Online Supporting Information for "Labour Supply, Service Intensity, and Contracts: Theory and Evidence on Physicians"

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A Indexes

Quantities: Let p_a^t stand for the price of the service a at time t and $S_{a,i}^t$ for the number of a-type services a physician i provided at time t. The annual level of services S_i^t is then measured as:

$$\begin{cases} S_i^t = \sum_a S_{a,i}^t \, p_a^{1996} & \text{if } 1996 \leq t < 2000, \\ S_i^t = \sum_a (S_{a,i}^t \, p_a^{2000}) \dfrac{\sum_a S_{a,i}^{2000} \, p_a^{1996}}{\sum_a S_{a,i}^{2000} \, p_a^{2000}} & \text{if } 2000 \leq t \leq 2002. \end{cases} \tag{16}$$

The same price are used for weighting billable and non-billable services. The variable S_i^t in (16) then stands for either non-billable services, $S_i^t = S_i^{\mathrm{NB}t}$, or billable ones, $S_i^t = S_i^{\mathrm{B}t}$, aggregated using the same price levels.

Prices: For the same reasons, the weights used for price indexes are the average level of services provided by FFS physicians. This avoids incorporating into price measures the effect of the variations in services due to switching to MR. Let $\overline{S}_a^t$ denote the average level of billable services of type a provided by all the FFS physicians belonging to the specialty considered. The price index of services is then given by:

$$\begin{cases} p^t = \dfrac{\sum_a \overline{S}_a^{1996} \, p_a^t}{\sum_a \overline{S}_a^{1996} \, p_a^{1996}} & \text{if } 1996 \leq t < 2000, \\ p^t = \dfrac{\sum_a \overline{S}_a^{2000} \, p_a^t}{\sum_a \overline{S}_a^{2000} \, p_a^{2000}} \dfrac{\sum_a \overline{S}_a^{1996} \, p_a^{2000}}{\sum_a \overline{S}_a^{2000} \, p_a^{2000}} & \text{if } 2000 \leq t \leq 2002. \end{cases} \tag{17}$$

Once again, we hold constant the weights used for measuring the price index under MR, PF^t, since it is calculated using the average billable services provided by FFS physicians, at MR reduced prices.

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B Calculation of MR earnings

A number of issues arise in calculating gross income under the MR system (see eq. (1)). First, a physician's income depends on the number of *per diems* claimed. As this is unknown, we must approximate it. To do so, we assume that each MR physician works the maximum number of *per diems* possible for a given number of hours worked, the remainder of his time is then allocated to FFS.

We estimate the number of (half) *per diems* worked during a week by

$$\widehat{\mathcal{N}} = \frac{\min\left\{floor\left(\frac{2\times(h^c+h^o)}{\overline{d}}\right), 28\right\}}{2}, \tag{18}$$

where $\overline{d}$ is the number of hours per *per diem* and 28 represents the maximum number of (half) *per diems* that a physician can claim over a two-week period.

Second, recall that we distinguish between billable services provided under the *per diem*, denoted S^{B}_{FFS}, for which the physician is paid a discounted fee, αp, and those provided outside of the *per diem*, denoted S^{B}_{MR}, for which the physician is paid the regular fee, p. Given that we do not observe whether or not a given service was remunerated under the *per diem*, we use θS^{B} and $(1-\theta)S^{\mathrm{B}}$ to estimate S^{B}_{MR} and S^{B}_{FFS}, respectively. Here θ is the proportion of time spent under the *per diem*, estimated as the share of total hours worked in a week under the *per diem* and given by

$$\hat{\theta} = \frac{\overline{d}\,\widehat{\mathcal{N}}}{h^c + h^o}. \tag{19}$$

Hence we attribute billable services to MR and FFS in the same proportion as we attribute hours worked to MR and FFS.

