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Employment projections for London by sector

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Contents

Introduction

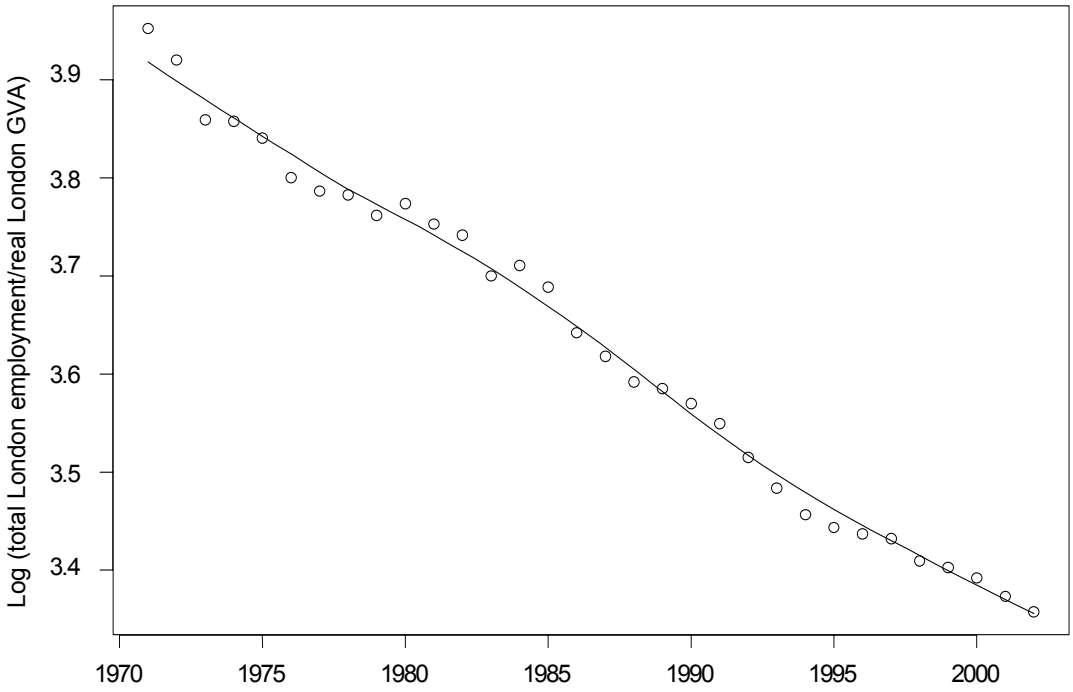
This working paper details the updating of the London employment projections supplied by Volterra Consulting for the Greater London Authority (GLA). The original projections were produced in 2002 with a start year of 2000. Projections were produced for 12 London sectors. These projections are being updated using the same techniques used in 2002 and include two more years of recorded data. The new start year is 2002 with projections being extended to 2026.

The economic theory that underpins the approach is described in detail in Appendix A. Essentially, it is based on standard models of economic growth.

Total London employment projections

This section reviews London's *overall* employment projection. The technique used examines the ratio of total London employment to total London output. This relationship is shown in Figure 1 as a logged ratio. The gradient in Figure 1 is equal to growth that would be required to maintain stable employment.

Figure 1: Log of total employment as a proportion of total output (GVA)[1] in London
1971-2002



Source: Volterra

[1] GVA = Gross Value Added, a measure of output.

Overlaid on Figure 1 is a fitted local regression line, highlighting the historic trend. It can be seen that the last two years of recorded data, for 2001 and 2002, fit the trend almost perfectly. Consequently, the growth rates previously calculated have not been altered. The short-term growth required (2003 to 2007) for stable employment is equal to 1.65 per cent per annum. This is equal to the linear fitted trend from 1990 to 2002. For the short-term trend this is equal to the productivity growth of workers in London. Taking our long-term projected output growth at 2.5 per cent, the implied short-term employment growth is equal to 0.85 per cent per annum. This gives rise to a total employment increase of 194,000 in the five years between 2002 and 2007.

For the longer-term employment projection (beyond 2007) the slightly higher value of 1.7 per cent is taken as the productivity growth, implying slightly lower employment growth of 0.8 per cent per annum. This gives rise to total employment growth of 541,000 between 2002 and 2016, and 958,000 between 2002 and 2026, equal to 21 per cent of total employment in 2002.

These compare to previously forecast rises of 550,000 and 969,000 over the same periods. The primary reason for the slight difference in these projections is that the previously forecast value for 2002 was starting at an employment point 39,000 higher. The difference is equal to the compound growth on these numbers.

Total employment for London in 2000, 2001 and 2002 was recorded at 4.49 million, 4.52 million and 4.48 million respectively. As there was a drop in employment between 2001 and 2002, the most recently recorded year does not match the long-term expected trend. Given this, there is an argument for taking an average of several of the most recent years as the start point for employment growth. If an average of total employment is taken between 2000 and 2002, a period for which average output growth was only 0.3 per cent higher than the long-term forecast value of 2.5 per cent, the theoretical start employment level would be 4.5 million, which is only 19,000 higher than the 2002 recorded figure. Therefore it was decided to keep 2002 as the actual start point for the projections.

London sector employment projections

The same technique used for forecasting total London employment (looking at the historic ratio of employment to London output) was also used to project employment broken down to the sector level. Total London output is used instead of local sectoral growth rates, as local sectoral growth rates are estimated on the basis of employment, which would lead to a circular argument.

The historic data used for the projections is supplied by the GLA, originally from Experian Business Strategies and based on Office of National Statistics figures. One very important difference between this data and the original data in 2002 (supplied by Cambridge Econometrics) is the definition used for financial services. Originally this was

defined to be the Standard Industrial Classification (SIC)[2] two-digit codes 65 and 66, with code number 67, 'activities auxiliary to financial intermediation', allocated to business services. The new data takes the more conventional definitions of financial and business services, allocating code 67 to financial services. As a consequence, the historic data, and subsequently projections for these two sectors are somewhat altered from the previous projections. However, the total for financial and business services taken together is not affected by how the various component sectors are divided between the two.

Taking each of the sectors in turn, breaks in the historic trend of log employment divided by output are identified. The full set of these charts can be found in Appendix B. Depending on the characteristics of the historic trend identified, the year from which the trend up until 2002 best represents the likely future trend varies. In several cases the average of two trends is taken, where it is felt that future growth is more likely to be somewhere between a short and long-term historic trend.

