

Students' understanding of causation in pricing: a phenomenographic analysis

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- Causality is a key dimension in developing a complex understanding of pricing
- A problem's form affects the dimensions of a phenomenon that come into view
- Conceptions of causality are related to a producer or market perspective
- Developing complex conceptions may be held back by a problem in one dimension

Purpose: The aim of this study is to extend previous research on conceptions of price by highlighting variation in students' understanding of causality. It also aims to offer a new way of using 'dimensions of variation' in phenomenographic research to analyse the structure of conceptions of complex phenomena.

Method: The study uses data from 94 upper secondary students who were asked to provide written answers to two problems before and after a short programme of teaching. This yielded a total of 328 open responses which were analysed phenomenographically.

Findings: The study revealed four qualitatively distinct ways of understanding causation in pricing. It also revealed new insights in how different dimensions of variation in conceptions of pricing are related to each other. The study suggests that the form of a problem posed to students will affect the dimensions of variation in conceptions that are exposed.

Implications: Conclusions drawn are relevant for research and teaching.

Keywords: Causal relationships, price, economics education, phenomenography, dimensions of variation

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1 Introduction

This study offers a new way of understanding the development of more complex conceptions of pricing. The novelty of the study lies in its approach to identifying distinct dimensions of variation within these conceptions, relationships between those dimensions of variation and different conceptions of causation that are embedded in those dimensions of variation. The contribution of this study in relation to causation may be relevant not only to understanding conceptions of economic phenomena but also in the analysis of other phenomena in social science (such as migration and crime – see Miller & Tewksbury, 2004; Minton, 2014) that are experienced by individuals as outcomes of others' intentions, but which scholarly discourse treats as systemic processes.

Our study builds on the pioneering work that has been conducted by researchers in the field of phenomenography and variation theory (e.g. Dahlgren, 1984; Pang & Marton, 2003, 2005; Marton, 2015). These studies not only provide a body of empirical evidence on which to draw, but, crucially, a way of approaching and addressing the research problems. Our study follows the methods established in this tradition and uses the terminology that has been developed to express the distinctions that are highlighted in this approach. We endeavour to clarify the meaning of these terms during the exposition of the paper.

Section 2 reviews evidence from previous studies whilst outlining the phenomenographic approach that is pursued by this study. Section 3 briefly summarises the aim of the study and also presents the research questions. We do not include these in the introduction as they use terminology which is explained in Section 2. Section 4 describes and justifies the method. Results are presented in Section 5 and these are discussed in Section 6. The paper concludes with a summary of our answers to our research questions, whilst noting some limitations and possible implications.

2 Literature review: Students' understanding of causal relationships in pricing

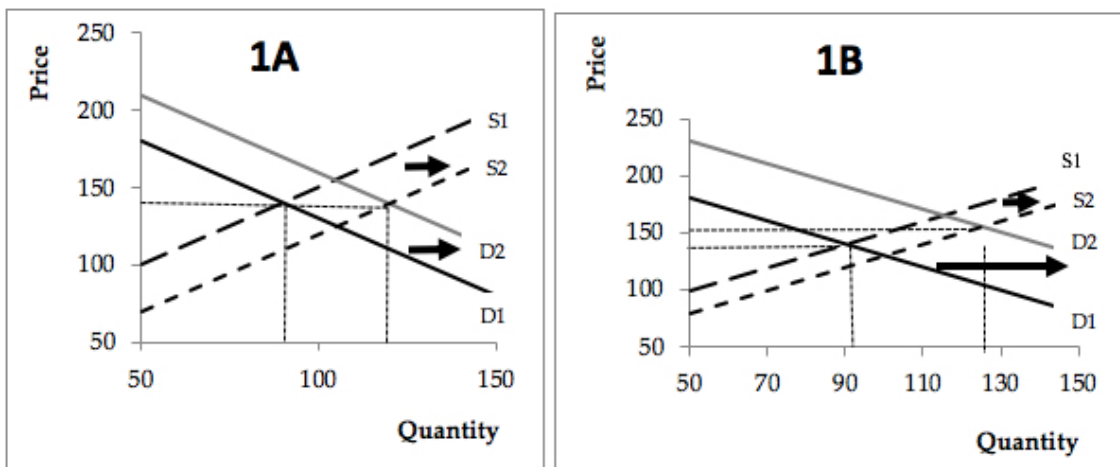
This study was carried out using a phenomenographic perspective and method (see for example, Birke & Seeber, 2011; Speer & Seeber, 2013; Aprea & Sappa, 2014). We begin this section with a brief summary of what this means for the description of learning. Phenomenography aims to identify qualitatively distinct conceptions of a phenomenon. These conceptions are ordered in an 'outcome space' from the least to the most powerful conception (Åkerlind, 2005). More recently, the tradition has evolved through 'variation theory' to identify the elements that make each conception distinctive. The key idea is that each conception recognises variation in some elements of a phenomenon whilst ignoring other elements. This approach is illustrated in Table 1 which is reproduced from Marton (2015, p. 103). Each element of the phenomenon gives rise to a 'dimension of variation' which are presented in the columns in Table 1. When a conception recognises variation in a dimension it is labelled v , otherwise it is labelled i for invariant.



Table 1. Outcome space in observed conceptions of pricing. Adapted from Marton, F. (2015). Necessary conditions of learning, New York, Routledge, p. 103.

