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How did country and industry effects develop since the introduction of the euro?

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Abstract:

Over the last two to three decades, several economists conducted research regarding country and industry effects. I study the role of the country and industry effects on stock prices to determine how the effects changed and what this meant for portfolio diversification strategies. I use a dataset starting at the introduction of the Euro in January 1999 until the first of January 2018. I find that the value weighted country and industry effects are equal over time, during tranquil times in the Eurozone. Only during a crisis or a period of financial distress, one dominates the other. The data also shows that the equally weighted industry effect dominates the equally weighted country effect over almost the entire sample period.

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I. Introduction

I study the role of country and industry effects on stock prices to determine how the effects changed and what this meant for portfolio diversification strategies. The current empirical research on the country and industry effects show several controversies. Beginning with Roll (1992) and Heston and Rouwenhorst (1994), who found contradicting results regarding country and industry effects. Roll found in 1992 that the industrial structure of a country plays a major role in explaining price movements of country indices. Heston and Rouwenhorst (1994) estimated a pure country effect that canceled out the effect of a country specific industrial structure. Pure country effects solely look at how stock prices moved together simply because they are listed in the same country. They found that the pure country effect had much more explanatory power than the industrial structure of a country on stock price movements, which was not in line with Roll (1992).

Research regarding country and industry effects is still being conducted. The implications of this research are useful for portfolio managers who want to diversify their portfolio. The pure country and pure industry effects of Heston and Rouwenhorst (1994) are still being used in today's asset management theories and classes for various reasons. They not only have implications for diversification strategies but are also used as an estimation for financial integration between countries. I will only look at the implications for portfolio diversification strategies in this thesis.

Furthermore, the literature shows that the strength of both effects, and therefore the implications, change over time. Since the establishment of the European Monetary Union (EMU), several papers found a shift in importance from country to industry effects. For example, Cavaglia et. al (2000) and Baca et. al (2000) reported a shift in importance from country to industry diversification. They point at the increased financial integration in Europe as an explanation for their results.

In 2004, Brooks and Del Negro conduct the same research, whilst taking the IT crisis into account. Brooks and Del Negro found a significantly lower industry effect when taking the Telecommunications, Media and Technology (henceforth, TMT) industry out of the sample. Nonetheless, they still measure an increase in industry effect compared to the findings from Heston and Rouwenhorst (1994) and other literature from the mid-nineties.

Papers like Flavin (2004) and Moerman (2008) expected the country effect dominance over the industry effect to decreased after the start of the EMU, because of the increasing financial integration between EMU countries. Moerman conducted a mean-variance analysis with euro area stock market data and finds strong results in line with Cavaglia et. al (2000) and Baca et. al (2000). He concludes that the industry effect is becoming increasingly important. Taking the IT crisis into account does not change the conclusions of Moerman, although it decreases the strength of the industry effect. Flavin (2004) looks at Europe as a continent and finds that the shift from country to industry importance also applies to non-EMU markets.

Within the last decade, research on this topic is limited. As a result, the influence of the financial and sovereign crisis on country and industry effects has not yet been researched. This research will examine the development of these effects to this day, including a specific focus on the financial crisis. This thesis will thus address the following research question: "*How did country and industry effects develop since the introduction of the euro?*"

This thesis will provide further evidence on the question which effect dominates and how it developed over the last two decades. I will also analyze if there are specific individual countries or industries driving the change in the effects. I update the dataset from 01-01-1999, the date on which the euro was introduced, to the 01-01-2018, the nineteenth anniversary of the euro. I follow Heston and Rouwenhorst (1994) and Cavaglia et. al (2000), and use the pure country and pure industry effect variances and mean absolute deviations (henceforth, MAD) of the pure country and industry effects as a measure to determine the importance of both effects. To clarify, the pure country effect of e.g. Germany measures the average return of the German companies relative to companies which are in the same industry but located in another Eurozone country. The pure industry effect of e.g. the Health Care industry measures the average return of the Health Care companies relative to companies that are located in the same country but active in a different industry.

I find that the value weighted variances of the pure country and pure industry effects are almost of the same magnitude over the entire sample. But, when I split the sample into three parts, to isolate the financial crisis, I find that the pure industry effect variance only dominates the pure country variance in the first subsample, from January 1999 till November 2007. During the second (December 2007 – July 2009) and third subsample (August 2009 – January 2018) the pure country effect variance is larger than the pure industry effect variance.

These results are also visible in the MAD graphs, which show that the value weighted country MAD is smaller than the industry MAD around the IT crisis but that it dominates the value weighted industry MAD during the financial and sovereign crisis. On the other hand, the graphs also show that during times that are not influenced by crises, the ratio of country MAD over industry MAD is close to 1.

Lastly, I also find that the equally weighted pure country effect variances are smaller than the equally weighted pure industry effect variances, for every subsample as well as the whole sample. The equally weighted MAD graph shows that the equally weighted industry MAD is larger than the equally weighted country MAD. Also, the ratio of equally weighted country MAD over equally weighted industry MAD is constant around 0.6 over the entire sample. This result is different from earlier results, e.g. Brook and Del Negro (2004) found a MAD ratio of 2 over their sample from 1985 to 2001.

This thesis is structured as follows. In Section II I will provide a literature overview that describes the different methodologies and results of research papers over the last two and a half decades. In Section III I will discuss the data and provide descriptive statistics. In Section IV I will discuss the two methodologies used to determine and analyze the country and industry effects. The results will be presented in Section V. The conclusion and some suggestions for further research will be discussed in Section VI.

II. Literature overview

Since the seventies, various research regarding industry and country diversification has been conducted. In 1994, Heston and Rouwenhorst came with a real breakthrough. They developed a model which isolated industry and country effects on equity prices. Heston and Rouwenhorst documented a strong country specific effect and very little impact of industrial structures on country return volatility. Their results are in line with those of Beckers, Grinold, Rudd and Stefek who published two years earlier in 1992. Beckers et al. and Heston and Rouwenhorst investigated roughly the same time period, from 1978 till 1990. The main difference between Beckers et. al and Heston and Rouwenhorst is that the former used a model to estimate national and international shock effects to determine the country and industry effects.

More relevant for this thesis is the methodology developed by Heston and Rouwenhorst (1994). Heston and Rouwenhorst used a cross sectional regression including dummies for each

industry and country for every point in time. With these time series of individual effects, they constructed a time series of average industry and country effects. Heston and Rouwenhorst then looked at the variances of these time series to determine which of the two effects would have been the most effective diversification strategy. They also used the individual coefficients to calculate the pure country and pure industry effect. Based on the average and the pure country and industry effects, Heston and Rouwenhorst concluded that country diversification is a much more effective risk reducer than industry diversification.

After 2000 the general opinion changed. Cavaglia et. al (2000) were one of the first to find the shift from country to industry effect importance over the time period from 1995 to 2000. In a reaction to Cavaglia et. al, Longin and Solnik (2001) used the extreme value theory to analyze the effects. An extreme value analysis (EVA) investigates the extreme deviations from the median. Longin and Solnik saw very fat tails on the variance distribution and used EVA to analyze these tails.

They found that correlations across countries significantly increased during bear markets. In other words: if Europe is in a financial crisis, correlations across countries increase, while in tranquil or bullish times the correlations across countries diminish. The strength of the effect biased the entire sample.

This leads to the first hypothesis of this thesis: *"The relative strength of the country or industry effect changed during the financial crisis?"*

The results of Longin and Solnik were one of the drivers for Fratzscher (2002) and Baele (2005) to develop a model with time-varying coefficients that account for structural changes in volatility. Fratzscher and Baele specifically used their models to estimate the financial integration after the founding of the European Monetary Union (EMU). While this new model was still under debate, Flavin (2004) published a paper that also underwrites the findings of Cavaglia et al. (2000). Flavin made a relatively small adjustment to Heston and Rouwenhorst's (1994) model which solved one of the main shortcomings. He used a pooled regression to estimate the industry and country effects instead of averaging the individual industry effects. Heston and Rouwenhorst's original model tends to over-estimate the coefficients standard errors while a pooled regression that accounts for individual and time effects, solves this problem.

Foreign exchange rate risk is one of the suggested explanations for the results of these papers found after 2000. With the single currency, all foreign exchange rate risk was cancelled out. The

EMU also introduced a central monetary and fiscal policy. The EMU seemed to diminish the country effect and increase the correlations between Euro countries.

Shortly after, however, Brooks and Del Negro (2004) published a paper investigating the effect of the IT bubble on industry and country effects. Their research tempered the implications of Flavin's work. Brooks and Del Negro found that the largest part of the increase in industry effect was due to the IT bubble. When they took the TMT industry out of the sample, it appeared that industry effects didn't become more dominant than country effects. Nonetheless, they measured a small increase and decrease in respectively industry effect and country effect. However, the country effect was still dominant. This leads to the second hypothesis of this thesis: "*The changes in country and/or industry effects during a crisis, were driven by individual countries and/or industries?*"

In line with Brooks and Del Negro, Moerman (2008) investigated the portfolio optimization opportunities, in regard to industry and country indices, with a mean-variance approach. He found that an industry diversification strategy is more efficient than a country diversification strategy in terms of risk and return. In addition, Moerman also paid attention to the IT bubble. He divided his sample into two subsamples, from 1995-1998 and from 1999-2004. The results showed that in the first subsample the TMT industry had a significant effect on the results, but in the second subsample that effect disappeared. Leaving out the TMT industry even results in evidence of country effect dominance. On the other hand, leaving the TMT industry out of the second subsample has no effect. Moerman argues that this is due to the increased integration in Europe in the second subsample.

