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At the origins of increased productivity growth in services. Productivity, social savings and the consumer surplus of the film industry, 1900-1938

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Abstract

This paper estimates and compares the benefits cinema technology generated to society in Britain, France and the US between 1900 and 1938. It is shown how cinema industrialised live entertainment, by standardisation, automation and making it tradable. The economic impact is measured in three ways: TFP-growth, social savings in 1938 and the consumer surplus enjoyed in 1938. Preliminary findings suggest that the entertainment industry accounted for 1.5 to 1.7 percent of national TFP-growth and for 0.9 to 1.6 percent of real GDP-growth in the three countries. Social savings were highest in the US (c. 2.5 billion dollars and three million workers) and relatively modest in Britain and France, possibly because of the relative abundance of skilled live-entertainment workers. Comparative social savings at entertainment PPP-ratios inflate British social savings to above the US level. Converging exchange rates and PPP price ratios suggest rapid international market integration. The paper's methodology and findings may give insight in technological change in other service industries that were also industrialised.

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So long as the number of persons who can be reached by a human voice is strictly limited, it is not very likely that any singer will make an advance on the £10,000 said to have been earned in a season by Mrs. Billington at the beginning of the last century, nearly as great as that which the business leaders of the present generation have made on the last.

Alfred Marshall[1]

1. Introduction

This paper deals with a major issue in the study of economic development, namely that of knowing whether the tertiary sector is ever capable of achieving, through technological progress, the productivity gains that historically have characterised mainly industry and agriculture. It aims to show that there is nothing inevitable in the long term slow or even nil growth of labour productivity in service industries predicted by some,[2] and it uses the example of mass public entertainment during the first half of the 20th century to mount this challenge to the received wisdom on the subject. The idea is that services could be ”industrialised” and subjected to continual technological improvement. The result was a product that became many times cheaper, of better quality and greater accessibility, with the attendant welfare gains that the paper tries to quantify.[3]

The emerging film industry was the first in a chain of modern entertainment industries that industrialised services. It automated and standardised live entertainment, and transformed it into a tradable product, thereby integrating previously isolated markets. As the industry developed, its competition with existing live-entertainment increased, and consumers gradually substituted filmed entertainment for live-entertainment. The rate of substitution accelerated when sound film technology was introduced in the late 1920s,

[1] *Principles of Economics*, 8th edition (New York, MacMillan, reprint 1947), pp. 685-686; quoted in Rosen, “Economics of superstars.”

[2] Baumol, “Macroeconomics of Unbalanced Growth;” ---, Blackman and Wolff, “Unbalanced Growth Revisited;” ---, and Bowen, *Performing Arts*.

[3] The author is grateful to Jaime Reis for helping to put these thoughts into shape.

automating away the orchestras and supporting acts in cinemas - thus doing away with the last major competitive advantage of live-entertainment.

In the period between the turn of the century and the Second World War, film was a major new consumer good. It had a massive impact on the daily life of consumers: by the late 1930s, the majority of the population in the Western world went to the movies at least once a month. Like other major innovations—such as the car, electricity, chemicals and the aeroplane—cinema emerged in most Western countries at the same time. From the 1910s onwards, each year billions of cinema-tickets were sold and consumers who did not regularly visit the cinema became a minority. In Italy, today hardly significant in international entertainment, the film industry was the fourth-largest export industry before the First World War. In the depression-struck US, film was the tenth most profitable industry, and in 1930s France it was the fastest-growing industry, followed by paper and electricity, while in Britain the number of cinema-tickets sold rose to almost one billion a year.[4]

Despite this economic significance, despite its rapid emergence and growth, despite its pronounced effect on the everyday life of consumers, and despite its importance as an early case of the industrialisation of services, economic historians have hardly examined the film industry. This paper will try to assess the contribution of cinema to total economic welfare. It will assess the impact of film technology on productivity growth in the entertainment industry and the consumer surplus it generated. It will first estimate the growth of total factor productivity (TFP) in the industry, then the social savings it generated in 1938, and finally, the consumer surplus generated in 1938. These findings will be compared, as the three approaches have some raakvlakken: the social savings should equal the intensive growth contribution, and the elasticity measured in the consumer surplus section can be used to make a social savings estimate at

[4] Bakker, "Entertainment Industrialised."

'actual' elasticities. Combined, these three approaches are a powerful tool to assess the impact of a new product, even if their results differ.

An alternative hypothesis would be that cinema required disproportionately more capital, and that TFP-growth and social savings actually were negative, and cinema technology led to a decrease in total consumer welfare. This implies that the live entertainment technology as available in 1900 would have been able to achieve the same output growth at lower costs, and serve consumers the same quantity they were consuming in 1938 at lower costs, assuming quality was the same.[5]

This paper will also try to show that productivity growth in entertainment could differ substantially across countries. Intuitively, if live entertainment could only show infinitesimal productivity increase, one would expect to see roughly the same level of productivity in each country, since it would be easy for national industries to reach the 'basic level' before productivity growth becomes impossible. Since the production possibility frontier would be in easy reach of everybody, and would shift outward only incrementally or not at all, most countries can be expected to be conveniently located close to this frontier. When there exists the occasional pronounced difference this could then be explained by a peculiarity, for example, an extremely high cost of labour, which would make such an infinitesimal increase feasible. If there is no theoretical limit to productivity increase in entertainment, one would expect to see quite some differences between countries, as the productivity adapts to the relative factor costs of land (city-centre real estate), labour and capital in the countries, and specific endowments such as population density and geography.

The research in this paper is worthwhile to undertake because the emergence of the film industry was one of the first cases in which a service industry became industrialised, and in a revolutionary way. The findings of this paper may therefore change the notions of economic historians on service

industries and the ideas of Baumol e.a. that productivity in services is inherently stagnant.[6] The paper estimates the increase in welfare generated by a new technology and examines a new form of 'service industries-industrialisation', but also more in general, because the productivity of services constitutes the frontier of research in economic history today. Agriculture has reached astronomical levels of productivity and uses a small part of the labour force, and manufacturing has gradually moved in the same direction: either it is highly competitive or heavily subsidised. In developed countries today, the majority of persons work in services: apparently, the parasite has grown larger than the body that is parasited. Moreover, on a methodological level, scholars have a relatively good knowledge and intuition about how productivity and automation work in manufacturing, and how it can be measured. For services, more research needs to be done.[7]

Analysis of the American market will be the main object of this paper: it was the largest film market and eventually became the world's film production and distribution centre. Two countries have been selected to represent the European market: Britain, because it was the world's second largest entertainment market and culturally close to the US; France because it was the world's largest or second-largest film exporter before the 1920s, despite its limited home market, and it was culturally more distant from the US.

The late 1930s are chosen as end-point because at that time cinema was at its height and generated on its own the most social savings: the coming of sound in the late 1920s had driven out most live entertainment and despite a few experiments, television had still to arrive. The other two media technologies, recorded music and radio, had not reached their peak yet. The phonograph had always remained a kind of luxury, elite product for niche groups of consumers,

[5] It could also have been the case that cinema was only viable because of large wage increases, and that it therefore made sense to use more capital-intensive production.
[6] E.g. Baumol, "Unbalanced growth."
[7] Pioneering work in this respect has been done by Broadberry and Ghosal, "Counting House."

and although radio expanded rapidly in the 1920s, it would only reach its peak during the 1940s and early 1950s.

Reliable and exact data sources on the entertainment industry were difficult to obtain. Especially for the 1900 figures, sometimes estimates had to be made based on indirect indicators. Although the estimated values are not very precise, it is expected that further precision will not fundamentally affect the findings of the paper and the cross-country differences. In the data appendix, for each individual estimate it is explained in detail how it is arrived at, so that readers can follow each step of the estimation process and judge the value of the estimates by themselves. Despite the impreciseness in the data, this paper will argue that the degree of precision is large enough to reject competing hypothesis, and to convincingly show that the 'industrialisation hypothesis' is the most likely.

2. Theory

2.1 General

In recent years, more and more research has been done on the contribution of new goods to economic welfare and productivity growth. William Nordhaus concluded that the decrease in the price of light is severely understated in the consumer price index, Walter Oi examined the welfare effect of air conditioners, and others the effects of products such as mobile phones, minivans and Apple Cinnamon breakfast cheerios.[8] J. Bradford de Long has tried to evaluate the contribution of all kinds of new goods combined since the late 19th century.[9]

The calculation of social savings and consumer surplus are based on two different interpretations of cinema. On the one hand, it can be considered as a substitute for theatrical live entertainment (as that was the next-best alternative), and in that case, the social savings measured should be rather high. On the other hand, it can be considered an entirely new good, in which case the consumer surplus will be very large, but the social savings lower. It will be argued here that initially, cinema was an entirely new product, but that over time, from the 1910s onwards, it increasingly became a substitute for theatrical entertainment, and that cinema was more of a new good in Europe than in the US.

2.2. The next best alternative

Although cinema was one of many leisure activities, the next best alternative can be considered spectator entertainment such as music hall, vaudeville, variety, theatre etc. Between c. 1905 and 1917, prices for film increased, while demand grew rapidly,[10] which suggests that it was used as a substitute. Although prices

[8] Nordhaus, "Real-output," Oi, "Welfare Implications," Hausman, "Valuing the Effect of Regulation," Petrin, "Quantifying the Benefits."
[9] De Long, "Cornucopia."
[10] See for example Gomery, *Shared Pleasures.*

went up, changes in quality made film an ever better substitute for live entertainment. In the silent period, films were often interspersed with live entertainment or vice versa. During the first years, cinema was for the most part a totally new product, but gradually the substitutability with other entertainment increased. The introduction of sound films in the late 1920s constituted a major jump in substitutability.[11] Shortly before, Americans spent $1.61 a year on theatre, vs. $3.41 on movies, while in 1940 the figures were $0.44 vs. $4.51 (and in 1945 $1.12 vs. $11.01).[12]

Additional proof is given by the theatre history literature, which often mentions the increasing competition of film. Jack Poggi, for example, writes:

> First the movies created a new audience, many of whom had never been to the theatre; but the desertion of the galleries in theatres in all the large cities indicates that they also began to lure away that part of the theatre audience with the lowest income. Then, as the movies improved in quality and respectability, people from the business and professional classes might be expected to change their entertainment habits. (...) Possibly the habitual New York theatergoers went to both theatre and films for a time and then gradually limited their attendance at live theatre to special occasions. This theory would explain why the less popular plays began closing more quickly, causing a drop in the number of theatre weeks.[13]
>
> (...) the motion pictures could not have crushed the legitimate theatre if there had been a real preference for live drama. Theatre managers would never have turned their buildings over to the movies if they could have made more money by booking plays; a few might have been satisfied if there had been equal profit, or even a little less, in live theatre. Again we come back to the same

[11] For a study of the disastrous effect of sound film technology on the employment of musicians see James P. Kraft, "The "Pit" Musicians. Mechanization in the Movie Theaters, 1926-1934," in: *Labor History*, Vol. 35 No. 1 (Winter 1994), pp. 66-92; ---, "Musicians in Hollywood. Work and technological change in entertainment industries, 1926-1940," in: *Technology and Culture*, Vol. 35 (April 1994), pp. 289-314. See also ---,*Stage to studio.* For a discussion of the impact of sound film on British musicians, see Ehrlich, *Music profession*, pp. 197-210. Concerning the labour-saving aspect of sound film, Ehrlich discusses the cinema organ as an important labour-saving innovation before the coming of sound. Ibid., p. 200.

[12] See figure 3.10.

[13] Poggi, *Theater in America*, p. 79.

> point: people were simply not willing to pay the price necessary to maintain live theatre, except in the largest cities. If they could get what they wanted from the movies, why should they look elsewhere?[14]

Nevertheless, film was only partially a substitute. It also was a new product with new qualities, such as exteriors, many different sets, realistic surroundings, close-ups, points-of-view.

2.3. Measurement

To measure and compare output and consumption, a measure is borrowed from the airline industry, namely the passenger-mile, here changed into the 'spectator-hour'. This is one spectator who watches entertainment for one hour. The number of seats in a theatre during a performance times the time will constitute the number of spectator-hours produced, the number of filled seats times the time, the number of spectator-hours actually sold.[15]

To measure the consumer-surplus, the method of Jerry Hausman is used, who uses own-price elasticity, price and quantity of a good to estimate a lower bound of the consumer surplus generated by a good. So one would only need to estimate price elasticity and have prices and quantities.

[14] Poggi, *Theater in America*, p. 43.

[15] The idea of the spectator-hour is partially the result of the advice of Philip Scranton to look at commonalities between the film and the transport industries. It is also partially based on the notion of William Nordhaus that goods themselves do not really matter, but more the services they provide. In his effort to estimate how much the consumer price index has underestimated the decrease of the price for lighting (several thousand times, according to Nordhaus), covering the period from c. 2500 B.C. until the present, Nordhaus focuses on the services the product (e.g. the candle or light bulb) provides, measured in lumens, not on the price of the lighting device itself. Nordhaus, "Real-output."

3. The growth in total factor productivity

3.1. Estimating the factor shares

The factor shares in growth for the TFP-calculation have been estimated at 0.75 for labour, and 0.25 for capital. For the US, the most complete data on wages are available. In 1938, wages were roughly 69.5 percent of industry revenue.[16] In 1933 and 1935, wages were 86.11 and 75.6 percent of revenue, and in 1939 63.9 percent.[17] It seems likely that between 1900 and 1940, as cinema received a larger and larger share of revenues, the share of labour in output growth became lower and lower. For this reason the labour share has been set at 0.75, and this may even be an underestimate of the actual share. For Britain, no wage data are available, but profits can be estimated to have been £21.3 million in 1938.[18] This amounted to 32.8 percent of industry revenue, putting the British figure in the same ballpark as the US one. The French data seem the least reliable. If a low profitability is assumed and from the 1938 capital data [19] a ten percent profit is calculated, the capital share would still be very high, 37.5 percent. Either the French entertainment industry was more capital-intensive or it was way less profitable. Given the above, the estimate of 0.75 is maintained for all three countries.

3.2. Estimating changes in the labour quality

For the labour data, the number of employees has been used. An issue here is the possibility of changes of quality in the labour force. On the supply side, first of all the over-all average quality of labour of the entire working population increased between 1900 and 1940, because of increased education, in the US for

[16] US Historical Abstracts.
[17] US Historical Abstracts.
[18] The British capital data from the Appendix is combined with Feinstein's estimate that profitability of entertainment increased from roughly 15 percent in 1927 to 18 percent in 1937. C. H. Feinstein, *Domestic capital formation in the United Kingdom, 1920-1938* (Cambridge, 1965).

example from 6.38 years of education in 1900 to 10.03 years in 1938.[20] Further, for the film industry it can be argued that with the ageing of the industry the quality of labour should improve, because of experience and an increasing number of employees who have been trained on the job. So the increase in labour quality of the film industry can be expected to be higher than the national averages. The question, then, is whether the entertainment industry's demand for labour valued a higher quality of labour. Entertainment labour can be divided into managers (company directors, film producers, theatre and cinema managers etc.), creative specialists (actors, directors, writers and the like), technical specialists (cameramen, set designers, make up artists etc.) and medium-skilled and unskilled labour (extras, set-builders, drivers, cash register clerks, cinema employees etc.).

For the creative inputs, the special skills and qualities are difficult to describe, and could only be partially learned by formal education and training. They would include popular appeal, likeability, acting ability and voice. Apart from that, the actors need to have an 'inner motivation' to do their job, as it is difficult to discipline actors (or other creative inputs) in the way that one would discipline workers in a factory. Acting was a skill which needed, apart from learning and training, a certain kind of predisposition and inner motivation, if not popular appeal. It thus could not have been easy to extract every year five percent more actors out of every 100,000 inhabitants, the growth rate between 1870 and 1940, especially in the United States, where skilled labour was in short supply.

Star creative inputs did receive very large payments, but this was only partially for their acting quality.[21] While this quality was a necessary condition,

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[19] See Appendix.
[20] Maddison, *Monitoring*.
[21] A substantial economic literature on the economics of superstars has emerged, starting with Rosen, "Economics of superstars," Adler, "Stardom and Talent," in: *American Economic Review*, Vol. 75 (1985) No. 1, pp. 208-212; Philip J. Cook and Robert H. Frank, *The Winner-take-all Society. How More and More Americans Compete for Ever Fewer and Bigger Prizes, Encouraging Economic Waste, Income Inequality, and an Impoverished Cultural Life* (New York, 1995).

the movie studios used them mainly as brands to creative brand-awareness for their films, which had too short product life-cycles to be branded in themselves. Replacing an actor with a well-known brand name by an unknown actor of the same quality could be costly to film companies.[22] Before 1950, seven-year contracts, asymmetric in practice, enabled the Hollywood studios to capture part of the rents of the creative inputs' brand names.[23] The skills of the managers and technical specialists were also highly industry-specific and difficult to exactly describe or formalise in a degree (at that time).

