Employment effects of offshoring. An application to Japanese industries, 1980-2005*

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September 28th, 2009

Abstract

This paper estimates the direct effects of materials and services offshoring on Japanese employment. My main finding is that the net amount of jobs lost to offshoring during the past two and a half decades is negligible, as it was the role of offshoring as a source of sector-bias change in an era of major structural changes for Japan. I argue that, as a natural result of trade and profit-seeking, the positive and negative forces entailed in the relocation of activities worldwide tend to compensate each other. My estimations indicate a total net loss of approximately 25,000 jobs during 1980-2005. This is a rather non-significant figure when compared to the 9.5 million jobs created in the same period. Further, the evidence presented here hints at the possibility of skill upgrading only as a result of services offshoring.

Keywords: offshoring, employment, Japan, deindustrialization

JEL Classification: F16, J23

*__Acknowledgments:__ I am grateful to Fundación BBVA for financial support through project grant 162/06. Also, I wish to thank Professors Ricart and Sala for their staunch support and insightful comments.

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1 Introduction

The goal of this study is to determine the effects of offshoring, both of materials and services, on Japanese domestic employment. Strictly speaking, relocation processes usually entail the laying off of workers domestically. But what if this "job destruction" is a mere reassignment of tasks within or between firms, industries, or sectors of the economy? What if the final net effect on employment is not significant overall? And finally, can we not be led to believe that this "job destruction" actually makes room for more productive activities (e.g. skill upgrading)? I answer yes to all three questions.

Offshoring in general and services offshoring in particular seem to be relatively new phenomena. Multiple breakthroughs in the past few decades in the area of telecommunications have opened the door to such entrepreneurial practices. Thanks to the development of the Internet, every task that can now be put through a wire is liable to be relocated. These technological advances have motivated a new or second-generation offshoring chiefly centered around services, which came after the first wave of offshoring of production processes.[1]

But to what point this is really new? After all, from the era of Smith and Ricardo entrepreneurs have unalterably kept on maximizing their profits through trade. The invisible hand is as valid today as it ever was. Can we not think of offshoring as a particular form of trade? In fact, some modern economists define it as the ultimate manifestation of trade (Mankiw and Swagel, 2006) from which the world as a whole cannot lose (Blinder, 2006). We might as well reason that, as in the basic Ricardian theory of trade, there are two sides, the offshoring and hosting partners, which can mutually benefit from this particular exchange.

Of course, adjustment costs for some workers and firms are one harsh reality. But productivity gains and price cuts that could lead to a gradual stimulation of the domestic demand for goods and services and, through that, of the domestic demand for labor, are yet another possibility. These changes in domestic employment can be understood basically in two ways. One way is to address the shifts in the employment composition across industries or sectors as a form of sector bias (Arndt, 1997, 1998, and 1999). Here, certain sectors are benefited at the expense of others as a result of offshoring. Another alternative is to interpret offshoring as a factor-bias change (Feenstra and Hanson, 1996, 1999). In this case, high-skilled employment results favored after offshoring takes place, because low-skill activities are more prone to go offshore due to potential labor cost gains. This might just produce an increase in the skill-intensity of production that comes with an increase in the wage rate for high to low-skilled labor.[2]

In the past few decades Japan has entered an era of structural changes. Some of them

[1] Here I refer to it as materials offshoring, for reasons that will become clear later. This has been the usual name given in the literature.

[2] In a comprehensive manner, Krugman (2000) and Leamer (1998) elaborate models on relative factor prices adjustments as a result of either sector or factor bias.

were encouraged by the government (like the change in lifestyle habits), but others were the natural result of a fully developed economy. Especially during the 1990s, the manufacturing sector began to lose terrain to services as the exports-led model showed its first signs of exhaustion (Balassa and Noland, 1988). Naturally, this late deindustrialization process implied a readjustment of factors among both these sectors that coincided with the post-bubble restructuring and a regional crisis in 1997. Was there a role for offshoring during this era? Can offshoring account for much of this sector bias? I argue below that the amount of workers actually involved in this process is negligible. As for factor bias, even though it goes beyond the scope of this paper, I present some evidence that hints at potential skill upgrading for Japanese workers.

To carry out the empirical analysis, the Japanese Industry Productivity database (JIP) offers a vast amount of information on 108 industries covering the whole economy during the years 1970 to 2005. The industry classification used by the JIP database does not correspond exactly to the industry classification of other well-known databases (e.g. ISIC, rev. 3, or the EU KLEMS project), yet stands as a close approximation.

Following Feenstra and Hanson (1996, 1999) I use these data to produce an index of offshoring intensity based on the import content of intermediate trade. Afterwards, I estimate the direct effects of offshoring on employment through the labor demand setting proposed by Amiti and Wei (2005, 2006). There, offshoring enters the labor demand equation as an inverse proxy of foreign labor prices. The final effect of both types of offshoring on employment is ambiguous, and depends on the strength of the substitution and scale effects which may vary from industry to industry. Luckily, the structure of the data allows for an industry-by-industry approach, thus offering a rather informative overview as we shall see. Once I obtain the offshoring elasticities for each industry, both of materials and services, I estimate the change in employment that resulted from a change in the offshoring variable. That is, the contribution of offshoring to the real changes in employment.

Additionally, I perform a simple correlation analysis between the estimated elasticities and other variables of interest. Here I try to identify a general profile of industries with large effects (positive and negative) of offshoring. In doing this separate analysis I take advantage of the information on the different categories of workers, also provided by the JIP database. This part of the paper, yet humbler in its pretensions, is more in line with studies concerning a factor bias of offshoring.[3] For instance, in a sample of US occupations Blinder (2007) finds that there is little or no correlation between the occupation's level of "offshorability" and the skill level of its workers. However, when controlling for education it is found that highly offshorable occupations earned significantly lower wages in 2004.

The structure of the paper goes as follows. Section 2 explains our offshoring measure

[3]There is a heap of references on this particular subject. Among others, see Berman *et al.* (1994), Canals (2006), Crinò (2010), Egger and Egger (2003, 2005), Ekholm and Hakkala (2006), Feenstra and Hanson (1996, 1999), Geishecker and Görg (2005), Hijzen *et al.* (2005), and Strauss-Kahn (2004).

and discusses its evolution for the Japanese economy in a very general way. Section 3 presents data on Japan for the period 1970-2005, highlighting the deindustrialization process undertaken in later years and the contribution of each industry to the country's offshoring intensity. Section 4 sets up the framework on which we later take up our empirical analysis. In section 5 we show our estimations on the offshoring-induced employment change, both for our materials and services offshoring indices, and both as regards positive and negative effects. Section 6 goes over some final remarks.

2 The offshoring index

The particular subject of offshoring for Japan is even less clear and documented than that of her blazing success throughout great part of the 20^{th} century. The truth is that few surveys have so far gone exhaustively through the details on the real extent of this relatively new phenomenon.

One of these surveys is Tomiura (2005), who considers data from 1998 of 118.300 firms in the manufacturing sector. Here, nearly 98 percent of the firms did not offshore any of their production overseas. The study also finds the endowment of human skills and the experience with FDI to be highly related to these business practices. In the same line, more productive firms and those whose products are more labor-intensive display a larger offshoring intensity. Two limitations of the study, as made explicit by the author, lead us to treat these conclusions with some care. First, offshoring of services is not covered, and second, only manufacturing firms are considered.

Another survey is Ito *et al.* (2007). The authors here analyze data from 2006 including more than 5.000 large-sized firms from the manufacturing sector. Their main results indicate that offshoring is more present now than five years ago, and that services offshoring is still of a rather narrow scope as compared to materials. Also according to these data, offshoring of Japanese firms is mainly restricted to own affiliates within East Asia. To the problem of the limited size of the sample we should also add that the data refers to manufacturing firms alone.

It is therefore of key interest to fill in the gaps left by the previous literature and thus enrich the ongoing research. More, estimates by consulting companies (Forrester, 2004, and McKinsey, 2003, for instance) have in general tended to magnify the real extent of offshoring as well as its potential effects in terms of job losses. For this reason, a more in-depth analysis is certainly required, now introducing the services sector into the picture and implementing a comprehensive index of both materials and services offshoring.

Following Feenstra and Hanson (1996, 1999) I define the offshoring intensity of industries as the share of imported intermediate inputs in the total purchase of inputs. This is indeed an indirect indicator, and the rationale for using it goes as follows. To begin with,

offshoring always implies the relocation of entrepreneurial functions or activities abroad. These foreign activities, it is to expect, will eventually feed back into domestic production processes through the importing of inputs. We should yet note that importing trade stands for an important amount of intra and inter firm trade nowadays, and this, it is also argued, can have a stronger influence on employment and wages than trade in final goods (Feenstra and Hanson, 2001, p.1). As a result, offshoring "intensity" is proxied by an index of input trade, and this is equally useful both for its measurement and the assessment of its effects on the labor market.

As done subsequently and for the very first time by Amiti and Wei (2005, 2006), I divide this index in its materials and services versions. Respectively, these indices stand for the share of imported material inputs in total material inputs (OSM) and the share of imported service inputs in total service inputs (OSS). More formally, we have:

$$OSM_{it} = \sum_j \left(\frac{M_{jt}}{Q_t^M}\right)^i \left(\frac{\Pi_{jt}}{D_{jt}}\right) \qquad and \qquad OSS_{it} = \sum_k \left(\frac{S_{kt}}{Q_t^S}\right)^i \left(\frac{\Pi_{kt}}{D_{kt}}\right) \tag{1}$$

where M_{jt} and S_{kt} are purchases of material input j and service input k by industry i at time t, Q_t^M and Q_t^S are total inputs of materials and services used by i at time t, while Π is total imports of goods j or k and D their domestic demands.[4] Due to data availability issues, the first term in both formulas generally stems from input-output tables, while the second term, which is an economy-wide import share, is obtained from trade data. This is not our case though, for the JIP database contains all the necessary information to calculate both indices. However, the dark side of it is that they cannot escape the drawbacks commonly attached to all the Feentra-Hanson-type indices. First, offshoring does not necessarily imply an increase of imports, and vice versa. And second, to estimate the import content of intermediate trade in (1), the economy-wide import share or import penetration ratio (the second term) is taken as equal for every industry. This is due to data constraints, and supposes that all industries import the input material j and the input service k with the same intensity.

It is also to note that our formulas above are somewhat different to those offered by Amiti and Wei (2005, 2006), and thus, not directly comparable. Relying almost exclusively on data from the manufacturing sector, these authors split the ratio of imported inputs to total inputs (that is, a "total offshoring index") in two, materials and services, so as to share a common denominator.[5] Contrariwise, the two indices presented here are not related because the denominators are not the same. Consequently, adding up both indices is not possible and would not, in our case, deliver a "total offshoring" index. The reason for doing

[4] Other similar indices often found in the literature are: the share of imported inputs in output (Egger and Egger, 2003, 2005), or the vertical specialization index, which accounts for the imported input content of exports (Campa and Goldberg, 1997, and Hummels *et al.*, 2001).

[5] This translates to: $OS_{it} = OSM'_{it} + OSS'_{it} = \sum_j \left(\frac{M_{jt}}{Q_t}\right)^i \left(\frac{\Pi_{jt}}{D_{jt}}\right) + \sum_j \left(\frac{S_{jt}}{Q_t}\right)^i \left(\frac{\Pi_{jt}}{D_{jt}}\right)$ where OS_{it} represents total offshoring and Q_t is all nonenergy material inputs plus the following five service inputs: communication, financial, insurance, other business services, and computing and information.

this is the following. Consider for a moment a hypothetical economy where only two cars are produced: Ford and Chevy. If we were interested in knowing the overall share of defective cars, we only have to divide the total number of defective by the total production. Yet the story would be a slightly different one if we were to gauge the number of defective in both brands as a share of their outputs. This is what I do here and where I depart from Amiti and Wei. I think this observation was necessary at this point, for since I do use data for the whole economy (unlike Amiti and Wei), our measures here should better illustrate the phenomenon in both its versions, materials and services.

Figure 1: Materials and services offshoring, 1980-2005

Note: materials and services offshoring indices according to formula (1), weighted by industry GDP.
Source: all tables and figures calculated from JIP database (2006, 2008).

According to the formulas in (1), figure 1 reproduces both offshoring measures at the country level.[6] I should point that these offshoring indices do not account for the region of origin of the imported intermediate inputs, since these data were unavailable. What we get from figure 1 is that materials and services offshoring, proxied by the trade in intermediates, have dissimilar patterns of growth in Japan. While the one has grown unrelentingly for much of the period of study, the other has remained practically unchanged. A couple of facts are worth stressing at this point.

[6] To calculate both indices I employ the Input-Output tables in section 1.4 of JIP and the final demand tables in section 1.7, both at constant prices (2000). The import figures had to be linearly interpolated; only years 1980, 1985, 1990, 1995, and 2000 were available. As a result, the analysis of the employment effects of offshoring in a following section starts in 1980.

First, materials offshoring, proxied by its import content in the industries' total use of materials, is expectedly more predominant. Second, the annual rate of growth of services offshoring is, on average, surprisingly smaller than that of materials in the whole sample period (1.98% to 5.31%). Globalization and the technologies revolution would have led us to believe the opposite. Only prior to the bubble crisis and the period known as the lost decade (1990-2000) do we get to see similar rates of growth for both indices.

3 Japanese industries through 1970-2005

Even after the Izanagi boom (1965-1970), that period of unusual growth characterized by real GDP growth rates above the 10%, the Japanese managed to keep a more than enviable position in the world economy. It is a known fact that Japan has for long trod on the shiny path of success, pretty much unaware of the many international crises that shook less fortunate economies. However, the economy awoke to the toils of real life as soon as the Heisei ("bubble") boom ended in 1990, and people started wondering about the country's uncertain fate. With a large and eager market at the doorstep and the need to gain efficiency to accommodate to the ups and downs of the slump, Japanese entrepreneurs began to put aside their former suspicions and embark more confidently on offshoring strategies. This change in the business philosophy has notably materialized in higher levels of materials offshoring, yet time is apparently not ripe for services (see figure 1).

In this section I intend to set out the study as to account for the main features that characterize the different industries in our sample. Accordingly, it is first necessary to assess the weight of every industry in the real economy, and then proceed to check their contributions to the aggregate index of offshoring. This would hopefully give an idea of the relative importance of offshoring across the industries and sectors of the economy.

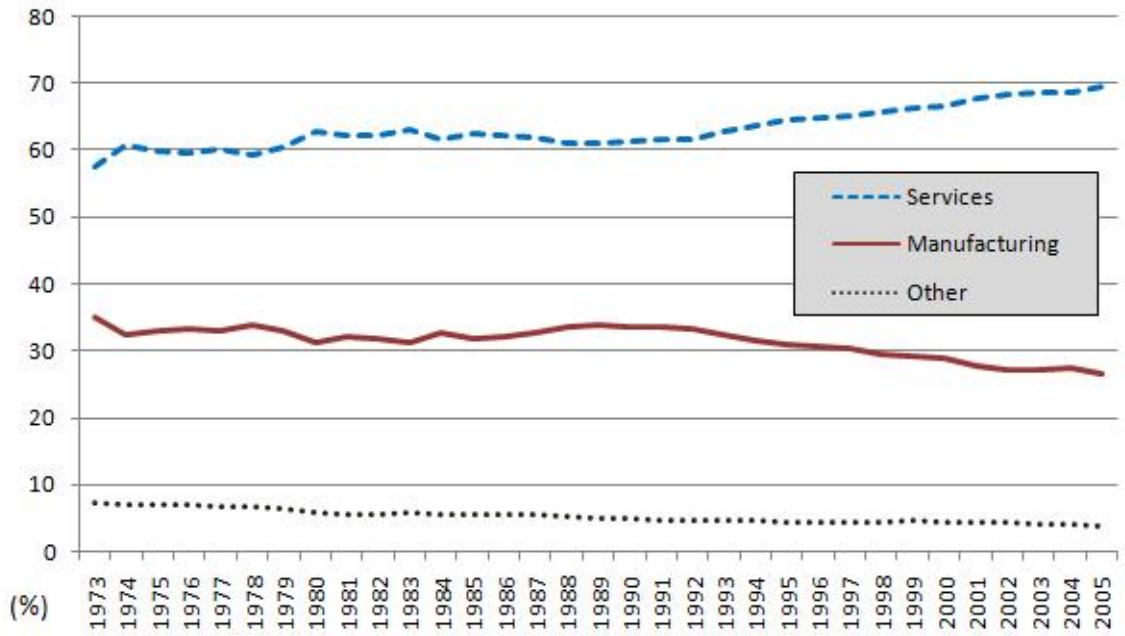
3.1 Towards a deindustrialization era

A first step in understanding offshoring, especially for such a particular economy, is to understand how much its industries contribute to the GDP. Is Japan really that much different when considering the shares of her manufacturing and services sectors? A look at figure 2 would suggest that it is somewhat different. Compared to other developed countries, the increase in the share of services that comes naturally with economic development and rising incomes has taken longer to manifest. Indeed, it is to remark the apparent stability of the shares throughout the sample, except for the period starting in 1990. It looks like the three-sector hypothesis has taken a while to finally sink in.[7] Foresightedly, back in the 1980s

[7] The three-sector hypothesis is an economic theory which divides economies into the three main sectors of activity: primary (extraction of raw materials), secondary (manufacturing), and tertiary (services). According to this theory, as development takes place, the main focus of the economy should shift gradually

Balassa and Noland (1988) put forth an explanation on why this could be so. Seemingly, the share of services went up in the 1990s and not before, because of the diminishing of Japan's strong reliance on exports as a source of growth. With the continued decline of exports, which had previously contributed to a high manufacturing share, the 1990s witnessed a significant increase in the services share of the economy. While manufacturing moved from almost 34% of the share in 1990 to 29% in 2000, services went up from 61% to 67%; for the latter, that is roughly a 10% increase in a decade (JIP database).

Figure 2: Sectors' shares of GDP, 1970-2005



Note: Manufacturing includes construction and civil engineering; Other is primary sector plus energy.

