

Price indexing and calculations of procurability: public transport markets in the making

Paper for Market Situations – Situated Markets. 5th Interdisciplinary Market Studies Workshop, Copenhagen Business School, June 6 – 8, 2018

Alexander Paulsson, Lund University
alexander.paulsson@fek.lu.se.se

Stig Westerdahl, Malmö University
stig.westerdahl@mah.se

Abstract

This paper takes a fresh look at an economic calculation device vital to actions and investments in various markets, the price index. Despite its importance, the price index has been surprisingly overlooked in previous studies in the sociology of market devices and financial instruments. In economics and in the history of economic thought, however, there is substantial amount of intellectual work concerning the construction of index numbers, desirable characteristics of index numbers and the relationship between index numbers and economic theory. To overcome this gap, this paper zooms in on the construction of a basket of price indexes on the one hand, and on the application of this basket in the processes of standardizing calculations in the market for procured public transport in Sweden, on the other. As such, the paper contributes with new knowledge to the sociology of market devices by providing conceptualizations of the price index as a device to standardize calculations and thereby levelling out the market conditions, which are, as it were, understood as necessary for constructing procurability.

Introduction

In most countries, price indexes are used to measure the value of money in the short term. In specific sectors and industries, the prices of goods and services that are particularly important for that part of the economy is collected and placed in a basket. Price indexes are used to measure both price trends and inflation, but also the impact of taxes on the cost and capital structure across the industry. Like many other sectors and industries, the public transport sector has its own price indexes.

Price indexing has received surprisingly little attention in the sociology of market devices and financial instruments thusfar. Indexing has been mentioned in analyses of the operations of stock markets (Maurer, 2002; MacKenzie, 2006), arbitrage and arbitration (Ashton & Christophers, 2015), investors' and traders' decisions and behaviors (Svetlova, 2012) and in the construction of prices (Muniesa, 2007; Caliskan, 2007). Yet, even when prices as phenomena in their own right are interrogated socio-culturally (Zafirovski, 2000; Beckert, 2001; Beunza, et al, 2006), price indexing and the contested terrain of calculating aggregated averages is largely absent from the discussions.

In economics, there is a long history of calculating and debating the construction and use of price indices (e.g. Klein and Morgan, 2001). The idea that price levels fluctuate and that the value of money change over time has been known for ages, as consumers and businesses often have experienced the harsh costs of inflation. Finding a formula for calculating a price index that displayed the variations over time did not emerge until the late 17th century (Klein and Morgan, 2001). Yet, it was not until Irvine Fisher (1911; 1922), who brought a broader interest in the quantity theory of money and business cycles to bear on the development of price indices, that an allegedly robust formula using a geometric mean was introduced (Boumans, 2001; 2004).

Looking at economic theory, a number of theoretical-cum-methodological challenges linked to price indexing have emerged. What prices are to be measured? Is it selling price or listed price that should be measured? Different customer groups sometimes pay different prices for the same product. How is this reflected in the index? Prices may also vary between different places. The same product or service can be sold using differentiated prices depending on where it is consumed. How can indexing incorporate this? These issues have been discussed within economic theory for a long time. Yet, they are not only of theoretical interest, for they also reflect attempts by states and public authorities to govern and regulate certain sectors and industries of the economy, including publically procured public transport.

The purpose with this paper is to investigate how and why price indexing emerged in the market for procured public transport in Sweden and in what ways it has been used since it was introduced in the mid 1990's. What indices and measurements have been included in the index basket and how have the market actors perceived and used the indexes as a device for calculating and evaluating bids in the procurement process? This study has been conducted within a larger research project that explores the creation and operation of markets for public transport in Sweden. During early 2018, observations and interviews were conducted with key staff at metropolitan public transport authorities and with members of the Index Council, a council that sorts under the Partnership for Public Transport, a multi-stakeholder trade association working on establishing various standards for the sector. In total, eight interviews were conducted and each interview lasted between 45 minutes and one hour. Prior to conducting the interviews, we produced an interview guide with a handful of questions and

issues to be brought up during the interviews. We focused on the standardization of the procurement processes and procurement contracts, including the standardized design of the price index basket as well as the use of it in recent procurement processes. The interviews were transcribed and analyzed on the basis of the theoretical discussion informing this paper.

