Wal-Mart innovation and productivity: a viewpoint

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Abstract. Technology effects, business process development, and productivity growth are considered in the context of a single company: Wal-Mart. The starting point is the 2001 McKinsey Global Institute report, which finds that over 1995–2000, a quarter of U.S. productivity growth is attributable to the retail industry, and almost a sixth of that is attributable to Wal-Mart. Wal-Mart is interesting as well because of its rapid growth in Canada. This is now Canada's largest private sector employer. We also consider other evidence relevant to public policy formation concerning Wal-Mart and conclude with a discussion of options for partially filling important data gaps. JEL classification: J2, L5, L11, L25, L81

Innovation et productivité chez Wal-Mart : un point de vue. On considère les effets de la technologie, le développement des processus d'affaires, et la croissance de la productivité dans le contexte d'une seule compagnie : Wal-Mart. Le point de départ est le rapport de 2001 du McKinsey Global Institute qui révélait que, pour la période 1995-2000, le quart de la croissance de la productivité aux Etats-Unis était attribuable au commerce de détail, et un sixième à Wal-Mart. Le cas Wal-Mart est aussi intéressant à cause de sa croissance rapide au Canada. C'est maintenant le plus grand employeur privé au Canada. On considère certains résultats pertinents pour la formation de la politique publique en

ce qui concerne Wal-Mart, et on conclut par une discussion des options ouvertes pour résoudre des problèmes de trous importants dans les données.

1. Introduction

In a *New York Times* article about the 2001 McKinsey Global Institute (MGI) productivity report, Postrel writes: 'Europeans assume that American growth is driven by Silicon Valley ... That view is wrong.' She goes on to write that MGI finds that a quarter of U.S. productivity growth is attributable to the retail industry, and almost a sixth of that improvement is attributable to Wal-Mart. Commenting on the findings of that same MGI study, Solow is quoted as stating: 'The technology that went into what Wal-Mart did was not brand-new and not especially at the technological frontiers, but when it was combined with the firm's managerial and organizational innovations, the impact was huge' (Schrage 2002).

Wal-Mart is also said to be boosting Canada's productivity. For instance, drawing on Sharpe and Smith (2004) and the Conference Board (2004), Dion and Fay (2008) of the Bank of Canada write: 'The Wal-Mart name is synonymous with the surge in productivity growth in retail trade. In fact, the Wal-Mart effect is used to define the changing retail landscape where relentless competition forces investment and organizational change that drives productivity growth.' Wal-Mart entered Canada in 1994 as a general merchandise retailer. By 1999, its share of national retail sales was roughly the same in Canada as in the United States. In 2004, Wal-Mart began selling groceries in Canada as well. Wal-Mart is now Canada's largest grocer and largest private sector employer.

When Wal-Mart began selling groceries in Canada, the company already had U.S. revenues that exceeded the combined revenues of the next five largest U.S. retailers. In addition to having become important to thousands of suppliers[1] by then Wal-Mart had become an important trading partner to nations. The $18 billion Wal-Mart spent that year on Chinese products made it China's eighth-largest trading partner, ranking ahead of Russia, Australia, and Canada (Jingling 2004). Moreover, Wal-Mart has continued to grow. Some empirical research suggests that poorer families have especially benefited (Broda and Romalis 2008; Ghemawat and Mark 2006). Others, however, worry Wal-Mart has become so large it could readily indulge in predatory pricing and other anti-competitive behaviours. [1]

In this paper we examine the MGI report's main conclusions in the context of related literature. After outlining the logic and content of the report in section 2, we consider four sorts of other evidence:

- The results of our own search of the business literature for information regarding Wal-Mart technology and business process leadership (section 3).

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1 Already by 2004, the percentage of sales made by Wal-Mart was 38% for Playtex, 25% for Clorox, 21% for Revlon, 13% for Kimberly-Clark, and 17% for Kellogg's (Weinswig and Tang 2006).

- Results of U.S. panel data studies of Wal-Mart price effects (section 4.1).
- Results of U.S. panel data studies of Wal-Mart employment effects (section 4.2).
- And, the results of our own panel data study for Canada of Wal-Mart employment and productivity effects (section 5).

We provide background on prior attempts to curb anti-competitive behaviour in the retail industry and for transportation services that retailers rely on (section 6). This material further illustrates why answers to questions like those addressed by the MGI report do matter. The MGI report claims the results are not seriously affected by data availability or measurement problems, though such problems are acknowledged. We explain why we still worry about measurement bias and especially about data gaps (section 7). We conclude with a discussion of options, including a proposal for partially filling the most serious of the identified data gaps (section 8) and with closing recommendations (section 9).

2. The 2001 McKinsey Global Institute report

The MGI report caught the attention of government officials and continues to be referenced. Since the report is very long (more than 600 pages), we review some of its features here. The report explains that the 1995–2000 U.S. annual labour productivity growth rate of 2.5 was dramatically better than the growth rate for 1972–95 and 'within sight' of the 2.9% growth rate achieved during the 'golden' 1947–72 period. The key research challenge addressed in the 2001 MGI report is understanding the sources of the post-1995 jump in U.S. labour productivity.

