

Towards financial resilience in manufacturing companies: A toolbox for the mitigation of consumption factors' market price risks

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Abstract

In recent years, market price risks of industrial consumption factors have become a major issue of manufacturing companies. The aim of this paper is to provide an overview on existing market price risk mitigation strategies to support manufacturing practitioners in making their company more resilient to this risk type and to provide a theoretical basis for future research. Based on a literature review, an explorative industry study, and 8 semi-structured interviews, we identified 34 market price risk mitigation strategies. Following Tang (2006), we clustered these strategies and built up a toolbox for the mitigation of consumption factors' market price risks.

Keywords: risk mitigation, market price risks, consumption factors

Introduction

During the last 10 to 15 years, *market price risks* of various industrial *consumption factors* (i.e., according to Gutenberg (1983) and Heinen (1992) raw materials, semi-finished goods, finished goods, auxiliary, and operating materials) have risen significantly (Chandy et al., 2012; Shah, 2009). Market price risks of consumption factors are, apart from exchange rate and logistics price risks, a special type of purchase price risks. They predominantly refer to potential financial losses of manufacturing companies that may result from unanticipated changes in the market price. These unexpected price changes are manifest in two forms: (i) price volatilities and (ii) severe price increases. Price volatilities are characterized by up and down movements of the price in regard to a certain price level (BAFU, 2010). In contrast, severe price increases or price shocks feature an enduring change of the price level (BAFU, 2010).

Price volatility and increase on the supply side have always been an issue for manufacturing companies. Depending on the branch of industry, the average share of material and energy costs account for 35% to 65% on total production costs (U.S. Census Bureau, 2011; Statistisches Bundesamt, 2011). Hence, unexpected changes in the market price of consumption factors may directly and severely impact manufacturing companies margins (Ellram et al., 2013; Zsidisin and Hartley, 2012a; 2012b). Some might argue that solely raw materials and commodities, and thus manufacturing companies processing natural resources or producing basic materials, are affected by rising market price risks. Companies further downstream the supply chain generally have a smaller share of raw materials and commodities on their overall material and energy costs (cf. Chandy et al., 2012) and therefore are not that severely affected. This is certainly right. Nevertheless in recent years, it has become more and more difficult even for companies in the downstream supply chain to evade market price risks. Price risks on supply markets have caused above average turbulence in the manufacturing industry and reached unprecedented levels (Chandy et al., 2012, KPMG, 2011). Never before in history had particularly such high and frequent price swings been seen (Schoenherr, 2012). Consequently, plenty of suppliers and sub suppliers no longer accept to absorb market price risks of raw materials and commodities completely on their own. They refuse to make long-term contracts and attempt to pass increased market prices through the supply chain. This passing on of risk in the supply chain is often possible due to consolidated markets with few suppliers available. Buyers fear that suppliers in these markets might go bankrupt and market consolidation will continue to proceed, if they did not accept at least a certain share of price increase. Hence, semi-finished and finished goods and companies in the downstream supply chain are also increasingly affected by market price risks.

Even though many consumption factor markets have stabilized during the last few months, market price risks are likely to continue and intensify in the future. Higher demands by emerging markets (Bell et al, 2012; Allwood et al., 2011), growing natural resource scarcity (Slowinski et al., 2013; Bell et al, 2012), increased speculation (Tse and Williams, 2013; Gilbert, 2010), and political power plays (e.g., export restrictions of rare earths in China) are the predominant drivers for this development. Consequently, manufacturing companies have to engage in systematic and effective market price risk management to obtain competitive advantage (Scannell et al., 2013). Knowledge on systematic and effective price risk mitigation strategies, however, is still scarce (Schoenherr et al, 2012; Fischl, 2013). The supply chain risk management (SCRM) as well as the purchasing and supply management (P&SM) literature provide several risk mitigation strategies for general supply chain and supply risks. However, there is little known about risk mitigation strategies of specific supply risk types, such as price risks (cf. Fischl, 2013). We strive for filling this gap by answering the following research questions pertaining to consumption factors' market price risks:

- (1) Which strategies exist in theory and practice to mitigate consumption factors' market price risks in manufacturing companies?
- (2) How can these strategies be classified in order to build up a toolbox for the mitigation of consumption factors' market price risks in manufacturing companies?
- (3) How can a toolbox for the mitigation of consumption factors' market price risks in manufacturing companies look like?

