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What drives professional services prices? *

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Highlights:

- High quality professional services workers are matched with the largest clients while gathering in the largest professional services firms [PSFs]. This means that large clients are ultimately matched to large PSFs.

- Professional services market have different scales. While the management consulting and architectural and engineering sector appears international, the accounting domain is national, while legal markets are highly localized.

- Professional services prices across sector have a similar elasticity with respect to the overall services demand. However professional services sector differ in their potential impact on clients profitability and have therefore different price level.

Abstract

In this paper, clients welfare maximization is shown to result in a matching mechanism between large clients and high quality professional services workers. On the other hand, professional services workers welfare maximization results in their association in firms under a principle of quality standard. The associated competitive equilibrium results in a definition of prices under a condition of market structure. This parameters of this price model are estimated across 26 OECD countries and over the last 10 years to define the market structure of the legal, accounting, management consulting and engineering professional services sector and to explain the prices differences between sectors.

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1 Introduction

Amongst the OECD, professional services firms [PSFs] prices (defined as the ratio of PSFs production over the number of employees adjusted by the purchasing power parity [PPP]) have been exhibiting significant variations across both countries and time over the past decade. There is however a scarce empirical literature on PSFs prices, which, according to a recent meta analytic study (Fuentes & Porcuna, 2016) features three main type of explanatory variables for prices fluctuations: the client complexity (associated to its size), the services quality and the length of the client relationship (Lassala, Carmona, & Momparler, 2016). On the other hand, there is an abundant theoretical economic literature on the matching mechanisms that associate high quality or high reputation agents (e.g. workers) with a given type of principal (e.g. firms) (Anderson & Smith, 2010).
I therefore build upon the matching model of (Gabaix & Landier, 2008) to propose a micro level explanation of professional services prices that is consistent with a positive assortative matching between client size and service quality. This model leads to a definition of prices under a condition of market structure that is tested across the OECD. It shows that market in professional services differ in local nature and that prices are ordered according to clients benefits.
This article contribute to the PSFs literature by proposing a test of the market span of professional services and by providing a measure between services benefit to clients and services prices. It also expand the current body of knowledge that focuses on auditing by giving estimates across 3 main additional PSFs sector: management consulting, legal and engineering.

2 Model.

2.1 General Framework.

In a given market, assume that PSFs workers can offer services of quality $q \in [Q_{min}; Q_{max}]$ and let $h(q)$ be the number of workers of quality q. Assume that clients have a size $s \in [S_{min}; S_{max}]$ and call $f(s)$ the number of clients of size s. Clients of size s generate a profit in period 0 ($\pi_0(s)$), with $\pi_0'(s) > 0$. To optimize their profits in period 1 ($\pi_1(s)$), they can contract PSFs workers of quality q for a price $P(q)$, so that:

$$\pi_1(s) - \pi_0(s) = \pi_0(s)^{\gamma}.q - P(q) \tag{1}$$

Where $\gamma > 0$ is a scaling factor that accounts for differences in services return with respect to clients profits. Note that in this case the clients profit is assumed to be linearly increasing with service quality with a slope normalized to 1 (this could be easily rescaled without any loss in generality). The problem for a client of size s therefore is:

$$\max_q(\pi_0(s)^{\gamma}.q - P(q)) \tag{2}$$

As clients are seeking the highest quality of service, professional services workers compete with each other and gather in firms of size $z \in [Z_{min}; Z_{max}]$ to brand their quality. Let's assume for the sake of simplicity that PSFs are all composed of individuals of the same quality q and are distributed according to $g(z)$, so that there a relationship R exists between a PSF size and the quality of its workers: $q = N(z)$. Assume that the PSFs workers are allocated across firms to maximize the overall sectoral welfare. It therefore comes that:

$$max_{N(.)} \int_{Z_{min}}^{Z_{max}} P(N(z)).z.g(z)dz \tag{3}$$

We now turn to the characterization of the competitive equilibrium associated to this problem. This first consists of an assignment function $M : [S_{min}; S_{max}] -> [Q_{min}; Q_{max}]$ which pairs clients of size s with workers of quality $M(s)$ and of price function $P(q)$. The equilibrium is efficient if it maximizes the overall clients surplus generated by services (e.g.$\int_0^S \pi_0(s)^\gamma.M(s).f(s)ds$) subject to resource constraints.

Proposition 2.1 *As $\gamma \geq 0$, there is a positive assortative matching in the market at equilibrium (i.e. larger clients get better services) and:*

$$M(s) = E^{-1}(F(s))$$

Where $F(s) = \int_s^{S_{max}} f(x)dx$ is the number of clients of size above s and $E(q) = \int_q^{Q_{max}} h(q)dz$ is the number of professional services workers with quality above q

When leveraging the maximization condition from (2) and normalizing $P(Q_{min})$ to 0, the proposition (2.1) leads to:

$$P(q) = \int_{Q_{min}}^{q} (\pi_0(F^{-1}(E(x)))^\gamma.x)'dx \tag{4}$$

Proposition 2.2 *If PSFs revenues are increasing with size (i.e. $\partial_z(P(N(z)).z) > 0$), the best workers are assigned to the largest firms and the firm - worker assignment function N is such that:*

$$N(z) = E^{-1}(G(z))$$

Where $G(z) = \int_z^{Z_{max}} g(x)dx$ is the number of PSFs larger than z.