Table 1 shows which trends have been used for each of the 12 sectors, along with the associated growths. Taking long term output to be equal to 2.5 per cent, it can be seen that 'other services' is the fastest growing sector at 2.9 per cent per annum and is the only sector that does not require output growth in order for employment to grow. This is closely matched by hotels, bars and restaurant employment at 2.3 per cent, and business services at 2.5 per cent (reducing to 1.7 per cent after 2007).

The worst performing London sectors are manufacturing and construction, falling by 2.5 percent and 2.7 per cent respectively.

Trend based forecasting has been used here for all sectors with the exception of business services. If the current trend for business services were allowed to continue the sector would grow by around four per cent per annum. Taking this forward, the 2002 level of 1.1 million would increase to around 2.85 million in 2026, an increase of 1.75 million. This would account for over 40 per cent of London employment. It is not believed that such a trend can continue. Therefore the other 11 employment sectors were allowed to grow at the trend-based rates, and business services is constrained as the remainder against the total London employment projections. This leads to short-term growth of 2.5 per cent up until 2007, and 1.7 per cent after that.

[2] SIC is a code used to classify economic activity. It is commonly used when compiling and presenting official statistics.

Table 1: Summary of trends used for sector-based projections

Sector	Trend for projection	Growth required for stable employment	Long term growth with output at 2.5% PA
Primary and utilities	from 95 to 02	4.0	-1.5
Manufacturing	from 93 to 02	5.0	-2.5
Construction	from 88 to 02	5.2	-2.7
Wholesale	½ trend from 81 to 02 ½ trend from 93 to 02	2.2	0.3
Retail	from 92 to 02	1.9	0.6
Hotels & restaurants	from 83 to 02	0.2	2.3
Transport & communications	½ trend from 82 to 02 ½ trend from 90 to 02	3.1	-0.6
Financial services	½ trend from 85 to 02 ½ trend from 93 to 02	1.8	0.7
Business services	NA (residual of total employment)	0.0 (for 02 to 07) 0.8 (for 08 to 26)	2.5 (for 02 to 07) 1.7 (for 08 to 26)
Public administration	½ trend from 78 to 02 ½ trend from 91 to 02	4.3	-1.8
Health & education	from 92 to 02	2.0	0.5
Other services	from 91 to 02	-0.4	2.9
Total employment	from 89/90 to 02	1.65 (for 02 to 07) 1.70 (for 08 to 26)	0.85 (for 02 to 07) 0.80 (for 08 to 26)

Source: Volterra

With these growth rates calculated, the revised sectoral employment projections were produced and are presented in Table 2.

The changes to employment remain broadly in line with previous projections. Four of the sectors have changed by more than 10,000 employment difference across the two projections between 2002 and 2016:

- Construction now falls by 63,000 over the period, instead of 48,000 reflecting a weak trend over the last two years.
- Retail sees growth increase from 9,000 to 35,000 continuing the initial shorter-term trend.
- Hotels, bars and restaurant employment grows slightly less at 112,000 rather than the previous 133,000.
- 'Other services' employment growth increases from 169,000 to 181,000, reflecting a stronger trend in the revised historic data for the sector.

As previously mentioned, 'financial services' and 'business services' employment levels cannot be directly compared to those previously forecast, as employment defined to be in SIC two-digit code 67 has changed from previously being allocated to business services to now being allocated to the more conventional financial services. However the combined change can be compared. Previously the two sectors were forecast to grow 385,000 between 2002 and 2016. The revised combined financial and business services sectors are now forecast to grow by almost exactly the same amount over this period, at 386,000.

Table 2: London sectoral employment projections

2002-2026, assuming output growth of 2.5 per cent

GVA Growth = 2.5% pa (000s)	Primary and utilities	Manufacturing	Construction	Wholesale	Retail	Hotels & restaurants	Transport & comms	Financial services[3]	Business services	Public administration	Health & education	Other services	Total
2002	21	285	201	247	403	298	354	322	1116	221	639	373	4480
2003	21	278	196	247	405	305	352	324	1145	217	642	384	4518
2004	20	272	191	248	408	312	350	326	1175	213	646	395	4557
2005	20	265	186	249	410	319	348	329	1204	209	649	407	4595
2006	20	258	181	250	413	327	346	331	1234	205	652	418	4634
2007	20	251	176	251	415	334	344	333	1265	201	655	429	4674
2008	19	245	172	252	418	342	343	335	1287	198	659	443	4711
2009	19	240	167	252	420	350	341	337	1309	195	662	456	4749
2010	19	234	163	253	423	359	339	340	1332	191	665	470	4787
2011	18	228	159	254	425	367	337	342	1354	188	668	484	4825
2012	18	223	155	255	428	375	335	344	1377	184	672	498	4864
2013	18	217	151	256	430	384	333	347	1400	181	675	511	4903
2014	18	211	146	257	433	392	331	349	1423	178	679	526	4942
2015	17	205	142	257	435	401	329	351	1447	174	682	540	4981
2016	17	199	138	258	438	410	327	354	1471	170	685	554	5021
2017	17	195	135	259	441	420	325	356	1486	168	689	571	5061
2018	17	191	131	260	443	430	324	358	1502	165	692	589	5102
2019	16	186	128	261	446	440	322	361	1518	162	696	607	5143
2020	16	182	125	262	449	450	320	363	1534	159	699	625	5184
2021	16	177	122	263	451	461	318	366	1550	156	703	643	5225
2022	16	173	119	263	454	471	316	368	1567	154	706	661	5267
2023	15	168	115	264	457	482	315	370	1583	151	710	679	5309
2024	15	164	112	265	459	493	313	373	1600	148	713	698	5352
2025	15	159	109	266	462	503	311	375	1616	145	717	716	5395
2026	15	154	105	267	465	514	309	378	1633	142	720	735	5438

Source: Volterra

[3] Financial services is defined to be SIC two-digit codes 65, 66 and 67 N.B. Previous Volterra forecasts allocated code 67 to business services.

