



**Analyzing the systematic
risk of logistics service
providers:**
The influence of market,
industry and company effects



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Agenda

- 1. Paper background**
2. Methodology
3. Results
4. Implications, conclusion and outlook

Current research relevance

Paper Background

Cost of capital of Deutsche Bahn's infrastructure operation

The president of the German network regulation agency (Bundesnetzagentur), Matthias Kurth, today hosted the annual German rail regulation forum. Discussion focussed on the current consultation by Bundesnetzagentur in relation to the allowable return for regulated rail infrastructure activities in Germany.

Christoph Riechmann, a Director at Frontier (Europe), presented the highlights of a Frontier report for the regulator. The report describes approaches to identifying and analysing international benchmark companies that exhibit a similar risk profile to the infrastructure operation of Deutsche Bahn and other operators. This analysis helps to understand the cost of capital of rail infrastructure.

Frontier regularly advises regulators and infrastructure operators across Europe on the financing conditions and cost of capital in industries such as rail, telecoms, water and energy.

Source: <http://www.frontier-economics.com/europe/es/practices/1/n/1027/>



We review these factors every year and update them as required for the following year's corporate planning and performance measurement. In doing so we bear the long-term orientation of the concept in mind and try to smooth short-term fluctuations. As a result the WACC can remain constant in some years even if individual elements change at short notice. This was the case with the regular review of individual parameters for 2010, where the sharp fall in base-rate interest more than offset the effect of higher risk premiums, resulting in a lower figure for WACC. As interest rates were expected to rise again, we nevertheless decided to maintain the WACC at its current figure of 7.9 per cent. It has since been recalculated for 2011 and reduced to 7.0 per cent.

Despite increased operational efficiencies, the company's management believes the current yield of its assets is not yet commensurate with its cost of capital and risk considerations, as such, management will be working diligently to improve such yields.

Source: Agility logistics annual report



Source:

<http://reports.lufthansa.com/2010/ar/groupmanagementreport/companyandorganisation/value-basedmanagement/cashvalueadded.html>

Creditor Relations

The Group's goal is to minimise financial risk and the cost of capital, whilst preserving the Group's lasting financial stability and flexibility. In order to maintain its unrestricted access to the capital markets, the Group continues to aim for a credit rating appropriate to the sector.

By including the cost of capital in our business decisions, we encourage all divisions to use resources efficiently and to organise our operating business to increase value sustainably whilst generating cash flow. In the reporting year, EAC served as a key performance indicator in

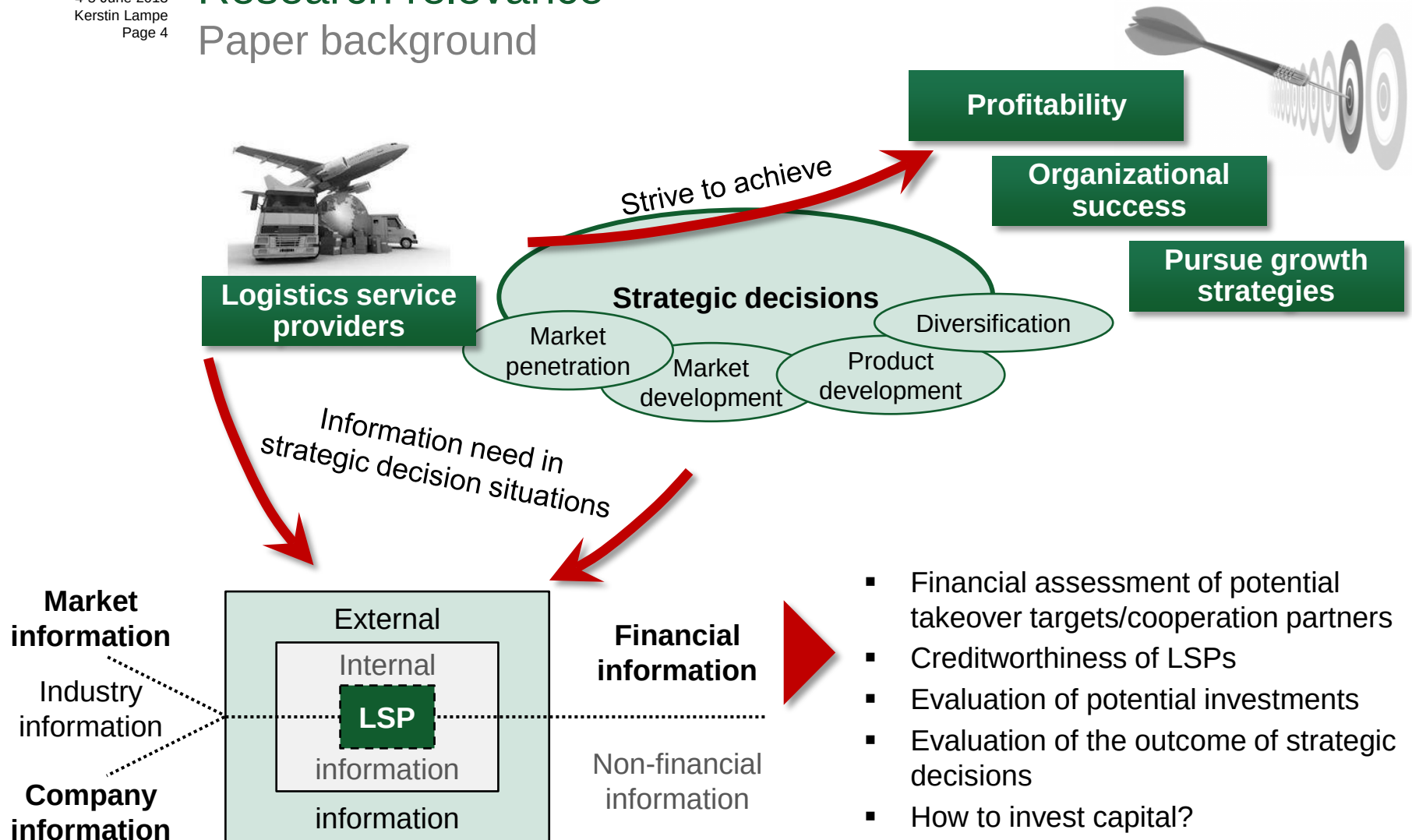
Source: http://www.dp-dhl.com/en/investors/creditor_relations.html