Methodology

To answer research question 1 and 2, we conducted a data collection and analysis process comprising three elements: (a) an extensive review of the literature, (b) an explorative cross-industry survey, and (c) 8 semi-structured expert interviews. The objective of the first element, the literature review, was twofold. First, we aimed at identifying strategies for the mitigation of market price risks that have been already explored by theory. In this way, we contributed to research question 1. Second, we strived for gaining an overview on existing classifications of risk mitigation strategies in the SCRM and the P&SM literature. By this means, we targeted research question 2 and identified different existing categorization schemes for supply chain and supply risk management strategies. The second element of our data collection and analysis process is the cross-industry survey. Its purpose was to serve as a complementary empirical data source feeding into research question 1. The survey was conducted as online survey between February 2013 and April 2013 (response rate: 16.8%). 146 practitioners (primarily managing directors, supply chain and purchasing managers) working for manufacturing companies that are affected by price risks were asked for their risk mitigation strategies used. Their answers were analyzed and synthesized by two independent researchers. The third part of our data collection and analysis process is the interview series. Its aim was to verify and complement our findings regarding research question 1. Since we wanted to gain a broad overview, we selected companies that are strongly affected by price risks in different industries (food industry, plastics processing industry, metalworking industry, chemical industry, and textile industry). We interviewed managing directors, supply chain and purchasing experts who are responsible for price risk management in these companies. The interviews lasted 45 minutes on average. All interviews were recorded, evaluated, coded, and validated by three researchers according to the four-step approach following qualitative data analysis of Miles and Hubermann (1992). To further validate not only the results of the literature review, the survey and the interviews but also the developed classification, we conducted a dual moderator focus group (cf. Morgan, 1993) in February 2014. The focus group consisted of 10 additional purchasing and supply chain experts from different industries. Based on the results of the focus group, we refined the classification. By assigning the related strategies, we finally built up a toolbox for the mitigation of consumption factors' market price risks and answer research question 3.

Literature review

Market price risk mitigation strategies

Adopting an operation management perspective, the herein regarded market price risks of consumption factors can be assigned to the supply side of the manufacturing company. They are traditionally handled by strategic procurement function or in smaller companies, which often do not have any strategically oriented purchasing function, the upper management. Correspondingly, the Purchasing and Supply Management (P&SM) and the Supply Chain Risk Management (SCRM) literature provide a suitable knowledge base for price risks and their mitigation strategies on a theoretical level. We examined these streams of literature during an extensive review. As we found, price risks are seen in both streams of the literature as a specific type of supply (e.g., Kraljic, 1983; Manuj and Mentzer, 2008) or supply chain risk (e.g., Kaku and Kamrad, 2011; Matook et al., 2009; Shah, 2009). However, although each risk type requires its own specific risk mitigation strategy, which must be aligned with its risk sources and drivers

and the company's environment (Chopra and Sodhi, 2004; Zsidisin and Wagner, 2010), only few contributions concentrate on specific risks and their mitigation strategies. This applies also to consumption factors' price risks (Fischl, 2013).

The contributions of Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013), Ni et al. (2012), and Hofmann (2011) can be cited as rare exceptions in regard to this topic. Zsidisin and Hartley (2012a; 2012b) and Zsidisin et al. (2013), for instance, provide a conceptual framework for the management of commodity price risks. They name six risk mitigation strategies, namely (1) *substitution of commodities*, (2) *sharing/passing price risks with/to customers or* (3) *suppliers*, (4) *forward buying*, (5) *hedging by using futures contracts*, and (6) *cross-hedging*. In case of non-applicability of the five first price risk mitigation strategies, absorbing risk and reducing demand are suggested as remaining options. Ni et al. (2012) take a more theoretical step to enter the field of commodity risk management. They suggest a multi-stage financial hedging approach and develop a discrete-time stochastic control model (DSCM) for financial hedging. Hofmann (2011) also examines the potential of hedging and stresses its positive impact on exchange rate and commodity price risks.