This increased integration was already found by Kim, Moshirian and Wu (2005), Baele (2005), Berben and Jansen (2005) and Hargis and Mei (2006). All these papers use different econometric methodologies to estimate the degree of integration in the Eurozone after the founding of the EMU. They all conclude that financial integration within the Eurozone has significantly increased. Kim et al., Baele and Hargis and Mei even imply a shift in importance from country diversification to industry diversification due to the increased integration.

Moerman was not the only one to revisit industry and country effects around that time. Baele (2009) reacted to the expected shift in dominance himself. With an econometric model that accounted for structural changes and temporary fluctuations in volatility, he found support for the expected shift from country to industry effects dominance.

More recently Dias and Ramos (2015) showed that industry effects are becoming more important than country effects, but that this is not the case for all industries and countries. Dias and Ramos show there are two core countries in the Eurozone, namely Germany and France, and that there are different levels in synchronization of the other countries with these core countries. They show that countries like Austria, Ireland and Portugal have a low correlation with these core countries and that countries like the Netherlands and Belgium have a high correlation. This also accounts for specific industries, e.g. the Industrials industry in Germany is leading for most other Industrials industries across the Eurozone.

III. Data

I use monthly returns and market capitalizations from Datastream on 1200 companies based in the Eurozone (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) over a time period from the first of January 1999 till the first of January 2018. All companies come from the Datastream country indices. The geographical and industrial breakdown of this dataset is reported in Table I.

The industry classifications are based on the Industry Classification Benchmark (henceforth, ICB) also from Datastream. This industry classification is in line with earlier research, e.g. Flavin (2004). The ICB distinguishes ten different industries, Oil & Gas, Basic Materials, Industrials, Consumer Goods, Health Care, Consumer Services, Telecommunications, Utilities, Financials and Technology.

Table I shows that there is a non-uniform distribution of firms across the different countries and industries, e.g. Portugal only accounts for 3.9% of the total number of companies and only for 0.8% if we weigh the companies by their market capitalization. While France respectively accounts for 21.2% and 31.1% of the total sample. Also, the industry composition within different countries can vary significantly. 20.6% of the companies that are labeled Irish are active in the consumer services industry, while only 2.3% of the Austrian companies are and 11.4% in the whole sample.

Table II summarizes the average monthly returns of the individual country and industry portfolios and the respective standard deviation as well as a correlation matrix. The bottom part, below the blank diagonal, reports the equally weighted portfolio correlations and the upper part, above the blank diagonal, reports the value weighted portfolio correlations. I find an average

correlation between the Eurozone countries of 0.679 for equally weighted returns and 0.588 for value weighted returns. For industries within the Eurozone, I find an even stronger average correlation of 0.739 equally weighted and 0.6 value weighted.

Interesting about these correlations is that when we compare it with the correlations found by Heston and Rouwenhorst (1994) over the time period from 1978 till 1992 we see that the country correlations have increased from 0.434 and 0.407 to 0.679 and 0.558 and that the spread between equally and value weighted correlations for the industry portfolios have substantially increased. Respectively 0.757 and 0.714 to 0.739 and 0.6. This difference between equally and value weighted correlations suggests at a size effect. It implicates that the correlation between the firms with a relatively larger market capitalization in the different industry portfolios is smaller than the correlation between the firms with a relatively smaller market capitalization in the industry portfolios.

These findings in the descriptive statistics implicate two questions that I will attempt to answer. First, do the differences in equally weighted and value weighted correlations implicate that the equally weighted country effect relative to the equally weighted industry effect is smaller than the value weighted country effect relative to the value weighted industry effect?

And second, do the higher country correlations mean that the country effect, in general, has weakened relative to the industry effect?

IV. Methodology

In order to separate country and industry effects I follow Heston and Rouwenhorst (1994) who developed a model which measures the individual effects of industry and country variables, while it rules out any interaction between these effects. Their model is broadly accepted by other literature and the basis of most research in this field:

$$R_{i,t} = \alpha_t + \beta_{j,t} + \gamma_{k,t} + \varepsilon_{i,t} \qquad (1)$$

$R_{i,t}$ is the return of security i at time t. $\beta_{j,t}$ and $\gamma_{k,t}$ are respectively the industry and country effect for industry j and country k at time t. $\varepsilon_{i,t}$ is a firm specific error term.

First, I rewrite (1) to estimate the individual industry and country effects. I will use a model with a dummy variable for all industries ($I_{i,j}$) and countries ($C_{i,k}$) which is one if security i is in industry j and country k:

$$R_i = \alpha + \beta_1 I_{i,1} + \beta_2 I_{i,2} + \cdots + \beta_{10} I_{i,10} + \gamma_1 C_{i,1} + \gamma_2 C_{i,2} + \cdots + \gamma_{12} C_{i,11} + \varepsilon_i \qquad (2)$$

Table I

Panel A gives the equally weighted percentage of firms by country and industry of the total Eurozone sample. Panel B gives the value weighted percentage of firms by country and industry of the total Eurozone sample.

	Industry										
Country	O&G	BM	I	CG	HC	CS	Tele	U	F	Tech	Total
Panel A: Equally weighted percentage of firms by country and industry											
Austria	0,27	0,27	1,24	0,44	0,00	0,09	0,09	0,27	1,33	0,00	3,99
Belgium	0,09	0,62	1,33	0,98	1,06	0,44	0,18	0,09	2,75	0,27	7,80
Finland	0,09	0,62	1,60	0,44	0,18	0,44	0,09	0,09	0,35	0,35	4,26
France	0,53	0,62	4,61	3,46	1,86	2,66	0,09	0,89	4,08	2,39	21,19
Germany	0,35	1,77	4,79	2,84	1,51	2,13	0,27	0,80	3,99	2,57	21,01
Greece	0,18	0,27	0,71	0,53	0,27	0,62	0,09	0,44	0,89	0,18	4,17
Ireland	0,27	0,35	0,27	0,44	0,09	0,62	0,09	0,00	0,80	0,09	3,01
Italy	0,35	0,27	3,46	2,39	0,35	1,51	0,35	0,98	3,10	0,44	13,21
Netherlands	0,18	0,71	1,77	1,06	0,80	0,98	0,27	0,00	2,57	1,15	9,49
Portugal	0,09	0,35	0,80	0,27	0,18	1,06	0,18	0,18	0,44	0,35	3,90
Spain	0,44	0,71	1,68	0,62	0,62	0,89	0,27	0,62	1,77	0,35	7,98
Eurozone	2,84	6,56	22,25	13,48	6,91	11,44	1,95	4,34	22,07	8,16	100
Panel B: Value weighted percentage of firms by country and industry											
Austria	0,28	0,20	0,36	0,02	0,00	0,01	0,08	0,10	0,73	0,00	1,77
Belgium	0,00	0,43	0,24	2,46	0,33	0,26	0,15	0,04	1,25	0,07	5,24
Finland	0,20	0,49	0,83	0,16	0,07	0,13	0,08	0,22	0,42	0,39	2,99
France	1,79	0,94	6,17	8,28	2,47	2,77	0,57	1,43	5,12	1,56	31,09
Germany	0,05	3,00	4,84	6,31	2,71	1,32	1,29	1,09	4,36	2,81	27,77
Greece	0,07	0,01	0,07	0,07	0,01	0,08	0,08	0,03	0,14	0,00	0,55
Ireland	0,00	0,01	0,20	0,34	0,00	0,43	0,00	0,00	0,40	0,00	1,38
Italy	0,85	0,25	1,27	1,76	0,22	0,25	0,27	1,42	2,83	0,06	9,19
Netherlands	0,06	1,00	0,56	2,42	0,59	0,90	0,39	0,00	2,23	1,09	9,25
Portugal	0,18	0,07	0,07	0,00	0,00	0,24	0,01	0,18	0,09	0,00	0,84
Spain	0,48	0,12	1,49	0,14	0,28	1,56	0,72	1,44	3,27	0,43	9,92
Eurozone	3,97	6,50	16,11	21,97	6,67	7,93	3,65	5,93	20,85	6,42	100

O&G = Oil & Gas, BM = Basic Materials, I = Industrials, CG = Consumer Goods, HC = Health Care, CS = Consumer Services, Tele = Telecommunications, U = Utilities, F = Financials, Tech = Technology.

