



Supply Chain Risk Management:

Country Selection, Sustainability and Competitiveness

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Seite 1

Technology
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Country Selection, Sustainability and Competitiveness

THIS IS A WORK-IN-PROGRESS REPORT – FIRST STEPS

Presentation based on:

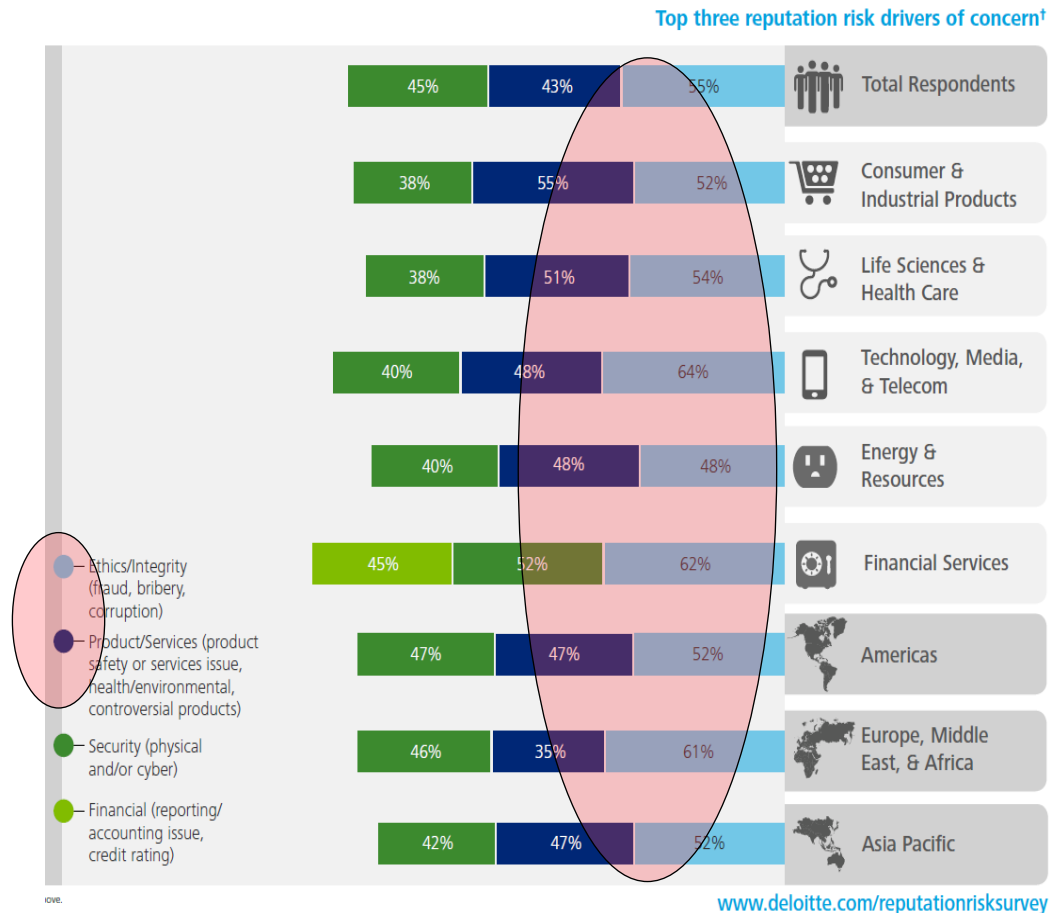
Wolfgang Veit&Moritz Brand: „Nachhaltigkeit und Wettbewerbsfähigkeit“, to be published by Springer 2018

Contents:

- Introduction
- Literature overview
- Methods and Data
- Analysis
- Discussion

Problem Statement: Reputation Risk

- Violating ethical norms damages firm's reputation
- Sustainability has increasingly been accepted as an ethical norm
- Reputation Risk is considered to be a major strategic risk (Deloitte 2014)
- Sustainability is a major risk driver
- Sustainability is assumed to be a cost driver



Problem Statement: Reputation Risk

Deloitte: “...*More than half of companies surveyed say they plan to address reputation risk by investing in technology such as **analytical and brand monitoring tools** as well as crisis management and scenario planning*”.