Consumption in alternative j, in year t, under MR is then given by

$$X^{MR}_{j,t} = 46\widehat{\mathcal{N}}_j\mathcal{D}_t + (1-\hat{\theta}_j)p_t S^{\mathrm{NB}}_j + \hat{\theta}_j \alpha p_t S^{\mathrm{B}}_j + (1-\hat{\theta}_j)p_t S^{\mathrm{B}}_j, \tag{20}$$

where $\widehat{\mathcal{N}}_j$ is the number of (half) *per diems* worked in alternative j, $\mathcal{D}_t$ is the payment per (half) *per diem* in year t, and $\hat{\theta}_j$ is the estimated share of total hours worked in a week in alternative j attributed to the *per diem*. The variable S^{NB}_j is the total non-billable services (both under and outside of the *per diem* periods), as approximated by $(S^{\mathrm{NB}}_{NP})_j/(1-\hat{\theta}_j)$, where $(S^{\mathrm{NB}}_{NP})_j$ is the (observable) non-billable services under the non *per diem* period. We accounted for government imposed income ceilings and regional income differentials. The actual provisions governing regional remuneration rate calculations involve a wide variety of individual characteristics—such as city of practice – not included in the data set. However, our data contains each physician's quarterly income before and after the correction for the regionally differentiated remuneration rate. We therefore approximate the actual regionally differentiated remuneration rate facing physician i, and denoted τ_i, as the ratio of the two reported levels of income over the whole sample period.

The actual level of income ceilings during the period is publicly available from government authorities in charge of physician compensation. However, these ceilings depend on the establishment in which the services were provided, information that is not available to us. To take account of these exceptions in a tractable manner we calculate the average percentage of time that pediatricians spent in establishments where income ceilings were applied. The relevant ceiling for physician i, is then taken to be the actual income ceiling adjusted for the average percentage of time spent in establishments where the cap applies.

The actual consumption in each alternative is predicted based on equations (2) and (20). To convert consumption into real terms we deflate actual (nominal) consumption in each alternative using the price index provided by *Statistics Canada*. The average inflation rate for the whole period is 1.92%. Overall, our strategy for approximating consumption in each alternative proved to be a precise predictor of the observed income of physicians included in our sample.

C Estimates and Elasticities

The parameter estimates are presented in Table A. The utility function parameters are generally statistically significant. In the constraint function ψ, only the regional dummy variables are significant. Physicians in a metropolitan area have a higher probability of being constrained than do those in non-metropolitan areas. Neither gender nor male has any effect on the probability of being constrained.

The likelihood function increases significantly with the inclusion of observable characteristics in the constraint, from -4352.14 to -4291.60, we therefore use this specification to conduct our policy analysis. The proportion of observations with a negative marginal utility of income also decreases from 8.47% to 6.78%. The probability of being constrained ψ is the logit transformation of the estimated parameters. Its average value is equal to 0.542 in specification 2, suggesting that a large proportion of the physicians were constrained in their choice of a compensation system. This suggests that introducing a reform allowing physicians to choose their compensation system individually will have a strong effect on their behaviour.

Table B provides results on the elasticities of practice variables with respect to non-labour income, hourly wage rate, and fee per service.[4] The second column provides our benchmark; it is computed as the average practice choice simulated from the estimated model against a simplified budget constraint, broadly representative of the prevailing case before the reform. We assume an hourly wage rate equal to \$10, the full fee under FFS on all clinical services, and an exogenous non-labour income equal to \$10,000.[5] We remove all the other parameters that may affect a physician's budget constraint (for instance, income ceilings and regionally differentiated remuneration). The physician's budget is thus linear in (w, p, y) with all arguments strictly positive. As the MR reform involved substantial changes in the fee per service and wage parameters, for comparison-sake, we also performed our elasticity simulations based on large (50%) percentage changes in each of these parameters. Similarly, the computation of the income elasticity, $\varepsilon_{k/y}$, for each practice variable, k, is based on the variation in practice induced by a 50% increase in non-labour income. Also, we use Slutsky decompositions of uncompensated elasticities into compensated and total income elasticities: $\varepsilon_{k/w} = \widetilde{\varepsilon}_{k/w} + wh^t \frac{\mathcal{W}}{y} \varepsilon_{k/y}$ and $\varepsilon_{k/p} = \widetilde{\varepsilon}_{k/p} + \frac{pS}{y} \varepsilon_{k/y}$, and where $\mathcal{W}$ is set at 45 weeks of work, to

[4]The reader should bear in mind that an important difference between the elasticity simulations and the actual reform is that, under the actual reform, the *per diem* (hourly wage) simultaneously becomes positive.

[5]We add small positive hourly wage and non-labour income to the observed FFS contract in order to allow us to simulate elasticities at the benchmark.