I run this model for every month so I get a time series of individual industry and country effects. Normally I should leave one industry and one country dummy out of the model to serve as a benchmark, but instead of using an arbitrary benchmark I follow Suits (1984) and Kennedy (1986) to interpret the results in a more effective fashion. Normally you would use an equation like (3) which leaves one dummy out for both dummy variables.

$$R_i = \alpha + \beta_1 I_{i,1} + \beta_2 I_{i,2} + \cdots + \beta_9 I_{i,9} + \gamma_1 C_{i,1} + \gamma_2 C_{i,2} + \cdots + \gamma_{11} C_{i,10} + \varepsilon_i \qquad (3)$$

Suits (1984) shows that once equation (3) has been estimated we can get coefficients for all β_i and γ_i in equation (2). Following Suits I add a constant k to all β_i and h to all γ_i including β_{10} and γ_{12} and subtract k and h from the constant α. k and h are calculated based on the coefficients from equation (3):

$$k = -(\sum \beta_i + 0)/10 \tag{4}$$

$$h = -(\sum \gamma_i + 0)/12 \tag{5}$$

I also impose two restrictions to regression (3):

$$\sum_{j=1}^{10} n_j \beta_j = 0, \tag{6}$$

$$\sum_{k=1}^{12} m_k \gamma_k = 0 \tag{7}$$

n_j and m_k denote the number of securities in industry j and country k. These restrictions mean that the weighted sum of all industry and country effects is equal to zero at every point in time. When I impose these restrictions to calculate the value weighted coefficients I replace n_j and m_k, with w_j and v_k which are the weights of each country and industry weighted by their market capitalizations. Due to this method we can interpret all the coefficients for both dummy variables relative to the sample average, which is in this case the equally or value-weighted Eurozone market (Kennedy, 1986). Due to the restrictions the statistical properties of the model do not change and we can interpret the coefficients and standard deviations similarly to those from equation 3.

The next step is to estimate the pure industry effect, $\hat{\alpha} + \widehat{\beta_j}$. In order to do this, I need a portfolio for every industry that is perfectly geographically diversified. This portfolio will hold the same country composition as the Eurozone equally weighted market. The same accounts for a pure country effect, $\hat{\alpha} + \widehat{\gamma_k}$, for which I need an equally weighted portfolio, with the same industry composition as the Eurozone equally weighted market for each country. Then I follow Heston and Rouwenhorst (1994) again to estimate the pure industry and country effects:

$$R_k^{ew} = \hat{\alpha} + \frac{1}{m_k} \sum_i \sum_{j=1}^{10} \widehat{\beta_j} I_{i,j} + \widehat{\gamma_k} \tag{8}$$

Table II

Correlation matrix of the returns of all industry and country portfolios over the full sample period, 01/01/1999 till 01/01/2018. Portfolios are constructed based on Industry Classification Benchmark from Datastream. Avg. return is the average montly return of the specific industry or country portfolio. The correlations above the blank diagonal refer to the value weighted portfolio returns, below to equally weighted portfolio returns.

Panel A: *Correlation matrix by industry*

	Equally weighted		Value weighted		Correlation matrix									
	Avg. return	St. Dev.	Avg. return	St. Dev.	O&G	BM	I	CG	HC	CS	Tele	U	F	Tech
O&G	1,194	5,966	4,660	22,479		0,658	0,586	0,524	0,493	0,493	0,144	0,594	0,591	0,396
BM	1,168	5,122	2,220	10,195	0,792		0,789	0,704	0,583	0,641	0,238	0,585	0,751	0,474
I	1,243	5,165	0,740	2,944	0,786	0,922		0,705	0,768	0,906	0,539	0,653	0,821	0,715
CG	1,238	4,316	1,020	3,769	0,751	0,919	0,995		0,617	0,691	0,316	0,556	0,688	0,510
HC	1,335	4,899	2,390	10,424	0,603	0,665	0,798	0,720		0,812	0,512	0,555	0,656	0,723
CS	0,813	4,878	0,900	4,930	0,694	0,810	0,917	0,880	0,823		0,639	0,655	0,773	0,759
Tele	0,506	7,156	5,240	61,607	0,413	0,438	0,536	0,491	0,627	0,707		0,353	0,401	0,703
U	0,885	4,187	1,740	11,841	0,761	0,752	0,825	0,775	0,716	0,793	0,521		0,715	0,420
F	0,946	4,467	0,420	3,480	0,753	0,864	0,920	0,898	0,755	0,885	0,551	0,832		0,576
Tech	1,385	7,450	2,172	11,898	0,551	0,628	0,754	0,671	0,816	0,854	0,789	0,619	0,697	

Panel B: *Correlation matrix by country*

	Avg. return	St. Dev.	Avg. return	St. Dev.	AU	BE	FI	FR	GE	GR	IR	IT	NL	PO	ES
AU	1,071	4,354	3,604	14,365		0,644	0,574	0,590	0,438	0,642	0,481	0,445	0,590	0,680	0,409
BE	0,932	4,194	1,208	6,739	0,771		0,626	0,589	0,434	0,678	0,371	0,426	0,576	0,770	0,479
FI	1,298	5,028	0,657	3,142	0,796	0,718		0,757	0,671	0,904	0,429	0,470	0,744	0,849	0,624
FR	0,813	5,149	1,371	8,268	0,742	0,695	0,752		0,558	0,822	0,552	0,449	0,766	0,774	0,698
GE	1,306	5,390	3,416	20,147	0,786	0,719	0,819	0,735		0,754	0,333	0,412	0,548	0,652	0,483
GR	1,336	4,901	0,570	2,520	0,795	0,752	0,892	0,805	0,848		0,523	0,515	0,840	0,894	0,698
IR	1,180	9,389	2,369	21,176	0,458	0,452	0,460	0,524	0,440	0,529		0,347	0,509	0,461	0,440
IT	1,191	6,793	5,926	42,612	0,754	0,629	0,702	0,657	0,715	0,719	0,396		0,475	0,522	0,318
NL	0,887	5,716	0,852	5,361	0,726	0,673	0,806	0,819	0,755	0,890	0,469	0,654		0,796	0,710
PO	0,852	4,891	1,083	6,327	0,799	0,722	0,895	0,766	0,817	0,894	0,434	0,717	0,823		0,631
ES	0,797	5,603	2,122	16,400	0,503	0,508	0,587	0,688	0,513	0,652	0,375	0,537	0,673	0,615	

O&G = Oil & Gas, BM = Basic Materials, I = Industrials, CG = Consumer Goods, HC = Health Care, CS = Consumer Services, Tele = Telecommunications, U = Utilities, F = Financials, Tech = Technology. AU = Austria, BE = Belgium, FI = Finland, FR = France, GE = Germany, GR = Greece, IR = Ireland, IT = Italy, NL = Netherlands, PO = Portugal, ES = Spain.

$$R_j^{ew} = \hat{\alpha} + \widehat{\beta_j} + \frac{1}{n_j}\sum_i \sum_{k=1}^{12} \widehat{\gamma_k}\, C_{i,k} \quad (9)$$

Where the i-summation is taken over the securities in industry j and country k. The model to calculate the value weighted pure industry and country effects is quite similar only the weights of the securities are based on their relative market capitalization at the beginning of the each month.

Elaborating on the interpretation of the results from equation (8) and (9). The pure country and industry effects are the respective return of their equally or value weighted portfolio minus the return of the Eurozone portfolio and the respective weight of each industry or country with times the average of those specific industry or country coefficient from equation (2).

Lastly, to compare the relative importance of the industry and country effects I follow Rouwenhorst (1999) and Cavaglia et al. (2000) who used MADs to compare the relative importance of the pure country and pure industry effects. Cavaglia et al. used the MADs of the industry and country effects to construct a ratio to measure the relative importance of both effects:

$$\frac{MAD_{Kt}}{MAD_{Jt}} = \frac{\sum_{k=1}^{12} n_{k,t-1}|\gamma_{k,t}|}{\sum_{j=1}^{10} m_{j,t-1}|\beta_{j,t}|} \quad (10)$$

A ratio above one means that the pure country effect was dominating the pure industry effect at time t. Again, I do the same with value weighted MADs by replacing $n_k$and m_j, with w_j and v_k and using the market capitalization restricted coefficients.

V. Empirical results

Both Table III and Table IV show the variances of the pure country and industry effect and the weighted average of the country and industry coefficients (sum of effects), calculated from coefficients from equation (2), (8) and (9). Table III shows the equally weighted results and Table IV the value weighted, both tables report variances based on monthly returns. I present variances in these tables because this gives a better insight into the underlying sources of variation in the country and industry returns. As explained in Section IV the return of an industry or country index is decomposed in three components, the Eurozone portfolio effect (denoted as $\hat{\alpha}$), the pure country effect and the sum of effects. The higher the variance in the pure effect or sum of effects the more likely this is the source underlying the variance in the specific country or industry index returns.

Table III

The table shows the variances of the equally weighted pure country and industry effects and the sum of industry and country effects. The sample is split in to three separate time frames to isolate the financial crisis from December 2007 till July 2009.

