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ABSTRACT

Perhaps more than any other sector of the economy, healthcare depends on government resources. As a result, many healthcare systems rely on the use of government monopsony power to decrease spending. The United States is a notable exception, where prices in large portions of the healthcare sector are set without government involvement. In this paper we examine the economic implications of a greater use of monopsony power in the United States. We present a model of monopsony power and test its predictions using price differences between the United States and Canada – a country that represents an example of a "Medicare for All" style system. Overall, we find that wage differences for medical providers across the two countries are primarily driven by the broader labor market while price difference for prescription drugs are more directly the result of buyer power. We discuss theoretical reasons why a Canadian monopsonist may be more willing to exploit its buyer power over prescription drugs rather than provider wages and why a U.S. monopsonist might not be willing to do the same

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Health care spending varies markedly across countries. It is widely accepted that at least a portion of spending differences results from the willingness and ability of governments to exercise monopsony power when purchasing healthcare goods and services. Broadly speaking, governments that finance healthcare services often use their buyer power to push down the prices paid for healthcare inputs such as pharmaceutical products, medical devices, and the wages of medical providers. Differences in the willingness and ability to exercise buyer power certainly contributes to the considerable healthcare price and wage dispersion across countries. However, the degree to which these price differences across countries are the result of buyer power as opposed to other economic forces is an open question that we explore in this paper.

At an aggregate level, the United States stands at an extreme of a relatively parsimonious government role in the financing of healthcare services, a limited use of government buyer power, and a relatively large percentage of its economic activity occurring in the health sector.[1] Concerned about the rising cost of U.S. healthcare, many policymakers have proposed that the federal government make greater use of its buyer power. Proposals include various "Medicare-for-All" policies that would expand existing public insurance systems to cover more than simply the elderly, poor and disabled, as well as more limited proposals, such as requiring Medicare to use its size to negotiate lower pharmaceutical prices. The economic effects of a greater use of monopsony power obviously depend on the specifics of the proposed policy reform. While proponents have offered a variety of "Medicare-for-all" alternatives, we will use the term in this paper to refer to a truly single payer system where no private insurance options exist. Under this option, which has been proposed by numerous policymakers, the federal government would be the single purchasing agent for all Americans.[2]

[1] U.S. healthcare spending was estimated to be 16.8% of GDP in 2015, compared to an average of 8.75% of GDP for other OECD countries. Half of healthcare spending in the U.S. was financed through government transfers or social insurance contributions, compared to 71% on average for other countries (OECD Health Statistics 2018).
[2] Other policies that now fall under the rubric of "Medicare for all" include allowing individuals to buy in to private managed care plans (i.e. Medicare Advantage) and allowing individuals to buy in to traditional Medicare (https://www.vox.com/2018/12/13/18103087/medicare-for-all-explained-single-payer-health-care-sanders-jayapal).

The potential savings from implementing such a single payer system would primarily come from two sources[3]: (1) decreased administrative costs resulting from a single firm providing health insurance and (2) the exercise of buyer power to reduce input prices. We will briefly discuss the former before moving on to the latter, which is the main focus of this paper.

Centralizing insurance in a single entity would certainly eliminate some duplicative administrative functions. In addition, a single insurer that lacked competitive pressures would likely have lower marketing expenses. On the other hand, individuals could no longer choose a plan that best met their idiosyncratic preferences for plan design (Dafny et al, 2013), and centralization might also stifle innovation in insurance offerings. Overall, the exact magnitude of the economic benefits from changes in administrative costs resulting from a single payer system is unclear.[4]

While administrative expenditures are a potential source of savings, a single payer aiming to meaningfully reduce spending would, by necessity, follow the proverbial "Willie Sutton" rule of health spending[5] and target the prices paid to healthcare inputs such as medical providers and pharmaceuticals. These input prices represent the bulk of U.S. healthcare spending with labor costs comprising approximately 60 percent (Kocher and Sahni, 2011) and pharmaceuticals accounting for an additional 15 percent.[6] A government payer could cut both of these prices either by directly reducing the fees paid to physicians, other

[3] Savings could also result from a more efficient use of medical services that reduced the uncompensated care burden of hospitals, which are substantial and may represent inefficient care (Garthwaite et al., 2018). However, the impact of insurance on use of healthcare services is a point of debate in the literature with some studies seeing increased spending and others finding decreased spending (Finkelstein et al., 2012; Anderson et al, 2012; Garthwaite et al., 2017; Sommers et al, 2012; Sommers et al., 2016)

[4] For example, the net savings from eliminating these functions could be tempered by different onerous administrative requirements for public payers that have been recently identified (Gottlieb, Shapiro and Dunn 2018). In addition, some of these administrative requirements, such as prior authorization, may decrease moral hazard and reduce spending (Gottlieb and Mark Shepard 2018). Another source of savings could come from reduced marketing and underwriting expenditures by commercial insurers, which themselves would either be eliminated or vastly restructured. However, to the extent that advertising and outreach improves the matching of customers to networks and other features of insurance products the economic savings here may again be limited. In particular, the degree to which this would be a source of savings is a function of whether Medicare Part C (i.e. Medicare Advantage) continues to exist as a program. Given Medicare Advantage is the private, managed care version of Medicare, many of these administrative costs could remain if that form of coverage remained an option in the insurance market.

[5] Explaining why he robbed banks, Willie Sutton reportedly said, "because that's where the money is."

[6] The exact amount of spending on pharmaceuticals is difficult to estimate because many pharmaceuticals are administered by providers and therefore are accounted for as hospital or physician spending. The 15 percent figure includes retail prescription drugs spending as well as spending for certain drugs, such as infusion drugs, sold directly by physicians, or drugs dispensed in hospitals (Yu, Atteberry and Bach 2018).

medical personnel, and pharmaceutical manufacturers or by reducing payments to hospitals and other institutions, which would then have to reduce their costs (i.e., cut wages and reduce other medical inputs) to remain financially viable.

Proponents of an expanded use of government buyer power frequently cite the experiences of other developed countries that have both far more extensive government involvement in healthcare and lower health spending. Within these comparisons, the Canadian system is perhaps the most similar to Medicare-for-all. In Canada, provincial governments offer health insurance and finance care delivery under rules established by the government, but medical services are mostly provided by private providers in privately owned and operated facilities.[7] The similarity of the Canadian system to many U.S. proposals for Medicare-for-all can perhaps be most clearly seen in Senator Bernie Sanders (I-VT) explicit statements that the Canadian system is a model for his widely discussed universal coverage proposal (Kliff 2017).[8] Thus, the decisions of Canadian insurers provide perhaps the best evidence of the potential optimal savings available from the creation of a single monopsonist in the United States.[9]

Projections for healthcare spending in a U.S. Medicare-for-all system that are based on the experiences of Canada implicitly assume that under Medicare-for-all, American healthcare providers would earn broadly similar wages to their Canadian counterparts and Americans would obtain drugs at Canadian prices. At first blush, these seem like reasonable assumptions. After all, if a relatively small centralized Canadian payer can use its monopsony power to achieve those spending levels, certainly a meaningfully larger centralized U.S. payer could do the same or even better.

However, assuming the U.S. monopsonist would find it optimal to adopt the Canadian input price schedule requires the further assumption that the entirety of the price difference between the two nations

[7] Primary care and specialist physicians are typically self-employed in private practice and bill fee-for-service. Hospitals are a mix of public and privately owned non-profits, with hospital-based physicians typically not being salaried employees regardless of ownership type (Allin and Rudoler 2017).
[8] To the extent that Medicare-for-all involves multiple firms competing for customers rather than the single entity in Canada, the potential savings from both administrative costs and lower prices listed above would likely decrease.
[9] Another potential comparison is the United Kingdom, where the National Health Service (NHS) directly provides health insurance, owns hospitals, and employs many physicians. The NHS is meaningfully more involved in the health economy than nearly all of the single payer proposals currently being debated in the United States and the creation of such a system would involve far more than simply the increased use of monopsony power.

results from the greater exercise of buyer power by the Canadian government. This ignores the multitude of factors that can drive prices differences across countries. Even without any exercise of buyer power, a country with a single payer system could have markedly lower healthcare wages and drug prices simply because local economic conditions result in lower optimal prices for all goods and services in that nation. Estimating the potential opportunities and limitations of increased monopsony power in the U.S. healthcare sector clearly requires a more careful understanding of the role of buyer power in causing the observed price differences across the two nations. In this paper, we present a simple theoretical model to predict the optimal decisions of a healthcare monopsonist such as Canada. We then use price data across the U.S. and Canada to empirically test the predictions of this model to help understand the scope of savings optimally available to a similar monopsonist in the United States.

The model makes several predictions about how a monopsonist would optimally exercise its market power. These predictions rest on the elasticity of supply the monopsonist faces. This is because the monopsonist must balance a fundamental tension between the benefits of lower spending resulting from exercising its buyer power and the potential adverse consequences of moving away from the unfettered market outcome. As supply becomes more elastic, the adverse consequences of a monopsonist exercising market power also increases. For example, a monopsonist facing elastic labor supply that heavily suppresses wages may simultaneously suppress current and future labor market participation to unacceptably low levels. Physicians, nurses and other medical personnel might leave (or never enter) the sector in favor of higher wages in other fields. Similarly, lowering drug prices may suppress entry into this market in the short run, although the magnitude of this is unclear given the relatively low marginal cost of a drug. Perhaps more concerning, if the profit implications are big enough (i.e. if the local monopsonist is also a global monopsonist) the exercise of monopsony power may affect the development of new drugs in the long run.

The predictions of the model suggest the optimal exercise of market power will differ based on both the relative size of the monopsonist in the relevant market and the resulting elasticity of supply it faces. We test the predictions of this model using U.S. and Canadian price data for two key inputs of healthcare services: prescription drugs and medical providers.

These two outcomes were selected because they are both important inputs to the healthcare production function and they have specific economic features that highlight the model's different predictions. Specifically, we leverage differences in the Canadian monopsonist's relative importance in the local labor market for physicians and the global pharmaceutical market. Given our model predicts a different response based on the monopsonist's relative market size (and therefore the respective elasticity of supply), it predicts different exercises of market power across these two input markets. Specifically, our model predicts the Canadian monopsonist would exercise more of its market power for pharmaceuticals than for labor.

At a high level, the data support the model's prediction that a monopsonist facing elastic labor supply will limit its use of buyer power. Specifically, we find that highly educated Canadian healthcare workers earn approximately 26 percent less than their U.S. counterparts – which matches the conventional wisdom that the Canadian single payer depresses provider wages. However, it is unclear whether this difference truly reflects the exercise of buyer power, or merely is the result of broader local labor market conditions. If these lower wages reflect the exercise of buyer power by the Canadian monopsonist, the gap in healthcare wages across the United States and Canada would differ from the gap in wages earned by similarly skilled employees in other parts of the economy. The data, however, largely do not show this. Instead, we find that Canadians with similar amounts of education as skilled healthcare workers earn 22 percent less than U.S. workers in similar professions. Thus, while skilled healthcare workers do earn less in Canada, these lower wages primarily reflect differences in earnings for all high-skilled employees across the two countries.