A way to measure the role of human capital, including training on the job, is to examine wage differentials. A large difference between a maximum and minimum wage would then suggest a large importance of human capital and training on the job, while a small difference would not.[24] In the film industry these wage differentials between the stars and the average wage were enormous. The highest wage for actors and actresses in 1916 was at least 200 times the minimum wage, conservatively estimated, while by 1923 this ratio had increased to 600. For directors, in 1926, the ratio was 50, again conservatively estimated.[25] It is hard to believe that the quality of the services rendered by these creative inputs differed with a similar factor.[26] Also, the ratio does not seem (positively) correlated with the number of years the creative input has been in the industry.

One could argue, however, that at least part of the wage difference would be because of a large training-on-the-job component, especially because film was a new industry. Companies needed to take into account that new actors needed more training and coaching (by, for example, the director) and needed some experience.[27] Also, it is difficult to perfectly observe the likely ticket sales capacity of an actor ex-ante. Initial wages could have been larger when increased

[22] Bakker, "Stars and Stories."
[23] Ibid.
[24] Roses, "Human Capital." See also Mincer, "On-the-job Training," — "Distribution."
[25] Bakker, "Stars and stories."
[26] The crux for this is how quality could be measured.
[27] See e.g. Mincer, "On-the-job training."

with a charge for on-the-job training and an uncertainty premium. Another factor is the intensity of effort. Creative inputs, and to some extent also technical specialist, needed to deliver an extremely intensive effort. A cold or a flue could be disastrous for an actress, and having a 'bad day' in which performance was less, is hardly a possibility in entertainment. The inputs needed to be able to travel and have dynamic and irregular work working lives, while still maintaining an extreme intensity of effort in their work.

Since it is rather difficult to correctly measure the increase in the over-all labour quality, this paper will use the increase in the labour quality of the overall population as a lower bound for that in the entertainment industry. Data from Maddison on the growth of years of education per person aged 15-64 for 1890-1913 and 1913-1950 has been used.[28] The values of 1900 and 1938 have been estimated by geometric interpolation. For France, 1890-1913 data are lacking, and the growth rate for this period has simply been estimated to have been 1.5 times the growth rate between 1913-1950. The labour force in the entertainment industry is thus measured by person-years of education.

[28] Maddison, *Monitoring*, pp. 37, 253.

Table 1. *TFP-growth in the entertainment industry in the US, Britain and France, 1900-1938 (exchange rates).*

	Total			Index		
	US	Britain	France	US	Britain	France
Annual growth 1900-1938 (%)						
Output	7.01	3.01	11.07	100	43	158
Capital	3.64	4.11	6.38	100	113	175
Labour	4.85	1.54	2.45	100	32	51
Combined inputs	4.55	2.19	3.43			
TFP	2.46	0.83	7.63	100	34	310
TFP/Output	35.10	27.46	68.97			
Capital productivity	3.24	-1.06	4.41	100	-33	136
Labour productivity	2.06	1.45	8.41	100	70	408
Capital/labour ratio	-1.15	2.53	3.83	100	-221	-334

Note: all amounts at 1938 prices; a one percent growth in capital is assumed to increase output by 0.25 percent;
a one percent growth in labour to increase output by 0.75 percent (see text).

Sources : see Appendix A, and Appendix B table B1.

Table 2. *TFP-growth at PPP-exchange rates for entertainment, 1900-1938.*

	US	Britain	France	Range max/min
TFP (% per annum)				
Exchange rates	2.46	0.83	7.63	
US prices	2.46	1.69	7.30	
British prices	1.57	0.83	6.38	
French prices	2.78	2.00	7.63	
TFP (US TFP-growth rate = 100)				
Exchange rates	100	34	310	9.2
US prices	100	69	297	4.3
British prices	100	53	406	7.7
French prices	100	72	274	3.8
Capital (% per annum)				
Exchange rates	3.64	4.11	6.38	
US prices	3.64	0.67	7.70	
British prices	7.19	4.11	11.39	
French prices	2.37	-0.57	6.38	
Capital (US capital growth rate = 100))				
Exchange rates	100	113	175	1.8
US prices	100	18	212	11.5
British prices	100	57	158	2.8
French prices	100	-24	269	-11.2

Note: Index numbers are based on US annual growth *rate*; the negative number for Britain means that British capital shrunk in French prices, not that the the stock was negative.
"Range" measures the magnitude of difference between the highest and lowest growth rate; a range of 2.8 means that the fastest growth rate was 2.8 times the slowest growth rate.
Source: Tables 1, B1. Exchange rates: Federal Reserve Bank 1944.

3.3. The growth of total factor productivity

The productivity estimation is shown in table 1, at exchange rates. Because entertainment was a service that was not internationally traded—at least initially—the relative price may not be well represented by using exchange rates. Therefore, purchasing power parity (PPP) is used to obtain appropriate price ratios.[29] If one spectator-hour, for example, costs $1 in the US and £0.16 in Britain, then the appropriate price ratio would be $1=£0.16. The TFP-growth figures at PPP price ratios are shown in table 2. US internationally comparative TFP-growth lays within the range of 1.57 to 2.46 percent per annum, British TFP-growth within 0.83 to 2.00 per annum and French TFP-growth from 6.38 to 7.63 percent per annum.

The US experienced considerable TFP growth, and also considerable growth in capital productivity, which tripled, and labour productivity, which doubled. Although labour productivity grew slower than capital productivity, the amount of labour used grew faster than the amount of capital used. The large output growth of 7 percent annually came down to only 4.5 percent in expenditure terms, reflecting a fall in prices of roughly fifty percent.

In the UK, TFP growth was only a third of US-TFP growth. Relative productivity was the reverse of the US: labour productivity grew faster than capital productivity (the growth of which was negative), and the amount of labour used slower than the amount of capital used. An explanation may be that in 1900 the UK productivity level was already very high, much higher than in the US, leaving less room for further improvements. This is also reflected by the rise in prices of three percent over the whole period, compared to the fifty percent fall in the US.

In France, TFP growth was highest: roughly three times the US growth and nine times the British growth. Labour productivity grew faster than capital

[29] See Broadberry, *Productivity Race*, pp. 19-22.

productivity, and labour used grew slower than capital used. French prices declined by a staggering 82 percent. The most obvious explanation are the extremely low productivity levels in France in 1900: capital productivity was just six percent of that in the UK and 19 percent in the US (converging to 49 and 30 percent in 1938), and labour productivity even was two percent of that in the UK and 6 percent of that in the US (converging to 27 and 63 percent in 1938). The extreme difference and subsequent convergence may be the result of market integration. Furthermore, the French data is the least reliable of the three countries.[30]

France was known for having low levels of entertainment consumption relative to Britain, and also had a low level of urbanisation in 1900. This meant that still many unrealised economies of scale existed, for example, larger theatre/cinema buildings (made possible by increasing urbanisation and entertainment expenditure) and better cinema circuits. Both the UK and the US were already far more urbanised than France in 1900. Moreover, the staggering price decrease suggests that initially, entertainment was largely a luxury product, and a lot probably confined to the Paris region, and that cinema probably quickly brought prices down and brought entertainment to far-out areas.

3.4. Market integration

At exchange rates, prices are considerably closer to each other in 1938 than in 1900, as are individual factor productivity levels and the revenue per creative input. Over time, entertainment became more and more an industry with tradable intermediate products (rolls of exposed celluloid protected by copyright) and local delivery facilities. One would therefore expect that initially, prices varied more widely, but that over time, they should converge because of this process of market integration. The degree to which the PPP price ratio differs from the

[30] See Appendix A.

exchange rate could partially reflect the degree to which the service was tradable and internationally competitive rather than location-bound.

Table 3 lists the PPP ratios using US, British and French prices, respectively.[31] It shows that in 1900, indeed the differences were enormous. At US prices, the price of British entertainment was over four times as expensive as one would expect from the exchange rates, while French entertainment was only a tenth of what one would expect. Similar magnitudes are revealed by using PPP ratios at other prices. By 1938, prices still differed substantially, but had converged closer to exchange rates. The range of difference narrowed from 12-462 in 1900 to 100-126 in 1938, at PPP at US prices. Although one can quibble over the price estimates, it is not expected that further precision, if at all possible, would fundamentally change these findings.[32] The price convergence to exchange rates clearly suggests international market integration at work.

Because cinema used tradable intermediate products, it is expected that 1938 cinema prices are closer to exchange rates than live entertainment prices. Table 5 shows that, indeed, the former ranged between 100-134 and the latter between 100-392, substantial further evidence for the existence of market integration. Even though live entertainment itself did not become tradable, its prices also came closer to exchange rates, narrowing from 12-462 in 1900 to 100-392 in 1938. This suggests that cinema put competitive pressure on live entertainment, and, being internationally traded, the effect was in the same direction across countries.

[31] Following Broadberry, *Productivity Race*, pp. 19-22.
[32] See Appendix A.

Table 3. *Entertainment prices at PPP ratios and exchange rates, US, Britain and France, 1900/1938.*

Year		US Prices			British prices			French prices			Range
		US	Britain	France	US	Britain	France	US	Britain	France	max/min
					Price (in 1938 currencies per spectator-hour)						
1900	Entertainment	0.358	0.016	15.740	0.358	0.016	15.740	0.358	0.016	15.740	
1938	Entertainment	0.104	0.017	2.860	0.104	0.017	2.860	0.104	0.017	2.860	
1938	Film	0.084	0.015	2.180	0.084	0.015	2.180	0.084	0.015	2.180	
1938	Live	0.394	0.020	8.890	0.394	0.020	8.890	0.394	0.020	8.890	
					PPP entertainment and exchange rates						
1900	Entertainment	1.000	0.046	43.970	21.978	1.000	966.374	0.023	0.001	1.000	
1900	exhange rates	1.000	0.210	5.184	4.762	1.000	24.686	0.193	0.041	1.000	
1938	Entertainment	1.000	0.164	27.500	6.116	1.000	168.196	0.036	0.006	1.000	
1938	Film	1.000	0.179	25.950	5.587	1.000	144.972	0.039	0.007	1.000	
1938	Live	1.000	0.051	22.560	19.608	1.000	442.353	0.044	0.002	1.000	
1938	exhange rates	1.000	0.200	34.750	5.000	1.000	173.750	0.029	0.006	1.000	
					Divergence exchange rate/PPP						
1900	Entertainment	100	462	12	22	100	3	848	3915	100	39.15
1938	Entertainment	100	122	126	82	100	103	79	97	100	1.26
1938	Film	100	112	134	90	100	120	75	83	100	1.34
1938	Live	100	392	154	26	100	39	65	255	100	3.92

Source : entertainment prices: Appendix A. Exchange rates: Federal Reserve Bank 1944.

3.5 The relative importance of factors

A difference exists between the Anglo-Saxon countries and France, however. While in the US and the UK roughly two-thirds of output growth could be accounted for by increased inputs of labour and capital (65 and 73 percent, respectively) and one-third by TFP, for France only a third of the rise in output could be explained by increased inputs, and two-thirds by TFP-growth.

Figure 1 plots the capital and labour combinations in 1938, together with hypothetical production isoquants. At the aggregate level, the UK and French entertainment industries were more capital intensive than the US one, possibly because of scale economies and market size effects. The disaggregated data show that for the US and France, the capital/labour ratio for live entertainment in both countries lay within the same ballpark, while that for cinema was markedly different (figure 2). The French film industry was far more capital intensive, possible again because the US could benefit from scale economies, given its market size and urbanisation level. However, the British situation does not fit this pattern well. While the capital/labour ratio in the film industry is roughly comparable to that of French, in its live entertainment industry it is way higher than both the US and French ratios. One could speculate that the British live entertainment industry was the most developed of the three countries, having come to maturity before the rise of cinema, and that this resulted in the relative capital intensity, or that the British entertainment industry could reap larger scale economies because of its high urbanisation levels.

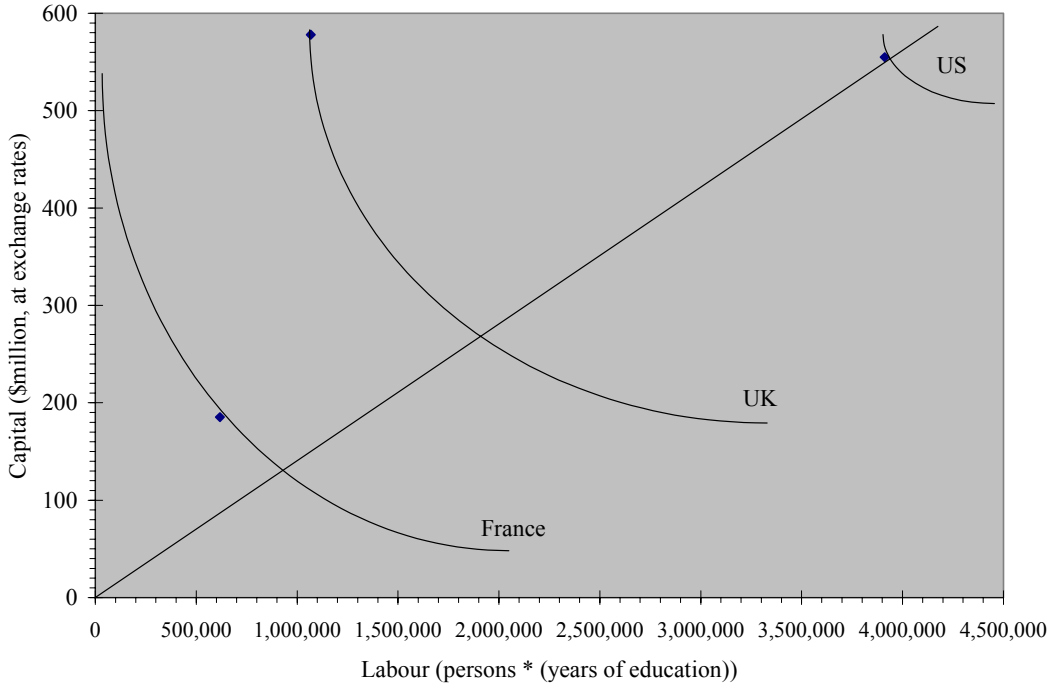

Figure 1. *Capital and labour in the entertainment industry and speculative production isoquants, US, Britain and France, 1938.*

Source: see Appendix.

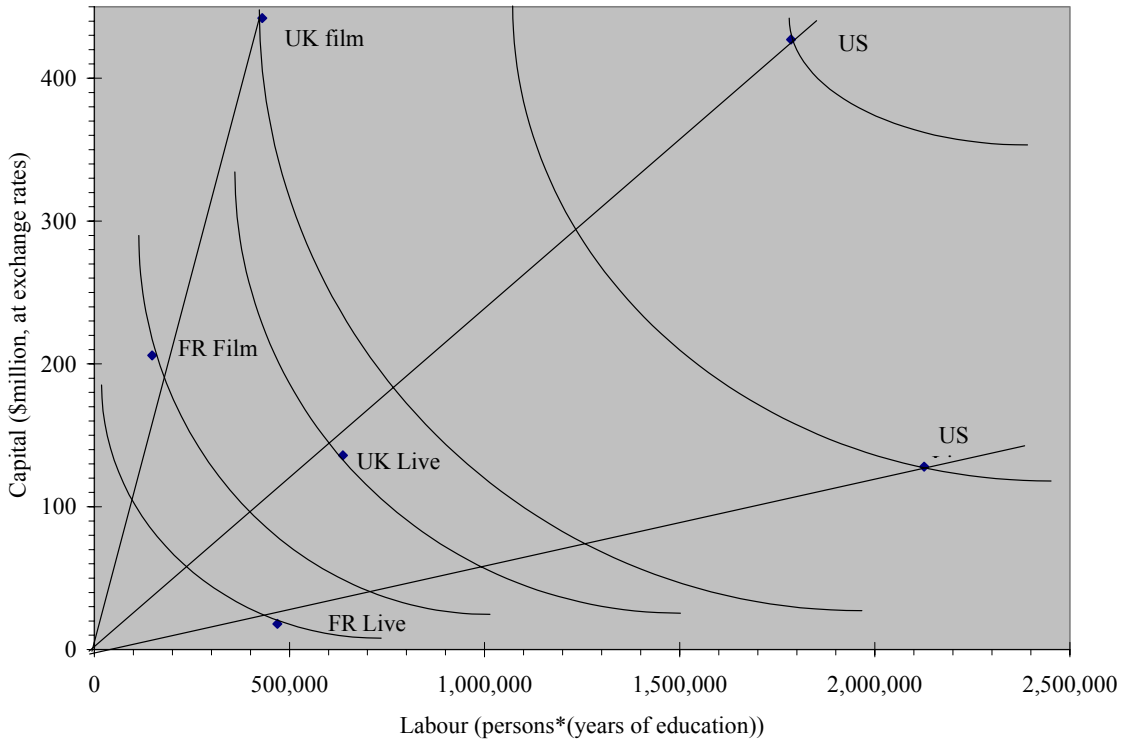

Figure 2. *Capital and labour in the filmed and live entertainment industry and speculative production isoquants, US, Britain and France, 1938.*

Source: see Appendix.