Deutsche Post DHL

- The cost of capital plays an important role in the management of logistics service providers (LSPs), especially regarding their strategic directions and decisions.
- The systematic risk (β) is an important factor when calculating a company's cost of capital.

Research relevance

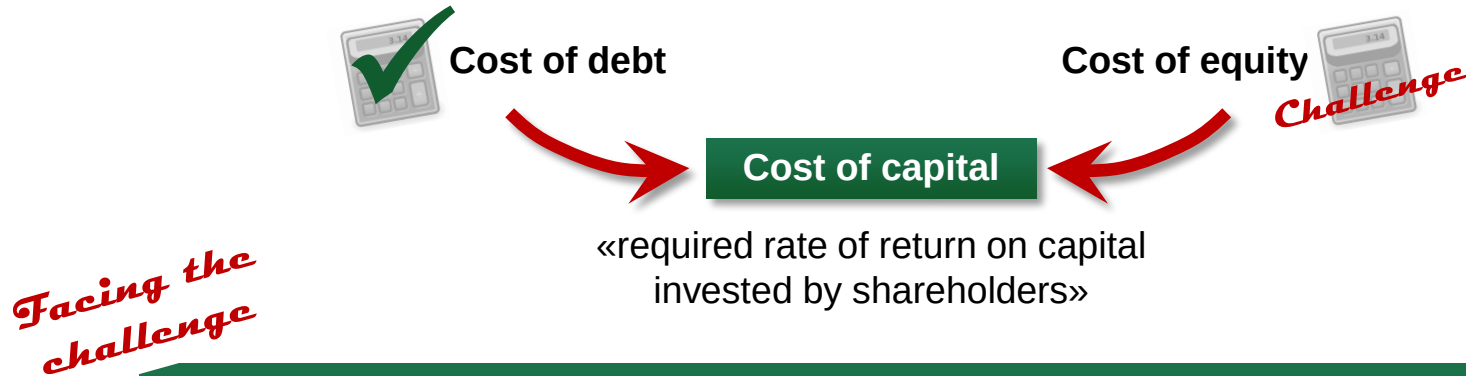
Paper background



- To make financial evaluations and determine financial controls, LSPs have to know their cost of capital.

Cost of capital and systematic risk

Paper background



Weighted average cost of capital (WACC)

within the context of the capital asset pricing model (CAPM)

$$WACC = \left(\frac{E}{E + D} \right) \times r_E + \left(\frac{D}{E + D} \right) \times r_D \times (1 - T_C)$$

$$r_E = r_f + \beta \times (r_m - r_f)$$

E = equity

D = debt

r_E = cost of equity

r_D = cost of debt

T_C = corporate tax rate

r_f = risk free interest rate

r_m = expected return on the market portfolio

β = **beta factor, systematic risk**

R_i = stock price index

R_m = market index

Beta (β) is a key component of the WACC

$$\beta = \frac{\text{cov}(R_i, R_m)}{\sigma^2(R_m)}$$

- Beta is a measure of stock price volatility – that is, the sensitivity of each stock's price to changes in the market.
- Beta represents the percentage performance of the stock which has historically accompanied a one per cent move in the market.