This role of the broader labor market can be clearly seen in Figure 1, which depicts the income distributions across the two countries using harmonized household survey data (Minnesota Population Center 2018). Panel A contains data for all workers and shows that at most points of the distribution, incomes are quite similar. For example, the median income in the United States is $31,043 compared to $27,885 in Canada. However, the upper tail of the income distribution stretches much higher in the United States. For example, income at the 95th percentile is $117,396 in the United States compared to $89,783 in Canada. Figure 2 limits the sample to employees with at least a bachelor's degree, with Panel A containing data for all workers and Panel B containing the data for healthcare workers. The similarity across the two panels suggests

that differences in earnings primarily reflect differences in returns to skill and training across the broader labor markets in the two countries.

Turning to drug prices, a monopsonist with a relatively small global footprint faces relatively inelastic supply. Given the large fixed cost nature of developing pharmaceutical products, it's important to separately consider both the short run and long run elasticity of supply. In the short run, the marginal costs of production are quite low and therefore a manufacturer would likely find it optimal to sell even at a markedly depressed price. In the long run, manufacturers face the full and substantial costs of drug development and the supply of new products might be more sensitive to prices. However, investment decisions regarding the development of new products are dictated by global rather than local profits – and a relatively small monopsonist has little impact on global profits. Therefore, a relatively small monopsonist will likely still find it optimal to suppress drug prices even after considering the long run impact on the supply of new products. Consistent with this prediction, we find evidence that the Canadian monopsonist does exercise buyer power with respect to drugs.[10] Using highly detailed pricing data that has not been previously studied for this purpose, we estimate that for a consistent basket of pharmaceutical goods, Canadian consumers pay 54 percent less than Americans.

Again we consider whether this cross-country price difference results from broader economic conditions or the use of buyer power. Given the similarity across much of the income distribution in Figure 1, it is unlikely that the profit-maximizing price for most goods and services is wildly different across the two nations. A variety of data supports this assumption. For example, in 2017 the price level index for Canadian dollars relative to US dollars, which is the ratio of purchasing power parity to market exchange rate, was 0.96. This suggests that average prices in Canada are four percent lower than in the U.S. Over the past decade, this index has been greater than one for most years, meaning U.S. prices have actually been lower. In addition, Numbeo (an online service that uses a variety of data sources to calculate cross-country cost of living indices) finds that consumer prices in Canada were 5.69 percent lower than in the United States from May 2017

[10] Ideally, we would like to exploit meaningful inter-drug variation in Canadian drug consumption as a percentage of global drug consumption. Canada represents too small a share of the global market for such meaningful variation.

through November 2018 (Numbeo 2018). Given these statistics, we might expect the prices for pharmaceuticals could be slightly lower in Canada. However, our analysis finds that Canadian drug prices are 54 percent lower – a difference that is far greater than for other goods and services. We interpret this as evidence that Canadian provincial governments are willing and able to exercise monopsony power over drugs to a greater degree than in the labor market – which is consistent with our monopsony model's predictions.

The fact that Canadian wages for highly skilled employees show limited evidence of an exercise of buyer power while prescription drug prices indicate a large role for the public payer's negotiations suggests that Canadian policymakers carefully consider the potential consequences of exploiting monopsony power in healthcare markets. For products where Canadian consumers represent a relatively small part of the market, such as prescription drugs, policymakers have the freedom to exploit buyer power without meaningful consequences – and they do. In contrast, in labor markets, Canadian policymakers must contend with the fact that if they use their negotiating power to push down input prices it could have large and potentially harmful short and long term consequences for healthcare labor supply.

We proceed in this paper as follows. In Section I we present a theoretical model of a monopsonist and developing testable predictions for the wage and price structure based on the model. Section II discusses the prescription drug pricing and wage data we have gathered from the United States and Canada. In sections III, IV, and V we present evidence from these data to support the predictions of our model. Section VI concludes and discusses implications for these healthcare markets.

I. Input Prices and Monopsony

A switch from the current mixed U.S. health economy to a "Medicare for all" monopsony market could affect input prices for several reasons. The overarching reason is that a single monopolist/monopsonist (henceforth, the monopsonist) would replace a combination of government payers and commercial insurers. If the monopsonist is a profit maximizer, this would normally lead to a suppression of output, with a corresponding reduction in input demand and reduced input prices. A government monopsonist might choose greater or lesser output than a profit-maximizer, for example by imposing different copayments or by

directly rationing access to services. If the monopsonist chose to reduce output, this would cause corresponding decreases to expenditures on inputs, leading to reductions in worker salaries, which we interpret as a change in input prices.

The extent to which the switch to monopsony suppresses input prices depends, to a large extent, on the elasticity of input supply. We show the importance of input elasticities using the classic formulation of the monopsonist's input demand decision. For simplicity, we compare the competitive outcome with the outcome for a profit-maximizing monopsonist, though we would draw similar conclusions if we compared the oligopsonistic outcome to monopoly. In keeping with the textbook model, we refer to input prices as wages but the model can be used to predict any input market.

Figure 3 presents the classic monopsony problem. Let D denote industry demand and S denote industry supply. In a competitive equilibrium, wages are w^c and quantity supplied is q^c. A profit maximizing monopolist/monopsonist still faces output demand D and input supply S, but optimizes input demand using the corresponding marginal revenue MR and marginal factor cost MFC. The monopsonist selects wage w^m with corresponding inputs q^m. Compared with the competitive equilibrium, wages are suppressed by w^c-w^m.

Figure 4 depicts the monopsonist's problem when it faces elastic supply, in the sense that input supply changes more rapidly as the monopsonist deviates from the competitive equilibrium wage w^c. The industry supply curve rotates around the competitive equilibrium to S*, and MFC flattens to MFC*. The resulting wage w^{m*} is generally higher than before, and the extent of optimal wage suppression (w^c-w^{m*}) falls. Note that the change in quantity is generally indeterminate.

The elasticity of input supply will vary by input, depending on several factors:

1) The alternatives for suppliers
2) The time horizon
3) The size of the purchaser relative to the overall size of the input market

We next address these in turn.

A monopsonist cannot easily suppress wages when supply is elastic. In the healthcare context, even a government monopsonist must pay prevailing wages for low skilled positions, such as hospital aides and orderlies, as these workers have many alternatives. The availability of alternatives helps explain cross-payer

wage patterns within the market for U.S. physicians. Commercial insurers in the United States pay fees that are 30 to 75 percent higher than those paid by Medicare (Clemens and Gottlieb 2014). Medicare can currently suppress payments because the supply of physician labor to Medicare is relatively inelastic – despite the low fees, the percentage of physicians accepting new Medicare patients is nearly identical to the percentage accepting new commercially insured patients (Boccuti, et al. 2015). In contrast, physicians who refuse to contract with a commercial insurer trying to suppress wages may still retain many patients enrolled with that insurer.[11] Some patients will stay with the insurer but pay higher copayments in order to continue accessing their preferred physician. Other patients will switch to a different insurer so that they may continue with their preferred physician without increased cost-sharing. As a result, physicians are more willing to say no to a commercial insurer that attempts to suppress wages than they are willing to say no to Medicare.[12] In terms of the model, commercial insurers face relatively elastic supply and are less able to suppress physician wages.

The discussion thus far has taken a short run perspective. In the long run, the supply of physicians and other skilled medical personnel is likely to be more elastic, as talented young individuals have the option to choose other career options before they have sunk the cost of training. Facing long run elastic supply, payers might be reluctant to reduce wages. Of course, long run responses depend on the size of the payer relative to the size of the market. United Healthcare, the largest commercial insurer in the United States, has about 41 million members, or less than 13 percent of the U.S. population (and an even smaller share of total health spending). Medicare, the largest single purchaser, covers less than 18 percent of the population and accounts for just 22 percent of health spending. Thus, no individual payer in the current U.S. market is likely to be overly concerned with the impact of its own fee schedules on long run labor supply.[13] In contrast, fee reductions by a Medicare-for-all monopsonist could have a substantial effect on long run supply. Even so,

[11] This is an important feature in models of insurer provider bargaining (Ho and Lee 2017).

[12] If physicians refused to accept traditional Medicare, they could attempt to persuade their patients to switch to a Medicare managed care plan. There is considerable evidence that patients are reluctant to do so, as was brought out in the recent Department of Justice challenge to the Aetna/Humana merger. Moreover, Medicare managed care payment rates are similar to traditional Medicare (Chen, Hicks and Chernew 2018). Taken together, these facts suggest that physicians have little leverage against traditional Medicare.

[13] A few insurers in some states may have relatively large shares of the commercial insurance market. The wages paid by these insurers may affect the willingness of medical providers to work in that state. Whether or not this affects the exercise of monopsony power is beyond the scope of this paper.

any impact would not be felt overnight and might never affect those individuals with idiosyncratic preferences for a career in medicine. Thus, the monopsonist would not face perfectly elastic supply in the intermediate or even the long run and might suppress wages to a certain extent.[14]

Thus far, we have focused on the supply of labor. Similar issues arise when we consider the supply of innovative medical products such as drugs and devices. The marginal costs of medical products with patent protection are well below prices. As a result, in the short run, a monopsonist can reduce prices without driving away supply. In the long run, however, lower prices may translate into fewer innovations because investments in medical innovation strongly respond to profit incentives (Acemoglu and Linn 2004, Finkelstein 2004, Dubois, et al. 2015, Blume-Kohout and Sood 2013, Dranove, Garthwaite and Hermosilla 2014). At the same time, innovators produce for global markets and therefore base their investments on expectations about global rather than local profits. Thus, the effect of local monopsony pricing on global innovation depends on the size of the local monopsonist relative to the global market. Canada accounts for just 2.8 percent of global pharmaceutical spending (Torreya Partners 2017). If Canada (or a similarly small purchaser) suppresses the prices it pays for drugs, this will not materially affect global profits and therefore should have little effect on the global supply of new drugs. If U.S. drug spending did not change, a Medicare-for-all purchaser would account for 36.9 percent of global pharmaceutical spending. (Torreya Partners 2017). Suppression of prices by such a large monopsonist would meaningfully impact profits and therefore suppress global investments in research and development for new pharmaceuticals. Thus, even if the U.S. monopsonist and the Canadian monopsonist held the same view about the welfare consequences of decreased innovation, the fact that they face different long run elasticities of drug supply means they might optimally choose to exercise different amounts of buyer power in the drug market.

[14] Considering the elasticity of supply for the physician market requires also thinking about the fact that the potential supply of physicians is constrained by the number of available spots at medical colleges. The number of slots may affect the elasticity of supply for the physician workforce. That said, a monopsonist is likely concerned not just with the quantity of physicians but also their underlying quality. To the extent that the exercise of market power moves higher quality candidates out of the medical field, this could be a negative consequence that the monopsonist must consider. In addition, we note that Canadian medical schools are oversubscribed so, to the extent that the actions of Canadian monopsonist serves as a benchmark for the decisions of a United States monopsonist, the Canadian monopsonist also (to some degree) accounts for this rationing of slots at medical schools.

