did not work the same way as traditional tickets, and the data structure was not advanced enough to track and record additional costs such as having one or two additional handbags or the cost of a meal on the plane. The IATA EDM standard solved this problem. This was a big step for Amadeus in terms of recognition and establishing a strong image just as they were about to quote on the IBEX35, which happened on January 1, 2011.

In 2013 Amadeus acquired Newmarket for \$500 million. This was a period where Amadeus was aiming to establish their position in the hospitality industry and Newmarket was a leading provider of cloud-based group and event IT solutions for this industry. Furthermore, in the airline sector it achieved a breakthrough having its first customer in the Indian subcontinent which signed for the complete use of the *Altéa* system, SriLankan Airlines.

In 2014 Amadeus signed a long-term contract with BeNe Rail International, proving it could also operate in the railway market. Going into 2015, Amadeus had a very good year full of key partnerships and acquisitions, focused on expanding its geographic presence, of which main events include:

- In April, Amadeus partnered with the InterContinental Hotels Group to develop a groundbreaking next-generation Guest Reservation System (GRS) in line with its commitment to drive innovation in the hospitality industry.
- The company expanded its hotel IT portfolio to include property management with the acquisition of Itesso BV, a Netherlands-based company that owns a digitalized, remote access property management system (cloud-based) specializing in the hospitality industry.
- Marking another milestone for the company in the hospitality sector it acquired Hotel SystemsPro from a United States software provider catering to more than 4500 hotels in the US, Canada and the Caribbean.

These events marked Amadeus' commitment to the hotel sector, but many advances were also made in regards to the airline industry in 2015:

- Amadeus went on to increase its presence in the North American market with the acquisition of AirIT, a firm based in Florida that provides air transport IT solutions to a wide range of customers.
- In July, the company announced it would acquire Navitaire, a wholly owned subsidiary of Accenture, which provides technology and business solutions to the low cost airline industry.
- Also in 2015, previous partnerships produced a set of very good results that boosted Amadeus. For instance, Scandinavian Airlines (SAS) introduced a revolutionary revenue management system developed in collaboration with the Amadeus R&D team.

Finally, in 2016 Amadeus completed the transaction and acquired Navitaire, a company operating in low-cost travel and hybrid markets for \$830 million. Navitaire's portfolio of products and solutions complemented the Altéa Suite reservation system used by Amadeus and broadened the range of airlines to which Amadeus can offer its services, giving the company the ability to serve a wider group of airlines. Also in 2016 Amadeus launched B2B (business-to-business) Wallet Prepaid, a virtual credit collection system which enhanced its existing method.

In 2018 Amadeus carried out numerous merger and acquisition operations, several of which were smaller in size such as the acquisition of a 70% stake in Hiberus Travel IO Solutions S.L. for €8.3 million and others with greater weight in their operations, such as the acquisition of 100% of TravelClick Inc. for €1336.2 million. This acquisition represents the largest acquisition in the history of the company and confirms its commitment to the hospitality industry.

Amadeus M&A strategy is focused on expanding its portfolio and customer base. Most recently, in 2019, it acquired ICM Airport Technics for €40.1 million diversifying its strategy and increasing its presence in the airport market, specially in the Asia-Pacific region. ICM Airport Technics specializes in providing automated passenger processing solutions and self-service baggage check-in systems for customers. We can see through

the analysis of all these M&A transactions that Amadeus has been focusing for the past couple of years on establishing their business in the hospitality industry and improving their presence in the global market.

3. Sector Analysis

To gain a deeper understanding of Amadeus it is essential to understand the market it operates in and compare the company with its competitors. The company operates in a very niche market. This is the Global Distribution System (GDS) sector. It is a collection of companies that provide distribution, technology and payment solutions in the form of software for the travel and hospitality industry.

The GDS sector is composed mainly by three companies. They are Amadeus, Travelport and Sabre, these provide for the entirety of the global market. Additionally, there is TravelSky which is exclusive to the People's Republic of China.

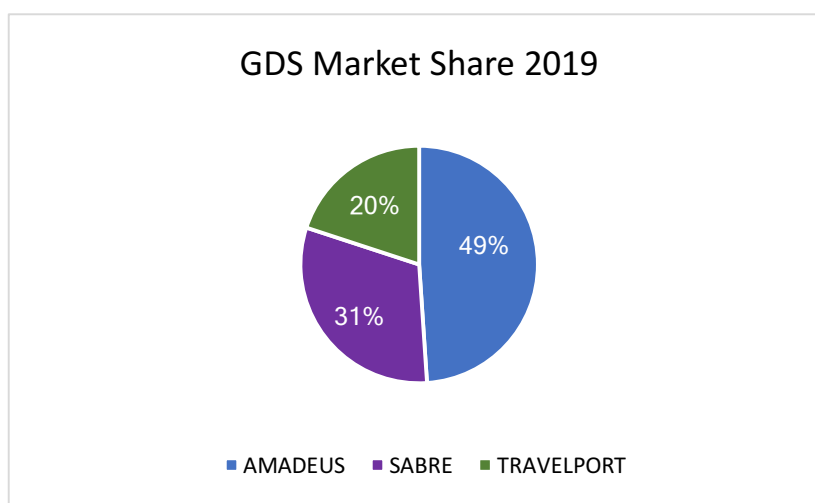


FIGURE 1. GDS Market Share 2019

Source: Amadeus, Sabre and Travelport Annual Reports, Own Elaboration, Excel.

As *Figure 1.* shows Amadeus is the leader in the GDS sectors market share and has been in this position since it pioneered its Central Reservation System (CRS). For the past seven years, its market share has been over the 40% barrier.

Information and communication technologies have changed the management, promotion and marketing of tourism companies and institutions. Travel agencies have experienced the arrival of GDS at the end of the eighties. The development of Internet networks at the end of the nineties caused a radical transformation in the operations of travel agencies and strengthened the need for a more efficient system. Here is where Amadeus and other GDS companies come into play.

With GDS systems, these companies can offer a variety of tourism product and service providers such as flights, hotels, cruises, car rentals or tour operators. GDS terminals are installed in travel agencies, through which the services offered are booked and purchased. The platform enables these agencies and their clients to access travel data, buy, sell and compare reservation options providing real-time information on availability, features and prices. This helps with tracking tickets, debts and managing a wide network dedicated to the sale of tourist products. The systems can store and instantly update vast amounts of information on the offerings of a wide range of tourism companies worldwide. This has modified the role of the travel agent, going from being a mediator to a real travel advisor.

Due to the technological transformation that has occurred throughout the last decades of the 20th century, we are now living in the so-called Information Society. This new economy has made GDS an essential element for travel agencies and establishing their competitive advantage in the market.

4. Financial Statements Analysis

To commence the financial analysis, it is important to review and comment the last available financial statements which in this case correspond to the years 2018 and 2019. These represent Amadeus' current situation and give us an in depth look at how the company's business model is structured.

Balance Sheet

From the asset side of the Balance Sheet results observed in *Figure 2*. on the next page, the company's focus in research and development is notable since Intangible assets represent a 40% of the total assets. In conclusion patents, trademarks and licenses as well

as technology are an important asset for Amadeus. Intangible Contractual Relationships are also an important asset that provides Amadeus, these are usually related to data collection and information on customer related systems. Observing the companies Goodwill, the importance of M&A transactions is confirmed since this represents a 35% of total assets. As for the rest of the asset side Amadeus has poor liquidity having the majority of its assets, an 86%, as non-current. The company has a negative working capital of (€1527.2) this means that Amadeus finances its short-term debt by borrowing from customers and suppliers, in other words, it is doing sufficiently good in terms of sales that it has no need to cover short-term debt with short-term assets. This is confirmed by seeing how sales and debt are increasing despite having a current ratio of 0.49. The quick ratio is of the same amount given Amadeus does not hold inventory being a software distributor.

ASSETS	December 31, 2019	December 31, 2018
Goodwill	3661,5	3598,0
Patents, trademarks, licences and others	330,6	338,3
Technology and content	2843,1	2710,7
Contractual Relationships	1014,1	1044,8
Intangible Assets	4187,8	4093,8
Land and buildings	68,6	71,3
Data processing hardware and software	251,7	253,6
Other property, plant and equipment	111,8	108,3
Property, plant and equipment	432,1	433,2
Right of use assets	336,4	351,2
Investments accounted for using the equity method	30,5	14,3
Other non-current financial assets	92,0	108,8
Non-current derivative financial assets	3,7	1,5
Deferred tax assets	37,4	19,9
Other non-current assets	176,6	138,3
Total non-current assets	8958,0	8759,0
Trade account receivables	529,5	498,2
Current income tax assets	61,2	43,5
Other current financial assets	11,3	10,0
Current derivative financial assets	9,3	7,5
Other current assets	267,8	249,3
Cash and cash equivalents	564,0	562,6
Total current assets	1443,1	1371,1
TOTAL ASSETS	10401,1	10130,1

FIGURE 2. Amadeus Balance Sheet (Asset Side) 2018-2019

Source: Amadeus Annual Reports, Own Elaboration, Excel.

The return on assets (ROA) for Amadeus is an 11%, much higher compared to its competitors Sabre and Travelport, with 4% and 2% respectively. Concluding that Amadeus has a much more efficient system in terms of effectively using its assets to generate income in comparison.

In regards to the company's equity, *Figure 3.*, from 2018 to 2019 Amadeus has increased its funding through equity by 19%. The debt to equity ratio is 1.74. The company is financed in its majority by debt, having a long-term debt to equity ratio of 0,95 and short-term debt to equity ratio of 0.78. In total Amadeus is financed 64% by debt and 36% by equity. This is due to Amadeus having to frequently recur to long-term debt as a medium of financing for its numerous acquisitions of other companies. As mentioned before its short-term debts are re-financed by regular cash inflows that originate from day to day operations. This is confirmed by checking the receivables turnover ratio, in this case, being 10.5 which indicates a high effectiveness by Amadeus in collecting its receivables or money owed by clients.