SAP (Germany): “...*ensure **early** identification of potential events impacting our reputation*”

CEMEX (Mexico): “*We need to know about it **beforehand** ... Because when you discover that something happened the same day, it will be very difficult to manage*”

(Forbes Magazine, Jan 5th, 2015)

Problem Statement: Sustainability vs. Competitiveness

Thomas Malthus (1798):

Population growth will exceed supply of natural resources

Meadows/Club of Rome (1972: The limits to growth):

Economic activity is incompatible with environmental protection

Politics:

USA/Trump (withdrawal from international agreements/global agreement on climate change)

German State of NRW: protecting coal mining

Widened Concept of Sustainability:

Triple Bottom Line

...

Definition of Sustainability

TBL

„*Providing for economic and intangible fundamental needs of present and future*”

- trade off between now and later necessary : allocation of resources to present and future

Sustainability Paradox:

Hotelling: *The Economics of Exhaustible Resources (1931)*:

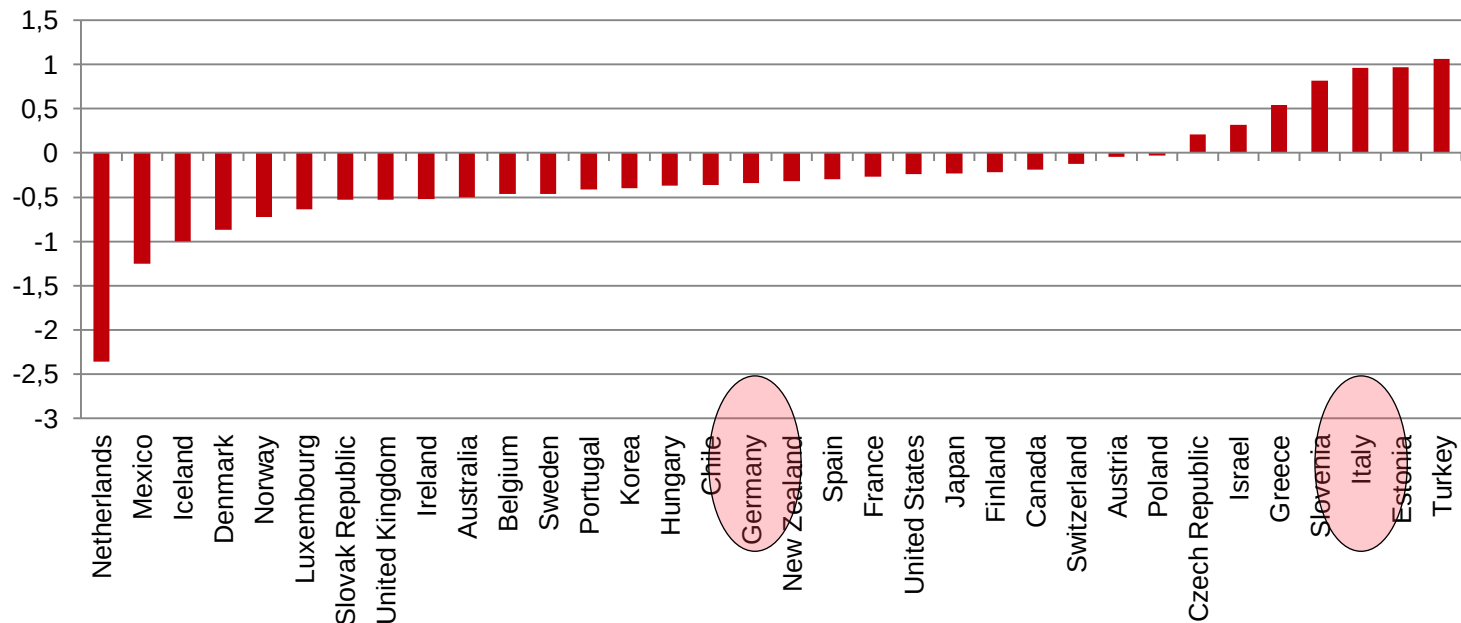
“present and future prices of exhaustible resources determine their consumption”

Conclusion: sustainability margin to work as a wedge between producer and consumer prices

Sustainability vs. Competitiveness

Sustainability Margin: empirical evidence

Fig. 1: Change in Ratio of Environmental Taxes to GDP
2000-2014 in %-Points



OECD, author's calculations

Literature Review

Costs of Sustainability

Hotelling based: reduced resource consumption

Jaffe (1995), Erlei (2007), Bolognesi&Nahrat (2017):

- Transaction cost
- Indirect (spill over) cost
- Direct cost
- Change in property rights (Energy Turnaround, „Dieselgate“ in Germany!)