Table 1 summarizes the short run, long run, and purchaser size effects of supply elasticities for three broad categories of inputs: unskilled labor, skilled labor, and medical products. This analysis generates several predictions for comparisons of input prices between the U.S. and other nations, and for the U.S. today versus a U.S. monopsonist. These appear in Table 2. Regardless of nation, unskilled labor will receive wages based on overall macroeconomic activity. To the extent that unskilled labor receives higher pay in the U.S., unskilled medical workers will also receive higher pay. Skilled medical labor will receive higher pay than unskilled labor. All nations may suppress wages of skilled labor to the extent that supply is inelastic in the long run. There may be less suppression in the United States today, however, because commercial insurers face relatively elastic short run supply. Smaller nations may suppress prices for medical products because they have minimal impact on innovation incentives.

The monopsony model thus makes predictions about how a monopsonist would approach setting an optimal price for inputs. This should vary both by the monopsonist's local market power as well as its presence in the global market. To understand the degree to which this model predicts the variation in input prices across countries, we will test its predictions on wage and price data from Canada and the United States. Specifically, the monopsony model above would suggest the following patterns in the data from these two markets:

(1) Unskilled healthcare and non-healthcare workers should earn similar wages in Canada;

(2) Skilled healthcare workers may earn less than skilled non-healthcare workers in Canada;

(3) The difference between U.S. and Canadian unskilled healthcare workers should be the same as the difference for unskilled non-healthcare workers;

(4) U.S. and Canadian skilled healthcare workers may have a larger wage differences than non-healthcare workers – with the size of that difference reflecting the Canadian monopsonist's market power;

(5) Pharmaceutical prices should be lower in the Canada than the average difference in prices for other goods and services across the two markets; and

(6) Differences in the quantity of workers and pharmaceuticals, on a per capita basis, is indeterminate.

If these patterns appear in the data, it has economically meaningful implications for the expected effect of the optimal exercise of monopsony power on U.S. healthcare spending. Specifically, if the U.S. switches to monopsony and follows the example of the Canadian monopsonist, we would expect no impact on wages for unskilled workers, and some wage suppression for skilled labor. To the extent that there is some global commonality in the degree to which skilled medical labor is supplied inelastically (e.g., medicine is as much a "calling" in the U.S. and Canada), we may see similar degrees of wage suppression in both nations – but U.S. wages would not fall to Canadian levels. Finally, we would expect some price suppression for medical products, but this could be limited by concerns about disrupting global supply and the ability of a monopsonist to internalize these concerns (which is fundamentally a political economy question).

II. Data and Methods

We analyze employment income and labor supply using data from two nationally representative household surveys: the Current Population Survey (CPS) for the United States and the National Household Survey (NHS) for Canada. We focus our analysis on the surveys from 2011, the last year that income and labor statistics are available for Canada with the level of occupation detail we require. For the United States, we use the March 2011 edition of the CPS, which features an expanded set of questions and a larger sample of households.

Both the Canadian and U.S. data provide detailed employment information for a broad set of occupational groups. In particular, Statistics Canada reports estimated average and median employment income as well as the total number of employees for 500 detailed occupation classes defined by the National Occupational Classification (NOC) coding system.[15] For the U.S., we calculate mean and median employment income and the quantity of workers from the CPS microdata form IPUMS. Occupations in the CPS are coded into 525 classifications using the American Community Survey OCC codes.

[15] Statistics Canada, 2011 National Household Survey Data Tables, Catalogue number: 99-014-X2011042

For privacy reasons, various income components in the CPS are altered above certain levels to reduce the risk of identification of individuals with very high incomes. However, respondents' incomes are not capped at these values. Instead, each income value above the topcoded level is systematically swapped with another topcoded value within a bounded interval, and rounded to two significant digits.[16] The intervals used in the swapping procedure are not released, so we do not observe how much measurement error or potential bias is introduced to our overall measure of employment income for respondents with wage income subject to the swapping procedure. For this reason we consider both the mean and the median – both of which have benefits and drawbacks. Although this procedure does not necessarily bias our ultimate outcome measure of mean employment income by occupation, it does introduce unknown and heterogeneous measurement error to this variable. Estimates for the median wage avoid this concern. However, the median provides no information on the upper tail of income – a feature of the wage distribution that may be of interest to a monopsonist interested in reducing healthcare spending. Therefore, in our tables we report both measures and in the text we primarily discuss the mean wages by profession in each country.

In the U.S. data, we construct occupation-level average employment income and quantity of employees that match the definitions of these variables in the data tables for Canada. Specifically, for Canada, total employment income in the NHS is defined as the total of wages and salary, net income from a non-farm unincorporated business or professional practice, and net farm self-employment income. For the U.S., each of these income components is available in the CPS microdata. Since employment income by occupation for Canada is reported only for sample respondents with employment income, we impose the same sample restriction on the CPS microdata before aggregating by occupation. Therefore, the quantity of workers reported is the number of workers with employment income for each occupation. We then attempt to match occupation categories across the two countries for all healthcare related occupations by job title. Our cross-country analysis of the healthcare sector focuses on the 18 matched occupation classes shown in Table 3 and Table 4. Section A.1 of the appendix provides a full list of OCC and NOC codes that are used to form each

[16] For our income measure, two components of total employment income are subject to the swapping procedure. These are incomes from primary employment (either wages or from self-employment) above $250,000, wage incomes from secondary employers above $47,000, and secondary self-employment business incomes above $60,000.

occupation category and describes the matching process in greater detail. We convert incomes for Canada to 2011 USD using the 2011 purchasing power parity (PPP) conversion rate and normalize quantity of workers to be per 100,000 members of the total population of the each country in 2011 (OECD 2018).

Note that all of our results are subject to varying degrees of survey error and may be both noisy and biased. We use these survey data to gain an understanding of the role of wage differentials rather than to develop a precise estimate of the differential. We have seen no evidence to suggest that our results grossly misstate the importance of wage differentials.[17]

We note that while our data are appropriate for cross-country comparisons, they are incomplete in two ways that lead to small and potentially offsetting biases. First, our data could overstate or understate U.S. physician earnings due to the topcode swapping procedure in the CPS. For this reason, and as described above, we present both mean and median income estimates – with the qualitative conclusions being broadly similar across the two measures. Second, we lack data on employee fringe benefits (such as healthcare or retirement programs). The impact of this omission difference should be relatively consistent across health and non-health professions with the important exception of U.S. physicians, who are often self-employed and must provide their own health insurance. An apples-to-apples comparison of wages would deduct the cost of health insurance from U.S. self-employed physicians. Failure to do so causes us to slightly overstate U.S. physician earnings and creates an upward bias in our estimates of the wage differences across the two countries.

To examine prescription drug prices, we require data on a comparable set of products in the United States and Canada. Our data on Canadian drug prices comes from the Ontario Drug Benefit Formulary as of July 2018. We use Ontario for Canada as it is the largest province by population and the formulary has each

[17] For example, we also compared U.S. healthcare wages against several European countries, using data analyzed by the Washington Post that was compiled by the University of Amsterdam's Wage Indicator Foundation, which surveys workers in dozens of nations on six continents and reports average wages adjusted for purchasing power parity (Noack 2015). This survey, which includes voluntary responses submitted online and is therefore less reliable than the NHS/OES data, nevertheless shows similar wage differentials as those between the United States and Canada. Similarly, the ratio of physician earnings across a number of developed countries has been found to be broadly similar to the ratio of earnings for other high income occupations (Cutler and Ly 2011).

data element we need to match drugs.[18] For each Drug Identification Number (DIN) listed on the Ontario formulary, we observe the unit price and convert this price to US dollars using the 2017 OECD PPP conversion rate.

Obtaining accurate market-wide drug pricing data for the United States is a perpetual problem for researchers. While list prices in the United States are available, these prices rarely represent the actual prices paid for these products. Instead, pharmaceutical firms provide a variety of rebates (i.e. discounts from the list price) that allow them to price discriminate across the various payers in the system. In order to facilitate profit maximization these rebates are confidential and thus researchers often lack data on the actual prices paid. That said, federal regulations require that firms provide the Medicaid system with a rebate equal to the largest rebates provided to any private payer in the system, effectively guaranteeing Medicaid pays a price equal to the lowest price paid in the market.

To determine drug prices in the United States, we first estimate post-rebate drug prices and then exploit the Medicaid rules to estimate minimum price differences between private purchasers in the United States and the formulary unit price in Ontario. We use the 2018Q1 Medicaid Drug Utilization Data for two main reasons: it contains data for a wide range of drugs and, as noted, there is a mechanical relationship between post-rebate Medicaid prices and minimum prices for private purchasers. In these data, we observe the average pre-rebate unit price for each National Drug Code (NDC), limiting the sample to prescription drugs. To estimate post-rebate unit prices in the United States, we use the 2015 Medicaid Financial Management Reports to calculate rebates as a share of total of Medicaid drug spending, which is 45 percent. As we are interested in comparing brand name drug prices, we calculate an upper bound of the rebate share for brand name drugs by dividing the overall rebate share by the fraction of Medicaid spending on brand name drugs, which is 78 percent. Together, this implies that rebates for brand name drugs were at most 57 percent of total spending on brand name drugs. We estimate post-rebate prices for Ontario in a similar fashion. Following Kang et al. (2019), we reduce list prices by the average rebate share for brand name drugs in 2016 and 2017 – 30 percent.

[18] Although our data is for Ontario, drugs are purchased at the national level.

Finally, to match drugs across countries we create a one-to-one correspondence between NDCs and DINs for a subset of drugs by matching on generic name, manufacturer, dosage form, and dosage strength.[19] We further limit to tablet and capsule dosage forms measured in milligrams to ensure comparability of units.

Overall, we match 183 NDCs in the Medicaid data to a DIN on the Ontario formulary, 48 of which are brand name drugs. These matched brand name drugs account for 26 percent of Medicaid prescription drug spending on brand name tablets and capsules. The composition of the matched drugs by major drug class (as listed on Ontario formulary) is similar to the overall composition of the formulary at the drug level, although the share of Medicaid spending on neurological drugs in our sample is higher than the share of spending on neurological drugs overall in Medicaid.[20] Our sample is therefore largely representative of the broader formulary and the drugs included represent a meaningful portion of the overall prescription drug spending.

III. Differences in Healthcare Labor Costs between the United States and Canada

In order to understand the healthcare labor cost differences between the United States and Canada we begin by comparing the salaries earned by medical professionals. Recall that the wage patterns for skilled and unskilled healthcare and non-healthcare workers inform the potential implications of using monopsony power in the United States. Table 3 contains the wages for the 18 matched health occupations. Column 2 contains the mean U.S. salaries, Column 3 contains mean Canadian salaries, and column 4 contains the ratio of U.S. to Canada salary. Columns 5-7 replicate Columns 2-4 but with median salaries instead of means. Employees in nearly every healthcare profession earn higher wages in the United States.