EQUITY AND LIABILITIES	December 31, 2019	December 31, 2018
Share Capital	4,3	4,4
Additional paid-in capital	141,5	634,4
Retained earnings and reserves	2623,3	2153,7
Treasury shares	-5,4	-511,3
Profit for the year attributable to owners of the parent	1113,1	1002,4
Unorganized gains / (losses) reserve	-94,3	-107,9
Early attributable to owners of the parent	3782,5	3157,7
Non-controlling interests	14,6	16,0
Equity	3797,1	3191,7
Non-current provisions	26,8	29,5
Non-current debt	2328,2	2898,1
Non-current derivative financial liabilities	6,0	14,5
Other non-current financial liabilities	1,0	15,3
Deferred tax liabilities	751,1	759,0
Non-current income tax liabilities	245,7	271,3
Non-current contract liabilities	137,6	126,7
Other non-current liabilities	137,3	130,9
Total non-current liabilities	3633,7	4245,3
Current provisions	8,4	10,5
Current debt	1245,5	986,9
Other current financial liabilities	11,1	8,5
Dividend payable	241,4	219,6
Current derivative financial liabilities	28,1	19,8
Trade accounts payable	801,2	846,2
Current income tax liabilities	47,2	41,7
Current contract liabilities	238,6	221,5
Other current liabilities	348,8	338,9
Total non-current liabilities	2970,3	2693,1
TOTAL EQUITY AND LIABILITIES	10401,1	10130,1

FIGURE 3. Amadeus Balance Sheet (Equity and Liability Side) 2018-2019

Source: Amadeus Annual Report, Own Elaboration, Excel.

The return on equity (ROE) for Amadeus is 29% similar to its other competitor Sabre, which is also publicly listed in the stock market with a ROE of 25%. In the case of Travelport its ROE does not serve as comparable data being a privately-owned business since it was acquired by Siris Capital Group.

Income Statement

Observing the company's income statement in *Figure 4.*, both revenues and costs have increased, by 13% and 16% respectively, meaning that the company is growing its operations and doing well. Total operating income has increased 6%, and after paying interest and taxes the increase from 2018 to 2019 has been by 11% profit-wise.

PROFIT AND LOSS		
	December 31, 2019	December 31, 2018
Revenue	5570,1	4935,7
Cost of revenue	-1429,5	-1206,9
Personnel and related expenses	-1543,2	-1382,1
Depreciation and amortization	-773,2	-635,5
Other operating expenses	-348,8	-318,4
Operating income	1475,4	1392,8
Financial income	1,6	2,0
Interest expense	-42,0	-37,9
Other financial expenses	-10,3	-8,8
Exchange gains / (losses)	-8,3	-9,5
Financial expense, net	-59,0	-54,2
Other income / (expense)	-10,0	-2,3
Profit before income taxes	1406,4	1336,3
Income tax expense	-306,0	-336,8
Profit after taxes	1100,4	999,5
Share in profit of associates	12,8	3,0
PROFITS FOR THE YEAR	1113,2	1002,5
Attributable to owners of the parent	1113,1	1002,4
Attributable to non-controlling interests	0,1	0,1
Earnings per share basic and diluted	2,7	2,3
Items that will not be reclassified to profit or loss:		
Actuarial gains / (losses)	-18,9	3,4
Changes in fair value	1,7	0,6
Items that may be reclassified to profit or loss:		
Cash flow hedges	6,3	-29,3
Exchange differences on translation of foreign operations	20,2	58,9
OTHER COMPREHENSIVE INCOME / (EXPENSE) FOR THE YEAR	9,3	33,6
TOTAL COMPREHENSIVE INCOME FOR THE YEAR	1122,5	1036,1

FIGURE 4. Amadeus Income Statement 2018-2019

Source: Amadeus Annual Report, Own Elaboration, Excel.

5. Statistical Descriptive Analysis

5.1 Data Collection

The elaboration of this analysis uses the monthly closing prices of Amadeus stock (BME:AMA) obtained from April 2010 until December 2019. The reference index for the stock is the IBEX35.

In order to develop the CAPM for the analysis of Amadeus' stock the Fama-French European 3-Factors has been set as the risk-free variable. In addition to this, financial data from annual accounts and analyst reports have been used to support this analysis and offer a more detailed view of the company finance to explain changes in the price of the stock.

5.2 Descriptive Statistics

5.2.1 Stock Price Evolution

In first place, the Amadeus' stock price variation from their start in the IBEX35 in 2010 to 2019 will be analyzed. As observed in *Figure 5*, in April 2010, the stock price started at €9.90, increasing steadily until it reached a maximum of €78.03 at the point in September 2018 and finally it has managed to come up back to €71.76 at the end of 2019.

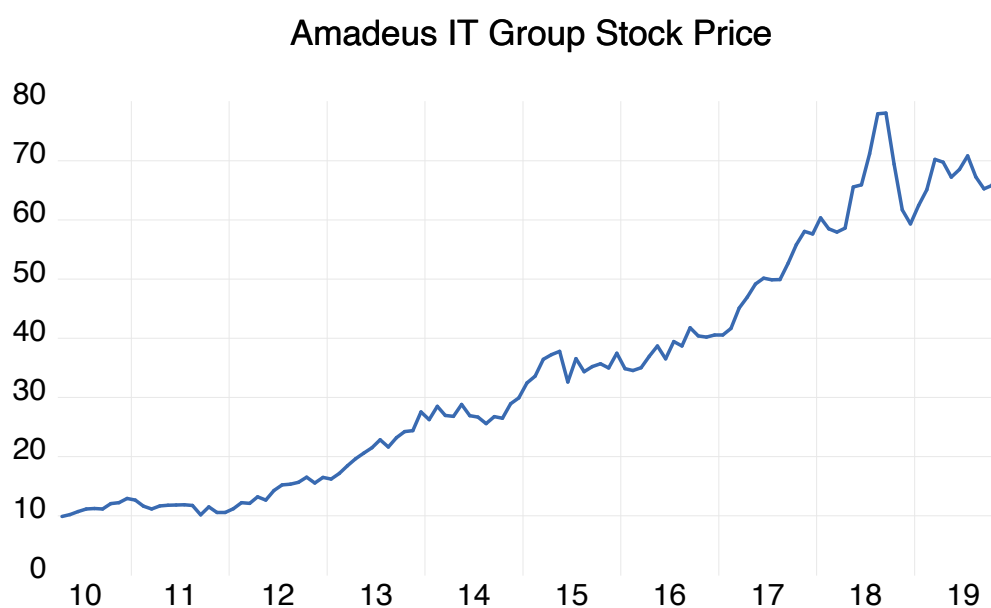


FIGURE 5. Amadeus Stock Price 2010-2019

Source: Bloomberg, Own Elaboration, E-Views.

To adequately analyze the stocks evolution, a comparison with market trends observed in the GDS sector will be performed. Below, in *Figure 6*, is the stock price evolution of the sectors main players Amadeus, Travelport and Sabre. TravelSky operating only in the People’s Republic of China and generally does not follow the same market trends as the others and is not considered a direct competitor.

Observing the line graph in *Figure 6*. Amadeus shows the most exponential growth since its beginning. This is due to the competitive advantage it has received in the market from being the pioneer of all global distribution systems. Sabre started listing in the NASDAQ stock market since April 2014. Travelport on the other hand is now privately owned and listed in the NYSE from September 2014 up until May 2019. TravelSky appears in the HKSTE and is listed as stock n° 0696. Since it operates in its own market and has its own regulation the general trends observed with TravelSky stock will give us a good view of global transport changes and the Asian market although is not considered a competitor for the other companies because its operations are limited to only make business within China.

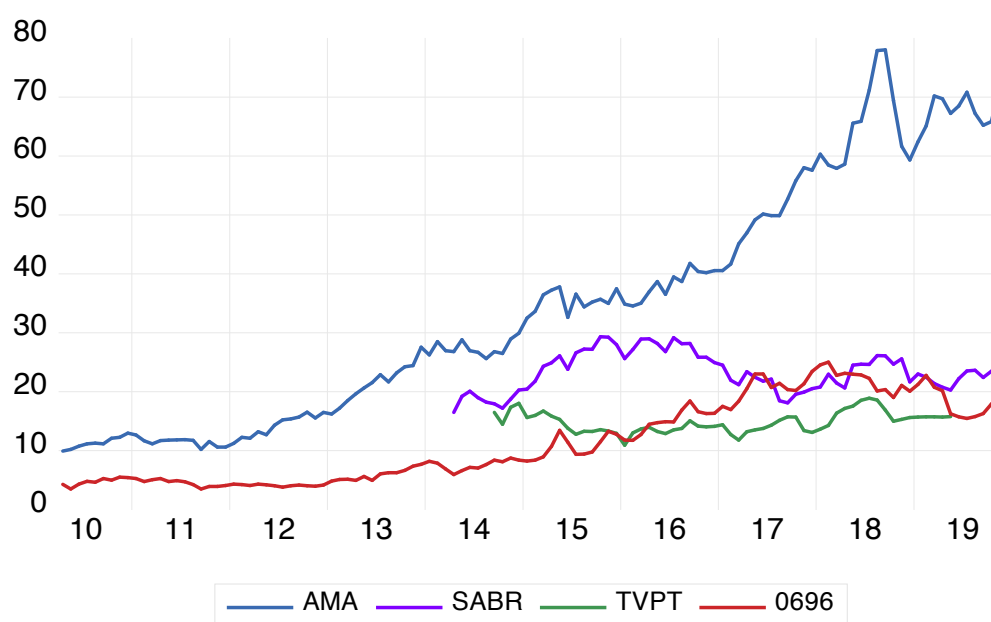


FIGURE 6. Amadeus, Sabre, Travelport and TravelSky Stock

Source: Bloomberg, Own Elaboration, E-Views.

