The Comparative Postwar Economic Performance of the G-7 Countries

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Abstract

We estimate the effects on real output of differences in inputs and relative productive efficiency for the Group-of-Seven (G-7) countries—Canada, France, West Germany, Italy, Japan, the United Kingdom and the United States—for the post-World War II period. The United States has been and continues to be vastly more efficient than the other G-7 countries. The other G-7 countries in 1999 ranged between 60 and 80% as efficient as the United States in transforming given inputs into output (70%-90% if constant returns to scale are assumed). Over time, there has been a substantial improvement in the relative productive efficiency of France, Italy and Germany, most of it accomplished by 1980; a modest deterioration in the relative productive efficiency of Canada and the United Kingdom; and a large gain by Japan, most of it evident by 1990. In Boskin and Lau (2003), we noted some tendency of the levels of GDP per capita to converge in the post-World War II period for the G-7 countries other than the United States. The same is not true of efficiency levels; if anything, there has been a slight divergence.

The large differences among the G-7 countries in labor market conditions and outcomes – labor force participation rates, employment rates, average hours of work, human capital levels, and female labor force participation rates – have also had large effects on their relative real output. The real output loss associated with these labor market differences are enormous in continental Europe, amounting to more than an entire decade of lost economic growth, and large in Canada and the U.K. as well.

In 1960, the efficiency effects as a share of the total real output gap relative to the U.S. ranged from 32% (Canada) to 63% (Japan). By 1999, they have declined significantly in France, Germany, Italy and Japan, and increased somewhat in Canada and the U.K., relative to the input effects. In 1999, these effects ranged from 24% (France) to 54% (Japan). If constant returns to scale are assumed, the shares of the efficiency effects in 1960 are reduced to between -8% (Canada) and 55% (Japan). However, the trend remains the same as in the non-constant returns to scale case.

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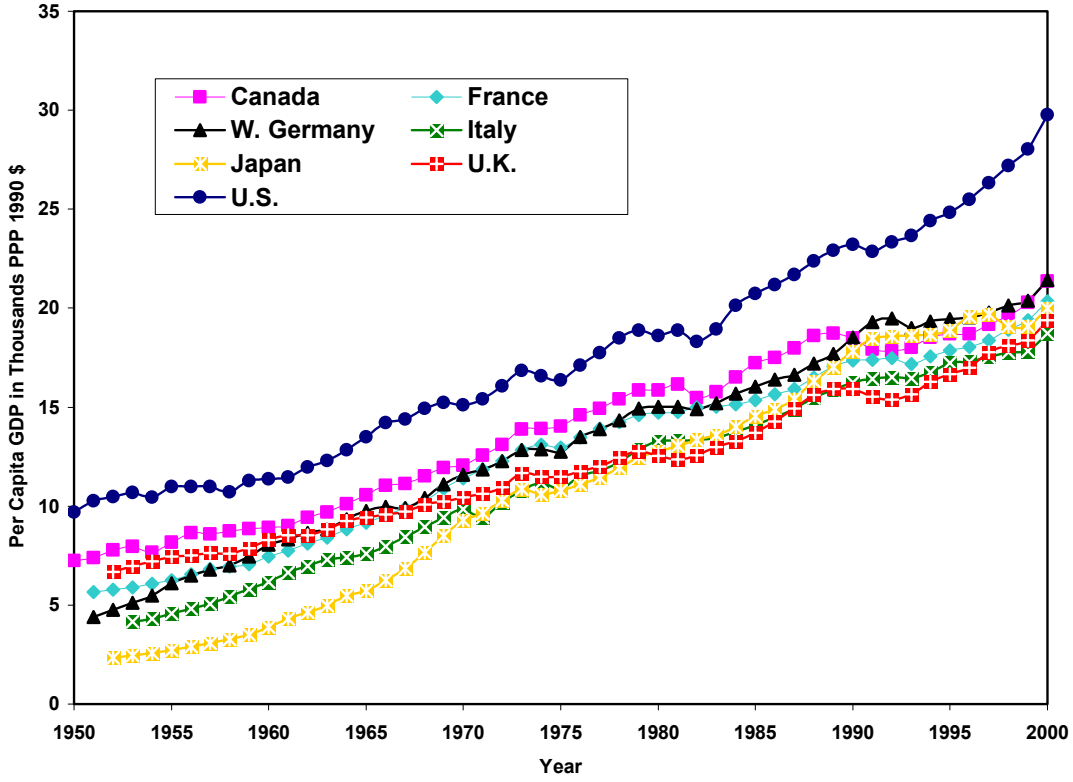
1. Introduction

The comparative economic performance of nations is among the most widely cited and hotly debated societal issues. In the U.S., for example, much debate in the 1970s, 1980s and early 1990s alleged the U.S. was in relative economic decline, soon to be surpassed first by Western Europe, later by Japan. Concomitant calls for the U.S. to adopt economic policies followed in these countries and perceived to be contributing to their relatively higher growth rates, for example, Japanese industrial policies, were rampant. In the last decade, however, calls for Europe and Japan to emulate the U.S. model have magnified, at least until the recent U.S. recession.

Levels of real GDP per capita (in terms of 1990 PPP prices) exhibit a wide variation among the Group-of-Seven (G-7) countries—Canada, France, West Germany, Italy, Japan, the United Kingdom and the United States (see Figure 1.1 and Table 1.1 in the Appendix). For example, in 2000, the U.S. real GDP per capita, ranged from 39 percent higher than the next highest G-7 country (Germany) to 59 percent higher than the lowest G-7 country (Italy). Given the importance of this subject, there has been relatively little study of the causes of these differentials. There have been numerous studies of growth rates, but few of the differentials in levels.[1] This study seeks to augment this understanding by analyzing in detail, currently and historically, both the input differentials among the G-7 countries, with special reference to human resource utilization, and the levels of relative productive efficiency, given input levels.

[1] A recent exception is the analysis by Hall and Jones (2000) of level differentials in output per worker among economies.

Figure 1.1: Real GDP per Capita, G-7 Countries (1950-2000)



Building on our earlier econometric analysis of postwar economic growth in the G-7 countries (Boskin and Lau, 2003), we analyze and compare levels of economic performance in the post-World War II period. Because of important differences among the countries in factor inputs, for example, the fraction of the working age population actually working and the level of education embodied in the labor force, real gross domestic product per capita alone may be quite misleading as a measure of relative economic performance or efficiency. Instead, we ask two more detailed questions; (1) What would other countries be able to produce with U.S. factor inputs, in comparison to U.S. output, and conversely? We develop indexes of relative productive efficiency both currently and historically. (2) Of course, these countries do not all have similar inputs[2];

[2] While the capital-labor ratios are not the same across the G-7 countries; the differences, when multiplied by modest capital elasticities of output, would account for only a small difference in real GDP. Hence we focus on labor input.

so, given the differences in the various components of labor input, such as labor force participation rates, employment rates, hours of work, and educational attainment, what are the implications for real output? We then compare the relative importance of differences in productive efficiency and input levels.