Conception	Dimensions of variation			
	Attributes of the product	Demand	Supply	Price
1 Price depends on attributes of the commodity	v	i	i	v
2 Price depends on people's willingness to buy	i	v	i	v
3 Price depends on how much there is to buy	i	i	v	v
4 The price is a function of willingness to buy and how much there is to buy	i	v	v	v

In Table 1 there is a linear hierarchy from conception 1 to conception 4 (most complex). A dimension of variation is evident in a conception when variation (v) in this dimension is recognised. Variation theory suggests that the hierarchy in Table 1 has a clear implication for teaching. For example, if teaching aims to develop an understanding of conception 4 it should simultaneously vary demand, supply and price whilst keeping the attributes of the product the same. If students currently hold conception 2 then the critical aspect in this variation is change in supply. If students currently hold conception 1, then the critical aspect is simultaneous variation in demand and supply whilst holding attributes of the product constant. Most earlier studies investigating students' conceptions of price (Dahlgren, 1984; Pong, 1997; Meyer & Shanahan, 2002; Marton & Pong, 2005; Pang & Marton, 2005) followed the way of categorising conceptions in Table 1. That is, they focus on one dimension of variation at the time. Each of these studies posed problems to students in the form of 'what affects price?' The causation is from quantity to price. By the time of Pang & Marton's (2005) study, five categories had been identified in this dimension: change in price as a consequence of a change in (i) product quality; (ii) demand; (iii) supply; (iv) demand and supply; (v) relative magnitude of change in supply and change in demand. Pang & Marton (2005) used conventional supply and demand graphs to illustrate the difference between categories (iv) and (v) in this dimension. Figure 1. Graphical representation of (A) Equal increase in demand and supply and (B) Greater increase in demand than supply.



In Figure 1A, equal increases in supply and demand (rightward shifts of same amount in demand and supply) lead to no change in price. In Figure 1B demand increases by more than supply increases, resulting in a higher price. The outcome in Figure 1A depends on demand



and supply having a similar slope. That is, this analysis (as with the representation in Table 1) abstracts from variation in the *slope* of supply and the slope of demand.

In another paper, Pang & Marton (2003) analysed variation in the *slope* of the demand curve (referred to in economics as the 'elasticity of demand'), and variation in the *slope* of the supply curve (referred to as 'elasticity of supply'). Their analysis of students' utterances distinguished between: no recognition of the possibility of variation in the slope of either supply or demand, recognition of variation in the slope of demand, but not supply, recognition of variation in the slope of supply, but not demand and recognition of variation in the slope of both demand and supply. Whereas the analysis in Figures 1A and 1B focuses on the effect of changes in the quantity demanded and quantity supplied *on price*, variation in the slopes of supply and demand concentrates on the effect of changes in price *on quantity* supplied and quantity demanded. This raises the question of how the outcomes of the 2003 study, which exposed variation in students' understanding of slopes or elasticities, should be related to the representations in Table 1 and Figures 1A and 1B.

Another dimension of variation in conceptions of price was identified by Davies (2011, 2019) and Durden (2018). They observed that utterances sometimes portrayed pricing as the consequence of decisions of an individual producer and sometimes as an outcome of market forces. Studies in which students were given a problem facing an individual producer typically elicited responses in terms of an individual producer even when terms such as 'supply' were used in utterances. Studies which posed a market problem tended to elicit responses expressed in terms of market behaviour. The form of the problem posed to students affects which dimensions of variation are exposed. Moreover, there is an ontological difference between conceptions which treat price formation as intentional behaviour by producers and conceptions that treat price formation as outcome of the operation of a market system. At first sight, this looks similar to the ontological difference between explanations of scientific phenomena in terms of the intentions of creatures and explanations of scientific phenomena in terms of physical processes observed by Chi (2008). However, as noted by Lundholm & Davies (2013), scholarly explanations of economic phenomena accept intentional action by economic actors. But these intentions interact in market contexts and the outcomes of systemic processes may well be different from actors' intentions.

A comparison of these studies prompts an alternative way of thinking (contrasted with Table 1) about dimensions of variation in conceptions of price. That is, a conception of price (or pricing) involves one dimension that focuses on the effect of quantity changes *on price* (as in Table 1). Two further dimensions focus on the effect of changes in price *on* the quantity demanded and the quantity supplied, that is the slope of the demand and supply curve, and also a dimension which focuses on locus of decision-making: producers or markets. These different dimensions, including qualitatively different categories within each dimension, are presented in Table 2 below.



Table 2. Dimensions of variation in conceptions of price identified in previous research.

	1	2	3	4
Dimension	Quantity supplied (Q_s) and demanded (Q_d) (Pang & Marton, 2005)	Slope of demand curve (Pang & Marton, 2003)	Slope of supply curve	Producer or market focus (Davies, 2011, 2019 & Durden, 2018)
Causal focus	Q affects Price (P)	P affects Q_d	P affects Q_s	Locus of decision-making affects Q_s
Categories within dimension	(i) Quantity not mentioned: price reflects quality of product (ii) Change in Q_s affects P (iii) Change in Q_d affects P (iv) Changes in Q_s and Q_d affect P (v) Differences between changes in Q_s and Q_d affect P	(i) No recognition of effect of price on Q_d (ii) Negative effect of price on Q_d (iii) Recognition that the extent to which price affects Q_d may vary.	(i) No recognition of effect of price on Q_s (ii) Positive effect of price on Q_s (iii) Recognition that the extent to which price affects Q_s may vary.	(i) Prices assumed to be set by individual producers (ii) Market forces determine prices (iii) Competition affects scope that providers have to vary prices in relation to market norm.