Appendix A: Notes on the Volterra model

1. The outline of the model is as follows:

- We make an assumption about the sustainable medium-term growth rate of the London economy.
- We project trends in the level of employment per unit of output.
- This gives us the level of demand for labour that would be associated with the level of output implied by the growth rate, in the absence of any constraints[4].
- The absence of constraints implies that the level of employment which workers are willing to supply equals the potential demand.
- We project trends in the number of journeys into central London per unit of employment in that area.
- This gives us the unconstrained number of journeys. In other words, the number of journeys that would be associated with the demand for labour, in the absence of any constraints.
- Crossrail provide us with estimates of the peak hour capacity of the transport system (into central London).
- Crossrail also provide estimates of the feasibility of actually carrying various levels of journeys relative to peak hour capacity.
- If the level of unconstrained demand for employment and hence for journeys is below a critical proportion of peak hour capacity, the actual level of employment is projected to be the unconstrained level.
- Within a certain range above this critical level, a proportion of the unconstrained journeys will not actually take place. There is therefore a constraint on the level of employment. Above the upper limit of this range, no additional journeys can be made.
- This constrained level of employment is associated with a lower level of output than would otherwise take place.

2. The model is a tool for thinking about the wide range of issues involved in assessing the potential demand for labour in central London, and how transport capacity constraints might affect this.

It cannot be stressed too strongly that, as is almost always the case in the social sciences, there is considerable uncertainty about what constitutes an appropriate model to analyse this question. The mere formalisation of a 'model' in simple algebra can often serve to complicate rather than clarify our understanding of what is a complex problem.

3. We can start with a simple production function:

$$Y = ALe^{\beta t} \qquad (1)$$

where Y is output and L is employment.

[4] Strictly speaking, we assume implicitly that whatever constraints might have existed in the past continue into the future. It is therefore any *additional* constraints which are relevant

We assume that in the medium term the rate of growth of potential output is given by:

$$Y_{trend} = Y(0)e^{\gamma t} \qquad (2)$$

Following HM Treasury's cautious trend growth assumptions, we assume that $\gamma = 0.025$.

In the absence of constraints, in the medium term actual output is assumed to be equal to potential. So we can re-write (1) as:

$$Y(0)e^{\gamma t} = ALe^{\beta t} \quad (4)$$

and solve for the potential level of demand for employment, subsuming the constant terms Y(0) and A as appropriate into a single term, k_1.

$$L_{trend} = k_1 \, e^{(\gamma - \beta)t} \qquad (4)$$

This is the level of employment which would enable the trend rate of growth to be sustained.

The parameter β is not in fact time-invariant in our model. We use a non-linear statistical approach on historical data to inform us on how to calibrate a piece-wise linear function for β, and use this as a basis for projecting β into the future.

Clearly, the choice of β and γ are crucial to the medium-term assessment of the potential demand for employment, but this much is obvious from the first three bullet points in (1) above.

If no constraints exist on meeting the potential trend demand for employment, then the supply of labour must grow at the same rate.

Suppose we assume that the supply of employment depends positively on the real wage. It is not clear theoretically even what sign the elasticity should be. Further, the elasticity of labour supply with respect to the real wage is one of the least understood issues in applied economics, which is certainly saying something.

But, pressing on and assuming that

$$L_{supply} = L(0)W^{\theta t} \qquad (5)$$

where W is the real wage and we would like $\theta > 0$.

The sustainable growth rate in the real wage can reasonably be assumed to be equal to the rate of growth of productivity:

$$W_{trend} = W(0)e^{\beta t} \qquad (6)$$

So, again subsuming constants in a term k_2,

$$L_{supply} = k_2 e^{\beta\theta t} \qquad (7)$$

But to sustain the potential growth rate, supply must grow at the same rate as demand, so that

$$k_2 e^{\beta\theta t} = k_1 e^{(\gamma - \beta)t} \qquad (8)$$

So $\beta\theta = \gamma - \beta$, and we have:

$$\theta = \gamma/\beta - 1 \qquad (9)$$

For plausible values of γ and β, $\gamma/\beta > 1$, so θ is positive. If we take our earlier assumptions that $\gamma = 0.025$ and $\beta = 0.017$, then the elasticity of labour supply with respect to the real wage is approximately 0.5.

Physical capacity constraints

We now consider the potential impact of capacity constraints. One way of thinking about this is the sheer physical capacity of the system. Even if workers are willing to supply their employment, it might not be feasible for the transport system to carry them in sufficient numbers. Another way is to think of the level of utility which arises from any given level of the real wage as depending on the level of crowding on the transport system. The higher the level of crowding, the lower the level of utility derived from any given level of the real wage.

In practice, we might expect to observe some combination of the two. Here are both versions in the context of the Volterra model:

Associated with any given demand for employment in central London will be a number of journeys into the area at peak time which are required to get the workers to their jobs.

$$J^* = \varphi_1 L \qquad (10)$$

where J^* is the number of journeys required to satisfy any given level of L, and $\varphi_1 < 1$ (not all journeys are at peak time; people may be on holiday; people may not travel every day into the central zone etc.).

Again, in our operational version of the model, φ_1 is not a time-invariant parameter. We use a non-linear statistical approach on historical data to inform us on how to calibrate a piece-wise linear function for φ_1, and use this as a basis for projecting φ_1 into the future.

Available to us for different scenarios are system capacity levels for the peak period rail travel across the central cordon[5]. From these we can work out a crowding ratio for the area.

$$\alpha = J / C \qquad (11)$$

where C is the capacity and α is the crowding ratio. We can calculate α_0, the currently experienced crowding ratio and also α^*, the crowding ratio that would be required to support future journey demands.

$$\alpha^* = J^* / C_F \qquad (12)$$

where C_F is a future capacity. From discussion with Crossrail, we choose to limit possible journey supply through the value of the crowding ratio. Denoting by J, the actual number of journeys made are determined by the following equations:

for $\alpha^* \leq \alpha_0$, $J = \alpha^* C$

for $\alpha_0 < \alpha^* \leq 1.4\alpha_0$, $J = \alpha_0 C + 0.2\alpha_0 C * ((\alpha^* - \alpha_0) / (1.4\alpha_0 - \alpha_0))$ {13}

and for $\alpha^* > 1.4\alpha_0$, $J = 1.2\alpha_0$

In other words, below the current level of crowding all journeys are feasible and the actual number is the same as the number required to satisfy potential demand.

Between the current level of crowding and a level 40 per cent higher than current, only half of the extra journey demand is met. Above this level of the implied crowding ratio, the journey demand is capped to half of the extra demand. In other words, the maximum obtainable crowding ratio is 20 per cent higher than currently observed and this is obtained when the future implied ratio would be 40 per cent higher.

If the level of J^* is such that $\alpha^* > \alpha_0$, then the actual number of journeys which are feasible to make is less than J^*. From (10), the level of employment is therefore lower than it would be in the absence of constraints. And from (1), the level of output is lower.