Besides these price risk focus contributions, some authors provide risk mitigation strategies for general supply and supply chain risks. They often mention risk mitigation measures that also may be relevant to market price risks. Shah (2009), for example, cites hedging and contract design (i.e., more or less passing on of price risks), as measures to deal with uncertain supply costs. Robust network design is also mentioned by the author. However, we have to emphasize that this risk mitigation measure is generally related to exchange rate and disruption risks. Tang and Tomlin (2008) suggest flexible supply via (7) *multiple suppliers* and the flexible supply contracts (i.e., passing of price risk) to avoid supply cost risks. Besides, they name (8) *postponement* and (9) *flexible pricing* to lower the demand of critical products as strategies to handle demand risks. Although these risk mitigation measures are not yet related to market price risks, an application for this risk type is conceivable. Manuj and Mentzer (2008) and Ghadge et al. (2012) also propose dual/multiple sourcing as risk mitigation strategy. In addition, Ghadge et al. (2012) describe further risk mitigation measures, such as (10) *outsourcing*, (11) *diversification of the product portfolio*, (12) *product design*, (13) *resource utilization*, (14) *enhancement of flexibility*, (15) *contingency planning*, (16) *supplier development*, (17) *improvement of buyer-supplier relations*, and again contract design, building up of security stock (i.e., forward buying), postponement, and dynamic pricing on the sales market. Boone et al. (2009) directly focus on different types of postponement, such as product design postponement, purchasing postponement, or production postponement. Jüttner et al. (2003) take a more holistic perspective. According to their view, risks may be avoided by (18) *dropping of specific products or markets*. (19) *Vertical integration*, which also is mentioned by Kraljic (1983), stockpiling, and passing on of risks to the supplier are seen as measures for risk control. Besides, Jüttner et al. (2003) name the improvement of (20) *visibility across the supply chain*, (21) *information sharing*, and the preparation of supply chain continuity plans. Juha and Pentti (2008) in turn concentrate on organizational purchasing. They stress the importance of both the (22) *improvement of the purchasing organization* and the (23) *purchasing process*. Salonen (2010) name closer (24) *collaboration between the procurement and finance function* and the establishment of visibility across the financial value chain as risk mitigation strategies for general supplier risks. In contrast, Ritchie and Brindley (2007) offer measures such as risk insurance, which is similar to hedging,

(25) *cooperative strategies in the supply chain*, information sharing, relationship development, (26) *joint training*, and supplier development programs. The (27) *use of recycling material* is promoted by Fliedner and Majeske (2010), who report on Ford's increased robustness to price volatility due to this measure.

Classification schemes for risk mitigation strategies

Besides pure risk mitigation strategies, the literature offers classification schemes to bundle different types of strategies. However, to the best of our knowledge, there exists no classification framework that is specifically tailored to mitigation strategies of price risks or even market price risks. Since we strive to base our research on existing knowledge, we first had a look on risk classifications for general supply chain and supply risk mitigation strategies.

