

“More Amazon Effects: Online Competition and Pricing Behavior” by Alberto Cavallo

Discussion by Yuriy Gorodnichenko (UC Berkeley and NBER)¹

1. Introduction

The job of a proverbial central banker is supposed to be straightforward: she has one tool (the nominal interest rate) and she must hit one target (two percent inflation per year). But, of course, it is not so simple in real life. Economies are relentlessly battered by shocks and, thus, a central banker should be constantly tracking ever-changing conditions. Yet, even when central banks are on guard 24/7, they may contemplate more basic questions: what price index should they target and how should they measure their preferred price index? These could appear to be classic academic questions with little bearing for day-to-day policymaking but, in fact, these questions have significant implications in the current economic environment.

Indeed, the Fed and other central banks in developed countries consistently undershot their inflation targets in recent years thus raising concerns about central banks’ ability to deliver on their promises. Furthermore, the record low levels of unemployment and the glaring lack of inflation in the U.S. appear to undermine the Phillips curve, a central tenet of how monetary policy influences macroeconomic outcomes.

One explanation of these puzzles is that inflation is mismeasured because of changes in the retail sector. Specifically, this theory posits that by offering lower prices, Amazon.com and other e-commerce outlets in the last 10 years or so have exercised a strong downward pressure on prices similar to what was experienced in the 1980s and 1990s with the rising dominance of Walmart and other discount retail chains (Figure 1). Because these changes in the market structure are transitory (i.e., at some point the market share of Amazon.com and similar stores will stabilize), the “underlying” inflation may be higher. In other words, if one removes this one-time “Amazon” effect, some notion of “true” inflation is potentially higher than the current inflation rate and so central banks should not be concerned about the low inflation of recent years. Opponents of this theory, however, may appeal to the findings of the Boskin commission (see Boskin et al. (1998) for a summary): a rapid expansion of discount stores like Walmart was not properly accounted for

¹ I thank Oli Coibion for comments on an earlier version of this discussion.

in the CPI (due to outlet substitution bias) and, as a result, the CPI overstated inflation by 0.1 percentage point per year. If so, the true inflation now is lower than the CPI inflation suggests.

Although what is the net effect of e-commerce on aggregate inflation remains to be established, we can still learn a great deal from the evolution of pricing behavior of stores facing the likes of Amazon.com to prepare central banks for the maybe not-so-distant future where e-commerce is *the* key force in retail. Alberto's paper is an important step in this direction.

I draw two main conclusions from his analysis. First, consistent with earlier studies, he finds that Amazon's prices are a lot more flexible than prices of conventional, brick-and-mortar stores. More importantly, he documents that this forces Walmart (and presumably other traditional retailers) to adjust prices more often for products that are also offered on Amazon.com. As result, via strategic complementarity, Amazon.com can have more influence on how prices are set than is suggested by Amazon.com's market share. This means that consumer prices may be more sensitive to cost shocks than thought before. Second, while traditional retailers have some scope for variation of prices across geographical locations (i.e., a bottle of Pepsi may cost more in New York than in Detroit), online stores effectively offer the same price across locations thus pushing uniform pricing to the extreme.

This is an excellent paper. Alberto is careful to not venture into speculations about what these facts mean for monetary policy. But my role as a discussant is more permissive and so I will make several claims about why central bankers should care about this paper.

2. More flexible prices

New Keynesian economics has long recognized the tremendous heterogeneity in price rigidities across sectors and its implications (Haltiwanger and Waldman 1991, Carvalho 2004, Nakamura and Steinsson 2008). A basic conclusion from this line of work is that central banks should try to target a price index that overweighs sticky prices for two reasons. First, sticky prices incorporate more information about future inflation. Intuitively, "flexible" prices may move rapidly in response to transitory shocks but firms which change their prices less frequently have to be more forward-looking in their pricing decisions because they are stuck with chosen prices for a while. At the same time, central banks may have lags in observing price data and monetary policy itself influences the economy only with a lag. Thus, by responding to higher-frequency price changes, a central bank can destabilize rather than stabilize the economy. In contrast, because sticky prices react to more persistent shocks, they provide an operational target (Eusepi et al. 2011). Second, cross-sectional price dispersion, which is the main cost of business cycles in the New Keynesian