Bolognesi&Nahrat (2017): higher “institutional complexity” through increasing marginal cost of sustainability measures

Literature Review

Benefits of Sustainability

Müller (2009), Brown (2010): social, economic and ecologic damages are prevented

Hotelling: improved intertemporal allocation of resources

World Bank (2009), Wolfer (2011), Fagerberg&Shrolec(2007):
Initiate product and process innovations

Byrne (2017): Protection of property rights

Muff&Kapalka(2017): indirect effects of sustainability margin

Literature Review

Competitiveness

Definition: relative concept

Porter (1998): Diamond-model

Davies&Ellies (2000): Diamond model not relevant

Rugman (2010): Double diamond model

Wignaraja (2003): politics dominates business competitiveness

Sneirson (2009): indirect effects of TBL through corporate governance

Porter (1995), Porter (2002), Jaffe (1995): inconclusive empirical results of effect of sustainability on national competitiveness

Margolis (2007), Haanaes (2013), Friede (2015), Halbritter (2015): weak positive relationship on firm level.

Literature Review

Investor perspective: empirical evidence on link between sustainability and competitiveness in Europe

	01.07.12 – 30.06.17 return	01.07.12 – 30.06.17 volatility	01.07.12 – 30.06.17 Sharpe Ratio
STOXX Europe ESG Leaders 50 Index	11,3%	17,0%	0,6
EURO STOXX 50 Index	12,5%	19,1%	0,7
STOXX Global ESG Leaders Index	12,0%	2,3	0,8
STOXX Global 1800 Index	11,7%	2,6	1,0

Literature Review

Investor perspective: empirical evidence on link between sustainability and competitiveness in US

	01.07.12 – 30.06.17 return	01.07.14 – 30.06.17 volatility	01.07.14 – 30.06.17 Sharpe Ratio
iShares MSCI USA ESG Select ETF	13,93%	10,96%	n/a
MSCI USA ESG Select Index	13,84%	10,97%	0,8
MSCI USA Index	13,88%	10,4%	0,82

Literature Review

Investor perspective: empirical evidence on link between sustainability and competitiveness in Emerging Markets

	01.08.12 – 31.07.17 return	01.08.14 – 31.07.17 volatility	01.08.14 – 31.07.17 Sharpe Ratio
MSCI AC Asia ESG Leaders Index	11,29%	12,14%	0,63
MSCI AC Asia Index	9,81	12,96%	0,50
MSCI Emerging Markets (EM) ESG Leaders Index	8,93%	15,25%	0,42
MSCI Emerging Markets Index	5,14%	16,38%	0,22

Methodology

Data sources: TBL-Sustainability Scores

Concept	Year	Classification by Muff/Kapalka
Agenda 21	1992	3
Millennium Development Goals	2000	
Happy Planet Index	2006	2
Sustainable Society Index	2008	2
Sustainable City Index	2008	2
Better Life Index	2011	2
Sustainability Adjusted Global Competitiveness Index	2011	1
World Happiness Report	2012	2
Country Sustainability Ranking	2013	1
Sustainable Competitiveness Index	2013	1
Social Progress Index	2014	2
Cercle Indicateur	2015	2
Sustainable Development Goals	2015	
GAPFRAME	2017	3

Methodology

Data sources:

Competitiveness

GCI (2016), WEF

PCI at PPP (2017), World Bank

TFP (2016), Conference Board

Methodology

Sustainability

SSI (Sustainable Society Foundation): 2016 scores

21 indicators for 154 countries

Methodology

SSI variables

Human Wellbeing	Basic Needs	Sufficient Food	HU_BN_1
		Sufficient to Drink	HU_BN_2
		Safe Sanitation	HU_BN_3
	Personal Dev. & Health	Education	HU_PDH_1
		Healthy Life	HU_PDH_2
		Gender Equality	HU_PDH_3
	Well-balanced Society	Income Distribution	HU_WBS_1
		Population Growth	HU_WBS_2
		Good Governance	HU_WBS_3
Environmental Wellbeing	Natural Resources	Biodiversity	EN_NR_1
		Renewable Water Resources	EN_NR_2
		Consumption	EN_NR_3
	Climate & Energy	Energy Use	EN_CE_1
		Energy Savings	EN_CE_2
		Greenhouse Gases	EN_CE_3
		Renewable Energy	EN_CE_4
Economic Wellbeing	Transition	Organic Farming	EC_T_1
		Genuine Savings	EC_T_2
	Economy	GDP	EC_E_1
		Employment	EC_E_2
		Public Debt	EC_E_3