During our literature review, we found that the regarded classification schemes are either based on (i) temporal characteristics of risk mitigation strategies, (ii) the type of risk practice, or (iii) the field of risk management. A classification scheme that is based on (i) temporal characteristics is provided by Thun and Hoenig (2011) and Ghadge et al. (2012). They distinguish preventive or proactive, and reactive risk mitigation strategies. Classifications that are more oriented towards (ii) the type of price risk mitigation strategy are offered by Miller (1992), Jüttner et al. (2003), Manuj and Mentzer (2008), Ghadge et al. (2012), and Hallikas et al. (2004). Whereas Miller (1992) and Jüttner et al. (2003) cite four generic risk mitigation strategy classes (avoidance, control, cooperation, and flexibility), Manuj and Mentzer (2008) name avoidance, control/share/transfer, postponement, speculation, hedging, and security as categories for classification. Supplier development or management, supply chain contracts, product and process management, supplier relationship, contingency planning, disaster management, and demand management are suggested by Ghadge et al. (2012) as classes. Hallikas et al. (2004) adopt a more theoretical perspective. They differentiate among risk elimination, risk reduction, risk transfer, risk taking, and further analysis of individual risks. Tang (2006) refers with his categorization to (iii) the field of risk management. He distinguishes the four basic categories supply management, demand management, product management, and information management as classes for managing supply chain risks.

Market price risk mitigation strategies in practice

Although the literature provides a bunch of valuable propositions for the mitigation of risks, we have to remark that the suggested strategies often are not yet directly linked to market price risks. In addition, the cited strategies have predominantly conceptual character. Anecdotal evidence is often given to highlight the relevance and the usefulness of the risk mitigation strategies. Theoretical or empirical grounding and testing in practice is, however, in most cases missing. Consequently, we decided to examine price risk mitigation practices also from an empirical perspective. In this way, we seek to triangulate and complement the results of the literature review. In a first step, we conducted an explorative survey among 146 experts in the field of manufacturing, purchasing and supply chain management. We asked the participants on their price risk mitigation strategies used. Only 91 respondents (62.3%) claimed to manage market price risks systematically. Asked as open question, 17 specific market price risk mitigation strategies were named by the respondents (cf. Table 1). In a second step, we interviewed experts responsible for price risk management in 8 different manufacturing

companies. In doing so, we wanted to gain greater insights in the management of market price risks in manufacturing companies. Altogether, we derived 7 additional risk mitigation strategies in this way (cf. Table 1). We found that many of the market price risk mitigation strategies identified in practice are described in literature. However to the best of our knowledge, some strategies have not yet been explicitly highlighted in the SCRM and P&SM literature as market price risk mitigation strategies. These newly added risk mitigation strategies are marked in Table 1 by an asterisk.

Table 1 – Overview on market price risk mitigation strategies used in practice

Market Price Risk Mitigation Strategy	Number of mentions in the survey (n = 146)	Number of mentions in the interviews (n = 8)
Hedging	22	3
Passing on of price risks to supplier (e.g., by long-term contracts)	16	5
Passing on of price risks to customer (e.g., price escalation clauses)	10	5
Cost models and market price forecasting	10	2
Dual/multiple sourcing	8	5
Substitution	8	1 ^{a)}
Forward buying and stock piling	7	4
Systematic risk management*	7	-
Increase of material and energy efficiency in products and processes	4	1
Supplier development	3	1
Diversification (e.g., by adaption of product portfolio, own trading)	3	-
Design-to-cost	2	3
Raw material exchange projects with customers* and/or suppliers*	2	-
Use of recycling material	1	2
Training of purchasing team	1	1
Strengthening of bargaining power (e.g., bundling of purchasing volume)*	1	-
Improvement of internal planning (e.g., demand forecasts)*	1	-
Active market observation*	-	4
Improvement of buyer/supplier relations, trust building	-	2
Vertical integration	-	1
Cooperation (e.g., procurement alliance)	-	1
Direct sourcing/avoidance of trading markets*	-	1
Increase of flexibility and agility	-	1
Development of contingency plans	-	1
Improvement of internal information exchange	-	1