models, is largely driven by sticky prices (Aoki 2001). As a result, the central bank can improve welfare by stabilizing inflation of sticky prices, which via strategic complementarity, can also stabilize inflation of flexible prices. Consistent with these insights, central banks often target “core” inflation that excludes commodity (food, energy) prices, which are highly volatile. Relatedly, Eusepi et al. (2011) propose a price index that explicitly weighs sectors by their price stickiness and there are similar alternatives (e.g., the Federal Reserve Bank of Atlanta published Sticky-Price CPI developed by Bryan and Meyer (2010)).

What if e-commerce makes consumer prices as flexible as commodity prices?

One can entertain several implications. First, central banks may have to recalibrate their targeted measures of inflation. If pass-through for online prices is as high as it is for food and energy prices, one could imagine that, in the limit, the core inflation measure would become *CPI All Items Less Food, Energy and Amazon*. Relatedly, one may expect that central banks in large, developed countries will have a weaker grip on inflation, especially in the short-run, since price dynamics will increasingly be driven by short-run forces outside their control. As a result, central banks in these countries may encounter similar challenges as those faced by central banks in small open economies face (Fraga et al. 2003) and may have more difficulty in establishing or maintaining their credibility.

Second, central banks are constrained in their ability to combat recessions in the current ultra-low interest rate environment. This constraint can be exacerbated by increasingly flexible prices. For example, De Long and Summers (1986) and, more recently, Eggertson and Krugman (2012) argue that price flexibility may be destabilizing. Intuitively, sticky prices can help avoid deflationary spirals: a negative shock pushes prices down but, because prices are not flexible, deflationary pressure is attenuated. Thus, increasingly flexible prices will require counter-cyclical policy to be more aggressive precisely at a time when central banks have only limited ammunition.

Third, modern New Keynesian models imply that the main cost of inflation is the cross-sectional dispersion of prices. For positive steady state inflation, this dispersion is increasing in price stickiness. Furthermore, the weight on inflation volatility in the second-order approximation of consumer utility is increasing in price stickiness. Therefore, if e-commerce makes prices more flexible, policymakers should care less about inflation and, instead, put a higher weight on the volatility of output.

Finally, the standard New Keynesian model emphasizes pricing frictions as a key mechanism of how changes in nominal interest rates affect the economy. Obviously, there are other channels for

how central banks can influence the economy but a move to a flexible-price world would mean that central banks need to rethink their analytical frameworks and change operations.

3. Uniform pricing

Central bankers are mandated to manage macroeconomic outcomes but, inevitably, regional variation in economic performance enters policy discussions implicitly or explicitly (Coibion and Goldstein 2012; Beraja et al. 2017, Cœuré 2017). Regional variation in prices provides one mechanism to smooth out (at least partially) regional shocks without much input from aggregate policies. Indeed, retailers and manufacturers can vary their profit margins in response to changes in local economic conditions. Consistent with this insight, Beraja et al. (2016) document robust evidence that states with higher unemployment have lower inflation. Uniform pricing however limits the scope of this adjustment mechanism: if Detroit is hit hard by a recession relative to other parts of the U.S., Amazon.com is unlikely to give a special discount to consumers in Detroit. In theory, other margins of adjustment (wages, migration, etc.) can compensate for uniform pricing. In practice, these margins likely have little power as painfully illustrated by the experience of the eurozone during the 2008 Global Financial Crisis. Even for countries like the U.S., these margins may be less active than before. For example, Molloy et al. (2011) and others document that internal migration in the United States fell considerably since the 1980s. Grigsby et al. (2018) report considerable wage rigidities (especially downward, a tangible constraint during downturns). In such an economy, recessions may be prolonged and costly because it takes more time for resources to reallocate.

