Offshoring and Wage Inequality: Using Occupational Licensing as a Shifter of Offshoring Costs

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Changes in information and communication technologies have increased the offshorability of tasks. As routine tasks (Pol Antràs, Luis Garicano and Esteban Rossi-Hansberg, 2006) and lower offshoring-cost tasks (Gene Grossman and Esteban Rossi-Hansberg, 2008) move abroad, production processes become increasingly fragmented. Recent empirical papers (e.g. Mary Amiti and Shang-Jin Wei, 2005; Runjuan Liu and Daniel Trefler, 2008; Rosario Crinò, 2009) have aimed to illuminate the extent to which this is the case, and the consequences of such changes. A finding of this literature is that offshoring hurts disproportionately lower skill occupations, and those occupations that are more tradeable.

However, this literature has been hampered by the difficulty of finding a good proxy for offshoring costs. To measure the effect of offshoring on workers, one would ideally want to increase offshorability of some tasks and not others, and then compare the resulting changes in wages and employment in the occupations performing the tasks that are offshored with the ones that are not. Instead, the literature has relied on proxies that are more or less directly linked to the skill content of the occupation and that, as a result, confound the effect of production technology and of offshoring cost. For example, Crinò (2009), uses how routine the task is (a measure, in our view, of its skill content) as one of the tradeability proxies. There exist some partial exceptions, such as J. Bradford Jensen and Lori G. Kletzer (2005), who argue that if a service is concentrated geographically in the US then it must be tradeable and therefore internationally tradeable, or Crinò's (2009) indicator for 'face-to-face interactions.' But no paper has been, to our knowledge, able to compare occupations with similar skill content but different offshoring cost.

Our paper contributes to this body of research by utilizing a direct measure of the offshorability of the task: the legal licensing requirements on its execution. Members of some occupations need to pass an exam in order to be allowed to practice that occupation. For example, in most countries, such as the UK, lawyers must be members of the bar in order to practice law, while, in contrast, consultants are usually not subject to licensing requirements. As a result, as information and communication technologies advance, they reduce the costs of offshoring for tasks performed by 'non-members' (e.g. by consultants) but not the costs of offshoring the tasks performed by 'members' (e.g. barristers). We thus have a direct shifter of offshoring costs, which allows us to examine, holding skill constant, the differential impact of offshoring cost on wages and employment. Specifically (as Grossman and Rossi-Hansberg, 2008 have noted) while the effect of offshoring on demand for those whose tasks become offshorable is ambiguous (they benefit from a productivity effect but are harmed by a labor supply effect and, potentially, a terms of trade-effect), the effect for those whose labor is complementary with the offshored tasks is in general positive. In terms of our example, increasing offshoring of services involving consulting tasks may increase or reduce the wages of consultants, but it will increase the demand for barristers, an input that is complementary with tasks being offshored- and thus increase barrister employment (depending on entry costs) and barrister's wages.

Our findings are consistent with this hypothesis. Indeed, we identify a class of occupations that unambiguously benefits from offshoring: wages and em-

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ployment of occupations subject to formal licensing requirements increase more the more offshoring increase in the services where these professionals are employed. Higher penetration of imports, in other words, helps, rather than hurts, these professions, suggesting that they benefit from complementarities with the offshored inputs.

I. Data

(a) Service Trade: The source of information on services trade is the Inquiry into International Trade in Services (ITIS) which since 1996 collects data on the international transactions in services of resident UK private sector companies. ITIS asks for the type of service traded (the classification includes 38 services), either exported or imported, and for the country of destination or origin of the transaction. Examples of the types of service contained in the ITIS include: legal services; accounting and auditing; management consulting and public relations; architectural; engineering; surveying. The ITIS survey is statutory, it collects from a sample of firms with ten or more employees (since 2001about 20,000 firms) information mainly on producer services (for more details on the survey see Holger Breinlich and Chiara Criscuolo, 2008).[1]

(b) Hours and Earnings: The Annual Survey of Hours and Earnings (ASHE) is based on a 1 per cent sample of employee jobs (with National Insurance numbers), this corresponds on overage to about 170,000 individuals observed every year during the period analyzed (2001-2007). Information on earnings (gross pay before tax, National Insurance or other deductions) and hours is obtained in confidence from employers. We calculate from the ASHE the weighted total employment and median gross weekly wage in each occupation (4-digit); sector (4-digit) cell. We exclude all occupations that belong to the major groups "Process, Plant and Machine Operatives" and "elementary occupations" and all occupations in local and national governments (e.g. Senior officials in national and local government; Civil Service executive and administrative officers and assistants; Local government clerical officers and assistants).