^{a)}mentioned as contingency plan

The toolbox for the mitigation of market price risks

Before finally developing a toolbox for the mitigation of market price risks, we have to set up a suitable classification framework for the strategies identified in literature and practice. As most of the detected strategies fit well into the categorization scheme of Tang (2006), we chose this classification as starting point. Whereas we adopted Tang's categories "Supply Management" and "Demand Management", we slightly extended the category product development and changed it into "Product & Process Development" following Ghadge et al. (2012). The category information management was transferred into "Knowledge Management" (cf. Lichtenthaler and Lichtenthaler, 2009) since not only information but also know-how is found to be a part of market price risk management. Moreover, we introduced "Financial Hedging Management" and the more strategically oriented "Cooperation & Portfolio Management" as additional categories.. To validate and refine the classification framework, we conducted a dual moderator focus group (cf. Morgan, 1993) consisting of 10 additional purchasing and supply chain

experts from different industries. Based on the results of the focus group discussion, we derived the final classification shown in Figure 1.

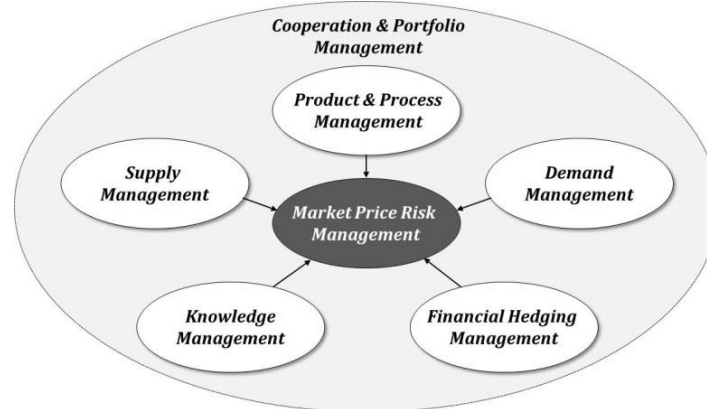


Figure 1 – Classification framework based on Tang (2006)

By assigning the market price risk mitigation strategies to the distinct risk mitigation classes and finally validating the results by the dual moderator focus group, we developed a toolbox for the mitigation of consumption factors' market price risks and answered research question 3. Some of the strategies were split up since they can be assigned to both suppliers and supply management, and customers and demand management. Table 2 not only depicts this toolbox but also relates the market price risk mitigation strategies to existing literature. Moreover, it shows whether or not the use of the single strategies was confirmed in practice.

Table 2 – Toolbox for the mitigation of consumption factors' market price risks

Class	Market Price Risk Mitigation Strategy	Related literature	Confirmed use in practice
Cooperation & Portfolio Management	Vertical integration	Kraljic (1983), Jüttner et al. (2003)	Yes
	Cooperation (e.g., procurement alliance)	Ritchie and Brindley (2007)	Yes
	Outsourcing of risky components	Ghadge et al. (2012)	-
	Diversification (e.g., extension of portfolio, trading)	Ghadge et al. (2012)	Yes
	Dropping of products or markets	Jüttner et al. (2003)	-
Supply Management	Systematic market price risk management	-	Yes
	Passing of price risks to supplier(s) (e.g., by long term contracts, flexible contracts)	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013), Shah (2009), Tang and Tomlin (2008), Ghadge et al. (2012), Jüttner et al. (2003)	Yes
	Forward buying and stock piling	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013), Ghadge et al. (2012), Jüttner et al. (2003)	Yes
	Dual/multiple sourcing	Ghadge et al. (2012), Tang and Tomlin (2008), Manuj and Mentzer (2008), Jüttner et al. (2003)	Yes
	Direct sourcing/avoidance of trading markets	-	Yes
	Active market observation	-	Yes
	Cost models and market price forecasting	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013)	Yes
	Improvement of purchasing organization	Juha and Pentti (2008)	-
	Improvement of purchasing processes	Juha and Pentti (2008)	-
	Improvement of buyer/supplier relations, trust building	Ghadge et al. (2012), Ritchie and Brindley (2007)	Yes
	Supplier development (e.g., improvement of supplier's risk management)	Ghadge et al. (2012), Ritchie and Brindley (2007)	Yes
	Raw material exchange projects with supplier(s)	-	Yes