3.6. The impact on national economic growth

The question remains what the impact of the productivity growth was on the rest of the economy. If the impact of growth in the entertainment industry on total growth is examined, it shows that this impact was limited (table 4). In the US, the extensive growth contribution of the entertainment industry added just 0.004 percent to real GDP growth between 1900 and 1938, while the intensive growth contribution added 0.019 percent. Together, they can explain just under one percent of all real GDP-growth between 1900 and 1938. Roughly four-fifths of this one percent can be attributed to intensive growth. In Britain, the entertainment industry contributed slightly more to real GDP growth, just over a percent, but only three-fifths of this could be explained by intensive growth. France showed the highest contribution of entertainment to total real GDP growth, of over one and a half percent of all growth, with as much as six-seventh of that explained by intensive growth.

Table 4. *Growth contribution of the entertainment industry, 1900-1938.*

	US	Britain	France
Growth capital (% p.a.)	3.460	4.110	6.380
Profits/GDP (%)	0.092	0.128	0.027
Extensive growth contribution	0.003	0.005	0.002
Growth TFP (% p.a.)	2.460	0.830	7.630
Output/GDP (%)	0.781	1.196	0.243
Intensive growth contribution	0.019	0.010	0.019
Total growth contribution	0.022	0.015	0.020
Real GDP growth (% p.a.)	2.502	1.261	1.253
Share of growth caused by entertainment	0.894	1.206	1.620
Explained by extensive growth entertainment (%)	0.127	0.418	0.138
Explained by intensive growth entertainment (%)	0.767	0.787	1.482
Extensive growth/all growth	14	35	9
Intensive growth/all growth	86	65	91

Note: Profits/GDP: 1938 ratio is used; output/GDP: the average of 1900 and 1938 ratios is used.

Source : Entertainment data: appendix A; GDP-data: Maddison 1995.

In both the US and the UK, TFP-growth in the entertainment industry was substantially above the national average. Between 1870 and 1913, TFP-growth in the US was 0.33 percent per annum, and between 1913 and 1950 1.59 percent per annum.[33] If this is compared to TFP-growth in entertainment, and we use the average share of entertainment in GDP (0.78 percent), we can explain 1.81 percent of national TFP-growth by the TFP-growth in entertainment (table 5). On average, TFP in entertainment grew twice as fast as economy-wide TFP, suggesting that entertainment was part of the US shift to accelerated TFP-growth in this period. If the high productivity of US entertainment was partially due to scale economies because of market size, then this suggests that part of the US accelerated TFP-growth could be explained by economic geography (urbanisation, market size).

Nationwide TFP-growth in the UK in the two periods was 0.31 and 0.81 percent per annum, respectively.[34] TFP-growth in entertainment, 0.83 percent per annum, can explain about 1.58 percent of nation-wide TFP-growth between 1900 and 1938. The relative TFP-growth in entertainment was slower than in the US, growing at only 1.3 times the national rate.[35] Possibly because Britain had both in 1900 and 1938 the largest share of entertainment in GDP of the three countries, it simply had the most advanced industry, and had already a very high efficiency in 1900. This is confirmed by its large and persistent lead in labour productivity (table B1), although it lost its lead in capital productivity between 1900 and 1938 to the US.

[33] Maddison, *Monitoring*, 255.
[34] Maddison, *Monitoring*, 255.
[35] This is a conservative estimate, as the Maddison TFP-figures are quite optimistic when they are compared to, for example, Mathews ea., who estimate British TFP-growth at 0.5 percent per annum between 1870 and 1913, and 0.7 percent between 1924 and 1937. R. C. O. Matthews, C.H. Feinstein and J.C. Odling-Smee, *British Economic Growth, 1856-1973* (Stanford, Stanford University Press, 1982), quoted in Bean and Crafts, "British Economic Growth," pp. 131-172. National British TFP-growth may have been lower and thus the share of entertainment higher. If TFP-growth would have been 0.57 percent per annum, the share of entertainment in national TFP-growth would have increased to 1.74 percent.

Table 5. *Contribution of the entertainment industry to national TFP-growth, 1900-1938.*

	US	Britain	France
National TFP growth (% per annum)	1.14	0.63	1.20
TFP-growth film industry (% per annum)	2.46	0.83	7.63
TFP-growth entertainment industry (% per annum)			
Entertainment TFP/national TFP-growth (index)	216	132	636
Share in GDP 1900 (%)	0.53	1.09	0.07
Share in GDP 1938 (%)	1.04	1.30	0.41
Average share entertainment in GDP (%)	0.78	1.20	0.24
(annual increase in share (% per annum))	1.81	0.46	4.72
National TFP-growth explained by entertainment (%)	1.69	1.58	1.55

Note: National TFP-growth US and Britain is weighted average of 1870-1913 and 1913-1950 (Maddison).
French TFP-growth is an adjusted estimate of the 1896-1931 rate computed by Breton e.a. (see text).
Source : appendix; Breton e.a. 1997: 144-145; Caron 1979: 192-202; Maddison 1995: 255.

National TFP-growth in France between 1900 and 1938 has been roughly estimated at 1.2 percent per annum.[36] TFP in the entertainment industry grew six times as fast, but since the industry had a relatively small share of GDP, the contribution of entertainment to national TFP-growth was in the same ballpark as the US and UK, 1.55 percent per annum. Because the share of entertainment in French GDP was very low, and because this share was expanding rapidly, ten times as fast as in Britain and nearly three times as fast as in the US, a lot of French TFP-growth can probably simply be explained by catching up, and modernising an entertainment industry that started out from a rather 'underdeveloped' level—in economic terms, at least.

[36] This estimate is based on Breton, Broder and Lutfalla, *Longue Stagnation*, pp. 144-145, who estimate French TFP-growth at 0.7 to1.1 percent per annum for 1831-1866, -0.1 to 0.7 percent for 1866-1896 and 1.3 percent for 1896-1931. They acknowledge this answer has considerably uncertainty. Although not submitting to a growth accounting exercise, Levy-Leboyer hints at a TFP-growth within the same ballpark. Lévy-Leboyer and Bourgignon, *L'Economie Française*, pp. 9-10. The TFP-growth estimated by Breton c.s. has been reduced by 0.1 percent for the 1930s, which probably yields an optimistic upper bound estimate of TFP, making the estimate of the contribution of cinema more conservative. Malinvaud found a comparable TFP-growth of 1.4 for the period 1913-1963, which seems rather modest given the large growth of TFP during the 1950s. Malinvaud, Carre and Dubois, *Croissance française*, quoted in Caron, *Modern France*, p. 200.

Because this paper argues that cinema was a new technology that industrialised entertainment, just as, for example, steam power industrialised the textile industry it is worthwhile to compare the importance of the film industry with that of developing industries during the industrial revolution. The share of entertainment in GDP, varying from 0.8 to 1.2 percent, was quite limited compared to the industries of the industrial transition. It was roughly a seventh of the share of the cotton industry and canals and railways between 1780 and 1860, which both were seven percent of GDP. Entertainment's share was similar to that of the iron industry in 1800, which accounted for one percent of British GDP at that time.[37] If we look at TFP-growth, the TFP-growth in entertainment is of the same magnitude as those in the emerging industries between 1780 and 1860. US TFP-growth of 2.5 percent per annum, was just below that in cotton of 2.6 percent, and well above iron (0.9), canals and railways (1.3) and shipping (2.3). British TFP-growth in entertainment is more limited, while French TFP-growth was three times TFP-growth in the British cotton industry during the industrial transition.[38] In the US, TFP in the film industry grew at about twice the rate of that in British railways during the industrial revolution.[39]

Remarkably, while the TFP of the entertainment industry was growing rapidly, at the same time its share in GDP grew rapidly, with a percentage per annum laying within the same ballpark as entertainment TFP-growth for each country, showing that even with sharply increasing efficiency the industry needed to grow rapidly to satisfy demand.

[37] Though it rose to three percent by 1860. D. N. McCloskey, "The industrial revolution 1780-1860. A survey," in: Roderick Floud and D. McCloskey, *Economic history Britain 1*, pp. 103-127; 112, 114.
[38] Ibid.
[39] Compared to a 1.3 percent growth rate for canals and railways between 1780 and 1860 mentioned in McCloskey in Floud, p. 114.

3.7. Causes of growth

The productivity growth in the entertainment industry can have been caused by several factors.[40] First of all, technical progress in itself, of course, as it decreases the amount of labour and capital per unit of output, results in TFP-growth. It is also possible that the improvements in the quality of labour—such as increased experience, training, formal education, improved health—have been underestimated in the above TFP-calculation, and that the ageing of the film industry resulted in substantially higher levels of human capital. Further, changes in the quantity of labour may have taken place, such as the hours worked and the intensity of effort. These changes will not have been captured in the calculation above, as the number of persons is taken, not the number of hours worked. However, given that over-all working hours dropped sharply between 1900 and 1940, if anything this would cause the above method to underestimate TFP-growth.

Changes in the industry structure are also an important factor: the entertainment industry became an industry with a modern sector (cinema) and a traditional sector (live entertainment), and this paper argues that part of productivity growth and TFP-growth can be explained by the transfer of labour and capital from the traditional entertainment sector to the modern entertainment sector. This is roughly congruent with technical progress, as we argue that this was the major way in which technical progress took place. It seems that technical progress in the film industry was a form of technical progress that only partially found its expression in physical capital, and for a large part found its expression in other ways, such as a change in the organisation of production,[41] with most content production done centrally in large studio-complexes rather then routing creative inputs through theatre circuits.

Changes in the utilisation rate of capital could also account for increased productivity and TFP-growth. In the film industry, this probably took place on a

[40] The factors listed below largely follow Feinstein, "Capital accumulation."

massive scale: before film, entertainment venues were dependent on human creative inputs travelling to their venues, which did not make operation profitable on marginal times of days/weeks/years and on marginal places. When this input was replaced by exposed celluloid entertainment venues could also operate at certain marginal times and entertainment venues could be created at marginal places. At the same time, the utilisation rate of creative inputs—human capital one could say—increased massively (see table 1), because they could be in many places at the same time.[42] Within the production of entertainment content, the utilisation rate also increased substantially. While theatre scenery needed to be duplicated for duplicate companies to travel the provinces/countryside, and while theatre scenery, stage equipment, stage lighting etc., was generally only used part of the day (mainly evenings), film scenery and equipment was used a larger amount of hours of each day, and often around-the-clock: the large Hollywood studios, for example, maximised their capital utilisation rate by using their night-time studio capacity to shoot B-movies. Although B-movies yielded far less revenue than the regular movies, their costs were literally marginal.

3.8. Potential errors

The above calculation can of course contain several errors: conceptual errors, errors of measurement and errors of specification.[43] Potential conceptual errors, such as measuring output net of depreciation or measuring the flow of services rendered by capital rather than stock, can hardly be alleviated because of data problems. Errors of measurement can be substantial. Especially making estimates for 1900 and for France required several assumptions, and substantial errors could be present in these estimates (see Appendix A). However, these estimates have been made with the best evidence available, and the method of estimation has been set out in detail in the appendix. Basically, this is what we have now,

[41] Ibid.
[42] Bakker, "Tradable Amusements."
[43] Following Feinstein, "Capital accumulation," pp. 140-141.

whether we like it or not. An error of specification could concern the assumed entertainment production function. Although it has been noted above that substantial evidence suggests increasing returns in the entertainment industry in this period, for the TFP-calculation constant returns have been assumed, to keep the calculation simple. The economies of scale should also be captured in the TFP-growth, meaning that in that case part of TFP-growth would not be caused primarily by technical progress, but by scale effects.[44]

[44] See, for example, Edward F. Denison, *Why Growth Rates Differ. Postwar Experience in Nine Western Countries* (Washington, Brookings Institution, 1967), pp. 225-254.

4. The social savings of the film industry in 1938

4.1. Estimating the social savings

To calculate the social savings of the film industry in 1938, two assumptions are made which make the estimate more conservative.[45] First, the unit cost is kept constant, and the counterfactual unit cost and price is set equal to the actual live entertainment cost and price.[46] One could expect an increase in cost, as the price of specialised creative and technical inputs could be driven upwards. One could expect at least constant prices, since an important alternative would not exist anymore, but one could also expect lower prices, because without cinema, more marginal and cheaper live entertainment could be produced in larger venues. The amount of output actually sold, in spectator-hours, has been used, not the amount produced, i.e. the venues' "production capacity" (seats x showing times x duration), because the former can be found easily, while the latter requires several assumptions.

Since this is a rather simple price counterfactual, and changes in costs and supply functions are ignored, the social savings exercise is rather innocent of rearrangement of productive activities as entertainment costs change, and of imperfect competition in the entertainment sector. The calculations therefore, must be seen as no more than a rough and ready approximation.

[45] This exercise, of course, follows the footsteps of Fogel, "Quantitative approach," —*Railroads.*
[46] It should be noted that it was rather difficult to obtain cost data on live entertainment, a problem not uncommon in social savings calculations. See for example Hawke, *Railways*.

Table 6. *Estimate of net social savings generated by the film industry, US, Britain and France, 1938, per capita (at exchange rates).*

		Actual			Counterfactual			
					Quantity =constant		Exp.=constant	
	Country	Film	Live-ent.	Total	Total	Saved	Total	Saved
Net expenditure ($)	US	4.33	1.60	5.93	24.15	18.22		
	UK	3.68	2.29	5.96	7.70	1.73		
	FR	0.71	0.36	1.07	3.56	2.49		
Quantity (hours)	US	60.2	4.3	64.5			17.1	47.4
	UK	57.1	24.2	81.3			67.1	14.2
	FR	13.2	1.5	14.7			4.7	9.9
Capital ($)	US	3.24	0.97	4.21	14.69	10.48	3.89	-0.33
	UK	9.31	2.86	12.17	9.61	-2.56	7.93	-4.24
	FR	5.03	0.44	5.48	4.37	-1.11	1.40	-4.07
Labour (fte/mln. inh.)	US	1,352	1,610	2,962	24,280	21,318	6,421	3,459
	UK	809	1,198	2,007	4,032	2,025	3,326	1,319
	FR	399	1,264	1,664	12,493	10,830	4,018	2,354

Note: fte = full-time employment equivalent; net social savings means expenditures minus profits are compared.
Sources : Appendix A; Appendix B table B2.

4.2. Results

In table 6, results are given for two counterfactual situations. The first, which shows the maximum net social savings, assumes a price elasticity of zero, while the latter assumes constant expenditure (and thus a constant-elasticity demand curve). After these situations have been discussed here first—because of their simplicity, and the 'boundaries' they give to social savings—the effect of price elasticity on social savings will be discussed below. At zero elasticity, the table shows (at exchange rates) the net social savings $((q_c*p_{c)}-\pi_c)-((q_a*p_{a)}-\pi_a)$. The largest social savings were in the US, both in terms of expenditure and employment saved. Social savings in France and Britain were more limited, mainly because of their live entertainment industry charging substantially lower prices (at exchange rates), and higher relative consumer preferences for live entertainment than for cinema.

A comparison at PPP-ratios has been made by using the 'all-entertainment' PPP-ratios for the actual situation and the live entertainment PPP ratios for the counterfactual situation. Social savings at PPP-ratios differ substantially from those at exchange rates, and are more what one would expect: the differences are now roughly in line with the differences of relative shares of entertainment in GDP. The share of the British entertainment industry was 1.25 times that of the US (which was 1.04 percent of GDP), and the French one 0.41 percent. The average net social savings of PPP ratios at US, British and French prices are 1.31 for Britain and 0.23 for France, the same ballpark as the GDP-share differences.