2.2 Professional services prices in a power law set up.

Assume that:

- clients are distributed according to a power law $F(s) = \hat{F}.s^{\alpha+1} = \int_s^\infty f(x)dx$ ((Axtell, 2001))
- profit follows a Cobb-Douglas type of function $\pi_0(s) = \Pi.s^\beta$ ((Ribes, 2018))
- quality is distributed according to a power law $E(q) = \hat{E}.q^{\nu+1} = \int_q^\infty h(x)dx$
- PSFs are distributed according to a power law $G(z) = \hat{G}.z^{\eta+1} = \int_z^\infty g(x)dx$

Assume that the bigger the client profit, the bigger the return of using professional services ($\gamma > 0$) and professional services firms revenues grow with their size ($\partial_z(P(N(z)).z) > 0$). Under those hypothesis, it comes from (2.2) that the worker - PSFs assignment function $N(z) = (\frac{\hat{G}}{\hat{E}})^{\frac{1}{\nu+1}}.z^{\frac{\eta+1}{\nu+1}}$, while from (2.1) comes that the worker - client matching is $M(s) = (\frac{\hat{F}}{\hat{E}})^{\frac{1}{\nu+1}}.s^{\frac{\alpha+1}{\nu+1}}$.

Proposition 2.3 *Under the assumptions of section (2.2), blending propositions (2.1) and (2.2) means that clients of size s are matched with PSFs of size $Z(s)$ s.t:*

$$Z(s) = (\frac{\hat{G}}{\hat{F}})^{\frac{1}{\alpha+1}}.s^{\frac{\eta+1}{\alpha+1}}$$

.

Proposition 2.4 *Under the assumptions of section (2.2), leveraging the matching results of (2.3) and the equation (4) leads to PSFs prices being given by:*

$$P(s) = \Pi^{\gamma}.(\frac{\hat{F}}{\hat{E}})^{\frac{1}{\nu+1}}.[S_{min}^{\beta.\gamma+\frac{\alpha+1}{\nu+1}}].((\frac{s}{S_{min}})^{\beta.\gamma+\frac{\alpha+1}{\nu+1}} - 1)$$

This can be further simplified assuming that the smallest client as a size $S_{min} = 1$ into:

$$P(s) = \Pi^{\gamma}.(\frac{\hat{F}}{\hat{E}})^{\frac{1}{\nu+1}}((s)^{\beta.\gamma+\frac{\alpha+1}{\nu+1}} - 1)$$

Therefore, defining the average professional service rate per employee (RpE) as the overall the overall PSFs sector revenue divided by the number of workers in the sector, it comes that:

$$RpE = \frac{\int_{S_{min}}^{S_{max}} P(s)f(s)ds}{\hat{E}.Q_{min}^{\nu+1}}$$

Proposition 2.5 *Under the assumptions of section (2.2), assuming that the smallest client (resp. PSFs) has a size $S_{min} = 1$ (resp. $Z_{min} = 1$) and that the lowest quality achievable is $Q_{min} = 1$, it comes that the overall professional sector employment is equal to $\hat{E}$. To ensure consistency in the overall employment, the following market condition appears:*

$$\hat{E} = \hat{G}.(\frac{\eta+1}{\eta+2}).[Z_{max}^{\eta+2} - 1] \tag{5}$$

Finally the average rate per employee obeys:

$$RpE = \Pi^{\gamma}.(\frac{\hat{F}}{\hat{E}})^{\frac{\nu+2}{\nu+1}}.((\alpha+1).\frac{(S_{max})^{1+\alpha+\gamma.\beta+\frac{\alpha+1}{\nu+1}}}{1+\alpha+\gamma.\beta+\frac{\alpha+1}{\nu+1}} - (S_{max})^{\alpha+1}) \tag{6}$$

3 OECD PSFs prices

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3.1 OECD Data.

The model analysis relies on the OECD Structural Statistics on Industry and Services (SSIS) database according to the 4th revision of the International Standard Industrial Classification (ISIC Rev. 4). Out of this database, four main time series where extracted. The variable "production" was used as a proxy for PSFs revenue R, the "number of enterprises" as $\hat{F}$ and the number of competitors $\hat{G}$, the "total employment" as $\hat{E}$ and to proxy Π, the actual sector production divided by the sector number of firms was used. Under a power law setting, a sector production is indeed $\int \Pi.s^{\beta+\alpha}.f_1 ds \propto \Pi.\hat{F}$. This resulted in time series for 26 countries, namely: Austria, Czech Republic, Estonia, Finland, Hungary, Latvia, Luxembourg , New Zealand, Norway, Poland, Portugal, Slovenia, Belgium, Denmark, Germany, Ireland, Italy, Netherlands, Slovak Republic, Spain, Sweden, United Kingdom, Greece, Turkey, France, Iceland. The extracted time series represented a time span of 10 years (from 2007 to 2016). Finally to allow a cross country comparison, all the production variables from the OECD