One potential solution is for monetary policy to be more countercyclical, but this may be difficult given the likely future constraints from the zero bound. An alternative solution is for monetary policy-makers to adopt tools that can be more targeted to specific regions, industries, or populations. To this end, Coibion et al. (2018) propose management of expectations as an alternative to conventional policies relying on changes in nominal interest rates. Intuitively, similar to advertising campaigns, communication policies can be tailored to a specific industry/region/population so that the perceived real interest rate moves at a subnational level, a task that is hard to achieve with nominal interest rates alone.

4. Additional forces

E-commerce not only changes how firms set prices but also how consumers do their shopping. With some oversimplification, a typical shopping trip for a consumer making purchases in a conventional store can be split in two stages. First, the consumer chooses a store that ex ante offers the best prices

for a bundle of goods that the consumer desires. Second, after coming to the chosen store, the consumer adjusts his basket in response to observed prices. Given that consumers buy many things conditional on coming to a store, retailers can use cross-subsidies to maximize total profit. A classic strategy for stores in this context is to lure consumers by offering them discounts on some goods and potentially charging high prices on other goods that are bundled with the discounted items.

Internet shopping has a different structure. First, consumers decide what they want to purchase. Second, they search the internet for the best deal. As a result, the ability of stores to bundle goods is more limited. Furthermore, because the search for the best deal online is particularly easy,² the elasticity of demand with respect to price becomes high. Indeed, even going from the lowest price to the second lowest price in online markets is associated with a large decline in quantities. As a result, a large market share in e-commerce does not necessarily translate into high markups because consumers are not terribly attached to an online retailer. Consistent with this prediction, profit margins of Walmart (more than 20 percent) are much higher than profit margins of Amazon.com (less than 4 percent).

These patterns have several implications for central banks. First, small markups limit the ability of retailers to absorb cost shocks and so the pass-through for online retailers should be higher. Second, because the Phillips curve in estimated DSGE models is quite flat, most of the variation in inflation is attributed to “markup” shocks. While these shocks should not be interpreted literally as variation in market power, these models may face greater skepticism because large variation in “markups” would be inconsistent with very low levels of price markups in the data (that is, there is little space for variation in markups for online retailers like Amazon.com). Third, greater elasticity of demand typical for online retailers entails greater strategic complementarity which in turn means a flatter Phillips curve.

There are other potential changes in shopping behavior that may be relevant for central banks. For example, the advent of big-box/warehouse stores has led to less frequent shopping trips and more prevalent purchases of goods in bulk (Coibion et al. 2017). As a result, spending inequality measured on short histories of purchases (e.g., the Diary Survey in the U.S. Consumer Expenditure Survey) has been drifting up since the 1980s. Online shopping can reverse this trend

² The European Commission (2014) finds that 74 percent of all shoppers in the European Union use internet comparison tools to compare prices and find the cheapest price.

as consumers do not have to buy goods in bulk to get discounted prices. Because the distributional consequences of monetary policy have become more important both in a positive (Coibion et al. 2017, Auclert 2017) and normative (Yellen 2014, Mersch 2014) sense, policy discussions should be cognizant of this potential change in the direction of the trend.

Finally, the emerging prevalence of e-commerce offering low prices can create new opportunities for consumers to switch their shopping outlets over the business cycle. For example, Coibion et al. (2015), Nevo and Wong (2015) and others document that households actively exploit price differentials across stores and “trade down” in recessions (e.g., switch from “Safeway” to “Walmart”). One may predict that this switching will be amplified in the future because switching to an online store is particularly easy. As a result, aggregate “true” inflation may be more cyclically sensitive than suggested by headline CPI inflation. Furthermore, such store switching reduces the weight on inflation volatility in micro-founded New Keynesian models because store switching reduces the cost of price dispersion.