We conclude that the U.S. has been and continues to be vastly more efficient than the other G-7 countries. In 1999, the U.S. was approximately 28 percent more efficient than the next most efficient country, France. The remaining (descending) order is Italy[3], West Germany, Canada, Japan and the U.K. Historically, the relative productive efficiency advantage of the U.S. has not varied nearly as much as the near-hysterical debate in the 1970 through early 1990s period seemed to indicate. In 1980, for instance, the U.S. was 35 percent more efficient than the next most efficient country, France. Over the postwar period, the most important trends were the large gains made by Japan until the 1990s; from more than 55 percent (1960) to less than 37 percent (1999) below the U.S., enough of a gain to surpass the U.K., which suffered a relative decline of more than five percentage points between 1960 and 1999, the trend of which was temporarily arrested during the Thatcher years. Canada is the only other country that also suffered a relative decline vis-à-vis the U.S., losing almost ten percentage points during the same period.

The analysis also reveals the huge costs of inflexible labor markets for the European countries. We decompose the shortfall in labor input into the contributions of lower levels of human capital, labor force participation, employment rates and hours of work, and show that the differentials in labor input have risen substantially over time, resulting by 1999 in a lost output for the continental European countries relative to the U.S. of 28 percent or more, over 10 percent for the U.K. and Canada, and a small

[3] The large underground economy in Italy makes comparisons using official data especially suspect (see the discussion in Schneider and Enste (2000)).

amount for Japan. The source of the lower effective labor input among educational attainment, labor force participation, unemployment, and hours of work differs across the countries and over time. By 1999, it is primarily the various dimensions of effective labor input, not human capital, that are the source of the differential.

The study proceeds as follows: Section 2 details the model and methodology used to develop indexes of relative productivity efficiency. It also briefly discusses some of the relevant literature. Finally, it presents the statistical results, both currently and historically. Section 3 reports the role of human capital (more accurately, education level) differentials in real output differentials, as measured by differentials in average years of education of the working-age population. Section 4 analyzes in detail the output implications of alternative labor market conditions – employment and labor force participation rates and hours of work – especially the inflexible labor market conditions in Europe. Section 5 analyzes in particular the effect of differences in female labor force participation rates across the countries. Section 6 compares the real output effects of differences in productive efficiency with those due to input differentials. Section 7 reports the results for all of these analyses under the assumption of constant returns to scale (CRS). Section 8 presents a brief conclusion.

2. The Relative Productive Efficiency of the G-7 Countries

In Boskin and Lau (2003), we estimate an aggregate meta-production function with three explicitly distinguished inputs – physical capital, labor, and human capital – and commodity-augmenting technical progress for the G-7 countries. It is found to exhibit generalized Solow-neutral technical progress, that is, technical progress is simultaneously purely capital- and human-capital-augmenting. Such a production function can be written in the form:

(2.1) $Y_{it} = A_{io}F\,(A_i(t)K_{it}^{\lambda}H_{it}^{1-\lambda},\ L_{it})$

where Y_{it} is the quantity of real output of the ith country in the tth period, K_{it}, H_{it} and L_{it} are the quantities of physical capital, human capital and labor, respectively, λ is a scalar constant with a value between zero and unity, A_{i0} is a country-specific positive scalar constant that may be identified as the level of output-augmentation, and $A_i(t)$ is the common augmentation factor associated with both physical and human capital. More specifically, $F(.)$ has the transcendental logarithmic form, and $A_i(t)=(1+c_i)^t$, with c_i a country-specific nonnegative scalar constant that may be identified as the (common) rate of augmentation of physical and human capital, so that the aggregate meta-production function for the ith country can be written as:

(2.2)

$$\ell nY_{it} = \ell nY_0 + \ell nA_{io} + (a_K + B_{KL})\lambda\ell nK_{it} + (a_K + B_{KL})(1-\lambda)\ell nH_{it} + a_L\ell nL_{it} + (a_K + B_{KL})\ell n\,(1+c_i)t$$

$$+ B_{KK}\lambda^2(\ell nK_{it})^2/2 + B_{KK}(1-\lambda)^2(\ell nH_{it})^2/2 + B_{LL}(\ell nL_{it})^2/2$$

$$+ B_{KK}\lambda(1-\lambda)(\ell nK_{it})(\ell nH_{it}) + B_{KL}\lambda(\ell nK_{it})(\ell nL_{it}) + B_{KL}(1-\lambda)(\ell nH_{it})(\ell nL_{it})$$

$$+ [B_{KK}\lambda(\ell nK_{it}) + B_{KK}(1-\lambda)(\ell nH_{it}) + B_{KL}(\ell nL_{it})]\ell n(1+c_i)t + B_{KK}(\ell n(1+c_i))^2 t^2/2\ .$$

Given the same measured inputs, the outputs of two countries can differ because of differences in these efficiency parameters. While the dependence of the real output on A_{i0} is monotonically non-decreasing and log-linear, the dependence on c_i (strictly speaking, $ln(1 + c_i)$) is monotonically non-decreasing and log-quadratic; moreover, the effects of the differences in these efficiency parameters also depend on the quantities of the measured inputs – physical capital, human capital and labor – and time. With

equation (2.2), we can estimate the hypothetical output of the ith country in the tth period under different assumptions on its inputs.

In Boskin and Lau (2003), we estimate this meta-production function for the postwar period[4]. The data used in this study come from the national income accounts of the G-7 countries and related series. The period covered is the late 1950s through 1997 for the production function estimation with minor exceptions (e.g., we truncate West Germany in 1994 for data consistency), and through 2000 for labor input measurement[5]. We conclude, after a series of statistical tests, that over this period, technical progress was generalized Solow-neutral. Technical progress was the major source of economic growth for the G-7 countries, contributing well over 50 percent for most of the countries. Capital was the second most important contributor in all but Canada and the U.S., with human capital next and labor input last. In the U.S. and Canada, both of which had large increases in labor force participation rates, especially for women, labor input was second to technical progress. The estimates are obtained both in a general form, where the degree of returns to scale is estimated (and found to be locally slightly decreasing[6]), and under the restriction of constant returns to scale[7]. The differences in the results between the two alternative specifications are non-trivial, as discussed below. We present both sets of results, since some readers may wish to focus on the constant returns case. In Table 2.1, we present the estimated output-augmentation level and