Research question

Information need/sources in
strategic decision making

β as a key factor for the
calculation of cost of capital



**To what extent is the systematic risk (beta) of
logistics service providers dependent on market,
industry and company effects?**

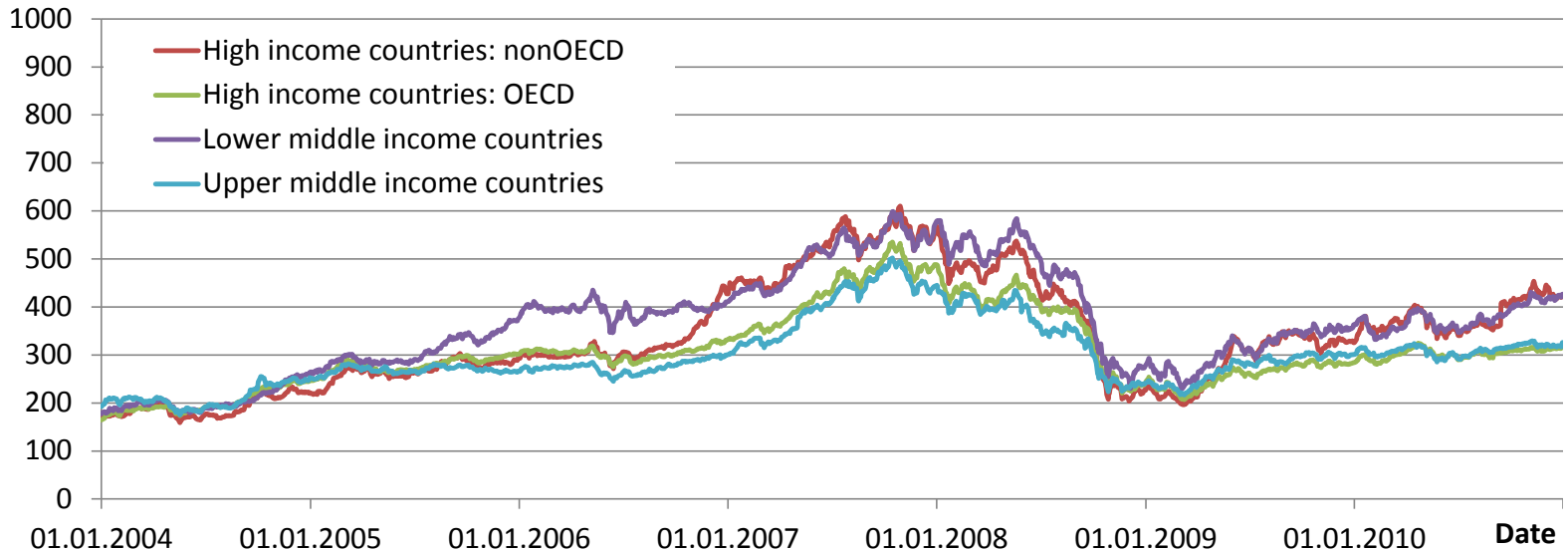
- The analyses shall allow conclusions on the leverage of market, industry and company effects on LSPs' beta and build the basis for further analyses on the composition and determinants of LSPs' cost of capital.

Stock price development of LSPs I/III

Getting a first overview

LSPs clustered by headquarters location (countries' income level)

Index (Year 2000=100)



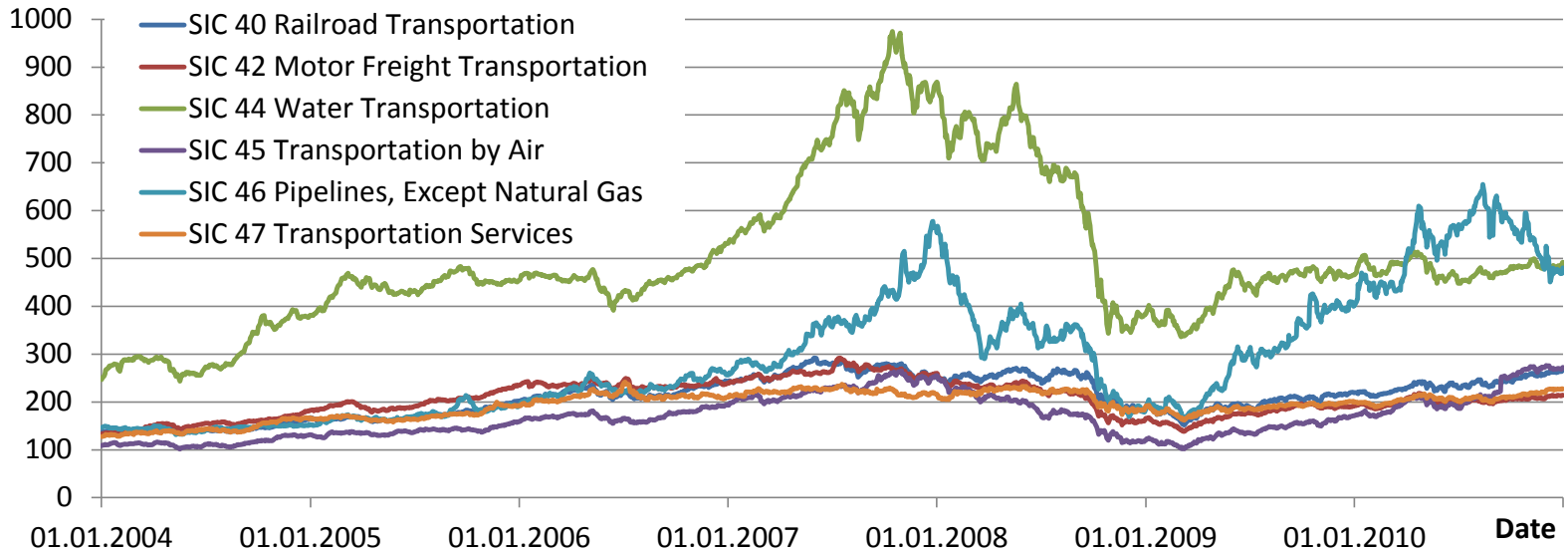
- Clustering LSPs by their headquarters' location does not reveal significant differences in stock price development,...