Theorizing market devices and price indices

Prices and pricing will here be discussed in relation to the calculation and use of indices based on averages. Whilst price indices have been intensely debated in economics and economic thought and involve several theoretical-cum-methodological challenges related to the nature of prices as conveyors of information, which will be explicated more below, less attention has come from the perspective of economic sociology of markets and market devices. To bridge that gap, this theoretization of price indexing is informed by the works of Callon, MacKenzie, Muniesa and others who have established the research agenda on the economic sociology of market devices during the past two decades.

Distriuted knowledge and the market as a society of prices

The research of markets devices in economic sociology, organization studies and science and technology studies has flourished since Callon et al (2007) published the edited volume *Market devices*. The concept of a market device denotes “a simple way of referring to the material and discursive assemblages that intervene in the construction of markets”, according to Muniesa et al (2007, p 2). As such it includes phenomenon like pricing models, rankings and score cards, merchandizing and marketing tools, as well as protocols for trading and aggregated indicators. This multitude of market devices also reflect the plethora of markets that have been studied in this field of research, including derivatives markets (Millo, 2007; MacKenzie and Millo 2003), consumer and whole-sale markets (Çalışkan, 2007) and markets for natural disasters (Fourcade, 2010) and carbon emission trading schemes (Callon, 2009; MacKenzie, 2009; Lovell, 2014; Bigger, 2017). Despite this multitude, a common theme within the literature is that markets are understood to operate as socio-technical networks whilst markets devices generally are equated with different forms of standardized economic calculations (Callon and Muniesa, 2005; Kalthoff, 2005). By following and modifying standardized economic claulations, like models, formulas and protocols, each market actor contributes to rendering the market operational and contribute to its performance.

Whilst much of the research on market devices and pricing zooms in on financial markets, where pricing is subjected to fairly advanced, mathematical and therefore black-boxed formulas and protocols, less attention has been devoted to retail or whole-sale markets, and even less on markets constructed through the means of public procurement. Looking at traders in whole-sale markets, Çalışkan (2007) has integrogated the market devices used by regional and local traders in a cotton market in Izmir, Turkey. A myriad of prices enter the picture as traders, besides using actual prices as they emerge through exchange, also deploy prosthetic prices to explore leverage and profit opportunities, and rehearsal prices that frame the cognitive spaces of the exchanges (Çalışkan, 2010).

When price indices are explicitly interogated, it is generally in the context of financial markets. Millo (2007) has studied the origins of index-based derivatives and observed that the growth in derivative trading has been closely connected to the development of stock market indices, like Dow Jones 30 and Standard and Poor’s 100 or 500 indices. Whilst index-based derivatives are “merely the products of mathematical procedures”, their construction as legitimate trading enteties has been dependant on “a heterogeneous forum of agents (exchanges and regulators) that together transformed the cultural, political and practical

aspects of commodities trading into qualities that were assigned to the new financial contract” (Millo, 2007, p 210). In other studies, composite stock market indices have been studied in relation to how they impact derivative markets and financial trading. Lépinay (2010), for example, has studied a global bank and the implications of designing financial services that promise to beat a basket of stock market indices by a factor of 1.2. The models that underpin these financial services, he explains, is black-boxed and not revealed to neither costumers nor competitors. Whilst calculating aggregated averages in stock markets is a rather straight forward procedure - by tracking a number of individual stocks and their prices during one day, an index is calculated by adding all prices and dividing them by the number of stocks – most other price indexes, such as the consumer price index, require more empirical work and involve more theoretical assumptions. Other than as benchmarks, stock market indices are rarely problematized in the literature on financial markets.

The methods of aggregating prices

The understanding of pricing and price indexing discussed above differs from the price indices as market devices that is the focus of this paper. Unlike financial markets and the use of indices as benchmarks, governments deploy price indices as devices to adjust its expenditures and to stifle monopolies and oligopolistic markets in the interest of consumers. Governments have also been using price indices to construct markets for publicly procured goods and services and adjust its expenditures according to changes in the average cost of living, e.g. by pegging welfare benefits to consumer price index (Blackorby & Russell, 1978; Diewert, 1990)

Price indexing has developed using two methods, one called the matching method, the other the hedonistic method. What differs between them is their opposing views on whether prices must be observed or estimated. With the matching method, governmental agencies simply observe prices by selecting a sample of sellers and products and collect a price in the initial period for each of the products selected. At a second period, the governmental agencies gather the price for the very same products from the same sellers as in the first period.