Further evidence of this shift is seen in table 1. Let us first take a look at the GDP rows. Either in terms of the total change or the compound annual growth rate index (CAGR),[8] we observe a contraction in the GDP growth of the primary (plus energy) and secondary sectors during 1990-2005. This is not the case of services, which only experienced a less steep growth path in the post-bubble period. As for the share figures we see the important downsizing process undergone by both the primary and manufacturing sectors. Naturally, the former started off long ago while for manufacturing industries it seemingly became significant during the 1990s The last row presents a summary of the evolution for the total economy, showing the same pattern as before: a less than modest growth from 1990 onwards.

from the primary to the secondary sector, and finally to the tertiary sector.

[8] This can be expressed as follows: $CAGR = \left(\frac{ending\ value}{beginning\ value}\right)^{\left(\frac{1}{\#\ of\ years}\right)} - 1$

Table 1: GDP and GDP shares, growth by sector, 1970-2005

		Total change (%)			CAGR (%)		
		1970-2005	1970-1989	1990-2005	1970-2005	1970-1989	1990-2005
Other	*GDP*	28,10	38,75	-10,65	0,69	1,65	-0,70
	share	-52,07	-36,29	-23,90	-2,02	-2,23	-1,69
Manufacturing	*GDP*	91,20	98,48	-7,04	1,82	3,49	-0,46
	share	-28,45	-8,87	-20,82	-0,93	-0,46	-1,45
Services	*GDP*	238,69	142,22	33,04	3,45	4,52	1,80
	share	26,74	11,22	13,31	0,66	0,53	0,78
Total	*GDP*	167,24	117,78	17,41	2,77	3,97	1,01

We need now to go deeper and see what particular industries make the economy tick. Without any doubt the 1990s were a special time for Japan, a time of changes (some would say it's not over yet). The burst of the bubble on the last day of 1989, a soaring unemployment rate, an unbridled government debt, the aging population problem, and a severe productivity slowdown, to name just a few. And along these events there came the take-off in services. This was motivated somehow by the exhaustion of an export-led model of growth, together with a change in the attitude of the Japanese towards a more leisure-oriented lifestyle. The government even pushed to achieve this "lifestyle transformation", in measures like adopting five-day weeks, establishing new public holidays, promoting Monday holidays and, also, promoting the shortening of the total working hours per week (see Fuess, 2006). Certainly, all these facts helped somehow in increasing the consumption of service goods and in making 1990 a turning point year for the Japanese economy.[9]

Table 2 offers some detailed information. A generalized drop in the shares of most manufacturing industries is perceived during the period that followed 1990. In fact, only 14 manufacturing industries out of 56 displayed a higher average contribution to the GDP for 1990-2005, compared to 1970-1989 (see the column labeled Δ). On the other hand, there were 22 services industries out of 42 displaying that same pattern. In terms of growth of these contributions (or shares) to the GDP, we have that the CAGR has been positive for 20 manufacturing and 27 services industries, for the whole sample period. Again, if we were to divide the sample in two as before (1970-1989 and 1990-2005), then the CAGR indices turn out higher for the latter period in 10 manufacturing and 22 services industries (see the column labeled Δ p.p.). All these data point to the agglomeration of activities in the services sector, suggesting that the 1990s implied a strong deindustrialization process.

[9] Funnily, though, this shortening of the working week, along with the drastic slowdown in productivity, are mentioned by Hayashi and Prescott (2002) as the main causes behind the Japanese slump in the 1990s.

Table 2: Industries' shares of GDP and employment growth, 1970-2005

JIP code	*Other*	Industries' (average) share of GDP, 1970-2005: AVG 1970-2005	AVG 1970-1989	AVG 1990-2005	Δ	CAGR (%) 1970-2005	CAGR (%) 1970-1989	CAGR (%) 1990-2005	Δ (p.p.)	Employment (workers), 1970-2005: Total change (%) 1970-2005	Total change (%) 1970-1989	Total change (%) 1990-2005	CAGR (%) 1970-2005	CAGR (%) 1970-1989	CAGR (%) 1990-2005
001	Rice, wheat production	0.57	0.79	0.32	-0.47	-4.36	-5.92	-2.63	3.29	-85.25	-65.50	-55.06	-5.18	-5.18	-4.88
002	Miscellaneous crop farming	0.85	1.05	0.63	-0.43	-2.72	-2.74	-2.61	0.13	-35.08	-18.49	-19.24	-1.19	-1.02	-1.33
003	Livestock and sericulture farming	0.28	0.36	0.20	-0.16	-3.60	-2.44	-4.89	-2.44	-77.94	-50.74	-55.77	-4.11	-3.48	-4.97
004	Agricultural services	0.09	0.11	0.08	-0.03	-1.64	-1.59	-2.07	-0.47	92.95	127.83	-14.40	1.84	4.20	-0.97
005	Forestry	0.20	0.24	0.16	-0.08	-3.45	-5.09	-1.85	3.24	-84.44	-48.39	-69.16	-5.04	-3.25	-7.09
006	Fisheries	0.58	0.83	0.30	-0.53	-4.78	-3.69	-5.79	-2.10	-69.24	-32.20	-50.83	-3.22	-1.92	-4.34
007	Mining	0.29	0.41	0.15	-0.27	-5.64	-6.60	-5.45	1.15	-79.74	-58.52	-48.78	-4.34	-4.30	-4.10
062	Electricity	1.49	1.31	1.69	0.37	0.28	0.65	-0.11	-0.75	-16.34	-4.07	-12.55	-0.49	-0.21	-0.83
063	Gas, heat supply	0.20	0.17	0.23	0.06	0.84	1.56	0.29	-1.26	-0.68	24.35	-19.55	-0.02	1.10	-1.35
064	Waterworks	0.43	0.48	0.38	-0.10	-0.95	-1.70	0.07	1.78	-5.52	11.16	-14.77	-0.16	0.53	-0.99
065	Water supply for industrial use	0.03	0.03	0.02	-0.01	-0.87	-0.78	-0.54	0.24	-1.66	49.44	-34.32	-0.05	2.03	-2.59
066	Waste disposal	0.35	0.40	0.30	-0.10	0.30	3.01	-1.59	-4.60	577.41	285.02	67.91	5.46	6.97	3.29
	Manufacturing														
008	Livestock products	0.22	0.24	0.20	-0.04	0.57	3.46	0.02	-3.44	25.20	44.99	-9.09	0.63	1.87	-0.59
009	Seafood products	0.29	0.30	0.27	-0.03	-1.38	-0.44	-1.33	-0.89	-3.20	22.77	-21.55	-0.09	1.03	-1.51
010	Flour and grain mill products	0.39	0.45	0.32	-0.14	-1.00	-0.30	-0.81	-0.51	-69.57	19.30	-72.24	-3.25	0.89	-7.70
011	Miscellaneous foods	1.08	1.23	0.93	-0.30	-0.54	0.88	-0.73	-1.61	27.92	29.20	-0.42	0.69	1.29	-0.03
012	Animal foods & fertilizers	0.11	0.16	0.05	-0.12	1.11	-5.61	3.97	9.58	-55.71	-7.27	-46.28	-2.24	-0.38	-3.81
013	Beverages	1.04	1.14	0.93	-0.21	-1.12	-1.76	-0.43	1.33	-25.32	-13.35	-16.42	-0.81	-0.71	-1.11
014	Tobacco	0.70	0.86	0.51	-0.35	-2.78	-3.57	-1.83	1.74	-79.31	-50.34	-50.02	-4.28	-3.44	-4.24
015	Textile products	1.07	1.41	0.69	-0.72	-5.97	-3.84	-8.36	-4.52	-71.30	-20.18	-63.64	-3.41	-1.12	-6.13
016	Lumber and wood products	0.35	0.43	0.26	-0.17	-2.18	-0.42	-4.34	-3.92	-71.29	-44.55	-47.85	-3.41	-2.91	-3.99
017	Furniture and fixtures	0.39	0.50	0.28	-0.22	-2.61	0.21	-5.95	-6.16	-51.42	-8.81	-47.07	-1.99	-0.46	-3.90
018	Pulp, paper, and other paper	0.34	0.37	0.31	-0.05	-1.43	-1.14	-1.62	-0.48	-43.64	-15.57	-32.12	-1.58	-0.84	-2.39
019	Paper products	0.31	0.32	0.30	-0.02	-0.49	1.25	-1.88	-3.13	-20.99	6.01	-26.50	-0.65	0.29	-1.91
020	Printing, and plate making	0.71	0.67	0.76	0.10	0.52	1.77	-1.27	-3.04	10.37	36.56	-23.07	0.27	1.57	-1.63
021	Leather and leather products	0.10	0.13	0.07	-0.06	-2.71	0.13	-6.63	-6.76	-45.93	18.65	-55.55	-1.69	0.86	-4.94
022	Rubber products	0.27	0.28	0.25	-0.03	0.20	2.17	-2.22	-4.39	-29.62	-2.86	-28.74	-0.97	-0.15	-2.10
023	Chemical fertilizers	0.07	0.10	0.04	-0.06	-8.65	-5.57	-10.53	-4.96	-82.39	-69.03	-39.89	-4.71	-5.69	-3.13
024	Basic inorganic chemicals	0.19	0.22	0.16	-0.07	-4.20	-2.98	-5.71	-2.73	-48.76	-25.16	-32.10	-1.84	-1.44	-2.39
025	Basic organic chemicals	0.08	0.08	0.08	0.00	0.59	-0.88	2.03	2.91	-47.51	-16.17	-46.77	-1.77	-0.88	-3.86
026	Organic chemicals	0.41	0.41	0.42	0.01	-3.08	1.33	-6.73	-8.06	-37.20	-14.45	-28.48	-1.28	-0.78	-2.07
027	Chemical fibers	0.06	0.07	0.04	-0.03	-4.29	-2.44	-5.37	-2.93	-85.10	-64.64	-55.50	-5.15	-5.07	-4.93
028	Miscellaneous chemical pdts.	0.45	0.41	0.49	0.08	1.15	3.49	-1.28	-4.77	2.61	6.33	-6.83	0.07	0.31	-0.44
029	Pharmaceutical products	0.45	0.33	0.58	0.25	3.18	3.67	2.84	-0.83	6.98	10.85	-6.82	0.19	0.52	-0.44
030	Petroleum products	1.23	1.29	1.15	-0.13	-4.45	-5.80	-1.83	3.97	-27.37	-0.22	-25.67	-0.88	-0.01	-1.84
031	Coal products	0.13	0.17	0.09	-0.08	-7.15	-5.29	-8.04	-2.75	-59.05	-21.61	-46.44	-2.45	-1.21	-3.83
032	Glass and its products	0.15	0.14	0.17	0.03	0.73	1.27	-0.01	-1.28	-24.83	-1.85	-25.43	-0.79	-0.09	-1.82
033	Cement and its products	0.39	0.45	0.33	-0.13	-3.68	-3.01	-4.15	-1.14	-44.60	-7.20	-40.50	-1.63	-0.37	-3.19
034	Pottery	0.11	0.13	0.09	-0.04	-2.47	-2.55	-1.96	0.58	-54.59	-13.93	-47.38	-2.17	-0.75	-3.93
035	Miscellaneous ceramic	0.25	0.31	0.18	-0.13	-2.59	-3.36	-1.25	2.11	-47.48	-14.88	-38.48	-1.77	-0.80	-2.99
036	Pig iron and crude steel	0.40	0.53	0.26	-0.27	-4.28	-5.08	-2.26	2.81	-65.80	-37.16	-43.31	-2.94	-2.30	-3.49
037	Miscellaneous iron and steel	0.87	0.99	0.74	-0.25	-1.74	-1.41	-1.64	-0.23	-50.87	-29.34	-30.93	-1.95	-1.72	-2.29
038	Smelting non-ferrous metals	0.09	0.10	0.08	-0.02	-1.20	-3.65	0.87	4.52	-40.38	-17.81	-27.29	-1.43	-0.98	-1.97
039	Non-ferrous metal products	0.31	0.31	0.31	-0.00	-1.73	-1.65	-1.98	-0.33	-4.99	31.30	-29.84	-0.14	1.37	-2.19
040	Metal products	0.43	0.45	0.42	-0.02	-2.81	-1.30	-5.40	-4.10	-22.12	5.64	-30.96	-0.69	0.27	-2.29
041	Miscellaneous metal products	0.83	0.87	0.77	-0.10	-1.77	-1.34	-2.43	-1.09	-16.22	4.97	-20.88	-0.49	0.24	-1.45
042	General industry machinery	0.74	0.75	0.74	-0.01	-0.11	0.81	-1.71	-2.52	-11.64	-4.62	-11.01	-0.34	-0.24	-0.73
043	Special industry machinery	0.96	0.97	0.94	-0.03	-0.03	1.21	-1.66	-2.87	-30.02	-19.79	-16.05	-0.99	-1.10	-1.09
044	Miscellaneous machinery	0.37	0.35	0.39	0.04	1.77	5.47	-1.71	-7.18	15.40	38.25	-19.86	0.40	1.63	-1.37
045	Office and industry machines	0.17	0.12	0.22	0.10	4.53	9.06	0.03	-9.03	5.38	74.09	-43.88	0.15	2.81	-3.55
046	Electrical and ind. apparatus	0.46	0.48	0.44	-0.04	-1.90	-1.15	-3.03	-1.88	-25.23	13.82	-34.57	-0.80	0.65	-2.62
047	Household electric appliances	0.43	0.33	0.53	0.20	3.74	5.51	0.92	-4.59	-43.42	25.14	-56.40	-1.57	1.13	-5.06

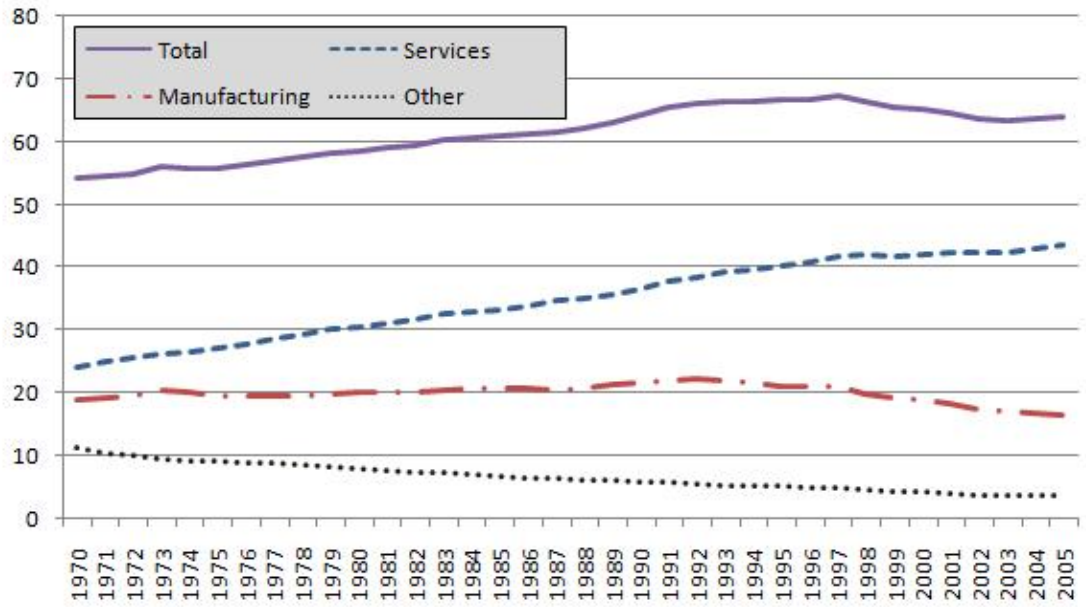
(continued)