	1999:1 to 2007:11		2007:12 to 2009:7		2009:8 to 2018:1		Full Sample	
	Pure Effect	Sum of Effects	Pure Effect	Sum of Effects	Pure Effect	Sum of Effects	Pure Effect	Sum of Effects
Panel A. Equally weighted country effects, $\widehat{\gamma_k}$ and γ_k								
Austria	0,34	0,13	0,85	0,05	0,23	0,05	0,37	0,09
Belgium	0,31	0,29	0,85	0,11	0,15	0,06	0,28	0,19
Finland	0,56	0,83	0,56	0,25	0,16	0,10	0,40	0,53
France	0,20	0,37	0,61	0,11	0,26	0,08	0,28	0,26
Germany	0,30	0,29	0,57	0,17	0,25	0,08	0,35	0,23
Greece	0,36	1,34	0,82	0,21	0,17	0,51	0,32	0,97
Ireland	1,29	1,30	0,61	0,67	0,71	0,33	1,12	1,00
Italy	0,35	11,67	0,69	5,22	0,33	3,50	0,51	8,44
Netherlands	0,30	7,45	1,70	0,64	0,30	0,29	0,36	4,07
Portugal	0,57	1,98	0,64	0,78	0,19	0,57	0,52	1,57
Spain	0,55	0,60	0,71	0,21	0,41	0,13	0,47	0,39
Cross Country	0,35	2,45	0,76	0,86	0,28	0,58	0,39	1,70
Panel B. Equally weighted industry effects, $\widehat{\beta_j}$ and β_j								
Oil & Gas	0,27	0,43	3,07	0,33	0,26	0,16	0,34	0,34
Basic Materials	0,36	16,76	0,49	0,94	0,32	0,21	0,42	8,81
Industrials	1,10	0,43	0,92	0,18	0,84	0,10	1,24	0,32
Consumer Goods	0,13	0,28	2,87	0,15	0,14	0,10	0,20	0,27
Health Care	0,41	0,20	0,53	0,11	0,20	0,09	0,32	0,18
Consumer Services	1,33	10,62	0,42	5,62	0,87	3,75	1,35	8,73
Telecommunications	0,88	1,12	2,61	0,49	0,21	0,24	0,53	0,73
Utilities	0,37	1,15	0,26	0,56	0,14	0,31	0,30	0,80
Financials	0,11	0,53	0,41	0,14	0,16	0,09	0,20	0,37
Technology	2,56	0,82	0,58	0,02	1,03	0,04	2,06	0,42
Cross Industry	0,77	2,86	1,01	0,86	0,47	0,53	0,76	1,91

The "Pure Effect" measures the average return of firms in a country/industry relative to the firms in the same country/industry but located or active in a different country/industry. The "Sum of Effects" measures the component of a country's/industry's return that can be attributed to the different country/industry composition compared to the Eurozone market.

The main finding of these two tables is that over the whole sample period the ratio of value weighted pure country effect variance over the value weighted pure industry effect variance is on average almost one. This shows that on average over the last nineteen years neither country nor industry effects was dominant. Over the different sub periods on the other hand, this ratio varies.

Table IV

The table shows the variances of the value weighted pure country and industry effects and the sum of industry and country effects. The sample is split in to three separate time frames to isolate the financial crisis from December 2007 till July 2009.

	1999:1 to 2007:11		2007:12 to 2009:7		2009:8 to 2018:1		Full Sample	
	Pure Effect	Sum of Effects	Pure Effect	Sum of Effects	Pure Effect	Sum of Effects	Pure Effect	Sum of Effects
Panel A. Equally weighted country effects, $\widehat{\gamma_k}$ and γ_k								
Austria	1,42	0,17	4,34	0,06	0,60	0,04	1,35	0,10
Belgium	0,44	0,38	0,50	0,10	0,19	0,05	0,33	0,20
Finland	1,03	0,99	0,41	0,25	0,10	0,08	0,51	0,53
France	0,60	0,42	0,34	0,11	0,22	0,06	0,39	0,25
Germany	6,39	0,36	3,15	0,16	0,62	0,06	3,33	0,22
Greece	0,39	1,64	0,49	0,23	0,20	0,55	0,32	1,01
Ireland	4,05	1,46	2,67	0,73	4,40	0,30	4,24	0,99
Italy	8,37	11,54	23,49	5,24	23,59	3,61	16,20	8,88
Netherlands	0,49	7,64	0,30	0,67	0,25	0,25	0,64	4,18
Portugal	0,55	2,09	0,16	0,77	0,42	0,53	0,72	1,54
Spain	3,13	0,71	1,78	0,20	0,64	0,12	1,81	0,40
Cross Country	3,20	2,55	4,05	0,81	2,64	0,43	3,07	1,59
Panel B. Equally weighted industry effects, $\widehat{\beta_j}$ and β_j								
Oil & Gas	6,72	0,29	5,18	0,22	1,93	0,10	4,65	0,24
Basic Materials	0,78	19,30	1,23	0,97	0,37	0,19	0,82	9,58
Industrials	0,09	0,23	0,16	0,09	0,05	0,04	0,09	0,20
Consumer Goods	0,28	0,14	0,63	0,07	0,05	0,05	0,21	0,18
Health Care	2,18	0,10	0,27	0,06	0,20	0,06	1,04	0,12
Consumer Services	0,00	11,46	0,01	6,41	0,00	4,18	0,00	9,80
Telecommunications	76,25	0,80	7,16	0,34	6,05	0,16	35,16	0,51
Utilities	1,36	0,83	0,96	0,33	0,60	0,20	1,04	0,60
Financials	0,44	0,30	0,24	0,07	0,10	0,05	0,29	0,25
Technology	1,96	0,63	0,41	0,05	0,13	0,04	1,11	0,31
Cross Industry	8,04	2,22	1,30	0,64	0,53	0,40	3,17	1,58

The "Pure Effect" measures the average return of firms in a country/industry relative to the firms in the same country/industry but located or active in a different country/industry. The "Sum of Effects" measures the component of a country's/industry's return that can be attributed to the different country/industry composition compared to the Eurozone market.

During the first subsample from January 1999 to the beginning of the financial crisis in November 2007 the variance in the pure industry effect was larger than the variance in the pure country effect (8.04% and 3.21%) for both the equally and value weighted results. Looking at the value weighted pure industry effect variances (Table IV) it is clear that the industry dominance is caused by the Telecommunications industry. This is broadly discussed by Brooks and Del Negro

(2004), they show that the variance in the Telecommunications industry is caused by the IT crisis. The IT crisis, also known as the dotcom bubble, was very specific for the Telecommunications industry. The effect of the IT crisis on countries was minimal. This explains the low variance in the sum of country effects of the Telecommunications sector over this period.

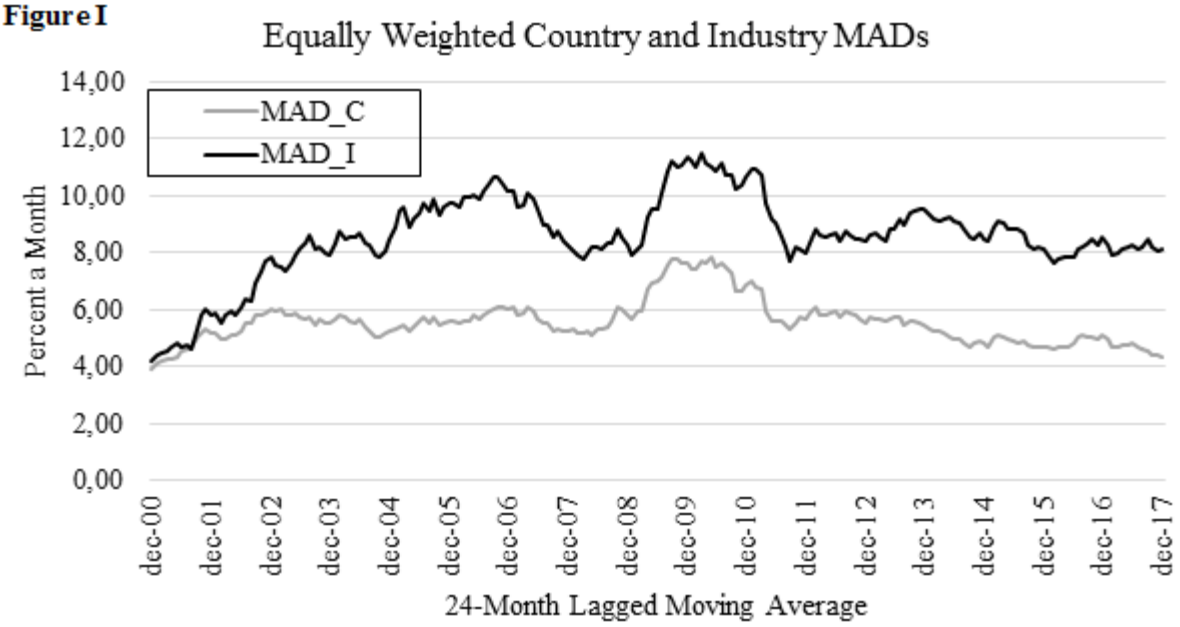
Compared to the equally weighted pure Telecommunications effect the value weighted pure effect is much larger. This would mean that on average the larger firms in the Telecommunications industry suffered significant volatility during the IT crisis.