For social savings in quantity-terms in the constant expenditure situation, however, the largest savings are generated in the US. In all three countries, because of the capital-intensity of cinema, more capital would become available for use elsewhere in the economy, and more labour would have to be drawn from

elsewhere. Given its relative scarcity of labour, it is not surprising that cinema was the most labour saving in the US.

4.3 Actual elasticity and social savings

Above hypothetical elasticities for the counterfactual situation have been used, as the calculation of social savings has traditionally meant assuming a price elasticity of zero, in order that the full savings from a new technology become visible. It would nevertheless be interesting to see what happens to the social savings when we use actual elasticities. Price elasticities for the film industry are estimated in section 5, below, and we will here simply ignore complications with live entertainment elasticities and assume that they hold for all spectator entertainment combined. First we will investigate the general relationship between social savings, price elasticity and counterfactual price, and then we will look at the specific situation in each country.

The relationship between social savings and elasticity and counterfactual price is as follows:

$$ss := q_c p_c - q_a p_a$$

$$q_c := q_a \left(1 - \varepsilon \left(\frac{p_c}{p_a} - 1\right)\right)$$

yielding:

$$ss := q_a \left(1 - \varepsilon \left(\frac{p_c}{p_a} - 1\right)\right) p_c - q_a p_a$$

which can be simplified to:

$$-\frac{q_a (p_c - p_a) (-p_a + \varepsilon p_c)}{p_a}$$

and normalised (p_a=1, q_a=1) to:

$$ss := (1 - \varepsilon (p_c - 1)) p_c - 1$$

(with p_a, q_a, p_c, q_c denoting actual and counterfactual prices and quantities; and ε price elasticity)

Intuitively, it is clear that the lower the elasticity, the higher the social savings, as consumers would reduce their spending by less in the counterfactual situation. The relationship of social savings to counterfactual price is less clear, and proves to be parabolic, with zero-points determining the positive interval depending on price elasticity.

Figure 3 shows the relation between social savings, elasticity and counterfactual price graphically. It clearly shows a series of parabolas projected towards the p_c-SS plane, the exact shape of which varies with elasticity. (Readers of the internet version of this paper should be able to rotate the figure.)

The question then is, what results would the actual elasticities give us. For the US, at an elasticity of 1.99, social savings are only positive when p_c (measured in p_a) lies between 0.5 and 1.0. Compared against the counterfactual price (3.79 p_a) this means that there would be no demand whatsoever for spectator entertainment. For Britain, social savings are positive at a p_c between 1.0 and 1.8, meaning that compared against the counterfactual price (1.22 p_a) Britain would benefit from social savings. For France, the price horizon ranges from 1 to 2, meaning social savings would be nil. A similar exercise can be done fixing the counterfactual price and varying elasticity. For the US, with the highest P_c, after an ε of 0.26 social savings become negative, again confirming that at the actual ε, no social savings would be achieved. For Britain and France, the elasticity horizons were 0.82 and 0.34, resulting in social savings in Britain but not in France at actual elasticities.

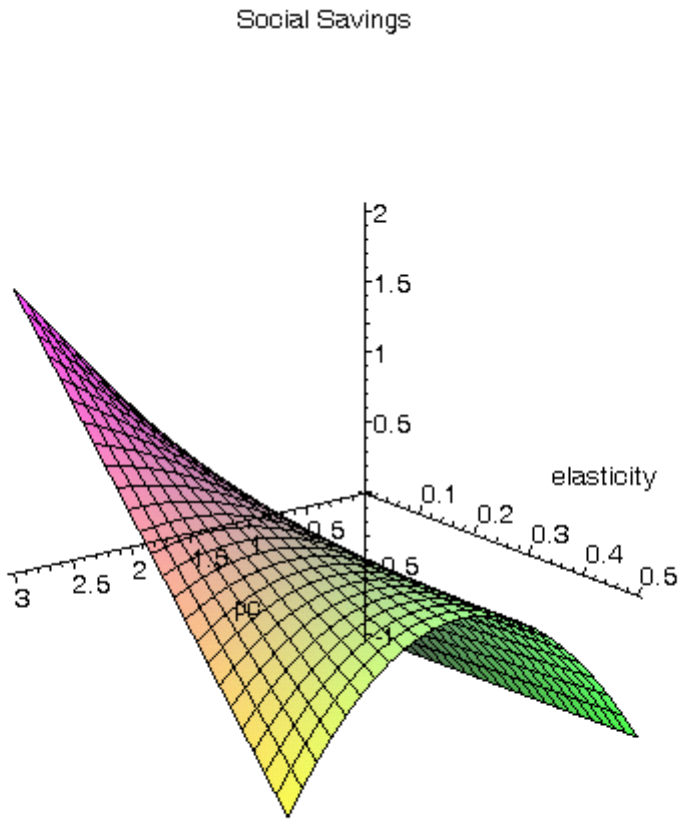

Figure 3. *Social savings in relation to price elasticity of demand and counterfactual price (standardised units).*

Note: epsilon = price elasticity, p_c=counterfactual price, the vertical axis shows the social savings, measured in the actual expenditure. For example, an elasticity of zero and a p_c of 2 yield socials savings of one time actual expenditure (which is the situation calculated in table 6).

Table 7 summarises the findings, and figures B1.1-B1.3 and B2.1-B2.3 in Appendix B show the individual diagrams for the above observations. In conclusion, one can say that only in Britain at actual elasticity and our counterfactual price social savings were generated by the film industry. In both the US and France, consumers would simply stop buying the service altogether at the counterfactual prices. This thought experiment is a departure from the usual social savings approach, and facilitates better understanding of the concept of

social savings and its underlying assumptions. Nevertheless, the social savings approach assuming zero price elasticity is a useful exercise, as it gives an estimate of the full effect of a new technology on society, and can therefore readily be compared to TFP-estimates (see section 4.5, below).

Table 7. *Price and elasticity horizons for social savings, US, Britain and France, 1938.*

	p_c	p_c horizon	maximum SS	Actual ε_p	ε_p horizon
US	3.79	0.5-1.0	0.12	1.99	0-0.26
Britain	1.22	1.0-1.8	0.09	0.56	0-0.82
France	3.12	1.0-2.0	0.13	0.49	0-0.34

Notes: pc = counterfactual price (measured in actual price); ep = price elasticity of demand; SS= social savings (measured in actual expenditure); horizon = interval over which SS are positive. Maximum SS are at mid-interval.
Source : table 9 and table B2.

4.4. Potential counterfactual histories of live entertainment

A critic could argue that in the absence of cinema live entertainment would have developed in another way and could also by non-cinema technological improvement, such as larger venues, fast rotation of creative inputs by plane, have increased productivity. However, one can say that around 1900 live entertainment had already realised this productivity possibility frontier: venue scales were larger then they ever had been before, the fastest trains and other means of transportation were used to move the top creative inputs around, booking systems were as efficient as possible.[47] In Britain in the late 19th century, each Sunday over a hundred trains were driving across Britain transporting entertainers to their next venue.[48] Cinema emerged only because live entertainment technology had reached its final production possibility frontier, and further process innovation yielded sharply diminishing returns. Only a radical product innovation could set the industry on a new path towards newly

[47] Bakker, "Tradable Amusements."
[48] Sanderson, *Irving to Olivier*.

increasing productivity growth, replicating the success of the nineteenth century and pushing productivity to even greater heights.

4.5. Comparing the social savings with the intensive growth contribution[49]

The social savings method provides an estimate which should equal the intensive growth contribution of cinema, while disregarding the extensive growth contribution. The rationale of the proponents of the social savings methodology is that the additional capital inputs for the entertainment industry merely displaced other investments that could also have earned the going rate of return.[50] The return to entertainment capital would have accrued to the economy in any case, although it would have done so through alternative investments had cinema not been invented. This means that the "unique" contribution of cinema was to be found only in the cost reduction benefits of intensive growth. The counter argument from those favouring the growth accounting methodology is that cinema technology must be embodied in a new and special form of capital equipment. As such it is more intuitive to include extensive growth in the effects of cinema on the economy.[51]

It is possible to compare the results of the social savings methodology with those of the growth accounting methodology. Since the social savings only include the intensive growth contribution, subtracting the social savings from 1938 GDP, recomputing the 1900-1938 real GDP growth rate, and subtracting this counterfactual rate from the actual real GDP 1900-1938 growth rate will yield the reduction in growth rate without cinema, according to the social savings

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49 This section follows the methodology set out in Dudley Baines, Nicholas Crafts and Tim Leunig, "Railways and the Electronic Age," *Fathom* (2000), web-article at http://www.fathom.com /story/story.jhtml?story_id=122057; Nicholas Crafts, "Steam as a General Purpose Technology. A Growth Accounting Perspective," in: *Working Papers in Economic History*, London School of Economics, No. 75 (2003).

50 Ibid.

51 This paragraph is almost a literal quote of Baines e.a., "Railways," with the word 'railways' replaced by 'cinema'.

method, and this can then be compared to the intensive growth contribution found by the growth accounting method. The exercise is printed in table 9.

For Britain and France, the reduction in growth rate is within the same ball park of the intensive growth contribution. Given that our estimates (as explained in Appendix A) are our best educated guesses based on all available data, and that they thus carry a substantial degree of uncertainty, one could conclude that for those two countries social savings methods and growth accounting roughly give the same result (i.e. the differences lie well inside the degree of potential inaccuracy of the data). For the US, however, the difference is very large, with the growth reduction being four times as large as the intensive growth contribution.

Table 8. *The effect of social savings on GDP-growth and the intensive growth contribution.*

	US	Britain	France
Real GDP growth (%)	2.502	1.261	1.253
Counterfactual real GDP growth (%)	2.423	1.254	1.230
Reduction in growth rate	0.079	0.007	0.023
Reduction/intensive contribution	411	74	126

Source : Appendix B table B1, B2; Maddison 1995.

Table 9. *The consumer surplus of the film industry in the US, Britain and France, 1938.*

	Local currencies				Dollars			
	US	UK	FR	UK Live	US	UK	FR	UK Live
Price elasticity	1.99	0.56	0.49	1.29				
Demand function	D=-2.49p + 85.1	D=-0.55p + 15.2	D = -0.18p + 3.2	D=-0.60p +11.7				
R^2	0.66	0.80	0.57	0.97				
Observations	6 (1933-38)	5 (1934-38)	6 (1931-35, 38)	5 (1934-38)				
Cons. surplus (mln.)	166	37	1327	9	166	181	38	44
per cap.	1.26	0.78	32.35	0.19	1.26	3.81	0.93	0.94
Virtual price (D=0)	0.34	0.12	17.78	0.08	0.34	0.56	0.51	0.40
Actual price	0.23	0.04	5.91	0.05	0.23	0.21	0.17	0.22
Index								
Price elasticity					100	28	25	65
Consumer surplus					100	109	23	27
per cap.					100	302	74	74

Note: for demand functions: US: price in cents; UK: price in pence; FR: price in francs; all quantities in 100 million tickets.

All other amounts in $, pounds or francs. Dollars for international comparison are at exchange rates.

Source : see Appendix A; method from Hausman 1997.

5. The consumer surplus in 1938

With the own price elasticity of demand for cinema tickets and 1938 prices and quantities, the consumer surplus enjoyed by cinemagoers can be estimated, as it equals $pq/2\eta$.[52] A linear demand curve has been estimated rather than an compensated one, yielding a lower bound for the consumer surplus.[53] Although coefficients of determination vary substantially, the results give a crude approximation. The highest consumer surplus was enjoyed by British consumers, both absolute and per capita. The French per capita surplus roughly equalled the US. For Britain, also sufficient price and quantity data for live entertainment has been traced to estimate a demand curve, showing a considerable consumer surplus, about a quarter of that for film.

The estimated the US price elasticity was several times higher than the French and British one. Although R^2 for the US is lowest of the three countries, the high US elasticity does not seem wholly implausible. First of all, it roughly concurs with the relative differences in income elasticity. Average US income elasticity of demand for motion pictures was 1.83, while average British and French income elasticities were 0.59 and 0.63.[54] Generally, price and income elasticities are correlated. The Slutsky equation in elasticities ($\varepsilon_p=\varepsilon_s -s\varepsilon_y$; with ε_s the elasticity of substitution and s the expenditure share of income) shows theoretically that price and income elasticities are generally correlated, if the elasticity of substitution is ignored.[55] On the empirical level, a set of elasticities for some non-durable consumer goods and services in the US between 1950 and 1990, for example, shows a linear correlation between price and income elasticity

[52] See Hausman, "Valuing the Effect of Regulation"; Jerry A. Hausman, "Sources of Bias and Solutions to Bias in the CPI," National Bureau of Economic Research, Working Paper 9298 (2002).
[53] Ibid.
[54] US figures for 1934-1936, British figures for 1937-1939, and French figures for Toulouse for 1936-1938. Bakker, "Entertainment Industrialised," pp. 389-395.
[55] See, for example, Nicholson, *Microeconomic Theory*, pp. 194-196.

with an R^2 of 0.98, even though the pairs are scattered within four decades.[56] If the substitution elasticity is put at zero, and the expenditure share ignored for convenience, income elasticities for the US, Britain and France would predict price elasticities of -1.83, -0.59 and -0.63, which lie in the same ball-park as the elasticities estimated above. If one takes the estimated price elasticities and the income elasticities, one obtains elasticities of substitution of -0.16, 0.03 and 0.14, which are all low, suggesting cinema had little substitutes. These are crude 'calculations', but they do suggest the estimates above are in the right order of magnitude. Also, because British price elasticity of live entertainment is higher than that of cinema, one would expect a higher income elasticity, and this is the case (2.24; US and French income elasticities were 4.72 and 2.52). The US price and income elasticities are also not exceptional given that elasticities for services are generally high. One present-day study found a price elasticity for entertainment of 1.6, and an income elasticity of 2.0, while another found an income elasticity for motion pictures alone of 0.81.[57]

Well then, given that US price elasticity was high, the question remains what could have been the reasons for it. One circumstance is that, at exchange rates, ticket prices in Britain and France were lower than in the US, bringing down price elasticity. The reason for the lower European prices could be a more competitive live entertainment industry. Also, the Hollywood studios were colluding during the 1930s and 1940s,[58] which probably resulted in higher prices. This is supported by the possibility of monopoly prices only at a price elasticity of one or higher. Using the Lerner index of market power, one can even calculate the mark-up for an elasticity of 1.99 in a monopoly situation, which amounts to 50 percent.[59] Transatlantic differences in income shares cannot have been the

[56] Ibid., p. 207. Marijuana has been taken out of the regression, because its income elasticity was stated as zero.
[57] Deaton, "Measurement"; Houthakker and Taylor 1970.
[58] Of which they were found guilty by the US Supreme Court in 1948.
[59] $\frac{MC}{P_m} = 1 - \frac{1}{\varepsilon}$

reason, as the US/UK difference was not that much, while the UK/FR difference was rather large.

Apart from a monetary cost, entertainment also had an opportunity cost in the sense of a certain amount of time that could have been used for other purposes. This opportunity cost can be expected to be correlated to the wage level, as has been argued by William Baumol.[60] The question then is whether price elasticity changes if one considers wages. For France, the real price of entertainment has been inflated by real wages, leading to the price change being expressed in the wage change, which resulted in virtually the same price elasticity, with only a difference in the third decimal.

Figure 4 maps the relation between the consumer surplus and price elasticity, fixing price and quantity at unity, for convenience. It clearly shows the high European consumer surpluses: at an elasticity close to 0.5, the consumer surplus equals consumer expenditure (and as elasticity gets smaller than 0.5, the surplus increases further, being double expenditure at $\varepsilon_p = 0.25$). It is also shown clearly how the US could have such a low consumer surplus compared to its social savings.

Tirole, "Industrial Organization." Although the Hollywood studios colluded, this did probably not amount to a full-blown monopoly.

[60] Baumol, William J., and Mary I. Oates, "On the economics of the theatre in renaissance London," in: *Swedish Journal of Economics*, Vol. 74 (1972) No. 1, pp. 136-60.