		Industries' (average) share of GDP, 1970-2005								Employment (workers), 1970-2005					
		AVG 1970-2005	AVG 1970-1989	AVG 1990-2005	Δ	CAGR (%) 1970-2005	CAGR (%) 1970-1989	CAGR (%) 1990-2005	Δ (p.p.)	Total change (%) 1970-2005	Total change (%) 1970-1989	Total change (%) 1990-2005	CAGR (%) 1970-2005	CAGR (%) 1970-1989	CAGR (%) 1990-2005
048	Electronics, computer eqpmnt.	0.30	0.33	0.26	-0.08	5.95	22.13	-8.39	-30.52	94.81	255.58	-45.51	1.87	6.55	-3.72
049	Communication equipment	0.16	0.08	0.25	0.17	7.31	8.74	4.69	-4.05	14.85	38.06	-23.05	0.39	1.63	-1.62
050	Measuring instruments	0.20	0.15	0.25	0.10	3.28	7.98	-2.83	-10.80	12.23	70.23	-30.13	0.32	2.70	-2.22
051	Semiconductor and circuits	0.23	0.05	0.45	0.40	14.29	17.29	9.96	-7.33	273.84	354.81	-13.25	3.73	7.87	-0.88
052	Electronic parts	0.47	0.20	0.78	0.58	9.01	9.51	8.98	-0.53	23.45	32.63	-5.41	0.59	1.42	-0.35
053	Miscellaneous machinery	0.36	0.26	0.47	0.21	3.05	4.06	0.82	-3.23	23.21	65.02	-25.56	0.58	2.54	-1.83
054	Motor vehicles	0.66	0.70	0.62	-0.08	2.01	5.65	0.71	-4.95	41.37	65.78	-12.04	0.97	2.56	-0.80
055	Motor vehicle parts	1.25	1.10	1.41	0.31	3.05	5.02	1.50	-3.52	117.30	85.93	13.34	2.18	3.15	0.79
056	Other transportation eqpmnt.	0.36	0.40	0.31	-0.09	0.46	1.02	-0.63	-1.65	-52.38	-37.25	-24.59	-2.04	-2.30	-1.75
057	Precision machinery eqpmnt.	0.36	0.38	0.33	-0.05	-0.30	1.57	-2.08	-3.65	-33.31	3.87	-36.99	-1.12	0.19	-2.85
058	Plastic products	0.71	0.71	0.71	0.00	-0.47	-0.19	0.03	0.22	69.16	75.33	-6.03	1.47	2.85	-0.39
059	Miscellaneous industries	0.38	0.38	0.37	-0.01	-1.02	1.22	-3.93	-5.15	-37.67	-2.00	-37.88	-1.30	-0.10	-2.93
060	Construction	5.20	5.66	4.68	-0.98	-1.32	-0.59	-2.40	-1.81	29.93	51.88	-17.11	0.73	2.11	-1.17
061	Civil engineering	3.56	3.78	3.31	-0.46	-1.63	1.09	-4.56	-5.64	23.47	16.14	5.37	0.59	0.75	0.33
	Services														
067	Wholesale	6.46	5.21	7.88	2.67	2.15	2.16	1.59	-0.57	30.62	39.77	-8.24	0.74	1.69	-0.54
068	Retail	5.02	5.05	4.98	-0.06	-0.51	-0.33	-0.85	-0.52	37.66	24.35	10.75	0.89	1.10	0.64
069	Finance	3.35	2.76	4.02	1.26	2.11	2.32	2.10	-0.22	46.69	62.57	-13.49	1.07	2.46	-0.90
070	Insurance	1.64	1.48	1.82	0.35	1.20	3.85	-1.26	-5.11	17.38	50.13	-25.64	0.45	2.05	-1.83
071	Real estate	2.13	2.55	1.66	-0.88	-1.13	0.51	-2.50	-3.01	178.01	150.57	3.84	2.88	4.70	0.24
072	Housing	8.47	7.96	9.04	1.09	0.75	0.08	1.38	1.30	na	na	na	na	na	na
073	Railway	0.83	1.00	0.65	-0.35	-2.81	-3.75	-1.67	2.08	-67.65	-54.80	-22.76	-3.09	-3.89	-1.60
074	Road transportation	3.02	3.23	2.80	-0.43	-1.09	-1.12	-0.63	0.49	54.12	37.87	8.49	1.21	1.62	0.51
075	Water transportation	0.47	0.51	0.42	-0.09	0.13	-0.54	0.48	1.02	-50.07	-28.12	-28.48	-1.91	-1.64	-2.07
076	Air transportation	0.26	0.24	0.27	0.03	0.14	1.81	-1.99	-3.80	122.66	178.63	-17.91	2.25	5.26	-1.23
077	Other transportation	0.49	0.53	0.44	-0.09	-1.81	-0.93	-2.54	-1.60	117.91	130.47	-8.34	2.19	4.26	-0.54
078	Telegraph and telephone	1.08	0.72	1.50	0.78	3.93	2.15	5.77	3.62	-34.03	-1.59	-32.14	-1.15	-0.08	-2.39
079	Mail	0.36	0.39	0.33	-0.06	-1.20	-1.29	-1.30	-0.01	36.02	1.38	33.42	0.86	0.07	1.82
080	Education (private and non-p)	0.96	0.87	1.05	0.18	1.74	3.45	1.41	-2.04	108.65	54.40	31.31	2.06	2.20	1.72
081	Research (private)	0.11	0.08	0.15	0.07	4.01	6.03	2.10	-3.93	334.05	174.31	56.32	4.16	5.17	2.83
082	Medical (private)	2.15	2.13	2.17	0.04	0.86	-0.08	2.56	2.64	355.40	134.90	86.55	4.30	4.36	3.97
083	Hygiene (private and non-p)	0.11	0.14	0.07	-0.07	0.55	-2.09	5.09	7.18	306.05	104.80	160.19	3.97	3.65	6.16
084	Other public services	0.27	0.39	0.13	-0.26	-2.27	0.54	-2.74	-3.28	-1.26	11.02	-10.45	-0.04	0.52	-0.69
085	Advertising	0.56	0.59	0.53	-0.06	-1.90	-5.64	2.31	7.95	58.54	45.83	11.45	1.29	1.90	0.68
086	Rental of office equipment	0.47	0.20	0.78	0.57	7.83	6.61	8.36	1.76	682.10	479.83	19.47	5.88	9.19	1.12
087	Automobile maintenance	1.11	1.11	1.11	-0.01	0.49	1.50	-0.36	-1.86	25.39	29.93	-8.15	0.63	1.32	-0.53
088	Other services for businesses	2.93	2.45	3.48	1.03	1.20	-0.97	2.32	3.29	479.20	197.32	79.08	5.00	5.60	3.71
089	Entertainment	1.80	1.90	1.68	-0.22	-0.44	0.67	-2.20	-2.87	123.88	70.17	21.95	2.26	2.69	1.25
090	Broadcasting	0.30	0.34	0.27	-0.07	0.71	0.54	1.16	0.62	59.60	32.02	17.63	1.31	1.40	1.02
091	Information and Internet ss.	0.99	0.59	1.44	0.84	5.04	3.97	7.20	3.23	4615.50	2005.94	98.34	11.30	16.46	4.37
092	Publishing	0.48	0.54	0.42	-0.13	1.60	4.24	-1.59	-5.83	8.42	16.82	-10.03	0.22	0.78	-0.66
093	Video and sound	0.09	0.05	0.13	0.08	4.28	6.94	-0.09	-7.03	1305.98	377.92	160.03	7.62	8.14	6.15
094	Eating and drinking places	2.33	2.56	2.08	-0.49	-0.26	0.73	0.01	-0.71	127.07	83.85	20.82	2.30	3.09	1.19
095	Accommodation	0.85	0.87	0.82	-0.05	-0.83	-1.89	-0.53	1.35	45.48	39.29	3.11	1.05	1.67	0.19
096	Laundry, beauty services	0.91	0.96	0.84	-0.11	-0.95	-0.48	-1.31	-0.83	60.54	27.70	24.79	1.32	1.23	1.39
097	Other services for individuals	0.77	0.64	0.92	0.28	1.47	1.31	0.84	-0.47	59.17	24.77	23.11	1.30	1.11	1.31
098	Education (public)	3.25	3.53	2.93	-0.59	-0.63	0.34	-1.66	-2.00	17.51	29.60	-7.64	0.45	1.30	-0.50
099	Research (public)	0.17	0.13	0.20	0.07	2.60	1.04	4.76	3.72	16.10	-5.05	24.35	0.42	-0.26	1.37
100	Medical (public)	0.47	0.41	0.54	0.12	1.08	0.84	1.02	0.18	130.65	73.79	30.36	2.35	2.80	1.67
101	Hygiene (public)	0.10	0.09	0.11	0.03	1.44	0.23	2.62	2.39	49.55	37.52	8.86	1.12	1.61	0.53
102	S. insur. & s. welfare (public)	0.44	0.43	0.45	0.02	1.02	0.23	2.07	1.84	165.79	112.35	26.56	2.75	3.84	1.48
103	Public administration	4.85	4.52	5.23	0.71	1.27	0.33	2.36	2.03	7.35	16.25	-9.25	0.20	0.76	-0.60
104	Medical (non-profit)	0.68	0.58	0.78	0.20	0.93	-0.10	1.91	2.01	220.21	111.72	47.62	3.29	3.82	2.46
105	S. insur. & s. welfare (non-p)	0.39	0.33	0.47	0.14	1.85	-1.33	2.84	4.17	1639.91	240.84	369.65	8.26	6.32	10.15
106	Research (non-profit)	1.20	2.04	0.24	-1.80	-17.32	0.94	-33.04	-33.98	182.67	107.48	29.34	2.93	3.72	1.62
107	Other (non-profit)	0.46	0.48	0.43	-0.04	0.96	-0.02	0.94	0.95	93.70	54.17	23.27	1.85	2.19	1.32
108	Activities not classified	0.29	0.25	0.32	0.07	-4.55	-18.56	2.00	20.56	52.75	30.35	15.24	1.18	1.33	0.89

Further, as a complementary note, employment data come to confirm the shift towards services industries as the economy went through the 1990s and on into the next millennium. A quick glance at the right-hand part of table 2 reveals how employment went down in later years in virtually all industries within the primary and secondary sectors. Other has been the story for the services sector, where a positive change is observed in the majority of industries (see the last column).

According to the JIP database total employment in Japan was around 54.2 million in 1970, while figures for years 1990 and 2005 were in turn 64.2 and 63.9 million.[10] This, in concurrence with the changes in employment experienced among sectors, can only be indicative of an important structural change taking place in the 1990s. Therefore, our data here seems to grant credit to a three-sector hypothesis that has taken longer to materialize in Japan, as compared to other developed countries.

Figure 3: Employment by sector (millions), 1970-2005



Note: Manufacturing includes construction and civil engineering; Other is primary sector plus energy.

To what extent this process can be blamed as taking a high toll on the economy during the 'lost decade' is difficult to know and escapes the limits of this work. However, it sure has to be taken into account whenever dealing with the causes and effects of a lost decade of growth. Figure 3 and table 3 complement all previous information, highlighting the capacity of employment absorption of the services sector during the 1990s. A cautionary remark need

[10] OECD data bear a high degree of similarity. Figures for those years were, according to the OECD Economic Outlook: 50.9 million (1970), 62.5 million (1990), and 63.5 million (2005).

here be made. Even though the employment level remained practically unchanged for the period 1990-2005, the unemployment rate rose from 2.1% to 4.5%, reaching a maximum of 5.5% in 2002 (OECD Economic Outlook). This meant, in numbers, a change from 1.3 to 2.9 million unemployed.

In Figure 3 we see the clear diverging paths for the employment records of the three sectors. In particular, it was from the year 1990 that manufacturing employment began to fall. Employment figures for the year 1990 stood at 7.9, 19.5, and 36.8 million for the three different sectors, that is: primary plus energy, manufacturing, and services. Since total employment practically did not budge during 1990-2005, sector composition remains of utter importance. Figures for 2005 were, respectively, 5.2, 15.0, and 43.7 million. In rough numbers this would imply that approximately 7.2 million workers shifted either to the services sector or the pool of unemployed in a span of 15 years. Curiously, services employment increased in 6.9 million, but due to the lack of job mobility so typical of Japan, one is prevented to draw the conclusion that all workers moving out of the manufacturing sector ended up hired in the services sector. Usually, it is new entrants to the labor force who are to be counted among those enlarging the ranks of the unemployed, but for Japan is not yet as clear.[11]

Table 3: Employment growth by sector, 1970-2005

	Total change (%)			CAGR (%)		
	1970-2005	1970-1989	1990-2005	1970-2005	1970-1989	1990-2005
Other	-66,76	-46,15	-36,71	-3,01	-3,05	-2,82
Manufacturing	-12,15	13,00	-23,23	-0,36	0,61	-1,64
Services	80,58	48,26	18,71	1,66	1,99	1,08
Total	17,96	16,51	-0,42	0,46	0,77	-0,03

The deindustrialization process is also neatly perceived in table 3, either in changes of sectoral employment or as seen through the compound index. As expected, the primary sector suffered the major fall for the whole sample period, whereas the manufacturing sector started to undergo its transformation in the 1990s. The negative figures in total employment, yet of little size, can be partly understood as the outcome of the disturbing times undergone by the economy very recently. The past slump, in coinciding with the deindustrialization

[11] The Japanese labor market is said to be characterized by lifetime employment, seniority wages, and firm-based labor unions, which all add to its extreme rigidity. However, evidence on this regard has apparently focused exclusively on male workers in large-sized companies and governmental agencies. Further research on the subject has shown that these "three pillars" of Japanese industrial relations might not hold true for part-time workers, short-term contract workers, and workers in small-sized firms (see Cheng, 1995, and Cheng and Kalleberg, 1996).

trend, must have certainly set up a network of interactions and distortions in the economy not to be neglected. Notwithstanding its relative importance, yet due to its complex nature, the subject is left aside for future research.

Table 4: Top and bottom industries, GDP share and employment growth

	Avg. share GDP (%), 1970-2005			Avg. share GDP (%), 1990-2005			CAGR (%), 1970-2005			CAGR (%), 1990-2005		
top 10												
1	72	Housing	8.47	72	Housing	9.04	51	Semiconductor and circuits	14.29	51	Semiconductor and circuits	9.96
2	67	Wholesale	6.46	67	Wholesale	7.88	52	Electronic parts	9.01	52	Electronic parts	8.98
3	60	Construction	5.20	103	Public administration	5.23	86	Rental of office equipment	7.83	86	Rental of office equipment	8.36
4	68	Retail	5.02	68	Retail	4.98	49	Communication equipment	7.31	91	Information and internet ss.	7.20
5	103	Public administration	4.85	60	Construction	4.68	48	Electronics. computer eqpmnt.	5.95	78	Telegraph and telephone	5.77
6	61	Civil engineering	3.56	69	Finance	4.02	91	Information and internet ss.	5.04	83	Hygiene (private and non-profit)	5.09
7	69	Finance	3.35	88	Other services for businesses	3.48	45	Office and industry machines	4.53	99	Research (public)	4.76
8	98	Education (public)	3.25	61	Civil engineering	3.31	93	Video and sound	4.28	49	Communication equipment	4.69
9	74	Road transportation	3.02	98	Education (public)	2.93	81	Research (private)	4.01	12	Animal foods & fertilizers	3.97
10	88	Other services for businesses	2.93	74	Road transportation	2.80	78	Telegraph and telephone	3.93	105	S. insur. & s. welfare (non-profit)	2.84
bottom 10												
99	34	Pottery	0.11	34	Pottery	0.09	27	Chemical fibers	-4.29	24	Basic inorganic chemicals	-5.71
100	101	Hygiene (public)	0.10	25	Basic organic chemicals	0.08	1	Rice, wheat production	-4.36	6	Fisheries	-5.79
101	21	Leather and leather products	0.10	38	Smelting non-ferrous metals	0.08	30	Petroleum products	-4.45	17	Furniture and fixtures	-5.95
102	4	Agricultural services	0.09	4	Agricultural services	0.08	108	Activities not classified	-4.55	21	Leather and leather products	-6.63
103	93	Video and sound	0.09	83	Hygiene (private and non-profit)	0.07	6	Fisheries	-4.78	26	Organic chemicals	-6.73
104	38	Smelting non-ferrous metals	0.09	21	Leather and leather products	0.07	7	Mining	-5.64	31	Coal products	-8.04
105	25	Basic organic chemicals	0.08	12	Animal foods & fertilizers	0.05	15	Textile products	-5.97	15	Textile products	-8.36
106	23	Chemical fertilizers	0.07	27	Chemical fibers	0.04	31	Coal products	-7.15	48	Electronics. computer eqpmnt.	-8.39
107	27	Chemical fibers	0.06	23	Chemical fertilizers	0.04	23	Chemical fertilizers	-8.65	23	Chemical fertilizers	-10.53
108	65	Water supply for industrial use	0.03	65	Water supply for industrial use	0.02	106	Research (non-profit)	-17.32	106	Research (non-profit)	-33.04

	Employment, Δ (%). 1970-2005			Employment, Δ (%). 1990-2005			CAGR (%), 1970-2005			CAGR (%), 1990-2005		
top 10												
1	91	Information and internet ss.	4615.50	105	S. insur. and s. welfare (non-profit)	369.65	91	Information and internet ss.	11.30	105	S. insur. & s. welfare (non-profit)	10.15
2	105	S. insur. and s. welfare (non-profit)	1639.91	83	Hygiene (private and non-profit)	160.19	105	S. insur. & s. welfare (non-profit)	8.26	83	Hygiene (private and non-profit)	6.16
3	93	Video and sound	1305.98	93	Video and sound	160.03	93	Video and sound	7.62	93	Video and sound	6.15
4	86	Rental of office equipment & goods	682.10	91	Information and internet ss.	98.34	86	Rental of office equipment	5.88	91	Information and internet ss.	4.37
5	66	Waste disposal	577.41	82	Medical (private)	86.55	66	Waste disposal	5.46	82	Medical (private)	3.97
6	88	Other services for businesses	479.20	88	Other services for businesses	79.08	88	Other services for businesses	5.00	88	Other services for businesses	3.71
7	82	Medical (private)	355.40	66	Waste disposal	67.91	82	Medical (private)	4.30	66	Waste disposal	3.29
8	81	Research (private)	334.05	81	Research (private)	56.32	81	Research (private)	4.16	81	Research (private)	2.83
9	83	Hygiene (private and non-profit)	306.05	104	Medical (non-profit)	47.62	83	Hygiene (private and non-profit)	3.97	104	Medical (non-profit)	2.46
10	51	Semiconductor and circuits	273.84	79	Mail	33.42	51	Semiconductor and circuits	3.73	79	Mail	1.82
bottom 10												
98	10	Flour and grain mill products	-69.57	14	Tobacco	-50.02	10	Flour and grain mill products	-3.25	14	Tobacco	-4.24
99	16	Lumber and wood products	-71.29	6	Fisheries	-50.83	16	Lumber and wood products	-3.41	6	Fisheries	-4.34
100	15	Textile products	-71.30	1	Rice, wheat production	-55.06	15	Textile products	-3.41	1	Rice, wheat production	-4.88
101	3	Livestock and sericulture farming	-77.94	27	Chemical fibers	-55.50	3	Livestock & sericulture farming	-4.11	27	Chemical fibers	-4.93
102	14	Tobacco	-79.31	21	Leather and leather products	-55.55	14	Tobacco	-4.28	21	Leather and leather products	-4.94
103	7	Mining	-79.74	3	Livestock and sericulture farming	-55.77	7	Mining	-4.34	3	Livestock & sericulture farming	-4.97
104	23	Chemical fertilizers	-82.39	47	Household electric appliances	-56.40	23	Chemical fertilizers	-4.71	47	Household electric appliances	-5.06
105	5	Forestry	-84.44	15	Textile products	-63.64	5	Forestry	-5.04	15	Textile products	-6.13
106	27	Chemical fibers	-85.10	5	Forestry	-69.16	27	Chemical fibers	-5.15	5	Forestry	-7.09
107	1	Rice, wheat production	-85.25	10	Flour and grain mill products	-72.24	1	Rice, wheat production	-5.18	10	Flour and grain mill products	-7.70

Note: codes by sector are 1 to 7 and 62 to 66 (other), 8 to 61 (manufacturing), and 67 to 108 (services).