During the crisis from December 2007 to July 2009 and the third sub period from July 2009 to January 2018 the variance in the value weighted pure country effect (4.06% and 2.64%) dominated the variance in the pure industry effect (1.30% and 0.53%). Analyzing the individual pure country effect variances shows that the country dominance is mainly caused by Italy. Italy has a pure country effect variance of 23.49% and 23.59%. This is extremely high compared to the cross-country pure effect variances of these sub periods (4.05% 2.64%). This means that Italy deviated a lot from the Eurozone market portfolio during the financial crisis and the sovereign crisis.

Looking at sum of effects in Table III it is interesting to notice that over the full sample the sum of effects in Italy and the Netherlands is substantially larger than the average cross-country sum of effects. When you look at the industrial composition of these countries you see that the Industrials and Consumer Services industry are relatively large industries in both countries. These industries have a substantially higher variance in their pure effects than the other industries, this explains the high sum of effects found for the Netherlands and Italy. The Technology industry is also quite large in the Netherlands and holds the highest variance of all industries. Especially for the Netherlands this is interesting since the variance of their pure effect is lower than the cross-country variance. This would mean that the variances in the stock price of the Dutch index is mainly caused by its industrial composition.

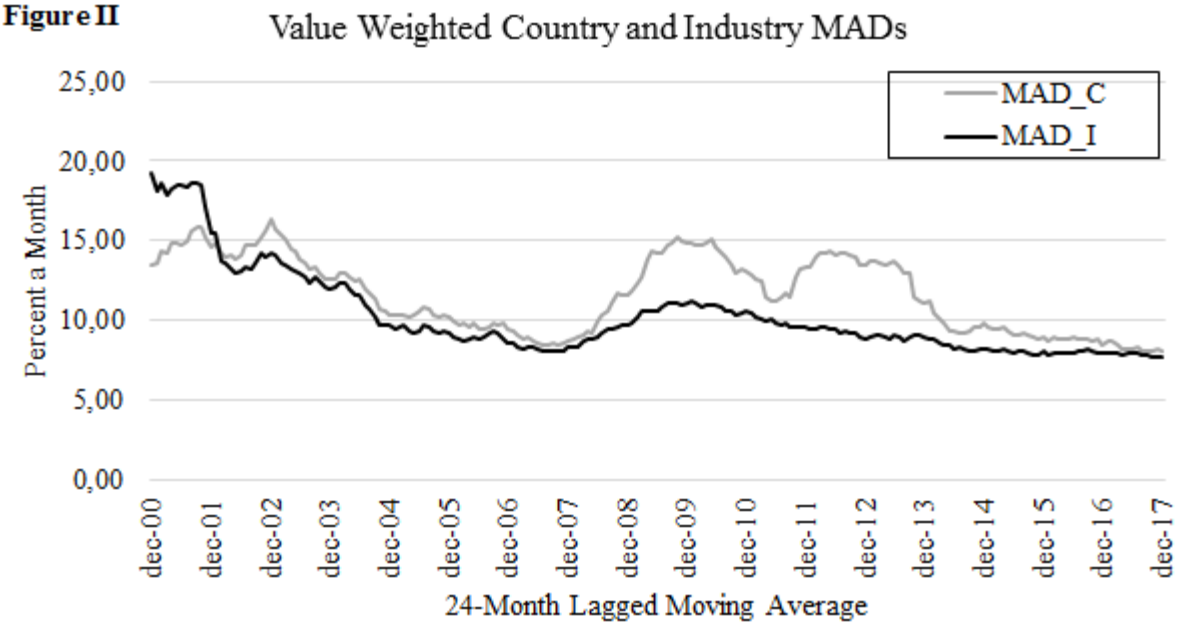
These results imply that portfolio managers who had an industrially diversified portfolio during the first sub period achieved more risk reduction than portfolio managers who had a geographically diversified portfolio. For the second and third sub period this would have been the other way around. But over the full sample neither strategy would have dominated the other.

Figure I



Equally weighted mean absolute deviations for the pure country and pure industry effects from the Eurozone market. Both series are 24-month lagged moving averages. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

Figure II



Market capitalization (Value) weighted mean absolute deviations for the pure country and pure industry effects from the Eurozone market. Both series are 24-month lagged moving averages. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

These results show that the country effect significantly changed during the financial crisis and dominated the industry effect. The first hypotheses is accepted. The main reason for this shift is the extreme increase in Italy's pure country effect variance.

Figure I and II show the equally and value weighted MADs of the pure country and industry effects from the Eurozone mean. The main findings are that the equally weighted industry MAD dominates the country MAD over the entire sample period. While the value weighted industry and country MAD show a more interesting pattern. The value weighted MADs tend to move together during relatively tranquil times, but during times of financial distress one tends to dominate the other. This is almost perfectly in line with Longin and Solnik (2001), who also found that during distressed times the importance of the country effect tends to rise.

On the left hand of Figure II you see that the industry effect is dominating the country effect during the IT crisis. It is interesting to see that the From 2008 to 2010 and from 2010 to 2013, respectively during the financial and sovereign crisis, you see that the country effect dominates the industry effect.

This means that during the IT crisis a portfolio that was not diversified across industries on average deviated more from the Eurozone market index than a portfolio that was not diversified across countries. And during the financial and sovereign crisis a portfolio that was not diversified across countries would on average deviate more from the Eurozone market index than a portfolio that was not diversified across industries.

Given the results from Table III and IV and the pattern found in Figure I and II I excluded Italian and the Telecommunication stocks from the sample and reproduced Figure I, II and III resulting in Figure IV, V and VI. Figure IV shows that the equally weighted MADs do not change significantly. On the other hand, looking at Figure VI, the industry MAD dominance during the IT crisis totally disappears while the country MAD still shows the same pattern only less extreme. Especially during the sovereign crisis the spike in the country MAD is smaller when we exclude Italy. Still I find that the country effect is decreasing and that the ratio is converting to one during tranquil times.

These findings are broadly in line with the literature discussed in Section II, e.g. Moerman (2008), Kim et al. (2005), Baele (2009) and Hargis and Mei (2006). They also find a shift from country to industry effect. I show that in tranquil times the value weighted MAD ratio is slightly

above one, which means that the country and industry effect are more or less equally dominant. But in distressed times, depending on the nature of the crisis, one effect dominates the other.

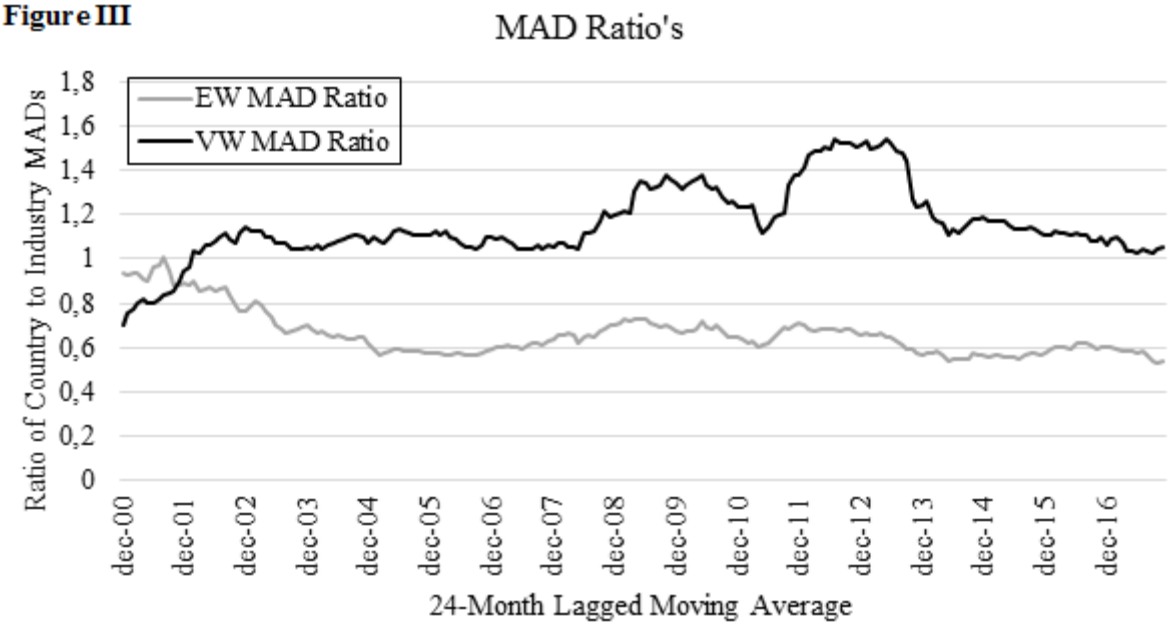
To research the second hypothesis I check the heterogeneity of these results using Figures VII, VIII, IX and X in the appendix. I check if those results underline the findings from Figures I, II, III, IV, V and VI and if there are specific countries or industries that drive the changes in country and industry MADs besides Italy and the Telecommunications industry. Figure I shows that the ratio of equally weighted effects barely change over time. This is also visible in Figures VII and VIII, these figures show that most equally weighted country and industry MADs move between two and eight percent. The dominance of the industry effect is mainly caused by three industries, the Basic Materials, Consumer Services and Technology industry. These three industry MADs move between ten and twenty percent.