[4] We actually allow the c_i's to vary across time. Specifically, on the basis of statistical tests, a different c_i is assumed to hold for the period 1973-1985 inclusive.
[5] Historical data are spliced to the most recent data to maximize comparability to the most recent data revisions and definitions. The capital stock data are built up from time-series data on constant-price gross fixed investment, using the perpetual inventory method. Labor force data come from OECD, Labor Force Statistics, and national data sources. Human capital is defined as the number of years of schooling per person in the working-age population (persons aged 15-64 inclusive), derived from annual time series data on enrollment and population and from national census data. Further detail is available in Boskin and Lau (2003).
[6] What this means is that locally, within a neighborhood of the values of the current quantities of factor inputs, the aggregate production function exhibits approximately constant returns to scale.
[7] Constant returns to scale are taken to mean that if capital, labor hours and total school years are all increased in the same proportion, output is increased in the same proportion.

capital augmentation rate parameters for the G-7 countries. The rankings of the A_{i0}'s by magnitude are the United States, France, West Germany, Italy, Canada, the United Kingdom and Japan. The rankings of the c_i's by magnitude are, for the period up to 1973 and after 1985: Japan, Italy, West Germany, France, the U.S., Canada and the U.K.; and for the period between 1973 and 1985 (the years of the oil shocks): France, Italy, West Germany, Canada, the U. K., Japan and the U. S.

Table 2.1: Estimates of the Efficiency Parameters A_{i0} and C_i

Country	A_{i0}	C_i (~1972, 1986~)	C_i (1973~1985)
Canada	0.69	0.067 (2.250)	0.063 (2.068)
France	0.75	0.094 (3.761)	0.087 (3.027)
West Germany	0.70	0.099 (4.348)	0.073 (2.858)
Italy	0.70	0.118 (4.112)	0.080 (2.917)
Japan	0.58	0.127 (3.793)	0.058 (2.349)
U. K.	0.61	0.063 (3.415)	0.059 (2.482)
U. S.	1	0.076 (4.342)	0.057 (2.680)

Note: Numbers in parentheses are asymptotic t-ratios.

We first pose the question of the relative productive efficiency among the G-7 countries. The real outputs of the G-7 countries may differ for two reasons: first, the quantities of the inputs – tangible capital, labor hours, and human capital – differ across countries; and second, even if the quantities of inputs are the same, the efficiency in

transforming the inputs into output may also differ across countries. We thus perform the following thought experiment: If each country is given the U.S. levels of tangible capital, labor, and human capital, but produces with its own efficiencies, what level of output will it be able to produce? What percentage (possibly greater than 100 percent) of the actual U.S. output will it be able to replicate? Let $F_i(K, L, H, t)$ be the production function of the ith country in terms of its measured inputs and time. Then an index of the relative productive efficiency, E_{1i}, in the tth period may be defined as:

$$E_{1i} = \frac{F_i(K_{US}, L_{US}, H_{US}, t)}{F_{US}(K_{US}, L_{US}, H_{US}, t)}. \quad (2.3)$$

The results of this thought experiment are presented for selected years in Table 2.2[8]. The E_{1i}'s in Table 2.2 show that the U.S. has been and continues to be the most productive economy in the G-7. Its nearest rivals – Canada in the 1960s and France in the 1980s and 1990s – would produce less than 80 percent of U.S. output, using the same U.S. inputs. The U.K., which used to be in the middle in terms of productive efficiency in the 1960s, fell to last place in the 1990s. Japan, which, as the least productive economy among the G-7 countries in 1960, was able to produce less than 48 percent of U.S. output using the same U.S. inputs, surpassed the U.K. in the 1980s and almost reached the same level of productive efficiency as Canada in the late 1990s. In 1999, in terms of relative productive efficiency, the G-7 countries rank in descending order as follows: U.S., France, Italy, Germany, Canada, Japan and the U.K.

Of course, we can also perform an alternative thought experiment: If the U.S. is given the levels of tangible capital, labor, and the human capital of each of the other six G-7 countries, but produces with its own efficiencies, what level of output will the U.S. be able to produce? How much is the hypothetical U.S. output as a percentage of the

[8] The data by year for all three measures of productive efficiency are presented in Appendix Table 2.1.

actual output of each of the other six G-7 countries? This index of relative productive efficiency is defined in Equation (2.4). For the purpose of maintaining comparability with the E_{1i}'s, we use the reciprocals of the indexes, the E_{2i}'s, so that we always measure the outputs of other G-7 countries in terms of a percentage of the U.S. output.

$$\frac{1}{E_{2i}} = \frac{F_{US}(K_i, L_i, H_i, t)}{F_i(K_i, L_i, H_i, t)} \tag{2.4}$$

Given that the U.S. is the more productive economy, one would expect the $1/E_{2i}$'s to exceed 100 percent, which indeed they do. The results are also presented in Table 2.2.

It turns out that the E_{1i}'s and E_{2i}'s tell a similar story. For example, the E_{1i}'s show that, in 1960, Japan could produce just under 48 percent of actual U.S. output, using actual U.S. inputs. Similarly, the $1/E_{2Japan}$ in 1960 shows that the U.S. could produce 225 percent of actual Japanese output, using actual Japanese inputs, which implies an E_{2Japan}, the ratio of actual Japanese to hypothetical U.S. output, of just over 44 percent, very close to E_{1Japan} for that year.

We note that, while both the E_{1i}'s and E_{2i}'s attempt to measure the relative productive efficiency (the levels of outputs holding inputs constant) between the U.S. and the other countries, their results are not identical. This is the familiar index number problem. Note that in this case the differences are small. Following Malmquist[9], we also calculate M_i's, the geometric means of E_{1i}'s and E_{2i}'s, and present them in Table 2.2.