This way of using the term ‘dimension of variation’ keeps the information in Table 1 intact. That table is here compressed in Column (1). A change from conception (i) to conception (ii) in this column requires variation in Q_s which affects P and invariance in the quality of the product (since this does not appear in ii). In contrast to Table 1, Table 2 allows us to see the different dimensions of conceptions of price that have been exposed by studies that have posed different kinds of problems to students.

Researchers in this field have explored variation through subtle, but important, changes to the form of the question or task that has been posed to students. Early studies (Dahlgren, 1984) asked ‘What affects *the* price (e.g. of a bun)?’ In contrast, Pang & Marton’s (2005) study asked ‘Why has the price (of a videorecorder) *changed*?’ This later study focused attention on the size of a change in demand or supply and they observed a conception that explained price change in terms of the relative size of a change in demand and a change in supply. Earlier studies do not report this conception. Pang, Linder & Fraser (2006) asked students what price they would set if they became the owner of a hot dog stall. Durden (2018) posed two different questions; one set in the context of an individual producer and one set explicitly in the context of a market in which there were many suppliers. He found that the likelihood that a student would express a conception in terms of a market with many suppliers was hugely dependent on which form of question they had been asked. His study revealed conceptions that are not reported in studies (e.g. Pang, Linder & Fraser, 2006) that posed questions in terms of an individual provider.

Finally, previous literature has not considered the relationship between learners’ progress in each of the dimensions in Table 2 and that is one of the issues addressed in this paper. Previous discussions of the implications for teaching of this outcome space have rather focused on individual dimensions of variation.



3 Aim and research questions

This study posed a problem to students that was designed to simultaneously expose conceptions of the effect of change in quantity on change in price *and* effects of change in price on change in quantity. The study examines conceptions of causation in pricing and considers relationships between the dimensions of variation presented in Table 2. The research questions were:

1. How does the scope of a question affect the dimensions of variation in conceptions of price that come into view?
2. What variation is there in the way that students understand causation in their conceptions of pricing?
3. How are dimensions of variation in conceptions of pricing related to each other?

4 Method

4.1 Design of the study

This paper reports evidence of students' understanding of the causal relationships in pricing that extends knowledge of the structure of conceptions of price. The evidence is drawn from a study which broadly replicated the design of an earlier, seminal, study (Pang & Marton, 2003). Evidence of conceptions was collected through written answers to open response questions. The evidence was analysed using phenomenographic methods (Marton, 2015; Åkerlind, 2005) to map the 'outcome space' by identifying dimensions of variation and the categorical differences observable within each dimension of variation.

We designed two questions that were intended to allow each of the dimensions of variation to be exposed. The key element in these questions was to ask how a change in one market had consequences in a related market. This design feature was included because it opens up possibilities to consider causation from price to quantity as well from quantity to price. Each problem starts with a change in quantity in one market and the student is encouraged to think about how this will affect price in that market. The problem also encourages the student to consider the effect of price in the first market on quantity *and* price in the second. Question 1 begins with a change in quantity that is attributable to a change in conditions of supply whilst question 2 begins explicitly with a change in demand. As student understanding of price may vary across different products (Ignell, Davies & Lundholm, 2017), the two questions focused on different products: film in Q1 and hamburgers in Q2.

Q1. Over the last decade there has been a significant increase in downloading film. What effects may this have on the price of movie tickets at cinemas and why? Explain and give arguments for your answer and use both words and a diagram to explain your thoughts.

Q2. Over the last years the demand for ecological hamburgers has increased as a result of a greater concern for the environment. What effects will this have on the price of ecological as well as non-ecological hamburgers and why? Explain and give arguments for your answer and use both words and a diagram to explain your thoughts.

Each student provided two written responses to each question, before and after a three-week period of instruction. This design feature was included to increase the range of conceptions that were captured by the study. Some conceptions might mainly be visible after



instruction. Students were not prompted in the pre-test regarding the type of diagram they might use. It was expected that in the post-test students would draw upon instruction they had received when choosing and using a diagram.

4.2 Pilot study

The two questions were trialled with 30 students who did not participate in the main study. Eight of these students volunteered for follow-up interviews to explore their understanding of, and reactions to, the questions. This trial had two main functions. First, we wanted to check whether students understood and engaged with the questions. Previous studies have aimed to use questions that focus on contexts that are relevant to students' experience. For example, Pang & Marton (2005) posed questions about bird flu and VCRs which they judged to be of interest to the Hong Kong students in their study. This means that the context for the questions has to be chosen locally. The importance of relevant context was confirmed in the interviews. Our second purpose was to check whether the form of the questions did open up different dimensions of variation that have been separately identified in previous studies. Results from the pilot study made clear that it was important to include one question placing supply in the foreground (Q1) and one placing demand in the foreground (Q2) in order for the data to be as diverse as possible, as what was placed in foreground seemed to affect what was being placed in the foreground in the answer. The results also showed that the questions used opened up for the students to elaborate on the causal relationships between supply, price and demand, which was the aim. Some small adjustments in terms of changing the words "environmental friendly"/"non-environmental friendly" to "ecological"/"non-ecological", were made to the questions on the basis of the pilot, however the choice of context and basic structure was confirmed.