It is a trend for early GDS companies to exit out of the market. Amadeus also had a short run in the IBEX35 from 1999 to 2005. It is frequent for companies in the GDS sector to participate in M&A, this means on occasion, they are bought out by other companies which prefer to operate the company as a private entity. It is the case for Travelport who was bought by Siris Capital Group and Evergreen Coast Capital; and Amadeus who as mentioned before, left the stock, due to a buyout by Cinven and BC Partners. Companies operating in the GDS sector are strengthened by the amount of data and variety of technological solutions they can offer. This means that very specialized technology companies often are acquired by the parent company. So being owned by big capital fund companies provide a source of capital for future investments in specialized technological companies. It is a strategic decision where the benefit of having strong funding from a parent company is bigger than being publicly funded through the sale of public shares.

In the line graph, there is a growth trend from 2014 to late 2016 present in both Amadeus and Sabre, but not Travelport. This period of growth continued for Amadeus while Sabre struggled to keep up. The main point where correlation between the companies is observed is in early 2018, where after an increase in stock price from all three companies, came a steep decline. 2018 was a critical year for the GDS sector. The International Airlines Holding (IAG) adopted a new airline ticket distribution system supported by the International Air Transport Association (IATA) and started to penalize tickets sold through Global Distribution Systems such as Amadeus, Sabre and Travelport. Individual airlines were trying to have customers buy tickets directly through their systems without the use of a GDS company. This made analysts consider these stocks as less attractive and damaged their value in the market. There was a fear that airlines would start to compete against GDS supported by IATA. There was an emphasis from investors in the need of de-regulating the GDS sector, and this was starting to affect the stock price negatively. The impact of airline regulatory fees had been overstated. This was later proven by JP Morgan², stating that the risk had been exaggerated and any disintermediation is unlikely to happen overnight. They specified investors should focus more on the merits of the GDS business such as visibility, predictability and strong cash generation as well as on the revenues.

² JP MORGAN ANALYST TEAM, REPORTUR (2018)

Furthermore, at this point in time Amadeus and Sabre were also being investigated by the European Commission in Brussels. They were investigating contracts between both companies to ensure they were not violating any anti-monopoly rules from the European Union. Both these reasons produced a steep decline in the stock price and affected the GDS market in general.

5.2.2 IBEX35 Comparison

As far as the relationship between the IBEX35 and Amadeus, in *Figure 7.* and *Figure 8.* there is not a strong correlation between both. Amadeus has followed an overall growth pattern since 2010. The most notable trend shared by both can be seen from 6/2013 to 9/2016. For this three-year period Amadeus and the IBEX35 seem to share the same growth pattern, although from 2016 onwards Amadeus continued growing above the IBEX35s performance and has done relatively better since 4/2018.

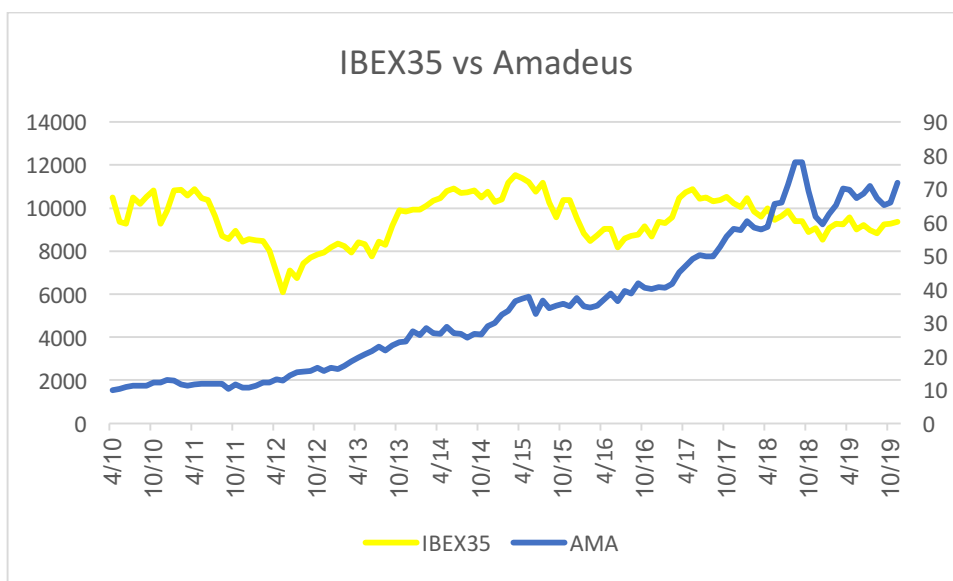


FIGURE 7. IBEX35 vs Evolution of Amadeus Stock

Source: Bloomberg, Own Elaboration, Excel.

Commenting on the monthly logarithmic variation as showcased in *Figure 8.* below, seen graphically, as a general norm both values do not follow the same trends. This suggests that Amadeus’ profitability is affected by exogenous variables that are not part of the factors that affect the variations in profitability the IBEX35 index.

Both IBEX35 and AMA stock seem to share a similar volatility in terms of significance, but not at the same places in time. Amadeus operates on a global scale while the IBEX35s volatility will represent trends according to national events in the country of Spain. Therefore, in terms of investment it would be wise to analyze factors affecting both Amadeus and the IBEX35 separately before deciding for one or the other. As Amadeus follows a growth trend observed clearly in *Figure 6*, and would be a solid option to invest in. The IBEX35 does not have such a steady predictability of results and does not follow an obvious growth pattern. This leads to the theory that the IBEX35 might be a more risky and volatile asset compared to Amadeus stock and will be further analyzed in the CAPM model from point 6 onwards.

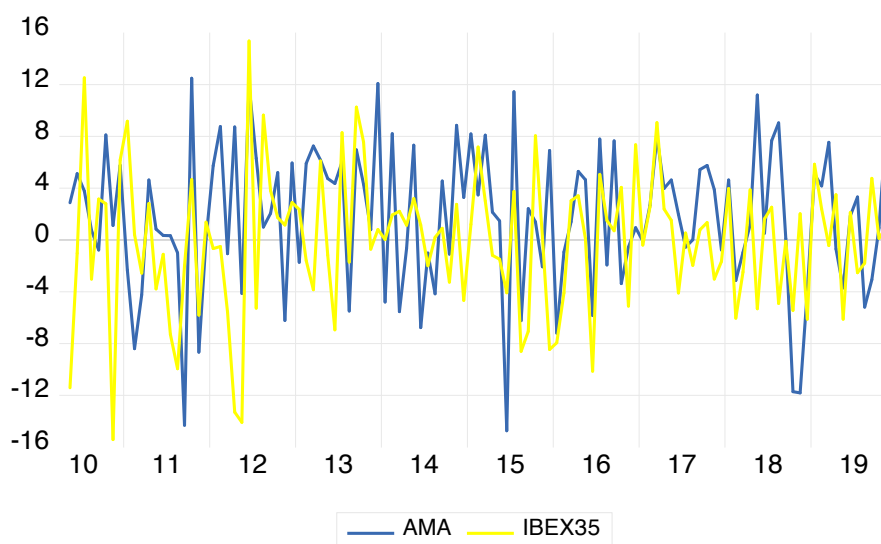


FIGURE 8. Variation Rate Between IBEX35 and Amadeus Stock

Source: Bloomberg, Own Elaboration, E-Views.

5.3 Histogram Analysis

In this section I will analyze two histograms showcasing the relative variation of the Amadeus stock (AMA) and the Spanish reference index, the IBEX35. By analyzing these two histograms the variation frequency of both values is observed. The aim is to test whether both these assets follow a normal distribution. It can also serve as a tool to confirm to what degree these assets are volatile and how many observations appear to deviate from the most frequent standard deviation.

The basic statistics and histograms represent the Premiums of both AMA and IBEX35. These premiums are calculated using the logarithmic profitability variation for both stocks, represented as RAMA and RIBEX and are calculated as follows:

- $RAMA = 100 * LOG\left(\frac{AMA}{AMA(-1)}\right)$
- $RIBEX35 = 100 * LOG\left(\frac{AMA}{AMA(-1)}\right)$

Once the variation rates have been obtained, the premiums are calculated by subtracting the monthly risk-free based on the Fama-French European 3-Factor, represented by FAMAM, in the following manner:

- $PAMA = RAMA - FAMAM$
- $PIBEX35 = RAMA - FAMAM$

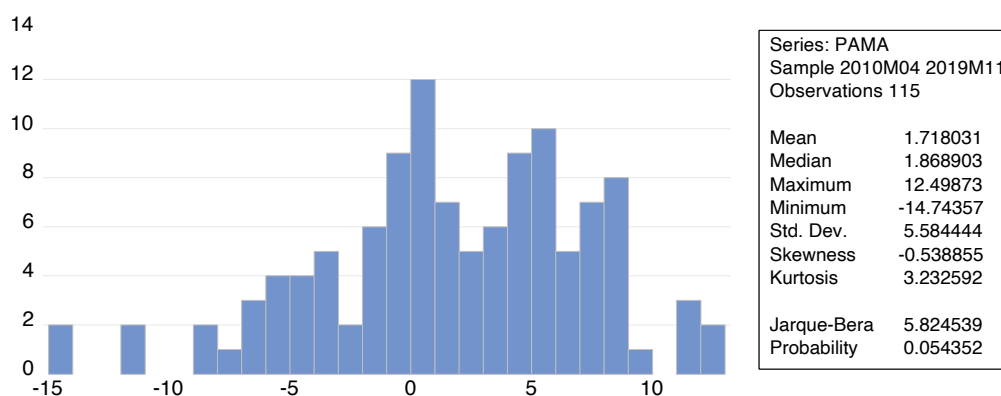


FIGURE 9. Histogram and Basic Statistics for Amadeus Premium

Source: Bloomberg, Own Elaboration, E-Views.