[1]ITIS focus primarily on producer, or intermediate services. Overall, in 2005 the sectors and types of service covered by ITIS accounted for 46% of total UK service exports and 31% of imports, but of 67% of exports and 80% of imports of the balance-of-payment category ‘other commercial services’. (reinlich and Criscuolo, 2008) In the analysis below we use weights provided by the Office for National Statistics for the period 2001-2007 to aggregate firm level information.

II. Empirical Strategy and Empirical measures

(a) Empirical Tests: The key contribution of our paper is to use an exogenous shifter of the cost of offshoring a particular task: the licensing status of the occupations legally empowered to undertake this task. Our empirical strategy thus requires two pieces of information. First, we must build a data set with information on how much each occupation in each sector is threatened by the import of a particular service. That is, a particular occupation may be used in services that are not traded (for example, *barmen*) and thus membership requirements are irrelevant. Conversely, some tasks may be critical in services that are highly subject to service trade. We explain below how we build these indexes. Second, we must identify the membership and licensing requirements for each occupation. Once we have done this, we proceed to run regressions of the following form:

$$(1) \quad w_{ijt} = \alpha + \beta\omega_{ijst}M_{st} + \gamma cD^m + \delta D^m\omega_{ijst}M_{st} + \theta z + u_{it}$$

$$(2) \quad E_{ijt} = \alpha + \beta\omega_{ijst}M_{st} + \gamma cD^m + \delta D^m\omega_{ijst}M_{st} + \theta z + u_{it}$$

Where w_{ijt} and E_{ijt} are the log real wage and the log employment in occupation (i) in industry (j) at time (t).On the right hand-side we include $(\omega_{ijst})M_{st}$ a measure of the exposure of each occupation to offshoring, the construction of which we describe in more detail below; and D^m, a dummy for whether the occupation has licensing requirements and a vector of other controls, such as industry, occupation and service fixed effects and indicators of the education requirements and of tradeability of the occupation.

The parameter of interest is δ, the differential impact of increasing import exposure on the wages of members and non members. Our hypothesis is that $\delta > 0$, that is, as import exposure grows, the ‘protected’ occupations see wage and employment gains relative to ‘non-protected’ occupations.

(b) Building a measure of Exposure: We do not have detailed information on which occupations are engaged in producing each “output” by service type;

we do have however pretty complete export data, and we thus use instead the weight of each occupation in producing exports. To the extent that intensity of use of different occupations in production is similar to intensity in exports, the analysis is correct, particularly since we do not vary the weights over time and all the identification comes from changes in exposure. We proceed as follows. Firstly, we calculate the weighted value of exports of each service in each 4-digit industry aggregating firm level services' exports from the ITIS dataset. Secondly we calculate the share of service s total exports coming from industry (j) to have a weight (ω^{sic}_{jst}) for each industry j at time t. Thirdly in the ASHE dataset we calculate for each occupation i a weight (ω^{occ}_{ijt}) that is based on the distribution of occupation i across sectors j at time t . In the analysis we use time invariant weights based on the initial distribution over 4-digit industries in 2001; using time varying weights does not change our results (see Chiara Criscuolo and Luis Garicano, 2010). Fourthly, we use the product of the two weights to calculate a third weight that is service (s), industry (j) and occupation (i) specific. Letting the exports of service s from sector j be X and $t = 2001$:

$$\omega_{ijst} = \omega^{occ}_{ijt} * \omega^{sic}_{jst} = \frac{emp_{ijt}}{\sum_j \; emp_{ijt}} \frac{X_{js}}{\sum_j X_{jt}}$$

In a final step we then use these weights ω_{ijst} to weight the logged values of each service imports (M_{st}) from the ITIS dataset. We now have a dataset with information of how much each occupation in each sector is exposed to (threatened by) imports of a particular service.