To ease comparison of these wages, we report the number of workers per capita in each occupation in Table 4, and use these to construct wage indices across matched occupations j of the form,

[19] We exclude authorized generics or other cases where these variables do not uniquely identify a DIN or NDC.
[20] 86% of spending on matched brand name drugs is for neurological drugs (first character of all ATC-4 codes is "N"), while neurological drugs account for 60% of Medicaid spending on brand name prescription tablets and capsules. As drugs have multiple ATC-4 classifications, here drugs are classified as "neurological" if any of its ATC-4 codes begins with and "N".

$$WageIndex = \frac{\sum_j Wage_j^{CAN} Q_j^{US}}{\sum_j Wage_j^{US} Q_j^{US}},$$

where Q_j is number of workers per capita 4 and $Wage_j$ is generally mean employment income unless stated otherwise. Table 5, Panel A contains our estimates of these wages indices. We find that Canadian wages are 24 percent lower than those in the United States.[21] This difference is driven both by higher salaries per professional and differences in the composition of the healthcare workforce. Specifically, we note that in addition to paying higher salaries, the United States also employs a greater percentage of specialists – each of whom earns a higher salary than a generalist. If we break out specialists and generalists and recalculate the wage index, the differential slightly increases to 27 percent, although this result should be interpreted with caution as it relies on a separate data source to split U.S. physician wages by generalist/specialist.[22] Reweighting using Canadian labor supply produces an identical wage differential of 24 percent when we combine all physicians and surgeons.

While these data provide clear evidence that wages are meaningfully higher in the United States, variation in the size and composition of the workforce beyond the number of specialists could also drive differences in spending. Table 4 reveals many differences in the number of workers per capita in each country. The U.S. has more workers in some occupations such as dietitians and respiratory therapists but Canada has more dental hygienists and occupational therapists. These differences, which may reflect labor supply, medical demand, or both, can contribute to differences in health spending, even if wages were the same in the two countries. For example, if the U.S. employs 10 percent more healthcare workers per capita in all occupations, this will contribute to 10 percent higher labor costs. In order to estimate the labor supply effect on total spending, separately from the wage effect, we constructed a quantity index using U.S. wages as weights.[23] We find that overall, the Canada healthcare labor supply is 6 percent lower than in the United

[21] The gap should not be construed, however, as indicating that U.S. medical workers enjoy a higher standard of living; that would depend on a myriad of other factors well beyond the scope of this analysis.
[22] We describe how we use the Medscape Physician Compensation Report to fill in this data in Section A.2.
[23] Note that this index fixes the composition of the labor force. We do not estimate how differences in composition, as opposed to aggregate supply, affect differences in health spending.

States. This implies 6 percent of the overall labor cost differential is due to the greater use of labor in the United States. Using Canada wages as weights does not change the results.

IV. Differences in Wages in the Broader United States and Canadian Labor Markets

We have shown that U.S. healthcare workers earn substantially more than those in Canada. Broadly speaking, there are three potential reasons for this. First, Canadian provincial governments may be exercising monopsony power. Second, there could be entry barriers into medical jobs, such as tuition or licensing requirements, and these barriers (particularly those related to the fixed cost of education) could be higher in the United States. Third, the wages for healthcare workers might reflect the conditions of the broader labor market. Put simply, highly skilled workers in the United States might make more than in Canada, regardless of occupation. If the first two reasons are the source of the wage differences, then we should observe higher U.S. compensation for certain occupations in the health sector, but not in other sectors. However, if the differences reflect the broader labor market, then we should see similar wage differentials across other occupations outside of healthcare.[24]

Understanding the source of labor market differences is not simply an academic exercise. If high U.S. healthcare wages reflect the broader labor market, then cutting healthcare wages could have unintended effects: current healthcare workers may decide to seek other employment opportunities outside healthcare – or at least outside of the scope of the monopsonist's power. Perhaps more detrimental would be the long run effect on labor supply. Talented young individuals have a choice of career paths, and if healthcare wages fall below what they could expect to earn in other jobs, the supply of qualified individuals training for healthcare careers will likely fall.

[24] It is also possible that the Canadian monopsonist chooses to exercise its market power to decrease wages which limits the attractiveness of healthcare as an employment sector. This could subsequently shift highly skilled applicants to other sectors, which would decrease their equilibrium wages. The effect of this decline would be based on the number and quality of potential physicians that shift into these other sectors. We believe that this effect, to the extent that it exists, is likely limited. Using the quantity of workers in Table 2, there were roughly 80,000 physicians and surgeons in Canada in 2010. Each decile of our sample of Canadian workers plotted in Figure 1, Panel A contains roughly 1.65 million observations, so the entire population of physicians is less than 5 percent of the size of the entire top decile of workers by employment income. Therefore, the potential scope for this effect appears small. It is also true that a United States monopsonist would also need to consider this potential suppression of wages in other sectors as it makes its optimal decision.

One way to determine if U.S. healthcare wages are "too high" relative to other occupations is to return to our comparison with Canada. As reported earlier, Canadian healthcare workers earn 24 percent less than their U.S. counterparts. If this reflects broader labor market conditions, then we would expect Canadian workers in other occupations requiring similar skills and training to also make about 24 percent lower wages. If this instead reflects differences in health policy, entry barriers or licensing restrictions in healthcare, then the Canada to U.S. wage differential in non-healthcare jobs should be well below that level.

Table 6 contains the wages for jobs in the health sector and the broader economy that require similar levels of education. Panel A contains the 10 healthcare occupations with the highest average years of completed education in the United States. On average, individuals in these occupations had 16.67 years of education with a high of approximately 20 years for doctors and dentists and a low of approximately 15 years for registered nurses. Similar to the results above, highly educated medical occupations in Canada earn about 26 percent less than their American counterparts. Panel B of Table 6 contains a set of non-health occupations that require broadly similar levels of education. Specifically, for each health occupation in Panel A, we find the non-health occupation with the most similar average years of education that we can match to a single Canadian occupation code. While there are many other potential careers a medical provider could have chosen, these occupations represent a reasonable counterfactual career path had these educated providers not initially chosen to pursue a healthcare occupation. The average years of completed education for workers in this comparison set of high-education non-healthcare occupations is 17.57. Overall, we find that Canadian employees in these occupations earn 22 percent less than their American counterparts. For example, lawyers in the United States earn approximately $145,000 a year while Canadian lawyers earn only $110,000.

This comparison of health occupations with the highest average education levels to the small subset of non-health occupations in Panel B of Table 6 has two advantages. One is that we are able to use the most detailed country-specific occupations codes possible and only compare occupations where there is a clear one-to-one correspondence between countries. The second advantage is that in terms of education, these occupations most closely resemble the health occupations in Panel A. However, these occupations may not be representative of all high-skill, non-health occupations. By using slightly broader occupation categories and

loosening the criteria for matching between countries, we show that our findings of higher earnings in the U.S., particularly for occupations with greater average years of education, are robust to expanding the set of non-health occupations we consider. We do this by aggregating our data on earnings and workers per capita from country-specific codes to 2008 International Standard Classification of Occupations (ISCO-08) codes. Using crosswalks from each country's occupations classifications, we are able to estimate average employment income and labor supply in each country for 115 of 429 ISCO-08 occupation classes.[25] Of these codes, 18 are health care occupations. These roughly correspond to the set of hand-matched occupations in Table 3, although the ISCO-08 occupation categories are often less precise. We calculate wage and quantity indices for these occupations with both U.S. and Canada weights and then average the two, with results shown in Panel B of Table 5. For this set of matched occupations, we find that Canadian workers earn 21 percent less in healthcare occupations and 14 percent less in non-healthcare occupations. Dividing both the healthcare and non-healthcare occupation groups in half by average years of education completed, we see similar patterns for each; more highly educated occupations have larger wage differentials. However, workers in the healthcare sample are much more educated on average than workers in the non-healthcare sample. If we compare the full healthcare sample, where workers have 15.57 years of education on average, to the above-median education non-healthcare sample, where workers average 15.05 years of education, the wage differential between countries looks similar. Overall, these results are similar to those from the small subset of high-education occupations in Panel B of Table 6, where we find those particular high-education, non-health occupations have 22 percent lower earnings in the Canada.

These data demonstrate that a large fraction of the difference in healthcare wages reflects the broader labor market. These differences by profession should also be visible across the distribution of wages for these two countries. We examine this in Figure 1, which depicts average wages by income ventile for the two countries. Panel A contains average employment income across ventiles for all workers and shows that wages are remarkably similar for all but the highest ventile, where on average American workers earn $204,000 and

[25] We can only calculate these at the ISCO-08 level for a subset of occupations because for each crosswalk from country-specific occupation codes to ISCO-08 codes, we must discard occupations where the mapping from country-specific codes to ISCO-08 is not well-defined, i.e. a country-specific code is related to multiple ISCO-08 codes.

Canadian workers earn $154,000. Panel B shows the same comparison for healthcare workers only, which is broadly similar except for the upper tail where there is a greater U.S. wage premium for healthcare workers than seen for all workers in Panel A.

Given that healthcare workers have a large amount of education, the wage distribution for more educated workers likely provides more information about the broader income differentials between the two countries. Figure 2 contains the same comparison of employment income across income ventiles for individuals with a graduate degree. Panel A contains data for all workers. Here the evidence of differences in the broader labor market is even more obvious, with higher income workers in the United States earning meaningfully higher salaries than their Canadian counterparts. For example, workers at or above the 95th income percentile (among advanced degree holders) in the United States earn $371,000 while those in Canada earn $286,000. Panel B contains data for healthcare workers with an advanced degree. In this sample, the spread between U.S. and Canadian workers begins earlier in the wage distribution. Thus these broader income distributions provide confirming evidence that the labor cost differences are not driven solely by the decisions of the monopsony insurer but instead reflect, in large part, the broader labor market.

There could be a remaining concern that the differences in pay for physicians across the United States and Canada reflects some differences in underlying productivity. While true measures of productivity are difficult to obtain, we provide some evidence of potential differences based on the number of hours worked. Figure 5 contains the average hours worked by U.S. and Canadian employees across eight broad occupational categories available in the harmonized household survey data from IPUMS International. These categories are arranged based on the percentage of individuals in the occupation category that have a college degree. For professions with a greater percentage of college graduates, United States employees do work more hours.

The greater hours worked in the U.S. may be one reason for the higher wages earned at the top of the income distribution. To examine whether this could be driving the higher wages for U.S. healthcare workers, we next examine whether these differences in hours among highly skilled professionals differ across health and non-health professions. Table 7 contains the average hours worked by U.S. and Canadian

employees based on whether they work in a professional occupation and whether they are a healthcare employee.[26] Overall, these results demonstrate that while employees in professions with a higher share of college grads do work longer hours, there is no discernible difference between health and non-health workers in those sectors. Together, these data suggest that the differences in the hours worked cannot explain the differences in wages for healthcare professionals across the two countries. In addition, they reinforce the importance of the broader labor market in explaining different wages for healthcare professional across the two countries.