Figures II and III show three moments in our time period were one effect is dominating the other. On the left side of the figures we see the value weighted industry effect dominating the country effect. Figure X shows that this is solely caused by the Telecommunications industry. Which, as discussed earlier, is due to the IT crisis from 2000. Figures II and III also show that there are two other periods between 2008 and 2014 were one value weighted effect dominates the other.

During the financial crisis (2007-2009) multiple countries, e.g. Ireland, Italy and the Netherlands, show an increase in pure country effect while the individual industry effects do not seem to be impacted by the crisis. During the sovereign crisis (2012-2014) the dominance of the country effect seems to be solely caused by Italy (Figure IX), as was also noted in Table IV and Figure V. Therefore, the second hypothesis is accepted.

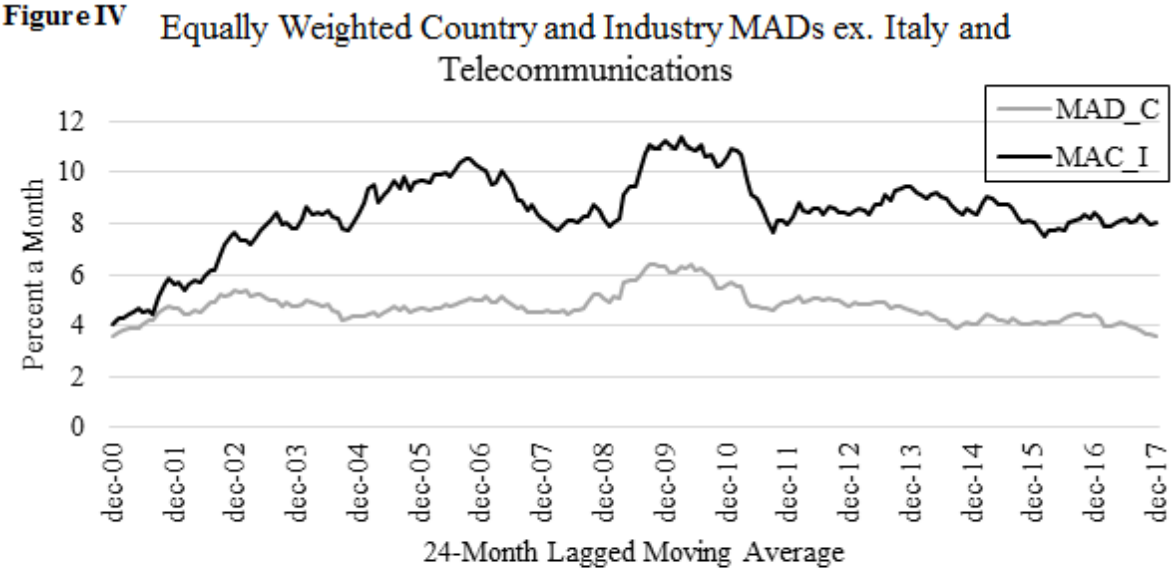
These findings underline the shifts in dominance but also raise question marks since during all the three periods were one MAD dominated the other there are clear individual industries or countries which cause the dominance.

Figure III



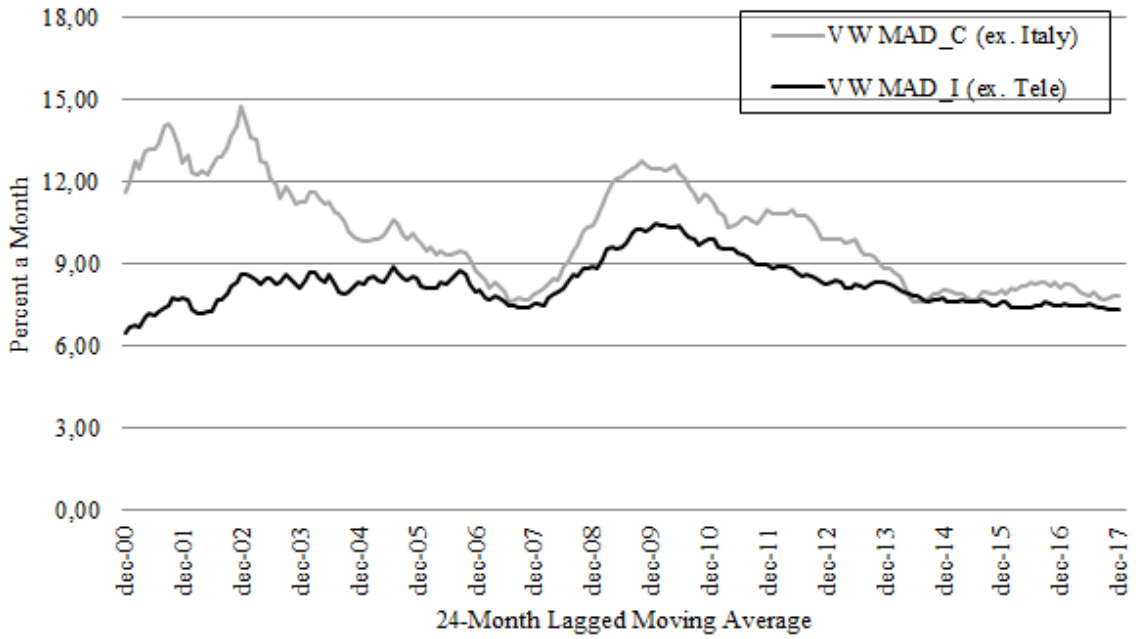
Ratio of the mean absolute deviations for pure country over pure industry effects. Both equally and value weighted 24-month lagged moving averages are shown. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

Figure IV



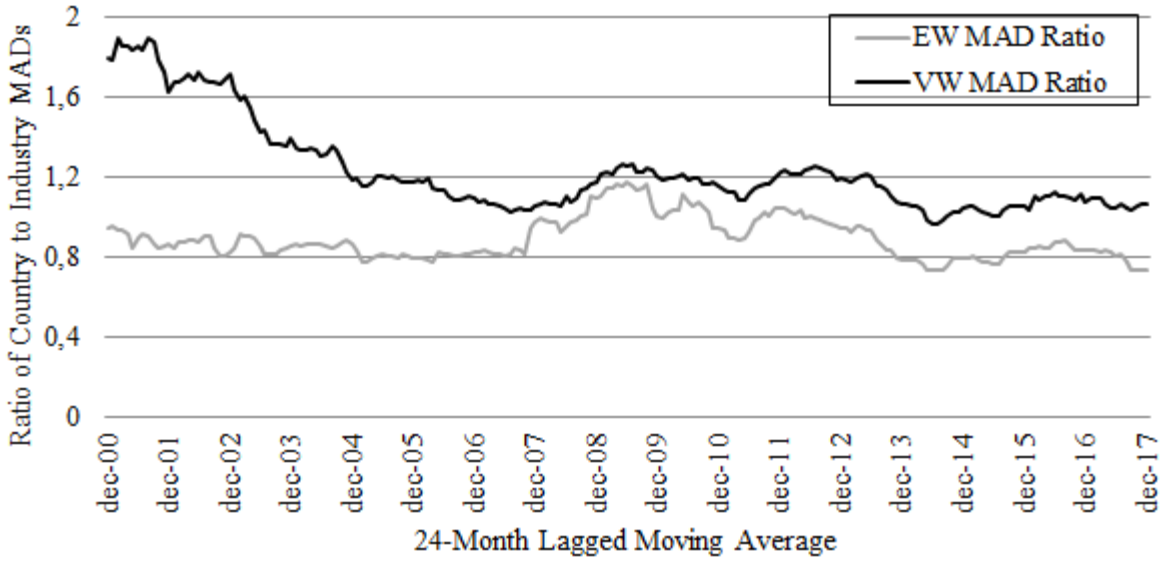
Equally weighted mean absolute deviations from the pure country and pure industry effects from the Eurozone market. Both series are 24-month lagged moving averages. I exclude Italy and the Telecommunications industry from the sample. The time period is from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

Figure V Value Weighted Country and Industry MADs ex. Italy and Telecommunications



Market capitalization (Value) weighted mean absolute deviations from the pure country and pure industry effects from the Eurozone market. Both series are 24-month lagged moving averages. I exclude Italy and the Telecommunications industry from the sample. The time period is from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-

Figure VI MAD Ratio's ex. Italy and Telecommunications



Ratio of the mean absolute deviations for pure country over pure industry effects. Both equally and value weighted 24-month lagged moving averages are shown. I exclude Italy and the Telecommunications industry from the data. The time period is from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

I. Conclusion

The results from this thesis are in line with earlier research but also provide some new insights. Various papers investigating the development of the industry and country effects around and after the introduction of the euro report a leveling between the industry and country effects in the Eurozone. I also find a further leveling of the value weighted country and industry effect. They on average moved towards a ratio of 1. In line with Longin and Solnik (2001) and Brooks and Del Negro (2004), I also find that one effect dominates the other during periods of financial distress. New insights come from Figure IX in the appendix and Table IV. This figure and table show that during the financial and sovereign crisis the value weighted country MAD dominates the value weighted industry MAD due to the extremely high country effect in Italy.