4.3 Participants

Two upper secondary schools participated in the study, both with diverse catchment areas. Four different classes, with a total of 94 students (ranging from 15-30 in each class), participated in the study. The students' age ranged between 16-18 years. 58 of the participants were girls and 36 were boys. An additional three students from three different classes chose not to participate in the study. All students were in their first or second year, studying the course Social Studies, which includes an introduction to economics and personal finance. The students had not had any previous teaching on the interaction of supply and demand. With some students not participating on the second occasion, our data consisted of 328 written student answers. 164 of these were answers to Q1 and 174 to Q2. Approximately half of the answers were from the first occasion of data gathering and half from the second.

4.4 Data analysis

The data analysis followed the conventions of phenomenography (Marton, 2015; Åkerlind, 2005). This study treats learning as a development of a more complex conceptual understanding of a certain phenomenon, in this case the causal relationships in pricing. The analysis focused on identifying qualitatively different ways of seeing/understanding the relationships in pricing. The analysis accepts that it is possible for one student to express more than one way of understanding the relationships in pricing, placing different parts of their response in different categories of conceptions (Marton, 2015). Only the written parts of students' answers were analysed for this paper and diagrams drawn were thus not included in



the analysis. Students' responses were independently analysed by two researchers who then compared and discussed their interpretations of the data. A reliability analysis of researchers' application of the agreed categories was high ($r = .94$).

5 Results

The results are presented in four sections: replication of results from previous studies (5.1); extension of categorisation of conceptions of supply (5.2); variation in conceptions of causation in pricing (5.3); and relationships between the dimensions of variation (5.4). Sections 5.1 to 5.3 provide answers to the first research question. Section 5.3 answers the second research question. Section 5.4 addresses the third research question.

5.1 Replication of results from previous studies

Since the problems we posed to students were different from those used in earlier studies, it is pertinent to ask whether they also expose the dimensions of variation revealed in those studies (as summarised in Table 2). We found examples of different conceptions in each dimension in Table 2 and these are illustrated in Appendix 1. This shows that our problems did expose the dimensions of variation that have been observed in previous studies.

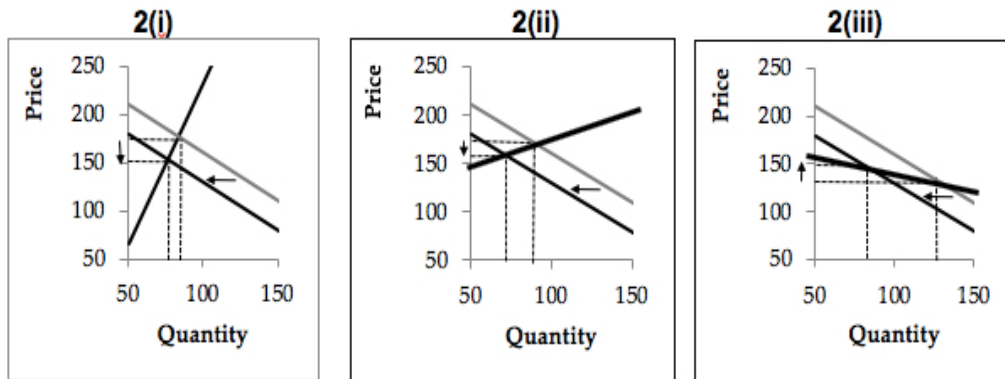
5.2 Extension of categorisation of conceptions of supply

We frequently observed a conception of the effect of price on quantity supplied that has not been reported in previous research. We use Figure 2 to illustrate the ideas expressed by students in their written answers. Each of the three diagrams in Figure 2 shows the same reduction (shift) in demand. The difference between the three diagrams lies in the shape of the supply curve which results in different effects on price. A comparison of Figure 2i and figure 2ii illustrates a conception of a positive effect of price on the quantity supplied (Table 2, dimension 3 row (ii)). The fall in price is greater in figure 2i than figure 2ii because the supply schedule is steeper (less price elastic). Pang and Marton (2003) noted that some students were aware of this and some were not. Utterance [1] from this study exemplifies this belief in a positive relationship between price and quantity supplied:

[1] *"Prices on ecological hamburgers will obviously increase as the demand for them increases."*

The effect of an increase in demand (rightward shift) on price depends on the slope of the supply curve. If the slope of the supply curve is perfectly horizontal, then an increase in demand would have no effect on price. Utterance [1] indicates that the student believes the supply curve slopes upward (as illustrated in Figures 2i and 2ii).

Figure 2. The consequence of different slopes in the supply revealed when there is a shift (reduction) in demand.



We also observed utterances which assumed that the supply schedule actually sloped down: suppliers would require a higher price if they sold less:

[2] *“Price must increase if demand decreases. If fewer people go to the cinema, the cinemas will make less money and the price on the tickets being sold must then be higher so that the cinemas make a profit.”*

[3] *“(If demand decreases) I think that there is a major risk that the tickets will become more expensive, since the film industry needs to get more paid in order to finance their business.”*

Utterance [2] expresses this idea in terms of the behaviour of individual businesses. Utterance [3] expresses the idea in terms of the behaviour of a whole industry. Both utterances suggest that the producers need to raise a fixed amount to cover their costs, so if they sell less, they will have to raise prices. These utterances imply the kind of causation shown in Figure 2(iii). This does not mean that these students would portray their understanding in this way, but it is a necessary implication of what they have said.