To wrap up this section I rearrange table 2 as to have the data, both on GDP and employment, laid out in rankings. Hence, the upper-left part of table 4 shows the preponderance of services industries over the whole period and for the sub-period of 1990-2005,

as regards GDP shares. Also, with a very few exceptions, manufacturing industries cover most of the industries placing at the bottom. On the upper-right side of the table we have the industries sorted out by their (annual) GDP growth rates. Surprisingly, we distinguish some manufacturing industries among the top ones. One possible reason is that these industries have traditionally had a key role within the economy, hardly to be affected by the deindustrialization process on which Japan has recently embarked herself. Worse performing industries are again to be found among those belonging to the primary and secondary sectors.

As for employment the story is straightforward. As mentioned before, the services sector shows itself as the great benefactor for both the entire sample and the sub-sample. This is the result of a late deindustrialization process that, coincidentally, took place in an era of turmoil. The structural change along with the uneasy situation experienced back in those years come to explain why total employment has remained stationary. Again, unlucky industries turn out to be the less dynamic ones from the primary and secondary sectors.

3.2 Offshoring by industry

Having first defined offshoring in that particular way, I now focus on some possible cases of interest. First, we can consider those industries which are offshoring-intensive and display high rates of growth. Second, an industry can be offshoring-intensive but, at the same time, either exhibit a large or a small GDP share. Finally, an industry can be said to meet all these characteristics, high offshoring intensity, high growth rates, and a large share of the economy. Table 5 compiles all this information. The first two broad columns comprise all data concerning the offshoring index by industry, both of materials (OSM) and services (OSS). The right-hand side of the table provides some information about the industries' GDPs (growth and share). The idea is not to establish a causal relationship, but rather, to come up with an overview of all major offshorers and the potential impact for the economy.

Let us analyze this table, step by step. The first column under OSM is the industries' offshoring index of materials as calculated by (1), and averaged through 1980-2005. The total average across industries (taking out outliers) is 6.40%, less than that of manufacturing industries (7.07%) and more than the other two sectors, primary plus energy (6.22%) and services (5.62%). The same can be said for the period 1990-2005 (the second column), although the figures are now larger.[12] Reasonably enough, materials offshoring is relatively more present in the manufacturing sector than in the other two. The third and fourth columns focus on the growth of this index. If we again take averages across all industries, this would tell an unanticipated story. The averaged CAGR is 4.90%, indicating that the services sector has an above than average growth (5.17%), while the primary plus energy

[12] The sheer growth in materials offshoring is more graphically seen in figure 1, where the index is aggregated to the country level by weighting by the industries' GDP.

(4.77%) and manufacturing (4.72%) sectors stay below this average. This is also perceived for the subperiod of 1990-2005.

The data in the next four columns repeats all previous information but this time on the OSS index. Its average across all industries stands at 2.05% (no outliers), and now there is no significant difference among services (2.05%), manufacturing (2.06%), and primary plus energy (1.96%). For 1990-2005 the average of services is higher than the total average, whereas for the other two is lower. As for the growth rates, the total average is 1.72% during 1980-2005, and the services sector (2.04%) naturally gets ahead of the manufacturing (1.63%) and primary (0.99%) sectors. In the period 1990-2005 all averages on the CAGRs (total, services, manufacturing, and other) turn out negatively signed, and that associated to services the less affected.

The right-hand side of table 5 reports GDP data as before, but this time on the period we have data on offshoring, 1980-2005. The averaged CAGR for the total economy is here negative (-0.24%), as it is for the manufacturing (-0.43%) and primary (-2.29%) sectors but not for services (0.63%). Data on 1990-2005 are similar, yet as speculated before and due to this transition towards a more services-oriented economy, the difference is somewhat higher. The last two columns corroborate this, further arguing in favor of a structural change taking place during the 1990s, specially between the manufacturing and services sectors.

According to the variable, let us now define those industries above the average plus half a standard deviation as big offshorers (offshoring index), highly-growing industries (GDP CAGR), and large industries (GDP share). Therefore, for both the OSM and OSS indices we can track down the possible cases set out in the first paragraph of this section: high offshoring intensity and high GDP growth, high offshoring intensity and a large GDP share, and all three. Let us first take a look at the OSM index.

Following these simple criteria for the whole period of analysis I recognize twenty big offshorers, of which two deal with services, two belong to the primary plus energy sector, and the rest are naturally from manufacturing. From these twenty industries I further filter the data to obtain four big offshorers which, at the same time, are highly-growing industries, namely: electronic, computer machines, and accessories; electronic equipment and measuring instruments; electrical machinery equipment; and rental of office equipment. The former three are manufacturing industries and the last one is a services industry. Now, if we filter the data as to try to get big offshorers which are also large industries, we cannot produce any. In fact, none of these four industries are even above the mean in terms of GDP share. The evidence then seems to point out that, even if materials offshoring is relatively more important than services offshoring, it can only have a small effect on the economy after all.

Table 5: Industries' offshoring indices and GDP, 1980-2005

JIP code		OSM (%) AVG 1980-2005	OSM (%) AVG 1990-2005	OSM (%) CAGR 1980-2005	OSM (%) CAGR 1990-2005	OSS (%) AVG 1980-2005	OSS (%) AVG 1990-2005	OSS (%) CAGR 1980-2005	OSS (%) CAGR 1990-2005	GDP growth (%) CAGR 1980-2005	GDP growth (%) CAGR 1990-2005	GDP share AVG 1980-2005	GDP share AVG 1990-2005
	Other												
001	Rice, wheat production	8,10	10,15	5,53	3,59	1,50	1,27	-3,03	-5,34	-3,29	-2,63	0,41	0,32
002	Miscellaneous crop farming	6,53	8,26	5,47	4,16	1,23	1,16	-3,13	-4,88	-2,61	-2,61	0,74	0,63
003	Livestock and sericulture farming	5,72	7,00	4,89	3,45	1,58	1,62	-3,14	-6,91	-3,10	-4,89	0,25	0,20
004	Agricultural services	4,68	6,17	6,07	5,34	3,39	3,81	3,44	2,14	-1,71	-2,07	0,08	0,08
005	Forestry	7,05	8,67	5,02	4,52	2,12	2,28	0,03	-0,41	-2,83	-1,85	0,17	0,16
006	Fisheries	6,45	7,85	4,71	3,68	1,87	1,84	0,76	-1,38	-5,34	-5,79	0,44	0,30
007	Mining	6,06	7,47	4,69	3,24	1,47	1,59	1,08	-1,61	-5,78	-5,45	0,21	0,15
062	Electricity	5,84	7,63	6,69	6,27	1,75	1,96	1,33	-0,65	1,24	-0,11	1,57	1,69
063	Gas, heat supply	8,18	8,95	0,58	0,44	2,35	2,64	4,54	-1,54	1,08	0,29	0,21	0,23
064	Waterworks	3,80	4,82	3,79	6,66	2,21	2,76	4,39	0,39	-0,72	0,07	0,40	0,38
065	Water supply for industrial use	6,06	7,33	4,26	3,62	1,97	2,25	1,89	2,70	-2,01	-0,54	0,02	0,02
066	Waste disposal	6,22	7,76	5,52	4,96	2,09	2,46	3,68	0,92	-2,44	-1,59	0,36	0,30
	Manufacturing												
008	Livestock products	3,66	4,36	3,86	4,39	1,65	1,60	0,27	0,95	-1,09	0,02	0,23	0,20
009	Seafood products	4,49	5,43	4,75	4,67	1,58	1,68	1,87	2,24	-0,85	-1,33	0,29	0,27
010	Flour and grain mill products	2,28	2,87	3,67	4,50	1,22	1,19	0,90	2,54	-1,60	-0,81	0,37	0,32
011	Miscellaneous foods	3,93	4,71	4,09	4,85	1,90	2,05	1,46	0,44	-0,94	-0,73	1,07	0,93
012	Animal foods & fertilizers	4,78	5,72	3,50	2,88	1,78	1,88	1,94	2,77	2,52	3,97	0,12	0,05
013	Beverages	3,84	4,64	4,27	4,38	2,24	2,49	1,74	-0,34	-1,06	-0,43	0,98	0,93
014	Tobacco	4,52	5,65	5,11	5,76	3,29	3,33	1,49	1,05	-3,13	-1,83	0,62	0,51
015	Textile products	7,38	9,96	8,71	11,96	1,96	2,09	1,75	1,04	-6,09	-8,36	0,88	0,69
016	Lumber and wood products	16,47	22,26	7,83	6,32	1,62	1,58	0,14	0,51	-3,56	-4,34	0,30	0,26
017	Furniture and fixtures	10,84	14,48	7,04	6,18	1,75	1,82	1,56	-1,12	-4,52	-5,95	0,36	0,28
018	Pulp, paper, and other paper	9,71	12,12	5,63	2,99	1,89	1,97	0,80	-0,81	-1,06	-1,62	0,33	0,31
019	Paper products	6,86	8,25	4,69	1,65	2,26	2,36	1,21	-3,65	0,04	-1,88	0,31	0,30
020	Printing, and plate making	4,84	5,44	2,96	2,45	2,44	2,57	2,34	-0,02	0,50	-1,27	0,74	0,76
021	Leather and leather products	24,56	34,26	7,85	8,31	2,06	2,05	0,93	-3,21	-4,88	-6,63	0,09	0,07
022	Rubber products	7,91	9,24	4,49	3,34	1,93	1,98	0,87	-4,66	-1,47	-2,22	0,27	0,25
023	Chemical fertilizers	8,90	11,36	6,96	3,77	2,18	2,28	1,84	-3,16	-9,08	-10,53	0,05	0,04
024	Basic inorganic chemicals	15,15	17,53	4,16	1,07	2,15	2,37	1,94	-2,77	-4,21	-5,71	0,17	0,16
025	Basic organic chemicals	4,55	5,10	2,47	-0,21	2,03	2,21	1,21	-1,11	3,54	2,03	0,07	0,08
026	Organic chemicals	6,89	7,43	3,09	1,74	2,09	2,25	1,90	-3,11	-1,87	-6,73	0,42	0,42
027	Chemical fibers	9,57	10,58	3,44	1,55	2,25	2,34	1,37	-3,91	-4,03	-5,37	0,05	0,04
028	Miscellaneous chemical pdts.	7,89	9,05	3,55	2,04	2,68	2,99	2,13	-2,20	1,10	-1,28	0,48	0,49
029	Pharmaceutical products	6,19	7,34	4,59	2,48	2,82	3,47	4,64	0,32	3,29	2,84	0,51	0,58
030	Petroleum products	5,04	5,84	2,78	-0,13	1,75	1,90	0,37	0,93	0,63	-1,83	1,07	1,15
031	Coal products	5,48	7,58	9,16	9,62	2,13	2,19	0,85	-1,48	-7,20	-8,04	0,11	0,09
032	Glass and its products	7,34	9,02	4,69	3,24	1,89	2,04	1,61	-2,53	2,12	-0,01	0,16	0,17
033	Cement and its products	2,26	2,93	5,72	4,65	1,81	1,79	0,18	-5,73	-2,89	-4,15	0,35	0,33
034	Pottery	10,16	12,75	4,83	3,77	2,04	2,14	2,07	-3,21	-1,15	-1,96	0,10	0,09
035	Miscellaneous ceramic	10,33	12,69	4,71	3,20	2,28	2,27	0,66	-2,51	-1,75	-1,25	0,21	0,18
036	Pig iron and crude steel	4,87	6,43	6,01	0,10	2,12	1,90	-0,15	-1,18	-3,50	-2,26	0,30	0,26
037	Miscellaneous iron and steel	4,09	5,18	4,96	-2,74	2,20	2,29	1,41	-2,16	-1,84	-1,64	0,81	0,74
038	Smelting non-ferrous metals	81,59	95,94	4,74	-0,25	1,94	1,87	-0,35	-3,48	0,32	0,87	0,08	0,08
039	Non-ferrous metal products	81,16	90,77	3,38	-0,61	1,83	1,89	1,84	-0,39	-1,14	-1,98	0,30	0,31
040	Metal products	3,45	4,49	7,53	5,08	2,36	2,53	2,55	-1,03	-2,53	-5,40	0,42	0,42
041	Miscellaneous metal products	4,38	5,41	5,74	3,65	2,03	2,19	2,30	-1,27	-1,20	-2,43	0,80	0,77
042	General industry machinery	3,81	4,62	3,56	4,19	2,16	2,26	1,99	-0,90	-0,85	-1,71	0,75	0,74
043	Special industry machinery	4,51	5,69	4,89	5,95	2,23	2,34	2,02	-1,81	0,03	-1,66	0,97	0,94
044	Miscellaneous machinery	3,81	4,68	4,79	3,14	2,33	2,61	3,00	-0,09	0,02	-1,71	0,41	0,39
045	Office and industry machines	5,28	6,94	5,10	7,33	1,74	1,87	2,15	1,24	3,35	0,03	0,20	0,22
046	Electrical and ind. apparatus	6,45	7,74	4,69	4,11	2,10	2,19	1,78	-2,27	-1,10	-3,03	0,45	0,44
047	Household electric appliances	6,14	7,69	4,96	5,01	2,11	2,23	1,92	-1,07	2,76	0,92	0,48	0,53

	(continued)	OSM (%)				OSS (%)				GDP growth (%)		GDP share	
		AVG 1980-2005	AVG 1990-2005	CAGR 1980-2005	CAGR 1990-2005	AVG 1980-2005	AVG 1990-2005	CAGR 1980-2005	CAGR 1990-2005	CAGR 1980-2005	CAGR 1990-2005	AVG 1980-2005	AVG 1990-2005
048	Electronics, computer eqpmnt.	10,50	12,38	2,45	4,03	2,47	2,73	2,37	0,16	2,70	-8,39	0,21	0,26
049	Communication equipment	6,51	7,97	3,18	4,41	2,22	2,44	2,26	0,57	6,27	4,69	0,19	0,25
050	Measuring instruments	8,23	9,45	1,94	4,21	2,20	2,39	2,34	0,19	2,30	-2,83	0,23	0,25
051	Semiconductor and circuits	7,24	8,51	2,19	0,97	1,68	1,87	1,94	0,82	11,94	9,96	0,30	0,45
052	Electronic parts	7,05	7,56	1,74	0,75	2,41	2,61	2,55	0,45	9,72	8,98	0,59	0,78
053	Miscellaneous machinery	16,21	19,43	5,42	2,50	2,19	2,23	1,68	-2,28	3,34	0,82	0,41	0,47
054	Motor vehicles	1,70	2,00	2,46	3,45	2,05	2,34	2,13	-0,52	0,63	0,71	0,68	0,62
055	Motor vehicle parts	2,67	3,14	4,52	2,81	1,68	1,70	1,26	-0,16	1,88	1,50	1,34	1,41
056	Other transportation eqpmnt.	6,03	7,21	4,40	2,83	1,93	1,98	0,19	-2,45	-1,77	-0,63	0,35	0,31
057	Precision machinery eqpmnt.	10,80	13,61	5,09	5,61	2,08	2,16	0,85	-1,92	-1,15	-2,08	0,37	0,33
058	Plastic products	6,33	7,19	3,26	1,92	2,19	2,32	2,48	-2,84	0,51	0,03	0,73	0,71
059	Miscellaneous industries	11,37	13,75	4,58	3,87	1,97	2,10	1,55	-1,40	-1,10	-3,93	0,38	0,37
060	Construction	6,94	9,33	7,14	6,94	1,73	1,91	3,27	-2,02	-1,26	-2,40	4,98	4,68
061	Civil engineering	3,37	4,51	7,43	7,04	1,58	1,77	2,83	-1,85	-2,93	-4,56	3,44	3,31
	Services												
067	Wholesale	5,59	7,00	5,36	6,05	1,75	2,00	1,44	0,21	1,48	1,59	7,01	7,88
068	Retail	4,37	5,45	4,98	6,34	1,85	2,17	2,62	-0,43	-0,99	-0,85	5,03	4,98
069	Finance	3,13	4,18	7,27	7,69	2,31	2,53	1,22	-2,87	2,34	2,10	3,64	4,02
070	Insurance	2,48	3,19	5,43	7,42	2,03	2,58	6,31	3,54	0,63	-1,26	1,76	1,82
071	Real estate	5,32	6,71	5,73	3,47	2,23	2,54	2,25	-3,04	-2,49	-2,50	2,03	1,66
072	Housing	4,98	6,45	6,70	4,68	2,11	2,20	-6,22	-17,30	0,58	1,38	8,65	9,04
073	Railway	8,36	9,71	3,73	1,44	1,75	1,74	-7,04	-15,13	-1,21	-1,67	0,69	0,65
074	Road transportation	5,30	6,33	3,64	1,29	1,39	1,61	2,53	-0,62	-0,64	-0,63	2,91	2,80
075	Water transportation	5,94	7,08	3,83	1,25	2,84	2,57	-2,06	-5,78	-0,02	0,48	0,42	0,42
076	Air transportation	5,42	6,30	3,00	-0,04	12,14	13,89	3,49	3,95	-0,13	-1,99	0,26	0,27
077	Other transportation	7,61	9,98	6,48	5,54	1,88	2,30	4,52	-1,12	-2,15	-2,54	0,47	0,44
078	Telegraph and telephone	5,83	8,04	8,25	8,63	2,10	2,38	2,87	-1,18	4,39	5,77	1,22	1,50
079	Mail	4,44	5,67	6,23	3,96	5,06	5,82	4,81	2,64	-1,05	-1,30	0,34	0,33
080	Education (private and non-p)	6,32	7,84	4,71	3,82	2,44	2,72	3,29	-0,05	0,80	1,41	1,02	1,05
081	Research (private)	3,73	4,52	3,40	3,33	1,56	1,77	2,64	0,20	2,64	2,10	0,13	0,15
082	Medical (private)	6,05	7,54	5,99	2,13	1,31	1,44	2,54	1,24	0,57	2,56	2,20	2,17
083	Hygiene (private and non-p)	6,37	7,93	5,47	4,51	1,84	2,22	3,00	-1,69	-2,67	5,09	0,10	0,07
084	Other public services	5,81	7,84	9,14	10,19	1,83	2,11	3,54	-0,19	-5,95	-2,74	0,25	0,13
085	Advertising	2,37	3,09	3,51	1,53	1,07	1,30	4,43	2,53	0,33	2,31	0,50	0,53
086	Rental of office equipment	8,78	11,33	6,39	5,96	1,49	1,54	-0,58	-3,29	9,69	8,36	0,58	0,78
087	Automobile maintenance	3,88	4,61	2,75	5,35	1,54	1,61	1,30	0,60	-0,65	-0,36	1,17	1,11
088	Other services for businesses	6,19	8,34	6,87	5,45	2,34	2,76	4,20	0,50	1,59	2,32	3,10	3,48
089	Entertainment	5,86	7,29	5,14	5,56	2,31	2,64	1,66	-0,48	-0,26	-2,20	1,77	1,68
090	Broadcasting	5,95	7,21	3,82	4,22	3,93	4,61	3,53	1,38	-1,11	1,16	0,28	0,27
091	Information and Internet ss.	5,28	6,62	5,01	4,90	2,05	2,47	4,70	1,61	4,39	7,20	1,16	1,44
092	Publishing	3,80	4,28	3,20	1,06	3,34	4,16	5,11	4,58	-1,78	-1,59	0,47	0,42
093	Video and sound	7,45	9,54	4,72	6,72	3,33	4,30	6,48	2,88	8,09	-0,09	0,11	0,13
094	Eating and drinking places	6,68	8,66	6,17	6,02	1,42	1,60	3,03	-2,17	-1,20	0,01	2,27	2,08
095	Accommodation	7,22	9,36	6,93	7,52	1,43	1,49	0,12	-4,62	-0,17	-0,53	0,82	0,82
096	Laundry, beauty services	6,77	8,23	4,45	4,59	1,17	1,32	2,42	-0,08	-0,86	-1,31	0,88	0,84
097	Other services for individuals	7,49	9,40	5,25	5,77	2,15	2,16	0,60	-0,99	1,94	0,84	0,83	0,92
098	Education (public)	6,10	7,42	4,22	3,39	3,21	3,54	4,24	4,35	-1,21	-1,66	3,18	2,93
099	Research (public)	5,13	6,35	4,41	3,79	2,35	2,77	4,97	4,16	2,54	4,76	0,17	0,20
100	Medical (public)	5,96	7,39	6,05	1,44	1,11	1,12	1,52	1,73	1,34	1,02	0,49	0,54
101	Hygiene (public)	6,16	7,57	4,48	4,32	1,44	1,53	0,93	0,24	1,81	2,62	0,10	0,11
102	S. insur. & s. welfare (public)	5,49	7,06	5,86	5,75	1,52	1,53	0,94	1,22	1,06	2,07	0,44	0,45
103	Public administration	7,29	8,79	4,13	2,78	2,12	2,48	4,16	0,30	0,89	2,36	4,93	5,23
104	Medical (non-profit)	5,98	7,40	5,88	1,32	1,14	1,16	1,59	0,28	2,07	1,91	0,74	0,78
105	S. insur. & s. welfare (non-p)	5,70	7,44	6,05	5,83	1,48	1,52	1,41	-1,60	1,42	2,84	0,40	0,47
106	Research (non-profit)	2,97	3,46	2,24	-0,04	2,52	2,99	3,71	1,13	-22,03	-33,04	0,98	0,24
107	Other (non-profit)	4,14	5,21	4,93	4,06	2,27	2,50	2,69	-0,64	0,45	0,94	0,47	0,43
108	Activities not classified	6,22	7,52	5,38	1,80	1,20	1,27	-9,18	-21,75	-0,85	2,00	0,29	0,32