As the MGI report notes, other studies have also found that the United States enjoyed rapid productivity growth over the 1995–2000 years and that a substantial share of the productivity growth came from the retail sector (e.g., Fernald and Ramnath 2004; Van Ark 2010; references in those papers). What makes the MGI report distinctive (besides its stellar Advisory Committee)[2] is that it claims to trace much of the retail sector productivity growth surge to *a single company*: Wal-Mart. Labour productivity is measured in the MGI study as output divided by a labour input measure. Output is predominantly measured as value added. The choice to use value added in calculating labour productivity was made, the MGI report states, because it can allow for differences in vertical integration over time and differences in the efficiency with which inputs are used, and because it provides a basis for 'linking' the MGI 'case studies' with the report's economy-wide findings. The 'linking' role ascribed to the use of value added output is part of how the MGI report manages to produce conclusions about the

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2 See, for example, Tsao (2002). For current reports of alleged abuses of this sort, see http://walmartwatch.com/.

impacts of a single company. This link is problematical, however, owing to the limitations of the data underlying the value added output measures.[3]

The MGI study uses data from the U.S. Bureau of Economic Analysis (BEA) for 60 industry sectors. A sector is classified as 'jumping' in year Y if its compounded annual growth rate of labour productivity for years Y through $Y + 3$ was at least 3% higher than for years $Y - 3$ to Y. Out of the 60 sectors, 38 had a productivity 'jump.' The MGI study finds that most of the 1995–2000 net productivity acceleration for the U.S. economy is attributable to just six key 'jumping sectors': retail trade, wholesale trade, securities and brokerage services, industrial machinery and equipment, electronics, and telecommunications.

More detailed analyses, referred to in the MGI 2001 report as 'case studies,' were carried out for the six key jumping sectors plus three paradox sectors.[4] These case studies make use of industry-level data from the BEA and from the U.S. Bureau of Labour Statistics (BLS). In addition, the report draws on McKinsey's proprietary surveys and firm-specific contacts and expertise, including discussions with company executives.

Within the retail sector, the MGI study focuses mostly on general merchandise retailing, which represented 14% of 1999 nominal sales. The report finds that productivity growth in general merchandise, which had been at a rate of about 5.3% per year for 1987–95, rose to 10.1% per year for 1995–9. Within general merchandizing, the MGI report concludes that Wal-Mart contributed roughly one-third of the productivity improvement, and that most of the remaining two-thirds was attributable to the diffusion of best practices to Wal-Mart's competitors. Increased consumer substitution toward higher-value goods also is reported to have had an effect.[5] According to the MGI report, in 1987 Wal-Mart had a market share of just 9%, but was 40% more productive than its competitors. By the mid-1990s, Wal-Mart's share was measured at 27% and its productivity advantage reportedly was 48%. The MGI report asserts that the growth of Wal-Mart heightened competitive intensity in the retail industry and hastened the diffusion of best practices.

3 The Advisory Committee members were Robert Solow of MIT (chairman), Barry Bosworth of the Brookings Institution, Ted Hall who is a retired McKinsey partner, and Jack Triplett of the Brookings Institution. Before joining Brookings in 1979, Bosworth was Director of the Council on Wage and Price Stability in the Administration of President Jimmy Carter. Triplett, prior to joining Brookings in 1997, was BEA Chief Economist, an Associate Commissioner for Research and Evaluation at the BLS, and an Assistant Director for Price Monitoring at the U.S. Council on Wage and Price Stability. A group of ten MGI consultants made up the working team for the report and the working team had four full day meetings plus phone and email interactions with the Advisory Committee.
4 See Diewert and Nakamura (2009), especially concerning needed but missing price deflators. As the MGI report also notes, the U.S. Census provides data on purchased services in Census years (every 5 years), so nominal value added can only be directly computed every fifth year. For inter-Census years, it was necessary to linearly interpolate between Census years, and also to linearly extrapolate forward from the 1997 Census figure to 1999.
5 These are industries where large ICT investments were made that failed to boost productivity. These cases were used to check whether apparent links between IT and productivity growth for the 'jumping sectors' were causal.

There are important interactions between the retail and wholesale sectors. For example, as the report notes, from early on Wal-Mart chose to handle its own distribution needs when possible and has consistently tried to reduce the role of wholesalers. According to the MGI report, many of the wholesalers that survived did so by partially automating the flow of goods, thereby increasing their productivity.

The wholesale trade sector is one of the largest sectors in the U.S. economy, accounting for 6.2% of employment and 7.9% of GDP in 1999. As measured by the BEA, the contribution of this sector to the U.S. productivity jump between the periods of 1987–95 and 1995–9 is the largest of any sector in the economy. While noticing the importance of the wholesale trade sector, the MGI report also states that a lack of data makes a comprehensive analysis of productivity growth impossible for this sector. Instead, the MGI report examines the only component of the wholesale trade sector where the light was shining – that is, where they could get data: pharmaceuticals wholesaling.

3. Wal-Mart: a technology and business process leader?

Our survey of the business literature supports the 2001 MGI report contention that Wal-Mart is a technology and business process leader, and it fills in some of the operational mechanisms. We identify the following five technology/business process areas where Wal-Mart is credited with being a retail leader:[6]

i) *Data warehousing*. Wal-Mart reportedly has the world's biggest private sector data warehouse. Almost from its inception, Wal-Mart collected and used data to improve the efficiency of core retail operations. In 1975, with 125 stores in the chain, the company leased a first computer to handle inventory control. Four years later, the company built a central data warehouse (Metters and Walton 2007). In contrast, as other chain stores grew, they typically established semi-autonomous regional data centres.