“The price index is computed by matching the price for the second period with the initial price, observation by observation, or “model by model,” as it is often somewhat inaccurately called.” (Triplett, 2004, p 12)

This is the standard and preferred method amongst statisticians, economists and government officials because of its accuracy and reliability. However, ever so often products disappear from the retailers’ shelves and are replaced by similar but somewhat different products, carrying different prices. When a product’s price cannot be observed and there are changes in quality, price is estimated. Hedonistic measurement methods, as these estimations are called, are often used for products where it is not possible to observe a change in price that does not also account for a change in quality (Triplett, 2004; Bascher & Lacroix 1999). High-tech products are a case in point, as both quality improves and prices change more frequently than prices are measured (Abel, et al, 2003). Economist Zvi Griliches (1930-1999) devoted his entire career to figuring out how to measure “hard-to-measure goods and services” (Berndt & Hultén, 2009) and was one of the most important contributors to the development of hedonistic measurements (see e.g. Griliches, 1971). He contributed by developing logarithmic methods to estimate the development of technology and its quality improvements and link these to changes in aggregated average prices (*National Research Council*, 2002; Abel et al, 2003).

Irrespective of which method used, all price indices face one and the same problem: how should quality and quantity be measured for different products and services, and over which time (Aizcorbe, & Pho 2005)? Depending on the measurement and time-scale used, prices vary. A minor error in one part of the equation might have huge impacts in other parts. To take one example, miscalculations in quality improvements for one product might have huge impacts when aggregated. Measurement is also another area of contestation. Should prices be observed or estimated, and during which period? And which products should be included or excluded in composite indices? As has been discussed above, the debates about the pros and cons on the different methods and schools of thought have fluctuated in economics, as has the prices in the economy that the indices seek to measure.

Whilst prices and price indices here has been discussed in relation to market devices primarily used in financial trading, and as devices used by governments in various ways, not much has been said about public consumption and public procurement. Unlike in a private market with many sellers and buyers, public procurement is organized in such a way that governmental agencies offer a contract on which anyone is free to place a bid. The governmental agency then evaluates the bids and choose the bid which is the most favourable in terms of price and quality. Different private markets operate according to their own idiosyncrasies, yet politically constituted markets, including public procurement processes, paradoxically resembles the ‘perfect and efficient market’ the way that it is often described, and to some extent problematized, in many undergraduate economics textbooks. This is hardly surprising though, as public procurement legislation is modelled on the basis of a disembedded, efficient market where buyers and sellers exchange “at arms length” in order to enhance public value whilst avoiding any suspicions about corruption and nepotism.

Building upon this view of the political constitution of markets, we follow Fourcade (2010) in her analysis of “prices as artifacts”. For as much as prices are artifacts of market exchanges, they are perceived and treated as objects by the market actors and the devices that they use in the making the market operational. Whilst this view of prices as artifacts unveil how the price mechanism establish “tradability” in the market (Fourcade, 2010), we seek to investigate how procurability is established with the use of a basket of price indices. So, let’s now turn to the case of publicly procured public transport in Sweden and trace how price indexing have been used as a market device for standardizing calculations and levelling out the conditions for the actors in the market, both incumbent and newly entering ones.

Standardized contracts and public procurement of public transport in Sweden

The Partnership for Public Transport is a multi-party collaboration for actors within the Swedish public transport industry. Representatives from the Regional Public Transport Authorities are members in their capacity as purchasers of public bus- and train-services together with the private bus- and train operators. Other members include The Swedish Transport Administration, which is a governmental authority, and the Swedish Association of Local Authorities and Regions. The partnership was formed with the aim of doubling both the market share for public transport and increasing the level of ridership. In order to fulfill these two aims, committees and councils have been formed to develop processes that are regarded as important for fulfilling these aims. The so-called Contract Process is one such process. Since the Regional Public Transport Authorities procure traffic from the private market, a market with a limited number of private bus- and train operators, the public procurement process constitutes the backbone of the market for public transport. As in the rest

of Europe, a few operators dominate the market for procured public transport. Besides the Swedish based company Nobina, there is Hong Kong-based MTR, German-owned Arriva along with the two French-owned Transdev and Keolis, which together has won so many contracts that the market for procured public transport has been described as “mature”. The ambition is to widen the group of bidders, something that proves difficult.