Stock price development of LSPs II/III

Getting a first overview

LSPs clustered by industry classification (SIC code)

Index (Year 2000=100)



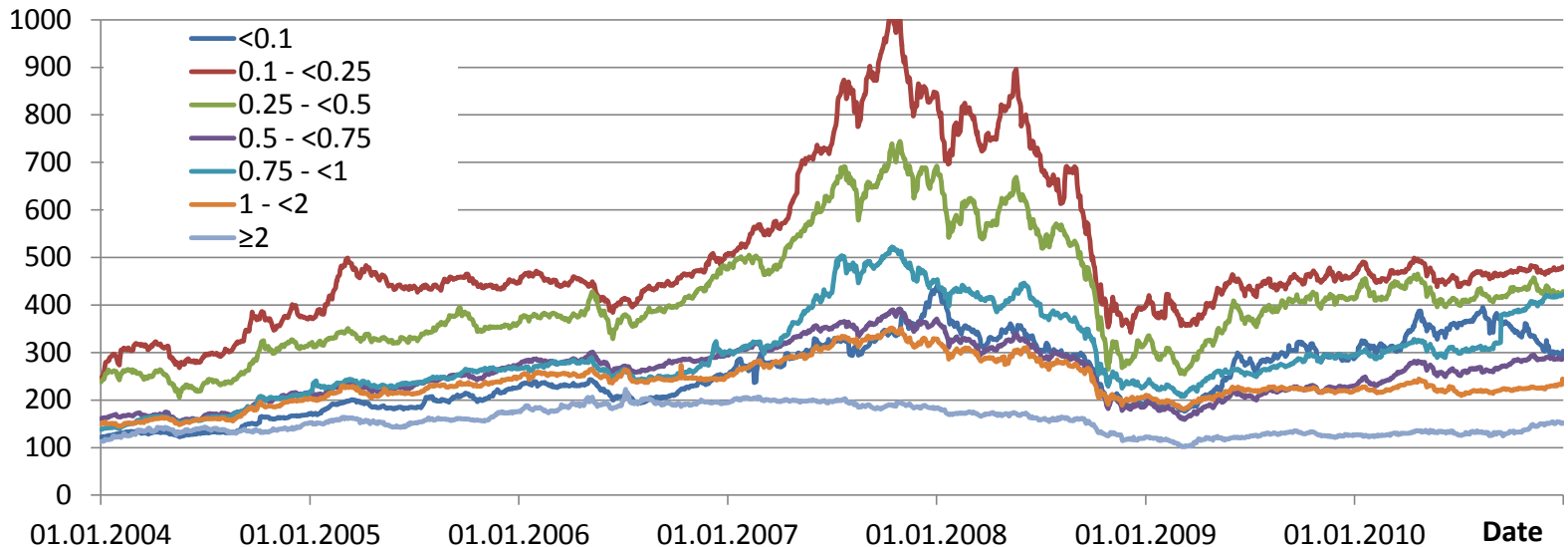
- ...while clustering LSPs by their industry classification (primary SIC code)...

Stock price development of LSPs III/III

Getting a first overview

LSPs clustered by asset turnover (annual revenues to total assets)

Index (Year 2000=100)