Wal-Mart provides not only its own managers but also its supply chain partners with access to its data warehouse. It was the first large retailer to give its suppliers data of this sort, thereby helping them reduce costs due to under or over producing. To improve the reliability of access to its data warehouse, in 1987 Wal-Mart also built the world's largest private satellite communications system. Then in 1991, the company spent $4 billion more to create their new data warehouse, Retail Link .

ii) *Data enabled supply chain coordination*. Wal-Mart also helped create a business support system called Collaborative Planning, Forecasting, and Replenishment (CPFR). This can be used by supply chain partners to make coordinated business plans (on CPFR see Kim and Mahoney 2006; Terwiesch

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6 Demand-related factors such as increasing incomes (suggested in the MGI report to be due to higher productivity growth in the rest of the economy), increased wealth, and increased consumer confidence are hypothesized to have caused this shift in consumer spending behaviour.

et al. 2005). CPFR spread within the supplier community via VICS, the Voluntary Inter-industry Commerce Standards, which Wal-Mart helped found and run(see http://www.vics.org/committees/cpfr/).

iii) *Product codes and bar code labels.* Electronic price and quantity data are required for retailers to be able to use a supply chain management system like CPFR. These data can be collected more cheaply if the producers put coded labels onto their products. However, for them to be willing to do this, the larger retailers at least must agree on the list of product codes. Wal-Mart played a leadership role in bringing about this agreement and in the development of procedures for updating the product code list over time.[7]

iv) *RFID tags and the use of RFID for retail sector logistics.* Bar code technology requires that items be scanned one by one, which is still far more efficient than manually carrying out these tasks. However, radio frequency identification (RFID) can be even more cost effective. RFID enables the automated capture of data transmitted by radio waves from tags placed on shipping containers and product items. No physical contact or line of sight between a tag and tag reader are required, and multiple tags can be read at once (see Angeles 2005; Maloni and DeWolf 2006; Murphy-Hoye, Lee, and Rice 2005; Rutner and Mentzer 2004; Want 2004). Wal-Mart has been steadily increasing the company's use of RFID for some time now. Recognizing the potential network and other externalities, the U.S. Government has now joined Wal-Mart in working to help spread RFID usage in the United States.[8]

v) *E-recruiting with automated candidate testing.* Though not mentioned in the MGI report, recruiting is another business process area where Wal-Mart adapted a new technology to meet retail industry needs. Retailers provide labour-intensive services and have quite high employee turnover rates, so hiring is a substantial burden. Traditionally, companies left store-level hiring to local managers. However, Wal-Mart switched to centralized e-recruiting with embedded testing. This is not the only large company to have done this; for example, Google also did so.[9] Nonetheless, Wal-Mart led the way in adapting this approach for bulk hiring of less skilled workers.[10]

The Wal-Mart online hiring centre is heavily trafficked.[11] This way of finding and vetting job applicants seems to have helped ensure that a steady supply

7 This might enable making an indicator like Alexopoulos (2010) and Alexopoulos and Cohen (2009, 2010) created.
8 In an international context, the assignment of product codes is now the responsibility of an organization called GS1 that is headquartered in Brussels (Belgium). For more on Belgium-based GS1, see http://www.gs1.org/gdsn. The U.S. Uniform Code Council is now called GS1 US.; see http://www.gs1us.org/.
9 Multiple U.S. government departments now require that suppliers put RFID tags on their product Deliveries, including the Postal Service (USPS), the Food and Drug Administration (FDA), and the Department of Defense (DoD).
10 See Hansell (2007) on the development of Google's automated applicant testing.
11 By 'bulk hiring' we mean mass hiring of workers who are hard to distinguish based on observable qualifications.

of applicants who have already passed the Wal-Mart preliminary online tests are waiting and ready to be considered for filling the company's job openings. Success in this respect may even have strengthened Wal-Mart's position versus the labour unions that have been trying to organize Wal-Mart workers to stop Wal-Mart expansion. Historically, unions have served as a counterweight to large firms. So far, however, Wal-Mart has been successful in keeping the unions out. Indeed, Wal-Mart permanently closed its few units that chose to unionize.[12]

3.1. Scale effects and the timing of technology investments

Other large retailers reportedly are now emulating Wal-Mart technologies and business processes.[13] However, even if competitors adopt these ways, in our view Wal-Mart is still likely to reap long-run productivity and profitability benefits from its investments. In any industry where increasing returns to scale technologies are important, a firm that has these technologies and that has managed to grow larger than its competitors, by any means, will then tend to have a continuing size-based productivity advantage.[14] We note also that increasing returns to scale technologies open up possibilities for predatory pricing. (In section 6, we note that the previous 'largest ever retailer,' A&P, was eventually found guilty of growing via the use of predatory pricing while claiming the company's growth was due to productivity superiority.)

4. Panel data studies of Wal-Mart economic impacts

As the MGI 2001 report explains, all else equal, a more productive firm will produce the same output with fewer inputs and typically will pass on at least some of this cost saving to consumers in the form of lower prices. Panel data studies of Wal-Mart price effects are taken up first, followed by studies of Wal-Mart employment effects.

4.1. Wal-Mart effects on prices

Wal-Mart could affect the local cost of living via both (1) the direct effects of the retailer's own prices, and (2) indirect effects due to the competitive responses of other merchants. Measuring the *direct price effects* for Wal-Mart, or for any

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12 https://hiringcentre.walmartstores.com/OnlineHiringCentre/ct_logon.jsp?CTAuthMode = BASIC&language = en
13 In 2000 a meat-cutting department successfully organized a union at a Wal-Mart store in Texas; a week later Wal-Mart announced the company-wide phase-out of its in-store meat-cutting operations. And in April 2005, Wal-Mart closed its store in Jonquierre, Quebec, after the employees received union certification.
14 There is evidence for Canada, too, that management matters (Alexopoulos and Tombe 2009). The evidence we have amassed adds more specificity to the 'management matters' perspective for Wal-Mart.

other store or group of stores, requires being able to differentiate the prices of the designated merchant(s). When data of that sort are not available, so direct effects cannot be measured, it is sometimes still possible to estimate the *indirect price effects*. If the indirect effects are negative, then consumers are paying less because of the competitive responses of other merchants. This is also circumstantial evidence that the direct effects are negative. (It is estimates of the direct effects that are needed to answer the main questions of the public and of the competition authorities.)