Methodology

Quantitative Analysis

Correlation analysis of SSI and competitiveness scores

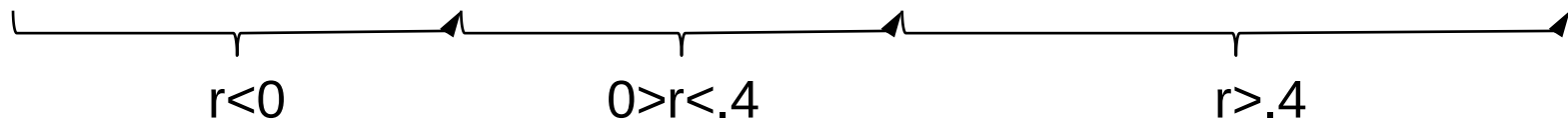
PCA to reduce number of dimensions

OLS regression to assess impact of PCA-variables on competitiveness

Analysis

Correlation analysis of SSI and competitiveness scores

		Environmental Wellbeing Environmental Wellbeing Environmental Wellbeing Environmental Wellbeing Environmental Wellbeing Economic Wellbeing Economic Wellbeing Environmental Wellbeing Human Wellbeing Human Wellbeing Economic Wellbeing Environmental Wellbeing Human Wellbeing Economic Wellbeing Human Wellbeing Human Wellbeing Human Wellbeing Human Wellbeing Human Wellbeing Economic Wellbeing Human Wellbeing Human Wellbeing																						
		Climate &Energy	Climate &Energy	Climate &Energy	Natural Resources	Natural Resources	Economy	Economy	Climate &Energy	Well-balanced Society	Well-balanced Society	Transition	Natural Resources	Personal Dev. & Health	Transition	Basic Needs	Basic Needs	Basic Needs	Personal Dev. & Health	Economy	Personal Dev. & Health	Well-balanced Society		
		Energy Use	Greenhouse Gases	Renewable Energy	Consumption	Renewable Water Resources	Public Debt	Employment	Energy Savings	Income Distribution	Population Growth	Genuine Savings	Biodiversity	Gender Equality	Organic Farming	Sufficient Food	Safe Sanitation	Sufficient to Drink	Education	GDP	Healthy Life	Good Governance		
		EN_CE_1	EN_CE_3	EN_CE_4	EN_NR_3	EN_NR_2	EC_E_3	EC_E_2	EN_CE_2	HU_WBS_1	HU_WBS_2	EC_T_2	EN_NR_1	HU_PDH_3	EC_T_1	HU_BN_1	HU_BN_3	HU_BN_2	HU_PDH_1	EC_E_1	HU_PDH_2	HU_WBS_3		
GCI	r	-,571	-,545	-,462	-,384	-,108	-,086	,031	,180	,223	,295	,310	,346	,402	,405	,451	,524	,544	,571	,631	,643	,697		
	p	<0.01	<0.01	<0.01	<0.01	,2	,3	,7	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		