In this model, different kinds of labour (cleaners, merger and acquisition specialists) are not differentiated. It is an important issue as to whether one or the other is more likely to be constrained from travelling, but expressing this in algebra does not help us decide the issue in any way, as the next section shows.

Incentive constraints

We can think of two variants of this. Suppose, for example, that the supply of journeys which people are willing to make depends in part upon the real price of travel.

[5] The central cordon roughly corresponds to the former Greater London Council boundary. For more information, please see Transport for London, *Transport Statistics for London 2001*, p. 25.

We might further assume that the authorities are sufficiently well informed about the price elasticity of demand amongst all social groups that they are able to, say, set price so the supply of journeys which people are willing to make is always less than or equal to $JT = \alpha_0 C$. In other words, they set price such that the carrying capacity constraints of the system never operate. It is a matter of judgement as to whether such a level of price would be deemed to be politically feasible, but this consideration is outside this working paper's scope and therefore does not need to be explored.

In these circumstances, it does not seem unreasonable to assume that people in less highly productive jobs are more likely to be deterred by the real price increases than wealthier people in more productive jobs. There would then be a supposition that most of the resulting shortfall in labour availability, below the potential level of demand, would be in less productive industries.

Suppose now, however, that the authorities make no attempt to control crowding by the price mechanism. Instead, individuals decide not to travel into central London because their utility is adversely affected.

We let utility depend upon some function of the real wage and the level of crowding:

$$U = f(W, [J| J>J_T]) \qquad (14)$$

where $f_W > 0$ and $f_{[\,]} < 0$.

In other words, if J rises above J_T, the utility associated with any given level of the real wage is reduced.

It is hard to imagine that this is not a feature of reality. Beyond a certain level of crowding, journeys become unpleasant and more unreliable as the system strains to cope.

However, it is not at all clear that wealthier people will be less deterred by crowding than poorer people. Indeed, poorer people have to put up with more inconvenience more generally in life, and so might simply carry on travelling in more or less the same numbers as they would otherwise have done. In addition, the budget constraint facing the wealthier is further from the origin, giving them more choice over whether, for example, to persist with crowded and unpleasant travel or whether to move to other cities such as New York or Paris.

4. The Volterra model can be set out in simple algebra. But this does not help us to make better judgements about the important issues that are involved.

Appendix B: Historic sectoral employment charts

All the figures in this Appendix are supplied by Volterra.

Figure B1: Log of primary and utilities employment as a proportion of total output (GVA) in London

1971 – 2002 (1980 and 1990 highlighted)

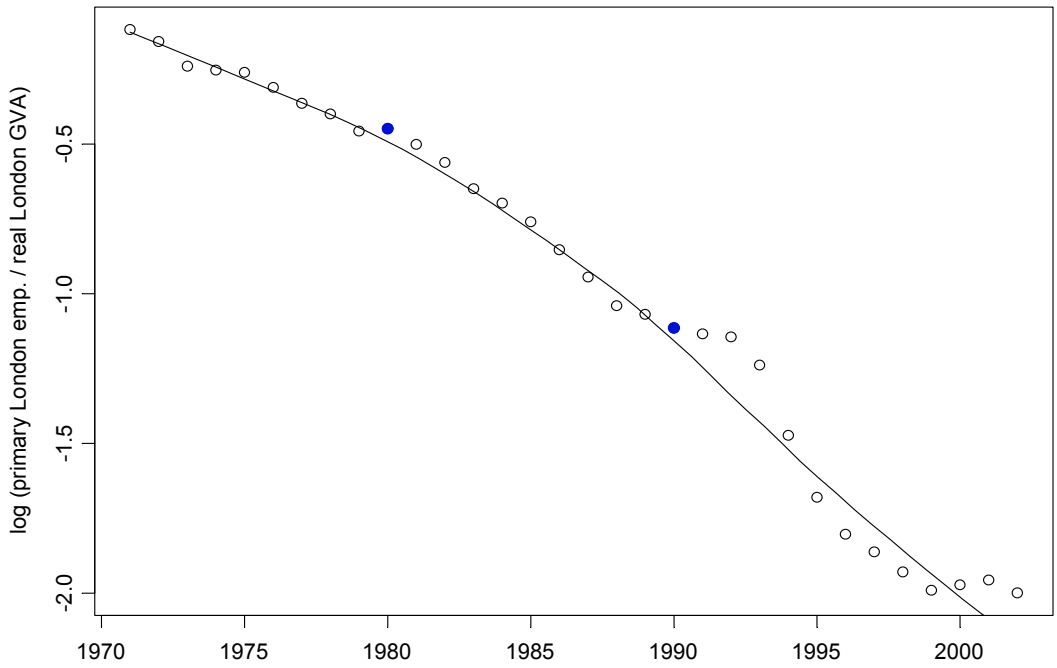


Figure B2: Log of manufacturing employment as a proportion of total output (GVA) in London

1971 – 2002 (1980 and 1990 highlighted)

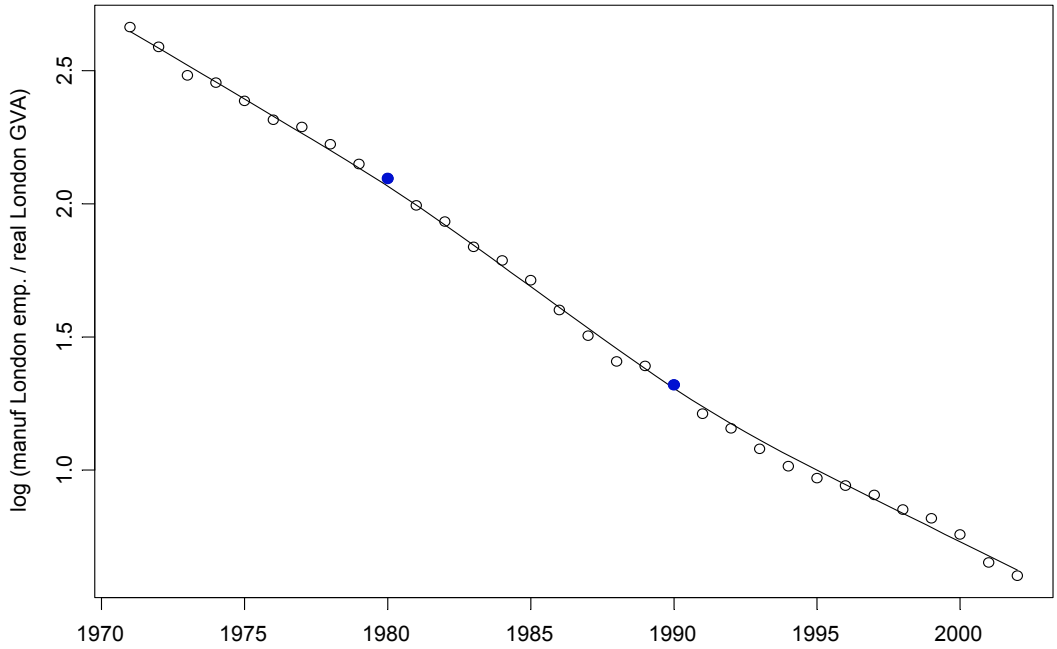


Figure B3: Log of construction employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)