Table 6: Industries' contributions to indices, 1980-2005

Rnk.	JIP code	*Industry*	OSM share (p.p.) 1980-2005	Rnk.	JIP code	*Industry*	OSS share (p.p.) 1980-2005
1	67	Wholesale	0.8171	1	103	Public administration	0.1004
2	72	Housing	0.7685	2	88	Other services for businesses	0.0872
3	103	Public administration	0.4816	3	67	Wholesale	0.0761
4	60	Construction	0.4654	4	98	Education (public)	0.0638
5	88	Other services for businesses	0.4409	5	69	Finance	0.0599
6	69	Finance	0.3208	6	91	Information and Internet ss.	0.0506
7	86	Rental of office equipment	0.2798	7	70	Insurance	0.0431
8	78	Telegraph and telephone	0.2777	8	52	Electronic parts	0.0412
9	68	Retail	0.2577	9	78	Telegraph and telephone	0.0410
10	62	Electricity	0.2005	10	60	Construction	0.0369
11	94	Eating and drinking places	0.1971	11	68	Retail	0.0287
12	91	Information and Internet ss.	0.1865	12	76	Air transportation	0.0256
13	82	Medical (private)	0.1662	13	82	Medical (private)	0.0247
14	98	Education (public)	0.1383	14	29	Pharmaceutical products	0.0220
15	89	Entertainment	0.1317	15	80	Education (private and non-p)	0.0211
16	97	Other services for individuals	0.1240	16	55	Motor vehicle parts	0.0176
17	95	Accommodation	0.1159	17	79	Mail	0.0169
18	53	Miscellaneous machinery	0.1138	18	74	Road transportation	0.0151
19	74	Road transportation	0.1117	19	51	Semiconductor and circuits	0.0150
20	52	Electronic parts	0.1025	20	89	Entertainment	0.0139
21	61	Civil engineering	0.0942	21	94	Eating and drinking places	0.0127
22	80	Education (private and non-p)	0.0891	22	62	Electricity	0.0125
23	39	Non-ferrous metal products	0.0761	23	86	Rental of office equipment	0.0124
24	71	Real estate	0.0741	24	92	Publishing	0.0115
25	70	Insurance	0.0703	25	47	Household electric appliances	0.0110
26	38	Smelting non-ferrous metals	0.0608	26	97	Other services for individuals	0.0107
27	104	Medical (non-profit)	0.0576	27	20	Printing, and plate making	0.0096
28	47	Household electric appliances	0.0570	28	53	Miscellaneous machinery	0.0094
29	51	Semiconductor and circuits	0.0568	29	58	Plastic products	0.0088
30	105	Ss. Ins. & ss. welfare (non-p)	0.0564	30	99	Research (public)	0.0086
31	29	Pharmaceutical products	0.0562	31	43	Special industry machinery	0.0085
32	43	Special industry machinery	0.0558	32	93	Video and sound	0.0084
33	102	Ss. ins. & ss. welfare (public)	0.0532	33	54	Motor vehicles	0.0083
34	96	Laundry, beauty services	0.0523	34	49	Communication equipment	0.0081
35	55	Motor vehicle parts	0.0511	35	90	Broadcasting	0.0081
36	58	Plastic products	0.0382	36	64	Waterworks	0.0079
37	16	Lumber and wood products	0.0378	37	104	Medical (non-profit)	0.0076
38	100	Medical (public)	0.0360	38	107	Other (non-profit)	0.0075
39	57	Precision machinery eqpmnt.	0.0357	39	85	Advertising	0.0072
40	28	Miscellaneous chemical pdts.	0.0345	40	28	Miscellaneous chemical pdts.	0.0067
41	13	Beverages	0.0325	41	44	Miscellaneous machinery	0.0050
42	73	Railway	0.0322	42	105	Ss. Ins. & ss. welfare (non-p)	0.0050
43	11	Miscellaneous foods	0.0317	43	100	Medical (public)	0.0046
44	77	Other transportation	0.0302	44	102	Ss. ins. & ss. welfare (public)	0.0042
45	49	Communication equipment	0.0293	45	63	Gas, heat supply	0.0041
46	2	Miscellaneous crop farming	0.0290	46	50	Measuring instruments	0.0041
47	41	Miscellaneous metal products	0.0290	47	42	General industry machinery	0.0038
48	87	Automobile maintenance	0.0288	48	13	Beverages	0.0035
49	15	Textile products	0.0280	49	45	Office and industry machines	0.0035
50	75	Water transportation	0.0273	50	96	Laundry, beauty services	0.0034
51	59	Miscellaneous industries	0.0273	51	41	Miscellaneous metal products	0.0032
52	30	Petroleum products	0.0271	52	77	Other transportation	0.0032
53	18	Pulp, paper, and other paper	0.0269	53	30	Petroleum products	0.0031
54	107	Other (non-profit)	0.0260	54	87	Automobile maintenance	0.0030
55	20	Printing, and plate making	0.0235	55	11	Miscellaneous foods	0.0023
56	46	Electrical and ind. apparatus	0.0205	56	32	Glass and its products	0.0023
57	42	General industry machinery	0.0194	57	81	Research (private)	0.0020
58	93	Video and sound	0.0192	58	66	Waste disposal	0.0020
59	45	Office and industry machines	0.0191	59	25	Basic organic chemicals	0.0017
60	79	Mail	0.0189	60	19	Paper products	0.0015
61	99	Research (public)	0.0185	61	12	Animal foods & fertilizers	0.0014
62	32	Glass and its products	0.0183	62	48	Electronics, computer eqpmnt.	0.0013
63	66	Waste disposal	0.0171	63	101	Hygiene (public)	0.0012
64	50	Measuring instruments	0.0165	64	46	Electrical and ind. apparatus	0.0011
65	19	Paper products	0.0157	65	4	Agricultural services	0.0011

(continued)

66	108	Activities not classified	0.0156	66	9	Seafood products	0.0011
67	17	Furniture and fixtures	0.0155	67	39	Non-ferrous metal products	0.0008
68	64	Waterworks	0.0154	68	59	Miscellaneous industries	0.0006
69	35	Miscellaneous ceramic	0.0150	69	34	Pottery	0.0003
70	22	Rubber products	0.0148	70	83	Hygiene (private and non-p)	0.0001
71	1	Rice, wheat production	0.0147	71	26	Organic chemicals	0.0000
72	44	Miscellaneous machinery	0.0140	72	38	Smelting non-ferrous metals	0.0000
73	90	Broadcasting	0.0136	73	65	Water supply for industrial use	0.0000
74	14	Tobacco	0.0134	74	40	Metal products	-0.0001
75	56	Other transportation eqpmnt.	0.0133	75	95	Accommodation	-0.0001
76	37	Miscellaneous iron and steel	0.0120	76	18	Pulp, paper, and other paper	-0.0004
77	101	Hygiene (public)	0.0118	77	27	Chemical fibers	-0.0005
78	9	Seafood products	0.0105	78	57	Precision machinery eqpmnt.	-0.0005
79	85	Advertising	0.0105	79	22	Rubber products	-0.0006
80	40	Metal products	0.0101	80	8	Livestock products	-0.0008
81	54	Motor vehicles	0.0097	81	23	Chemical fertilizers	-0.0010
82	21	Leather and leather products	0.0093	82	10	Flour and grain mill products	-0.0010
83	76	Air transportation	0.0088	83	21	Leather and leather products	-0.0012
84	84	Other public services	0.0083	84	24	Basic inorganic chemicals	-0.0013
85	34	Pottery	0.0082	85	35	Miscellaneous ceramic	-0.0013
86	63	Gas, heat supply	0.0075	86	61	Civil engineering	-0.0016
87	48	Electronics, computer eqpmnt.	0.0068	87	37	Miscellaneous iron and steel	-0.0019
88	5	Forestry	0.0060	88	84	Other public services	-0.0020
89	81	Research (private)	0.0059	89	71	Real estate	-0.0022
90	8	Livestock products	0.0059	90	56	Other transportation eqpmnt.	-0.0025
91	25	Basic organic chemicals	0.0057	91	31	Coal products	-0.0026
92	36	Pig iron and crude steel	0.0051	92	33	Cement and its products	-0.0027
93	12	Animal foods & fertilizers	0.0051	93	5	Forestry	-0.0028
94	83	Hygiene (private and non-p)	0.0050	94	7	Mining	-0.0035
95	10	Flour and grain mill products	0.0050	95	17	Furniture and fixtures	-0.0037
96	92	Publishing	0.0047	96	108	Activities not classified	-0.0038
97	3	Livestock and sericulture farming	0.0046	97	16	Lumber and wood products	-0.0041
98	33	Cement and its products	0.0044	98	3	Livestock and sericulture farming	-0.0041
99	4	Agricultural services	0.0040	99	75	Water transportation	-0.0046
100	26	Organic chemicals	0.0039	100	1	Rice, wheat production	-0.0057
101	31	Coal products	0.0013	101	36	Pig iron and crude steel	-0.0062
102	65	Water supply for industrial use	0.0008	102	14	Tobacco	-0.0073
103	27	Chemical fibers	-0.0006	103	6	Fisheries	-0.0085
104	24	Basic inorganic chemicals	-0.0008	104	73	Railway	-0.0105
105	23	Chemical fertilizers	-0.0012	105	2	Miscellaneous crop farming	-0.0114
106	7	Mining	-0.0044	106	15	Textile products	-0.0136
107	6	Fisheries	-0.0060	107	106	Research (non-profit)	-0.0255
108	106	Research (non-profit)	-0.0385	108	72	Housing	-0.1079
		total growth in index (p.p.):	**7.7279**				**0.8139**

Note: codes by sector are 1 to 7 and 62 to 66 (other), 8 to 61 (manufacturing), and 67 to 108 (services).

For the OSS index I identify nineteen big offshorers, ten services, seven manufacturing, and two primary industries. Our second-stage filter for GDP growth delivers five industries: pharmaceutical products; electronic, computer machines, and accessories (as with OSM); electronic parts; video picture, sound information, character information production and distribution; and research (public). That is, respectively, three manufacturing and two services industries. Focusing now in offshoring and economic weight I can only make out one industry, education (public), with a share of 3.18% in the total economy. Again, it is not possible to distinguish any single industry that takes all three characteristics. Hence, services offshoring does not seem more predominant in the services than in the manufacturing sector. Further, with the exception of public education, it is to argue that the final effect (e.g.

employment destruction) on the total economy should not be so different from that of materials offshoring.

Our simple exercise here might yet be hiding some information on the final contribution of each industry on the growth of both indices for 1980-2005. For this reason, table 6 ranks the contributions of each individual industry to the change in both indices from 1980 to 2005. To do that I simply multiply the industries' indices by their GDP weights. This is how I construct the aggregate versions of the indices in figure 1.[13]

The column labeled "OSM share" reflects the contributions to the growth in the OSM index during our period of analysis. The last row indicates that materials offshoring grew approximately 7.73 percentage points. Noticeably, much of this growth was due to activities undertaken within the services sector. With the exception of the construction industry, the rest of industries ranking at the top ten are from the services sector. At the other end of the ranking and with the sole exception of research (non-profit) services, we only find industries from the manufacturing and primary (plus energy) sectors.

On the other hand, under "OSS share" we find the contribution by industry to the OSS index, which grew only 0.81 percentage points. Again, most of the growth took place within the services sector. Construction and the electronic parts industries are the only two manufacturing industries to be found among the top ten. At the bottom we now find industries from all three sectors in a similar proportion. Remarkably, several industries appear at the top in both rankings, among which we can count: wholesale, public administration, construction, other services for business, finance, rental of office equipment, telegraph and telephone, retail, information and internet services, medical (private), education (public), and electronic parts. Aside from the construction and electronic parts industries, all other industries are from the services sector.

In conclusion for this section, there are several points worth stressing. First, only nearly a fifth of all industries can be justly categorized as big offshorers in both cases of materials and services inputs. On the materials side we have that only four industries are, at the same time, highly growing industries and yet none of them bears a great weight on the economy. On services we have only five "highly growing big offshorer" industries, and one "large big offshorer" industry. Second, no industry, out of the total of 108, enjoys all three features together as put forth at the beginning of this section: high offshoring intensity, high GDP growth, and a large share. Third, I find that, with a few exceptions, services industries became the engine of offshoring (both of materials and services) throughout the period of 1980-2005.

[13]It should remain clear that our study is already carried out at the aggregate level of the industry.

4 The industry's demand for labor

Hamermesh (1993) goes about the various ways that could be employed to estimate the factor substitution elasticities in a labor demand setting. He discusses three methods: (a) direct estimation of a cost or production function; (b) labor-demand conditions; and (c) system estimation (which is an approximation to a generalized cost or production function). Following Amiti and Wei (2005, 2006) and Cadarso *et al.* (2008), I address the estimation of the offshoring elasticities through method (b). If all data on inputs prices were available, labor-demand conditions for every input should be derived. This is not the case though.

Supposing that all industries behave as single profit-maximizing firms, and further supposing Cobb-Douglas technologies,[14] we have:

$$Y = A(OSM, OSS)\, F(K, L) = AK^{\alpha}L^{\beta} \tag{2}$$

where industries use capital K and labor L to produce output Y and α and β are the factor shares.[15] Moreover, A is the Hicks-neutral technology parameter further dependent on the offshoring indices. From the information embedded in the production function in (2), we can specify a general cost function like (3):

$$C(w, r, Z) = \phi r^{\alpha} w^{\beta} Z \tag{3}$$

where ϕ is a constant and Z a vector of other exogenous variables. Cost minimization then entails the optimal demand for inputs. In this way, minimizing total costs in (3) subject to (2) and using Shephard's lemma (Shephard, 1953), yields the factor demand functions for K and L. Therefore, the industry's labor demand function can be simply stated as:

$$L = \Gamma(w, Z) \tag{4}$$

and is dependent on the real average wages w and a vector Z of other control variables, among which we can find other factor prices, the real stock of capital, and the productivity of labor. Among these prices we can identify the price of foreign labor services, which are a substitute for domestic labor. Equation (4) then becomes:

$$L = \Gamma(w, p^{*}, Z') \tag{5}$$

and p^{*} is the prices on foreign labor services. Since data on p^{*} are difficult to get, Amiti and Wei suggest to use the offshoring intensity indices instead. Both OSM and OSS perform as inverse proxies of the prices on foreign labor services used in the production of materials

[14] A Cobb-Douglas technology is implicitly assumed in both works mentioned in the previous paragraph.