(c) Measuring Tradeability of services: We construct a measure of tradable vs non-tradable occupations (we calculate this for the first year in our sample only, i.e. 2001 to be sure that our definition is not affected by later development of trade). First, we identify sectors that do low trade, based on their services export intensity, where export intensity is defined as the ratio of export over gross output. Second, we define a minimum threshold to distinguish between low- and high-trade sectors. The threshold is the bottom quartile of the export intensity distribution: all those sectors with export intensity lower than the 25 percentile will be low-trade sectors. Now we turn to the occupational side. We calculate the share of each occupation across sectors. To determine which occupations are tradable or not, we calculate the share of an occupation in low-trade sectors and the share of occupations in high-trade sectors: we now define an occupation as 'high-trade' if the share of the occupation in high-trade sectors is in the top quartile of the distribution over all occupations. Examples of 'low-trade' occupations are: typists, psychologists, teaching professionals, farm managers, pharmacy managers, transport and distribution managers. Examples of 'high-trade' occupations are: engineers, financial managers, software professionals.

(d) Membership and Non-Membership Occupations: We need to determine membership occupations and the level of skills/qualifications needed in each occupation. To do this we exploit information from the detailed description of occupations at the 4-digit level. This detailed description contains information on the level of skills required and whether to be able to perform a particular occupation the worker needs to be a member of a particular institution or otherwise licensed. We incorporate both pieces of information into our dataset.

III. Results

In descriptive statistics not reported here due to space limitations (see Chiara Criscuolo and Luis Garicano, 2010 for these results), we find that, with few exceptions, service offshoring has increased between 2001 and 2007. On average the increase in employment for occupations with membership requirements is larger than the increase in employment in occupations that do not require a membership. For example, in legal services, employment in membership occupations has increased, while in non-membership occupations it has decreased. Trends in wages are more heterogeneous across different services. Table 1 reports the regression results. The first three columns report estimates of equation 1 (prices) and columns 4 to 6 report estimates of equation 2 (quantities). All regressions include year dummies; 37 service type dummies; 4-digit industry dummies; 2-digit occupation dummies (which we do not report for confidentiality reasons) and the error terms are robust to heteroscedasticity and serial correlations and are clustered by service. All regressions include controls for skill requirement of each 4-digit occupation[2]. We interact exposure with membership alone (column 1 and 4); with tradeability of the occupation (columns 2 and

[2]The education dummies reflect the education requirements of occupations, the referece group being occupations whcih require no qualification

5); and with the education dummies (columns 3 and 6); our results are qualitatively unchanged.

Our key parameter of interest is δ in equations 1 and 2, which measures the impact of the interaction between professional membership and import penetration on wages and employment. Our hypothesis is that as import penetration grows, those in protected professions see wage and employment gains relative to those who are not protected. We find that indeed δ is always positive: as import penetration grows, and in agreement with our hypothesis, wages and employment increase. Thus the empirical evidence suggests, as we hypothesized, that an increase in the import of services raises the relative demand (as seen in increases in both wages and employment) in occupations subject to licensing requirements. The effects we uncover are economically large: using estimates from column 1 of Table 2, a 1% increase in exposure to imports results in a decrease of 0.2% in wages of non-licensed occupations and 0.5% increase in wages of licenced occupations. This implies that, for example, an increase in exposure from the first to the third quartile of the distribution of exposure (6.1%) results in a 1.84% wage gain for members and a -1.22% loss for non-members. Similarly, using estimates from column 4, an increase in exposure is associated with an increase in employment of both licensed and non licensed occupations, but the increase in licensed occupation is almost twice as much as that of non-licensed occupations. The increase in employment is implausible large, however.[3]

IV. Conclusions

A recent set of theories have studied the impact of changes in offshoring cost on wages and employment (e.g. Grossman and Rossi-Hansberg, 2008 and references therein). Testing these theories has been challenging, given the difficulty of finding measures of offshorability. In this paper we propose and apply a new empirical strategy to test these theories: using legal licensing requirements that limit the ability of certain tasks to be undertaken offshore. This has allowed us to study, for a given skill group, the impact of a drop in offshoring cost, by comparing between subsets of occupations for which this drop is relevant (non-licensed occupations) and those for whom the drop in offshoring is irrelevant (licensed occupations). We find that as offshoring of services increases, those in licensed occupations dedicated to the production of those services experience *increases in demand for their occupation*, as manifested by increases in wages and employment as the exposure to offshoring increases. This result is consistent with models, such as Grossman and Rossi-Hansberg (2008) where non-offshorable tasks benefit from offshoring because of the complementarity between offshorable and non-offshorable tasks together with the increase in the demand for the entire product or service produced by the combination of the (now cheaper) offshorable tasks and the non-offshorable ones.