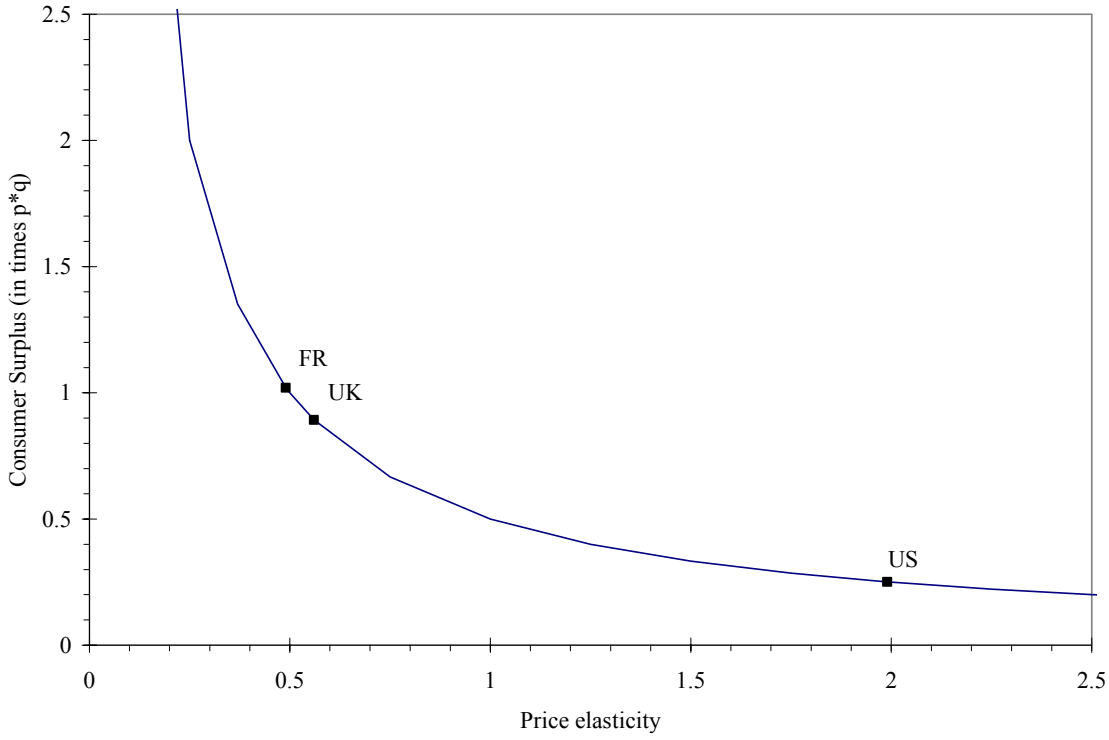

Figure 4. *Consumer surplus as a function of price elasticity, with positions of US, British and French entertainment demand in 1938 (in times actual expenditure).*

One way of combining the social savings and consumer surplus approach would be to calculate the lost consumer surplus in the counterfactual situation. It is possible to express this in price elasticity and counterfactual price, if actual price and quantity are normalised as one:

$$lostCS := \frac{1}{2} q_a (P_c - p_a) (1 - P_c + p_a) p_a \varepsilon$$

which after normalisation becomes:

$$lostCS := (Pc - 1)\left(1 - \frac{Pc}{2}\right)\varepsilon$$

(with p_a, q_a, p_c, q_c denoting actual and counterfactual prices and quantities; and ε price elasticity)

The relationship is shown graphically in figure 5. It is clear that if $p_c > 1$ the lost consumer surplus increases both with p_c and e_p, as was expected. At actual elasticities and counterfactual prices, the lost consumer surplus for the US, Britain and France would amount to 4.97, 0.05 and 2.36 times actual expenditure. The low value of Britain is mainly due to its low live entertainment prices, which were quite close to cinema prices.

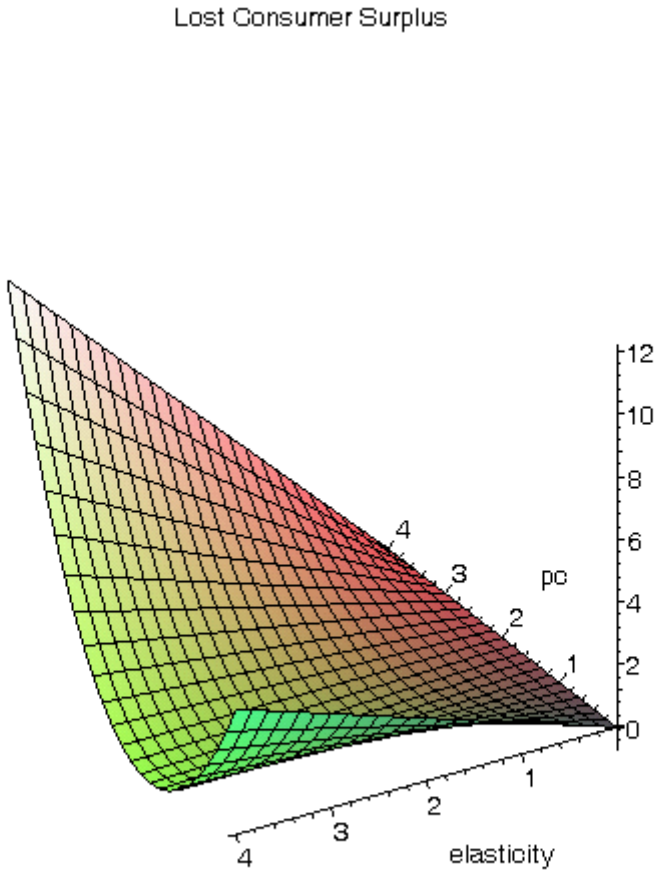

Figure 5. *Lost consumer surplus in relation to price elasticity of demand and counterfactual price (standardised units).*

Note: elasticity = price elasticity, p_c=counterfactual price, the vertical axis shows the lost consumer surplus, measured in the actual expenditure. For example, an elasticity of one and a p_c of 3 yield a lost consumer surplus of one times actual expenditure.

6. Comparison of the findings

Table 10 lists this paper's main findings in per capita terms. It is striking that the country with the slowest TFP-growth, Britain, generated the highest social savings, and also that the US, while having high social savings, had just a modest consumer surplus, only 19 percent of expenditure. One could argue that in the US cinema was primarily a substitute for live entertainment, automating away most live entertainment, and thus yielding large social savings, while in Europe film was less of a substitute, as it had competitive live entertainment industries, and consumers preferred live entertainment in their own language and culture when cinema screens showed largely foreign entertainment (contributing to the newness of the product in Europe). One could therefore argue that cinema had a both a 'substitute-character' and a 'newness-character' and that the mix varied across countries.

The large differences between social savings and consumer surplus could also indicate imperfect competition and a rather large producers' surplus, and thus a rather steep supply curve, consistent with large scale effects, especially in film production. Since films are sunk costs, and venue capacities are fixed, a fall in price will not lead to a sharp fall of the number of spectator-hours offered. Scale effect therefore gave producers a large producer's surplus. And because Britain had a relatively smaller film industry and larger live entertainment industry, less scale effects existed, and therefore British companies enjoyed a smaller producers' surplus and British consumers a larger consumer surplus (i.e. the supply curve was less steep because of limited scale effects, and therefore the industry more competitive).

Table 10. *The performance of the entertainment industry, 1900-1938.*

	US	UK	France
TFP-growth			
US prices	2.46	1.69	7.30
British prices	1.57	0.83	6.38
French prices	2.78	2.00	7.63
National TFP growth	1.14	0.63	1.20
Net social savings/capita			
US prices	18.22	23.42	4.13
British prices	0.26	0.35	0.06
French prices	381.7	491.7	86.5
Hours of work	43.1	3.9	86.5
Share of 1938 GDP (%)	3.00	0.30	0.90
Consumer surplus/capita			
US prices	1.26	4.35	1.25
British prices	0.23	0.78	0.22
French prices	32.70	112.95	32.31
Hours of work	3.0	8.7	32.3
Share of exp./cap. (%)	18.75	57.04	76.86

Note: social savings at zero price elasticity.

Source : Appendix A; Appendix B table B1, B2; table 9.

The entertainment industry can be placed within the debate on differences in manufacturing productivity between Europe and the United States. Stephen Broadberry, for example, writes that in British manufacturing, skilled labour was relatively abundant, reducing the need for automation, and resulting in focus on crafts-based production and shop-floor management. Further, the British market was so small and stratified by class differences, that often the optimum scale for automation could not be reached inside the home market, while manufacturers also faced differentiated European export markets.[61] In the US on the other hand, a shortage of skilled labour existed, which caused manufacturers to focus heavily

on research and development and on automation, and to employ professional managers.

The findings for the entertainment industry yield a similar picture, with relative abundant and cheap creative inputs in Europe, which enabled the live entertainment industry to remain competitive. Further, the European entertainment industry faced small home markets, often stratified by class differences, and a multitude of small, differentiated European export markets. The American entertainment industry, on the other hand, faced a large, relatively homogenous market and a shortage of creative inputs. The result of this was the American entertainment industry focused on increase in research and development caused and automation of the industry deploying film technology, while the European entertainment industry only did this to a smaller extent.

The above notion is supported by the census data on actors and actresses, which is, of all the entertainment professions, the best comparable across the three countries. Over the whole period 1870-1950, Britain and France had considerably higher levels of actors per 100,000 inhabitants than the US, even though the US was a large net exporter of filmed entertainment and of rights to live entertainment productions. This supports the notion that through management and automation by employing film technology, the US industry made up for its shortage of creative inputs. Further, a strong growth in the number of actors took place in all three countries between 1870 and 1910, and stopped abruptly afterwards, probably because of the take-off of the film industry. This again confirms that without cinema technology, the considerable output growth of the entertainment industry since the 1900s would have been hardly possible.

[61] Broadberry, *The productivity race*.

Film was a product which might have been closely related to the degree of industrialisation.[62] It may not be a coincidence that it was precisely in the highly industrialised societies of the U.S. and Britain the consumption and production of film was so high so early.[63] France may have lagged behind in industrialisation, with possibly less demand for live entertainment, and possibly also a live entertainment industry that was more competitive because of lower wages.[64] This may also explain the boom in French entertainment expenditure after World War II. At that time, French urbanisation levels had also come closer to those of the US and Britain.

[62] In Britain, in the nineteenth and early twentieth century (c. 1850-1920), the highest number of actors (as percentage of the population) were in the industrialised regions. Sanderson, *Irving to Olivier*.

[63] A speculative explanation for the higher level British live entertainment production may then be the earlier industrialisation. British entertainment consumption increased sharply when only live entertainment technology existed to meet the demand, thus creating a strong, established live entertainment industry, while the US experienced the highest growth in entertainment demand when cinema technology already existed, preventing the establishment of an entrenched live entertainment industry, and resulting in the emergence of a strong film industry. However, this reasoning is speculative and may be inaccurate.

[64] For a good comparative overview of the evolution of especially the productivity in services in France in this period see Dormois, *L'économie française*.

7. Conclusion

Some argue that to evaluate new goods' effect on economic well-being, the way in which consumers discount time should also be taken into account. Bowden and Offer argue that for several goods, consumers prefer instant gratification over larger satisfaction later, such as buying a CD versus learning to play guitar, watching movies versus joining a theatre group.[65] Nevertheless, satisfaction is difficult to compare in economic terms, and the hyperbolic discount of time is a consumer preference: a consumer compares instant with larger-later gratification at her individual discount rate. Second, the larger-later activities come out of the book of social reformers and progressive liberals, such as members of the Economic Club and the *Economic Journal* in 1890s London. The question remains whether without spectator entertainment, the cinemagoer really would have learned to play an instrument, joined a sports club, attended a public speaking course, or read a novel. He might just as well have enjoyed more drinking, more sex, and have smoked opium or injected heroin in his veins—all of which having a higher instant gratification than cinema or music hall, and at higher cost.[66] A. J. P. Taylor, who apparently adheres to this second way of thinking, aptly remarks: "The cinema was the greatest educative force of the early twentieth century. Yet highly educated people saw in it only vulgarity and the end of old England."[67]

In a society where increases in real income and leisure time spurred demand for entertainment, cinema technology generated substantial benefits. Without the film industry, the boom in demand for entertainment might have led to substantial bottlenecks in the service sector of the economy. Across the three countries, the entertainment industry accounted for 1.5-1.7 percent of national

[65] Bowden and Offer, "Household Appliances." The author also benefited from a conversation with Avner Offer during the 75th Anniversary Conference of the Economic History Society, Glasgow, on April 1st, 2001.

[66] The happenings during and (nine months) after the notorious power cut in New York City in the late 1970s, which deprived people of television for several days, lend more support to this latter type of consumer than to the progressive role model.

TFP-growth, and for 0.9-1.6 percent of national real GDP growth. TFP growth rates were higher than those for many key industries during the industrial revolution. The UK had the most developed and relatively largest entertainment industry, and showed the lowest TFP-growth. The US developed in rapid pace a large entertainment industry of its own, using the newly available cinema technology and showing rapid TFP-growth. France started at extremely low productivity levels in 1900, and showed exceptional TFP-growth while catching up, but in 1938 labour productivity was still half the US level and capital productivity half the UK level. The low share of entertainment in GDP, and its rapid growth pace (ten times as fast as in Britain and 2.5 times as fast as in the US) confirm the catch-up explanation, and the transition from a traditional to a modern entertainment industry. The lag of French urbanisation and industrialisation process probably also played a part.

Social savings were highest in the US. In 1938, American consumers would have had to spend nearly four times more—3.0 percent of US disposable income[68]—to enjoy the same amount of entertainment, and nearly three million extra workers would have been needed. Social savings in Britain were limited because of low live entertainment prices and those in France somewhat higher because of higher live entertainment prices. Comparative social savings at PPP-ratios inflate British social savings to above the US level. Converging exchange rates and PPP price ratios also suggest rapid international market integration. The consumer surplus was markedly lower than the social savings. In the US it was just $166 million, tiny compared to the social savings. While US consumer surplus was 19 percent of per capita expenditure, in Britain and France it was as high as 57 and 77 percent.. This could possibly be explained by lower live entertainment prices in Britain and France.

The productivity differences between the US and the European entertainment industry are somewhat similar to the productivity differences

[67] Taylor, *English history,* p. 181.

observed in manufacturing, as reflected in Broadberry's typology of a research and development intensive American industry with a shortage of skilled labour, mass-producing standardised products for a large, homogenous market; and that of flexibly specialised European industries using abundant skilled labour to produce for small home markets stratified by class differences and differentiated export markets. This paper suggests that these typologies may not only hold for manufacturing, but also for service industries.[69]

The wider significance of the findings of this paper may be that other technologies can be identified which industrialised other service industries. The observation of productivity slowdown in service industries depends more on the definition of the industry/market and on correct measurement, than on a real slow-down. The film industry, therefore, was not only first in a row of media industries that industrialised entertainment, but was also the first of a series of technologies that automated services. The happenings of the early film industry thus may give insight into technological changes in many service industries to come.

[68] Vogel 2001: 382.

[69] In his latest research Stephen Broadberry is investigating the idea that over-all productivity and growth differences between the American and European economies were not mainly because of poor European performance in increasing productivity in manufacturing, but mostly Europe's poorer ability to increase efficiency in service industries. Broadberry and Ghosal, "Counting house" examines attempts to increase productivity in office management, and has similar findings for that industry as this paper has for entertainment.

Appendix A: the data estimates

The purpose of this appendix is to provide the sources and the calculations for obtaining the estimates on labour, capital and output of the entertainment industry used throughout the text.

1. Unites States

1.1. US entertainment in 1900

US labour in 1900

1. The people working in entertainment from the US census have been used. These were 37,752 creative inputs, 20,025 working in management.

2. Practical workers were not listed in the entertainment industry, but amounted to 9,114 in 1910, and for 1900 this same figure has been used, but deflated with the growth of management and creative inputs from 1900 to 1910 (97%), arriving at 4,610 practical workers and thus at a total of 62,387 workers in 1900 that would have been classified under entertainment in the 1910 census.

3a. Data on workers that are classified in other industries but working for the entertainment industry are not available for 1900. The earliest year for which this data is available is 1930, and in that year they accounted for 42.0 percent of all people working for the entertainment industry (For the 1940 census, the classification system was changed and a lot of these people have been classified under the entertainment industry from then onwards [Edwards 1941]). Simply and very crudely assuming that in 1900 this share was the same, we arrive at an estimate of 45,273 workers classified under other industries. This is probably an overestimate, as the entertainment industry in 1900 was substantially less developed than in 1930. Owen, for example, finds that exactly in this period total recreation expenditure grew much faster than GNP, suggesting rapid industry growth [Owen 1970].