Collaboration

The Index Council is one of several collaborative councils under the Partnership for Public Transport. The joined efforts in this council with stream-lining the Contract Process have resulted in four types of standardized contracts, agreed upon among the members. Two for bus traffic and two for train traffic. For each mode of transport, there are two versions: one incentive-based and one production-based standardized contract. These standardized contracts constitute templates, or are seen as a kind of smorgasbord from which regional procurement agencies select sections or certain solutions, we were told by several civil servants. The Partnership has also support functions, mainly targeting smaller regions who are conducting public procurements only occasionally and therefore lack sufficient experience. The Index Council is described as one of the more successful results of the Partnership, as the members represent both Regional Transport Authorities on the one hand, and the bidding private bus- and train companies on the other. The current work done by the Index Council is fairly uncontroversial, we were told, but this is the outcome of negotiations and collaborative experiments over a longer period.

When price indices were introduced in the procurement processes of public transport in Sweden in the early 1990's, it was a disputed device. The bus companies were the main advocates for using indices, as they were reluctant to carry the risks that an uncertain future, following unpredictably price fluctuations, could potentially imply. The procuring public transport authorities were more hesitant, since many of them by then regarded the profits in the market as high enough and that indices would give the private companies additional advantages. When first implied, about 70 percent of the total contract sum was indexed using the official consumer price index, but over a ten-year period the share expanded and finally the entire contract sum was covered by a handful of indices, effectively making up a price index basket. After the 1990's the contracts also started to become longer. The extension of contract periods constituted a driving force behind the development of using several indices, since none of the parties regarded it as feasible to handle contracts over 10 years or more, without hedging the risks it would incur for both purchaser and operator.

Not only have indices become fundamental for the procurement process as such, but the methods have also become increasingly complex. The current construction the Index Council is suggesting as a standard basket, entails that each cost type has its own price index: one for labor costs, another for fuel and yet another for interest rates. The bidding companies specify in their bids how they want to allocate the weight of various types of costs, and thereby create their own version of the standardized index basket. The weight range for each type of cost is specified in the tender. For example, labor costs, the main item, can range between 50 and 60% of total costs, fuel between 10 and 15% and so on. The company compose from these weights their own bid and connect the right price indices to mirror the total costs they project.

But the complexity does not end there. As each cost type follows one specific price index, these indices must be determined in detail. For labor costs this has traditionally been the Swedish Labor Force Index (“AKI ArbetsKraftsIndex”). The catch is that this index is no longer the official index in Sweden, but it is still produced by Statistics Sweden and remains

in-use thanks to some anonymous purchasers of the data-set. It will be replaced by a corresponding index at EU-level, LCI or Labour Cost Index. The construction of this index is slightly different, where the main problem for the public transport market in Sweden has been related to the fact that it has both a preliminary and a final version, whereas the Swedish AKI is only published once for each period. This creates problems of how to construct the contracts where the index periods have to be fixed and this remains to be solved.

Transitions between indices

The transition from one index to another is one of the many concrete issues that aggravate the use of index and motivate the existence of an Index Council, the former head of the Index Council explained to us. Another motive is to give suggestions for a suitable base-year or base-month, which is essential in relation to the LCI-index described previously. Another chronically prevailing question concerns how the composition of various cost types in the contracts depend on technology shifts: many diesel and bio-gas buses are now replaced by electricly powered buses, with consequences for the use of indices since the technological developments are occurring at a fast pace. As older versions of batteries and busses are replaced by newer and more advanced ones, it is difficult to observe changes in prices from one period to the next. Prices therefore have to be estimated.

The importance of indices is also confirmed by a tacit agreement amongst the parties in the Contract Process, an agreement saying that indices and how they are constructed in practice should be excluded from a potential appeal process. This must be understood in light of the surge in legal processes related to appeals on decicions of public procurement. But to facilitate the longer contract periods that both public purchasers and private operators have agreed upon, the price indices are now regarded such an essential component that they have been placed beyond disputes in courts, according to the former head of the Index Council.

The indices have another important role in the procurement of public transport services. As the bids from the interested traffic operators disclose how they compose their index basket, and how they weight different cost types, this makes it easier for the regional PTA's to evaluate the realism of the individual bids. This, then, become the foundation for the "shadow calculations" the purchasing PTA's are making. Not only should the bids that are obviously too high or too low be removed, as the legislation states, but the index basket also make these "shadow calculations" slightly easier, as the complexity of the bids give the private operators an upper hand since they generally have more experience. Because bus operators place bids in different PTA's across the entire country more often than individual PTA's procure traffic, apart from the metropolitan PTA's who procure traffic in quite frequent intervals, they gain more experience with working with the contracts than most of the PTA's.