5. Limits of e-commerce

Although internet offers seemingly unbounded opportunities for retailers and the stock market believes that the future of retail belongs to the likes of Amazon.com, I have several reasons to believe that Amazon.com (and more generally e-commerce) will not take over the world and prices of consumer goods will not be as flexible as commodity prices. First, Alberto documents that Amazon.com changes the pricing behavior of Walmart. But strategic complementarity is a two-way street: Walmart can slow down Amazon’s price changes. Indeed, the conventional New Keynesian wisdom is saying that, in presence of strategic complementarity, flexible-price firms should mimic the behavior of sticky-price firms. Thus, although it is most remarkable that Amazon.com can reverse the flow of causality, one may expect that as long as brick-and-mortar stores remain a fact of our shopping lives, online stores should not deviate too much from conventional retailers characterized by sticky prices. Relatedly, stores selling goods offline *and* online have similar prices offline and online (Cavallo 2017). Hence, as Amazon.com and others move to conventional retail, they may be forced to set their prices in a way that is closer to how prices are set by traditional retailers.

Second, a great appeal of online retail is dynamic pricing, that is, the ability of firms to set prices every instant depending on demand and supply conditions. Indeed, online retailers are uniquely positioned to collect vast amounts of data about consumers and to employ algorithmic

pricing at very high frequencies (they do not face physical costs of nominal price adjustment, “menu” costs). A few industries (e.g., airlines and hotels) embraced this opportunity but many industries did not follow the suit. For example, Amazon.com continues to have rather sticky prices of books and other printed media (Boivin et al. 2012) despite having an overwhelming dominance in the market. Furthermore, although online prices change more frequently than prices in conventional stores, early evidence (Gorodnichenko et al. 2018) suggests that online prices are as unresponsive to monetary policy shocks and macroeconomic news shocks as offline prices. In fact, it is rather puzzling why we do not see more dynamic pricing. Perhaps, prices remain sticky because of psychological costs of alienating consumers by breaking implicit price contracts (Blinder 1994, Rotemberg 2011) even if they can change every second.

Third, the logic of internet markets characterized by easy search and absence of classical “menu” costs suggests that we should observe little (if any) price dispersion for a precisely defined good. Indeed, if there is a market where the law of one price must hold, e-commerce is that market. Yet, many studies (e.g., Ellison and Ellison 2009, Gorodnichenko et al. 2014) document that cross-sectional price dispersion for online markets is large and is comparable to that for offline markets. For example, on August 11, 2018, Google Shopping showed that prices (including shipping and taxes) for Samsung Galaxy S9 (64 GB, Midnight Black, Unlocked) varied from \$603 to \$878 across sellers with reviews (the price at Amazon.com was \$680), see Figure 2. More generally, by many metrics online markets are as imperfect as offline markets. What determines these surprising patterns is an area of active research.

Fourth, there are exogenous and endogenous barriers for Amazon.com and other online retailers to overtake some markets. For example, many services cannot be delivered over the internet (healthcare, education, housing, etc.) but they account for roughly a half of consumer spending. Perhaps, some day Amazon.com will find a way to make a flu shot or a haircut with a drone but for now prices in the service sector will likely remain as rigid as they have been in the past. There are also signs that firms attempt to protect themselves from e-commerce competition. For instance, conventional retailers can have goods sold exclusively by these retailers (e.g., Walmart and Costco use private labels Great Value and Kirkland). One may anticipate that this kind of behavior will be increasingly widespread. Indeed, many manufactures sell exclusively via their online and offline stores (e.g., Apple and IKEA do not sell their products via Amazon.com or other online retailers) which have rather rigid prices (Cavallo et al. 2014).

6. Concluding remarks

Walmart reshaped the landscape of retail in the 1980s and 1990s. Now a new revolution in retail is being led by Amazon, Ebay, Overstock and other online shops. In this new world, menu costs are negligible, search for best prices is cheap and easy, and the geographical location of consumers and stores is largely irrelevant. Undoubtedly, these characteristics of e-commerce will make prices more flexible and more uniform across locations, although consumer prices will not converge in their properties to commodity prices. What does this mean for central banks?