Table A: Preference Parameters

	Specification 1		Specification 2	
	Coef.	St.d.	Coef.	St.d.
γ^o	594.373*	(381.509)	589.548	(1061.209)
σ^o	145.722***	(22.940)	144.454***	(25.949)
$\gamma^o \times$ *Male*	358.852**	(198.886)	362.585*	(274.393)
$\gamma^o \times$ *Age*	-38.533	(98.138)	-38.158	(246.874)
γ^l	677.078**	(291.795)	659.293	(565.603)
σ^l	109.381***	(13.541)	109.124***	(13.755)
$\gamma^l \times$ *Male*	139.515	(149.366)	141.091	(202.723)
$\gamma^l \times$ *Age*	127.505**	(69.313)	131.546	(140.522)
$\gamma^{S^{NB}}$	-105.977**	(50.716)	-89.511	(95.056)
$\gamma^{S^{NB}} \times$ *Male*	4.910	(26.965)	3.958	(58.653)
$\gamma^{S^{NB}} \times$ *Age*	32.787***	(10.368)	28.845	(24.816)
$\gamma^{S^{B}}$	108.173*	(66.383)	126.988**	(66.560)
$\sigma^{S^{B}}$	93.618***	(10.595)	93.661***	(11.551)
$\gamma^{S^{B}} \times$ *Male*	61.609*	(44.873)	60.767	(91.427)
$\gamma^{S^{B}} \times$ *Age*	13.257	(17.781)	8.716	(18.572)
γ^x	40.379*	(27.768)	17.278	(64.908)
$\gamma^x \times$ *Male*	42.156***	(15.374)	43.683**	(24.602)
$\gamma^x \times$ *Age*	-6.445	(6.192)	-0.835	(11.800)
β^o_l	-1.985	(2.849)	-1.934	(5.970)
$\beta^o_l \times$ *Male*	-1.506	(1.510)	-1.530	(1.654)
$\beta^o_l \times$ *Age*	-0.269	(0.698)	-0.277	(1.393)
$\beta^o_{S^{NB}}$	1.898**	(0.906)	1.627**	(0.853)
$\beta^o_{S^{NB}} \times$ *Male*	0.187	(0.477)	0.202	(0.686)
$\beta^o_{S^{NB}} \times$ *Age*	-0.439***	(0.169)	-0.372**	(0.202)
$\beta^o_{S^{B}}$	-0.323	(0.799)	-0.606	(2.624)
$\beta^o_{S^{B}} \times$ *Male*	0.803**	(0.452)	0.813	(1.019)
$\beta^o_{S^{B}} \times$ *Age*	-0.383***	(0.156)	-0.313	(0.592)
β^o_x	-1.887***	(0.767)	-1.586*	(1.172)
$\beta^o_x \times$ *Male*	-0.245	(0.446)	-0.264	(0.644)
$\beta^o_x \times$ *Age*	0.404***	(0.141)	0.330*	(0.234)
$\beta^l_{S^{NB}}$	0.925***	(0.390)	0.951	(1.004)
$\beta^l_{S^{NB}} \times$ *Male*	-0.189	(0.202)	-0.193	(0.330)
$\beta^l_{S^{NB}} \times$ *Age*	-0.250***	(0.080)	-0.256	(0.228)
$\beta^l_{S^{B}}$	-0.011	(0.563)	0.003	(0.643)
$\beta^l_{S^{B}} \times$ *Male*	-0.694**	(0.367)	-0.693**	(0.339)
$\beta^l_{S^{B}} \times$ *Age*	-0.044	(0.131)	-0.047	(0.147)
$\beta^{S^{NB}}_{S^{B}}$	-0.078	(0.085)	-0.135	(0.162)
$\beta^{S^{NB}}_{S^{B}} \times$ *Male*	0.197***	(0.079)	0.204*	(0.155)
$\beta^{S^{NB}}_{S^{B}} \times$ *Age*	-0.009	(0.016)	0.004	(0.031)
β^o	-10.650***	(2.563)	-10.741**	(5.601)
$\beta^o \times$ *Male*	-3.731***	(1.531)	-3.738**	(1.959)
$\beta^o \times$ *Age*	1.611***	(0.635)	1.644*	(1.274)
β^l	-3.204***	(1.246)	-3.149*	(2.032)
$\beta^l \times$ *Male*	-0.190	(0.595)	-0.197	(0.787)
$\beta^l \times$ *Age*	-0.388*	(0.292)	-0.400	(0.504)
$\beta^{S^{NB}}$	-0.112*	(0.072)	-0.135	(0.188)
$\beta^{S^{NB}} \times$ *Male*	0.058*	(0.043)	0.063	(0.074)
$\beta^{S^{NB}} \times$ *Age*	-0.008	(0.014)	-0.003	(0.028)
$\beta^{S^{B}}$	-0.597***	(0.098)	-0.625***	(0.246)
$\beta^{S^{B}} \times$ *Male*	0.325***	(0.103)	0.327	(0.308)
$\beta^{S^{B}} \times$ *Age*	-0.079***	(0.027)	-0.073***	(0.021)
β^x	-0.100**	(0.056)	-0.067	(0.187)
$\beta^x \times$ *Male*	-0.115***	(0.041)	-0.119**	(0.069)
$\beta^x \times$ *Age*	0.021*	(0.014)	0.014	(0.032)
ψ	-178.079	(146.903)	3075.053**	(1377.607)
$\psi \times$ *Male*	—	—	489.569*	(371.394)
$\psi \times$ *Age*	—	—	135.731	(160.524)
$\psi \times$ *MetroUni*	—	—	-4329.354***	(1023.513)
$\psi \times$ *MetroNoUni*	—	—	-6138.808***	(1120.158)
LL	-4352.14		-4291.60	
Proportion UM negative	8.47%		6.78%	