3b. An alternative approach is to let these workers grow with the total growth in real expenditure, as they were probably difficult to automate. An alternative way of estimating is using the real average annual growth rate of consumer expenditure on recreation between 1901 and 1930 [Owen 1970], which was 5.24 percent (the highest in the twentieth century) to back project the number of 'non-classified workers to 1900. This yields 180,823/4.62 = 39,115 workers in 1900.

4. The estimate of the total number of people working in the entertainment industry is then 62,387 + 45,273 = 107,660 persons, or 62,387 + 39,115 = 101,502 persons. The second estimate has been used throughout the calculations, since it is well-reasoned, and it is the most conservative of the two, in the sense that it will contribute more output growth over 1938/1900 to an increase in labour rather than to an increase in TFP.

US consumer expenditure in 1900

1. A precise estimate for entertainment expenditure in 1909 [US Department of Commerce 1975] is $167 million theatrical entertainment and motion pictures, $22 million of 'commercial participant amusements', making a total of $188 million. This amounts to $293.75 million in 1938 dollars.

2. This figure is back projected to a 1901 estimate by using Owen's growth rates for real total US consumer expenditure for 1906-1913 (7.99 percent) and 1901-1906 (5.85%) [Owen 1970], yielding an expenditure of $175.54 million (in 1938 dollars) in 1901.

3. This figure is then further back projected by assuming 1900-1901 had roughly the same growth rate as 1901-1906, yielding 1900 expenditure of $165.84 million (in 1938 dollars).

US Prices in 1900

1. It is difficult to obtain reliable estimates of entertainment prices in 1900, but a reliable estimate for live entertainment in 1913 is $2 per ticket [Poggi 1968: 71].

2. To make a conservative estimate, and assume that outside the larger cities many smaller theatres existed, this price is then simply lowered to $0.75.

3. It is then assumed that ticket prices increased at the same rate at the general price level, this would mean the price would have been $0.63 in 1900, which amounts to $0.895 in 1938 dollars.

4. It is then conservatively assumed that a live performance in 1900 lasted 2.5 hours on average, yielding an average price per spectator hour in 1900 of $0.358 (in 1938 dollars).

US Capital in 1900

1. Exact data on capital invested in the entertainment industry in 1900 is not available. The number of theatres in the US in 1910 was estimated to be 1,520 [Bernheim 1932]. It is conservatively estimated that the number was 2,000 in 1900, that on top of this, 1,000 vaudeville theatres existed, and 1,000 other entertainment venues, yielding a total of 4,000 entertainment venues in 1900.

2. In the 1790s, it cost about $30,000 to build and construct a good theatre in the centre of a large city, including real estate costs. It is simply assumed that what was the capital needed to build a large theatre in 1790 will be sufficient to build the average theatre in 1900.

3. It is assumed capital will be depreciated in about fifty years, and it is further assumed that in 1900, the average age of an entertainment venue was 15 years, given the boom in entertainment expenditure towards the end of the 19th century. This yields an average depreciated invested capital per theatre of $21,000, and a total invested capital of $84 million, amounting to $142.37 in 1938 dollars.

1.2. US entertainment in 1938

US labour in 1938

Method I

The estimate of the people working in the entertainment industry has been obtained from the industry census in 1940 (421,000 persons), projected towards 1938 by linear interpolation with the 1930 census (430,000 persons), yielding an estimate of 422,785 persons working in the US entertainment industry in 1938.

Method II

The census of industry statistics [US Department of Commerce 1975], show annual employment figures. Figures for 1938 are: 178,000 fte in the film industry, and 212,000 fte in live entertainment, making a total of 390,000 fte.

Conclusion

The second method has been taken, as it does not involve interpolation, but simply uses available and reliable date.

US consumer expenditure in 1938

The consumer expenditure data has also been obtained from *Historical Statistics of the United States* [US Department of Commerce 1975: 854-855]. It was $663 million for cinema and $222 million for other spectator entertainment ($58 million for theatre, opera, etc. and $164 million for 'commercial participant entertainment'), making a total of $885 million.

US prices in 1938

1. The average 1938 price of cinema is exactly known and was $0.23 [Vogel 2001]. The average duration of a cinema performance is taken to be 2 hours and 45 minutes, which is a conservative estimate, as most US theatres showed double

features and of course shorts.[70] This yields an average price per spectator-hour of $0.0836

2. Since the total number of live entertainment admissions is not given with the expenditure data (as it is in the UK), the average price cannot be calculated exactly. Therefore, an estimate of the average price is being made on information from the trade press.

3. For Broadway tickets reliable and precise time series of actual average price of the top-tickets are available from 1926-1965, for both straight shows and musicals [Moore 1968]. In 1938, top tickets prices were $4.90 and $6.32 respectively.

4. From 1949 onwards, also time-series on the average Broadway ticket prices are available [Moore 1968]. Over this period, the range of the ratio top/average price for straight shows and musicals are 1.16-1.52 and 1.18-1.47, respectively. To keep the price estimate conservative, here the starting points of the range are used to calculate average Broadway ticket prices for 1938. This yields $2.12 and $2.83 as average ticket prices. To make the estimate even more cautious, the average price for musicals is discarded.

5. It is then assumed that the average ticket price of all other live entertainment in the US was $0.75, which is again conservatively low.

6. It then is assumed Broadway tickets accounted for 1/10 of all ticket sales in the US and other live entertainment for 9/10. ("Broadway" is here taken to represent most metropolitan entertainment, such as in Boston, Chicago, Los Angeles, etc.). This yields an average ticket price for live entertainment of $0.887.

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[70] Although exact statistics lack, the programme duration of 2 hours and 30 minutes is probably not an overstatement, as many theatres showed double features at the time. Ten years later, in 1950, a British survey was carried out, which found that in Britain, average programme duration was 2 hours and 42 minutes. Cinemas with over 2,000 seats had an average duration of 3 hours, while cinemas with between 750 and 1,000 seats had an average programme duration of 2 hours and 37 minutes. Likewise, the smallest cinemas, with below 250 seats showed films 20 hours per week, while the largest cinemas with over 2,000 seats showed films 60 hours a week (Political and Economic Planning, *British film industry*, p. 198). Although it is not known to what extent these figures are comparable to the late 1930s and to the US—Britain was, for

7. It is then assumed that a live performance lasted 2 hours and 15 minutes on average, which yields an average price of $0.3942 per spectator-hour.

8. Total spectator-hours sold for cinema were 663,000,000/0.23*2.75= 7927.2 million, and for live entertainment 222,000,000/0.75*2.25= 666 million. The average price then, is (0.922*$0.0836)+(0.078*$0.887)= $0.1458 per spectator-hour.

US capital in 1938

I. All theatrical entertainment

Data of Leontieff for 1939, shows that depreciated fixed capital was 36.1 percent of output in the entertainment industry, and that inventories were 8.6 percent of total output, and replacement requirements 4.9 percent of capacity [Leontieff 1953: 486-493].

1. We can assume that capacity in 1938 was roughly the same as in 1939, as in the depression many cinemas and theatres were not used, and the industry was producing well below capacity. If we deflate the $417.9 million of fixed capital stock to 1938 prices using the consumer price index we get 417.9*1.0125 = 423.12 million dollars.

2. If we then assume that the fixed capital stock has an average life of 25 years, we get a 1938 value of (423/24)*25 = $440.75 million.

3. Adding replacement requirements in 1938 dollars, $57.1 million, and adding capital in inventory at 8.6 percent of output-revenue, $57.0 million, we get total capital of $554.9 million.

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example, far more urbanised—they do suggest that two and a halve hours are a reasonable estimate for the US.

II. Disaggregated capital data

1. Leontieff does not give disaggregated data, but Greenwald [1950: 228], does give this for 1944. Greenwald's data is based on the US Bureau of Internal Revenue, *Statistics of Income for 1944* (Washington, 1949). In 1944, capital invested in the film industry was $500.8 million, and in other theatrical entertainment $168 million, at 1938 prices.

2. This gives a share of live entertainment of 25.12 percent of total capital. However, between 1938 and 1944 live entertainment grew considerably faster than film, at 18.58 percent per annum, vs. 14.87 for film, in constant dollars. It is assumed that the capital in live entertainment grew about 1.5 times the pace motion picture had to grow, suggesting that the share of live entertainment in 1938 would be roughly three percentage points lower, yielding a share of 23.12 percent in 1938.

3. Estimated capital invested in the film industry in 1938, then, was 0.77*554.9 = $426.61 million, and in live entertainment $128.29 million.

US production costs in 1938

I. Film

1. Film production costs in 1939 amounted to $215,700,084 dollars [Census of Manufacturers]. Although not all these costs would have to be amortised on the US market, this is assumed to make the estimate more conservative.

2. Between 1937 and 1939 film production costs grew 5.9 percent per annum in real terms. This yields production costs for 1938 of $203.66 million, in 1939 dollars, which amounts to $205.71 million in 1938 dollars.

3. Further, $345,676,000 was paid out in wages to people working in the motion picture industry [Historical Abstracts], of which roughly $43.62 million was included in film production costs [1939 Census of Manufacturers, deflated in same way as in 1 and 2 above].

4. So film production costs and wage costs outside of film production together amounted to $507.77 million.

5. To this figure an estimate of other costs, mainly cinema operation and real estate costs have to be added. These costs are estimated to have been about $4,200 per cinema for all 14,900 cinemas, from the neighbourhood sixth-run cinema to the high street first run theatres, amounting to $62.58 million. If this estimate of the exhibition costs were to be too low, this would probably be offset by accounting all production costs to the US market alone.

6. This yields total costs in 1938 of $570.35 million.

7. Compared with revenues of $663 million, this yields an industry profit margin of 13.97 percent, and a return on invested capital of 21.70 percent. This is not an exceptional figure, as film was the tenth most profitable US industry in the late 1930s [Leontieff or Fabrikant].

II. Live entertainment

1. Since cost data are lacking, costs have been set at 95 percent of receipts, to reflect the bad situation in which live entertainment found itself. A 1933 census lists costs for opera/legitimate theatre, vaudeville and other as 75.4, 100 and 80.4 percent of revenue, respectively. Because the situation in 1938 probably had not improved (many consumers substituted cinema for live entertainment), a margin of 95 percent has been used.

2. Britain

2.1. British entertainment in 1900

British labour in 1900

1. The 1901 census for England and Wales shows 76,040 persons working in the entertainment industry. The growth rate of employment in this industry between 1901 and 1911 was 3.97 percent per annum. Assuming that the growth rate in 1900-1901 was the same, this yields 73,136 persons employed in the entertainment industry in 1900.

2. To get the figure for Britain, the proportion of the population of England and Wales of the combined population of England, Wales and Scotland has been used (87.9 percent). Ireland has been ignored, because of the presence of London in the England sample, the density of entertainment workers will be markedly higher, and this way that might be corrected somewhat.

This also keeps the territory used for 1900 the same as the one that will be used for 1938.

This method yields 83,176 persons employed in the British entertainment industry in 1900.

British consumer expenditure in 1900

1. Prest [1954] estimated expenditure on entertainment in 1900, arriving at a figure of £19.6 million, which is £20.42 million in 1938 pounds.

2. However, the Prest figures show almost flat expenditure between 1900 and 1913, while from other sources, such as total seating capacity in London, one gets the impression that expenditure could still have been rising. It is likely that the war boom was more limited and that more growth took place between 1900 and 1914, as the figures from Prest are more reliable from 1915 onwards, because they are based on entertainment tax returns. Before 1914, Prest made a very rough estimate based on Giffen,[71] so the huge jump in 1915 and the subsequent fluctuations may be due to a rough estimate with a wide margin of error before 1915, reaching precise figures, and irregularities in the first years of the entertainment tax returns.

3. For this reason, an alternative estimation has been used to check the reliability of Prest's figure for 1900. The estimate of Leone Levi [1882] for entertainment expenditure in 1881 (£6.5 million on theatres and £6.1 million on other entertainment) has been compared with Prest reliable, 'tax-based' 1915 estimate,

[71] Sir Robert Giffen, "The wealth of empire, and how it should be used," in: *Journal of the Royal Statistics Society*, Vol. 66 part III, September 1903, pp. 582-598.

to yield a growth rate of real consumer expenditure over these 34 years, arriving at 3.47 percent per annum.

4. This rate has then be geometrically interpolated to estimate the 1900 expenditure, which would be £22.3 million, in 1938 pounds. This estimate is within the same ball park as Prest's estimate, being only nine percent higher, and therefore Prest's figure has been used as the 1900 figure for consumer expenditure.

British prices in 1900

1. Because no exact figures are available, estimates have been made on the basis of the literature [Purser 1978; Hoher 1986; Waters 1986]. This crude estimate is 25 pence for London theatre tickets, thirteen pence for provincial theatre tickets, nine pence for London music hall tickets, seven pence for provincial music hall tickets. For other amusements, such as the cider cellars and penny gaffs, the price has been set at half the music hall prices, arriving at 4.5 pence for London and 3.5 pence for the provinces.

2. It is assumed a quarter of all British tickets were sold in London.

3. In 1891, a detailed breakdown of London seating capacity is available, and this is used to allocate the proportions to the respective entertainments [London County Council, series *London Statistics*, 1891-1938]. In 1891, London had 49 theatres with 65,550 seats, 42 music halls with 49,980 seats, and 279 penny gaffs, cider cellars and the like with 123,495 seats, yielding weights of 27.4 percent for theatre, 20.9 percent for music hall and 51.67 percent for the other venues. Between 1891 and 1903, seating capacity of theatres declined 0.18 percent per annum, of music halls 0.14 percent, while capacity at other venues increased by a staggering 3.91 percent annually, resulting in 1903 proportions of 20.75 percent of seats in theatres, 15.9 percent in music halls and 63.34 percent in other venues.

4. Geometrically interpolating (using growth rates), we get respective proportions of 22.37, 17.12 and 60.5 for 1900.

5. This yields an average London price of (25*0.22)+(9*0.17)+(4.5*0.60) = 9.85 pence, and an average provincial price of (13*0.22)+(7*0.17)+(3.5*0.60) = 6.22 pence. Together these yield an average price for Britain of (0.25*9.85) + (0.75*6.22) = 7.13 pence, which amounts to 7.43 pence in 1938 money. It should be stressed the estimates have been made very conservatively, and should be considered as the lower bound to prices.

6. It is then conservatively assumed that a theatre or musical night lasted 2.5 hours, while the cheaper places lasted 1.5 hour, on average, yielding an average duration of (0.6050*1.5) + (0.3950*2.5) = 1.895 hours.

7. The price in 1900 per spectator-hour, then, would be 7.43/1.895 = 3.92 pence of 1938.

British capital in 1900

Method I

1. The 1903 rateable value per seat was £1.81 for theatres and £1.40 for music hall. For other venues, it has been estimated at one fifth of music hall, yielding £0.28.

2. It is then assumed these values also held for 1900.

3. Since the rateable value is seen by the London County Council as representing the annual rent that could be asked for the property, this is here considered equal to the gross return on the historical investment. This return is set at fifteen percent.

4. This would yield a historical investment in theatres of £12.067 per seat. Assuming that theatres had an economic life span of fifty years and the average age was 17.5 years, this would mean a capital per seat of (32.5/50) * 12.067 = £7.84 per seat.

For music halls, the historical investment would be £9.33. Assuming a similar life span and average age of fifteen years, this would yield a capital of (35/50) * 9.33 = £6.53 per seat.

For the other venues, the historical investment would be £1.87 per seat. Assuming a life span of thirty years and an average age of ten years, this would yield a capital of (20/30) * 1.87 = £1.24 per seat.

5. The above data yield a total invested capital in the London amusements of £1,044,410. Three assumptions are made subsequently:

a. One fifth of all British venues were located in London.

b. The average seating capacity of provincial venues is 0.6 times the London capacity.

c. The invested capital per seat in the provinces is 2/3 of the capital per seat in London.

Making these assumptions yields an invested capital for venues outside London £1,671,057, bringing the total invested capital for Britain to £2,715,467, which is £2,828,612 in 1938 pounds.

Method II

1. From Feinstein [1965] data of total capital invested in the entertainments, the ratio of capital over revenue can be established. This ratio was 1.49 in 1920, and then in the 1920s gradually declined to a low of 1.22 in 1930, after which it gradually increases again to a high of 1.62 in 1938. It could be assumed that the ratio declined because of the expansion of cinema and the coming of sound film during the 1920s, increasing capital, but even more increasing revenues: between 1920 and 1930, the capital stock at real prices, grew 3.37 percent per annum, while revenue grew more than double that rate, 7.08 percent per annum.