Basker and Noel (2009) estimate both direct and indirect Wal-Mart price effects. American Chamber of Commerce Research Association (ACCRA) data are utilized. ACCRA surveys from five to ten retail establishments per participating city in the first week of each quarter. The prices collected cover approximately 50 products. Beginning in mid 2001, ACCRA began retaining the store identities along with the store level price observations, thereby making the estimation of direct price effects possible.

Basker and Noel use the data for 24 products in 175 cities from the July 2001, 2002, 2003, and 2004 ACCRA surveys. The stores covered explicitly include Wal-Mart superstores. All of Basker and Noel's estimates of the direct as well as indirect Wal-Mart price effects are significantly negative.

Hausman and Leibtag (2004/2009, 2007, 2010) use Nielsen HomeScan panel data for 20 food products over 1998–2001.[15] These data are collected from a panel of approximately 61,500 U.S. households. After each shopping trip, panel members record the prices and quantities for items purchased and also where the purchases were made. Wal-Mart prices are included, but Nielsen removes the store identifiers. However, Nielsen does provide a 'merchant type' indicator. Wal-Mart is included in a Nielsen group for supercentres, mass merchandisers, and club stores (the SMCs). Hausman and Leibtag report estimates of the direct and indirect price effects for SMCs that are significantly negative.

In an earlier study, Basker (2005a) estimates indirect Wal-Mart price effects using ACCRA data for 1982–2002. Thus, this much cited study is inferior to the Basker and Noel (2009) one in that it uses data from before ACCRA began to retain the store identities for price observations.[16] For this 2005 study, Basker uses data for 165 cities and 50 quarters for 10 non-food products.[17] She notes that the ACCRA *Cost of Living Index Manual* instructs price collectors to 'select only grocery stores and apparel stores where professional and managerial households

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15 Taking a similar perspective on the longer-run implications of a first-mover benefit for businesses with technologies and business processes that have increasing returns to scale properties, the MGI report states that Wal-Mart was also a pioneer in the development of the big box store format, and that this larger format generated labour economies of scale at the store level. The MGI report argues that a virtuous cycle was established. As sales volume grew, Wal-Mart gained cost advantages due to scale and negotiating power versus suppliers. Passing on part of this cost advantage to consumers via lower prices caused a further share gain, restarting the cycle.
16 Nielsen also has an in-store scanner data collection program, but Wal-Mart dropped out of that program.
17 ACCRA did not keep records of individual prices collected until mid-2001.

normally shop.'[18] Basker reasons that therefore Wal-Mart prices will not be included and she can use these data to estimate lower bounds on Wal-Mart's indirect price impacts.[19] She reports statistically significant declines in prices associated with Wal-Mart growth.

4.2. Wal-Mart employment and wage effects

The available data on employment are even harder to use than the available price data for assessing the impacts of Wal-Mart. There are no employment data sets providing store level, or even store *type*, employment information with the observations identified by store or store type. Moreover, there are no data sets giving employment by region from which the Wal-Mart employees are omitted; that is, there are no data sets like the pre-2001 ACCRA data that Basker (2005a) argues omit the Wal-Mart prices. Hence, researchers have had no choice but to find *proxy variables* for Wal-Mart penetration. They then try to estimate the associations between these proxies and total retail sector employment by locality and time interval. It seems likely to us that these proxy variables will perform poorly in terms of identifying the Wal-Mart effects of interest. Also, there often are concerns that the specified proxies are correlated with the error terms for the estimating equations. Hence instrumental variables are often introduced for the proxy variables, and this introduces another potential source of noise and possible spurious correlations.

In the United States, Wal-Mart opened stores from the mid-1960s through the mid-1990s in a distinctive state-by-state pattern of advancement out from the company headquarters in Arkansas. Taking advantage of this pattern, Neumark, Zhang, and Ciccarella (2008) (NZC) use time-distance dummies as their proxy for Wal-Mart employment growth and measure distance from Wal-Mart head-quarters in Bentonville, Arkansas. They estimate substantial negative Wal-Mart effects. However, portions of this NZC study are replicated by Basker (2007a), who demonstrates that reduced-form estimates of the NZC regressions show sta-tistically indistinguishable effects in counties without as well as with a Wal-Mart presence. The implication is that other factors are most likely driving the NZC results. Basker argues that distance from Bentonville is spatially correlated with factors like the level of urbanization. Another reason why others are not copying the NZC proxy approach in more recent studies is that, after the mid 1990s, Wal-Mart switched its U.S. expansion pattern to one of adding stores in states where the company already had a presence, so the NZC proxy is not appropriate post 1995.

Basker (2005b) herself estimates the effect of Wal-Mart expansion on retail employment using employment data from the County Business Patterns for 1,750 U.S. counties annually as of the week of 12 March over the years of 1977–98

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18 ACCRA did not keep records of individual prices collected until mid-2001.
19 See p. 1.2 in the ACCRA Manual, found at http://www.coli.org/surveyforms/colimanual.pdf.

(for more on this source see http://www.census.gov/econ/cbp/index.html). Her proxy for Wal-Mart growth is a dichotomous variable for whether or not a county has a new Wal-Mart in a given time period. As an instrument for her Wal-Mart proxy, Basker creates a variable for the planned county-specific store openings. She argues that while the exact timing of a store's opening can be manipulated to coincide with favourable conditions, planning is done enough ahead that it is not likely to be endogenous. Her results show a small but statistically significant long-run increase in retail jobs at the county level. Also, wholesale employment is found to decline by approximately 20 jobs. This all makes sense given how Wal-Mart handles wholesaling, since some of the workers that Wal-Mart engages to handle the company's warehousing and distribution operations likely end up being counted as 'retail' workers, while those let go from independent wholesale companies that lose business as Wal-Mart grows are counted in the wholesale sector.