$$M = (E_{1i} E_{2i})^{1/2} \tag{2.5}$$

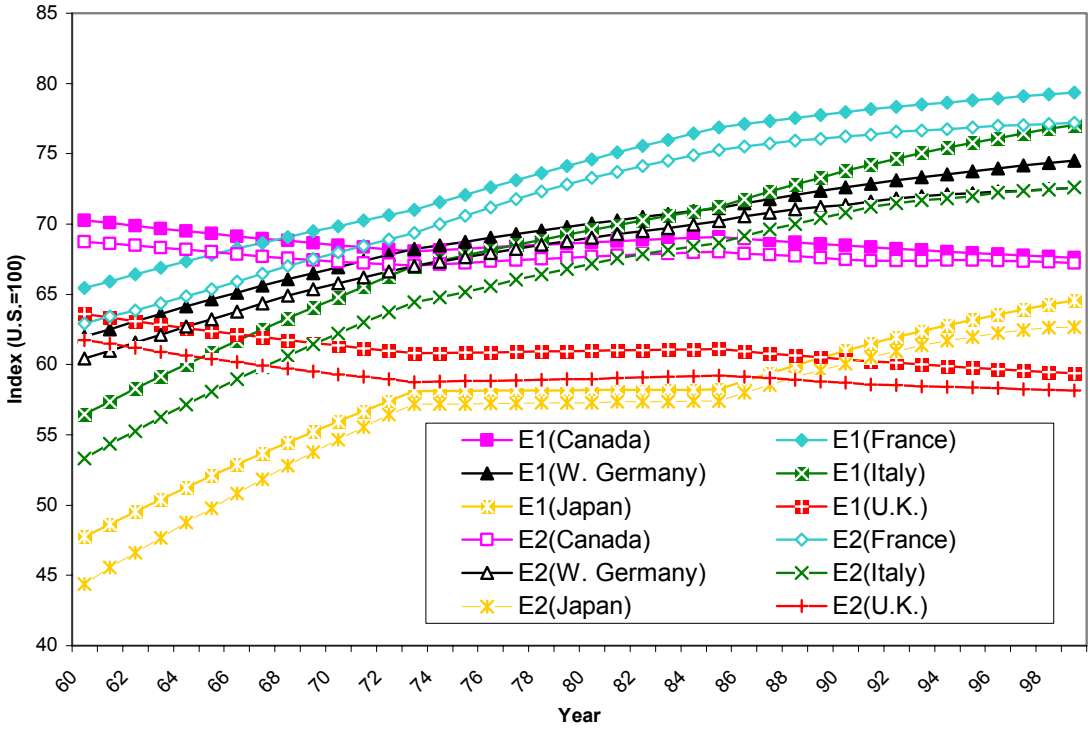
[9] See Malmquist (1953, 1993).

Table 2.2: Productive Efficiency Relative to the United States, Selected Years

Country	1960	1970	1980	1990	1999
France:					
E1	65.5	69.8	74.6	78.0	79.3
E2	62.9	68.0	73.3	76.2	77.2
M	64.2	68.9	73.9	77.1	78.3
Italy:					
E1	56.5	64.8	69.6	73.8	77.0
E2	53.3	62.2	67.2	70.8	72.6
M	54.9	63.5	68.4	72.3	74.8
West Germany:					
E1	62.0	66.9	70.0	72.6	74.5
E2	60.4	65.8	69.0	71.4	72.6
M	61.2	66.4	69.5	72.0	73.5
Canada:					
E1	70.3	68.5	68.7	68.5	67.6
E2	68.8	67.3	67.7	67.5	67.2
M	69.5	67.9	68.2	68.0	67.4
Japan:					
E1	47.8	56.0	58.2	61.0	64.6
E2	44.4	54.7	57.3	60.1	62.7
M	46.0	55.3	57.7	60.5	63.6
U.K.:					
E1	63.6	61.3	61.0	60.4	59.4
E2	61.7	59.3	59.0	58.7	58.2
M	62.7	60.3	60.0	59.5	58.8

The indexes of relative efficiency, E_{1i} and E_{2i} are also plotted in Figure 2.1. There is not a great deal of difference between E_{1i} and E_{2i}. For example, consider Canada: the hypothetical Canadian output using actual U.S. inputs relative to actual U.S. output is represented by a solid square, whereas the actual Canadian output relative to hypothetical U.S. output using actual Canadian inputs is represented by an open square. There is hardly any difference between the two series. There are minor differences for the other countries, but on the whole, they do not alter the general conclusions on the levels of relative productive efficiencies and their evolution over time.

Figure 2.1: Productive Efficiency of the G-7 Countries Relative to the U.S. (U.S.=100)



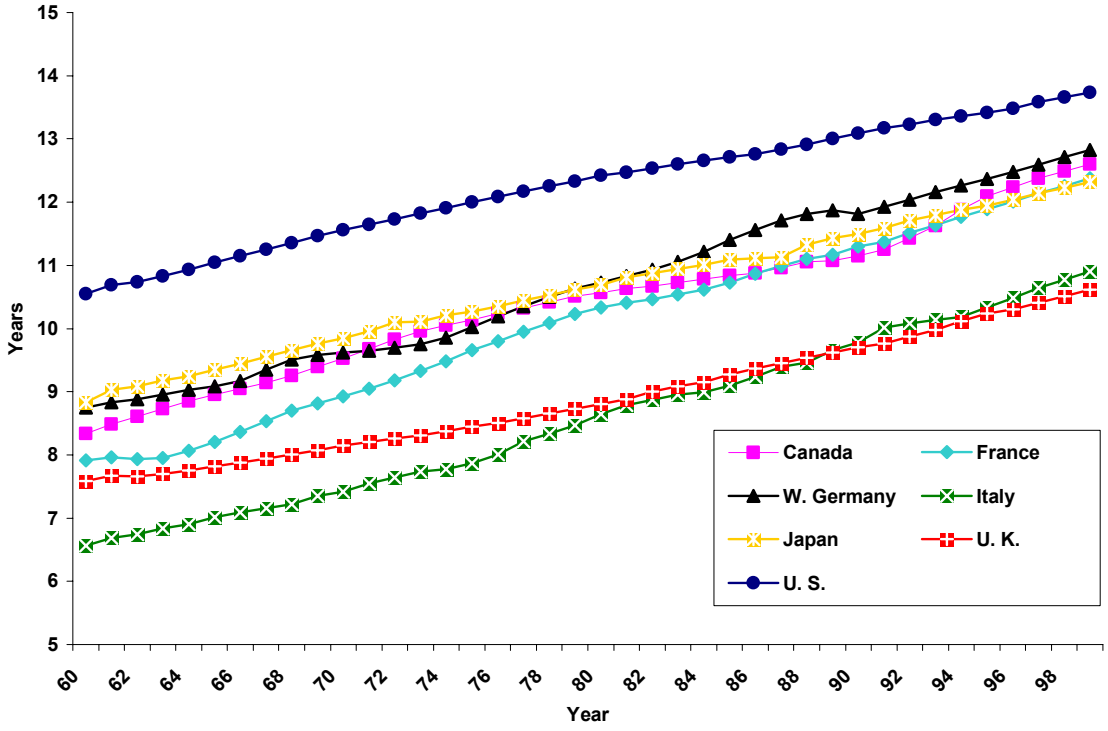
3. The Role of Human Capital

In addition to differences in productive efficiency conditional on the quantities of the measured inputs, we also estimate the impact on real GDP per capita of the differences in the quality of the labor inputs and their utilization. While differences in capital inputs per labor-hour are not small across the G-7 countries[10], when they are combined with modest capital elasticities of output, they account for only a small portion of real GDP per capita differences (Boskin and Lau, 2003). We first take up the issue of differences in the quality of the labor inputs. In Figure 3.1, the average levels of human capital of each of the G-7 countries, measured as the number of school years per person of the working age population (defined as all individuals aged 15-64, inclusive) are

[10] See Table 4.1 below. Note, however, that the exceptionally high physical capital per labor-hour in Italy may have been due to the under-reporting of employment and labor hours.

presented [11]. It is immediately apparent that the U.S. has throughout this period had a higher level of average human capital than any other G-7 country, and the U.K. the lowest. Overall, however, the advantage enjoyed by the U.S. in terms of average human capital has diminished over the years. Currently, Italy and the U. K. have attained early 1960s U. S. level of average schooling, whereas Canada, the other continental European countries and Japan are at early to mid- 1980s U.S. levels.