Therefore, the high 1920 ratio is taken as a ratio reflecting an industry with a lot of live entertainment, and is used to calculate the 1900 capital stock.

2. Revenue in 1900 was £20.42 million at prices of 1938, yielding a capital stock of £30.52 million. Since it is likely that the capital/revenue ratio further also

declined between 1910 and 1920, under the influence of the emergence of the first cinemas, this estimate can probably best be considered as a lower bound.

Method III

1. From the census of the film printing trade the growth rate of feet of positive film printed between 1924 and 1935 is calculated, which is 7.02 percent per annum, and this growth rate is applied to the whole period 1920-1938, yielding capital in the film industry of £26.02 million in 1920, and in other entertainment of £26.48 million in 1920, both in 1938 pounds.

2. Then annual growth rates are obtained using the number of seats in theatres, music halls and cinemas in London, and the number of venues for other live entertainment venues. This was -1.25 percent for theatre (1910-1919), -2.13 percent for music hall (1910-1919), -0.97 percent for other venues (1913-1926), and, last but not least, +13.27 percent for cinema.

3. This yields a capital invested in the film industry of £7.48 million in 1910. For other entertainment, the growth rates are weighted using the relative total seating capacities of 1903, and assuming capital per seat in other venues was a quarter of that in music halls and theatre, yielding an average annual growth rate of -1.43 percent, and a capital of £22.97 million in 1910.

4. Annual growth rates for seats are obtained from the London County Council for 1891-1911 for theatre and music hall (0.12 and 1.96 percent, respectively), and for the number of other venues between 1891 and 1912 (3.52 percent). Using the same weighting, this yields an annual growth rate of 1.71 percent. Using this growth rate one arrives at £19.39 million of capital in live entertainment in 1900, at 1938 prices.

5. No reliable growth data for the film industry is available for 1900-1910. Between 1909 and 1910 the length of feet of new negatives released grew 96 percent, which suggests a large growth rate. The real growth rate for the whole decade has simply been estimated at twenty percent per year, yielding £1.208 million of capital in 1900.

6. Total capital invested in 1900, then, amounted to £20.60 million, at 1938 prices.

Conclusion

1. The estimate resulting from method I is discarded, since it is very far off the outcome of the other two methods, and other data suggests this figure cannot be correct: data of Crowhurst, for example, suggests that at the very least £1,648,487 (in 1938 pounds) invested in music hall alone in Britain in 1900, a factor 2 higher than in method I [Crowhurst 1991].

2. Since method II and method II both seem quite sensible, and they yield outcomes within the same order of magnitude, the average of the two has been chosen: £25.56 million.

2.2. British entertainment in 1938

British labour in 1938

I. Total

1. Since no 1941 census was done, the employment figure for 1938 has been obtained by geometric interpolation of the 1931 (102,214) and 1951 (83,700) census figures for England and Wales, yielding an estimate of 95,309 persons employed in the entertainment industry in 1938.

2. The same correction has been made as in the 1900 calculation to get the figure for all of Britain, which then amounts to 95,309/0.8919 = 106,855.

II. Disaggregated

1. For 1931 and 1951 no data are available that are disaggregated in film industry and live entertainment. Therefore two estimates are made of the share of workers in the film industry in 1931 and in 1951.

2. In 1931, all the entertainment occupations are examined, and for each the number working in the film industry is estimated [the occupations are listed for 1931 and 1951 in Bakker, *Entertainment Industrialised*, pp. xx-xx]. This yields 5,000 actors; 3,000 musicians, 520 film producers; 2,000 managers; 250 agents; 8,000 stagehands, cinematograph operators etc.; 20,000 other employees, yielding a total of 38.770, which was 37.9 percent of all entertainment labour.

3. For 1951 are estimated: 5,000 actors; 1,000 musicians [silent film had gone]; 4,500 film producers; 1,000 managers; 11,000 general personnel; 11,200 cinematograph operators, yielding a total of 33,700 persons which is 40.3 percent of al entertainment labour.

4. In order not to underestimate labour in the film industry, the proportion has been set at 40 percent.

British consumer expenditure in 1938

These figures are available from Prest [1954] and are £41.5 million for cinema, and £23.4 million for all other entertainments, yielding a total of £64.9 million.

British prices in 1938

1. Since the number of admissions is also available from Prest, average prices can simply be calculated. They are £0.042 (about ten pence) for cinema, and £0.046 (about eleven pence) for live entertainment. It strikes that the price of other entertainment came close to that of cinema.

2. Using the same duration of performances as in the US, 2 hours 15 minutes for live entertainment and 2 hours 45 minutes for cinema, this yields average prices per spectator hour of £0.020375 (4.89 pence) for live entertainment and £0.0152917 (3.67 pence) for cinema.

3. In 1938, 987 million cinema tickets were sold and 510 million tickets to live entertainment, resulting in 2714.25 and 1147.5 million spectator-hours, respectively, and relative shares of 70.29 and 29.71 percent.

4. Using these relative shares, this yields and average for all entertainment of (0.7029*0.015) + (0.2971*0.02) = 0.0097769 + 0.0073521 = £0.01618019 (4.032 pence) per spectator-hour.

British capital in 1938

1. Using tax data, Prest [1954] calculated that at the end of 1938, £105 million was invested in cinemas, theatres, and other amusements, including sports.

2. From other sources, it shows that £77.25 million was invested in cinemas, meaning that £27.25 million must have been invested in other venues [Bakker 2001].

3. Capital invested in film production and film distribution, which is not counted in the Prest data, amounted to £12.219 million and £0.987 million, respectively.

This yields a total invested capital of £118.206, 77 percent of which was invested in the film industry.

3. France

2.1. French entertainment in 1900

French labour in 1900

1. The 1901 census lists 41,978 persons employed in the entertainment industry.

2. The censuses between 1886 and 1901 do not yield comparable employment figures. The growth rate of entertainment employment between the 1901 and 1921 census, however, was 0.73 percent per annum. Using this rate, an employment figure for 1900 is obtained of 41,675 persons.

French consumer expenditure in 1900

1. Expenditure on theatre and music hall in Paris in 1900 was about 7,823,200 francs [Le Roy 1992].

2. In the late 1920s and 1930s, music hall and theatre entertainment accounted for about 87 percent of all Paris live entertainment. Using this same ratio (87.3 percent) for 1900 gives 8,961,300 francs as the expenditure on all live entertainment in Paris.

3. Using the same ratio for Paris to all of France as is used for 1938 (0.38; see below), this yields 23,582,050 francs for all of France, which amounts to 175.33 million francs at 1938 prices. This is, of course, a rough estimate.

French prices in 1900

1. In 1900, in Paris, average ticket prices for theatres ranged roughly from seven to eleven francs, and average ticket prices for music hall between three and eight francs [LeRoy 1992: 320-322; Abel 1994: 31).

2. From these indications, the average ticket price for theatre is set at 10 francs, and for music hall at 5 francs.

3. It is assumed that theatre and music hall each counted for half of ticket sales. In reality, the proportion of theatre might have been less, but since the high end prices are left out in the ticket price indications above, the half if taken.

This leads to an average ticket price of (0.5*10)+(0.5*15)=7.5 francs.

4. It is then assumed that prices in the provinces were 25 percent of the Paris level. Taking the share of Paris revenue in all revenue (38 percent), this yields an average ticket price for all of France of (0.38*7.5)+(0.62*1.875)=4.0125 francs.

5. Then the average 1900 duration of live entertainment estimated for Britain is used, 1.895 hours, to arrive at the average price per spectator-hour, which is then 2.1174 francs, which is 15.7429 francs at 1938 prices.

French capital in 1900

1. Since hardly any figures on capital have been traced, we take the capital/output ratio for Britain (£0.01887/specator-hour), and using the French output we obtain a very crude estimate of the French capital, which was 82.7037 million francs, which amounts to 614.89 million francs at 1938 prices.

2.2. French entertainment in 1938

French labour in 1938

1. The 1936 census lists 68,525 persons employed in the entertainment industry.

2. The growth rate of employment in entertainment between the 1931 and 1936 censuses was 2.0 percent per annum (the 1946 census uses a different classification system and is not fully comparable with the 1936 census). If this rate is used, 1938 employment of 71,298 persons is obtained.

French consumer expenditure in 1938

1. French cinema box office revenue amounted to 1,177,234,927 francs in 1938 [Durand 1958: 213].

2. For live entertainment, precise national figures have only been traced from 1947 onwards. Two thorough works on the economics and economic history of French live entertainment, based on meticulous research on sources, only come up with precise figures for Paris, which are available from the nineteenth century onwards [Le Roy 1990; 1992].

It is therefore assumed that live entertainment in 1938 had the same Paris/Province ration as cinema. This approach appears to be justified. Concerning cinema, prices in Paris were substantially higher than in the provinces, and relatively, many more cinemas existed. The same probably held for live entertainment, although the factor may have been even higher than 38 percent.

Using this approach yields total live entertainment expenditure in France in 1938 of 540,540,541 francs (= 31.47 percent of all entertainment expenditure).

The figure for total expenditure on spectator entertainment in France in 1938 will then be 1,717,775,468 francs.

French prices in 1938

1. In 1938, a cinema ticket in France cost 6 francs on average [Rapport Banc de France: 33]. According to Crisp, the ticket price was the same in 1937, and in that year prices for theatre and music hall were 25-35 francs [Crisp 1993: 9]. If we take the lowest value of this range and make it more conservative, we arrive at 20 francs per ticket for live entertainment. It is assumed prices in 1938 were roughly the same as in 1937.

2. Using the same duration of performances as in the US and the UK, 2 hours 15 minutes for live entertainment and 2 hours 45 minutes for cinema, this yields average prices per spectator hour of 8.89 francs for live entertainment and 2.18 francs for cinema.

3. This implies 540.5 million francs/ 8.89 francs/spectator-hour= 60.8 million spectator-hours of live entertainment were consumed, and 1177.2 million francs / 2.18 francs/spectator-hour = 540 million spectator-hours of cinema.

4. In total, 600.8 million spectator-hours were consumed, and 1,717.8 million francs were paid for it, yielding an average price per spectator-hour of 2.86 francs per spectator-hour.

French capital in 1938

Method I

1. We take the capital/output ratio for Britain (£0.03114/specator-hour), and using the French output we obtain the French capital, which was 2118.7 million francs (which does not seem absolutely implausible).

Method II

We take the number of cinemas in France, and simply assume that the same capital/cinemas ratio exists for both Britain and France.

1. In 1937 France counted 4,500 cinemas with a total seating capacity of 2.3 million seats. 3700 cinemas were wired for sound [USDC 1938].

2. Britain in 1938 had 5,300 cinemas with 4.6 million seats, and £77.25 million in capital, yielding an average capital of £16.79 per seat [Wood 1986]. Note that the average seating capacity of a French cinema was 511 seats, and for a British one 868 seats, so the British industry enjoyed some scale economies, probably at least partially related to higher urbanisation levels.

3. Using the same capital/seat ratio for France, we arrive at £38 million capital in France, amounting to 6,560 million francs.

4. Capital invested in French film production in 1933 was 350 million francs [Chevanne 1933: 48]. Using the industry growth rate of 5.3 percent per annum [Sauvy], we arrive at 453 million francs of capital in 1938, which is 612.3 million francs at 1938 prices.

[BdF docs: 1938: 320 million francs invested in film production, but this seem only the films produced, not the studios, production companies, etc., so the above figure may be accurate].

5. In Britain in 1938, capital invested in live entertainment was £27.25 million, while revenues were £23.4 million, yielding a capital/revenue ratio of 1.165. Using the same ratio for the 540.5 million francs of French live entertainment revenue in 1938, we arrive at 629.73 million francs of capital.

6. Adding the three amounts above yields a crude estimate of invested capital in the French entertainment industry of about 7,802 million francs.

Method III

1. A 1932 estimate puts the total capital invested in the French film industry at 3400 million francs, which has to apply to 1931, since the estimate was published in early March [Auriol 1932]. It is unclear how this estimate was arrived at, only that it was made by a leading expert in the leading French cinema magazine.

2. Using the growth rate of Sauvy of the French film industry in the 1930s of 5.3 percent per year, an assuming that this is a real growth rate, and that depreciation

is included in this growth rate, we arrive at 4,881 million francs of 1931 in 1938, which is 5,810.3 million francs of 1938.

3. This is substantially (19 percent or 1362 million francs) lower than the estimate of 7172 million francs above, but is within the same ballpark. It would not be unlikely that capital per seat in France was lower than in Britain.

4. Adding the 629.7 million francs for live entertainment found in method II, we would get total invested capital in the French entertainment industry of 6,440 million francs.

Conclusion

Method III seems to give the most reliable and the most likely result, so this figure is adopted.

Appendix B: data used for the calculations

Table B1. Productivity indicators for entertainment in the US, Britain and France, 1900-1938 (exchange rates)

		Total			Index		
		US	Britain	France	US	Britain	France
Labour (p*yedu)							
	1900	647,583	596,372	245,883	100	92	38
	1938	3,911,700	1,067,481	617,441	100	27	16
Capital ($)							
	1900	142	125	18	100	88	12
	1938	555	578	185	100	104	33
Sold output (mln sh)							
	1900	463	1,250	11	100	270	2
	1938	6,070	3,863	601	100	64	10
Expenditure (mln 1938$)							
	1900	166	100	5	100	60	3
	1938	885	317	49	100	36	6
Price (1938$)							
	1900	0.358	0.080	0.453	100	22	127
	1938	0.146	0.082	0.082	100	56	56
Labour productivity (sh/(p*yedu))							
	1900	715	2,096	45	100	293	6
	1938	1,552	3,618	973	100	233	63
Capital productivity (sh per 1000$)							
	1900	3,254	10,000	629	100	307	19
	1938	10,939	6,683	3,242	100	61	30
Creative input productivity (sh/p)							
	1900	12,271	19,100	418	100	156	3
	1938	87,057	97,819	22,319	100	112	26
Creative inputs (number)							
	1900	37,752	65,440	26,618	100	173	71
	1938	69,724	39,488	26,920	100	57	39
Revenue per creative input ($)							
	1900	4,393	1,526	190	100	35	4
	1938	12,693	8,037	1,837	100	63	14
Revenue/(p*yedu) ($)							
	1900	256	167	21	100	65	8
	1938	226	297	80	100	131	35
Capital/(p*yedu)							
	1900	220	210	72	100	95	33
	1938	142	541	300	100	382	212

Note: all amounts at 1938 prices; p = person; yedu = years in education; sh = spectator-hour (see text).
Sources: appendix; education: Maddison 1995.