As observed from *Figure 9.*, Amadeus has a variation mean of 1.72 and a median of 1.86. There is a dispersion represented by the standard deviation of 5.58. This gives us a skewness of -0.53 representing a slightly longer left tail. The kurtosis measures the peakness or flatness of our Amadeus histogram, in this case it exceeds 3, meaning the distribution is peaked (leptokurtic) relative to the normal. Finally, the Jarque-Bera has a

probability of 5.44%, being over the 5% established significance we cannot reject the hypothesis of normal distribution. This fact does not strictly mean that the company does or does not follow normal distribution, although we can only effectively reject the H0 hypothesis of normal distribution with a p-value of 5.44%.

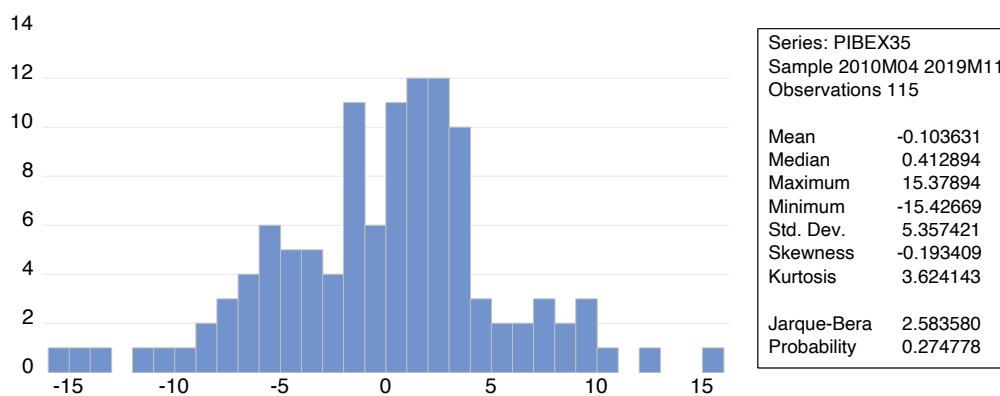


FIGURE 10. Histogram and Basic Statistics for IBEX35 Premium

Source: Bloomberg, Own Elaboration, E-Views.

For the PIBEX35, represented in *Figure 10.*, the mean is -0.10 and the median 0.41. in this case, there is a dispersion of 5.37, similar to the one shown in *Figure 9.* for PAMA. The skewness is -0.19 also representing a slightly longer left tail. The kurtosis also exceeds 3, meaning the distribution is peaked (leptokurtic) relative to the normal. Finally, the Jarque-Bera has a probability of 27.48%, again being over the 5% established significance we cannot reject the hypothesis of normal distribution. So PIBEX35 follows a normal distribution in the observed time range, 2010-2019 with a p-value 27.38%.

These observations confirm the points made in 5.2.2, in that the IBEX35 and Amadeus are both volatile but in a different manner. Having a similar standard deviation but showing differences in all the other values, sharing only the fact that they do not follow the normal distribution. The number of observations is higher for Amadeus in the right side while for the IBEX35 it is apparent by looking at the graph that there are more observations to the left, so the manner in which these deviations have occurred is different.

6. Capital Asset Pricing Model

6.1 General Model

The Capital Asset Pricing Model (CAPM) will be used to predict the rate of return of our asset, in this case, Amadeus stock. The model compares the relation between systematic risk and expected return.

The mathematic expression used for this model is the following:

$$R_a = R_f + \beta_a (R_m - R_f)$$

R_a : represents the expected rate of return for Amadeus stock (AMA).

R_f : represents the expected return for the risk-free asset, in this case the Fama-French European 3-Factor, *Figure a.* in the annex.

β_a : represents a measure of the stocks risk.

R_m : represents the expected return for the IBEX35 index.

$(R_m - R_f)$: gives us the market premium.

6.2 Econometric Approximation

To properly approximate the CAPM the Ordinary Least Squares (OLS) method will be used to estimate the unknown parameters of the linear regression model. For this econometric model, we adapt the mathematic equation to:

$$(R_a - R_f) = \alpha + \beta_a (R_m - R_f) + \varepsilon$$

$(R_a - R_f)$: dependent variable; represents the share premium of Amadeus Stock (AMA).

α : coefficient; used to measure AMAs profitability.

β_a : coefficient; used to measure variations in the profitability of the asset, AMA, when there are variations in the profitability for the IBEX35 index.

$(R_m - R_f)$: explanatory variable; represents the market premium for the IBEX35 index.

ε : residuals.

6.3 Ordinary Least Squares Estimation

Below in *Figure 11.*, is a regression of the CAPM using the Ordinary Least Squares (OLS), method given the outcome of R-Squared, the IBEX35 index can explain 8.58% of the variation in Amadeus stock. Graphically represented in *figure b.* in the annex. The model does not seem to suffer from serial correlation since the Durbin-Watson statistic is 2.2, it may not be conclusive only through this value, therefore it will be tested in depth in the following points.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 02/28/20 Time: 13:53
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.749676	0.500198	3.497964	0.0007
PIBEX35	0.305363	0.093756	3.256981	0.0015
R-squared	0.085819	Mean dependent var		1.718031
Adjusted R-squared	0.077729	S.D. dependent var		5.584444
S.E. of regression	5.363017	Akaike info criterion		6.214169
Sum squared resid	3250.101	Schwarz criterion		6.261907
Log likelihood	-355.3147	Hannan-Quinn criter.		6.233545
F-statistic	10.60793	Durbin-Watson stat		2.206941
Prob(F-statistic)	0.001487			

FIGURE 11. CAPM Estimation by OLS

Source: Bloomberg and Fama-French, Own Elaboration, E-Views.

The Beta coefficient obtained has a value between 0 and 1, this means that it does not move completely opposite to the market (<0) neither does it move at the same rate as the IBEX35 ($=1$). The value is significant given the probability is near 0 and under the 5% significance limit.

To explain variations in Amadeus stock, again from the data in *Figure 11.*, for each 100 Basis Points (BPS) that the IBEX35 Premium (PIBEX) increases, it is expected that the Amadeus Premium (PAMA) will increase by 30 basic points, since the value of beta is 0.30, lower than 1, the conclusion is that the variation of Amadeus' Premium is less risky, therefore less volatile, than the Spanish market. This confirms once again the expected outcome after observing the graphs commented in section 5.2.2.

As far as the constant term is concerned, it is very relevant with a p-value of 0,07%. The premium of Amadeus stock is affected by exogenous variables with an overall positive impact of 1,75%. This may be due good management decisions from the board of directors, a good adaptation policy to new market trends and an ability to maintain and predict future positive revenue streams.

6.2.1 Residual Analysis

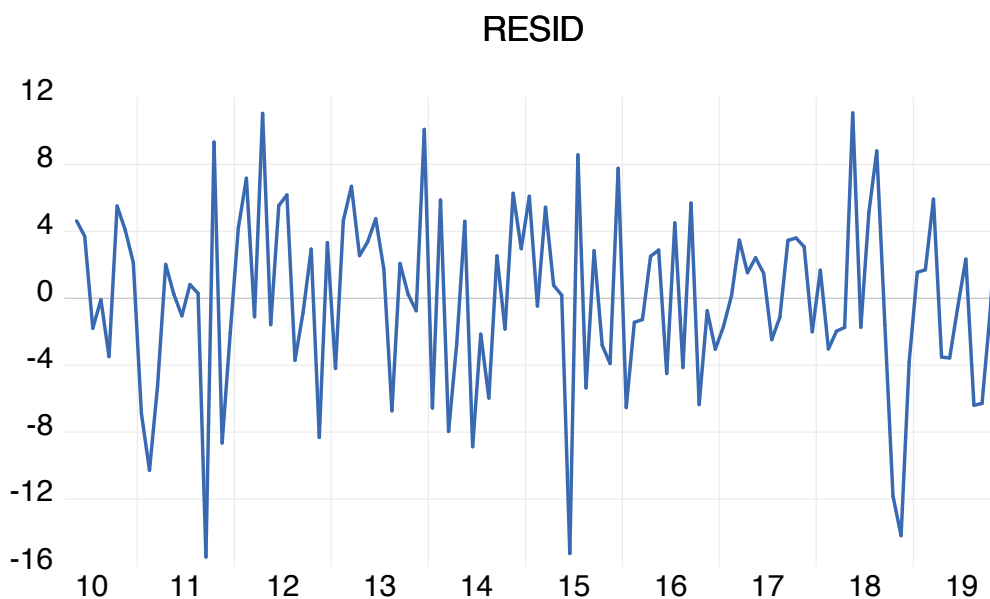


FIGURE 12. Residual Analysis
 Source: Own Elaboration, E-Views.

As Figure 12 shows There are no noticeable events that seem to affect the residuals in a particular way. They move randomly across the 0 line with a variation ranging in the +/- 12% with exceptions that will be considered and analyzed further along the line, in point 7.

6.2.2 Hypothesis Testing

To ensure the validity any contrast testing, any disturbances in the CAPM must be white-noise.

$$\varepsilon_t = i. i. d. N(0, \sigma_\varepsilon^2)$$

Therefore, the following hypothesis must be fulfilled:

- **Hypothesis 1:** All disturbances in the model must have a mean equal to zero.

$$E\varepsilon_t = 0 \text{ for } \forall t$$

In this regression model with constant term C , residuals have a mean equal to zero by default.