Figure 3.1: Human Capital of the G-7 Countries
(Average Number of Years of Schooling of the Working Age Population)



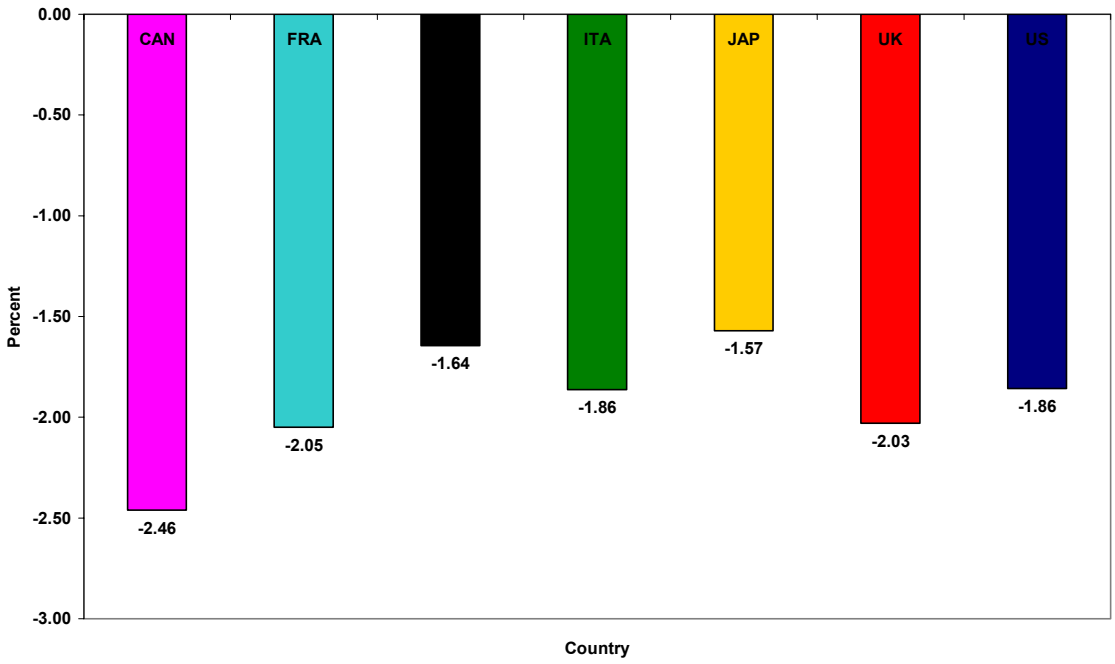
Source: Authors' calculations.

There are two interesting dimensions to the differentials in human capital: its growth over time and its variation across countries. First, suppose there had been no improvement in average human capital since 1960 in each of the G-7 countries; what

[11] The effects of any constant differences in quality per year of schooling level across countries would be captured by the country-specific constants in the meta-production function.

would have been the reduction in real output, expressed as a percentage of the actual output? The results for 1999 are presented in Figure 3.2. In all of the G-7 countries, including the U.S., there would have been a rather modest reduction in annual real output of between 1.5 and 2.5 percent. Canada would have had the largest reduction in real output, of almost 2.5 percent. Japan would have had the smallest reduction in real output, just over 1.5 percent, followed by Germany and the United States. The results are considerably larger, but still modest, in the constant returns to scale specifications presented in Section 7.

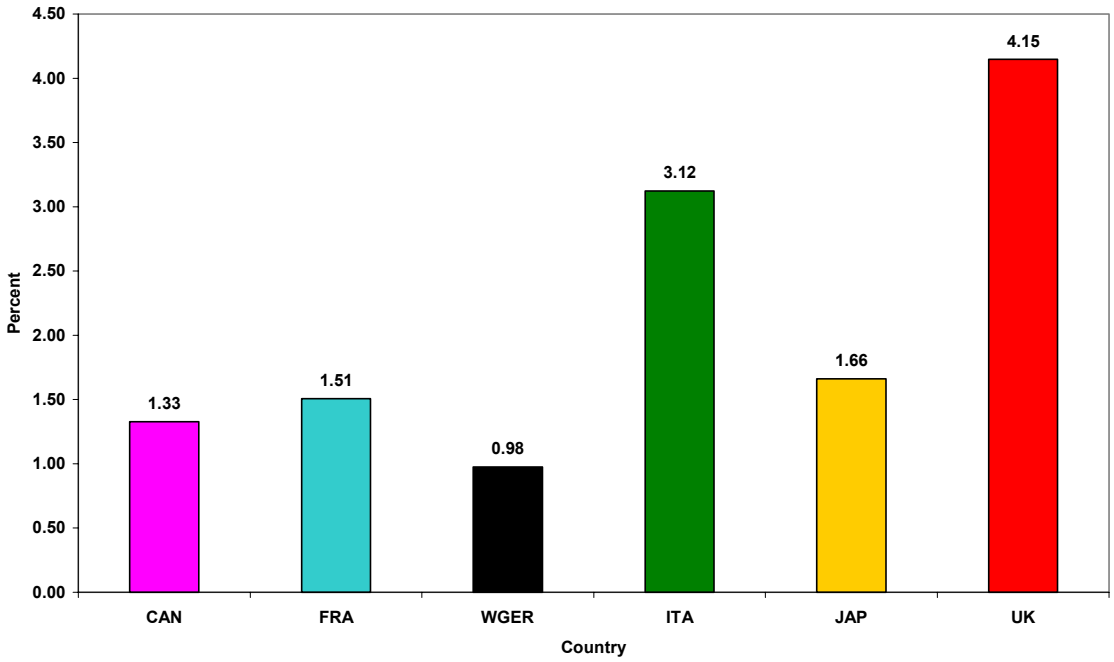
Figure 3.2: Hypothetical Output Losses in 1999 under the Assumption that Average Human Capital Has Not Grown Since 1960 (Percent of Real GDP)



Second, how much of the difference in real output across the G-7 countries can be accounted for by the difference in average human capital? To answer this second question, we perform the following thought experiment: suppose each G-7 country produced with the U.S. level of average human capital but its own measured inputs;

what would have been the hypothetical percentage gain or loss in its real output? The results are presented in Figure 3.3. These results show that the real output gains would be small currently and hence the gaps between the U.S. and the other G-7 countries would remain very significant. The United Kingdom would show the largest increase in its real GDP, over 4%, followed by Italy. West Germany would show the smallest increase in its real GDP, about 1%. Of course, the larger human capital differentials observed in earlier periods between the U.S. and the other countries imply considerably larger annual effects historically.