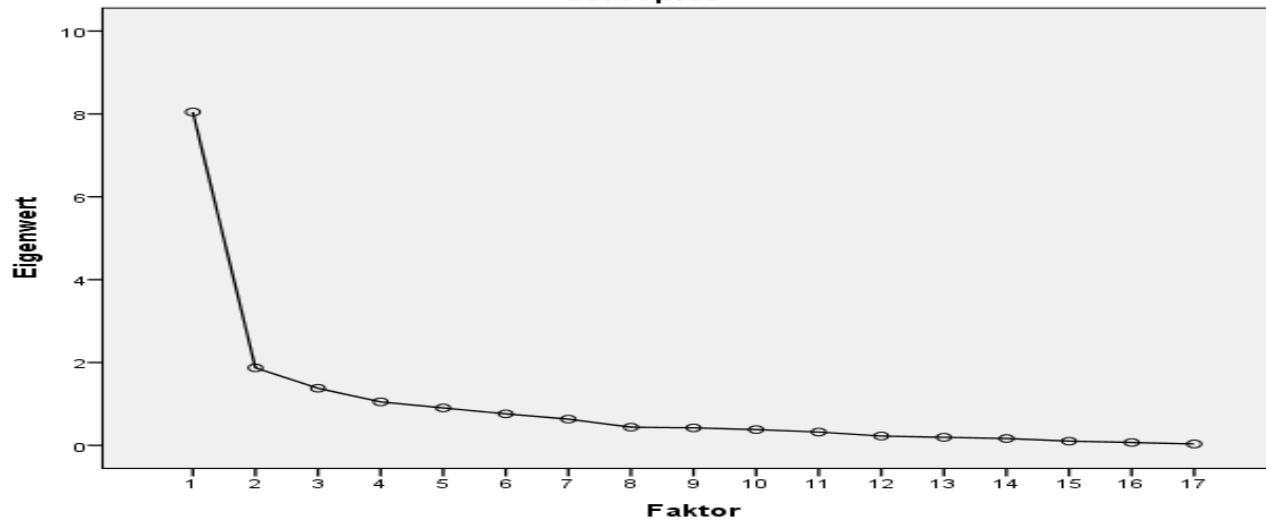
Analysis

PCA to reduce number of SSI dimensions

KMO- und Bartlett-Test

Maß der Stichprobeneignung nach Kaiser-Meyer-Olkin.		,882
Bartlett-Test auf Sphärizität	Ungefähres Chi-Quadrat	1943,742
	df	136
	Signifikanz nach Bartlett	0,000

Screeplot



Analysis

PCA to reduce number of SSI dimensions

PCA results

- Three components explaining a total 66% of variance
- Oblimin rotation shows strong loadings of variables on only one component
- Three variables identified:
 1. Personal Health (PG)
 2. Natural Environment (NU)
 3. Efficiency (EF)

Analysis

Correlation of new variables with GCI

	Korrelationen (Pearson)						
	TFP1016	PG	NU	EF	GCI	HU	EN
PG	-,102						
NU	,109	,169*					
EF	,226*	-,183*	,003				
GCI	,071	,648**	,285**	-,126			
HU	-,027	-,096	-,025	,074	-,194*		
EN	-,056	,110	,139	,018	,108	-,669**	
EC	-,070	-,042	-,049	,015	-,120	,570**	-,488**

*. Die Korrelation ist auf dem Niveau von 0,05 (2-seitig) signifikant.

**.. Die Korrelation ist auf dem Niveau von 0,01 (2-seitig) signifikant.

Analysis

OLS-Regression: impact of PG, NU on GCI

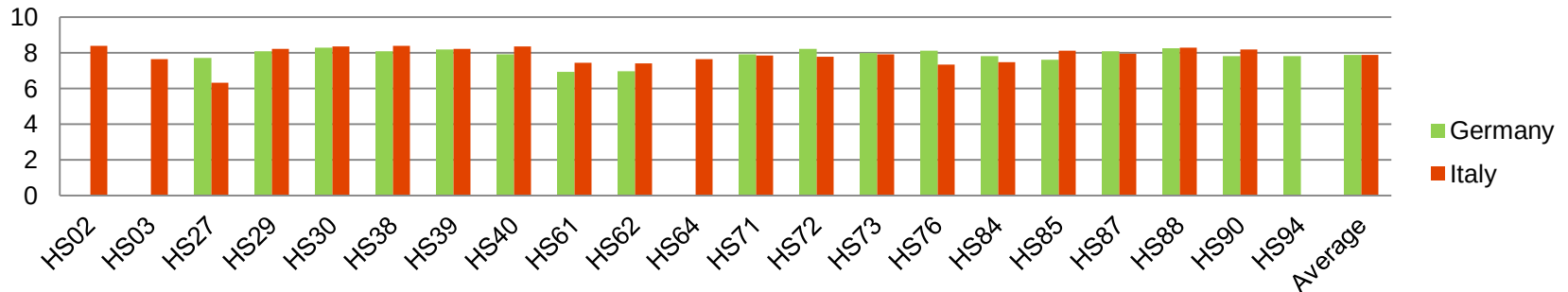
Regression

	Non-standard coefficients		standardized coefficients	T	Sig.	correlations			Collinearity statistics	
	Regression Coefficient B	Standard error	Beta			Zero order	Partial	Part	Tolerance	VIF
(constant)	3,904	,092		42,423	,000					
PG	,857	,094	,617	9,142	,000	,648	,635	,608	,971	1,029
NU	,251	,094	,181	2,676	,008	,285	,234	,178	,971	1,029