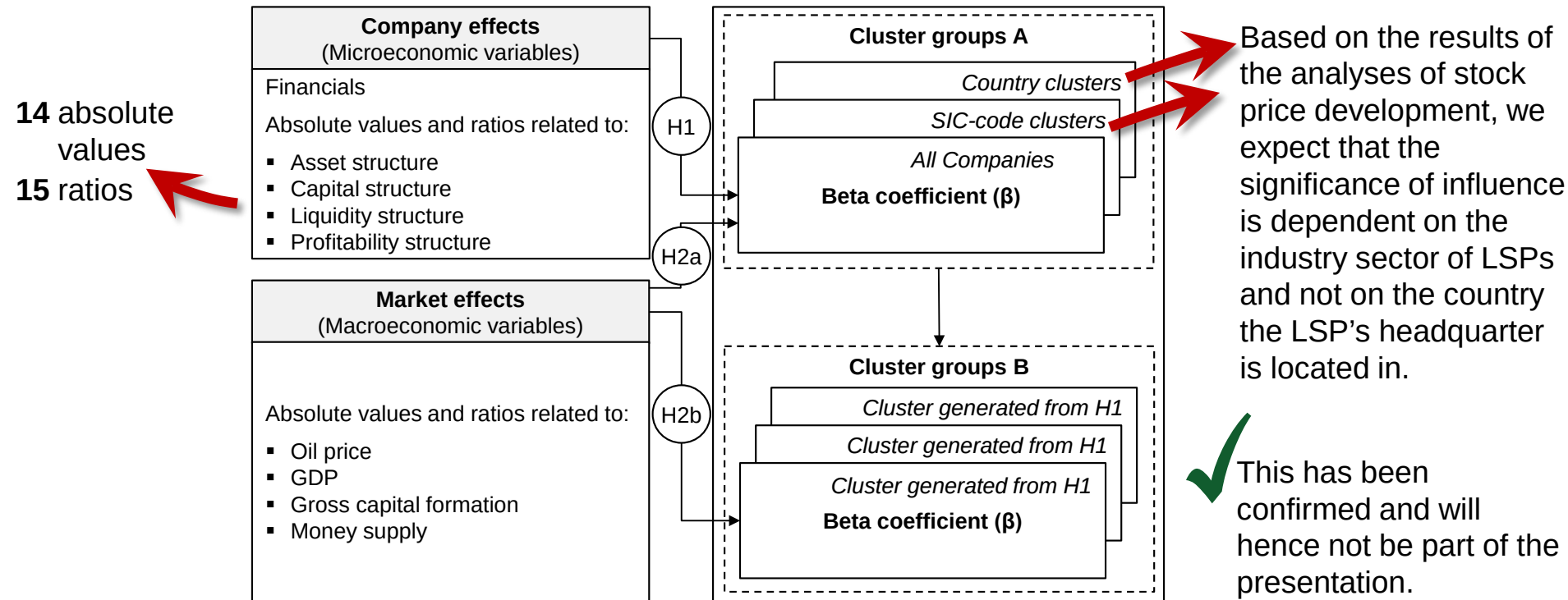
- ...or the level of asset turnover does show significant differences in stock price development.
- This analyses allow first conclusions on expected results.

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Theoretical model for analyses – derived from literature

Methodology



H1: The beta of LSPs is influenced by company effects.

H2a: The beta of LSPs is influenced by market effects.

H2b: Microeconomic characteristics of LSPs affect the explanatory power of macroeconomic variables.

- Correlation and multiple regression analyses are conducted in order to answer the research question.
- β is calculated for each LSP, using stock price and market index data for the time period of five years.

Sample selection – descriptive statistics I/II

Methodology

Cluster (SIC)	ALL LSPs	SIC 40	SIC 42	SIC 44	SIC 45	SIC 46	SIC 47
Cluster description		Railroad Transportation	Motor Freight Transportation	Water Transportation	Transportation by Air	Pipeline, Except Natural Gas	Transportation Services
Number of LSPs	760	48	187	337	140	23	25
Beta	0.32 (0.63)	0.38 (0.50)	0.18 (0.45)	0.33 (0.73)	0.41 (0.61)	0.38 (0.28)	0.52 (0.48)
Absolute (1000 US\$)	Mean value (standard deviation in parentheses)						
Cash flow per share	9.21 (107.45)	6.54 (18.71)	1.46 (57.74)	12.11 (138.86)	8.24 (67.11)	48.33 (199.66)	0.75 (1.18)
Total current assets	611'463 (1'673'788)	833'810 (1'221'419)	214'594 (529'906)	427'359 (1'247'787)	1'457'307 (2'826'401)	1'046'246 (2'890'201)	440'570 (714'312)
Total current liabilities	561'216 (1'643'365)	1'123'661 (2'246'278)	179'729 (441'518)	308'133 (947'317)	1'524'440 (2'967'761)	568'284 (1'150'455)	294'013 (496'098)
EBIT	158'989 (663'820)	620'750 (1'189'785)	35'612 (75'501)	106'245 (620'160)	265'244 (765'348)	379'730 (1'221'440)	76'518 (160'361)
EBIT & depreciation	269'234 (978'624)	949'368 (1'807'999)	64'433 (121'863)	178'426 (924'607)	503'247 (1'082'513)	538'949 (1'702'025)	99'178 (178'178)
Long term debt	816'868 (2'557'209)	2'901'161 (6'860'048)	159'940 (454'107)	586'662 (1'537'707)	1'502'034 (2'741'534)	1'730'225 (3'943'672)	42'301 (78'686)
Net income	84'968 (386'495)	309'690 (652'096)	18'608 (59'577)	55'049 (295'080)	149'305 (550'644)	228'952 (806'471)	43'835 (99'740)
Net sales/revenue	1'789'260 (5'430'791)	3'000'226 (5'448'536)	717'058 (1'692'502)	1'031'210 (3'942'464)	4'438'789 (9'514'687)	2'950'100 (6'064'315)	1'645'841 (2'536'230)
Operating income	144'827 (630'634)	621'057 (1'157'978)	33'306 (71'129)	94'772 (608'884)	220'337 (670'597)	367'708 (1'142'348)	79'751 (160'997)
Property, plant & equipment	1'569'333 (4'911'056)	6'646'942 (13'332'655)	367'438 (893'623)	1'018'166 (2'918'269)	2'699'078 (4'690'264)	3'154'995 (8'232'728)	147'637 (252'629)
Total assets	2'579'179 (7'092'887)	8'168'849 (15'160'763)	710'062 (1'488'464)	1'739'855 (4'803'834)	5'085'045 (9'367'922)	4'669'999 (11'247'478)	802'815 (1'328'270)
Total capital	1'734'691 (4'769'033)	5'786'458 (11'049'612)	466'030 (1'029'773)	1'355'365 (3'668'587)	2'788'102 (4'672'656)	3'800'373 (9'332'690)	474'392 (808'711)
Total debt	973'137 (2'883'166)	3'241'108 (7'462'934)	215'592 (527'176)	705'274 (1'765'481)	1'848'680 (3'352'426)	1'830'115 (4'062'999)	87'670 (165'016)
Total shareholder's equity	872'530 (2'466'281)	2'840'442 (4'861'755)	298'170 (659'711)	706'458 (2'123'467)	1'238'929 (2'542'922)	1'984'269 (5'183'103)	413'981 (734'967)