4.3. Lessons from U.S. panel data studies

This completes our review of U.S. panel data studies of the economic impacts of the spread of Wal-Mart. Points we hope the reader will take away from this review include the following:

- The data used for the studies of the Wal-Mart price effects are more adequate than the data that had to be used for the employment effects studies, since there is no identification of the observations for Wal-Mart in the employment data sets.
- Nevertheless, the best of the studies of Wal-Mart price effects (Basker and Noel; Hausman and Leibtag) cover very few products – a serious concern in the age of superstores carrying thousands of products and given the development by retailers of large data sets that allow sophisticated econometric analyses of consumer buying patterns and analyses that could support equally sophisticated product pricing strategies.
- It is the difference in the proxies used for Wal-Mart penetration that seems to be responsible for the difference in results between the NZC and Basker (2005b) employment effect studies.
- Basker (2005b) effectively defends her choice of a Wal-Mart growth proxy versus the choice made by NZC.
- The finding of Basker (2005b) that retail sector employment rises while wholesale employment falls following the opening of a new Wal-Mart store in a county is consistent with the fact that Wal-Mart typically handles its own procurement from producers and its own warehousing, the workers who handle those functions for Wal-Mart likely being counted in the retail sector while those once employed in wholesale companies that shank or closed were counted as wholesale workers.

5. Provincial panel data employment and productivity results for Canada

All the empirical studies of Wal-Mart's economic impacts discussed so far focus on the United States. There are many reasons why it would be desirable to re-examine findings for the United States on the impacts of the growth of Wal-Mart for the other countries that Wal-Mart has entered, including Canada. For one thing, there are multiple reasons why the growth of Wal-Mart might have different effects in other countries than in the United States. For instance, Canada's domestic firms are smaller and the retail and wholesale trade industries in Canada have lower measured labour productivity versus their U.S. counterparts. Thus, Canadian retailers could be more vulnerable to competition from Wal-Mart. Also, Wal-Mart might be less careful about avoiding anti-competitive behaviour on foreign soil. However, in carrying out studies of this sort, for Canada at least, researchers are faced with the reality that the nation does not have some of the sorts of data used in the U.S. studies. Also, some of the proxy variables used for Wal-Mart penetration in the U.S. studies are not appropriate because of differences in how Wal-Mart spread in Canada versus in the United States.

We do not have any price data sets for Canada where Wal-Mart prices are identified as such, or where the prices are identified for a group of firms such as the Nielsen SMC grouping for the United States. Also, whereas Wal-Mart expanded in the United States county by county and state by state in concentric circles outward from Arkansas, in Canada Wal-Mart entered by purchasing the Woolco chain and reopening 133 stores in 1994. This purchase gave the company an immediate presence in nine of the ten provinces. Thus, the manner in which Wal-Mart moved into Canada makes the NZC proxy for Wal-Mart growth inappropriate for Canada (just as it is inappropriate for the United States after 1995).

For Canada, we can, however, use a proxy similar to one used in the 2009 Basker and Noel study: a variable for the number of stores open in each locality. Based on information from the Wal-Mart Canada website, we created a list by province over 1993–2006 for Wal-Mart stores in operation. Table 1 shows the Wal-Mart store counts for the four provinces for which we also were able to obtain data on the other variables needed for our analysis: annual constant dollar provincial retail output and hours worked in the retail sector for the four largest provinces where roughly 83% of Canadians live.

Thus, we take as our proxy for Wal-Mart penetration the growth in the number of stores in operation in province i at the end of each year t, denoted by Stores (i, t) or simply S_{it}.[20] Letting Y_{it} denote a retail industry aggregate for province i (employment, constant dollar retail output, or productivity[21] and letting Δ denote a first difference operator, our regressions are set up as

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20 In that case, of course, prices for some of Wal-Mart's competitors also would not be included either because they are discount stores. This is why Basker states that she estimates a 'lower bound' on the true indirect effect.
21 Basker and Noel (2009) use a similar indicator, as explained in the text.

TABLE 1
Wal-Mart stores in Canada, 1993–2006

Year	Alberta	British Columbia	Ontario	Quebec	Total for four provinces	Total for nation	Four-province total as % of total for nation
1993	0	0	0	0	0	0	–
1994	16	13	46	23	98	133	73.7
1995	16	13	51	24	104	139	74.8
1996	16	13	51	25	105	141	74.5
1997	18	13	53	29	113	149	75.8
1998	20	14	58	31	123	159	77.3
1999	22	15	63	32	132	172	76.7
2000	24	16	65	32	137	178	77.0
2001	26	20	69	36	151	198	76.3
2002	30	22	70	39	161	211	76.3
2003	32	24	74	42	172	225	76.4
2004	34	27	84	45	190	247	76.9
2005	34	28	88	48	198	261	75.9
2006	38	29	94	51	212	277	76.5

follows:

$$\Delta Y_{it} = \beta_0 + \beta_1 f_{i,0} \Delta S_{it} + \delta_t + v_i + e_{it}, \tag{1}$$

where δ_t is a dummy variable set equal to one in year t and zero otherwise, is a province i fixed effect, f_i is a scaling factor included to allow for the fact that provinces differ in size,[22] and e_{it} is an error term that is assumed to be mean-zero and uncorrelated with the key explanatory variables.[23]