Implications for portfolio managers are that within the Eurozone country and industry diversification are equally important for strategies that take market capitalization weights into account. Only during a crisis one of the two will dominate the other, which is obviously hard to predict. An interesting suggestion for further research would be to test if there are predictive insights in the development of country and industry effects regarding a crisis.

Portfolio managers who look at each company individually and use an equally weighted strategy, industry diversification is more important than country diversification. Figure I and III show that the equally weighted industry effect dominates the equally weighted country effect over more or less the whole sample.

From the results found in this thesis it becomes clear that there is a significant difference between equally weighted and value weighted effects. This finding implies that there is a size effect within the industry and country effects. This is an interesting suggestion for further research.

One of the short comings of this thesis is the methodology, Heston and Rouwenhorst (1994) had criticism from various papers. E.g. the problem Flavin (2004) pointed out with regard to the error term measurements. Conducting this research again only using different methodologies will provide stronger evidence on the robustness of these results.

Lastly, further research regarding the sovereign crisis is also needed since it is counter intuitive that only Italy deviated from the Eurozone market index. Countries like Greece, Ireland, Spain and Portugal were also in financial trouble during the sovereign crisis.

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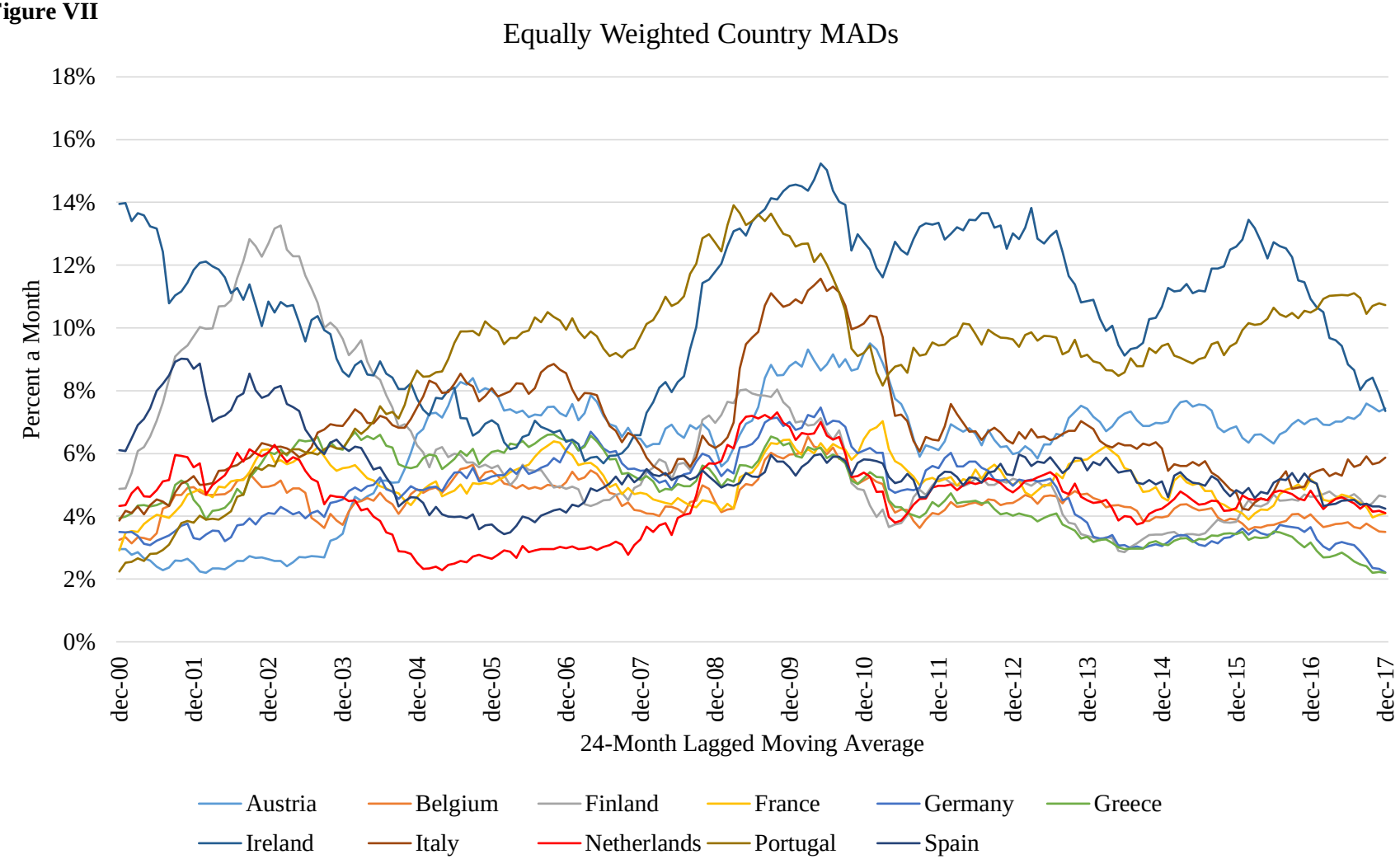
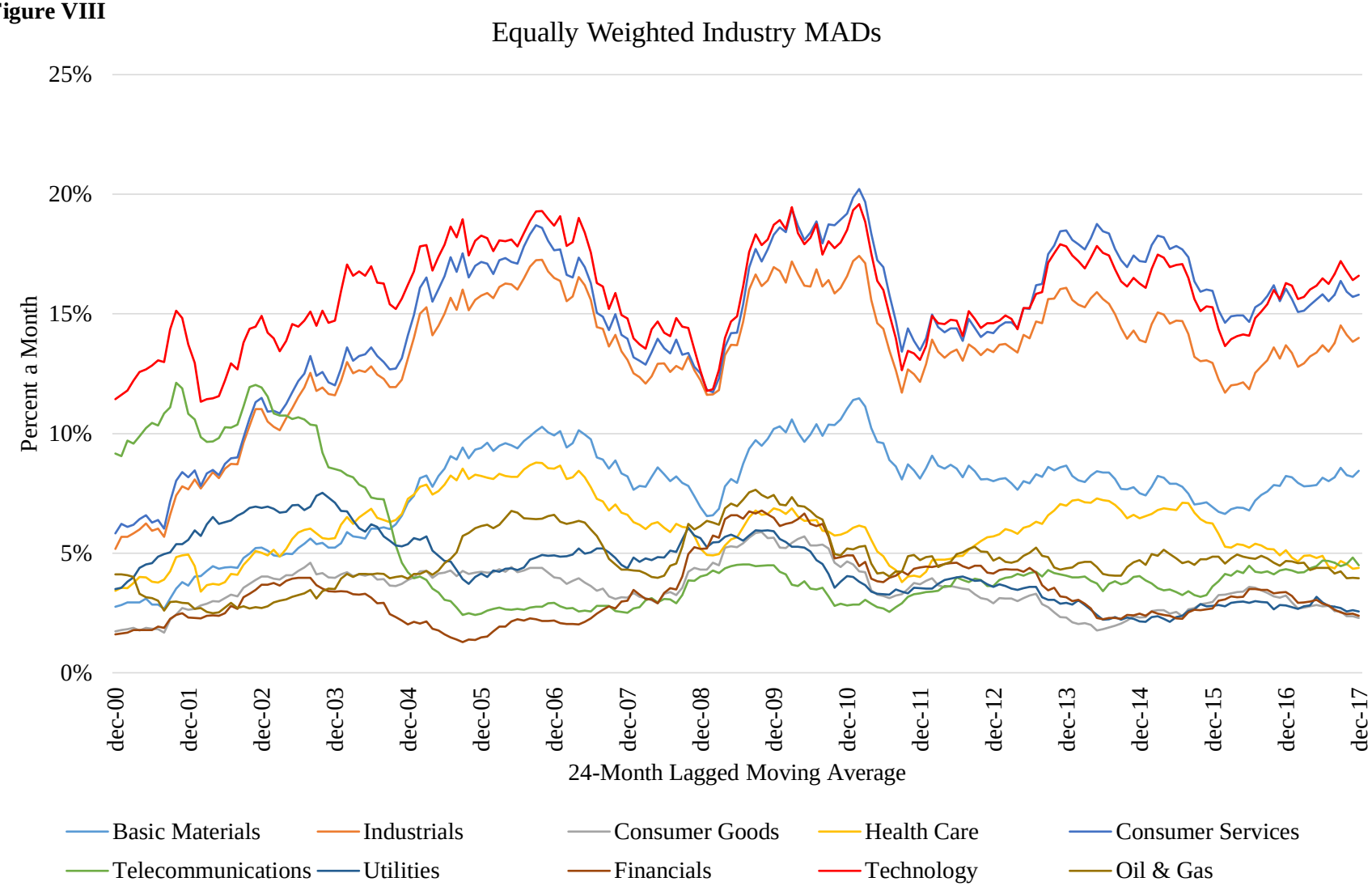
III. Appendix