V. Prescription Drug Prices in the United States and Canada

To compare brand name prescription drug prices, we estimate a between-country price index for each drug d in our sample of matched brand name drugs:

$$Price\ Index = \frac{\sum_d {P_d}^{CAN} {Q_d}^{US}}{\sum_d {P_d}^{US} {Q_d}^{US}}$$

Table 8 contains these price indices. We find that the estimated post-rebate Ontario prices are 54 percent lower than the estimated post-rebate Medicaid prices for our sample of brand name drugs. As we use an upper bound of brand name rebate share to calculate post-rebate Medicaid prices, this would understate the price difference between countries under the assumption that rebates as a share of total spending for our sample of drugs is similar to the overall Medicaid and Ontario Drug Benefit rebate shares.

As noted earlier, the percentage of Medicaid spending on neurological drugs is higher for our matched sample than for Medicaid as a whole, so this price index disproportionately reflects differences in neurological drugs prices. When we re-calculate the index separately by drug class, we find that brand name neurological drugs prices are 52 percent lower in Ontario compared to Medicaid, while other brand name

[26] The broad occupation categories in Table 7 and Figure 5 come from the ISCO-1988 occupation coding. We use these because they are coded consistently between countries in the IPUMS International versions of the 2011 National Household Survey and the 2010 American Community Survey. Almost all health occupations that we study (see Table 3) fall under the "Professionals" or "Technicians/Associate Professionals" occupation groups.

drugs are 64 percent less expensive in Ontario. This again suggests that the 54 percent price differential may understate the true price differential for all brand-name drugs.

Just as with our estimates of wage differences between countries, we caution that these estimates are imprecise and imperfect. However, our results are broadly similar to prior studies comparing prescription drug prices in Canada and the U.S. using alternative data and methods and covering earlier time periods (Danzon and Furukawa 2008, Graham and Robson 2000). Machado, et al. 2011 summarize previous studies on international drug price comparisons and outline six measures of quality for such comparisons. Our analysis performs well on these measures, failing only to have a fully representative sample of brand name drugs, but our sample is as representative as possible while still matching drugs across countires at the NDC/DIN level.

The difference in pharmaceutical prices reflects a combination of the different optimal prices for goods and services across the two markets and the exercise of monopsony power by the Ontario government. For a variety of reasons we find it unlikely that the optimal price differs by enough across the two countries to explain the totality of the difference. First, to the extent that a different optimal price is driven by the budgets of consumers, incomes across the two countries are quite similar. Figure 1 shows that incomes across the income distribution are comparable. For example, U.S. median income is $31,043 compared to $27,885 in Canada, just a 10 percent difference.

Second, broad measures of economy-wide price levels and cost-of-living indicies based on a fixed basket of goods suggest that the observed difference in prescription drug prices far exceeds general price differences between the two countries. One way to see this is to look at the price level index between Canadian dollars and U.S. dollars, which is ratio of purchasing power parity to market exchange rates. This provides a rough estimate of differences in overall price levels between countries at a point in time, but is noisy from year-to-year due to market exchange rate volatility. In 2017, the price level index of Canadian dollars to U.S. dollars was 0.96, implying Canadian prices are 4 percent lower. Given the volatility of market exchange rates, a better measure of price differences could be the average value of the index across years, which is 0.98 for all years since 1990. We show in the Section A.3 of the Appendix that differences between

countries (relative to the U.S. dollar) are stable and consistent with *ex ante* beliefs about countries with high or low prices compared to the U.S., and that the overall trend of this index for a given country is relatively flat. This implies that the average across years is informative about price level differences between countries. Cost-of-living indices that compare prices between the U.S. and Canada for a fixed basket of goods provide similar estimates. For example, the website Numbeo collects price data for each country from a combination of sources including firm websites, government institutions, and user input (Numbeo 2018). For goods and services for which they have data for each country, consumer prices were 5.69 percent lower in Canada than in the U.S. from May 2017 to November 2018. Therefore, this again suggests Canadian prices overall are slightly lower than prices in the U.S., but the difference is significantly smaller than the price differcnes we observe for prescription drugs, where Canadian prices are 54 percent lower.

These data on both income levels and the prices for other goods and services suggest that a potentially large fraction of the difference in prescription drug prices across countries is the result of the monopsonist's decisions. This would be consistent with the prediction of the monopsony model discussed above.

VI. Conclusions

In this paper, we examine the role of monopsony power in healthcare markets by comparing prices and quantities of healthcare inputs in Canada and the United States. We provide a theoretical framework and empirical evidence for the optimal behavior of a monopsonist. We focus on two critical inputs to the healthcare production function that illustrate key features of the theoretical model – labor and prescription drugs. In line with the theoretical expectations we outline, we find that the Canadian monopsonist is more willing to exploit its market power over prescription drugs than provider wages.

Examining a market basket of prescription drugs, we find that prices in Canada are 54 percent lower than in the U.S. This price differential is much larger than the general cost-of-living differences between the two countries, which we interpret as evidence that the Canadian monopsonist is willing to use its power to lower the cost of this particular medical input. This is in line with our theoretical expectations: because

Canada represents a small share of the global drug market, policymakers are able to exploit their buyer power without incurring broader consequences, such as reducing innovation.

In contrast, we find that the differential in provider wages between the U.S. and Canada can largely be explained by differences in the prevailing labor market conditions, implying that the Canadian monopsonist is not willing to exercise the full scope of its buyer power for this input. In particular, we find that Canadian medical workers earn about 24 percent less than their American counterparts. If this was solely the result of profligate U.S. health spending, we should expect that U.S. providers would not only be paid more than their Canadian counterparts but also relatively more than other highly skilled professionals in the United States. This is not the case. We primarily attribute differences in wages for U.S. medical providers to the structure of the broader labor market; i.e., U.S. providers are paid more than in Canada because all highly skilled U.S. professionals are paid more than in Canada. In particular, high skilled healthcare workers in Canada make about 26 percent less than similar workers in the United States, while high skilled non-healthcare workers make 22 percent less. Thus, the vast majority of the 26 percent wage differential likely reflects overall labor market conditions. The remaining 4 percentage point differential between healthcare and other professional wages may reflect a variety of factors—potentially including inefficiencies in the U.S. system that provide excess wages to healthcare providers or a choice by the Canadian monopsonist to exploit some of its market power.

Our findings are consistent with the idea that the Canadian monopsonist believes that a substantial reduction in the wages of physicians and other healthcare workers could cause a reallocation of talent across the economy. This is true even conditional on similar individuals receiving medical training. These individuals have a number of opportunities beyond clinical practice, and there are some reports physicians are increasingly choosing these options (Mostue 2017). Perhaps more concerning would be a reallocation of talent out of medical training altogether. For example, if the U.S. took steps so that its physicians were paid the same as Canadians, this would move physicians from the second highest paid profession in the U.S. to the eighth highest paid profession—situated just above computer engineers, mathematicians and biomedical engineers. This change in relative pay could push many talented young individuals considering medicine into

entirely different fields.[27] Given this concern, it should perhaps not be surprising that even the Canadian monopsonist does not appear to have chosen to meaningfully exercise its wage setting power. In Canada, as in the United States, physicians and surgeons are among the highest paid employees in society.

Staffing levels represent another important potential source of inefficiency in the U.S. healthcare labor market. Weighting by wages, we find that Canada has 6 percent fewer healthcare workers per capita than in Canada. Whether this reflects excesses in the United States, or shortages due to the exercise of monopsony power in Canada, is an open question.

That the healthcare wage differences appear to be the result of broad labor market consequences should perhaps not be surprising. That being said, there still appear to be minor differences between the wages earned by U.S. and Canadian physicians that are not driven by the broader labor market and could be a source of potential, albeit smaller, savings. For example, American medical specialists are compensated above and beyond the broad labor market differences between the countries. While both countries ration entry into the profession, and especially into specialties, this could reflect tighter entry restrictions in the United States. On the other hand, this is also consistent with the exercise of monopsony power in Canada, which we would expect to result in both lower equilibrium wages and quantities.

Taken together, our findings should temper the expectations of anyone who believes that Medicare-for-all will drive U.S. health spending to Canadian levels. Most health spending goes toward labor expenses. Returning to the Willie Sutton analogy, while labor is "where the money is," a U.S. monopsonist might find, just as in Canada, that it is not worth "robbing the bank" by lowering labor expenses, as this would drive highly skilled workers into other fields. And while the U.S. monopsonist could drive down drug prices to levels at or below those in Canada, it might be tempered by concerns about disruptions to long term drug supply, a problem not shared by the much smaller Canadian monopsonist.

[27] The exact effect would depend on several factors, such as the relative importance college students place on future income versus other job attributes.

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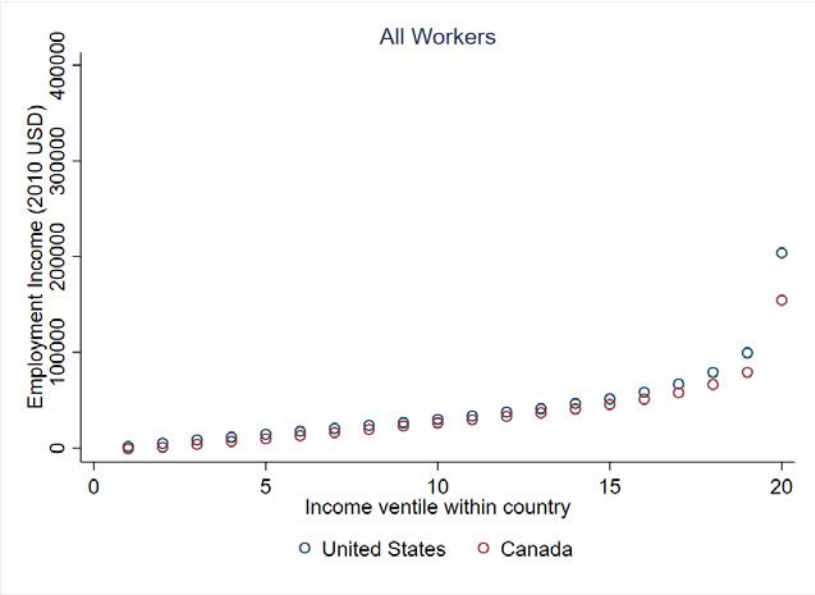
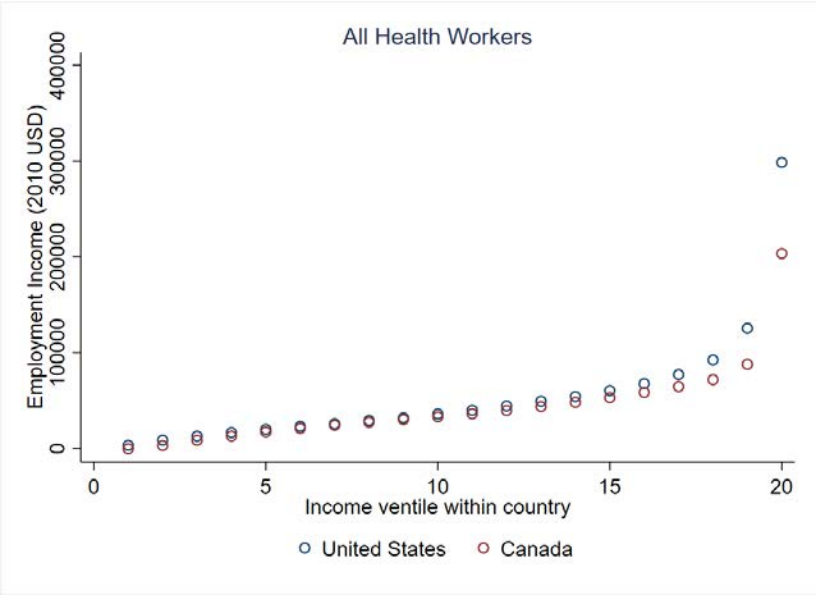
Figure 1. Income Distribution by Country