In spite of their importance, price indices have a secluded position in descriptions of the Partnership for Public transport and the work with standardizing the contracts and the procurement processes. The term "neutrality in business", that constitute the formal motive behind the work by the Index Council, hide the calculative practices conducted by both operators and purchasers. The indices require a continual maintenance and surveillance of how each index is composed and how it functions in relation to the traffic operations and ultimately in the procurement itself. Indices are constantly changing as regards what prices are collected and how various components are weighted. Sometimes an entire index is replaced, as the example with labor costs, where the national index will be replaced by the EU-index with problems following from such a transition. Another example of technical

questions requiring an Index Council, is what base year to select and the implications of the decision.

Calculations of procurability

As our case study has shown, public procurement is a device for making public transport a market in Sweden. Public procurement is a composite process managed by the Regional Public Transport Authorities. The tender document covers a wide array of topics: some of them technical in character, some involving safety, quality and a myriad of other “soft” aspects that are being evaluated after the bidding has closed. As discussed above, there is also a tendency of longer contracts, as the procurement process in itself is demanding. The amount of details, the overall complexity and longer contract periods, make the market and the cost associated with operating traffic more unpredictable. Fluctuations in the prices of natural gas, diesel and gasoline are examples of this. Price indexing is a market device that standardize calculations and thereby enable the hedging of risks for the winning bidder, and thus contribute to making a “mature market” for public transport possible in an unpredictable price environment.

Price indexing, as has been shown in this case, is not only a key to standardizing calculations and to hedge risks, but it also contribute to levelling out the market conditions. So, whilst public procurement here has emerged as a device for constructing public markets, price indexing has emerged as necessary for constructing procurability. Procurability, then, denotes the process whereby public transport services are boxed-in and turned into an investment object suitable to public procurement processes. With a basket of indexed prices, the costs the bidders have to cover is adjusted according to changes in the individual indexes. We suggest that procurability is achieved in a two-step process. First, price indexing works as a standardized form of calculative device to hedge risks. Second, when brought together and composing an index basket, this basket becomes a market device making possible the public procurement process.

The construction of an index requires identification of items and the price at a given moment in time for each item. Labor costs, to take one example, is not only wage, but also taxes and various additional costs that compose this type of cost. This index construction can also have wider implications, illustrated by the national and European alternatives for indexing of labor costs and the different principles they are based on. Drawing upon the theoretical discussion and our extended case study, price indexing here emerges as a calculative device heavily involved in the attempts to combine standardized reasoning and entrepreneurial imagination (Beckert, 2016). Price indexing is a necessary part of rational economic decision making, whereby an imagined future state of the world is created and stabilized. By relying on price indexing, an unpredictable future becomes ostensibly governable since it reduces the variations in cost risks.

The Index Council, constituting an arm of the Partnership for Public Transport, do however not restrict their work to isolated indices. To mirror the conditions in the industry, a basket of indices is agreed upon and functions as basis for the tendering processes in the regions. These baskets function as a template for both purchasers and operators and simultaneously have a flexibility as the bids differ in how the basket is composed. As far as the imagined futures hamper the interest among the potential bidders to become involved in or enter the market for procured public transport, the construction of the price index basket can be seen as an essential infrastructure for configuring and levelling out the conditions for the incumbent and

entering actors. At the same time, the construction of the price index basket forms a social arena for disputes, where different interests and conflicting views emerge, which are connected to the various techniques being used. The Index Council functions as this arena, a place where the idea of indices firstly gained acceptance by both parts in the early 1990's and currently hosts discussion on various technical issues such as transition of indices or consequences of technology shifts in the sector.

Discussion and conclusion

This paper has looked the price index as an calculation device vital to actions and investments in various markets. Whilst the price index has been quite overlooked in previous studies in the sociology of market devices and financial instruments, this paper zoomed in on the construction of a basket of price indices on the one hand, and on the application of this basket in the processes of standardizing calculations in the market for procured public transport in Sweden, on the other. The index basket emerged during the mid 1990's, when contrac periods where getting longer and fluctuations in prices of fuel and salary led to unpredictable cost structures for the traffic operators. At the beginning, all costs were pegged to the consumer price index, but only a few years later, a industry specific basket was developed, including labor costs, gas prices, vehicle costs, interest rates etc. The use of the indexed price is entrenched in the public procurement process as the bidding companies want to hedge risks in cost structure. For the regional PTA's the use of the indexed prices is related to the evaluations of bids. By using the price indices, the PTA's engage in "shadow calculations" and thereby figure out how much a bid should be worth if calculated accurately.