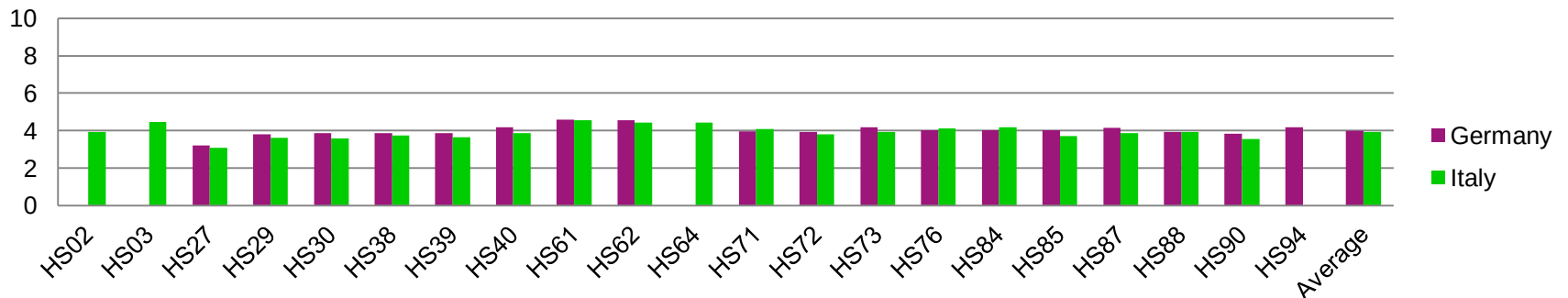
Analysis

Sustainability of Italian and German Supply Chains

**Social Sustainability of Supply Chains
Italy and Germany, 2016**



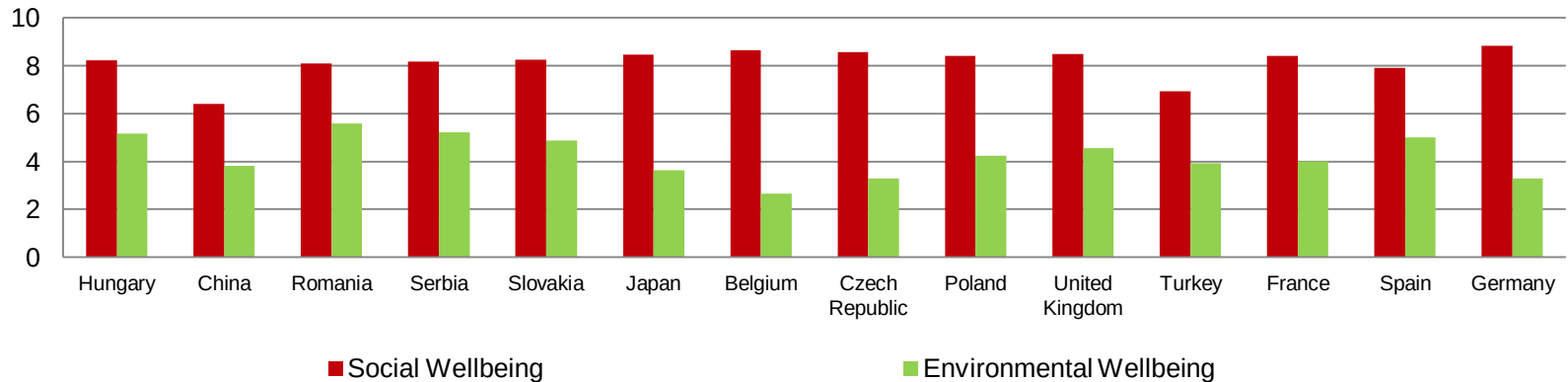
**Environmental Sustainability of Supply Chains
Italy and Germany, 2016**