- **Hypothesis 2:** All disturbances for the model must have an equal variance.

$$(\varepsilon_t) = \sigma_t^2 \text{ for } \forall t$$

The White Test is used to confirm if our model presents a heteroscedasticity problem. In which the null hypothesis is that all the disturbances have the same variance and the alternative hypothesis is that the variances are different, so there would be a problem of heteroscedasticity.

H0: Residuals have the same variance.

H1: Residuals differ in variance.

As observed from the graph in *Figure c.*, in the Annex, the F-Statistic value for the contrast is 1.206659 with a p-value of 0.3031 above 0.05, so we cannot reject the null hypothesis *H0*.

- **Hypothesis 3:** Disturbances must be independent.

$$cov(\varepsilon_t, \varepsilon_s) = 0 \text{ for } \forall t$$

In first place, the Durbin-Watson (DW) test will be used. The limitation of this statistic is that it only serves to detect the presence of an auto-regressive model of order one (AR1) in the disturbances.

$H0$: no serial correlation exists. ($\rho = 0$)

$H1$: serial correlation exists. ($\rho \neq 0$)

In the first CAPM model estimation shown in *Figure 11*, the DW is 2.206941 is close to 2 suggesting we cannot reject the null hypothesis $H0$ of no serial correlation, although not concluding, AR1 serial correlation may not exist in the model. Since the model is based on monthly periodical data an auto-regressive model of a higher order can be followed to further test this point.

The Breush-Godfrey (BG), which has the same null hypothesis $H0$ mentioned before, but includes an alternative hypothesis $H1$ that allows for an auto-regressive model of any order (ARp). This model also establishes the dependence of ε with all past disturbances.

The BG for the last two months, as shown below in *Figure 13.*, and *Figure d.* in the annex, has a p-value of 0.1872, far from the 5% level of significance. This again leads to not rejecting the null hypothesis, to be sure the BG for twelve months will also be tested.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.665692	Prob. F(2,111)	0.1938
Obs*R-squared	3.350867	Prob. Chi-Square(2)	0.1872

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/28/20 Time: 14:01
Sample: 2010M05 2019M11
Included observations: 115
Presample missing value lagged residuals set to zero.

FIGURE 13. Breusch-Godfrey 2 Month Serial Correlation test
Source: Own Elaboration, E-Views.

As shown if *Figure 14.*, and *Figure e.* In the annex, the twelve month BG test also proves that there is no serial correlation is present in the model with a statistic value of 8.804125 and a p-value of 0.7196 even further from the 5% level of significance.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 12 lags

F-statistic	0.697780	Prob. F(12,101)	0.7502
Obs*R-squared	8.804125	Prob. Chi-Square(12)	0.7196

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/28/20 Time: 14:02
Sample: 2010M05 2019M11
Included observations: 115
Presample missing value lagged residuals set to zero.

FIGURE 14. Breusch-Godfrey 12 Month Serial Correlation test

Source: Own Elaboration, E-Views.

- **Hypothesis 4:** Disturbances must follow a normal distribution. To test this hypothesis the Jarque-Bera for the CAPMs residuals will be performed. The following hypothesis can be tested:

H0: residuals follow a normal distribution

H1: residuals do not follow a normal distribution.

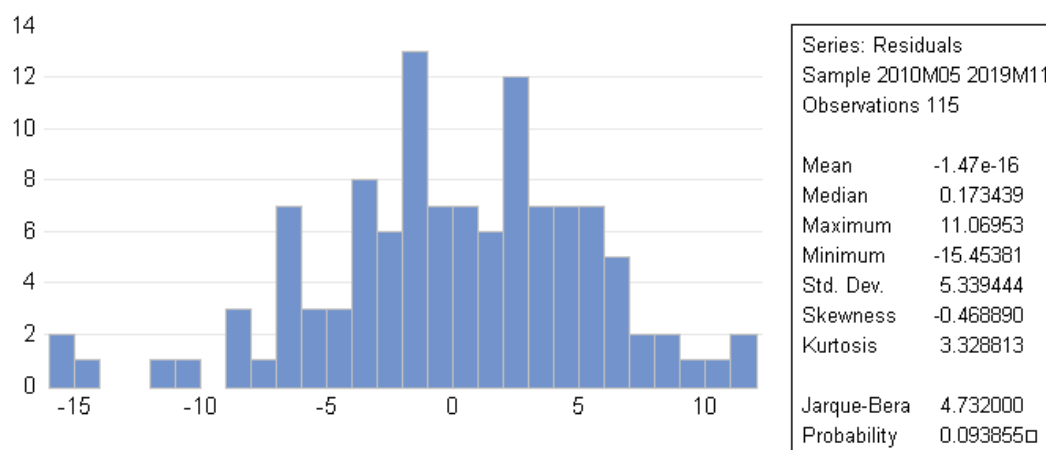


FIGURE 15. Histogram and Basic Statistics for CAPM

Source: Own Elaboration, E-Views.

With the results given by *Figure 15.*, we cannot reject the null hypothesis H_0 and confirm that the disturbances for the CAPM follows a normal distribution given that the p-value for the Jarque-Bera test is 0.093855 and is above the established 5% significance.

6.3 Method Conclusion

To assess if the CAPM disturbances are white-noise results of the previous hypothesis testing will be gathered and summarized. Given the results of Hypothesis 1, 2, 3 and 4, The following conclusions can be made:

- The mean of disturbances in the model is equal to zero.
- The White Test has proved there is no heteroscedasticity problems in the model.
- Durbin-Watson suggests there may be AR1 serial correlation, while both the two and twelve month Breusch-Godfrey tests have proven no serial correlation exists in the model. These tests confirm no serial correlation in auto-regressive models of order two (AR2) and twelve (AR12).
- The model follows a normal distribution.

Therefore, being white noise, we can ensure validity of any further hypothesis testing. The problem with an OLS estimation method when faced with a problem of heteroscedasticity or autocorrelation is that the matrix of variances and covariance's of the estimators will be poorly estimated. Therefore, the standard deviations, t-statistics for the contrast of individual significance and the corresponding p-values of the CAPM would be incorrect and invalidate all contrasting hypotheses.

7. Newey-West Estimation

7.1 Method Overview

To address the issues raised in the hypothesis tests of the OLS method a new estimation will be performed using Newey-West (NW) estimation method.

The NW method allows to consistently estimate the variance and covariance matrix of OLS estimators in the presence of heteroscedasticity or autocorrelation problems, so the Wald's statistician and the conventional t-statics will be suitable instruments for statistical inference.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 03/21/20 Time: 18:44
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.749676	0.456513	3.832701	0.0002
PIBEX35	0.305363	0.081242	3.758676	0.0003

R-squared	0.085819	Mean dependent var	1.718031
Adjusted R-squared	0.077729	S.D. dependent var	5.584444
S.E. of regression	5.363017	Akaike info criterion	6.214169
Sum squared resid	3250.101	Schwarz criterion	6.261907
Log likelihood	-355.3147	Hannan-Quinn criter.	6.233545
F-statistic	10.60793	Durbin-Watson stat	2.206941
Prob(F-statistic)	0.001487	Wald F-statistic	14.12765
Prob(Wald F-statistic)	0.000272		

FIGURE 16. CAPM Estimation by NW

Source: Bloomberg and Fama-French, Own Elaboration, E-Views.

7.2 Hypothesis Testing

The hypothesis tests performed in point 6.2.2 will be re-assessed using the NW method of estimation. Comparing the NW estimation results in *Figure 16.* with the OLS estimation results in *Figure 11.* the estimation of the coefficients are the same, although standard deviations, t-statistics and p-values have slightly varied as they are now consistently estimated.

By observing this Newey-West Estimation we confirm the OLS hypothesis testing. This implies that in the studied period the premium for Amadeus stock is mainly affected by exogenous variables different to the IBEX35s with approximately 0% significance and that the premium of Amadeus, to some extent, can reflect changes in the premium of the IBEX35 index.

7.3 Method Conclusion

From the data analyzed from the NW estimation method the main conclusions confirmed are the following:

- Amadeus' premium (PAMA) is affected by exogenous variables which are different from the ones that cause variation in the IBEX35 and its respective premium (PIBEX35).
- Amadeus stock reflects changes in the IBEX35 to a certain degree, increasing by 30 basic points for every 100 basic points added to the market.
- The risk for both assets is not the same, in fact Amadeus stock premium is less risky than the IBEX35s premium.

These conclusions justify the fact that Amadeus operates in a global market and its performance in terms of sales and revenues is not exclusively dependent on the Spanish market, which is represented in the IBEX35 index. If the Spanish airline or hospitality market suffer one year, Amadeus may compensate with good figures in other markets on an international scale.

8. Dummy Variable Analysis

8.1 Dummy Selection

In order to allow an easier interpretation of our regression dummy variables will be included and analyzed that represent specific events in Amadeus' stock variation. These dummies have cause a variation on standardized residuals value that exceeds the standard ± 3 standard deviations.

These outliers detected in the standardized residual graph in Figure 17., are located in three points in time. These are in September 2011, June 2015 and November 2018. The first can be associated with a downfall in the IBEX35. For the last two, there is an exogenous factor that explains the motive behind the variation and will be regarded as dummy variables for the model.