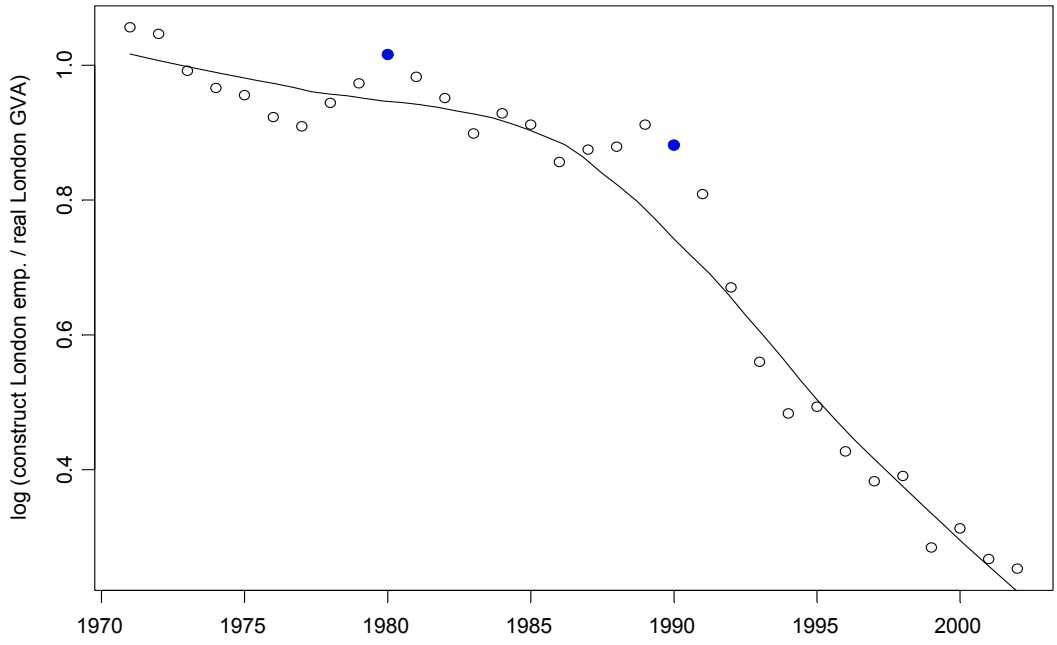


Figure B4: Log of wholesale employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)

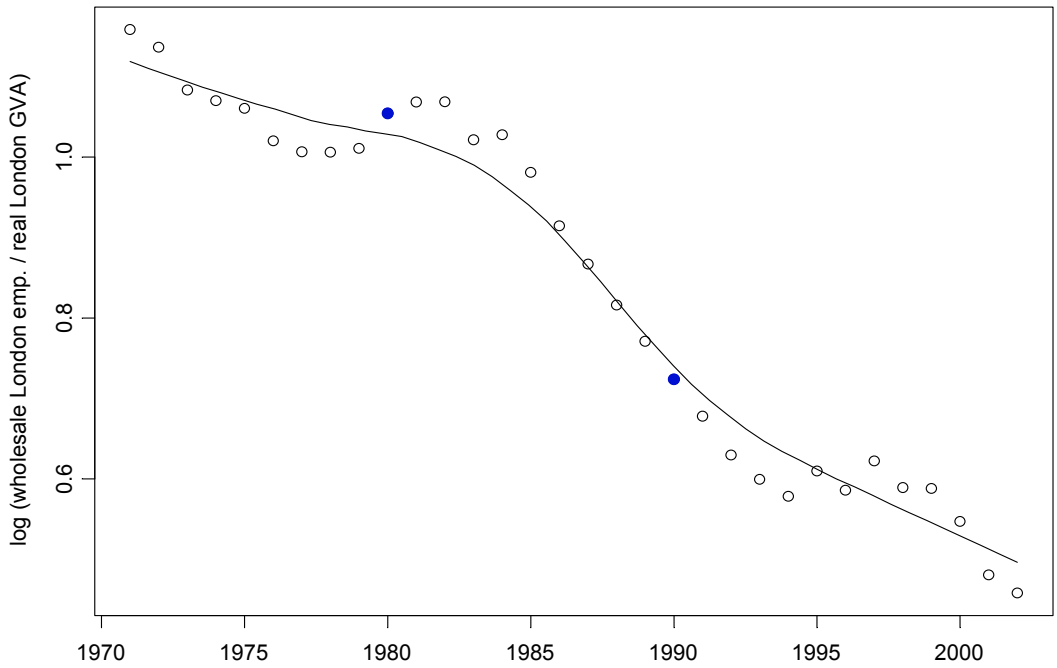


Figure B5: Log of retail employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)