This paper has contributed to previous studies by going beyond stock market indices to investgate price indices as market devices in public markets and public procurement process. By providing conceptualizations of the price index as a market device used to standardize calculations and thereby levelling out the market conditions, this paper has showed that bidders hedge risks related to the cost structure in the industry. Indexing as a calculative device is not enough to make public procurement possible in the context of public transport, but the additional use of the basket of indices, what we here have termed procurability is established. The basket of indices and a broad acceptance of this market device has emerged as a requirement to facilitate the procurement process. Procurability denotes the construction of something – a public transport services in this case – so it can be publicly procured. For public procurement to be possible, then something must obtain the attributes of procurability. It is in this process that price indexing and the construction of a basket of indices play vital roles as they turn prices into artifacts, whilst at the same time render public transport a fixed object of investment by financially boxing-in the service that is being subjected to public procurement.

References

- Abel, J. R., E. R. Berndt and A. G. White (2003), "Price Indexes for Microsoft's Personal Computer Software Products", *NBER working paper* no. 9966, September, Cambridge, MA: National Bureau of Economic Research.
- Aizcorbe, A. & Y. Pho (2005). Differences in Hedonic and Matched-Model Price Indexes: Do the Weights Matter? WP2005-06 September 1. *US Department of Commerce, Bureau of Economic Analysis*. Available: <https://www.bea.gov/papers/pdf/hedonicprice.pdf>

- Ashton, P., & Christophers, B. (2015). On arbitration, arbitrage and arbitrariness in financial markets and their governance: unpacking LIBOR and the LIBOR scandal. *Economy and Society*, 44(2), 188–217. <http://doi.org/10.1080/03085147.2015.1013352>
- Bascher, J. and T. Lacroix (1999), “Dish-washers and PCs in the French CPI: Hedonic Modeling, from Design to Practice”, presented at the Fifth Meeting of the International Working Group on Price Indices, Reykjavik, Iceland, August 25-27. Available at [http://www.ottawagroup.org/Ottawa/ottawagroup.nsf/home/Meeting+5/\\$file/1999+5th+Meeting+-+Lacroix+and+Bascher+-+Dish-washers+and+PCs+in+the+French+CPI+hedonic+modeling,+from+design+to+practice+2nd+Edition.pdf](http://www.ottawagroup.org/Ottawa/ottawagroup.nsf/home/Meeting+5/$file/1999+5th+Meeting+-+Lacroix+and+Bascher+-+Dish-washers+and+PCs+in+the+French+CPI+hedonic+modeling,+from+design+to+practice+2nd+Edition.pdf)
- Beckert, J. (2016). *Imagined Futures: Fictional Expectations and Capitalist Dynamics*. Cambridge: Harvard University Press.
- Beckert, Jens. 2011. "Where Do Prices Come From? Sociological Approaches to Price Formation." *Socio-Economic Review* 9 (4), 757-86.
- Berndt, Ernst R & Charles R. Hulten (Eds.) (2009). *Hard-to-Measure Goods and Services: Essays in Honor of Zvi Griliches*. Chicago: University of Chicago Press
- Beunza, D., I. Hardie, and D. MacKenzie (2006). A Price is a Social Thing: Towards a Material Sociology of Arbitrage. *Organization Studies*. Vol 27, Issue 5, pp. 721 – 745. <https://doi.org/10.1177/0170840606065923>
- Bigger, P. (2017). Hybridity, possibility: Degrees of marketization in tradeable permit systems. *Environment and Planning A: Economy and Space*. Vol 50, Issue 3, pp. 512 – 530. <https://doi.org/10.1177/0308518X17737786>
- Blackorby, C., & Russell, R. (1978). Indices and Subindices of the Cost of Living and the Standard of Living. *International Economic Review*, 19(1), 229-240. doi:10.2307/2526406
- Boumans, M. (2001). “Fisher's Instrumental Approach to Index Numbers.” *History of Political Economy* 33(5), 313-344.
- Boumans, M. (2004). *How Economists Model the World Into Numbers*. Abingdon: Routledge and Taylor & Francis.
- Caliskan, K. (2007), Price as a market device: cotton trading in Izmir Mercantile Exchange. *The Sociological Review*, 55: 241-260. doi:10.1111/j.1467-954X.2007.00738.x
- Çalışkan, K. (2010) *Market Threads: How Cotton Farmers and Traders Create a Global Commodity*. Princeton: Princeton University Press
- Callon, M (2009) Civilizing markets: Carbon trading between in vitro and in vivo experiments. *Accounting, Organizations and Society* 34(3-4): 535–548
- Callon, M., Y. Millo and, F. Muniesa. (Eds.) (2007) *Market devices*. Wiley & Sons
- Diewert, W.E. (1990) The Theory of the Cost-of-Living Index and the Measurement of Welfare Change. *Contributions to Economic Analysis*, Vol 196, 79-147, <https://doi.org/10.1016/B978-0-444-88108-3.50007-X>
- Fisher, I. (1911). *The Purchasing Power of Money: Its Determination and Relation to Credit, Interest and Crises*. New York: Macmillan.
- Fisher, I. (1922). *The Making of Index Numbers: A Study of Their Varieties, Tests, and Reliability*. Boston & New York: Houghton Mifflin.
- Fourcade, M. (2010) “Price and Prejudice: On Economics, and the Enchantment/Disenchantment of Nature”, in Jens Beckert and Patrik Aspers (Eds.) *The Worth of Goods*. Oxford: Oxford University Press
- Griliches, Z. (Ed.) (1971), *Price Indexes and Quality Change: Studies in New Methods of Measurement*, Cambridge: Harvard University Press