The OLS coefficient values for the store variable (table 2, row 1, columns 1, 3, and 5) are always statistically significant using a two-tailed critical region of 0.20. Of course, changes in the number of Wal-Mart stores could be correlated with other factors that might be dependent variable determinants. Thus, the coefficient estimates could be affected by endogeneity biases. As an instrument for this variable we tried various lags for the number of stores, much as in the Basker and Noel (2007) price effects study. We recognize the limitations of these instruments, but were unable to come up with better alternatives. The fact that our results are similar to those of the Basker (2005b) employment effects study, despite very different economic conditions and the use of different proxy and instrumental variables, is somewhat reassuring, as is the conformity (noted below) between our OLS and IV results, but we do not wish to oversell the

22 According to NAICS, retail productivity is provincial retail GDP, divided by hours worked, over 1993–2006.
23 Wal-Mart stores tend to have similar employment and sales; a given store is likely to have a larger impact in a province with a smaller retail sector. For this reason, we divide stores through by the (normalized) base year retail sector employment to reduce heterogeneity.

TABLE 2
Wal-Mart impact regressions, 1993–2006, for Alberta, British Columbia, Ontario, and Quebec

	Dependent variable for each estimated equation:					
	Provincial hours		Provincial constant dollar retail output		Provincial labour productivity	
Independent variables	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)
Stores (i,t)	2.418^c	2.707	117^b	147^a	0.409^c	0.512
	(1.719)	(2.596)	(51.8)	(44.6)	(0.304)	(0.440)
Instrument	None	Lag	None	Lag	None	Lag
Within R^2	0.876	0.864	0.971	0.970	0.791	0.839
First-stage R^2		0.978		0.978		0.978
Observations	56	52	56	52	56	52

NOTES: Year dummies and provincial dummies were included in all equations. Bootstrap standard errors are shown in parentheses. A superscript a, b, or c indicates significance with a two-sided critical region of 0.01, 0.05 or 0.20.

quality of these empirical results. Indeed, one point we wish to make is that the data resources available for carrying out studies like this are poor even in the United States and more so in Canada.

For our IV estimation results shown in columns 2, 4, and 6 of table 2, we show just our results using a one period lag since the results are similar for other lag specifications and since this choice results in the least loss of observations. The store coefficient is statistically significant for only the provincial retail sector constant dollar output equation. However, all of the estimated coefficients are similar in value to the OLS ones. The results provide weak support for the conclusion that constant dollar retail industry output, employment, and labour productivity all grew with the spread of Wal-Mart in Canada, in line with Basker's (2005b) findings (but not the findings of NZC) for the United States. Note, however, that there are *no* estimates for Canada of the direct or the indirect price effects of the spread of Wal-Mart in Canada.

6. Price discrimination issues

The problem of a largely unmet public need-to-know about the price and other effects of the growth of large retailers did not originate with the growth of Wal-Mart, as can be seen from the history of measures to control price discrimination: a history briefly reviewed here.[24] Price discrimination control laws were

24 To remove the fixed effect there are two basic choices: within transformation (de-meaning) and first- difference transformation. For simplicity we limited our results to a first-difference

introduced in the United States as part of the 1887 Interstate Commerce Act. The objective was to stop railroads from giving rebates to large shippers that were not available to others. The U.S. Interstate Commerce Act of 1887 states: 'It shall be unlawful for any common carrier . . . to make or give any undue or unreasonable preference or advantage to any particular firm . . . or locality, or any particular description of traffic, in any respect whatsoever, or to subject any firm . . . or locality, or any particular description of traffic, to any undue or unreasonable prejudice or disadvantage in any respect whatsoever.' Subsequently, similar regulations were also developed for truck lines and air carriers. Thus, most freight transportation companies were compelled to operate as 'common carriers,' puEven ocean freight bound to or from the United States moved under published tariffs (Mukherjee and Bal 2009).[25]

In 1936, the U.S. Congress further strengthened the prohibitions against price discrimination with the passage of the Robinson-Patman Act, also known as the 'Anti-A&P Act.' Understanding the reasons for the association of this act with the Atlantic & Pacific (A&P) grocery store chain requires a little historical background. In 1920 A&P had 4,000 stores. The company grew rapidly and by the mid-1930s had over 15,700 stores. A&P claimed this growth was based upon 'greater efficiencies' – that is, upon productivity growth. However, a 1936 investigation by a U.S. House Judiciary Committee concluded that the growth was due primarily to the company's success in extracting lower prices from suppliers than competitors were able to obtain. In the U.S. Congressional records, the spectrre of 'a few great economic overlords' was raised and actions were recommended to prevent a drift back toward 'economic feudalism.' Preserving democracy in governance was said to depend on preserving 'democracy in opportunity' (US Congressional Record p8109 27 May 1936). It was stated, too, that sometimes the public may have to pay more to keep markets competitive and to protect a level playing field (Tedlow 1990). Yet the evidence on which the House Judiciary Committee had to base its decisions suffered from a lack of price data with store identifiers for the observations: the same lack that is responsible for Canada's lack of studies of the direct or the indirect price effects of the growth of Wal-Mart here.

The Robinson-Patman Act was passed. Congressman Wright Patman (1938) explains the workings of the act as follows: 'Essentially the present act provides that when a man sells a product to two or more customers who are in competition of the resale of that product, he must not discriminate between them in such a way that one is given an unfair advantage over the other.' The House Committee

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formulation. We also used analytical robust standard errors as well as bootstrapped standard errors and obtained the same basic results. A test for autocorrelation accepted the null hypothesis that there is none, which is not surprising, given that our specification includes annual fixed effects and we are using annual data.