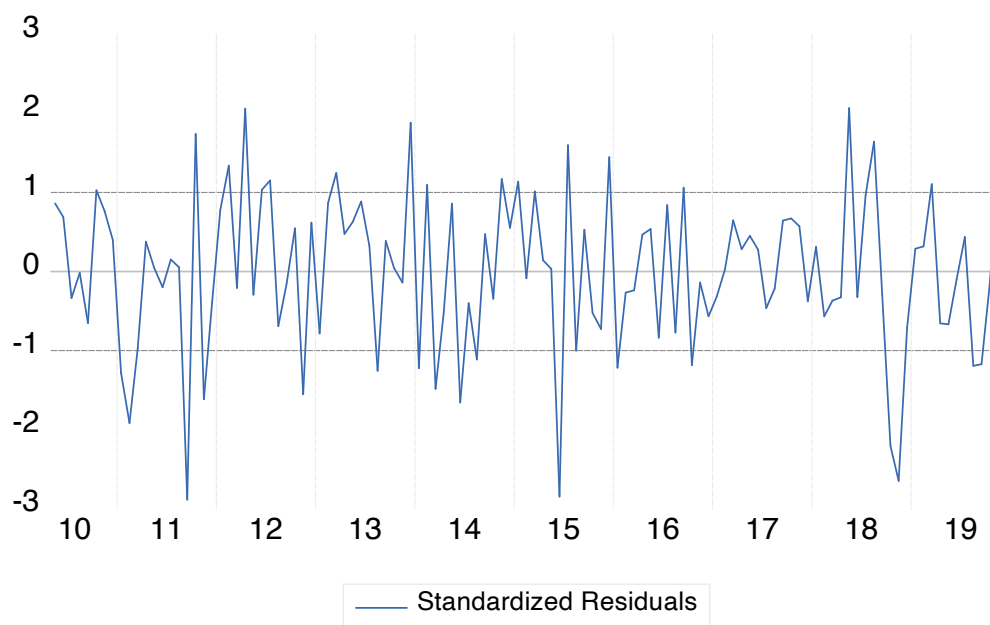


FIGURE 17. *Standardized Residuals Graph*

Source: Own Elaboration, E-Views.

Dummy June 2015

The first dummy in order of appearance has been selected for June 2015. As seen in the standardized residuals graph, *Figure 17.*, this specific date caused a notable drop in the company's usual logarithmic variation rate.

In this period of time Lufthansa Group had introduced a surcharge on airplane tickets for any travel agency selling tickets through a GDS system. The Lufthansa group formed by Lufthansa, Austrian Airlines, Brussels Airlines and Swiss Airlines included a surcharge amounting to €16 per ticket. The aim was to eliminate GDS intermediaries and have travel agencies make business directly with Lufthansa. The Commission Nacional del Mercado de Valores (CMNV) said this would not create a significant impact in the economy of GDS companies.

Investors seemed to worry that other Airlines would follow the steps of Lufthansa and this caused a major drop in Amadeus stock. In this specific point in time Air-France publicly announced it was also considering to implement a similar surcharge for tickets sold through a GDS.

Dummy November 2018

The second and last dummy included to the model has been selected for November 2018. Again, as seen in *Figure 8.* and on the standardized residuals graph, this point also caused a drop which can be justified by a specific event in Amadeus' history.

In November 2018, big values such as Aena and Inditex had dropped on the IBEX35. Amadeus is one of these big values in the index and dropped too. In the case of Amadeus investors were concerned by the company's dependency on aerial traffic, which at the time was 80%. Investors trusted on how the company's management but did not trust on the dependency of their results. Recommendations to buy Amadeus stock went down to 40%, this is extremely unusual for Amadeus. The slump in the Eurozone was causing uncertainty in the banking sector and this accounted in irregularities in some sectors and markets affecting many European countries. Furthermore, recent events in Spanish politics, such as the ongoing issue with Catalanian independence, augmented this drop in the IBEX35.

8.2 Model Including Dummy Variables

Once the dummy variables have been identified and explained, they can be inserted into the CAPM model previously formulated. As observed in *Figure 18.* seen on the next page, the coefficient has now been slightly reduced, now only 29.58% of Amadeus premium variation can be explained by the IBEX35.

From *Figure 18.*, both dummies have caused a drop of Amadeus premium with a significance of 0%. The variations have been drops in the premium price of the stock since both coefficients are negative. The drop in June 2015 in percentage terms, has been of 15,5% more notable in terms of variation than the one that occurred in November 2018 that has been of 14,4%. Both events showcase how the company is sensitive to airlines that are trying to compete with GDS systems and how it is affected by investor allegations on their airline dependency.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 03/27/20 Time: 19:12
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
 bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.009280	0.431452	4.657019	0.0000
IBEX35	0.295887	0.077614	3.812284	0.0002
D2015M06	-15.54664	0.592178	-26.25333	0.0000
D2018M11	-14.42078	0.422959	-34.09495	0.0000
R-squared	0.210018	Mean dependent var		1.718031
Adjusted R-squared	0.188668	S.D. dependent var		5.584444
S.E. of regression	5.030132	Akaike info criterion		6.102933
Sum squared resid	2808.547	Schwarz criterion		6.198409
Log likelihood	-346.9186	Hannan-Quinn criter.		6.141686
F-statistic	9.836537	Durbin-Watson stat		2.312704
Prob(F-statistic)	0.000008			

FIGURE 18. CAPM with Dummy Variables

Source: Own Elaboration, E-Views.

With these two dummy variables, two of the most notable variation of Amadeus’ stock premium have been associated with known factors. This has effectively reduced the dependency of Amadeus variation on the IBEX35 as mentioned before and relates the variations to identifiable exogenous variables such is the case with Lufthansa and Air-France in 2015, and the Eurozone banking slump in 2018.

9. Explanatory Macroeconomic Variables

To expand on the dummy variable analysis exogenous macroeconomic variables and competitors’ premium variation can be tested for significance on whether they affect Amadeus’ stock premium or not and to what degree.

The following variables will be tested:

- Spanish Air Passenger Traffic: $PsATP = 100 * LOG (sATP/sATP (-1))$
- Sabre Premium: $PSABRE = RSABRE - FAMAM$
- Travelport Premium: $PTVPT = RTVPT - FAMAM$
- TravelSky Premium: $PHSKE:0696 = RHSKE:0696 - FAMAM$

In first place, exogenous macroeconomic variables have been tested, such as the Spanish Air Passenger Traffic from 2010 to 2019. As you can in *Figure e.* annex, this variable has not resulted relevant in the model with a probability of 0.2974 well over the established significance of 5% and 10%. The same has occurred with other Spanish market data such as the Spanish Plane Traffic, with 0.2350, in *Figure g.*; and the Spanish GDP for Hospitality and Tourism, with 0.3272 in *Figure h.*

This confirms that Amadeus' Premium variation is mainly due to exogenous factors not related to the IBEX35 or the Spanish market. Since Amadeus operated on a global scale a bad year in the Spanish market may be compensated with tourism or air-traffic spikes in other countries of the world. Making these Spanish macroeconomic variables irrelevant in the variation of stock price and Amadeus' general results.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 04/23/20 Time: 14:45
 Sample (adjusted): 2014M05 2019M11
 Included observations: 67 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.823471	0.465661	3.915876	0.0002
PIBEX35	0.358645	0.124982	2.869571	0.0056
D2015M06	-12.66300	0.926855	-13.66232	0.0000
D2018M11	-15.33239	0.552273	-27.76234	0.0000
PSABRE	0.265820	0.080477	3.303077	0.0016

R-squared	0.441429	Mean dependent var	1.464571
Adjusted R-squared	0.405392	S.D. dependent var	5.479704
S.E. of regression	4.225445	Akaike info criterion	5.791822
Sum squared resid	1106.972	Schwarz criterion	5.956351
Log likelihood	-189.0260	Hannan-Quinn criter.	5.856926
F-statistic	12.24938	Durbin-Watson stat	2.197998
Prob(F-statistic)	0.000000		

FIGURE 19. CAPM with Dummy Variables and Sabre Premium

Source: Own Elaboration, E-Views.

In regards to competitors, as seen in *Figure 19.* Sabre has shown to be a relevant variable in the model, a significant p-value close to zero. While Travelport and TravelSky have resulted irrelevant with values of 0.4251 and 0.3549, seen in *Figure i.* and *Figure j.* in the annex.

This is because Sabre is the only competitor which competes in CRS Distribution, IT Solutions and Hospitality IT with Amadeus. Travelport only competes in Distribution and in the case of TravelSky, being exclusive to the Chinese market was expected to not result in any relevancy to the model. Although Distribution is the main weight of GDS companies having IT Solutions and competing in Hospitality makes Sabre the most relevant competitor for Amadeus in the GDS market.

10. Fama-French Three Factor Model

10.1 Exposure to SMB and HML

The Fama-French three factor model accounts for more than 90% of diversified portfolio returns compared to an average of 70% explained by the CAPM. Therefore, in addition to the CAPM, we can add the remaining two factors of the Fama-French model, aside from the risk free, which are the following:

- Small Minus Big (SMB): or size effect, size referring to the amount of market capitalization by the company. It is the excess in returns of small sized companies in comparison to large sized companies.
- High Minus Low (HML): or value premium, which is the outperformance of value stocks. It measures spread in returns between companies with high book-to-market ratios (value stocks) and companies with low book-to-market ratios (growth stocks).