Figure 3.3: Hypothetical Output Gains in 1999 under the Assumption that All Other G-7 Countries Have the Same Average Human Capital as the U.S.(Percent of Real GDP)



After accounting for differentials in productive efficiency among the G-7 countries, the remaining gaps in real GDP per capita are mainly due to differences in the labor market institutions, practices, and outcomes. We now turn to these differences.

4. The Effect of Labor Market Institutions, Practices and Outcomes

We note that the aggregate quantity of labor-hours, L in equation (2.2), may be expressed as follows:

(4.1) $$L = (L/E).(E/LF).(LF/N).N$$

where E is the aggregate number of employed individuals, LF is the labor force, and N is the working-age population. The ratios in parentheses can be interpreted as hours per employee, the employment rate (or one minus the unemployment rate), and the labor force participation rate, respectively.

Labor market institutions, practices and outcomes differ considerably across the G-7 countries. The rate of labor force participation, the rate of employment (or unemployment), and the actual annual number of hours worked per employee all differ significantly. In Table 4.1, we present statistics on these indicators of labor market institutions and practices. In terms of the labor force participation rate, Japan has consistently had the highest—76 percent in 1960 and 78 percent in 1997. Italy has consistently had the lowest labor force participation rate among the G-7 countries, registering only 60.2 percent in 1997. Canada and the U.S. have had major increases in their labor force participation rates between 1960 and the late 1990s. Japan and the U.K. have had moderate increases. In contrast, the three continental European countries—France, West Germany and Italy—have all had declining labor force participation. In terms of the rate of employment, both Canada and the U.S. have held steady, although Canada has a much lower level. The continental European countries have had very large declines in their employment rates. The rate of employment in Japan, while historically very high, also declined significantly in the 1990s.

Table 4.1: The Levels and Average Annual Rates of Growth of Selected Labor-Market Indicators Group-of-Seven (G-7) Countries

	Output per Capita (1990 US$)		Output per Labor-Hour (1990 US$)		Physical Capital per Labor-Hour (1990 US$)		Human Capital per Working-Age Population (Years)		Average Hours Worked per Employee per Year (Thou.)		Employment Rate (%)		Labor Force Participation Rate (%)		Female Labor Force Participation Rate (%)	
Levels																
	1960	1997	1960	1997	1960	1997	1960	1997	1960	1997	1960	1997	1960	1997	1960	1997
Canada	8916	20206	13.94	24.96	19.09	53.18	8.34	12.38	1.916	1.768	89.9	90.3	59.4	70.9	32.0	67.8
France	7441	18404	8.62	28.95	11.46	68.02	7.91	12.14	2.120	1.688	98.5	87.4	66.7	65.9	n.a.	59.7
W.Germany[1]	8298	18846	8.90	27.06	13.40	71.68	8.75	12.26	1.969	1.623	99.0	91.7	70.5	68.6	49.3	61.8
Italy	6169	17448	8.00	29.51	13.58	88.95	6.56	10.64	1.925	1.629	94.1	85.7	62.7	60.2	36.7	44.1
Japan	3899	19693	3.44	19.82	4.19	74.34	8.84	12.14	2.383	1.911	98.3	96.6	76.0	78.0	n.a.	63.7
U.K.	8292	17630	9.26	22.06	16.26	62.99	7.59	10.41	1.982	1.758	98.5	94.4	70.4	74.6	48.5	67.5
U.S.[2]	11379	26284	15.06	29.71	34.91	65.43	10.55	13.56	2.076	1.860	94.5	94.9	64.5	76.6	42.5	71.1

	Average Annual Rates of Growth (percent p.a.), 1960-1997							
Canada	2.2	1.6	2.9	1.07	-0.2	0.01	0.5	2.1
France[3]	2.6	3.4	4.9	1.16	-0.6	-0.32	0.0	0.8
W.Germany[1]	2.6	3.5	5.1	1.00	-0.6	-0.23	-0.1	0.6
Italy	3.0	3.7	5.3	1.32	-0.4	-0.25	-0.1	0.5
Japan[4]	4.7	5.0	8.0	0.86	-0.5	-0.05	0.1	1.0
U.K.	2.2	2.5	3.8	0.86	-0.3	-0.11	0.2	0.9
U.S.[2]	2.3	1.9	1.7	0.68	-0.3	0.01	0.5	1.4

Notes:
1. Data for West Germany are only available through 1994.
2. For the U.S., the levels of net tangible capital stock per labor-hour in 1960 and 1997 are 29.06 and 48.75 respectively, implying an average annual rate of growth of 1.5%.
3. The rate of growth of the female labor force participation rate is between 1966 and 1997.
4. The rate of growth of the female labor force participation rate is between 1976 and 1997.
Source: Authors' calculations as described in the text.

Average annual number of hours worked per employee have declined in each of the G-7 countries. However, the U.S. still lags slightly behind Japan but is otherwise much higher than any other G-7 countries. Canada and the U.K. are about mid-way between the U.S. and the much lower continental European countries.