25 The term 'price discrimination' means that the same products are offered to different parties at the same point in time for different unit prices, the price differences being unrelated to the costs of supply.

report states that the act 'limits the use of quantity price differentials to the sphere of actual cost differences.' The accompanying argument is that 'Otherwise, such differentials would become the instruments of favor and privilege and weapons of competitive oppression.'[26] Other countries followed with similar laws, including Canada with the 1985 Competition Act (http://laws.justice.gc.ca/en/C-34/).

Subsequently, however, the anti-price discrimination rules for freight shipping were abandoned. Arguments were made that permission to engage in joint pricing activity was needed to stabilize rates and service. With the passage of the 1994 Shipping Act, shipping lines regained the right to offer different rates to different customers, though the terms of contracts still had to be made public (http://www.fmc.gov/about/shippingact.asp). Four years later, the Ocean Shipping Reform Act of 1998 also got rid of the requirement of public access to contract terms.[27] Similar changes were enacted for truck shipping. Hence, the post-1998 shipping cost information is mostly anecdotal because there no longer is a requirement for shipping rates to be reported.[28]

Turning our attention back to Wal-Mart: whether or not the company is getting special price deals from producers, it is almost surely getting special deals on shipping, and those deals are fully legal. The special shipping arrangements Wal-Mart enjoys plus Wal-Mart's widely reported insistence that suppliers, year after year, either improve their products or reduce their prices mean that Wal-Mart almost surely has lower unit input costs than its competitors do. Wal-Mart claims to pass on to consumers much of its hard-won cost savings from investments in technology and business processes and from returns to scale. The available empirical evidence suggests that Wal-Mart prices are lower and that Wal-Mart's growth also has had no discernable negative impact on retail sector employment. We worry, however, that modern-day regulators and the public also lack the data they need to reach conclusions on issues like this.

7. Measurement issues

The MGI 2001 report raises, but then rejects, the possibility the reported findings may be substantially affected by data gaps and measurement errors, though numerous such problems are mentioned. Multiple potentially serious measurement issues are glossed over. For example, the BEA provides industry data at the 2-digit SIC level in their Gross Product Origination release for nominal and for

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26 The liner conferences are cartels whose memberships comprise seagoing common carriers engaged in providing sea transport services under a common tariff.

27 Committee on the Judiciary – US House of Representatives, 74th Congress – 2nd Session Report No. 2287 Prohibition of Price Discriminations

28 A 2000 U.S. Federal Maritime Commission report explains: 'The key components of the new law are the enhanced confidentiality of service contracts between shippers and ocean common carriers and the inability of carrier conferences to prevent conference members from entering into individual service contracts . . . now fewer essential terms are public information. The rates are no longer publicly filed.'

chain-weighted constant price gross output and value-added data, from which the MGI report states that implicit price deflators were derived. The report states that the first step in the sector contribution analysis was to mathematically separate output and employment growth from productivity growth and to note that a sector can contribute to aggregate productivity growth through both 'within' and sector 'mix' effects. The MGI report states that a GDP growth contribution formula developed by Dikhanov was utilized. While nothing is mentioned in the MGI report regarding problems with this decomposition when the price deflators must be approximated because of data gaps and other such data issues, a range of problems including this one are considered, for example, in Reinsdorf, Diewert, and Ehemann (2002).[29]

In another part of the MGI report, it is acknowledged that some measurement issues in retail revolve around the fact that the retail sales deflator is based on the retail consumer price index (CPI), which does not incorporate any adjustments for differences in the cross-section or over time in the mix of retail outlets (e.g., superstores, conventional supermarkets, convenience stores) or the services offered by different types of stores (e.g., convenience, location, customer service, length of lines). The report states that the current CPI procedures implicitly assume that price differentials between stores reflect differences in service levels and notes that the continuing share gains of low-priced, 'big box' formats (i.e., large stores) call this practice into question. Yet the report simply asserts that the biases introduced are 'small and unlikely to introduce a meaningful error in period-to-period comparisons.'

The assessment of the MGI report of the seriousness of the bias problems in the price indexes they utilize, given the purposes of their study, is in stark contrast, for example, to the views of Jerry Hausman on how the growth of Wal-Mart has affected the CPI of the United States. Hausman (2003) lists four sources of bias in the present calculation of the CPI and notes that the most frequently mentioned of these bias problems is a second-order bias, while the other three sources are first-order effects: the new good bias, the quality bias, and the outlet substitution bias. All three of those first-order price index bias problems have almost surely been made worse by the growth of Wal-Mart, this being especially so for the outlet substitution bias;[30] Hausman and Leibtag (2010) explain why this is so for the outlet substitution bias problem: 'The BLS employs a 'linking procedure' that assumes 'quality-adjusted' prices at Wal-Mart are exactly equal to prices at conventional supermarkets ... Even though packaged

29 The freight shipping situation may change further. Frittelli (2008) notes that the European Union (EU) has now outlawed collective rate setting among container carriers engaged in EU trade lanes. Since the commercial U.S. liner fleet has essentially disappeared by now, Fusillo (2009) argues that, despite the low prices and reliable shipping services that the large shippers like Wal-Mart now enjoy, there is a significant risk that in place of the historically familiar collusive price-setting groups, U.S. businesses eventually will be faced with fewer alternatives to move their goods, lower service quality, and significantly higher prices.
30 The approach was actually first derived by van IJzeren (1952, 108–10) and later by both Ehemann (1997) and Dikhanov (1997).

food items are physically identical at the two stores, the BLS procedure does not recognize any price difference between the stores. *This procedure is not based on any empirical study. Rather, it is based on mere assumption*' (emphasis added). The MGI report seems to imply that they were able to deal with problems like this via the use of proprietary information that MGI has access to through the surveys and the clients and the other corporate contacts of McKinsey & Company. That proprietary information is not shared in the report, making it impossible for others to replicate or explore the robustness of those components of the study.