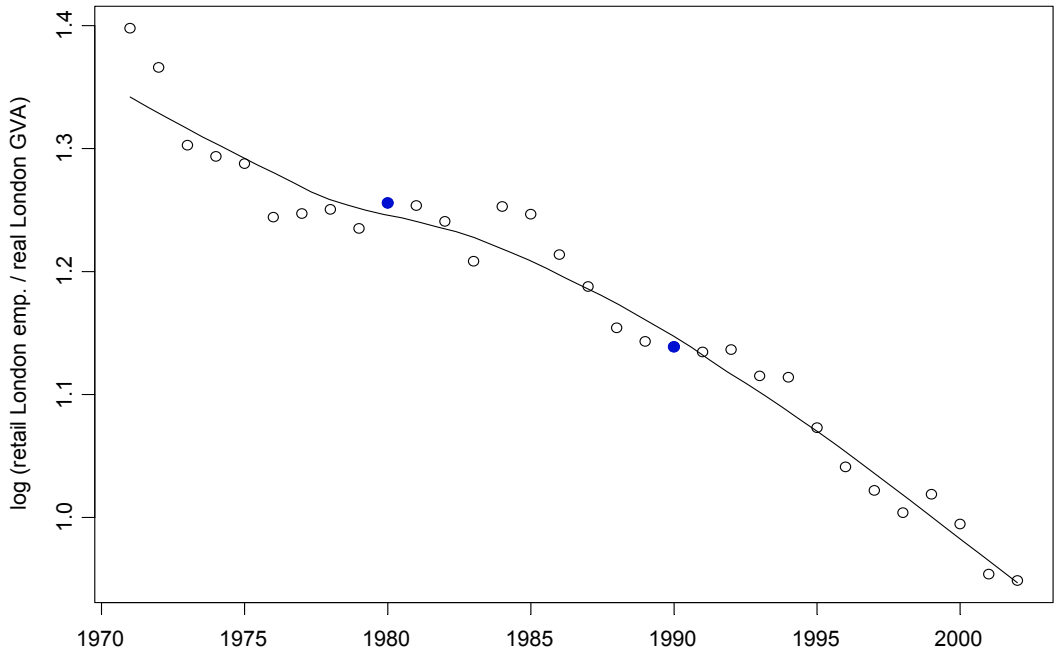


Figure B6: Log of hotels, bars and restaurant employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)

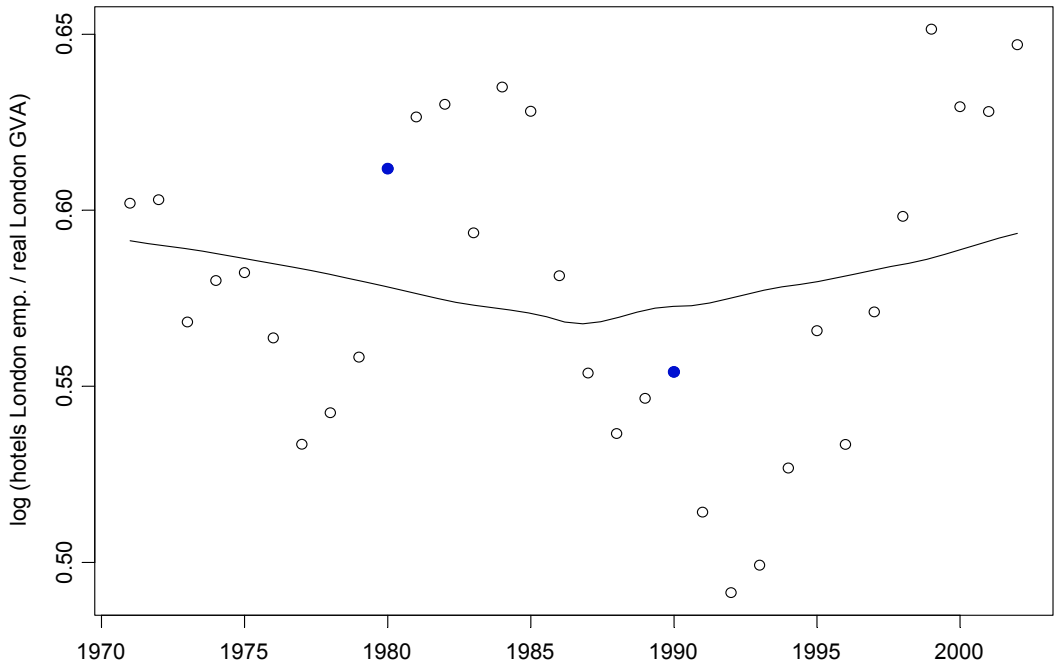


Figure B7: Log of transport and communication employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)

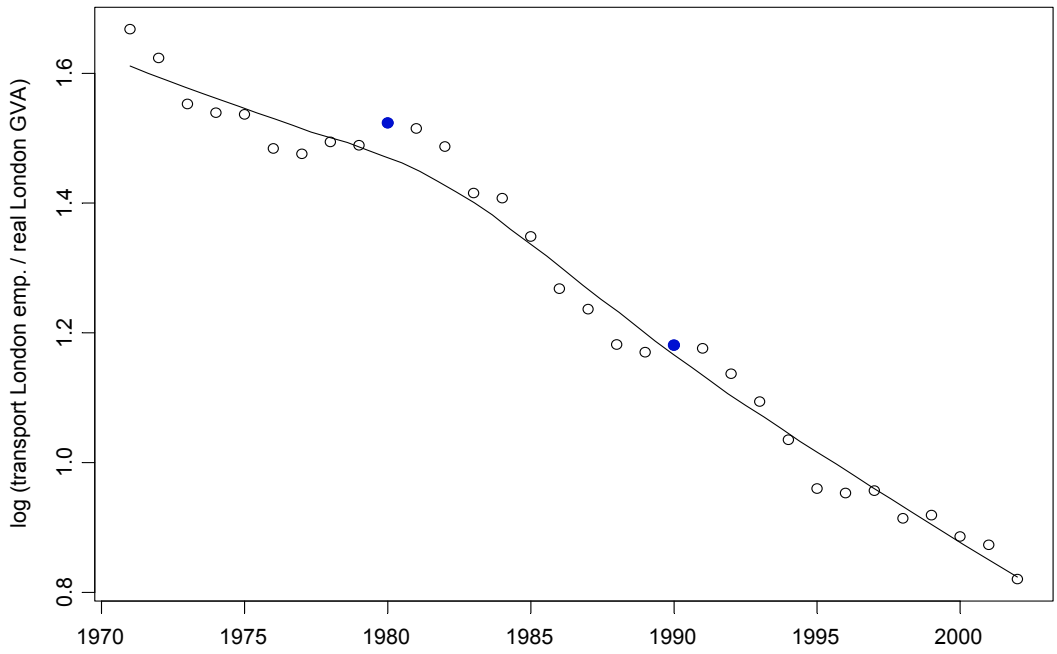
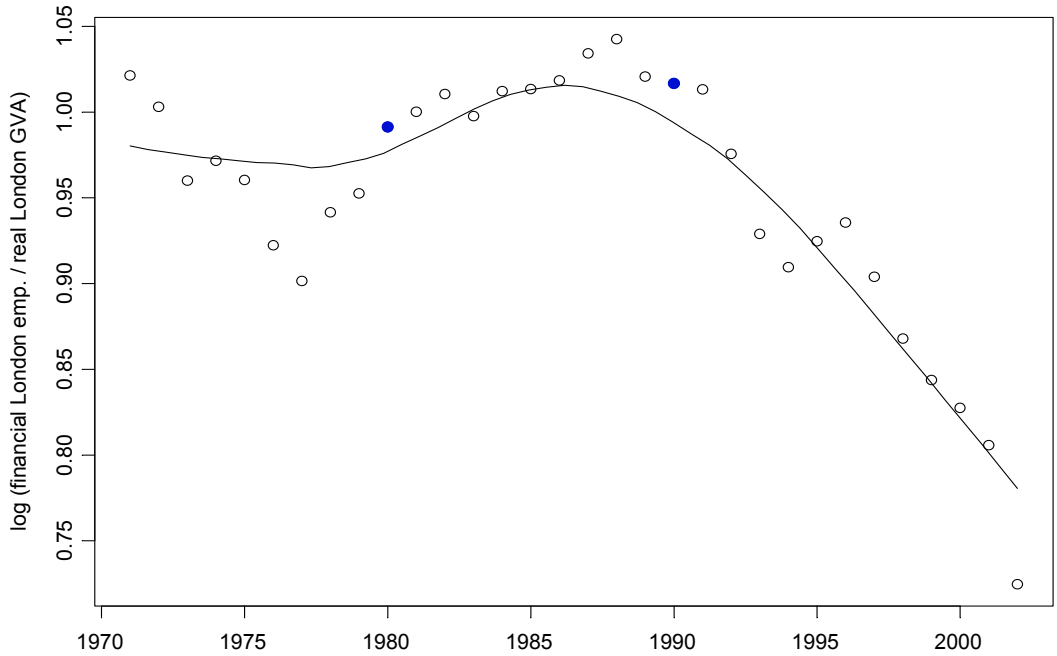