[15] Notice that equation (2) does not necessarily imply constant returns to scale. Therefore, the coefficients of the labor demand below are not restricted as to comply with such hypothesis.

and services respectively.

$$L = \Gamma(w, OSM, OSS, Z') \mid A(OSM, OSS) \tag{6}$$

Here Amiti and Wei (2005, 2006) identify three channels through which offshoring might affect the labor demand. First, a possible substitution effect between labor and prices of imported inputs (services or materials); a drop in the latter or, equivalently, an increase in the offshoring indices, would lead to a fall in the demand for labor. Second, a possible short run productivity effect of offshoring to impact negatively on employment. And third, the scale effect (or long run productivity effect) which might affect labor positively, provided firms are more efficient and competitive in the longer run due to previous productivity gains. Adding subscripts, a dynamic log-linearized representation of (6) can be expressed as:

$$\ln L_{it} = \beta_o + \beta_1 \ln L_{it-1} + \beta_2 OSM_{it} + \beta_3 OSS_{it} + \beta_4 \ln w_{it} + \beta_5 \ln Z'_{it} \tag{7}$$

where labor by industry (i) is regressed on its lagged value and a set of other explanatory variables. Dynamics is justified since we can reasonably suppose that labor does not adjust automatically to changes in the other variables. Indeed, the level of employment might stay away from its steady state when the adjustment takes place (see Cadarso *et al.*, 2008, and Görg and Hanley 2005). Explanatory variables include, respectively: the services and materials offshoring indices, OSS and OSM,[16] real average wages w, and a vector Z' including the real capital stock and/or the productivity of labor.[17] Error terms are omitted.

On the expected signs of the coefficients we have that $\beta_4 < 0$ (a downward-sloping labor demand), while β_2 and β_3 are inconclusive, since it is not clear whether the scale effects are large enough to outweigh the substitution and productivity effects. As stated before, the output may be increased in response to offshoring-related productivity gains. Proof of that for Japan can be found in the short report by Ando and Kimura (2007). Their study on Japanese data puts the stress on the complementarity between firm level trade and FDI, suggesting that firms establishing affiliates abroad do not necessarily shrink their domestic activities. Rather, it is quite the contrary, and domestic employment can be expanded since these operations are usually "complementary to the rest of the value added chain".

Underlying the estimation of an equation like (7) there is the potential endogeneity problem of the offshoring variables. Even though instrumental variable techniques are often employed, I refrain from doing so due to the quality of the available instruments.

[16] Introducing lags of both these variables into equation (7) would allow us to account for the longer run scale effects. The signs of the coefficients would eventually tell the final effect on employment. Remember that this simple methodology is only concerned with the direct effects of offshoring of industry i on industry i. No spillovers effects between industries are contemplated (see here Egger and Egger, 2005).

[17] Instead of these variables the great burden of work done so far considers an output variable (either its volume or value measure) as entering the labor demand equation. As a result of this, Webster (2003) asserts that the interpretation of the coefficient on real wages remains ambiguous, since this is to be thought as a partial and not total elasticity. For an earlier reference see Nadiri (1968).

5 Employment effects of offshoring, 1980-2005

To study the employment effects of offshoring I rely on the estimation of every industry's demand for labor in equation (7). I then calculate the long run elasticities[18] of the offshoring coefficients so as to sort out the industries in the database, and see the potential effect (both positive and negative) in terms of employment. Next point is to check on several correlations and examine if some pattern does emerge. Particularly, I am interested in the correlations between the estimated elasticities of OSM and OSS and other indicators (GDP growth, GDP weight, share of technical workers, etc.).

Before embarking in the estimation of a great number of regressions I should check the trustworthiness of the data. Considering the structure of our database, one reasonable way to go about it is by computing the labor share of industries and see if this furnishes a sensible result (e.g. the labor share is less than 1).[19] Out of a total of 108 industries in the original database, I am finally left with 83 where the data behave correctly. Therefore, I estimate 83 dynamic labor demand functions separately, all entertaining both offshoring indices as explanatory variables. The method used is ordinary least squares.[20]

Thus, for 14 industries in our final sample I find that the long run elasticity of OSM turns out positively signed, on 37 is zero, and on 32 is negative. On the other hand, for the coefficient on OSS I observe that long run elasticities are positive on 29 industries, zero on 41, and negative on 13. In sum, positive effects of both types of offshoring are found in 43 (14+29) industries and negative effects in 45 (32+13).[21] Moreover, at first sight services offshoring appears as much friendlier than materials offshoring with regards to employment creation. However, we should come to terms with the previous statement looking at how employment changed during 1980-2005, and how much of this change could be attributed to offshoring. Now I turn to the study of these numbers more in detail. This is done in two parts, first considering the positive effects and then the negative effects on employment. Later, and using this information, I try to disentangle the correlation between

[18] These are simply: $\varepsilon^{LR}_{osm,oss} = \dfrac{\hat{\beta}_{2,3}}{1-\hat{\beta}_1}$

[19] See Appendix A for the calculation of the labor share and further comments on its evolution through time. Several up-to-date references on this particular subject can be found, for instance, in Wakita (2006), and the reports by Iiduka (2006) and Takeuchi (2005).

[20] Being this a simple accounting exercise, the use of this method should suffice for our purposes. I am well aware, though, of the potential endogeneity problem entailed by offshoring variables entering a labor demand specification, as pointed earlier by Amiti and Wei (2005, 2006). However, due to the lack of adequate instruments I finally decided to carry out all estimations via OLS. Different control variables like the real capital stock or a measure of (labor) productivity were also tried with success in most of the industries. Additionally, all estimated equations display several lags of the dependent and the offshoring variables, as well as the expected negative sign associated to the real wages. Due to the thoroughness of the analysis in tables 7 to 10, I only focus on the coefficients associated to OSM and OSS. All the final estimated equations are available on request.

[21] I only pay attention to those equations which deliver a non-zero elasticity of either OSM or OSM.

those elasticities and other selected key variables. The idea is to find out, if possible, what features are in correlation with large effects on employment (high elasticities). Is it those which grew the most? Or perhaps those which bear a large weight of the economy. Are capital-intensive industries different in this regard? Here again I split the analysis into the positive and negative effects.

5.1 Long run elasticities

5.1.1 Positive effects

Out of those 14 industries where OSM turns out positive, I identify 10 services and 4 manufacturing industries. Among those which have grown the most we should note the rental of office (9.69% CAGR, ranks 3rd) and information and internet services (4.39%; ranks 6th) industries. Among the most representative we notice the business services[22] industry (3.10% share of the GDP, which makes it the 5th larger industry) followed by private medical services (2.20% share and 8th place). All four industries are from the services sector.

Among those 29 industries with a positive effect of OSS I distinguish 6 industries from the services sector, 3 from the primary sector plus energy, and 20 from the manufacturing sector. For those which have grown the most we have the following industries: semiconductor devices (11.94% CAGR; 1st), rental of office equipment (9.69%; 3rd), telegraph and telephone (4.39%; 5th), information and internet services (4.39%; 6th), and electrical machinery equipment (3.34%; 9th). This is two manufacturing and three services industries. As noted before, both the rental of office and internet services industries also display positive effects of OSM. For those industries which account for relatively large shares of the GDP we should highlight the retail and finance industries (5.03% and 3.64%, ranking them 2nd and 4th), both from the services sector.

Tables 7 and 8 rank all industries by their long run (positive) offshoring elasticities. Precisely, the first two columns display the short and long run elasticities of offshoring.[23] Other indicators of relevance are also shown in tables 7 to 10 (the GDP CAGR and the averaged GDP weight, both for 1980-2005).[24] Now I concentrate on the estimated impact on employment, relying on the estimated coefficients of OSM (table 7) and OSS (table 8).

Combining the information on the long run elasticities with the change in the offshoring index (percentage points) and the change in the employment variable (workers) delivers the output in the last two columns. These represent an estimation of the offshoring-induced employment growth from 1980 to 2005. In other words, both columns show the growth

[22] This is actually labeled as "Other services for businesses", which includes all miscellaneous services industries not listed explicitly in the JIP database.

[23] Remember that the estimated coefficients associated to our offshoring variables are actually semi-elasticities.

[24] These shall be used in determining the patterns in the next section.

in employment due to offshoring practices (e.g. intermediate trade), the first in absolute values and the second as a share of the change in employment. The last row in the last four columns exhibits the values for the whole period.

For those industries enjoying positive effects of materials offshoring (table 7) we see that the employment growth is rather substantial (more than 7 million). However, the creation of job as a direct result of offshoring is not very significant (23,997, only 0.32%). For industries sporting a positive effect of services offshoring (table 8) we see now that the growth in employment is not as large (nearly 1 million). The estimated amount of jobs that originate as a consequence of offshoring is significantly higher nonetheless, both in absolute and relative terms (34,637 workers, 3.66%). More in detail, the industries which have contributed more to the previous numbers are medical (private) and other services for businesses, for materials offshoring (both with approximately 6,000 workers), and the retail industry for services offshoring (21,365 workers in total).

5.1.2 Negative effects

In the 32 industries where negative effects of OSM are found, the distribution of industries shows a clear leaning towards the manufacturing sector. Industries are: 21 manufacturing, 7 services, and 4 primary plus energy. The industries which grew the most through 1980-2005 are telegraph and telephone (4.39%; 5th place) and miscellaneous machinery (3.36%; 9th place). Those industries that represent an important share of the economy are retail (5.03%; 2nd), finance (3.64%; 4th), and real estate (2.03%; 9th). Except for machinery, the rest belong to the services sector.

As for the 13 industries displaying negative effects of OSS I find 6 manufacturing and 7 services. The basic organic chemicals industries appears as the most rapidly growing (3.54%, 7th) whereas private medicine and real estate are among the most representative (2.20% and 2.03% shares; standing at the 8th and 9th places, respectively). The former industry belongs to the manufacturing sector and the other two to the services sector.

Following up with the information comprised in tables 7 and 8, tables 9 and 10 now sort out the (negative) long run elasticities obtained from the labor demand equations. As before, I want to estimate the employment effects of OSM (table 9) and OSS (table 10). Again, using the long run elasticities with the change in the offshoring index (percentage points) and the change in the employment variable (workers), I am able to compute the data in the last two columns.

Table 7: Positive effects of materials offshoring

Rnk.	LD (workers) - OLS estimation (1980-2005)												
OSM-LR	Sector	Industry	OSM-SR	OSM-LR	GDP CAGR	CAGR (Rnk)	GDP weight	weight (Rnk)	ΔOSM (p.p.)	Δwrks. (R)	Δ% (R)	Δwrks. (O)	Δ% (O)
1	S	Research (public)	6.67	**24.16**	2.54	12	0.17	72	5.56	6,617	10.42	853	12.89
2	S	Advertising	9.51	**19.40**	0.33	35	0.50	34	1.74	28,616	18.48	523	1.83
3	M	Petroleum products	2.59	**19.16**	0.63	28	1.07	17	3.29	-21,775	-52.11	263	-1.21
4	S	S. insurance and s. welfare (non-profit)	7.71	**16.74**	1.42	21	0.40	46	9.04	1,473,638	624.77	3,569	0.24
5	M	Pig iron and crude steel	4.71	**15.44**	-3.51	75	0.30	57	4.34	-111,749	-68.38	1,095	-0.98
6	M	Motor vehicle parts and accessories	7.51	**14.02**	1.88	17	1.34	13	2.54	258,855	52.82	1,745	0.67
7	S	Medical (private)	2.34	**13.81**	0.57	31	2.20	**8**	6.30	1,308,166	189.50	6,006	0.46
8	S	Rental of office equipment and goods	2.28	**10.33**	9.69	**3**	0.58	32	13.99	206,061	202.71	1,469	0.71
9	S	Information ss. and internet-based ss.	3.55	**8.80**	4.39	**6**	1.16	16	6.95	948,576	1045.84	555	0.06
10	M	Paper products	1.46	**7.27**	0.04	37	0.31	55	5.98	-21,201	-11.95	772	-3.64
11	S	Publishing	1.72	**5.41**	-1.78	65	0.47	37	2.37	-8,326	-4.09	261	-3.14
12	S	Other services for businesses	1.80	**3.70**	1.59	19	3.10	**5**	10.42	3,108,796	203.63	5,886	0.19
13	S	Other (non-profit)	0.73	**3.46**	0.45	34	0.47	38	5.00	181,322	53.23	589	0.33
14	S	S. insurance and s. welfare (public)	1.06	**2.02**	1.06	25	0.44	40	8.52	82,900	34.69	411	0.50
Note: M manufacturing and S services; Rnk is ranking; SR and LR are short and long run elasticities; (R) and (O) are real and offshoring-induced employment growth.										**7,440,496**	**164.63**	**23,997**	**0.32**

Table 8: Positive effects of services offshoring

Rnk.	LD (workers) - OLS estimation (1980-2005)												
OSS-LR	Sector	Industry	OSS-SR	OSS-LR	GDP CAGR	CAGR (Rnk)	GDP weight	weight (Rnk)	ΔOSS (p.p.)	Δwrks. (R)	Δ% (R)	Δwrks. (O)	Δ% (O)
1	M	Semiconductors and circuits	24.21	**187.37**	11.94	**1**	0.30	58	0.81	99,778	111.96	1,353	1.36
2	O	Electricity	22.88	**170.52**	1.24	22	1.57	12	0.50	-27,064	-15.04	1,534	-5.67
3	M	Miscellaneous industries	13.28	**150.86**	-1.10	54	0.38	48	0.66	-122,453	-32.48	3,754	-3.07
4	M	Pig iron and crude steel	16.11	**52.78**	-3.50	75	0.30	57	-0.07	-111,749	-68.38	-60	0.05
5	S	Rental of office equipment	11.03	**49.94**	9.69	**3**	0.58	32	-0.14	206,061	202.71	-71	-0.03
6	S	Information ss. and internet-based ss.	19.48	**48.21**	4.39	**6**	1.16	16	1.84	948,576	1.045.84	805	0.08
7	M	Flour and grain mill products	21.88	**40.91**	-1.60	62	0.37	49	0.34	-405,353	-73.25	770	-0.19
8	M	Smelting non-ferrous metals	29.41	**38.13**	0.32	36	0.08	79	-0.14	-31,542	-39.01	-43	0.14
9	O	Mining	6.19	**37.25**	-5.77	81	0.20	69	0.35	-95,552	-64.45	193	-0.20
10	S	Retail	6.94	**35.69**	-0.99	49	5.03	**2**	0.97	804,067	13.03	21,365	2.66
11	M	Pottery	11.62	**27.79**	-1.15	57	0.09	78	0.81	-54,591	-49.28	249	-0.46
12	M	Miscellaneous electrical machinery	7.21	**22.54**	3.34	**9**	0.40	45	0.79	23,730	11.21	377	1.59
13	M	Electrical and industrial apparatus	11.72	**21.99**	-1.09	53	0.44	39	0.79	4,600	2.19	365	7.93
14	M	Organic chemicals	6.77	**20.81**	-1.87	67	0.42	43	0.80	-24,167	-21.15	190	-0.79

(continued)

Rnk.	Sector	Industry	OSS-SR	OSS-LR	GDP CAGR	CAGR (Rnk)	GDP weight	weight (Rnk)	ΔOSS (p.p.)	Δwrks. (R)	Δ% (R)	Δwrks. (O)	Δ% (O)
15	M	Livestock products	11.65	**18.78**	-1.09	52	0.23	66	0.13	6,310	3.96	39	0.62
16	M	Motor vehicle parts	8.96	**16.73**	1.88	17	1.34	13	0.51	258,855	52.82	418	0.16
17	M	Chemical fibers	9.09	**15.90**	-4.03	77	0.04	82	0.67	-31,609	-72.24	47	-0.15
18	S	Finance	10.95	**15.77**	2.34	13	3.64	**4**	0.55	21,879	2.07	918	4.20
19	M	Coal products	10.31	**12.91**	-7.20	82	0.11	76	0.43	-35,004	-74.68	26	-0.07
20	O	Forestry	12.88	**12.88**	-2.83	71	0.17	74	0.02	-246,983	-80.70	8	-0.00
21	M	Rubber products	12.16	**12.16**	-1.47	61	0.27	62	0.32	-44,811	-20.94	83	-0.19
22	M	Seafood products	4.33	**11.28**	-0.84	45	0.28	60	0.82	-36,230	-14.07	238	-0.66
23	M	Plastic products	1.22	**9.85**	0.51	32	0.73	28	1.11	121,831	27.60	483	0.40
24	S	Telegraph and telephone	6.30	**9.76**	4.39	**5**	1.21	14	1.26	-134,900	-41.95	395	-0.29
25	S	Other (non-profit)	1.94	**9.21**	0.44	34	0.47	38	1.36	181,322	53.23	427	0.24
26	M	Miscellaneous metal products	6.54	**8.58**	-1.19	59	0.80	24	0.98	-127,751	-18.14	592	-0.46
27	M	Paper products	1.61	**8.03**	0.04	37	0.31	55	0.57	-21,201	-11.95	81	-0.38
28	M	Beverages	6.91	**6.91**	-1.06	51	0.98	20	0.92	-13,991	-9.47	94	-0.67
29	M	Cement and its products	3.65	**4.80**	-2.88	72	0.35	52	0.06	-164,454	-51.41	9	-0.01
Note: M manufacturing, S services, and O other (primary plus energy).										**947,604**	**6.95**	**34,637**	**3.66**