5.3 Variation in conceptions of causation in pricing

Our problems were explicitly designed to expose variation in conceptions of causality of pricing, i.e. the causal relationships between supply, price and demand. We identified four different categories of conceptions in this dimension: (i) a relationship between supply and demand with no reference to price; (ii) a unidirectional causal relationship between price and demand/supply; (iii) bidirectional causal relationships between either price and demand or between price and supply; (iv) complex relationships, where price, demand and supply are interrelated. The differences between these four categories are explained below with the aid of exemplifying quotations. At the end of this section (Figure 3) we suggest a hierarchy of relationships between these conceptions.

5.3.1 Category 1: A relationship between supply and demand with no reference to price

Some utterances suggested causal relationships between supply and demand, without referring to any co-ordinating role for prices.

[4] *"The increased access to downloading film makes people feel that they don't have the need to go to see new films on the cinema."*

[5] *"When there is an increase in something, there is also a decrease somewhere. The demand determines the supply."*

Utterance [4] relates the supply of downloaded films to readiness to demand cinema tickets, but it makes no mention of price. Utterance [5] explicitly suggests a general relationship between supply and demand without any mention of price.

5.3.2 Category 2: Unidirectional causal relationship between price and demand/supply

Some utterances explained pricing as a unidirectional causal relationship: either in terms of the effect of price on either demand or supply or in terms of the effect of a change in demand or supply on price.

[6] *"When the price increases, fewer people will go to the cinema, because it is too expensive."*
(effect of change in price on quantity demanded)

[7] *"I guess that the price on cinemas will decrease as a result of demand not being as great."*
(effect of change in quantity demanded on price)

[8] *"If more farmers produce ecological hamburger meat, the prices will decrease, as it will be easier to get hold of."* (effect of change in quantity supplied on price)

Utterance [6] expresses a unidirectional causal relationship from price to demand. Utterance [7] expresses a unidirectional causal relationship from demand to price and utterance [8] expresses a unidirectional causal relationship from supply to price. Most utterances classified in this category (just over 90%) focused on demand rather than supply. Utterances that referred to a causal relationship between demand and price and *separately* to a causal relationship between supply and price (see for example, Appendix 1, dimension 4, example 2), were included in this category.

5.3.3 Category 3: Bidirectional causal relationships between either price and demand or between price and supply

Some utterances explained pricing in terms of bidirectional causal relationships between price and demand or between price and supply:

[9] *"I think that the price on non-ecological hamburgers will decrease, as the demand for them will decrease and it is only when the price decreases that people want to buy them."*

[10] *"Because demand for cinema tickets decreases, prices will decrease. When price decreases people will again be attracted to go to the cinemas."*

The mutual influence within the causal relationship was explicitly expressed, such as demand affecting price as well as price affecting demand, as exemplified in utterances [9] and [10]. All but a handful answers belonging to this category of conceptions dealt with the bidirectional relationship between price and demand, rather than price and supply.

5.3.4 Category 4: Complex relationships where price, demand and supply are interrelated

Finally, some responses referred to ways in which demand, price and supply were dynamically interrelated.

[11] *"As the demand of ecological burgers will increase, the price will also increase, but this will create competition on the market and the prices on burgers will then decrease again so that customers want to buy from them and the price on non-ecological hamburgers will decrease as the demand decreases."*

[12] *"The fact that demand increases also leads to higher prices, because they know that people are willing to buy the product. The supply will also increase, which leads to the product being less exclusive and the price will decrease."*

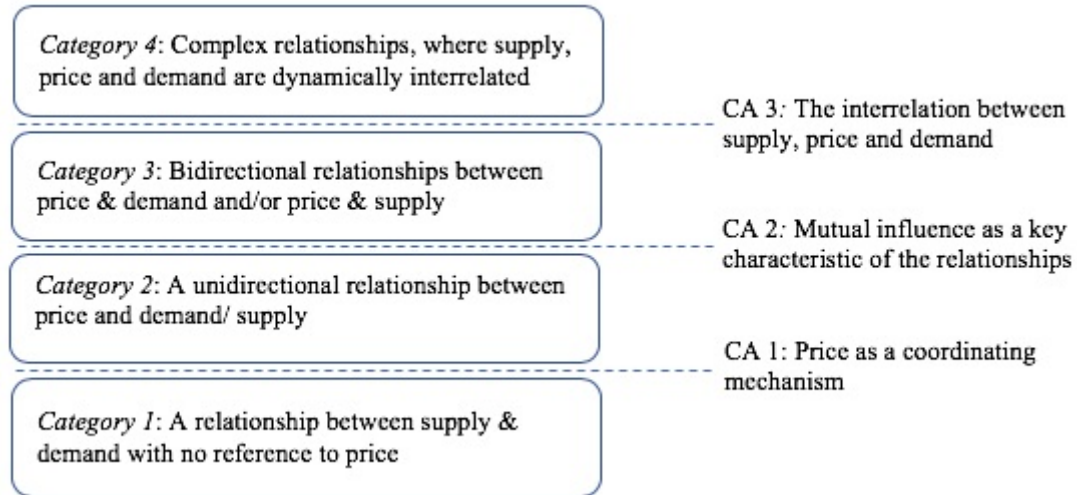
These utterances are different from utterances in category 3, because they explicitly refer to price as a mediating mechanism. Both utterances suggest a feedback effect that ultimately causes a fall in price. From the perspective of the representations in Figure 2, it would have been more appropriate to refer to a feedback effect which moderated the original rise in price. The language in both utterances does not clearly distinguish between shifts in a demand or supply schedule and movements along a supply or demand schedule. Nonetheless, these utterances suggest interactions in causation between demand and supply that are absent from the other conceptions of causation.