Panel A



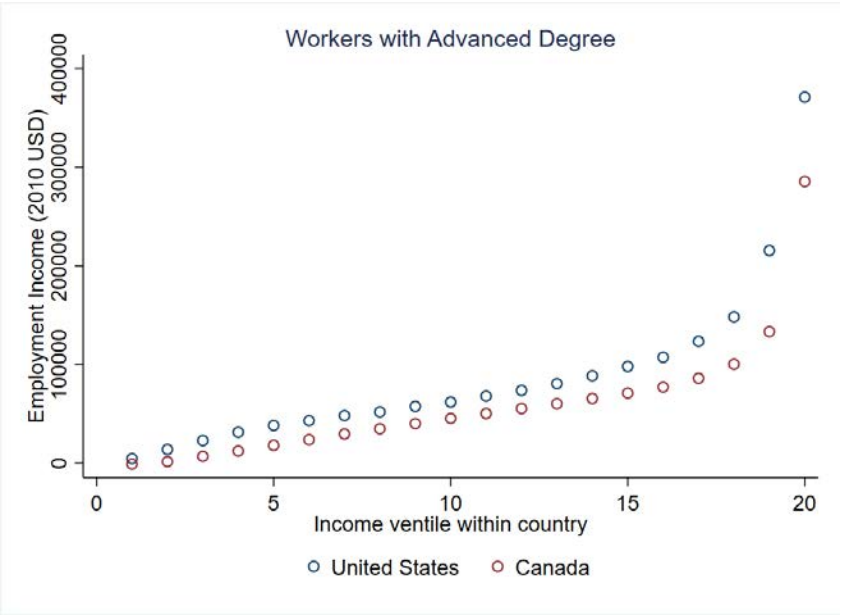
Panel B



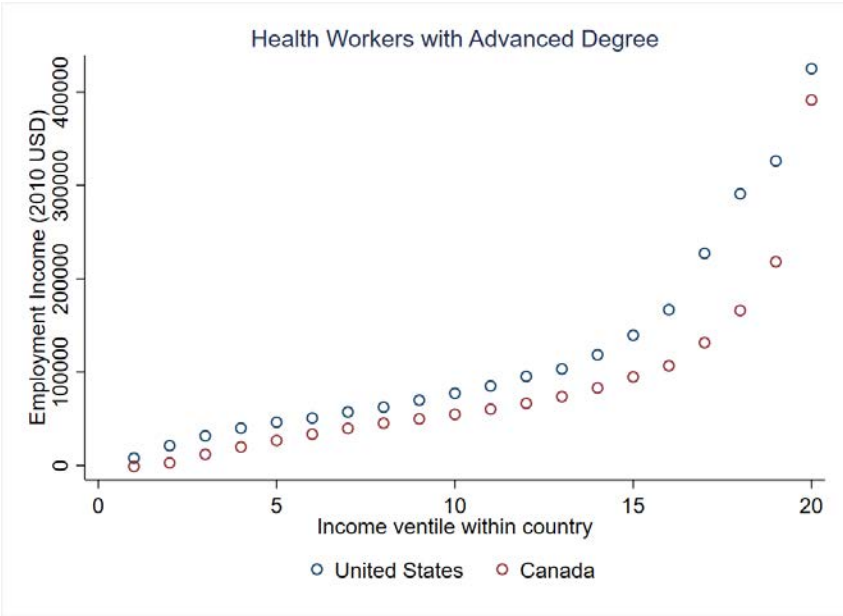
Notes: Figure plots the mean income for each within-country income ventile for all workers and workers in a health care occupation. For Panel B, income quantiles are calculated only among individuals in health care occupations. Sample is employed, paid workers in the 2011 National Household Survey (Canada) and 2010 American Community Survey (U.S.), using the harmonized versions of each data source from IPUMS International.

Figure 2. Income Distribution by Country for Advanced Degree Holders

Panel A



Panel B



Notes: Figure plots the mean income for each income ventile (within country and degree status) for all workers and workers in a health care occupation. For Panel B, income quantiles are calculated only among individuals in health care occupations. Sample is employed, paid workers in the 2011 National Household Survey (Canada) and 2010 American Community Survey (U.S.), using the harmonized versions of each data source from IPUMS International.

Figure 3. Classic Monopsonist Market

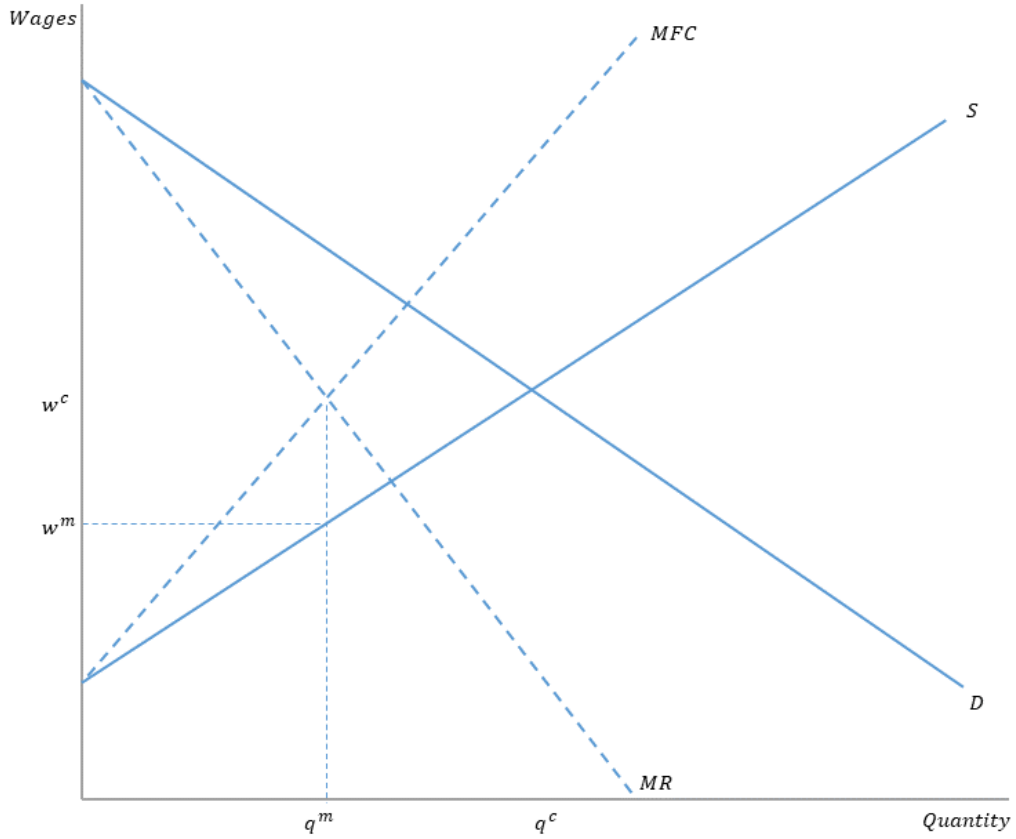


Figure 4. Monopsonist Market with Elastic Supply

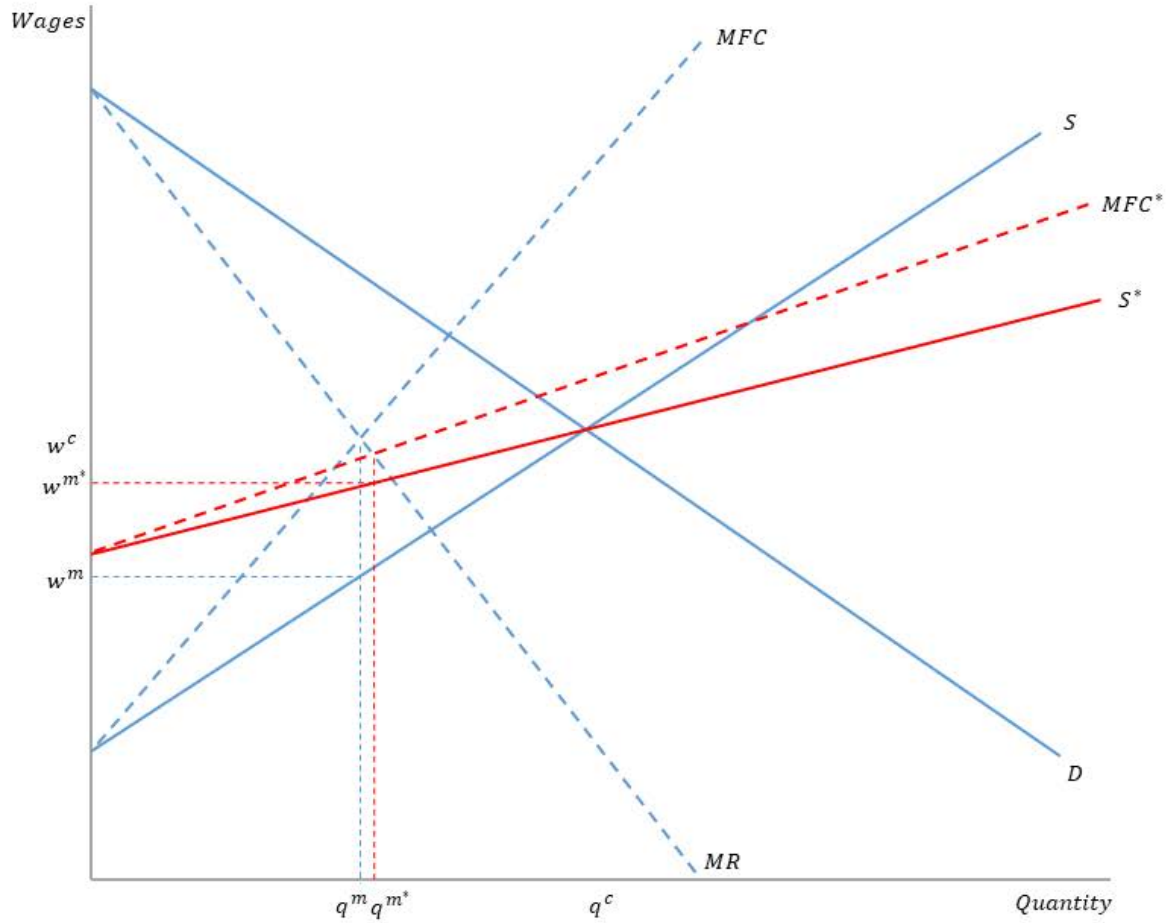
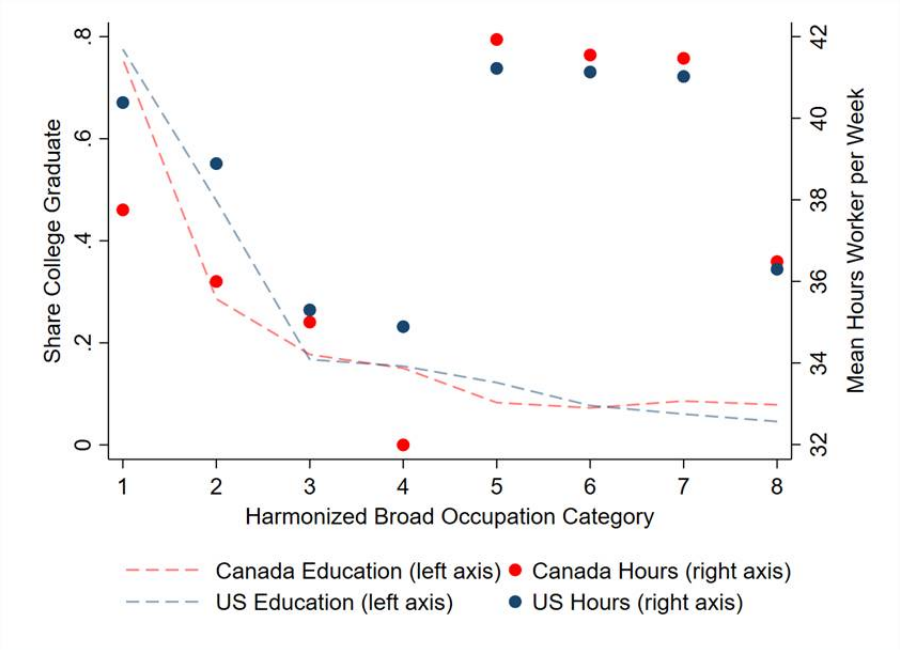