Table 9: Negative effects of materials offshoring

Rnk.	LD (workers) - OLS estimation (1980-2005)												
OSM-LR	Sector	Industry	OSM-SR	OSM-LR	GDP CAGR	CAGR (Rnk)	GDP weight	weight (Rnk)	ΔOSM (p.p.)	Δwrks. (R)	Δ% (R)	Δwrks. (O)	Δ% (O)
1	M	Miscellaneous industries	-4.08	**-46.31**	-1.10	54	0.38	48	11.74	-122,453	-32.48	-20,496	16.74
2	M	Cement and its products	-17.82	**-23.41**	-2.89	72	0.35	52	3.53	-164,454	-51.41	-2,643	1.61
3	M	Chemical fibers	-9.37	**-16.38**	-4.03	77	0.05	82	7.75	-31,609	-72.24	-555	1.76
4	M	Flour and grain mill products	-8.38	**-15.67**	-1.60	62	0.37	49	2.49	-405,353	-73.25	-2,159	0.53
5	S	Telegraph and telephone	-8.81	**-13.67**	4.39	**5**	1.22	14	12.60	-134,900	-41.95	-5,537	4.10
6	S	Air transportation	-1.50	**-12.94**	-0.13	40	0.26	63	3.87	-1,191	-3.22	-185	15.54
7	M	Motor vehicles	-8.31	**-12.85**	0.63	29	0.68	29	1.14	12,206	5.65	-316	-2.59
8	O	Mining	-1.99	**-11.98**	-5.78	81	0.21	69	7.39	-95,552	-64.45	-1,313	1.37
9	S	Real estate	-2.27	**-10.70**	-2.49	69	2.03	**9**	7.16	373,521	61.90	-4,625	-1.24
10	M	Seafood products	-4.07	**-10.59**	-0.85	45	0.29	60	5.44	-36,230	-14.07	-1,484	4.09
11	O	Forestry	-10.58	**-10.58**	-2.83	71	0.17	74	9.38	-246,983	-80.70	-3,038	1.23
12	M	Organic chemicals	-3.35	**-10.30**	-1.87	67	0.42	43	5.09	-24,167	-21.15	-599	2.48
13	M	Tobacco	-10.07	**-10.07**	-3.13	74	0.62	30	6.46	-16,804	-72.85	-150	0.89
14	M	Miscellaneous metal products	-6.99	**-9.18**	-1.20	59	0.80	24	5.44	-127,751	-18.14	-3,517	2.75

(continued)

Rnk.	Sector	Industry	OSM-SR	OSM-LR	GDP CAGR	CAGR (Rnk)	GDP weight	weight (Rnk)	ΔOSM (p.p.)	Δwrks. (R)	Δ% (R)	Δwrks. (O)	Δ% (O)
15	M	Livestock products	-5.61	**-9.05**	-1.09	52	0.23	66	3.96	6,310	3.96	-571	-9.05
16	M	Plastic products	-1.09	**-8.80**	0.51	32	0.73	28	4.99	121,831	27.60	-1,938	-1.59
17	M	Electrical and industrial apparatus	-4.37	**-8.21**	-1.10	53	0.45	39	7.33	4,600	2.19	-1,264	-27.48
18	M	Beverages	-7.88	**-7.88**	-1.06	51	0.98	20	4.43	-13,991	-9.47	-516	3.69
19	M	Coal products	-5.85	**-7.33**	-7.20	82	0.11	76	15.78	-165,602	-93.31	-2,053	1.24
20	M	Electronic measuring instruments	-3.48	**-6.53**	2.30	14	0.23	65	4.28	-7,988	-8.90	-251	3.14
21	M	Other transportation equipment	-6.31	**-6.31**	-1.77	64	0.35	53	6.42	-142,704	-42.16	-1,371	0.96
22	S	Finance	-3.91	**-5.63**	2.34	13	3.64	**4**	6.04	21,879	2.07	-3,598	-16.44
23	O	Water supply for industrial use	-5.61	**-5.61**	-2.01	68	0.02	83	6.60	-778	-30.44	-9	1.22
24	M	Rubber products	-3.65	**-3.65**	-1.47	61	0.27	62	8.84	-44,811	-20.94	-691	1.54
25	S	Broadcasting	-2.81	**-3.59**	-1.11	55	0.28	61	5.90	17,034	34.08	-106	-0.62
26	S	Medical (non-profit)	-3.56	**-3.56**	2.07	16	0.74	27	5.64	414,537	98.18	-848	-0.20
27	M	Lumber and wood products	-1.02	**-3.48**	-3.56	76	0.30	56	30.73	-312,655	-63.14	-5,294	1.69
28	S	Retail	-0.45	**-2.31**	-0.99	49	5.03	**2**	6.84	804,067	13.03	-9,764	-1.21
29	M	Pottery	-0.92	**-2.20**	-1.15	57	0.10	78	12.12	-54,591	-49.28	-295	0.54
30	M	Miscellaneous machinery	-0.36	**-1.14**	3.34	**9**	0.41	45	16.45	23,730	11.21	-396	-1.67
31	O	Waterworks	-1.06	**-1.06**	-0.72	44	0.40	47	4.58	-13,061	-16.42	-39	0.30
32	M	Smelting non-ferrous metals	-0.51	**-0.66**	0.32	36	0.08	79	59.41	-31,542	-39.01	-316	1.00
Note: M manufacturing, S services, and O other (primary plus energy).										**-395,456**	**-2.73**	**-75,935**	**19.20**

Table 10: Negative effects of services offshoring

Rnk.	LD (workers) - OLS estimation (1980-2005)												
OSS-LR	Sector	Industry	OSS-SR	OSS-LR	GDP CAGR	CAGR (Rnk)	GDP weight	weight (Rnk)	ΔOSS (p.p.)	Δwrks. (R)	Δ% (R)	Δwrks. (O)	Δ% (O)
1	**M**	Petroleum products	-9.43	**-69.90**	0.63	28	1.07	17	0.17	-21,775	-52.11	-50	0.23
2	**S**	Real estate	-12.45	**-58.82**	-2.49	69	2.03	**9**	0.83	373,521	61.90	-2,946	-0.79
3	**M**	Basic organic chemicals	-43.13	**-55.82**	3.54	**7**	0.07	80	0.51	-10,181	-61.88	-47	0.46
4	**M**	Lumber and wood products	-16.19	**-55.06**	-3.56	76	0.30	56	0.06	-312,655	-63.14	-164	0.05
5	**S**	Medical (private)	-6.80	**-40.14**	0.57	31	2.20	**8**	0.84	1,308,166	189.50	-2,328	-0.18
6	**S**	Advertising	-13.52	**-27.59**	0.33	35	0.50	34	1.22	28,616	18.48	-521	-1.82
7	**S**	Research (public)	-4.03	**-14.57**	2.54	12	0.17	72	2.67	6,617	10.42	-247	-3.73
8	**M**	Other transportation equipment	-14.12	**-14.12**	-1.77	64	0.35	53	0.08	-142,704	-42.16	-38	0.03
9	**S**	Publishing	-2.49	**-7.82**	-1.78	65	0.47	37	3.94	-8,326	-4.09	-627	7.54
10	**M**	Motor vehicles	-4.68	**-7.24**	0.63	29	0.68	29	0.95	12,206	5.65	-149	-1.22
11	**S**	Air transportation	-0.75	**-6.47**	-0.13	40	0.26	63	11.17	-1,191	-3.22	-267	22.43
12	**S**	Education (private and non-profit)	-5.61	**-5.61**	0.80	27	1.02	19	1.63	314,976	64.42	-447	-0.14
13	**M**	Tobacco	-4.99	**-4.99**	-3.13	74	0.62	30	1.04	-16,804	-72.85	-12	0.07
Note: M manufacturing and S services.										**1,530,466**	**50.92**	**-7,842**	**-0.51**

The last row in the last four columns summarizes the results. For the large number of industries showing a negative effect of materials offshoring (table 9) I observe a relatively mild reduction in employment (almost 400,000 jobs), yet the contribution of offshoring to that amount turns out meaningful (19.20%). Contrarily, industries with a negative effect of services offshoring (table 10) experience an increase of the employment level (one and a half million), yet the effect of offshoring is fairly unimportant.[25] Looking upon the industries which stand out, I can identify the one labeled as miscellaneous (around 20,500 workers) and the retail industry (almost 10,000) for materials offshoring, and the real estate and medical (private) industries for services offshoring (both with small numbers in comparison).

5.2 Correlation analysis

5.2.1 Positive effects

The first two charts in figure B1 in the appendix present the correlation between the long run elasticities of materials (ε_{osm}^{LR}) and services offshoring (ε_{oss}^{LR}) and GDP growth. As shown there, there is no apparent reason to believe that those industries faring better under this category ought to display larger effects of offshoring. In fact, data seem rather dispersed and the correlations are almost null. The same logic applies to the correlation between these elasticities and the industries' GDP weights.

The labor share measures the allocation of national income to workers, as opposed to the owners of capital. Lower labor share ratios imply that industries are more capital intensive. In the next two charts I wonder about this and the extent of the employment effects of offshoring. Both regression lines go in the same direction and even though the adjustments are slightly better, we are far from saying that capital intensive industries are prone to larger elasticities.

The last four charts are related. First I plot the correlation between the estimated elasticities and the most technical group of workers as defined by the JIP database.[26] Then I add up all those groups above the production category and label this new group as nonproduction workers. In both cases, yet much more significantly in the second, a positive relation is perceived between larger effects of services offshoring and a higher complexity of the tasks performed by workers. Arguably, productivity gains could be made when redundant services are taken out and make room for new workers on new and more dynamic activities. In other

[25] One caveat is in order here. I am trying to estimate the contribution of offshoring to the change in the employment variable. Since employment has grown, and we are now dealing with the negative effects of offshoring, this can be interpreted as the jobs that failed to open. In the same line, all negative percentages in the last column should be read that way. Notice that I am supposing a positive change of the offshoring index, and this, also, might not have been the case for some of the industries.

[26] The JIP database includes information on the shares for different categories of workers. There are six in total which, ordered by their skill level, can be roughly identified as: 1) professional and technical, 2) managers and officials, 3) clerical and related workers, 4) sales, 5) service, and 6) Production process workers and laborers.

words, skill upgrading is expected in so far as the offshored services correspond to lower-end categories. On the other side, the strength of the effect for materials offshoring shows no seeming correlation with the skill of workers.

5.2.2 Negative effects

Now I repeat the analysis for the negative elasticities. The first two charts in figure B2 plot the correlation with the GDP growth. At least for materials offshoring, the evidence suggests that those industries which grew the most are less affected by the negative impact of offshoring. Further, industries with a high GDP weight are more influenced by the negative effects, but this time the significance is stronger for services offshoring.[27]

As for the correlations with the labor share, the fit of both regression lines is still small but higher than with the positive effects. This would point to the direction stated previously, that more capital intensive industries show larger elasticities, both of materials and services offshoring.

For the rest of the charts we now have a clearer and more significant correlation when we consider the most highly skilled group alone. When introducing all the other categories as to form the nonproduction group, the relation is not that clear-cut. Larger effects of offshoring, both of materials and services, are more closely related to those industries operating with larger shares of production (low skilled) workers. These lower-end activities are generally among the first to be considered for offshoring.

6 Concluding remarks

Here I have committed myself to the study of the employment effects of materials and services offshoring for the Japanese industries during the period 1980-2005. I have relied on a revised version of the offshoring intensity index first developed by Feenstra and Hanson (1996), thus producing both measures of materials and services offshoring. These indices have behaved rather differently, especially after 1990. While the former has increased dramatically, the latter has remained almost unchanged for the whole period.

Later I have reviewed the evolution of the Japanese industries towards an economy more focused on services. I have argued that the evidence presented here points to a delayed process of deindustrialization, possibly as a result of a protracted period of exports-oriented growth. Several of the macroeconomic indicators sustain this hypothesis. At this point I have retaken the subject of offshoring to deliver an industry-by-industry account of the extent of this phenomenon. I have found that, in the aggregate, it is services industries which have contributed the most to the growth in both indices during our period of analysis.

[27] Even though the outliers have been removed for every pair of variables, the charts might be sometimes deceptive. This is the result of having few data points for some of the correlations.

Subsequently, I have carried out an empirical exercise about the employment effects of offshoring, which constitutes the main contribution of the paper. This is basically divided in two. First, the estimation of the long run elasticities and, through that, the estimation of the amount of jobs lost or created as a direct result of offshoring. And second, the correlation analysis which intends to complement the previous analysis by throwing light on some particular features of the industries. In this manner, I have come to some conclusions that deserve some additional discussion and more of our attention.

Exaggerated numbers on the costs attached to offshoring are easily produced in the current debate, both by consulting companies and news reports alike. This usually moves politicians and the public opinion (unions, most representatively) in the same direction. Offshoring is necessarily bad for domestic employment, since those jobs previously performed within the national borders are now taken to other horizons ("one job offshored is one job lost"). However, a short-sighted reading like that could prevent a real understanding of the subject. Entrepreneurs, in reducing their costs (or maximizing their profits for that matter), are just fulfilling a social function. It is then natural that they look into the world pool of employment seeking to exploit the geographic comparative advantages (e.g. cheaper labor) whenever they deem it appropriate.

Economics is certainly not a zero-sum game. In effect, productivity gains of offshoring are a most probable result leading to price discounts and a boost in domestic demand, which might affect employment positively. In this paper I tried to prove that negative as well as positive effects of offshoring are natural and offsetting forces dwelling in the realm of international trade. Oppositely, and mainly motivated by political interests, hampering forces like trade unions and regulations would do nothing but distort the picture.

Productivity gains for Japanese firms due to offshoring activities have been documented in Hijzen *et al.* (2006). Although I have not dealt with the effects of offshoring on productivity, I have argued, following Amiti and Wei (2005, 2006), that positive employment effects are achievable when the scale effect (or long run productivity effect) overcomes both the substitution and short run productivity effects. This was the case in several industries of both the manufacturing and services sector, and as a consequence of both materials and services offshoring.

In particular, I have estimated an increase of 23,997 and 34,637 jobs as a result of materials and services offshoring respectively, for the period 1980-2005. As for the negative effects the estimations were 75,935 and 7,842 jobs. Hence, the negative net result rises to nearly 25,000 jobs lost due to offshoring during those 25 years. Undoubtedly, a non-significant figure when compared to the 9.5 million jobs created in these industries during the same period. These numbers are in line with previous findings. Amiti and Wei (2005) conduct a research that takes up the case of the UK with data from 69 manufacturing industries and 9 service industries during 1995-2001. Even though their results are not

quantified, they find no evidence of offshoring of materials and services as having a negative effect on total employment, while estimating a conventional labor demand function. In their companion paper, Amiti and Wei (2006) corroborate this for the US economy using 96 industries in 1992-2000.[28]

On other accounts, the presence of skill upgrading in Japan was studied by Head and Ries (2002). There, changes in overseas employment shares can explain increases in the domestic share of nonproduction (skilled) workers. We can reconcile this with our findings above. As noted before, major increases in employment due to both types of offshoring have taken place within the services sector, especially in retail, medical (private), and other miscellaneous services. Concurrently, major drops have been observed within the manufacturing sector (the industry labeled as miscellaneous manufacturing stands out). The services sector is often characterized by higher skilled workers, as compared to manufacturing. Furthermore, the evidence from the correlation analysis suggests that, for services offshoring only, the positive employment effect is larger and the negative effect smaller, the more the industry relies on high skilled workers. This gives the idea of an upgrading process going on for those industries, since high skilled workers are favored at the expense of lower skilled ones.

[28] When the economy is decomposed into 450 industries, a negative effect on employment is however detected.

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A Appendix: Japan's labor share

The labor share of industries can be usually expressed as the ratio of total compensation of employees to net and gross value added. In formulas, we have:

$$l_{it}^{s} = \left(\frac{w_{it}}{w_{it} + it_{it} + ops_{it}} \right) \tag{A1}$$

$$l_{it}^{s\prime} = \left(\frac{w_{it}}{w_{it} + ck_{it} + it_{it} + ops_{it}} \right) \tag{A2}$$

where w is compensation of employees, and the denominator in A1 is the industry's net value added, which is made up of those compensations plus indirect taxes and subsidies (it) and operating surplus (ops); the denominator in A2 is the industry's gross value added, which adds consumption of fixed capital (ck).

So I drop all industries in the sample which do not comply with $0 < l_{it}^{s\prime} < 1$, since this would not be realistic.[29] The following are the 25 industries not considered in the estimations due to the erratic behavior of their labor shares. We can see a clear majority of services industries.

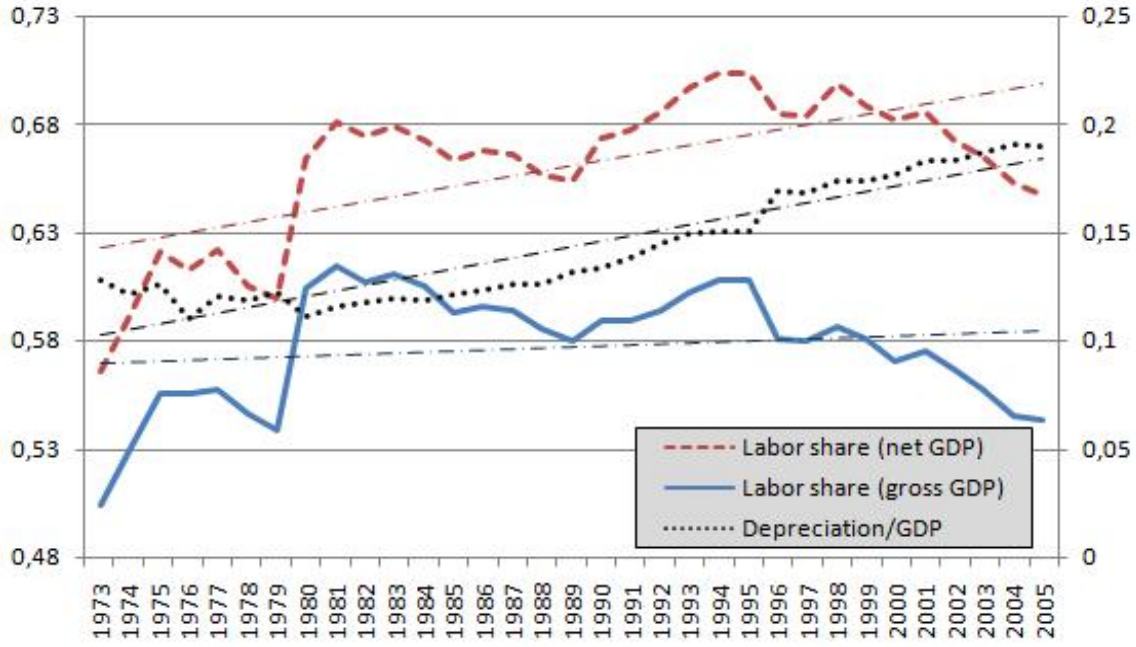
Other:	*Manufacturing:*	*Services:*
Rice, wheat production	Animal foods & fertilizers	Housing
Miscellaneous crop farming	Textile products	Railway
Agricultural services	Leather and leather products	Water transportation
Waste disposal	Electronics, computer eqpmnt.	Other transportation and packing
	Construction	Mail
	Civil engineering	Research (private)
		Hygiene (private and non-profit)
		Other public services
		Video and sound
		Accommodation
		Other services for individuals
		Education (public)
		Medical (public)
		Research (non-profit)
		Activities not elsewhere classified

Furthermore, we should note, following Wakita (2006), that a constant labor share is implied in theory by the Cobb–Douglas production function. Thus, calculations on labor shares should be based on the production function, as the latter would include the depreciation of capital. On the other hand, relying on national income data would otherwise mean the risk of overstating the labor share due to increasing depreciation, a well-known fact in Japan throughout our whole period of analysis.