My tentative analysis suggests several predictions. First, monetary policy should be more aggressive in combatting recessions. Second, central banks should likely put a higher weight on volatility of output as more flexible prices lead to smaller distortions in the allocation of resources. Third, holding everything else constant, inflation will likely become more volatile and cyclically sensitive, more dominated by transitory shocks, and potentially more difficult to control in the short run. Fourth, central banks will possibly need to redefine their targets and operations to respond to the evolving nature of price setting in the retail sector. Perhaps, central banks will need to develop new tools to make their policies more targeted.

Of course, these changes will not happen overnight but central banks will be well advised to prepare themselves early on. Indeed, despite the growing importance of e-commerce, the properties of online prices are still relatively understudied. Somewhat surprisingly, efforts to collect online price data are largely confined to individual academics like Alberto but this kind of endeavor requires considerable investment and institutional support. Since statistical agencies appear to show little appetite to gather price quotes and volumes of sales for e-commerce, central banks should fill in this void. Having such data will help us better understand the nature of online markets and adjust policies accordingly.

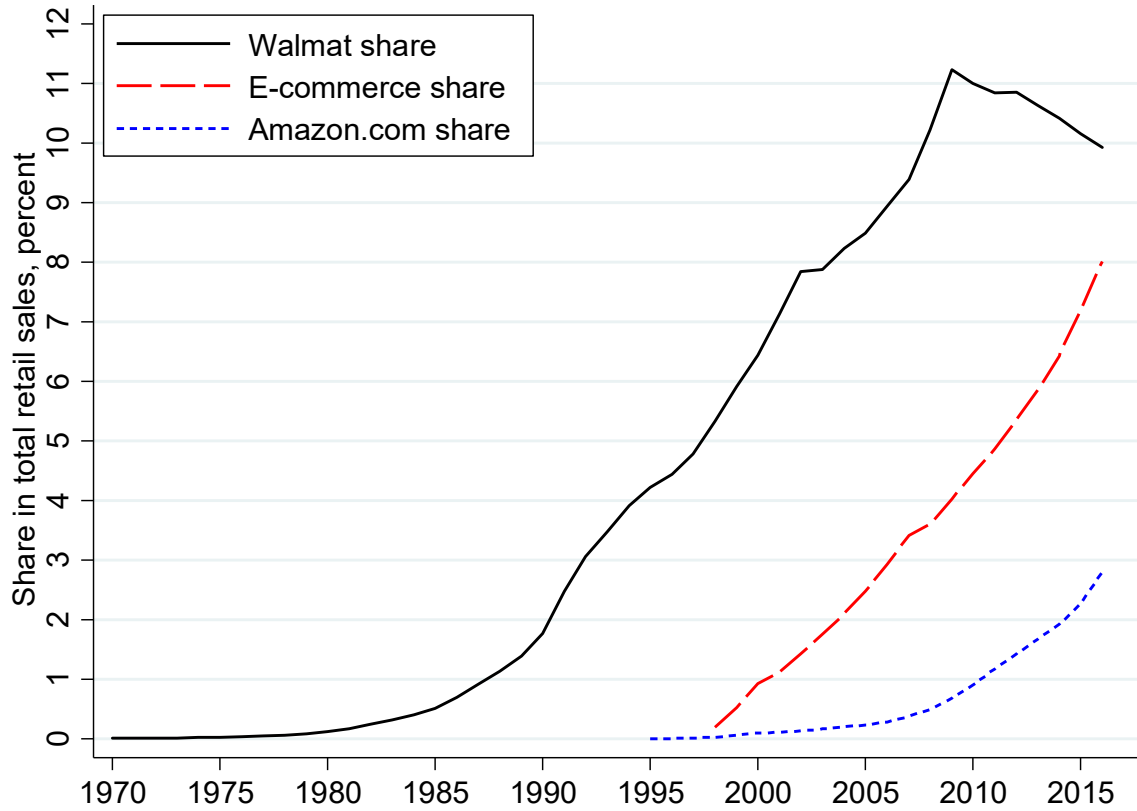
References

- Auclert, Adrien, 2017. "Monetary Policy and the Redistribution Channel," NBER Working Papers 23451, National Bureau of Economic Research, Inc.
- Beraja, Martin, Andreas Fuster, Erik Hurst, and Joseph Vavra, 2017. "Regional Heterogeneity and Monetary Policy," NBER Working Papers 23270.
- Beraja, Martin, Erik Hurst, and Juan Ospina, 2016. "The Aggregate Implications of Regional Business Cycles," NBER Working Paper No. 21956.