Note. Estimated parameters of the utility function on the full sample in years 1996-1999, 2001 and 2002. Income and service parameters are associated with variables measured in Thousands of (1996) Can. Dollars. To ease readability of the table, all estimated parameters (and bootstrapped standard errors, in parentheses) are re-scaled by a factor $1e^4$.

Table B: Elasticity of Practice Variables

	Ref.	Non-labour income		Hourly wage rate				Service piece-rate			
		Δy	$\varepsilon_{k/y}$	ΔW	$\varepsilon_{k/w}$	$\widetilde{\varepsilon}_{k/w}$	$\frac{whW}{y}\varepsilon_{k/y}$	ΔIP	$\varepsilon_{k/IP}$	$\widetilde{\varepsilon}_{k/IP}$	$\frac{PA}{y}\varepsilon_{k/y}$
Weekly Total Hours	45.30	45.22	-3.470e-03	45.30	1.408e-04	6.076e-02	-0.061	44.65	-0.028	0.076	-0.104
	(5.29)	(5.33)	$(9.266e-06)$	(5.29)	$(2.809e-08)$	$(2.190e-03)$	(0.0022)	(5.98)	(0.0021)	(0.0030)	(0.0083)
______ clinical (h^c)	39.69	39.61	-3.898e-03	39.69	9.708e-05	6.820e-02	-0.068	39.11	-0.029	0.088	-0.117
	(3.02)	(3.00)	$(7.702e-06)$	(3.02)	$(2.546e-08)$	$(2.774e-03)$	(0.0028)	(2.96)	(0.0015)	(0.0042)	(0.0072)
______ non-clinical (h^o)	5.61	5.61	-4.420e-04	5.61	4.502e-04	8.174e-03	-0.008	5.54	-0.025	-0.012	-0.013
	(3.78)	(3.82)	$(4.264e-04)$	(3.78)	$(9.663e-07)$	$(1.186e-01)$	(0.1193)	(4.42)	(0.0623)	(0.1833)	(0.3932)
Total Services[a]	149.99	148.69	-1.731e-02	149.93	-7.426e-04	3.016e-01	-0.302	140.67	-0.124	0.395	-0.519
	(9.76)	(10.06)	$(7.765e-05)$	(9.77)	$(1.465e-07)$	$(2.044e-02)$	(0.0205)	(28.64)	(0.0993)	(0.0441)	(0.0698)
______ Non-billable (NBS)	65.06	64.04	-3.120e-02	65.01	-1.356e-03	5.438e-01	-0.545	58.24	-0.209	0.726	-0.935
	(6.22)	(6.54)	$(3.622e-04)$	(6.24)	$(6.472e-07)$	$(8.999e-02)$	(0.0905)	(20.95)	(0.2338)	(0.0931)	(0.3343)
______ Billable (BS)	84.93	84.65	-6.664e-03	84.92	-2.731e-04	1.162e-01	-0.116	82.43	-0.059	0.141	-0.200
	(9.31)	(9.39)	$(2.969e-05)$	(9.31)	$(7.328e-08)$	$(1.244e-02)$	(0.0125)	(13.08)	(0.0457)	(0.0706)	(0.0268)
Service intensity $\left(=\frac{NBS+BS}{h^c * W}\right)$	75.59	75.08	-1.343e-02	75.55	-8.398e-04	2.339e-01	-0.235	71.93	-0.097	0.306	-0.403
	(6.85)	(6.67)	$(8.200e-05)$	(6.85)	$(1.645e-07)$	$(2.230e-02)$	(0.0224)	(12.02)	(0.0990)	(0.0317)	(0.0767)
Annual income[a] (X)	142.19	145.14	4.150e-02	142.33	2.000e-03	-7.230e-01	0.725	196.73	0.767	-0.477	1.244
	(8.83)	(9.08)	$(4.849e-05)$	(8.85)	$(2.412e-07)$	$(3.270e-02)$	(0.0329)	(37.60)	(0.1914)	(0.0938)	(0.0567)