In analogy with the analysis of efficiency differences above, we pose the following hypothetical question: If each of the G-7 countries had the same labor market outcomes as the United States, what would be the percentage gain or loss in terms of their actual real output? We examine this question at three points in time: 1960, 1980 and 1999[12]. We decompose the differences in labor input into the contributions of different levels of human capital, labor force participation, employment rates and hour of work. The results are presented in Figures 4.1, 4.2 and 4.3. In 1960, the major source of gain in output relative to the U.S. for the other G-7 countries would have come from the upgrading of human capital, amounting to between 5 and 10 percent. In the postwar recovery, the European G-7 countries and Japan had very low rates of unemployment. France, West Germany and Japan, in some sense, were even more efficient than the U.S in terms of utilization of their human resources. Canada was the only country that would have benefited significantly from having the U.S. labor market conditions. This situation gradually changed over time. By 1980, differences in labor market conditions would result in a greater loss of real output than the (decreasing) human capital differentials, except for Japan and the U.K. By 1999, the lost output due to the even smaller human capital differentials would remain modest, whereas differences in the labor market conditions would result in real output losses that are quite

[12] While there are some cyclical differences among the countries, especially in 1980, (a brief U.S. recession), and 1999 (the stock bubble), the results vary only slightly if we use 1978 or 1979 rather than 1980 and 1996 or 1997 rather than 1999, as the U.S. unemployment rate, for example, would be about 1% lower and 1% higher, respectively. Using 1997 rather than 1999, for example, would reduce the labor input effects by a couple of percentage points for France and Italy and by about five percentage points for Japan; barely change Germany and the U.K.; and increase Canada by a couple of percentage points.

large for Canada (10 percent), France (26 percent), West Germany (28 percent) and Italy (44 percent). Among the components of labor input, by 1999, participation rates and hours are the most important differences for the four European G-7 countries and Canada.

Figure 4.1: Hypothetical Output Gains (or Losses) in 1960 under the Assumption that U.S. Labor Market Conditions and Human Capital Prevail in the Other G-7 Countries (Percent)

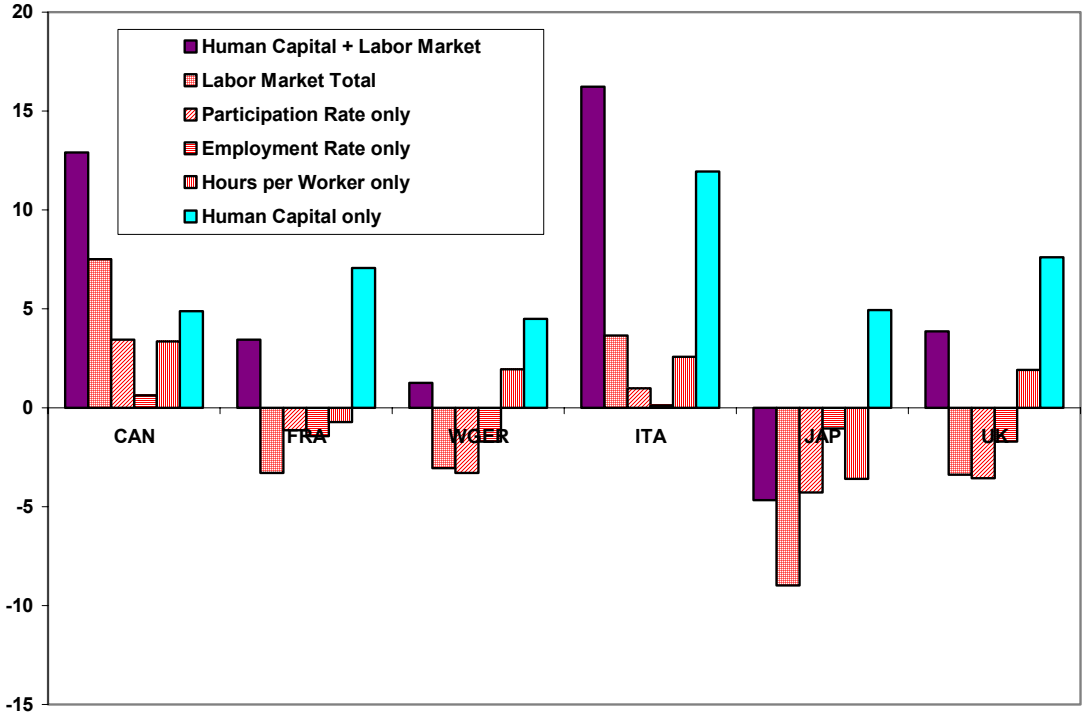


Figure 4.2: Hypothetical Output Gains (or Losses) in 1980 under the Assumption that U.S. Labor Market Conditions and Human Capital Prevail in the Other G-7 Countries (Percent)

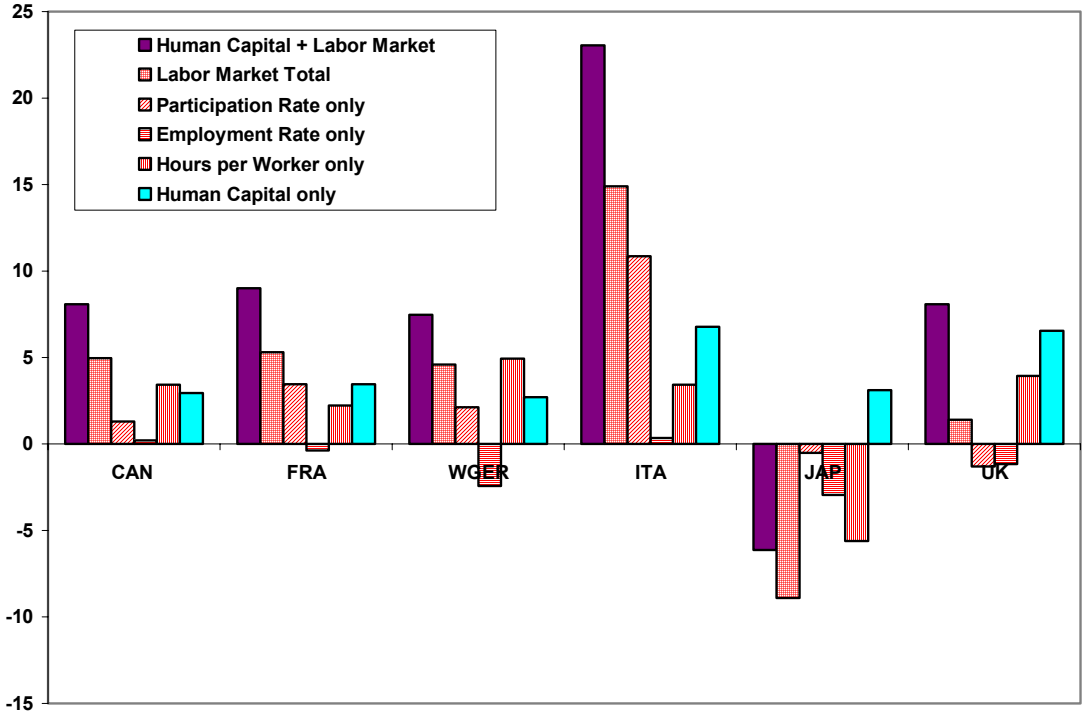
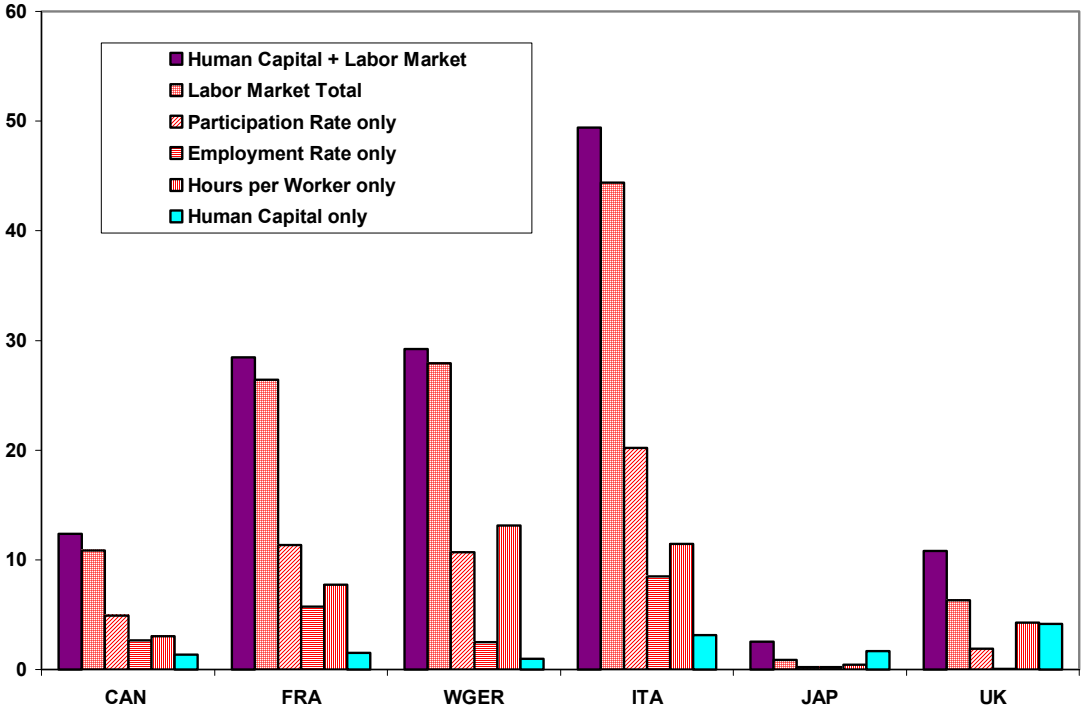