- Blinder, Alan S., 1994. "On Sticky Prices: Academic Theories Meet the Real World." In *Monetary Policy*, edited by N. Gregory Mankiw, pp. 117–154. University of Chicago Press.
- Boivin, Jean, Robert Clark, and Nicolas Vincent, 2012. "Virtual borders," *Journal of International Economics* 86(2): 327-335.
- Boskin, Michael J., Ellen L. Dulberger, Robert J. Gordon, Zvi Griliches, and Dale W. Jorgenson, 1998. "Consumer Prices, the Consumer Price Index, and the Cost of Living," *Journal of Economic Perspectives* 12(1): 3-26.
- Bryan, Michael F., and Brent Meyer, 2010. "Are some prices in the CPI more forward looking than others? We think so," *Economic Commentary*, Federal Reserve Bank of Cleveland, issue May.
- Carlos, Carvalho, 2006. "Heterogeneity in Price Stickiness and the Real Effects of Monetary Shocks," *The B.E. Journal of Macroeconomics* 6(3): pages 1-58.
- Cavallo, Alberto, 2017. "Are Online and Offline Prices Similar? Evidence from Large Multi-channel Retailers," *American Economic Review* 107(1): 283-303.
- Cavallo, Alberto, Brent Neiman, and Roberto Rigobon, 2014. "Currency Unions, Product Introductions, and the Real Exchange Rate," *Quarterly Journal of Economics* 129(2): 529-595.
- Cœuré, Benoît, 2017. "Convergence matters for monetary policy," speech at the Competitiveness Research Network (CompNet) conference on "Innovation, firm size, productivity and imbalances in the age of de-globalization" in Brussels, 30 June 2017. Available at https://www.ecb.europa.eu/press/key/date/2017/html/ecb.sp170630_1.en.html.
- Coibion, Olivier, and Daniel Goldstein, 2012. "One for Some or One for All? Taylor Rules and Interregional Heterogeneity," *Journal of Money Credit and Banking* 44(2:3), 401-432.
- Coibion, Olivier, Yuriy Gorodnichenko, and Dmitri Koustas, 2017. "Consumption Inequality and the Frequency of Purchases" NBER Working Paper 24788.
- Coibion, Olivier, Yuriy Gorodnichenko, and Gee Hee Hong, 2015. "The Cyclicalities of Sales, Regular and Effective Prices: Business Cycle and Policy Implications" *American Economic Review* 105 (3): 993-1029.
- Coibion, Olivier, Yuriy Gorodnichenko, Lorenz Kueng, and John Silvia, 2017. "Innocent Bystanders? Monetary policy and inequality," *Journal of Monetary Economics* 88(C): 70-89.
- Coibion, Olivier, Yuriy Gorodnichenko, Saten Kumar, and Mathieu Pedemonte, 2018. "Inflation Expectations as a Policy Tool?" NBER Working Paper 24788.
- De Long, J. Bradford, and Lawrence H. Summers, 1986. "Is Increased Price Flexibility Stabilizing?" *American Economic Review* 76(5): 1031-1044.