5.3.5 Critical aspects in understanding causation in price: what does it take to develop more complex conceptions?

This section identifies critical aspects necessary for students to discern in order to develop a more complex and nuanced way of understanding the causal relationships in pricing (summarised in Figure 3).

First, *seeing price as a coordination mechanism* seemed to be critical in order to move beyond conception 1, which suggests a direct relationship between demand and supply, neglecting the role of price. Second, moving from conception 2 to conception 3 requires awareness of feedback effects: *treating causation as bidirectional rather than a unidirectional process*. Third, moving beyond conception 3 requires awareness of interactions between each of *supply, price and demand*. The conventional supply and demand diagram (Figure 1) handles these interactions through distinguishing between shifts in supply or demand and movements along a supply or demand curve. There were students who expressed this way of understanding the causal relationships in pricing, but who had yet to develop precision of language that enabled them to distinguish between 'a moderation of a rise' and 'a fall'.

Figure 3. A hierarchical outcome space of the causal relationships in pricing, highlighting critical aspects of the phenomenon.



5.4 Relationships between the dimensions of variation

Table 3 summarises the five dimensions of variation in conceptions of price suggested by this study. This section considers relationships between these dimensions, with a focus on dimension of variation 4 (producer or market focus).

The analysis suggests that an understanding of the locus of decision-making concerning price – being producers or markets – is crucial for students' understanding of price. This dimension of variation (dimension 4 in Table 3) is in different ways linked to other dimensions of variation, which is especially clear in two cases.

First, we identified a strong association between *a producer perspective on price* (dimension 4, category (i)) and treating the supply curve as *downward sloping* (dimension 3, category (ii)). Utterances which suggested that suppliers would raise the price when they sold less were always framed by an individual producer perspective (see for example utterance 5). Utterances that suggested an *upward sloping supply curve* (dimension 3, category (iii)), almost invariably were framed by a *market perspective* (dimension, 4 category (ii)) (see for example, utterance 6).

Second, there was an association between the stated locus of price decision making and the suggested causal relationships in pricing. Utterances that expressed *a producer perspective on pricing* (dimension 4, category (i)) typically suggested a *unidirectional* causation (dimension 5, category (ii)). However, utterances that suggested a *market perspective* usually expressed a *more complex causal relationship* (dimension 5, categories (iii) and (iv)). Shifting from an individual producer perspective to a market perspective appeared to be a critical aspect in developing a more complex understanding in dimensions 3 and 5. Or the other way around, a more complex understanding of the causal relationships in pricing prompted a market perspective on pricing.

Table 3. Dimensions of variation in conceptions of price identified in previous research and in the present study (in italics).

	1	2	3	4	5
Dimension	Quantity supplied (Q_s) and demanded (Q_d) (Pang & Marton, 2005)	Slope of demand curve (Pang & Marton, 2003)	Slope of supply curve	Producer or market focus (Davies 2011, 2019 & Durden, 2018)	<i>The causal relationships in pricing</i> (This study)
Causal focus	Q affects Price (P)	P affects Q_d	P affects Q_s	Locus of decision-making affects Q_s	<i>The direction of causation</i>
Categories within dimension	(i) Quantity not mentioned: price reflects quality of product (ii) Change in Q_s affects P (iii) Change in Q_d affects P (iv) Changes in Q_s and Q_d affect P (v) Differences between changes in Q_s and Q_d affect P	(i) No recognition of effect of price on Q_d (ii) Negative effect of price on Q_d (iii) Recognition that the extent to which price affects Q_d may vary.	(i) No recognition of effect of price on Q_s (ii) <i>Negative effect of price on Q_s (implied)</i> (iii) Positive effect of price on Q_s (iv) Recognition that the extent to which price affects Q_s may vary	(i) Prices assumed to be set by individual producers (ii) Market forces determine prices (iii) Competition affects scope that providers have to vary prices in relation to market norm	(i) Q_d affects Q_s (with P not involved) (ii) Q_d/Q_s affects P or P affects Q_d/Q_s (iii) Q_d/Q_s and P mutually affect each other (iv) Q_d , Q_s and P interrelatedly affect each other



6 Discussion

This discussion comments on three ways in which the study extends knowledge in this field. First, as shown in Table 1, previous research on students' understanding of price has presented dimensions of variation as either variant or invariant in an expressed conception. This format has the advantage of signalling to teachers the pattern of variance and invariance they should aim for when helping students to understand phenomena in more complex ways. However, Table 1 does not include categorical differences in understanding supply, understanding demand or understanding the relationship between supply and demand. Pang & Marton (2003) found categorical differences in understanding demand and supply. This study extends that result by identifying a further categorical distinction within understanding of supply: an understanding that the price suppliers will charge will rise when demand decreases (dimension 3, category (ii)). We have suggested that Table 3 offers a more complete picture of variation in conceptions of price than Table 1 by identifying five dimensions of variation and by identifying categorical differences within each dimension. The representation in Table 3 treats Table 1 as focusing on a single dimension (column 1 in Table 3) which is concerned with the effect of a change in either quantity supplied or quantity demanded on price.