Whereas the authors of the MGI report conclude that they had the price and other data they needed to properly carry our their analyses, we are left wondering if this was, indeed, the case, at least where the retail sector is concerned. Based on the evidence available to us, we feel that the data gaps and other problems that have been mentioned cast a pall of doubt on all of the Wal-Mart impact studies, including both the MGI report and the studies using sub-national panel data, a pall of doubt that would be lifted in important respects if retail prices were as available the prices for financial markets are.

8. Discussion

The U.S. retail industry history suggests that maintaining market competition matters. For instance, Hausman and Leibtag (2007) point out that over the period from 1991 to 2001 the operating profit margins substantially increased for Kroger's and Safeway. They contend that these increased gross margins presented Wal-Mart with an enticing invitation to enter the grocery business.[31]

Even Wal-Mart's then CEO, Lee Scott, said in an August 2005 interview with the *Sunday Times* that the government should become involved once a firm grew too large compared with the size of the markets it served: 'As you get over 30% and higher I am sure there is a point where government is compelled to intervene.' Scott made these remarks in the context of a discussion about Tesco's 30.5% share of the British food market. Wal-Mart reportedly had 10% of the U.S. retail market at that point in time. An editor's note states as well that, according to the Toronto-based firm Talbot Consultants International, by 2005 Wal-Mart already had a 52% share of all department store sales in Canada!

Do regulators and the public have the price and other data they need to interact on an informed basis with large retailers? Leonard Nakamura (1999) points out that rich retail firm data resources have facilitated the ability of retailers (including grocers) to cheaply and efficiently analyze consumer demand patterns for a vast array of products. Einav and Levin (2009) speculate that the availability of vastly richer data will soon enable the use of more direct and powerful econometric methods in empirical studies of firm growth, pricing strategies, and economic

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31 This bias problem was first recognized by Reinsdorf (1993).

impacts. At present, however, it is only the large retail companies that have convenient and timely access to data on prices and transaction quantities for grocery products. The Canadian economist John Kenneth Galbraith (1967, 217) was right, we think, when he wrote of the practice of 'protecting' merchant price information from disclosure: 'It is not the individual's right to buy that is being protected. Rather, it is the seller's right to manage the individual.'

Lately, some labour leaders have come up with the idea of publicly challenging Wal-Mart to substantiate the company's 'Every Day Low Pricing' claims by publishing online on a daily basis their grocery prices by outlet for all their U.S. and Canadian stores. We believe that this proposal has the potential to help the shopping public, regulators, *and* Wal-Mart. If Wal-Mart is, in fact, practising 'Every Day Low Pricing' in its stores, the company stands to gain greater public recognition of the overall cost savings the company is making possible for consumers[32]

If Wal-Mart were to put all its prices (or at least all its grocery prices) online daily, other online services would soon spring up offering convenient wizards for the buying public to use for storing their grocery lists and for generating current-day cost totals for those lists. The online services also could make it easy for those still shopping at other stores to input the information on their check-out receipts and see what a comparable basket of goods would cost at a Wal-Mart in their vicinity. Moreover, studies of price and other effects of the growth of Wal-Mart could be more reliably and cheaply carried out. If Wal-Mart claims of 'Every Day Low Pricing' are true, then putting all of the company's grocery prices online on a daily basis would allow consumers and regulators alike to see that Wal-Mart has reliably low prices.

Alternatively, of course, if Wal-Mart is already engaging in anti-competitive behaviours such as predatory pricing, as critics contend, then the company would have a strong motive to resist this proposal. For instance, it is possible that Wal-Mart is systematically raising prices in some stores on items where there is little competition in the local market areas, or is selectively lowering prices to undercut specific local competitors. With no data there is no fear of discovery; with data, the company risks providing evidence that could be used, say, to prosecute it for anti-competitive pricing. Grocers are required by law in virtually all jurisdictions of the United States and Canada to display product prices either with stickers on the product items or on the store shelves. However, these laws predate the electronic information revolution, and lawmakers so far have failed to update them. Hence, the laws do not require grocers to publish their prices in electronic forms. All grocers over some minimum size could be required, by law, to publish their prices online daily.

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32 Founded in 1962, Wal-Mart carried only general merchandise until 1998, when the company began carrying groceries, too, in the company's U.S. stores. It was not until 2004 that Wal-Mart began carrying groceries in Canada.

9. A price transparency proposal

In summary we see at least four reasons why all the current price and transaction quantity data for large retailers, including especially grocers, should be published online daily, just as the prices are for the products offered on major financial markets. The advantages we see are as follows:

1. Price signals are essential allocative mechanisms for market economies. A modern grocery story has too many products and makes too many product and price changes too often for consumers (or regulators) to be able to intelligently extract the price signal information without having comprehensive, real time, off site, electronic access to product prices.
2. When consumers must incur time and monetary costs to obtain price information, this impairs market efficiency and acts as a drag on national productivity.
3. Wal-Mart and other large retailers already have their price information in electronic form and use a uniform set of product codes at least for most manufactured grocery products. Publishing all of their price information by outlet daily would impose negligible direct costs on large retailers.
4. This change would substantially improve the accuracy, while reducing the costs of compiling, the monthly CPI in the United States and Canada, since grocery price quotes are a large portion of the monthly data collection operation for the statistical agencies in these nations.

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