Figure B8: Log of financial employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)[6]



[6] Financial services is defined to be SIC two-digit codes 65, 66 and 67.

Figure B9: Log of business service employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)[7]

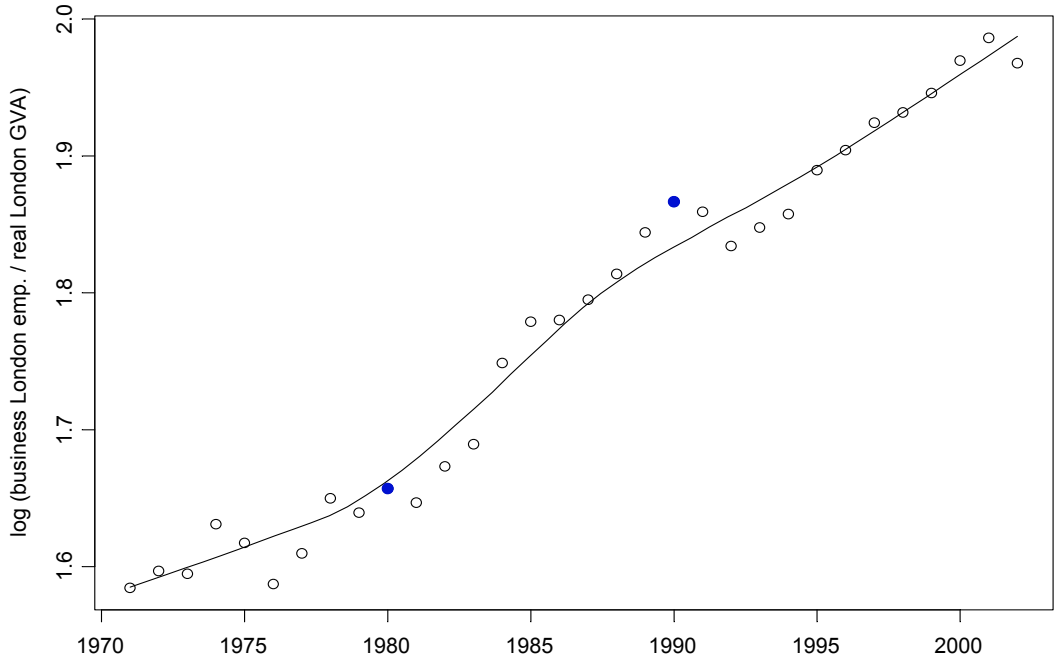
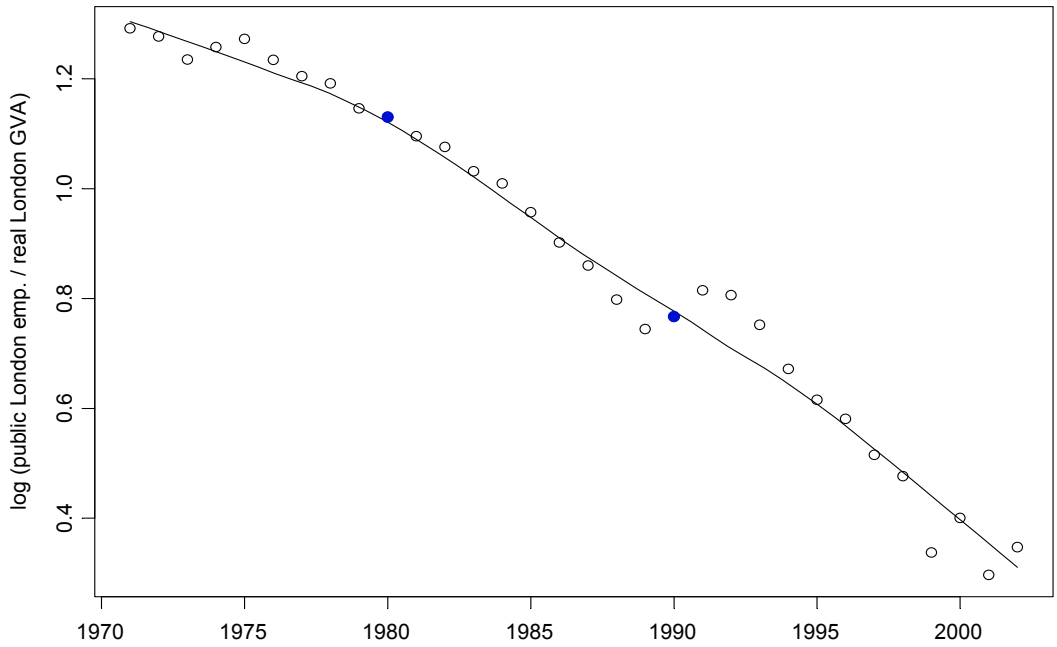


Figure B10: Log of public administration employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)



[7] Business services is defined to be SIC two-digit codes 70, 71, 72, 73 and 74.