<i>Class</i>	<i>Market Price Risk Mitigation Strategy</i>	<i>Related literature</i>	<i>Confirmed use in practice</i>
	<i>Strengthening of bargaining power (e.g., bundling of purchasing volume)</i>	-	Yes
<i>Product & Process Management</i>	<i>Substitution of materials within products and processes</i>	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013)	Yes
	<i>Product design/design-to-cost</i>	Ghadge et al. (2012)	Yes
	<i>Use of recycling material</i>	Flidner and Majeske (2010)	Yes
	<i>Increase of material and energy efficiency in products and processes</i>	Ghadge et al. (2012)	Yes
	<i>Postponement of processes (e.g., purchasing, production, payment, delivery)</i>	Ghadge et al. (2012), Boone et al. (2009), Tang and Tomlin (2008), Jüttner et al. (2003)	-
	<i>Increase of flexibility and agility</i>	Ghadge et al. (2012), Jüttner et al. (2003)	Yes
	<i>Improvement of internal planning (e.g., demand forecasts)</i>	-	Yes
	<i>Development of contingency plans</i>	Ghadge et al. (2012), Jüttner et al. (2003)	Yes
<i>Demand Management</i>	<i>Passing of price risks to customer(s)(e.g., by flexible contracts, price escalation clauses)</i>	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013)	Yes
	<i>Flexible pricing to lower the demand of critical products</i>	Tang and Tomlin (2008), Ghadge et al. (2012)	-
	<i>Raw material exchange projects with customer(s)</i>	-	Yes
<i>Financial Hedging Management</i>	<i>Financial hedging (e.g., futures, forwards)</i>	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013), Ni et al. (2012), Hofmann (2011); Shah (2009)	Yes
	<i>Cross-hedging</i>	Zsidisin and Hartley (2012a; 2012b), Zsidisin et al. (2013)	Yes
<i>Knowledge Management</i>	<i>Improvement of internal information exchange (e.g., between procurement and production, process development, or finance and treasury) and enhancement of financial transparency along the internal supply chain</i>	Salonen (2010), Ritchie and Brindley (2007), Jüttner et al. (2003)	Yes
	<i>Improvement of external information exchange in the supply chain and enhancement of financial transparency along the external supply chain</i>	Salonen (2010), Ritchie and Brindley (2007)	-
	<i>Training of purchasing team (e.g., risk management, forecasting methods)</i>	Ritchie and Brindley (2007)	Yes

Discussion and Conclusion

In this article we systematically built up a toolbox for the mitigation of consumption factors' price risks. To the best of our knowledge, this is the first triangulated and empirically based classification of price risk mitigation strategies in manufacturing companies. Since we concentrate on a specific risk, we contribute to the sophistication of the current SCRM and P&SM literature. Our results represent a starting point for future research projects that explore the effectiveness of different price risk mitigation strategies as demanded by Schoenherr et al. (2011). Filled with the belonging strategies, the developed classification can serve moreover as a useful toolbox for practitioners. Thus, we support manufacturing companies in facing current and future challenges with respect to consumption factors' price risks.

Nevertheless, this research also holds some shortcomings. The literature review, the survey, and the interviews hold explorative character. Although the toolbox is based on empirical findings and validated by a focus group, further empirical testing would be recommended. Furthermore, we have to state that, even if we did not find evidence for the use of several risk mitigation strategies in practice (e.g., improvement of purchasing process, postponement, flexible pricing), these risk mitigation strategies might be applied in other manufacturing companies and represent effective market price risk mitigation strategies. Future research thus might do well in engaging in further examination of the topic of market price risk management in manufacturing companies

and explore the most suitable and effective market price risks mitigation strategies in different risk contexts. In this way, the practical use of this toolbox might be enhanced. Moreover, we believe that also other types of price risks, such as exchange rate risks, and their belonging risk mitigation strategies have to be investigated in greater detail. The suggested classification framework might therefore provide a suitable starting point.

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