[3] As usual, measuring prices is relatively straightforward, since the law of one price ensures that a few prices are enough to reconstruct the price sequences, while accurately measuring changes in employment is much harder as no similar arbitrage condition holds.

V. References

Amiti, Mary. and Shang-Jin Wei, 2005, "Fear of Service Outsourcing: Is It Justified?," *Economic Policy*, 20(42), pp. 308-347.

Antràs, Pol, Luis Garicano and Esteban. Rossi-Hansberg, 2006, “Offshoring in a Knowledge Economy,” *Quarterly Journal of Economics*, 121(1), pp. 31-77.

Breinlich, Holger and Chiara Criscuolo,2008, "Service Traders in the UK", CEP Discussion paper No 901

Crinò, Rosario. “Service Offshoring and White-Collar Employment,2009, ” *Review Economic Studies*, forthcoming.

Criscuolo, Chiara and Luis Garicano, “Offshoring and Wage Inequality: Using Occupational Licensing as a Shifter of Offshoring Costs.”

Grossman, Gene M. and Esteban Rossi-Hansberg, 2008, “Trading Tasks: A Simple Theory of Offshoring,” *American Economic Review*.

Jensen, J. Bradford and Lori G. Kletzer, 2005, “Tradeable Services: Understanding the Scope and Impact of Services Offshoring,” in L. Brainard and S.M. Collins, eds., *Offshoring White-Collar Work - The Issues and the Implications,* pp. 73-133, Washington, D.C.: Brookings Trade Forum 2005.

Liu, Runjuan and Daniel Trefler, 2008, “Much Ado About Nothing: American Jobs and the Rise of Service Outsourcing to China and India,” *NBER Working Paper* 14061.

TABLE 1—WAGE AND EMPLOYMENT REGRESSIONS

Dep. Var.	Log real Wage			Log employment		
	(1)	(2)	(3)	(4)	(5)	(6)
Membership*Exposure	0.005***	0.005***	0.002***	0.035***	0.032***	0.022***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.006)	(0.006)
Membership	-0.021**	-0.024***	0.013	-0.661***	-0.621***	-0.510***
	(0.008)	(0.008)	(0.008)	(0.062)	(0.062)	(0.059)
Exposure	-0.002***	-0.001***	-0.006***	0.040***	0.034***	0.018***
	(0.000)	(0.000)	(0.001)	(0.003)	(0.003)	(0.003)
High Trade	0.184***	0.201***	0.209***	-0.036***	-0.228***	-0.200***
	(0.002)	(0.006)	(0.005)	(0.011)	(0.021)	(0.021)
High Trade*Exposure		-0.002***	-0.002***		0.018***	0.015***
		(0.001)	(0.000)		(0.002)	(0.002)
GSVC	0.066***	0.066***	0.072***	-0.065**	-0.065**	-0.343***
	(0.006)	(0.006)	(0.023)	(0.026)	(0.026)	(0.044)
A-level	0.060***	0.060***	0.009	-0.098***	-0.100***	-0.280***
	(0.005)	(0.005)	(0.015)	(0.015)	(0.015)	(0.023)
Diploma	0.055***	0.055***	-0.040**	-0.578***	-0.577***	-0.774***
	(0.006)	(0.006)	(0.017)	(0.017)	(0.017)	(0.035)
first degree	0.239***	0.240***	0.150***	-0.233***	-0.245***	-0.544***
	(0.007)	(0.007)	(0.016)	(0.015)	(0.016)	(0.034)
Higher degree	0.096***	0.101***	0.500***	-0.362***	-0.421***	-0.055
	(0.027)	(0.028)	(0.086)	(0.044)	(0.046)	(0.083)
GSVC*Exposure			-0.000			0.025***
			(0.002)			(0.004)
A-level* Exposure			0.005***			0.017***
			(0.001)			(0.002)
Diploma* Exposure			0.008***			0.019***
			(0.001)			(0.003)
first degree * Exposure			0.009***			0.028***
			(0.001)			(0.003)
Higher degree * Exposure			-0.026***			-0.019***
			(0.006)			(0.006)
Observations	428022	428022	428022	429542	429542	429542
R-squared	0.44	0.44	0.44	0.19	0.19	0.19

Notes: Unreported coefficients on service type and education dummies, 4-digit industry, 2-digit occupations and year dummies. Standard errors robust to heteroscedasticity and serial correlation clustered by service.