As an extension to the CAPM the Fama-French model gives us the following mathematic expression:

$$Ra = Rf + \beta_a (Rm - Rf) + \beta_s SMB + \beta_v HML$$

- β_s : this coefficient is determined by the linear regression that can take positive and negative values and represents the size effect.
- β_v : this coefficient is determined by the linear regression that can take positive and negative values and represents the value effect

Both factors serve as an extension to the CAPM and added to our initial model result in the following interpretation:

$$(Ra - Rf) = \alpha + \beta_a (Rm - Rf) + \beta_s SMB + \beta_v HML + \varepsilon$$

10.2 New Model Conclusions

As seen in *Figure 20*, the inclusion of the last two factors in the Fama-French model have caused a variation in the initial result. The main difference is that having included these factors the IBEX35 seems to explain Amadeus' stock variation to a higher degree, this time 59.63 basic points of variation in the premium of Amadeus for every 100 basic points in the IBEX35. Although the asset analyzed is still less risky, more of it can be explained by market variations when we account for SMB and HML.

In regards to the dummy variables on June 2015 and November 2018, they still are significant negative drops in the stock premium with a significance of p-value of zero.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 03/27/20 Time: 19:13
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.739187	0.423166	4.109936	0.0001
IBEX35	0.596363	0.086151	6.922320	0.0000
D2015M06	-14.97962	0.685236	-21.86052	0.0000
D2018M11	-14.70873	0.633549	-23.21638	0.0000
HML	-0.992422	0.195727	-5.070444	0.0000
SMB	0.523268	0.294961	1.774024	0.0789

R-squared	0.319275	Mean dependent var	1.718031
Adjusted R-squared	0.288049	S.D. dependent var	5.584444
S.E. of regression	4.711995	Akaike info criterion	5.988864
Sum squared resid	2420.116	Schwarz criterion	6.132077
Log likelihood	-338.3597	Hannan-Quinn criter.	6.046993
F-statistic	10.22470	Durbin-Watson stat	2.328996
Prob(F-statistic)	0.000000		

FIGURE 20. CAPM with SMB, HML and Dummy Variables

Source: Own Elaboration, E-Views.

Now we can re-interpret the results accounting for both the size effect (SMB) and the value effect (HML).

- Size effect (SMB): as seen in *Figure 20*, the SMB has a coefficient of 0.523268 with a p-value of 7.89% over the 5% level of significance so we cannot reject the null hypothesis stating that the SMB has no significant effect over Amadeus premium.
- Value effect (HML): as seen in *Figure 20*, the HML has a coefficient of -0.992422 with a p-value of zero. This means we can reject the null hypothesis and therefore we can conclude that the HML has a significant effect over Amadeus premium variations.

Concretely, the value effect has a negative impact on Amadeus. This means that Amadeus is likely not buying only value stocks, rather it is diversifying in other areas not necessarily with a high book-to-market ratio.

This leads to the conclusion that Amadeus' investment portfolio is composed of a variety of stocks which include growth stocks. This is a reasonable conclusion since the Amadeus IT Group invests in many technological companies. These companies often come up with a technological breakthrough or a new way to improve a data system and are initially considered growth stock. Amadeus network of companies rely on new software, technologies and upgrades to their existing GDS. This way they can keep up-to-date with new information systems and databases and effectively gaining a competitive advantage in the GDS market.

11. Structural Changes

This section will be dedicated to search and analyze any dramatic shift in the way Amadeus operates that may have been an influence on the evolution of their stock premium and general performance on the IBEX35.

To do this a Cumulative Sum Control chart (CUSUM) will be analyzed based on the CAPM data, including the selected dummy variables. The CUSUM is a statistical quality

control test that allows the monitoring and detection of drastic changes in data evolution based on the established criterion that describes the data, in this case a structural change.

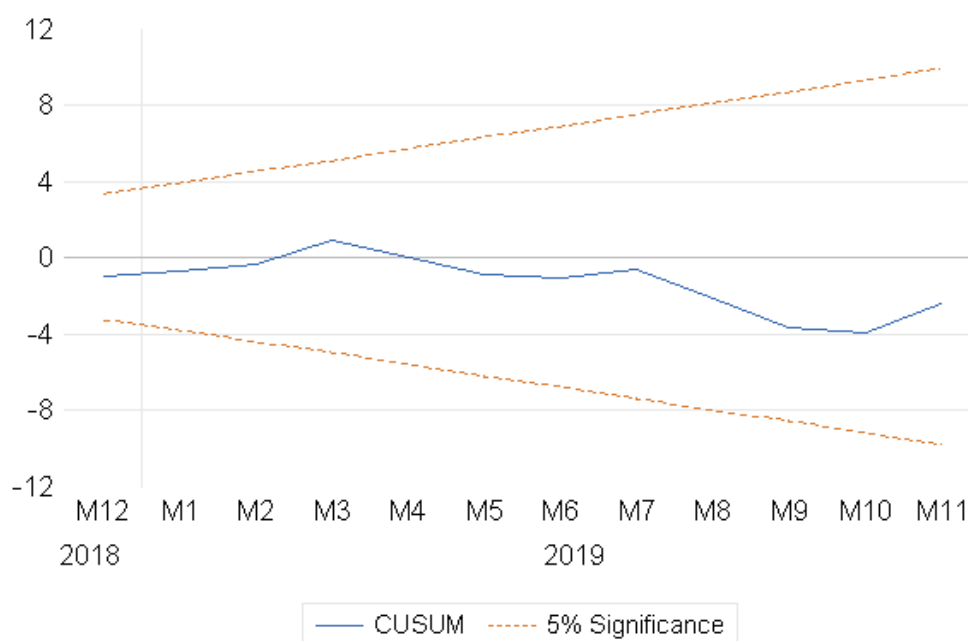


FIGURE 21. CUSUM Graph

Source: Own Elaboration, E-Views.

As seen in Figure 21. there is no moment in Amadeus history where the CUSUM line crosses the threshold of the 5% significance established in our model. Given that the recursive estimate is within the confidence lines, this confirms that there have been no structural changes in Amadeus notable enough to drastically change the progression or the way the company operates.

12. Conclusion

Amadeus IT Group S.A. has demonstrated through its results and stock price evolution to be a key asset in the IBEX35. The solid positive evolution of the company and non-existing structural changes demonstrate that the company has been managed well and wise financial decisions have been made from the board of directors in terms of M&A transactions and operation diversification. From establishing themselves as the leader of the airline GDS sector to widening their reach in the Hospitality sector Amadeus has followed a path of coherent business decisions which have led to a strong position in the Spanish stock market.

With this stability in structure and operation management, through the data analyzed both descriptively and through econometric methodology, Amadeus has shown to be less risky than its host-index the IBEX35. Being less volatile and more predictable, Amadeus stock (AMA) is a solid long-term investment when no unexpected situations occur in the market, that is, in times of stability.

Amadeus has a degree of dependency on exogenous global factors, external to the IBEX35, which are the most notable reason for any variations. The stock premium has shown particular sensibility to airlines trying to compete with GDS companies, as was the case with Lufthansa and Air France assigning extra fees to customers using these CRS systems, such as the Altéa pack offered by Amadeus.

The global GDS market has operated in fairly stable circumstances that have allowed for Amadeus to grow and thrive on the IBEX35. The main challenges it will face in the future will be regarding competition with airlines trying to profit from direct sales and take CRS systems out of the picture. Although the benefits companies like Amadeus bring to the table in terms of data collection and centralization are far superior to those offered by individual airlines, it is still a matter to consider and study before deciding to invest. The same goes for global and local market trends, essential to analyze for any investment in an IBEX35 listed asset.

On a last note, regarding the impact of global air traffic and un-expected market events being the main drive of Amadeus stock variation, the 2020 COVID-19 outbreak caused the value of Amadeus stock (AMA) on the IBEX35 to half. This is unprecedented given the data analyzed and the historical evolution of the company and serves to prove that what really poses a challenge for investors when considering to invest in Amadeus is the predictability of events, unexpected or not, which may affect airline traffic.

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14. Annex

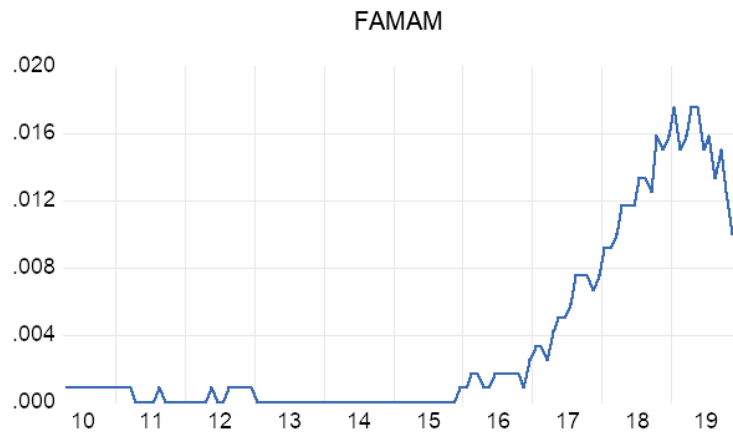


FIGURE a. Fama French Risk-Free Rate evolution
 Source: Own Elaboration, E-Views.