The representations of conceptions of a phenomenon in the form shown by Tables 2 and 3 make the task of placing conceptions in a hierarchy somewhat more complex. Earlier studies that focus on just one of the dimensions of variation in Table 3 suggested that the first conception in that dimension (e.g. Table 3, dimension of variation 1, category (i)) was the least qualified and the final conception in that dimension (e.g. Table 3, dimension of variation 1, category (v)) was the most developed. However, in multi-dimensional analysis, it is possible that an utterance can suggest that price is affected by changes in supply and by changes in demand, whilst using limited conceptions of either supply or demand. Therefore, in multi-dimensional analysis, we cannot claim that a conception referring to supply *and* demand (the most complex categories in dimension 1, Table 3) is necessarily more complex than a conception referring to either supply *or* demand in terms of bidirectional relationships (dimension 5, category (iii) in Table 3). Likewise, understanding price in terms of both supply and demand, but from a producer perspective is not more qualified than understanding it in terms of supply *or* demand, but from a market perspective. The aim in teaching will be to enable learners to combine the most complex conceptions in each dimension of variation. The critical steps in learning about price may lie as much in the way that dimensions of variation are combined as with developing a more complex conception within any one dimension of variation.

Second, we have also examined relationships between dimensions, something which is not possible when research (e.g. Pang & Marton, 2003, 2005) focuses on a single dimension of variation. The multi-dimensional approach in this study has highlighted a critical role for understanding price from a market perspective rather than a producer perspective, building on earlier research by Davies (2011, 2019) and Durden (2018). This multi-dimensional form of analysis may well be appropriate in the study of other complex phenomena in social science and other fields of study.

Third, a comparison of Tables 2 and 3 shows how our study has added to knowledge of conceptions of price. In dimension 3 (shape of supply curve) we found a conception (negative effect of price on quantity supplied) which has not been identified in previous studies (category (ii) in Table 3). This finding exposes a way that students might be thinking about supply which could hinder the development of more qualified ways of understanding the phenomenon. We also identified a new dimension of variation (dimension 5 in Table 3), which

focuses on conceptions of causation. Previous studies have either focused on causation from a change in quantity to a change in price (e.g. Dahlgren, 1984; Pang & Marton, 2005) or on causation from a change in price to a change in quantity (e.g. Pang & Marton, 2003). However, conventional economic analysis of price (e.g. through a supply and demand diagram, Figure 1) aims to represent interaction between demand, supply and price whereby causation runs in both directions. Table 3 identifies different ways in which utterances may portray the nature of causation in explanations of pricing.

7 Conclusion

This study answers three research questions. Our first question was 'How does the scope of a question affect the dimensions of variation in conceptions of price that come into view?' We designed problems that aimed to create opportunities for students to offer explanations that could vary within each of the dimensions referred to in Table 2 *and* could also vary in terms of the conception of causation that was employed. We did this by setting problems that asked students to consider the effect of a change in one market on price and quantity in another market. This form of question has not been used in previous research in this field. As we anticipated it prompted students to reveal their understanding of causation in pricing: in particular whether their reasoning was unidirectional or bidirectional. This dimension of variation has not been observed in earlier studies. This confirms that the formulation of a question/problem posed to students needs to be given a lot of attention. The way that a problem is posed seems to substantially affect what understanding of a phenomenon or concept is being expressed by the students. This conclusion is highly relevant for research as well as teaching.

Our second question was 'What variation is there in the way that students understand causation in their conceptions of pricing?' We were interested in this question because understanding causation lies at the heart of the more complex ways of understanding price. Students' understandings of economic phenomena are often formed through isolated experiences of those phenomena (e.g. in buying or selling, receiving an income or saving some money). Economics is concerned with the ways in which these individual transactions are related in systems. Single transactions involve unidirectional causation. Systems involve feedback loops. There is an ontological difference between the nature of reality that is assumed by these two types of explanations. Therefore, it is reasonable to expect that moving from a unidirectional view of causation to a systemic, bidirectional view will be critical to the development of more complex understanding of phenomena such as pricing. We found four qualitatively distinct ways of understanding causation in pricing. Two of these treated causation as unidirectional and two treated causation as bidirectional.

Our third question was 'How are dimensions of variation in conceptions of pricing related to each other?' We found that less developed conceptions of how supply is related to price and unidirectional conceptions of causation were associated with treating pricing as a single producer decision rather than the outcome of interacting market forces. This reinforces the picture arising from this research that readiness to understand pricing as a phenomenon of a system rather than an individual decision is critical for complex understanding. We need to add a caveat here that the decisions of an individual producer are a legitimate focus for enquiry, but from an economic perspective, these decisions will be constrained by market forces.



This study only includes students in upper secondary education. It may well be that results would be partly different if other age groups were involved. We may also have further deepened our understanding of the variations exposed if interviews with students were included in the study. Also, if the form of the question posed to students matters for what dimensions of variation that come into view in the student answers, as our results suggest, it is possible that if yet a different question was added, even more dimensions of variations of conceptions of price would emerge. Given the results from this study, pointing towards the importance of developing a complex understanding of the causal relationships between supply, price and demand, future research ought to investigate how teaching could be designed in order for students to develop such an understanding.

This study has implications for practice as well as for theory. Concerning the former, we suggest that it is highly relevant to consider how a question/problem is posed to the students, as this considerably affects what understanding of the phenomenon that come into view in their answers. Also, helping students to develop a complex understanding of the causal relationships involved in pricing, as well as an understanding of price as dependent on the market rather than an individual producer, seems to be central in teaching price to upper secondary students. Concerning the latter, we suggest that in order to understand the structure of a conception such as price, there is much to gain from a multi-dimensional analysis where several dimensions of variation of conceptions are understood in relation to each other.