[a] Thousands of (1996) Can. Dollars.
Note. Elasticities of practice variables simulated from estimated preferences. In the reference situation, physicians are paid the full fee under FFS on all clinical services, an hourly wage rate equal to \$10 and an exogenous non-labour income equal to \$10,000. Elasticities are computed from a 50% change in each parameter of the resulting budget constraint—for each parameter, the first column displays predicted average behaviour from the updated budget constraint. Bootstrapped standard errors appear in parentheses.

compute the wage and fee per service compensated elasticities of each practice variable.[6]

Results from the second panel of Table B indicate that physicians' average clinical and non-clinical weekly hours of work, as well as the volume of (billable and non-billable) services are negatively affected (with $p < 0.01$) by an increase in non-labour income. Overall, the simulated elasticities are modest (in absolute value) though, ranging between -.003 for weekly hours of work and -0.017 for services. Moreover, physicians' service intensity, as measured by the volume of services provided (in 1996 Can. dollars) per clinical hour of work, decreases with non-labour income but very slightly, with an elasticity of -0.013 (with $p < 0.01$).

The third panel indicates that the uncompensated own wage elasticity of total weekly hours is close to zero. This suggests that physicians' labour supply curve for weekly hours is essentially vertical. The elasticity estimate is similar to that reported in Showalter and Thurston (1997) for employee physicians, but is lower than estimates from other studies. Baltagi, Bratberg, and Holmas (2005) and Showalter and Thurston (1997) reported a wage elasticity for hours worked of 0.34 and 0.27, respectively. Our estimate of the compensated own wage elasticity is positive, although quite small, being estimated at 0.068 (with $p < 0.01$). Our results also indicate that services and hours of work are net complements, as cross compensated wage elasticity of services is positive (= 0.335, with $p < 0.01$).

The last panel provides results regarding elasticities with respect to changes in the FFS. The own uncompensated service elasticity is negative and equal to -0.124, with $p < 0.01$. Thus, the labour supply curve for services is backward-bending. This concords with estimates reported in Shearer, Somé, and Fortin (2019) for broad-based price increases. Interestingly, the negative effect of an increase in the fee per service is much larger (in absolute value) on non-billable services ($= -0.209$) than on billable services ($= -0.059$). The compensated own service elasticity is positive as

[6]This is an approximation since the choice set is discrete and the variations in wage and fee per service are not infinitesimal.

expected and quite large and significant (= 0.395). Notice also that the compensated elasticity of weekly hours of work with respect to fee per service is positive but small (= 0.076). As expected, a compensated increase in the fee per service induces the physician to spend less time in non-clinical (teaching and administrative) activities and more time to perform clinical services, but again these effects are small (−0.012 and 0.088, respectively). These results suggest that compensated changes in the fee per service have a positive and significant impact on physicians' behaviour—especially on the volume of their services and their service intensity.

Our results on elasticities suggest that physicians (pediatricians) react to incentives in the directions predicted by the theory. The compensated own elasticities are all positive and the effects of non-labour income are all negative on weekly hours of work and on services. The small elasticities with respect to wage and the FFS on compensated and uncompensated weekly hours are consistent with studies focusing on hours of work supplied by physicians who are not self-employed: for example, Sloan (1975); Noether (1986) found that the wage elasticities are modest or non-significant in this context. Finally, we note that the incentive effects on services provided are generally much larger (in absolute value) than are those on hours worked.

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