Figure B11: Log of health and education employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)

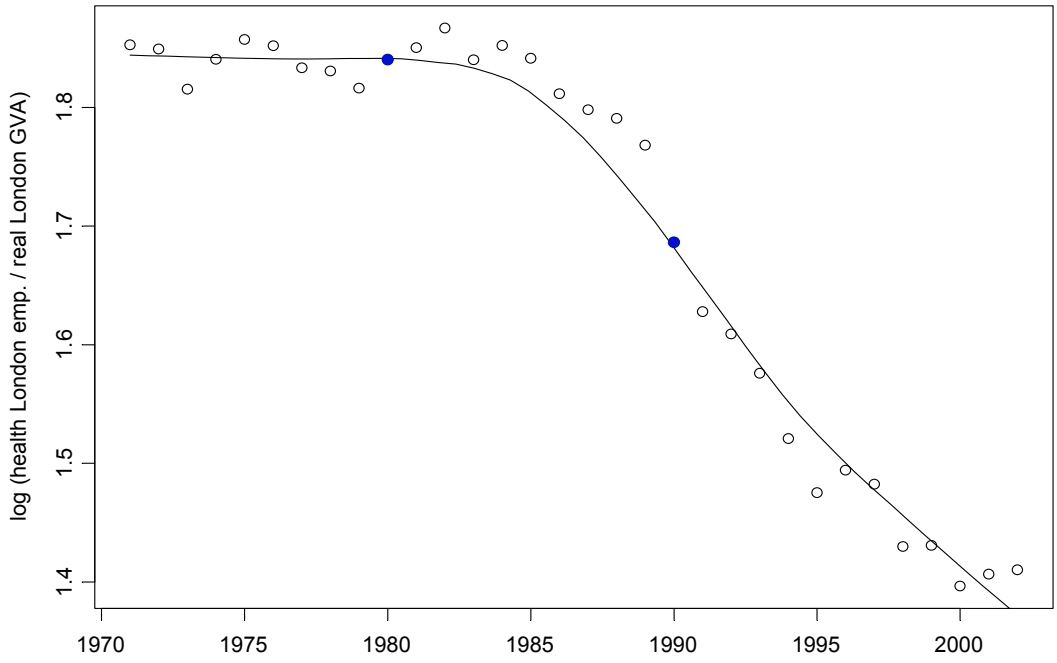
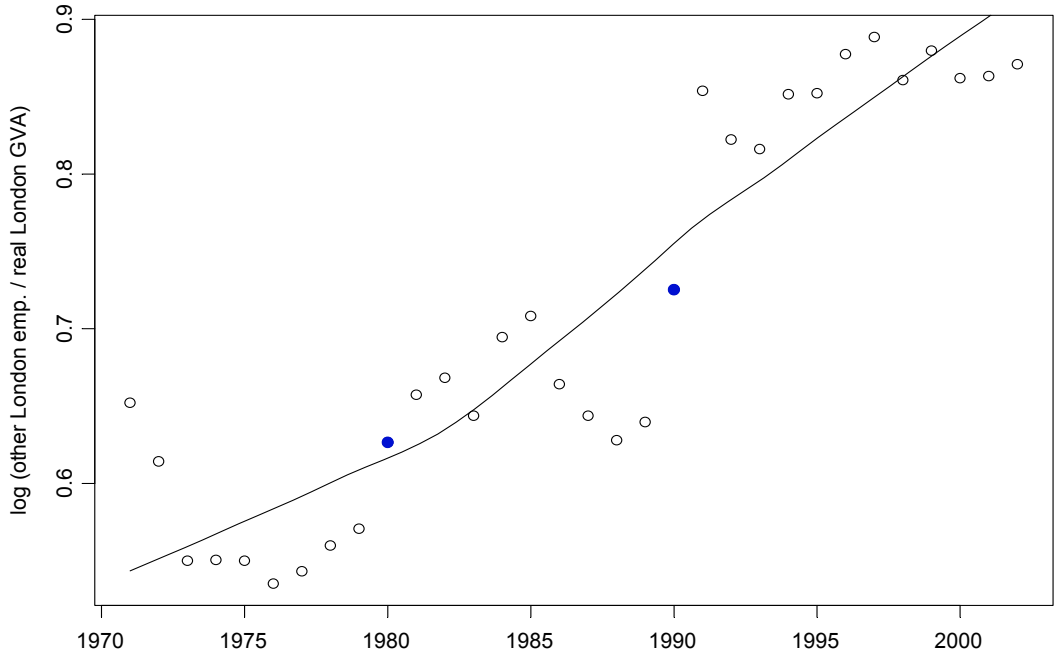


Figure B12: Log of other services employment as a proportion of total output (GVA) in London
1971 – 2002 (1980 and 1990 highlighted)



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Chinese

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Hindi

यदि आप इस दस्तावेज की प्रति अपनी भाषा में चाहते हैं, तो कृपया निम्नलिखित नंबर पर फोन करें अथवा नीचे दिये गये पते पर संपर्क करें

Vietnamese

Nếu bạn muốn có văn bản tài liệu này bằng ngôn ngữ của mình, hãy liên hệ theo số điện thoại hoặc địa chỉ dưới đây.

Bengali

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি (কপি) চান, তা হলে নীচের ফোন্ নম্বরে বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

Greek

Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος εγγράφου στη δική σας γλώσσα, παρακαλείστε να επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυδρομικά στην παρακάτω διεύθυνση.

Urdu

اگر آپ اِس دستاویز کی نقل اپنی زبان میں چاھتے ھیں، تو براہ کرم نیچے دئے گئے نمبر پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

Turkish

Bu belgenin kendi dilinizde hazırlanmış bir nüshasını edinmek için, lütfen aşağıdaki telefon numarasını arayınız

Arabic

إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى الاتصال برقم الهاتف أو مراسلة العنوان أدناه

Punjabi

ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫ਼ੋਨ ਕਰੋ ਜਾਂ ਹੇਠ ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

Gujarati

જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

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