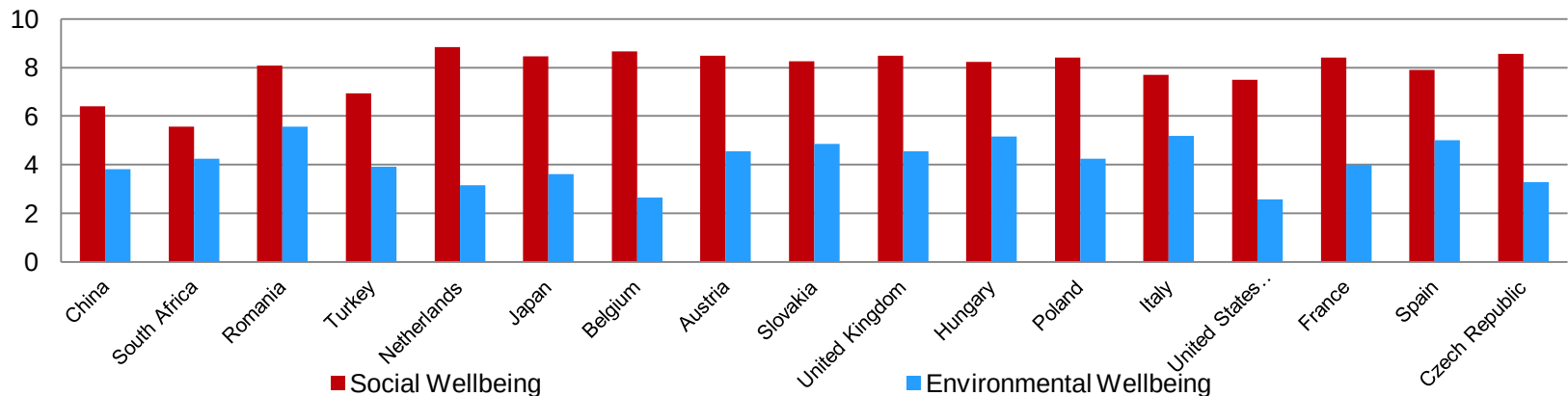
Source: SSF, International Trade Center, author's calculations

Analysis Sustainability of HS 87 suppliers

Social and Environmental Sustainability for HS 87 suppliers to Italy



Social and Environmental Sustainability for HS 87 suppliers to Germany



Source: SSF, International Trade Center, author's calculations

Discussion

- Social sustainability compatible with competitiveness
- Environmental sustainability moderately compatible with competitiveness if measured by selected sustainability variables
- Environmental sustainability not compatible with competitiveness if measured by SSI level two indicators
- Further research: Identification of more TBL elements in alternative measures of sustainability
- Country selection in Supply Chains: high competitiveness and social sustainability possible. Good news for firms targeting socially aware customers
- More difficult to reconcile economic and environmental sustainability with competitive supply chains.
- Industries not equally exposed to reputation risk

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Annex

HS Code	Product label	Cumulative Share 2016 G	Importing Country
'TOTAL			
'02	Meat and edible meat offal	75%	I
'03	Fish and crustaceans, molluscs and other aquatic invertebrates	74%	I
'27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral ...	43%	G
'27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral ...	21%	I
'29	Organic chemicals	58%	G
'29	Organic chemicals	56%	I
'30	Pharmaceutical products	48%	G
'30	Pharmaceutical products	44%	I
'38	Miscellaneous chemical products	75%	G
'38	Miscellaneous chemical products	69%	I
'39	Plastics and articles thereof	52%	G
'39	Plastics and articles thereof	49%	I
'40	Rubber and articles thereof	74%	G
'48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	73%	I
'61	Articles of apparel and clothing accessories, knitted or crocheted	69%	G
'61	Articles of apparel and clothing accessories, knitted or crocheted	63%	I
'62	Articles of apparel and clothing accessories, not knitted or crocheted	68%	G
'62	Articles of apparel and clothing accessories, not knitted or crocheted	64%	I
'64	Footwear, gaiters and the like; parts of such articles	66%	I
'71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad ...	72%	G
'71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad ...	61%	I
'72	Iron and steel	60%	G
'72	Iron and steel	52%	I
'73	Articles of iron or steel	71%	I
'73	Articles of iron or steel	62%	G
'74	Copper and articles thereof	67%	I
'76	Aluminium and articles thereof	70%	I
'76	Aluminium and articles thereof	71%	G
'84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	31%	I
'84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	13%	G
'85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	39%	I
'85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	25%	G
'87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	36%	G
'87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	11%	I
'88	Aircraft, spacecraft, and parts thereof	66%	G
'90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical ...	59%	I
'90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical ...	55%	G
'94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; ...	64%	G