[29] Below I explain why I decide to go for the gross output-based measure ($l_{it}^{s\prime}$) and not the net output-based measure (l_{it}^{s}).

From the examination of figure A1 we notice that the labor share based on the production function approach (that is, accounting for depreciation) has remained rather stable in the last three decades (especially from 1980 to 2000). I here present both measures, with and without depreciation, yet for the filtering of our database it is the gross measure I use as a reference.[30] As shown by the linear trends drawn in the graph, the increasing consumption of fixed capital might lead to exaggerating the real extent of the share. The figure below confirms previous evidence on its relative stability when taking account of the depreciation of capital. Wakita (2006, p. 79) presents a similar figure using data from the System of National Accounts (93SNA).

Figure A1: Labor share, 1973-2005

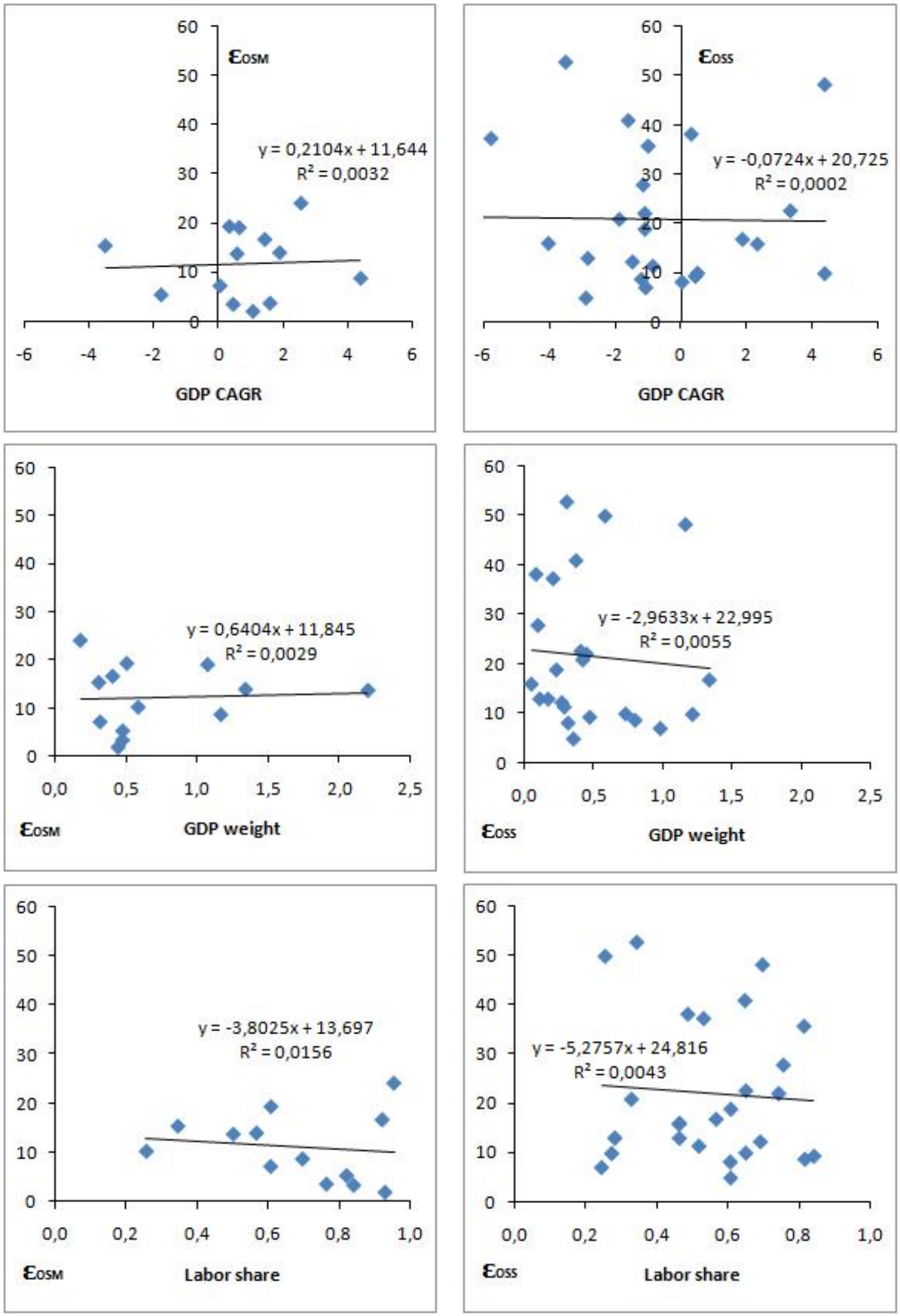


Note: slash-dotted lines show linear trends; left axis is for labor shares, right axis for depreciation.
Source: own calculations, JIP database (2008).

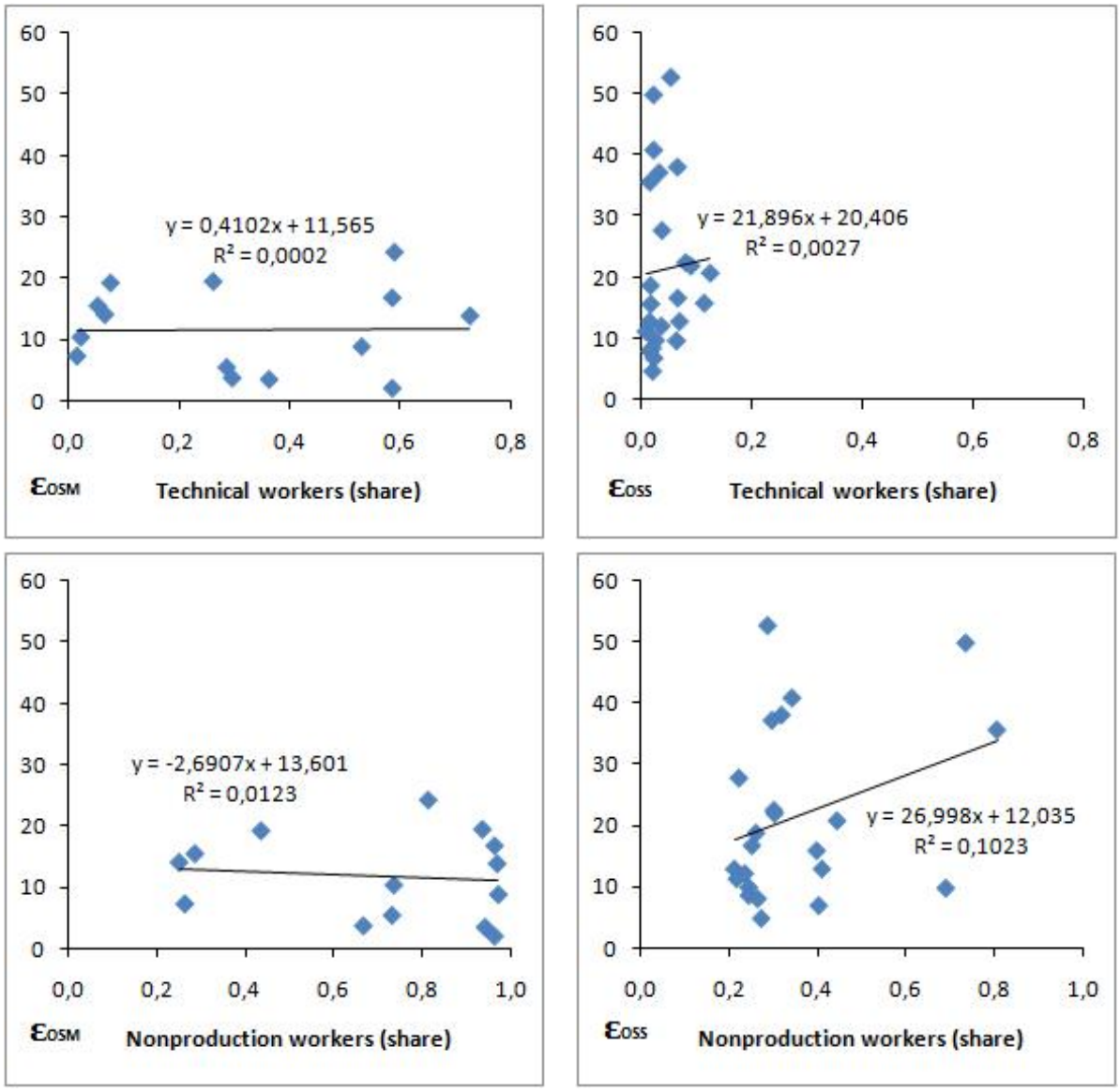
[30] As stated before, for the gross GDP measure I discard 25 industries. For the net GDP measure, in turn, the number of industries where the labor share does not behave properly is now 41. Accordingly, both measures in figure A1 are calculated having this peculiarity in mind.

B Appendix: Correlation analysis

Figure B1: Positive elasticities and selected key variables

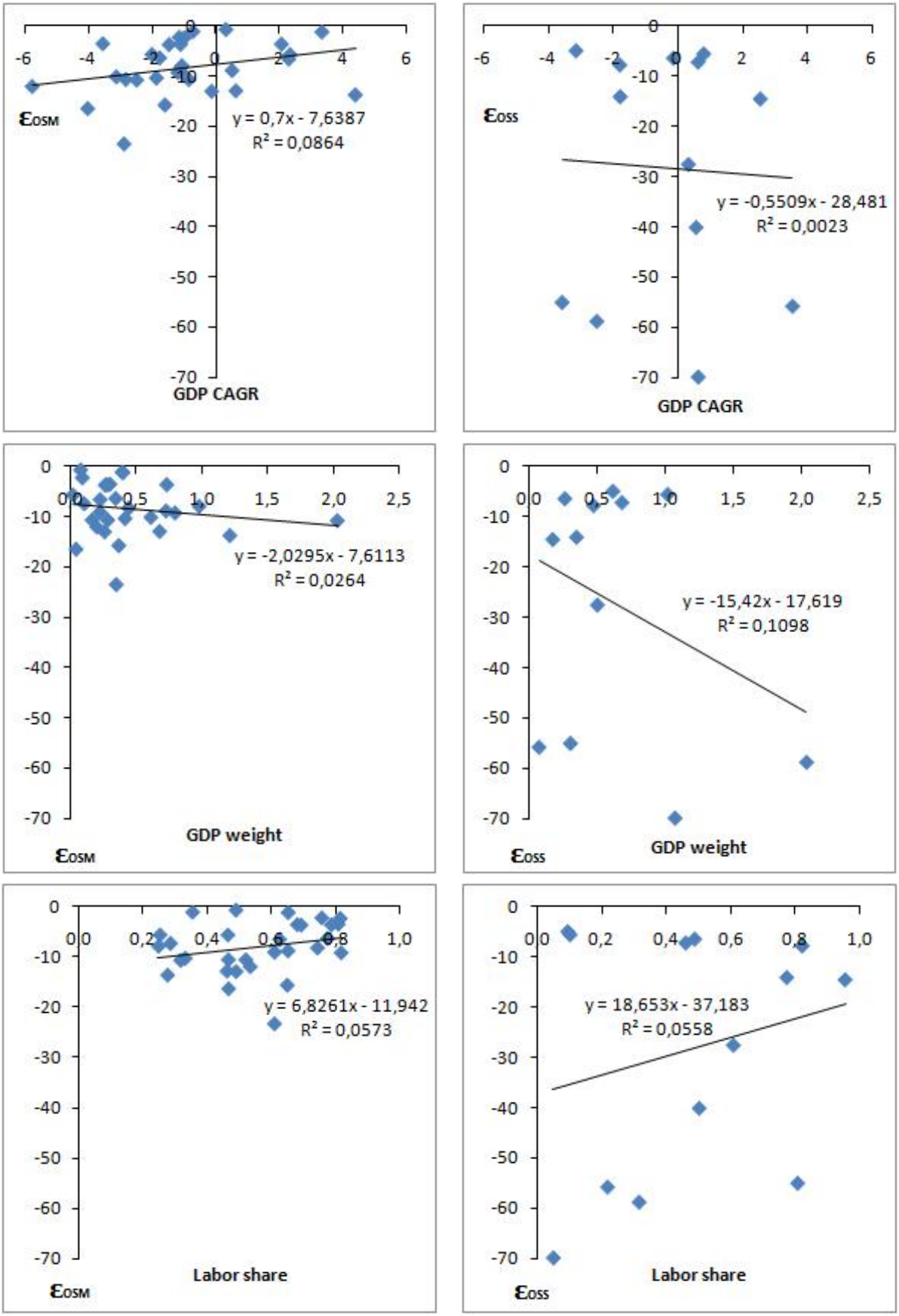


(continued)

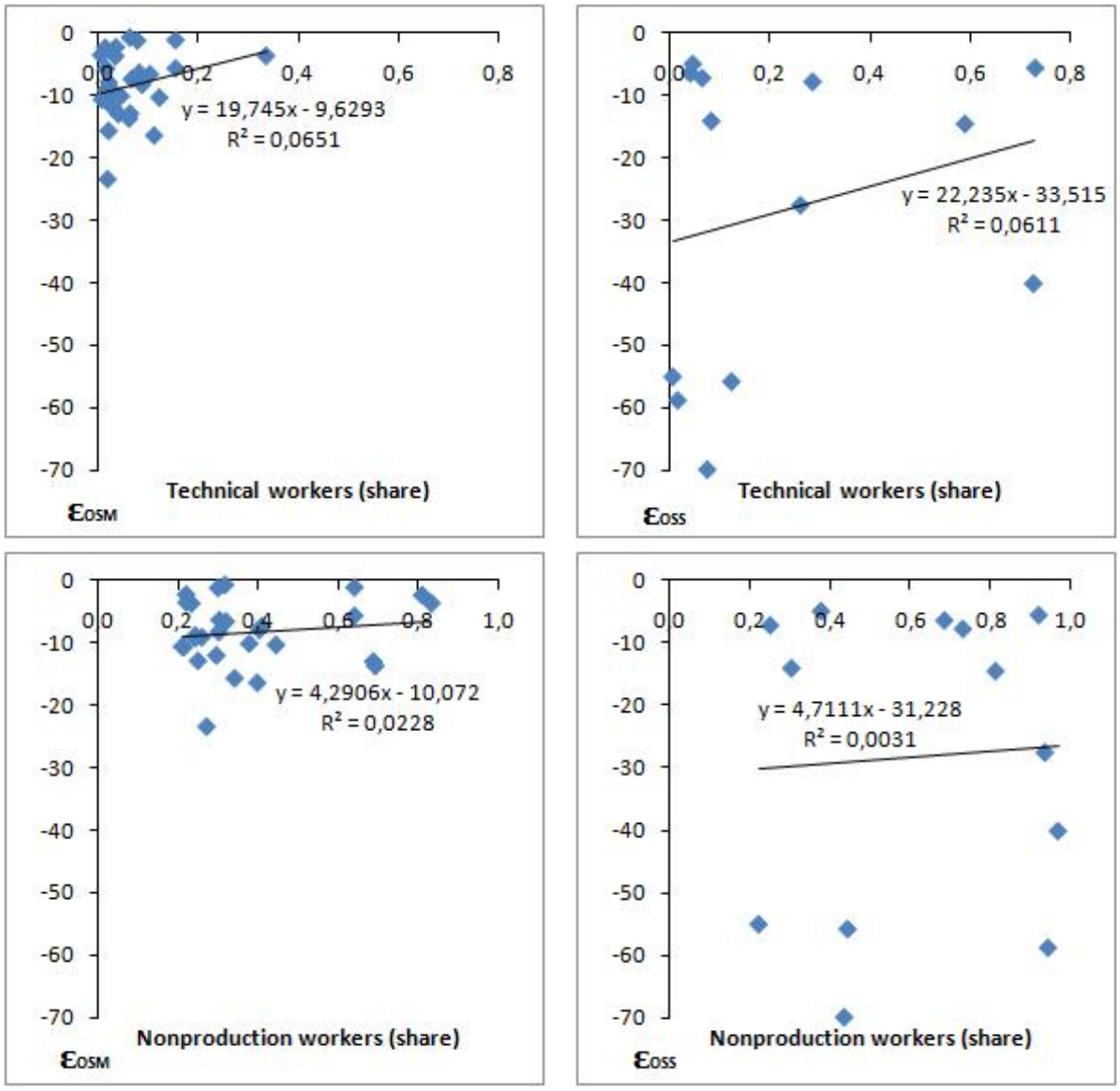


Note: vertical axes are the estimated long run elasticities; outliers removed (2σ range).

Figure B2: Negative elasticities and selected key variables



(continued)



Note: vertical axes are the estimated long run elasticities; outliers removed (2σ range).