- LSPs with the appropriate SIC code and being active since at least 2006 have been chosen for the analysis of microeconomic variables...

Sample selection – descriptive statistics II/II

Methodology

Cluster (SIC)	ALL LSPs	SIC 40	SIC 42	SIC 44	SIC 45	SIC 46	SIC 47
Cluster description		Railroad Transportation	Motor Freight Transportation	Water Transportation	Transportation by Air	Pipeline, Except Natural Gas	Transportation Services
Number of LSPs	760	48	187	337	140	23	25
Ratios	Mean value (standard deviation in parentheses)						
Cash flow/sales	8.85 (188.13)	19.47 (14.36)	8.84 (23.05)	7.14 (279.85)	9.86 (14.31)	24.66 (23.85)	-7.73 (69.83)
Quick ratio	1.81 (4.25)	2.08 (2.11)	1.55 (3.42)	2.10 (5.65)	1.51 (1.55)	1.55 (1.56)	1.28 (1.02)
Current ratio	2.09 (4.65)	2.37 (2.27)	1.78 (3.51)	2.41 (6.27)	1.76 (1.62)	1.79 (1.58)	1.65 (1.07)
Intensity of investment	0.54 (0.26)	0.68 (0.20)	0.49 (0.24)	0.60 (0.24)	0.48 (0.24)	0.59 (0.28)	0.27 (0.27)
Asset intensity 1	4.44 (9.71)	5.97 (4.66)	2.72 (3.78)	5.83 (12.79)	2.57 (5.44)	6.38 (6.64)	3.74 (14.36)
Continuous intensity	0.31 (0.20)	0.20 (0.17)	0.34 (0.18)	0.27 (0.19)	0.37 (0.20)	0.24 (0.25)	0.53 (0.23)
Asset intensity 2	2.06 (6.90)	0.49 (1.00)	2.50 (9.59)	1.47 (5.53)	2.91 (7.08)	0.95 (1.90)	6.10 (6.15)
Asset turnover	0.84 (0.85)	0.55 (0.34)	1.09 (0.88)	0.52 (0.48)	1.17 (0.94)	0.51 (0.50)	2.33 (1.61)
Current asset turnover	2.93 (2.12)	3.39 (2.00)	3.34 (2.02)	2.36 (2.14)	3.28 (1.63)	3.05 (2.35)	4.70 (2.62)
Debt to equity ratio	0.81 (12.48)	1.21 (1.88)	0.79 (2.07)	0.22 (18.21)	2.10 (5.73)	0.95 (3.99)	0.87 (2.09)
Equity ratio	0.79 (3.64)	0.57 (0.26)	0.71 (0.33)	0.93 (5.37)	0.66 (1.49)	0.61 (0.29)	0.81 (0.25)
Debt ratio	0.32 (4.61)	0.51 (0.35)	0.60 (1.92)	0.08 (6.68)	0.44 (1.62)	0.51 (0.44)	0.29 (0.35)
ROE	0.11 (1.18)	0.05 (0.21)	0.07 (0.56)	0.06 (0.78)	0.17 (1.80)	0.04 (0.15)	0.90 (3.57)
ROA	0.00 (0.33)	0.03 (0.05)	0.00 (0.25)	0.02 (0.10)	-0.03 (0.53)	0.03 (0.05)	-0.16 (0.99)
Net profit margin	-0.03 (1.98)	0.06 (0.17)	0.05 (0.54)	-0.09 (2.84)	0.02 (0.13)	0.04 (0.14)	-0.50 (2.63)

- ...the active period from 2006-2010 is required in order to calculate beta. In total, 760 LSPs from 70 countries have been analyzed.