- Eggertsson, Gauti B., and Paul Krugman, 2012. “Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach,” *Quarterly Journal of Economics* 127(3): 1469-1513.
- Ellison, Glenn, and Sara Fisher Ellison, 2009. “Search, Obfuscation, and Price Elasticities on the Internet,” *Econometrica* 77(2): 427–452.
- European Commission, 2014. “Study on the Coverage, Functioning and Consumer Use of Comparison Tools and Third-Party Verification Schemes for Such Tools.” Available at <https://ec.europa.eu/futurium/en/content/study-coverage-functioning-and-consumer-usecomparison-tools-and-third-party-verification>.
- Fraga, Arminio, Ilan Goldfajn, and André Minella, 2003. “Inflation Targeting in Emerging Market Economies,” *NBER Macroeconomics Annual* 18 (2003): 365-400.
- Gorodnichenko, Yuriy, Viacheslav Sheremirov, and Oleksandr Talavera, 2018. “The responses of internet retail prices to aggregate shocks: A high-frequency approach,” *Economics Letters* 164(C): 124-127.
- Grigsby, John, Erik Hurst, and Ahu Yildirmaz, 2018. “Aggregate Nominal Wage Adjustments: New Evidence from Administrative Payroll Data,” manuscript.
- Haltiwanger, John, and Michael Waldman, 1991. “Responders versus Non-responders: A New Perspective on Heterogeneity,” *Economic Journal* 101(408): 1085-1102.
- Mersch, Yves, 2014. “Monetary policy and economic inequality,” keynote speech by Mr Yves Mersch, Member of the Executive Board of the European Central Bank, at the Corporate Credit Conference, hosted by Muzinich, Zurich, 17 October 2014. Available at <https://www.bis.org/review/r141020d.htm>.
- Molloy, Raven, Christopher L. Smith, and Abigail Wozniak, 2011. “Internal Migration in the United States.” *Journal of Economic Perspectives* 25 (3): 173-196.
- Nakamura, Emi, and Jón Steinsson, 2008. “Five Facts about Prices: A Reevaluation of Menu Cost Models,” *Quarterly Journal of Economics* 123(4): 1415-1464.
- Nevo, Aviv, and Arlene Wong, 2015. “The Elasticity of Substitution Between Time and Market Goods: Evidence from the Great Recession,” NBER Working Paper No. 21318.
- Rotemberg, Julio J., 2011. “Fair Pricing.” *Journal of the European Economic Association* 9(5): 952–981.
- Yellen, Janet, 2014. “Perspectives on Inequality and Opportunity from the Survey of Consumer Finances,” speech delivered at the Conference on Economic Opportunity and Inequality, Federal Reserve Bank of Boston, Boston, Massachusetts, October 17, 2014. Available at <https://www.federalreserve.gov/newsevents/speech/yellen20141017a.htm>.

Figure 1. Retail shares



Notes: the figure reports the share of sales for selected retailers in total retail sales. Shares for Walmart and Amazon.com are computed as the ratio of each company's revenue (reported in Compustat) to total retail sales. Total retail sales and e-commerce retail sales are from the U.S. Census Bureau.

Figure 2. Prices for a specific product on Google Shopping

 Samsung Galaxy S9 - 64 GB - Midnight Black - Unlocked \$634 online ★★★★★ 2,907 product reviews					
Sellers	Seller Rating	Details Special Offers	Base Price	Total Price	Visit site
BuyVPC.com	97% positive (200)		\$765.98 +\$70.85 tax. Free shipping	\$836.83	Visit site
PCNation	96% positive (1,839)		\$758.51 +\$56.89 tax. Free shipping	\$815.40	Visit site
CompSource	95% positive (655)		\$744.75 +\$55.86 tax. Free shipping	\$800.61	Visit site
Sam's Club	94% positive (692)		\$790.90 +\$79.85 tax and \$7.60 shipping	\$878.35	Visit site
B&H Photo-Video-Audio + Show all 2	93% positive (188,962)	Used	\$633.50 Free shipping. No tax	\$633.50	Visit site
Electronicsforce.com	93% positive (700)		\$603.19 Free shipping. No tax	\$603.19	Visit site
BLINQ.com	92% positive (4,858)	Refurbished	\$652.99 +\$60.40 tax. Free shipping	\$713.39	Visit site
NothingButSavings.com	92% positive (390)		\$725.01 +\$52.56 tax. Free shipping	\$777.57	Visit site
Best Buy + Show all 2	92% positive (228)		\$669.99 +\$61.97 tax. Free shipping	\$731.96	Visit site
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