- Kalthoff, H (2005). Practices of Calculation: Economic Representations and Risk Management . *Theory, Culture & Society*. Vol 22, Issue 2, pp. 69 – 97. <https://doi.org/10.1177/0263276405051666>
- Klein, J. L. & Morgan, M. S. "The Reader's Essential Non-Guide to The Age of Economic Measurement." *History of Political Economy*, vol. 33 no. 5, 2001, pp. 3-3
- Lovell H.C., (2014). "Climate change, markets and standards: the case of financial accounting", *Economy and Society*. 43(2) pp. 260-284
- MacKenzie, D (2006). *An Engine, Not a Camera: How financial models shape markets*. Cambridge: MIT Press
- MacKenzie, D (2009) Making things the same: Gases, emissions rights, and the politics of carbon markets. *Accounting, Organizations and Society* 34(3-4): 440–455.
- MacKenzie, D, and Y. Millo. 2003. Constructing a market, performing theory: The historical sociology of a financial derivatives exchange. *American Journal of Sociology* 109:107-45
- Maurer, B. (2002). Repressed futures: Financial derivatives' theological unconscious. *Economy and Society*, 31(1), 15–36. <http://doi.org/10.1080/03085140120109231>
- Millo, Y. (2007), Making things deliverable: the origins of index-based derivatives. *The Sociological Review*, 55: 196-214. doi:10.1111/j.1467-954X.2007.00736.x
- Muniesa, F. , Millo, Y. and Callon, M. (2007), An introduction to market devices. *The Sociological Review*, 55: 1-12. doi:[10.1111/j.1467-954X.2007.00727.x](http://doi.org/10.1111/j.1467-954X.2007.00727.x)
- Muniesa, F. (2007). Market technologies and the pragmatics of prices. *Economy and Society*, 36(3), 377–395. <http://doi.org/10.1080/03085140701428340>
- National Research Council (2002). *At What Price?: Conceptualizing and Measuring Cost-of-Living and Price Indexes*. Washington, DC: The National Academies Press
- Svetlova, E. (2012). On the performative power of financial models. *Economy and Society*, 41(3), 418–434. <http://doi.org/10.1080/03085147.2011.616145>
- Triplett, J. (2004), "Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes: Special Application to Information Technology Products", *OECD Science, Technology and Industry Working Papers*, No. 2004/09, OECD Publishing, Paris, <http://dx.doi.org/10.1787/643587187107>.
- Zafirovski, M. Z. (2000). An Alternative Sociological Perspective on Economic Value: Price Formation as a Social Process. *International Journal of Politics, Culture, and Society*, 14(2), 265–295. <http://doi.org/10.1023/A:1026642624536>