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Example of quantitative results

Results of regression analysis of beta coefficient and absolute microeconomic variables

	All LSPs	SIC 40	SIC 42	SIC 44	SIC 45	SIC 46	SIC 47
R ²	0.261	0.272	0.262	0.151	0.165	0.574	0.847
Absolute (US\$)	Standardized slope of regression (t-value in parentheses)						
(Constant)	(13.656)	(2.319)	(3.251)	(8.470)	(4.443)	(2.793)	(1.318)
Cash flow per share	-0.096 -(1.369)	0.007 (0.047)	-0.102 -(0.978)	-0.226 -(0.916)	-0.015 -(0.168)	-2.002 -(0.766)	0.962 (3.163) ***
Total current assets	0.080 (0.532)	1.976 (1.180)	-0.526 -(0.822)	-1.039 -(2.989)	*** -(0.309)	-0.148 -(1.393)	-8.995 (4.641) ***
Total current liabilities	-0.281 -(1.130)	-2.717 -(1.465)	-1.565 -(2.203)	** (1.435)	1.033 -(0.023)	-0.025 (1.355)	3.473
EBIT	-0.029 -(0.054)	-8.007 -(0.847)	-0.539 -(0.927)	-2.189 -(1.151)	2.216 (1.722)	*	-1.085 -(0.198)
EBIT & depreciation	-0.294 -(0.578)	10.909 (1.016)	1.320 (2.559)	** -(0.654)	-1.118 -(1.866)	-3.043 *	-6.281 -(1.337)
Long term debt	-0.408 -(0.482)	-5.570 -(0.717)	-0.434 -(0.257)	1.780 (1.392)	0.673 (0.184)	16.863 (1.165)	3.120 (2.526) **
Net income	-0.070 -(0.313)	0.554 (0.165)	0.122 (0.422)	0.882 (1.588)	-0.188 -(0.286)	-6.735 -(1.294)	1.245 (0.770)
Net sales or revenues	0.135 (0.936)	-1.520 -(0.774)	1.465 (2.793)	*** -(0.816)	-0.318 (0.654)	0.402 (0.415)	1.202 (4.487) ***
Operating income	0.329 (1.461)	0.160 (0.074)	-0.487 -(1.141)	1.937 (2.840)	*** -(0.230)	-0.089 (1.790)	15.575 *
Property, plant & equipment	-0.025 -(0.091)	-1.805 -(0.288)	-0.433 -(1.091)	0.343 (0.680)	1.081 (1.580)	-0.316 -(0.037)	0.937 (1.006)
Total assets	0.851 (1.749)	* (0.366)	3.812 (0.385)	0.473 -(0.155)	-0.359 (0.165)	0.200	-16.765 -(3.186) ***
Total capital	0.465 (0.344)		0.580 (0.154)	1.620 (0.670)	0.870 (0.161)		
Total debt	-0.112 -(0.220)	3.067 (0.530)	0.409 (0.473)	-2.116 -(1.913)	* -(1.094)	-1.224 -(1.604)	-23.007 -(1.273)
Total shareholder's equity	-0.488 -(0.650)	-1.586 -(0.719)	-0.438 -(0.192)	-0.121 -(0.135)	-0.366 -(0.115)	5.182 (2.318)	** (3.223) ***

***significant at 1% level, **significant at 5% level, *significant at 10% level.

High explanatory power
Significant at 1% level
(p-value is not shown separately here)

- In total 10 result tables (only for regression analysis) exist, in addition to results of correlation analysis.

Summarized results

Based on the theoretical model

The beta of LSPs is influenced by company effects (**microeconomic variables**).

- There is no uniform “structure” of microeconomic variables influencing LSPs’ beta.
- All LSPs: Continuous intensity and asset turnover are highly significant (but overall explanatory power rather low).
- Industry clusters: Obvious differences regarding absolute values as well as ratios.
- Ratios more significant than absolute values.
- Country clusters are not appropriate to explain the correlation between microeconomic variables and beta of LSPs.

Microeconomic characteristics of LSPs affect the explanatory power of macroeconomic variables.

- Overall significant variables from microeconomic analysis: total current assets, total shareholders’ equity, net sales or revenue, continuous intensity, and asset turnover ► for alternative cluster formation
- High explanatory power and significance.