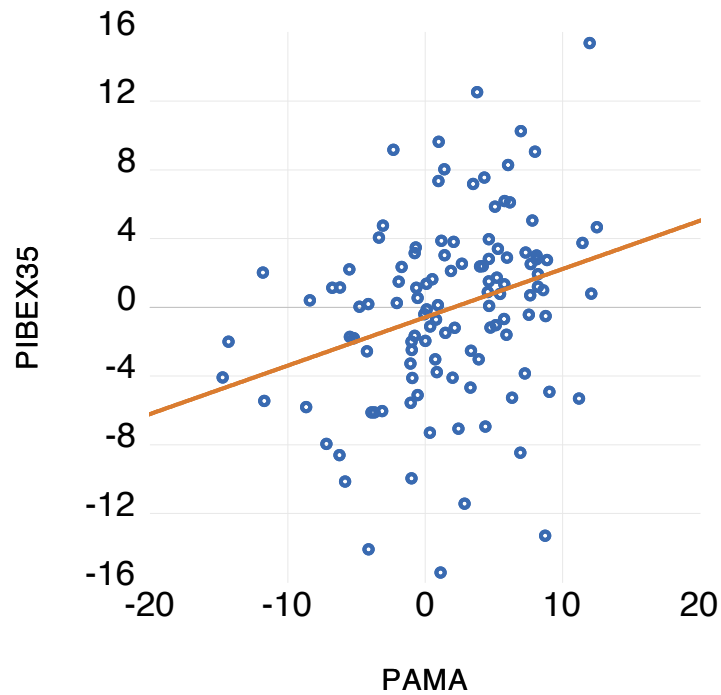


FIGURE b. OLS Estimate Graph
 Source: Own Elaboration, E-Views

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	1.206659	Prob. F(2,112)	0.3031
Obs*R-squared	2.425694	Prob. Chi-Square(2)	0.2973
Scaled explained SS	2.727105	Prob. Chi-Square(2)	0.2558

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/28/20 Time: 13:59
Sample: 2010M05 2019M11
Included observations: 115

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	29.29315	4.743083	6.175973	0.0000
PIBEX35^2	-0.040503	0.088112	-0.459681	0.6466
PIBEX35	-1.171885	0.763749	-1.534384	0.1278

R-squared	0.021093	Mean dependent var	28.26175
Adjusted R-squared	0.003613	S.D. dependent var	43.31745
S.E. of regression	43.23913	Akaike info criterion	10.39711
Sum squared resid	209397.7	Schwarz criterion	10.46872
Log likelihood	-594.8338	Hannan-Quinn criter.	10.42617
F-statistic	1.206659	Durbin-Watson stat	1.762327
Prob(F-statistic)	0.303054		

FIGURE c. White Test and Auxiliary Model for Squared Residuals

Source: Own Elaboration, E-Views.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.665692	Prob. F(2,111)	0.1938
Obs*R-squared	3.350867	Prob. Chi-Square(2)	0.1872

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/28/20 Time: 14:01
Sample: 2010M05 2019M11
Included observations: 115
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002153	0.497342	-0.004328	0.9966
PIBEX35	-0.024965	0.094296	-0.264756	0.7917
RESID(-1)	-0.103617	0.095461	-1.085438	0.2801
RESID(-2)	0.128165	0.095057	1.348295	0.1803

R-squared	0.029138	Mean dependent var	-1.47E-16
Adjusted R-squared	0.002898	S.D. dependent var	5.339444
S.E. of regression	5.331700	Akaike info criterion	6.219381
Sum squared resid	3155.400	Schwarz criterion	6.314856
Log likelihood	-353.6144	Hannan-Quinn criter.	6.258134
F-statistic	1.110461	Durbin-Watson stat	1.953788
Prob(F-statistic)	0.348051		

FIGURE d. Breusch-Godfrey 2 Month Serial Correlation with Test Equation

Source: Own Elaboration, E-Views.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 12 lags

F-statistic	0.697780	Prob. F(12,101)	0.7502
Obs*R-squared	8.804125	Prob. Chi-Square(12)	0.7196

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 02/28/20 Time: 14:02
Sample: 2010M05 2019M11
Included observations: 115
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010810	0.509062	0.021235	0.9831
PIBEX35	-0.010480	0.101595	-0.103160	0.9180
RESID(-1)	-0.118643	0.100458	-1.181026	0.2404
RESID(-2)	0.120158	0.101377	1.185262	0.2387
RESID(-3)	-0.104992	0.103058	-1.018767	0.3107
RESID(-4)	-0.167021	0.104358	-1.600455	0.1126
RESID(-5)	-0.078194	0.105920	-0.738239	0.4621
RESID(-6)	-0.051587	0.107000	-0.482124	0.6308
RESID(-7)	-0.050677	0.108680	-0.466299	0.6420
RESID(-8)	0.034166	0.108656	0.314443	0.7538
RESID(-9)	0.015614	0.106506	0.146599	0.8837
RESID(-10)	-0.006217	0.105735	-0.058796	0.9532
RESID(-11)	-0.017730	0.104795	-0.169183	0.8660
RESID(-12)	0.059523	0.104015	0.572255	0.5684

R-squared	0.076558	Mean dependent var	-1.47E-16
Adjusted R-squared	-0.042301	S.D. dependent var	5.339444
S.E. of regression	5.451207	Akaike info criterion	6.343218
Sum squared resid	3001.281	Schwarz criterion	6.677383
Log likelihood	-350.7350	Hannan-Quinn criter.	6.478854
F-statistic	0.644105	Durbin-Watson stat	1.939518
Prob(F-statistic)	0.811385		

FIGURE e. Breusch-Godfrey 12 Month Serial Correlation with Test Equation

Source: Own Elaboration, E-Views

Dependent Variable: PAMA
Method: Least Squares
Date: 04/23/20 Time: 15:10
Sample (adjusted): 2010M05 2019M11
Included observations: 115 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.989174	0.423364	4.698496	0.0000
PIBEX35	0.291402	0.077010	3.783964	0.0003
D2015M06	-15.77870	0.623238	-25.31728	0.0000
D2018M11	-13.12714	1.241056	-10.57739	0.0000
RPASSENGERS	0.031135	0.029738	1.046980	0.2974

R-squared	0.218896	Mean dependent var	1.718031
Adjusted R-squared	0.190492	S.D. dependent var	5.584444
S.E. of regression	5.024472	Akaike info criterion	6.109023
Sum squared resid	2776.985	Schwarz criterion	6.228368
Log likelihood	-346.2688	Hannan-Quinn criter.	6.157464
F-statistic	7.706581	Durbin-Watson stat	2.309311
Prob(F-statistic)	0.000016		

FIGURE f. CAPM with Dummy Variables and Passenger Traffic

Source: Own Elaboration, E-Views.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 04/23/20 Time: 15:32
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
 bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.991661	0.424384	4.693065	0.0000
PIBEX35	0.290652	0.076722	3.788376	0.0002
D2015M06	-15.75094	0.601251	-26.19696	0.0000
D2018M11	-12.95767	1.259077	-10.29141	0.0000
RPLANES	0.041263	0.034551	1.194244	0.2350
R-squared	0.220936	Mean dependent var		1.718031
Adjusted R-squared	0.192606	S.D. dependent var		5.584444
S.E. of regression	5.017907	Akaike info criterion		6.106408
Sum squared resid	2769.733	Schwarz criterion		6.225752
Log likelihood	-346.1184	Hannan-Quinn criter.		6.154849
F-statistic	7.798768	Durbin-Watson stat		2.306991
Prob(F-statistic)	0.000014			

FIGURE g. CAPM with Dummy Variables and Plane Traffic

Source: Own Elaboration, E-Views.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 04/23/20 Time: 15:43
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
 bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.966443	0.431237	4.560003	0.0000
PIBEX35	0.300614	0.080362	3.740763	0.0003
D2015M06	-15.80532	0.647294	-24.41751	0.0000
D2018M11	-14.05973	0.551544	-25.49156	0.0000
RHOSPITALITY	0.403008	0.409517	0.984104	0.3272
R-squared	0.217507	Mean dependent var		1.718031
Adjusted R-squared	0.189053	S.D. dependent var		5.584444
S.E. of regression	5.028936	Akaike info criterion		6.110799
Sum squared resid	2781.922	Schwarz criterion		6.230144
Log likelihood	-346.3709	Hannan-Quinn criter.		6.159240
F-statistic	7.644104	Durbin-Watson stat		2.302485
Prob(F-statistic)	0.000018			

FIGURE h. CAPM with Dummy Variables and Hospitality GDP

Source: Own Elaboration, E-Views.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 04/23/20 Time: 14:50
 Sample: 2014M10 2019M05
 Included observations: 56
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.322303	0.522185	4.447281	0.0000
PIBEX35	0.440554	0.143291	3.074533	0.0034
D2015M06	-14.59741	1.223330	-11.93252	0.0000
D2018M11	-15.16332	0.537979	-28.18569	0.0000
PTRAVELPORT	0.064677	0.080439	0.804044	0.4251
R-squared	0.414296	Mean dependent var		1.637990
Adjusted R-squared	0.368358	S.D. dependent var		5.577863
S.E. of regression	4.433056	Akaike info criterion		5.901101
Sum squared resid	1002.251	Schwarz criterion		6.081936
Log likelihood	-160.2308	Hannan-Quinn criter.		5.971210
F-statistic	9.018674	Durbin-Watson stat		2.375933
Prob(F-statistic)	0.000014			

FIGURE i. CAPM with Dummy Variables and Travelport premium

Source: Own Elaboration, E-Views.

Dependent Variable: PAMA
 Method: Least Squares
 Date: 04/23/20 Time: 14:56
 Sample (adjusted): 2010M05 2019M11
 Included observations: 115 after adjustments
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.920384	0.470224	4.083976	0.0001
PIBEX35	0.269279	0.077980	3.453177	0.0008
D2015M06	-14.54405	1.390770	-10.45756	0.0000
D2018M11	-14.92093	0.545337	-27.36095	0.0000
RHSKE696	0.062760	0.067552	0.929061	0.3549
R-squared	0.218809	Mean dependent var		1.718031
Adjusted R-squared	0.190402	S.D. dependent var		5.584444
S.E. of regression	5.024754	Akaike info criterion		6.109135
Sum squared resid	2777.296	Schwarz criterion		6.228480
Log likelihood	-346.2752	Hannan-Quinn criter.		6.157576
F-statistic	7.702637	Durbin-Watson stat		2.336812
Prob(F-statistic)	0.000016			

FIGURE j. CAPM with Dummy Variables and TravelSky Premium

Source: Own Elaboration, E-Views

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