Figure 5. Hours Worked by Occupational Category



Notes: Data source is the harmonized versions of the 2011 National Household Survey (Canada) and 2010 American Community Survey (U.S.) from IPUMS International. Sample is employed individuals that reported the number of hours worked in the past week (Canada) or on a typical week (U.S.). The harmonized occupation codes come from the ISCO-1988 occupation coding system. The occupation groups included in this figure, ordered by average years of education in the U.S., are: Professionals (1), Technicians and Associate Professionals (2), Clerks (3), Service Workers and Shop and Market Sales (4), Skilled Agricultural and Fishery Workers (5), Crafts and Related Trades Workers (6), Plant and Machine Operators and Assemblers (7), and Elementary Occupations (8). Legislators and Armed Forces/Military Officers are excluded.

Table 1. Supply Elasticities by Input Type

	Unskilled Labor: US Payer	Unskilled Labor: Monopsonist	Skilled Labor: US Payer	Skilled Labor: Monopsonist	Medical Products: US payer	Medical Products: Monopsonist
Short run	Elastic	Elastic	Somewhat elastic	Inelastic	Somewhat elastic	Inelastic
Long run	Elastic	Elastic	Somewhat elastic	Somewhat elastic	Somewhat elastic	Depends on size
Purchaser size	Not applicable	Not applicable	Not applicable	Larger elasticity for larger purchaser	Elastic for large purchaser	Elastic for large purchaser

Table 2. Monopsony and Wage Suppression

	Unskilled Labor	Skilled Labor	Medical Products
U.S v. Smaller Nation	Between country wage differences based on differences in overall labor markets. No suppression relative to non-medical workers.	Between country wage differences based on differences in overall labor markets. Some within-country suppression relative to non-medical workers.	Input price suppression in smaller nation.
U.S. today v. U.S. monopsonist	No change.	Some wage suppression possible. Comparable to additional wage suppression observed in smaller nation.	Some input price suppression, but not as much as U.S. versus other nations.

Table 3. Comparison of Employment Income for Healthcare Workers

	Mean Employment Income			Median Employment Income		
Job Title	U.S.	Canada	U.S./Canada	U.S.	Canada	U.S./Canada
Physicians and surgeons	$184,075	$124,033	1.48	$150,000	$98,543	1.52
Primary Care	$159,667	$110,045	1.45			
Specialists	$249,500	$141,200	1.77			
Dentists	$138,460	$100,637	1.38	$120,000	$84,761	1.42
Optometrists	$111,328	$75,211	1.48	$105,000	$66,111	1.59
Chiropractors	$106,010	$49,344	2.15	$55,000	$38,678	1.42
Pharmacists	$102,440	$72,506	1.41	$100,000	$69,268	1.44
Allied primary health practitioners	$73,884	$58,487	1.26	$51,000	$60,294	0.85
Physical therapists	$67,953	$43,679	1.56	$62,000	$43,552	1.42
Occupational therapists	$58,107	$42,540	1.37	$57,000	$43,955	1.30
Registered nurses	$56,452	$46,331	1.22	$55,000	$48,168	1.14
Dietitians and nutritionists	$54,806	$37,508	1.46	$46,000	$37,677	1.22
Respiratory therapists	$54,166	$47,192	1.15	$50,000	$46,401	1.08
Dental hygienists	$42,742	$36,552	1.17	$39,000	$36,427	1.07
Emergency medical technicians and paramedics	$42,360	$48,982	0.86	$40,000	$48,704	0.82
Licensed practical and licensed vocational nurses	$35,223	$30,603	1.15	$35,000	$31,959	1.10
Opticians, dispensing	$33,031	$32,041	1.03	$31,000	$31,094	1.00
Medical records technicians	$30,874	$35,415	0.87	$30,000	$34,753	0.86
Dental assistants	$27,560	$24,193	1.14	$27,000	$24,182	1.12
Medical assistants	$25,511	$26,144	0.98	$26,000	$26,584	0.98

Notes: Data sources are the 2011 Current Population Survey (U.S.), 2011 National Household Survey (Canada), and 2012 Medscape Physician Compensation Report. Shows the median employment income for the 18 health occupation categories that were matched between the OCC codes in the CPS data used for the United States and the NOC codes in the NHS data used for Canada. The matching process is described in more detail in the Section A.2. Income is in 2011 U.S. dollars, adjusting for purchasing power parity. Employment income is defined as wages and salary plus net income from self-employment. Income for primary care and specialist physicians in the U.S. is obtained from the 2012 Medscape Physician Compensation Report. Wage indices use the pooled physicians category obtained from the CPS unless explicitly stated otherwise.

Table 4. Comparison of Supply of Healthcare Workers

Job Description	U.S. Employees per 100,000	Canada Employees per 100,000	U.S. / Canada
Physicians and surgeons	261.2	235.8	1.11
Primary Care	94.75	129.92	0.73
Specialists	166.45	105.87	1.57
Dentists	63.8	52.8	1.21
Optometrists	8.2	14.0	0.58
Chiropractors	19.9	19.3	1.03
Pharmacists	93.0	97.6	0.95
Allied primary health practitioners	26.2	14.4	1.82
Physical therapists	71.4	62.2	1.15
Occupational therapists	36.4	42.0	0.87
Registered nurses	899.1	886.7	1.01
Dietitians and nutritionists	36.8	29.8	1.23
Respiratory therapists	38.2	28.9	1.32
Dental hygienists	48.6	69.1	0.70
Emergency medical technicians and paramedics	52.7	74.9	0.70
Licensed practical and licensed vocational nurses	178.2	166.8	1.07
Opticians, dispensing	16.8	25.6	0.66
Medical records technicians	43.1	13.9	3.10
Dental assistants	92.1	91.2	1.01
Medical assistants	132.8	45.6	2.91

Notes: Data sources are the 2011 Current Population Survey (U.S.), 2011 National Household Survey (Canada), and 2012 Medscape Physician Compensation Report. Shows the estimated number of employees per 100,000 members of the total country population in each of the 18 matched health occupation categories based on the CPS and NHS survey data for the United States and Canada, respectively. The matching process is described in more detail in the Section A.2. Worker quantities for primary care and specialist physicians in the U.S. are obtained from the 2012 Medscape Physician Compensation Report. Wage and quantity indices use the pooled physician category obtained from the CPS unless explicitly stated otherwise.

Table 5. Wage Indices

	Wage Index (Canada relative to U.S.)	Quantity Index (Canada relative to U.S.)	Mean Years of Education (U.S. workers only)	N
Panel A: Matched Country Specific Occupation Codes				
Healthcare (see Table 3)	0.76	0.94	15.89	18
Healthcare, High Education (see Table 6)	0.74	0.94	16.67	10
Non-Healthcare, High Education (see Table 6)	0.78	1.08	17.57	10
Panel B: Occupations Mapped to ISCO-08 Occupation Codes				
Healthcare	0.79	0.99	15.57	18
Below Median Education (within sample)	0.93	0.99	14.34	9
Above Median Education (within sample)	0.76	0.98	16.09	9
Non-Healthcare	0.86	1.01	13.75	97
Below Median Education (within sample)	0.90	1.09	12.62	49
Above Median Education (within sample)	0.83	0.97	15.05	48

Notes: Data sources are the 2011 Current Population Survey (U.S.) and 2011 National Household Survey (Canada). Table shows estimated wage and quantity indices as described in Section III. Mean Years of Education is the average number of years of education for workers in the CPS for each sample of occupations. For Panel A, the Healthcare occupation sample corresponds to the occupations listed in Table 3. The High Education samples correspond to the occupations in Table 6. Wage indices are calculated using mean employment income by occupation and US quantity weights. Panel B shows analogous results for occupations that could be matched to ISCO-08 occupation groups from each set of country-specific codes. High and low education subsamples are divided in half within the healthcare and non-healthcare samples separately.