The beta of LSPs is influenced by market effects (**macroeconomic variables**).

- Except the mean oil price, all variables significantly correlate with all LSPs beta.
- Mean oil price significantly correlates with SIC 46’s (pipeline) beta.
- Explanatory power of regression models nearly 1 in all models referring to SIC code clusters.
- Country clusters are not appropriate to explain the correlation between macroeconomic variables and beta of LSPs.

Cluster groups B

Cluster generated from H1

Cluster generated from H1

Cluster generated from H1

Beta coefficient (β)

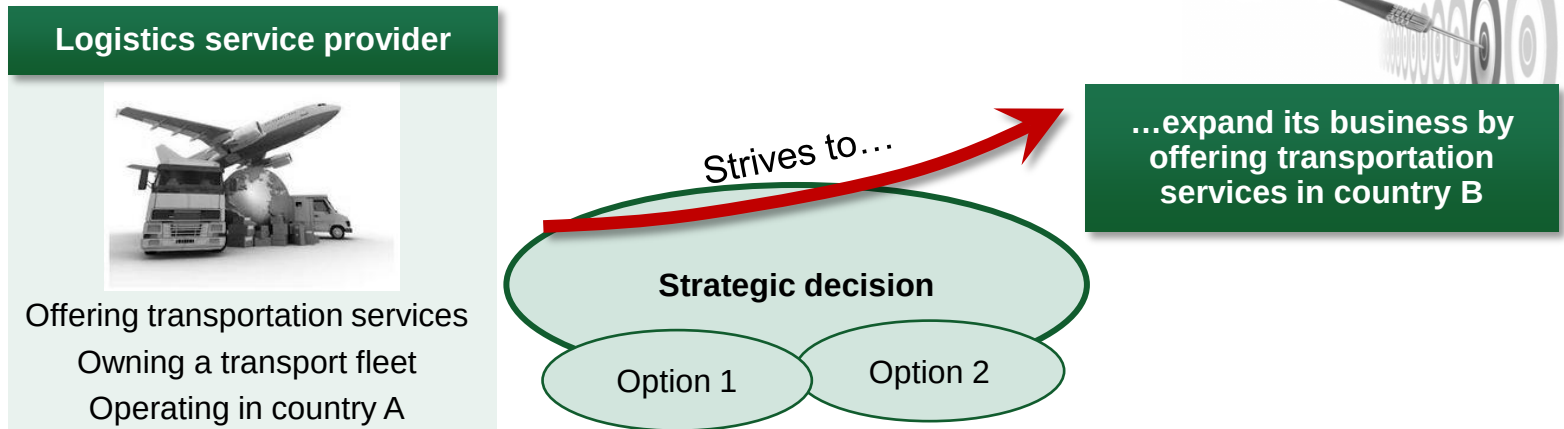
- All hypotheses could be confirmed, but the influence of macroeconomic variables on LSPs’ beta is more significant than of microeconomic variables.

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Practical implications

Hypothetical case



Option 1: Buy / enlarge the transportation fleet and offer transportation service on its own behalf.

Option 2: Establish cooperation with an LSP that is already offering transportation services in country B.

Choosing option 1 leads to (related to results):

- Higher total assets
- lead to a higher beta
- which implies higher cost of capital.
- Lower continuous intensity (current/total assets)
- Leads to a higher beta as well.
- Share price develops more closely to the stock market that means higher returns for stakeholders in case of a positive market development (v.v.).

Choosing option 2 leads to (related to results):

- No direct influence on the total asset structure and hence beta.

If the LSP is intended to reduce its cost of capital and the volatility of its share price to market development, the economic climate of the country the LSP wants to expand in is no less important. Economies tending to be rather less developed could enable a lower beta (in future, after having made a decision).

- Since not only microeconomic variables do influence beta, the LSP would also have to look at macroeconomic variable when making its decision.

Conclusion, limitations and future research

Outlook

CONCLUSION

To what extend is the systematic risk (beta) of logistics service providers dependent on market, industry and company effects?

- The influence of market effects is much more significant than of company effects.
- Clear differences can be observed regarding the industry sector (SIC code) LSPs are operating in.

LIMITATIONS

- Only quoted LSPs were analyzed whose primary SIC code refers to logistics services. Hence not all potential LSPs might have been identified.
- Beta has been calculated using daily stock data for five years. The time periods used for calculating beta vary in general between 2 to 10 years.
- S&P 500 was used as market index to calculate beta. Another one could have been used.
- Results of analyzing beta's determinants are also dependent on time period under consideration and industry sector.

FUTURE RESEARCH

- Can be derived from limitations.
- Integration of WACC or cost of capital into quantitative analyses to investigate further determinants of cost of capital.
- Integration of "classic" time series of logistics parameters (e.g. ton-kilometers or number of picks etc.) in order to gain new suggestion for strategic decision of LSPs – focusing on financial and non-financial information as well.



Thank you for your attention. Questions? Comments?



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