were adjust by the country purchasing power parities [PPP] for GDP, which normalizes the local production in local currency into an equivalent amount in US$ while accounting for differences in purchasing power.
After clean up, the dataset consisted in $n = 186$ points (one point per country per year). Each point n consisted of 5 coordinates $(\hat{F}_n, \hat{G}_n, R_n, \Pi_n, \hat{E}_n)$. Once PPP adjusted, the average revenue generated per employee in the PSFs sector was of 216k$ per year with a standard deviation of 85.5k$ per year. There was an average of 866k clients $(\hat{F})$ (std. 965k) for an average of 152k PSFs $(\hat{G})$ (std. 171k). The average client production $\frac{\Pi.(\alpha+1)}{\beta+\alpha+1}$ was of 1.95 M$ per year (std. 1.18M$).
Finally on the entire OECD PSFs landscape, the management consulting sector ["MC"] represents on average 20% of the total PSFs within each country, the legal and accounting domain about 29% and the architectural and engineering ["AE"] domain an average 23%.From a comparison standpoint, defining the average daily rate DR of one type of service as the average annual RpE reported on 1750 worked hours per year times 8 hours worked per day, it comes that PPP adjusted:

$$DR_L = 1039.7\$/day > DR_{MC} = 1008.3\$/day > DR_{AE} = 800.3\$/day > DR_A = 534.3\$/day$$

3.2 Model estimation.

As seen in proposition (2.5), the proposed framework imposed a condition on the profession services market through the equation (5). I therefore first tested for each of the four sectors if the professional services competition happened at an international or a national level represented by the parameters η and Z_{max}. Testing the international market hypothesis was done through regression (7), where ρ would have to be close to the unit for the hypothesis to be valid and where δ represents an adjustment factors associated to the the terms in η and Z_{max} in (5). On the other hand, testing the hypothesis that the PSFs market is local was done through regression (8), where $\delta_{c,n}$ is a dummy variable that represents the country c.

$$log(\hat{G}_n) = \rho. \log(\hat{E}_n) + \delta + \epsilon_n \tag{7}$$

$$log(\hat{G}_n) = \rho. \log(\hat{E}_n) + \sum_c \delta_{c,n} + \epsilon_n \tag{8}$$

International case	MC estimates	Legal estimates	Accounting estimates	AE estimates
ρ	0.90 (0.03)	0.69 (0.05)	0.83 (0.04)	0.94 (0.051)
R^2 [%]	85.5	53.3	66.5	66.4
National case	MC estimates	Legal estimates	Accounting estimates	AE estimates
ρ	0.78 (0.09)	0.63 (0.06)	1.00 (0.13)	0.23 (0.19)
R^2 [%]	99.9	53.3	99.9	99.9

Table 1: Test results of the market condition (5) across OECD countries.

The results displayed in table (1) show that the assumptions of section (2.2) lead to an international market definition for the AE and MC sectors. The accounting market seems national though, while the legal sector doesn't appear national or international. In the case of the legal sector, a city or city cluster market could be investigated.
The market for each sector being defined, I tested the professional services price sensitivity towards

clients profit γ and quality distribution ν as per proposition (2.5). This was done in the case of the multinational MC and AE market through regression (9) and through regression (10) in the case of the national accounting market.

$$\log(RpE_n) = \frac{\nu+2}{\nu+1}.ln(\frac{\hat{F}_n}{E_n}) + \gamma.ln(\Pi_n) + \delta + \epsilon_n \tag{9}$$

$$\log(RpE_n) = \frac{\nu+2}{\nu+1}.ln(\frac{\hat{F}_n}{E_n}) + \gamma.ln(\Pi_n) + \sum_c \delta_{c,n} + \epsilon_n \tag{10}$$

Parameter	MC estimates	Legal estimates	Accounting estimates	AE estimates
$\frac{\nu+2}{\nu+1}$	0.33 (0.06)	-	0.29 (0.04)	0.42 (0.04)
γ	0.63 (0.07)	-	0.13 (0.04)	0.34 (0.06)
R^2 [%]	28.4	-	99.9	32.5

Table 2: Regressions (9) and (10) calibration results on OECD countries across PSFs domains

The estimation results of table (2) show that from a client standpoint, all services yield less return as clients profits increase ($\gamma < 1$) and that the higher the client return the higher the activity daily rate. The estimation also shows that prices increase with demand (i.e. the number of potential clients per workers $\frac{\hat{F}}{\hat{E}}$) and client profit (Π). Finally from a quality distribution standpoint, all sectors appear similar within their own market with $\nu \approx -2.5$, which would suggest that the quality assessment is more ordinal in nature than cardinal.

4 Conclusion

In this paper, it is shown that engineering and management consulting markets appears international, while accounting is built on national practices and that legal practices are highly local. Professional services prices across sectors are shown to increase with services return on client profitability, while sharing the same competition structure towards clients.

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