Table 6. Comparison of Employment Income for High-Education Healthcare and Non-Healthcare Occupations

Job Title	U.S. Years of Education	Mean Employment Income			Median Employment Income		
		U.S.	Canada	U.S./Canada	U.S.	Canada	U.S./Canada
Panel A: Top 10 Matched Health Occupations by U.S. Years of Education							
Dentists	20.23	$138,460	$100,637	1.38	$120,000	$84,761	1.42
Optometrists	20.17	$111,328	$75,211	1.48	$105,000	$66,111	1.59
Chiropractors	20.02	$106,010	$49,344	2.15	$55,000	$38,678	1.42
Physicians and surgeons	20.00	$184,075	$124,033	1.48	$150,000	$98,543	1.52
Pharmacists	18.01	$102,440	$72,506	1.41	$100,000	$69,268	1.44
Physical therapists	17.15	$67,953	$43,679	1.56	$62,000	$43,552	1.42
Occupational therapists	16.16	$58,107	$42,540	1.37	$57,000	$43,955	1.30
Allied primary health practitioners	15.83	$73,884	$58,487	1.26	$51,000	$60,294	0.85
Dietitians and nutritionists	15.45	$54,806	$37,508	1.46	$46,000	$37,677	1.22
Registered nurses	15.27	$56,452	$46,331	1.22	$55,000	$48,168	1.14
Panel B: Matched Non-Health Occupations with similar years of education							
Lawyers	19.80	$142,922	$109,627	1.30	$100,000	$74,481	1.34
Psychologists	18.99	$63,920	$44,698	1.43	$60,000	$41,948	1.43
Astronomers and physicists	17.77	$72,335	$66,519	1.09	$55,000	$61,866	0.89
Biological scientists	17.64	$66,914	$48,435	1.38	$55,000	$46,823	1.17
Chemists and materials scientists	17.30	$75,638	$51,614	1.47	$74,000	$47,183	1.57
Secondary school teachers	16.43	$49,614	$47,107	1.05	$48,000	$50,430	0.95
Electrical and electronics engineers	16.24	$94,047	$68,432	1.37	$80,000	$63,459	1.26
Petroleum engineers	15.82	$165,320	$123,162	1.34	$185,000	$91,488	2.02
Computer programmers	15.47	$70,668	$48,440	1.46	$65,000	$48,490	1.34
Materials engineers	15.13	$67,573	$68,681	0.98	$55,905	$62,863	0.89

Notes: Data sources are the 2011 Current Population Survey (U.S.) and 2011 National Household Survey (Canada). Panel A shows the 10 matched healthcare occupations with the highest average years of education in the U.S. based on the 2011 CPS. Panel B shows the 10 matched non-healthcare occupations with the closest average years of education to the corresponding rank in Panel A. Years of educations is the estimated number of post-kindergarten years of education based on the category indicated for highest level of education attained.

Table 7. Comparison of Hours Worked

	Mean Hours Worked per Week		Share College Degree	
	Canada	US	Canada	US
Professionals	37.8	40.4	0.76	0.78
Healthcare	37.6	40.5	0.72	0.71
Non-Healthcare	37.8	40.4	0.76	0.79
Technicians/Associate Professionals	36.0	38.9	0.29	0.48
Healthcare	34.6	37.5	0.21	0.39
Non-Healthcare	36.2	39.3	0.30	0.51

Notes: Data source is the harmonized versions of the 2011 National Household Survey (Canada) and 2010 American Community Survey (U.S.) from IPUMS International. Sample is employed individuals that reported the number of hours worked in the past week (Canada) or on a typical week (U.S.), and is limited to workers in the two major ISCO-1988 occupation groups that contain healthcare professionals: "Professionals" and "Technicians/Associate Professionals."

Table 8. Prescription Drug Price Indices

	Estimated Price Index (Canada relative to United States)	Share of Medicaid Spending in Sample
Full Sample	0.46	0.26
Neurological Drugs	0.48	0.36
Non-Neurological Drugs	**0.36**	**0.12**

Notes: Table shows estimated price indices for the sample of brand name prescription drugs described in Section V. Share of Medicaid Spending in Sample gives the fraction of Medicaid spending on prescription tablets and capsules in the first quarter of 2018 reflected in our estimation sample for each drug class group.

Appendix

A.1 – Matching Healthcare Occupation Codes

Table A.1: Occupation codes used to construct each health occupation category

Job Description	OCC Code(s)	NOC Code(s)
Physicians And Surgeons	3060	3111, 3112
Dentists	3010	3113
Optometrists	3040	3121
Chiropractors	3000	3122
Pharmacists	3050	3131
Allied Primary Health Practitioners	3110, 3256, 3258	3124
Physical Therapists	3160	3142
Occupational Therapists	3150	3143
Registered Nurses	3255	3012
Dietitians And Nutritionists	3030	3132
Respiratory Therapists	3220	3214
Dental Hygienists	3310	3222
Emergency Medical Technicians And Paramedics	3400	3234
Licensed Practical And Licensed Vocational Nurses	3500	3233
Opticians, Dispensing	3520	3231
Medical Records And Health Information Technicians	3510	1252
Dental Assistants	3640	3411
Medical Assistants	3645	1243

Of the 44 healthcare occupations classified by the OCC for the United States, we are able to match 16 to an identical or near identical classification in the Canadian data. We also include two additional occupations where a group of occupations in one country can be aggregated to match a single occupation in the other. These occupations are “Physicians and Surgeons”, which the NOC system divides into generalists and specialists but the OCC combines, and “Allied Primary Health Practitioners”, which the NOC designates as a single category including nurse anesthetists, nurse midwives, nurse practitioners, and physician assistants, while the U.S. OCC codes classify each of these separately. In both cases we aggregate as needed to form comparable groups between the countries. We are able to separately break out generalist and specialist income and quantity information for the U.S. using a third data source, the 2012 Medscape Physician Compensation Report, and use these data in further comparisons of wage and labor supply differentials.

Table A.1 lists the occupation codes from each country that are used to form the occupation categories for the analysis comparing healthcare occupations between the U.S. and Canada. We match occupations between countries using the Find Your NOC tool provided by Statistics

Canada.[1] We first limit to healthcare OCC codes, then enter the job title for each OCC code into the search feature, looking for a single NOC code that has an identical or nearly identical job title. We are able to find such an NOC code for 16 of the 44 healthcare OCC codes.

As mentioned previously, we also include two additional job categories where one country has a unique occupation code that corresponds to several occupation codes in the other country: Physicians and Surgeons and Allied Primary Health Practitioners. Physicians and Surgeons is a single category in the U.S. data, and can be easily matched to the appropriate subgroups in the data for Canada: Specialist Physicians (NOC code 3111) and General Practitioners and Family Physicians (NOC code 3112). Allied Primary Health Practitioners is a single category in the Canadian data. The example job titles provided are anesthesia assistant, midwife, nurse practitioner, and physician assistant. We match these to three OCC codes for the U.S.: Nurse Practitioners and Nurse Midwives (3258), Nurse Anesthetists (3256), and Physician Assistants (3110).

A.2 – Primary Care and Specialist Incomes for the United States

Average incomes for primary care and specialist physicians in the U.S. are calculated using the 2012 Medscape Physician Compensation Report (MPCR).[2] The MPCR surveyed 24,216 physicians in the United States across 25 specialties in February of 2012. The exhibits available online report average income and the share of respondents for each specialty category. We define primary care to be internal medicine, family medicine, and pediatrics, and specialists to be all other specialties. We then calculate average income for each using the reported incomes and share of respondents for each specialty. These results are shown in the indented lines below the Physicians and Surgeons entry in Table 1 and Table 2. To estimate the number of primary care and specialist physicians, we use the share of respondents to the MPCR that are primary care/specialists, and multiply it by the total number of physicians and surgeons estimated by the CPS. These results are shown in the indented lines beneath the Physicians and Surgeons entry in Table 2.

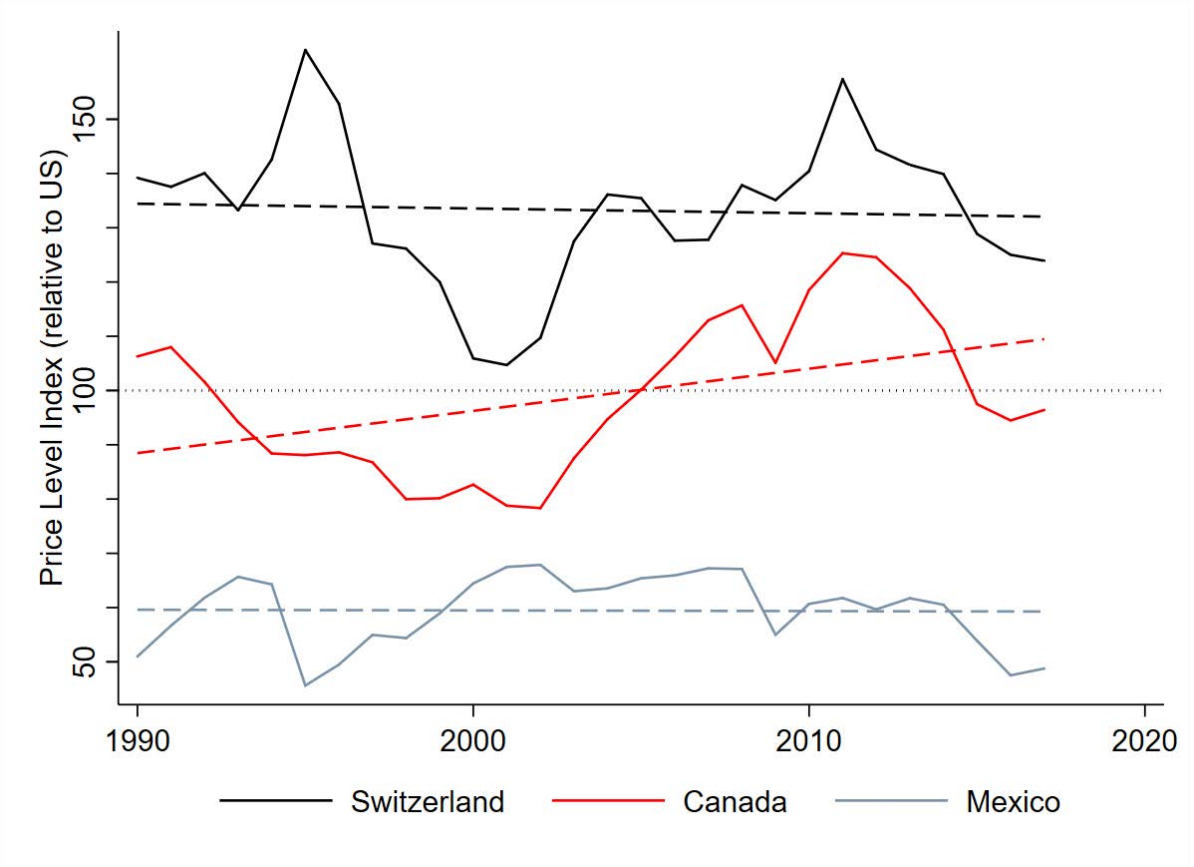
A.3 – Cost-of-Living Comparisons and Price Level Indices

In 2017, the ratio of purchasing power parity to market exchange rates from the Canadian dollar to US dollars was 0.95, which implies that the overall price level is 5 percent lower in Canada than in the United States. This measure is unstable over time due to fluctuations in currency exchange rates, and in fact this ratio was greater than one (implying higher prices in Canada) for most years since 2000. Appendix Figure X plots the time series of this price level index for Canada (relative to the U.S.) from 1990-2017. The unweighted average across years is 0.98, meaning prices have been 2 percent lower in Canada than the U.S. on average over the past three decades. We also plot this same time series for Switzerland and Mexico to show that differences

[1] http://www.cic.gc.ca/english/immigrate/skilled/noc.asp
[2] https://www.medscape.com/features/slideshow/compensation/2012/public

between countries are relatively stable, and that the mean across years for a country seems to provide a good estimation of general price levels relative to the U.S.

Figure A.1



Notes: Figure plots the price level index (ratio of PPP to market exchange rate) for each country-year. Dotted lines are predicted values from OLS regressions of price level on year, estimated separately for each country.