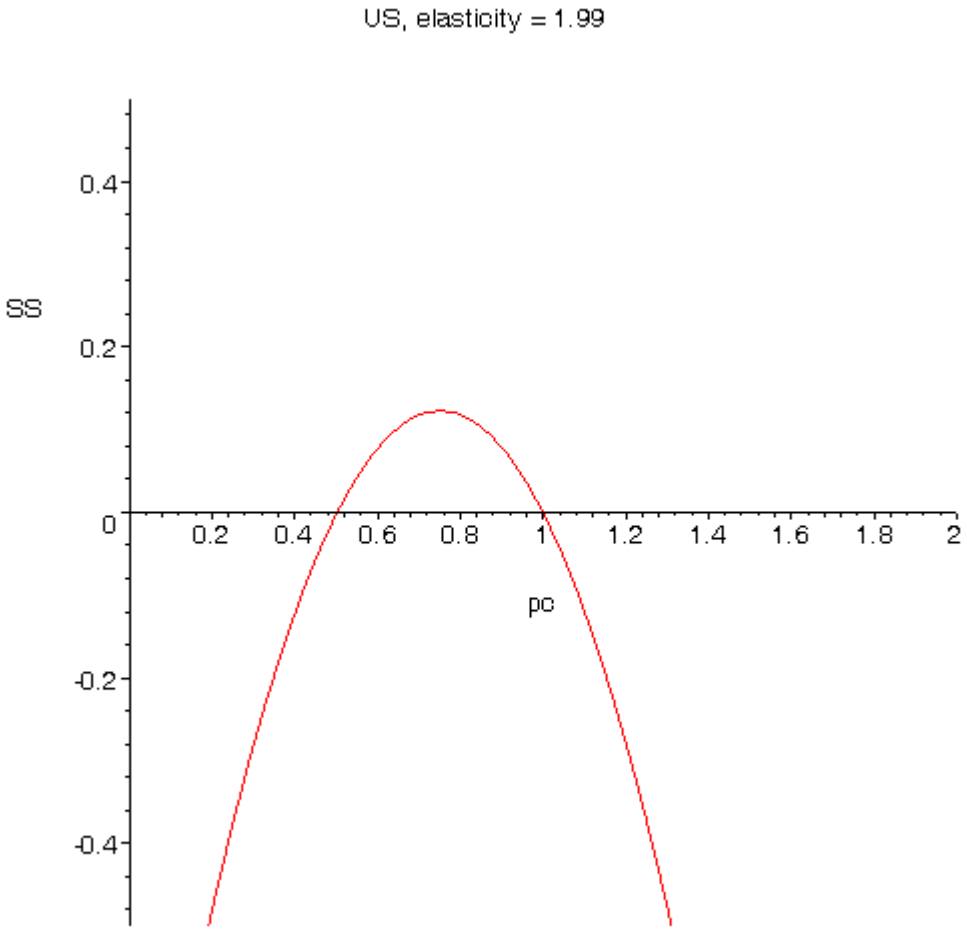
Table B2 (1)

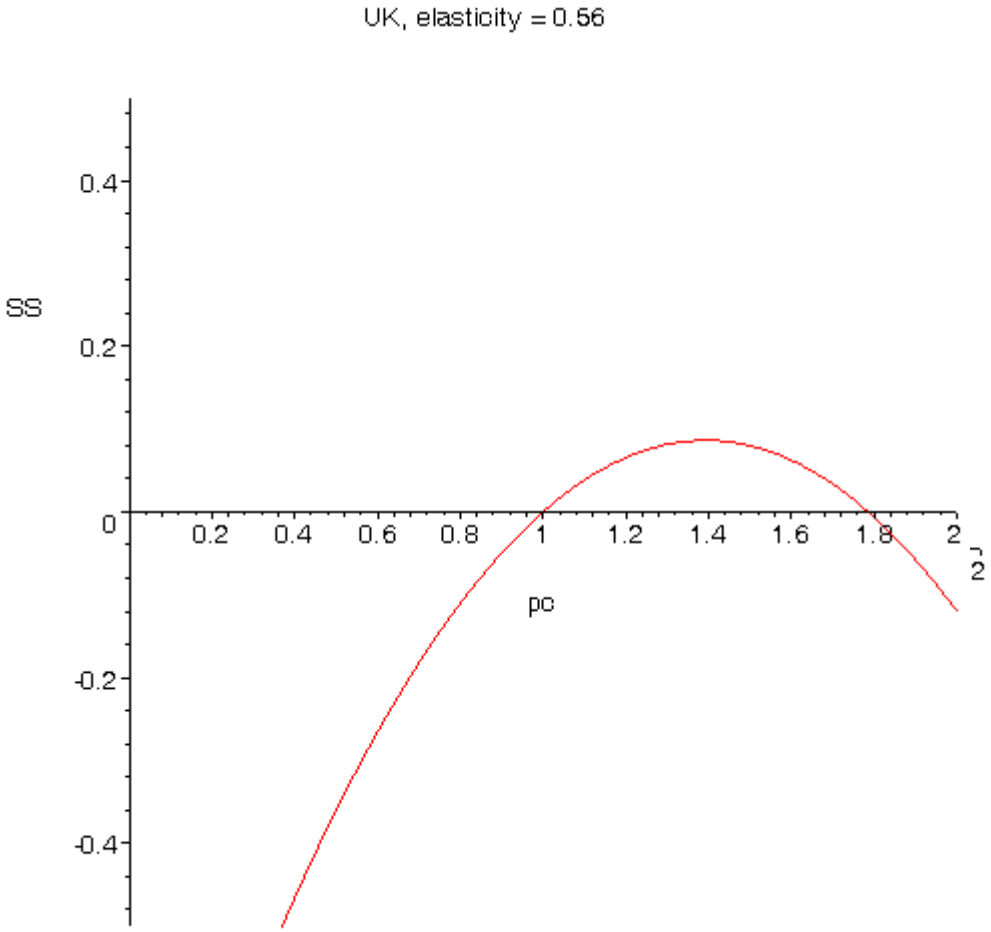
Table B” (2)

Table B2 (3)

Figures B1.1 to B1.3: *Social savings versus counterfactual price at given price elasticity of demand, US, Britain and France, 1938.*

Note: social savings stated in (q_a*$p_{a)}$, p_c in p_a.




UK, elasticity = 0.56
SS
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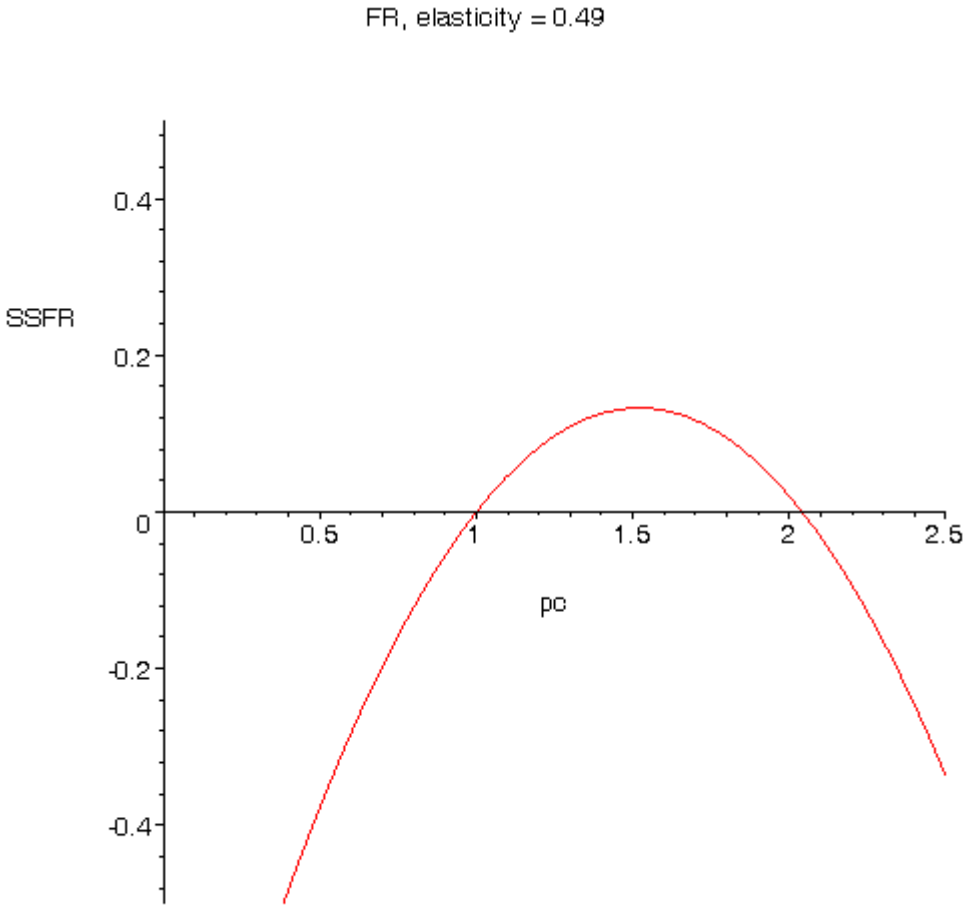
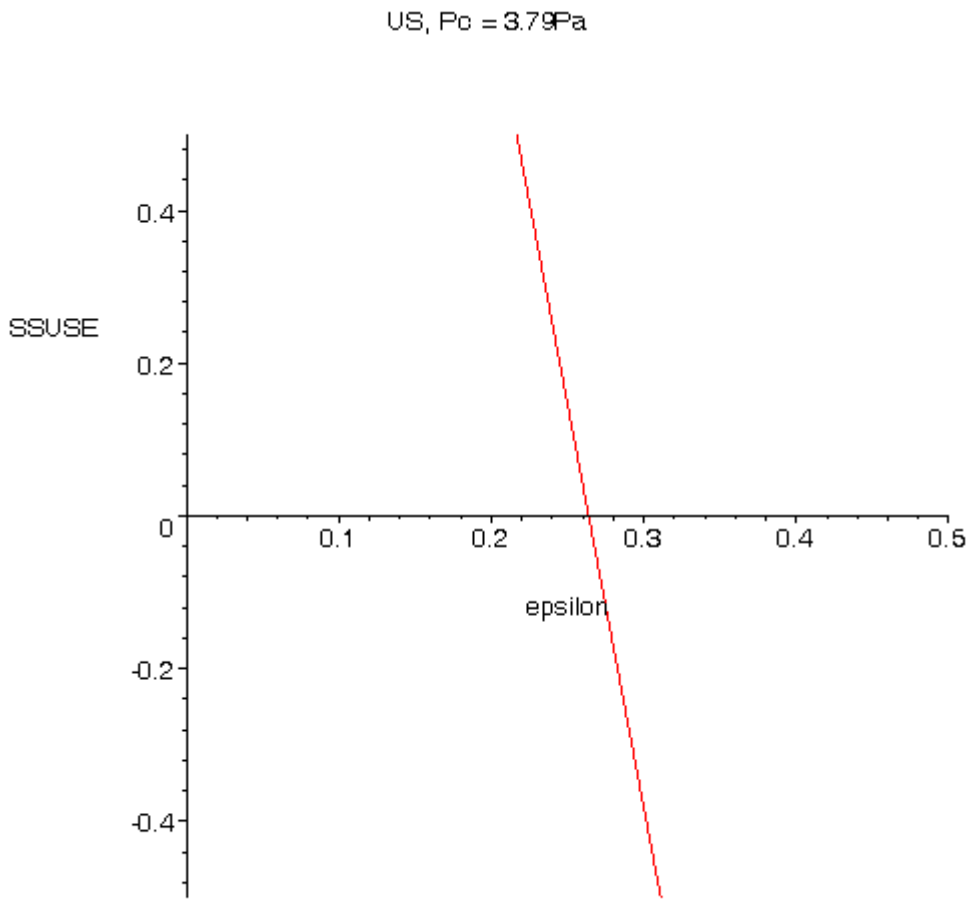
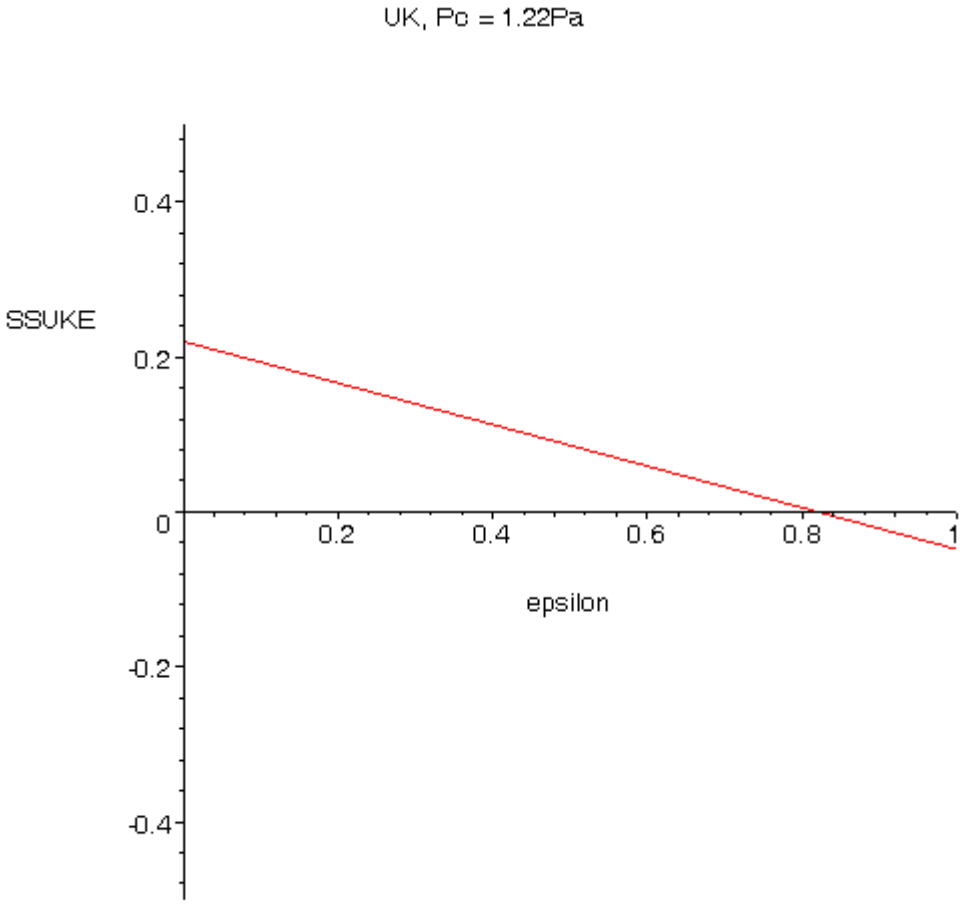
0.2
0
-0.2
-0.4
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
pc


FR, elasticity = 0.49
SSFR
0.4
0.2
0
-0.2
-0.4
0.5
1
1.5
2
2.5
pc

Figures B2.1 to B2.3: *Social savings versus elasticity at given counterfactual price, US, Britain and France, 1938.*

Note: social savings stated in $q_a * p_a$, p_c in p_a.; epsilon = price elasticity of demand.




UK, Pc = 1.22Pa
SSUKE
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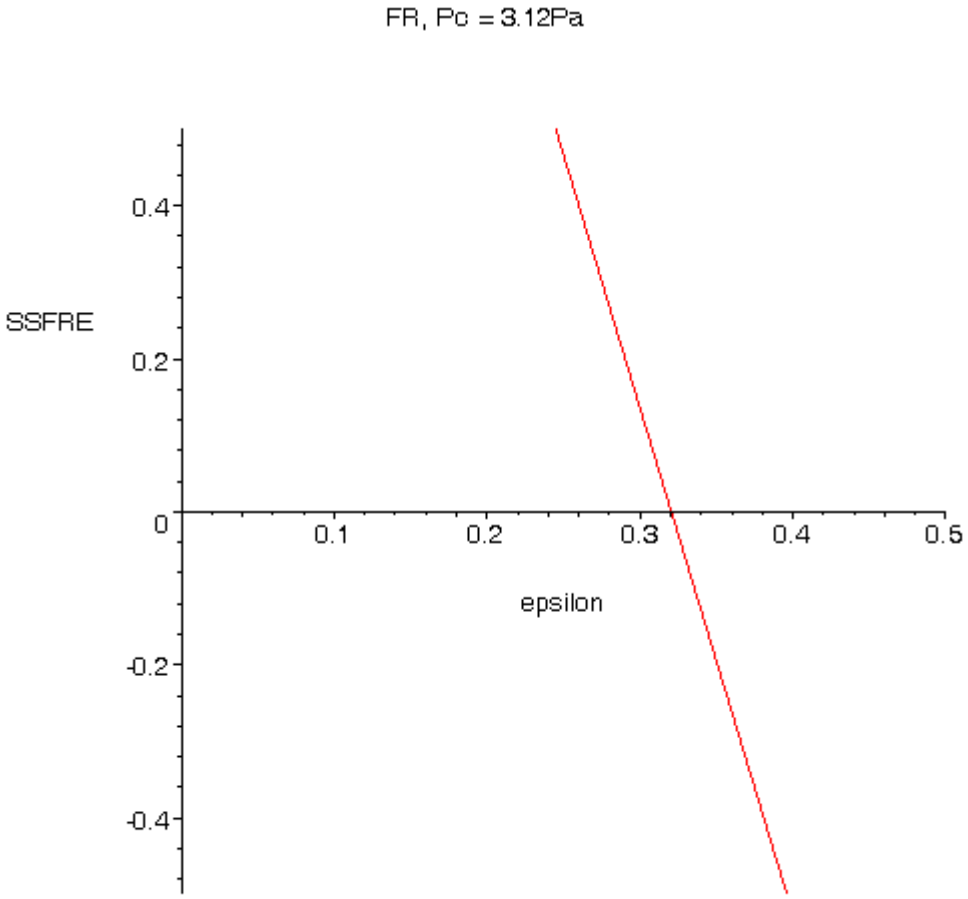
0.2
0
-0.2
-0.4
0.2
0.4
0.6
0.8
1
epsilon


FR, Pc = 3.12Pa
SSFRE
0.4
0.2
0
-0.2
-0.4
0.1
0.2
0.3
0.4
0.5
epsilon

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