Figure VII



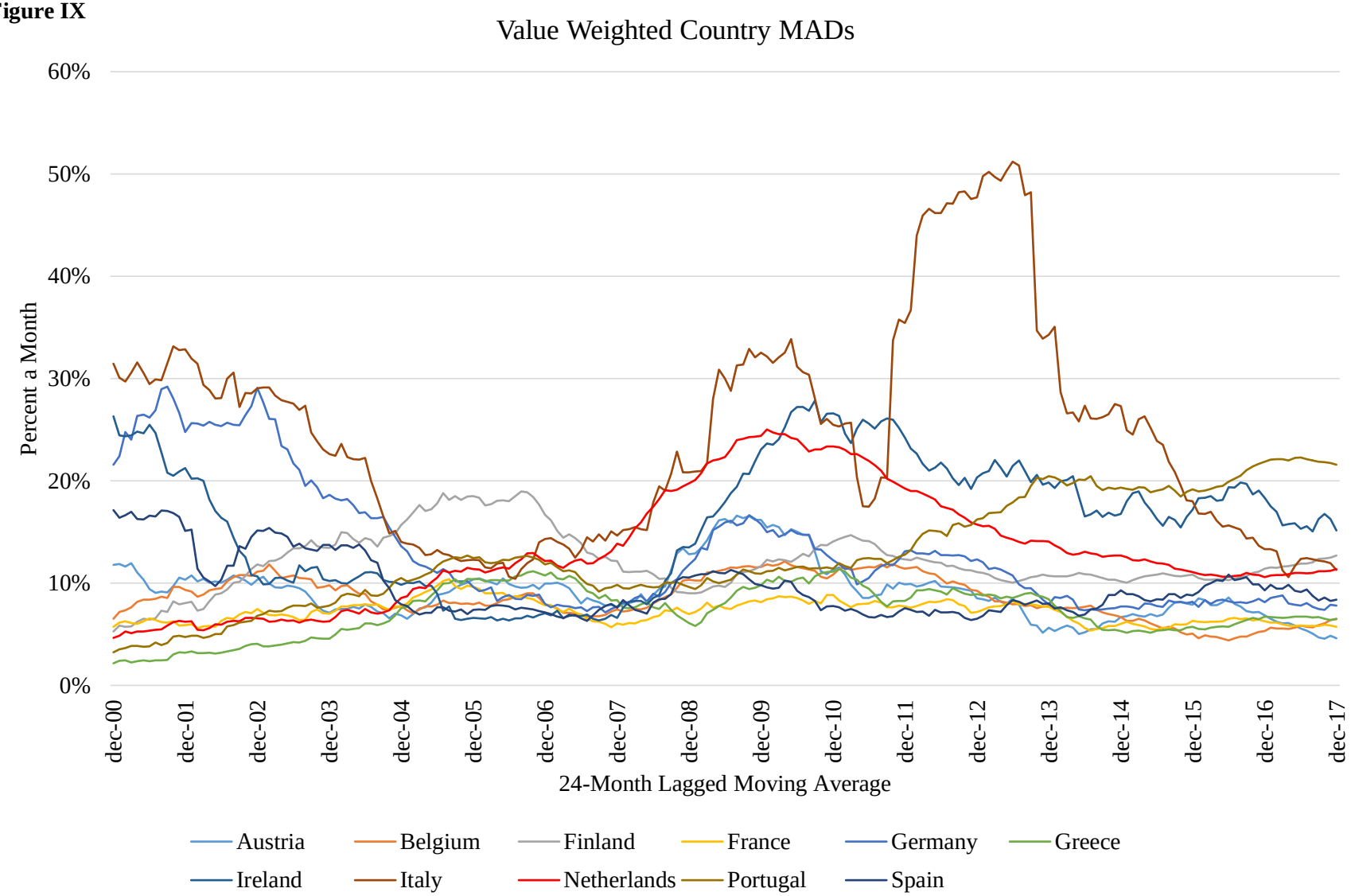
Equally weighted mean absolute deviations of all pure country effects in the Eurozone market. All series are 24-month lagged moving averages. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

Figure VIII



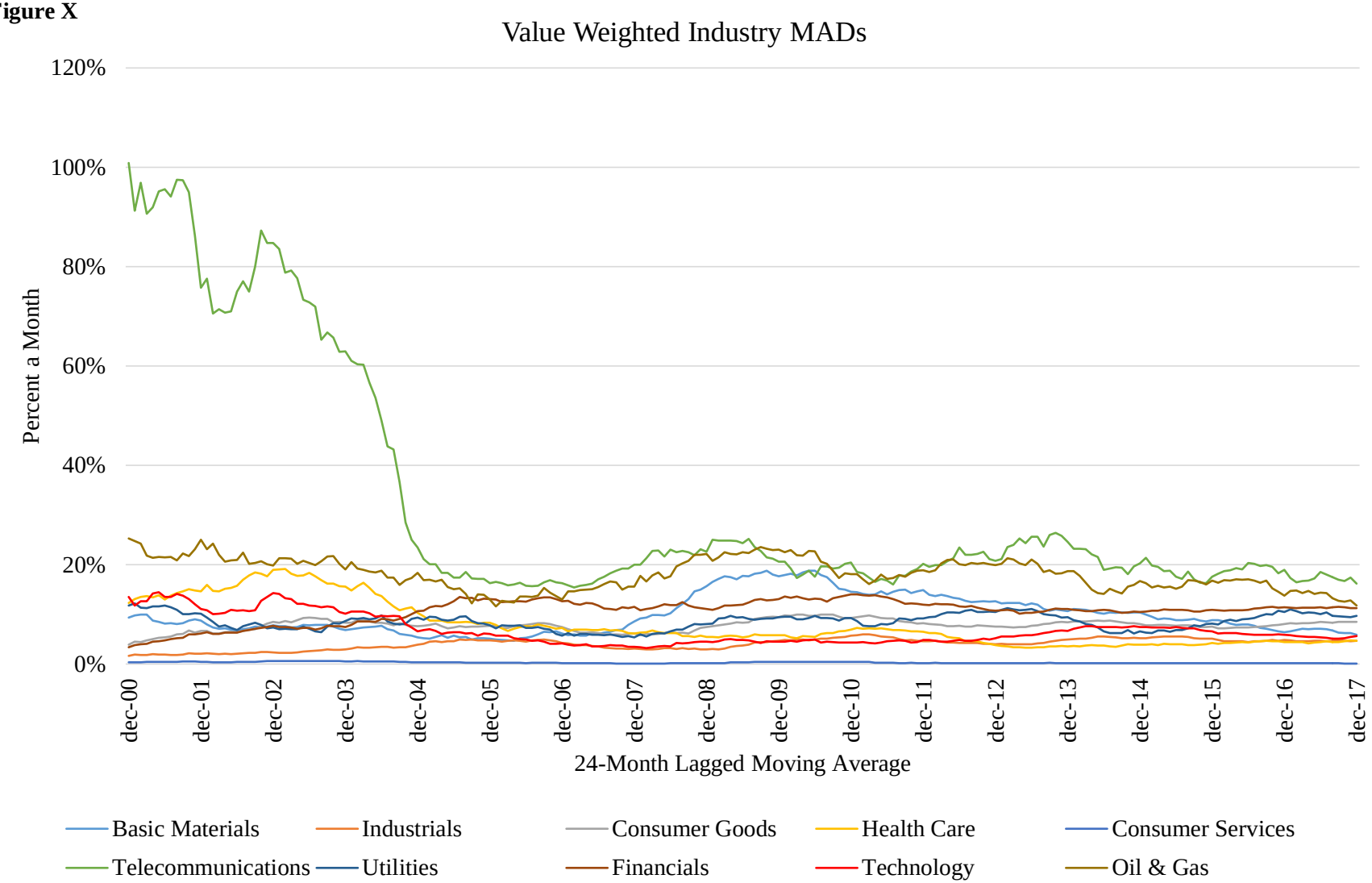
Equally weighted mean absolute deviations of all pure industry effects in the Eurozone market. All series are 24-month lagged moving averages. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

Figure IX



Market capitalization (value) weighted mean absolute deviations of all pure country effects in the Eurozone market. All series are 24-month lagged moving averages. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.

Figure X



Market capitalization (value) weighted mean absolute deviations of all pure industry effects in the Eurozone market. All series are 24-month lagged moving averages. I use the full data set with eleven Eurozone countries and ten industries over the time period from 01-01-1999 to 01-01-2018. Because of the 24-month lag the first data point shown in the figure is from 31-12-2000.