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References

- Aprea, C. & Sappa, V. (2014). Variations of young Germans' informal conceptions of financial and economic crises phenomena. *Journal of Social Science Education*, 13(3), 57-67.
- Birke, F. & Seeber, G. (2011). Students' heterogeneous concepts of economic phenomena: How to ascertain these and consequences in the classroom. *Journal of Social Science Education*, 10(2), 56-66.
- Chi, M.T.H. (2008). Three types of conceptual change: Brief revision, mental model transformation, and categorical shift. In S. Vosniadou (Ed.) *International Handbook of Research on Conceptual Change* (61-82). New York: Routledge.
- Dahlgren, L. (1984). Outcomes of learning. In F. Marton, D. Hounsell & N. Entwistle (Eds.) *The Experience of Learning* (19-35). Edinburgh: Scottish Academic Press.
- Davies, P. (2011). Students' conceptions of price, value and opportunity cost: some implications for future research. *Citizenship, Social and Economic Education*, 10(2-3), 101-110.
- Davies, P. (2019). The construction of frameworks in learners' thinking: Conceptual change and threshold concepts in economics, *International Review of Economics Education*, 30, 100135.
- Durden, G. P. (2018). [Accounting for the context in phenomenography-variation theory: Evidence of English graduates' conceptions of price](#). *International Journal of Educational Research*, 87, 12-21.



- Ignell, C., Davies, P. & Lundholm, C. (2017). Understanding price and the environment: Exploring upper secondary students' conceptual development, *Journal of Social Science Education*, 16(1), 68-80.
- Lundholm, C. & Davies, P. (2013). Conceptual change in the Social Sciences. In S. Vosniadou (Ed.) *International Handbook of Research in Conceptual Change 2nd. Edition* (288-304). London: Routledge.
- Marton, F. (2015). *Necessary conditions of Learning*. New York: Routledge.
- Marton, F., & Pong, W. Y. (2005). On the unit of description in phenomenography. *Higher education research & development*, 24(4), 335-348.
- Meyer, J.H.F. & Shanahan, M. (2002). On variation in conceptions of 'price' in economics, *Higher Education*, 43(2), 203-225. <http://dx.doi.org/10.1023/A:1013701101153>
- Miller, A. J., Tewksbury, R., & Hensley, C. (2004). College students' perceptions of crime, prison and prisoners. *Criminal Justice Studies*, 17(3), 311-328. <http://doi.org/10.1080/1478601042000281132>
- Minton, M. (2014). Challenging student misconceptions of immigration in the UK. *Teaching Geography*, 39(3), 108.
- Pang, M. F., Linder, C., & Fraser, D. (2006). Beyond lesson studies and design experiments – using theoretical tools in practice and finding out how they work. *International Review of Economics Education*, 5(1), 28-45.
- Pang, M.-F. & Marton, F. (2003). Beyond 'Lesson Study': comparing two ways of facilitating the grasp of some economic concepts, *Instructional Science*, 31(3), 175-194. <http://dx.doi.org/10.1023/A:1023280619632>
- Pang, M.-F. & Marton, F. (2005). Learning theory as teaching resource: enhancing students' understanding of economic concepts, *Instructional Science*, 33(2), 159-191. <http://dx.doi.org/10.1007/s11251-005-2811-0>
- Pong, W. Y. (1997). Students' ideas of price and trade. *Economic Awareness* Harlow, Economic Awareness Teacher Training Programme.
- Speer, S. & G. Seeber. (2013). Financial understanding: A phenomenographic access to students' concepts of credits. *Journal of Social Science Education*, 12(2), 42-52.
- Åkerlind, G, S. (2005). Variation and commonality in phenomenographic research methods. *Higher Education Research & Development*, 24(4) 321-334.

Appendix 1. Examples of conceptions exposed in this study that replicate the analysis in previous research (as shown in Table 2)

Dimension	Quantity supplied (Q_s) and demanded (Q_d) (Pang & Marton, 2005)	Slope of demand curve (Pang & Marton, 2003)	Slope of supply curve	Producer or market focus (Davies, 2011, 2018 & Durden, 2018)
Causal focus	Q affects Price (P)	P affects Q_d	P affects Q_s	Locus of decision-making affects Q_s
Example (1)	"The more there is of a good, the less rare it becomes and the less it is then worth". (ii) [†]	"Ecological burgers are more expensive mainly because the raw ingredients used to produce them are better and much nicer." (i)	"When people have the possibility to download films instead of having to go to the cinemas, the demand for cinemas will decrease and prices on tickets will change." (i)	"Those who produce the ecological hamburgers want to make money on it and sell them for as much money as possible in order to earn money on it." (i)
Example (2)	"I think that the prices will increase, because there is an increased demand for ecological hamburgers and if not many are supplied, prices will increase." (iv)	The price on cinema tickets should decrease so that more people go to the cinemas. Nowadays when prices are high, more people stay at home watching TV instead." (ii)	"If price on cinema tickets decreases, this will affect the supply of films, because no one wants to produce a film if they don't get paid for it." (ii)	"This can result in decreased prices on cinema tickets, as there will be a larger supply and more competitiveness. If the demand will decrease, prices must also decrease." (iii)

[†] The roman numerals in brackets refer to the row number in Table 2.

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