Figure 4.3: Hypothetical Output Gains in 1999 under the Assumption that U.S. Labor Market Conditions and Human Capital Prevail in the Other G-7 Countries (Percent)



Our analysis reveals the huge costs of inflexible labor markets for the continental European countries--their outputs in the 1990s could have been at least 28 percent higher with U.S. labor market outcomes, much more than a decade of economic growth at their recent growth rates. In this sense, the continental Europeans have literally suffered a totally lost decade, in the span of less than a generation.

5. The Effect of Differences in Female Labor Force Participation

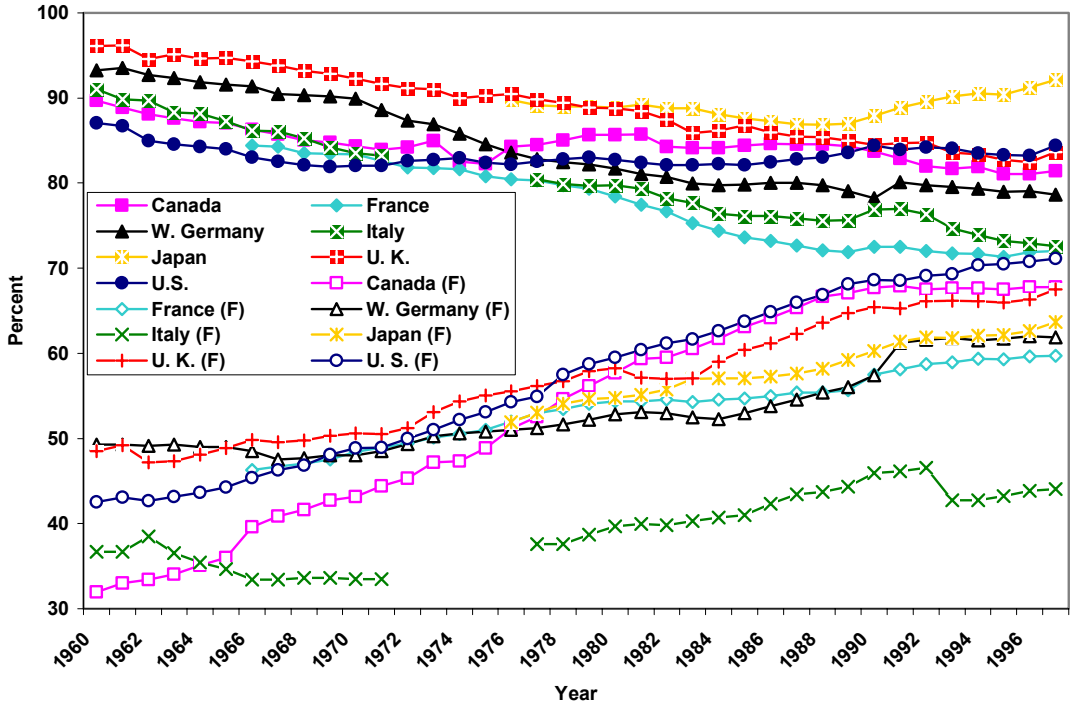
Another question of interest is the importance of the postwar rise in the female labor force participation rate in the United States and Canada in explaining the differences in the levels of real GDP in the G-7 countries. In Figure 5.1, the male and female labor force participation rates of the G-7 countries in the postwar period are presented.

The United States does not have and has never had the highest rate of male labor force participation. In 1960, the United Kingdom had the highest rate of male labor force participation, at slightly more than 96 percent, followed by West Germany, at a little more than 93 percent. However, the United Kingdom was gradually overtaken by Japan in the 1980s. In 1997, Japan had the highest rate of male labor force participation, at 92.1 percent, followed by the United States, at 84.4 percent; France had the lowest rate of male labor force participation among the G-7 countries, at 72 percent. For the European G-7 countries and for Canada, the rates of male labor force participation have been declining over time. For Japan and the United States, there was an initial decline, followed by a gradual rise. The decline in the male labor force participation rate is due in part to the aging of the population and to the trend of earlier retirement.

By contrast, the rates of female labor force participation have been generally rising in all of the G-7 countries in the postwar period. However, the rise was the most rapid in Canada and the United States. While West Germany had the highest rate of

female labor force participation in 1960, at 49 percent, it was soon surpassed by the United Kingdom, the United States, France and Canada. Toward the end of the 1990s, the rates of female labor force participation in the three English-speaking countries were approximately 70 percent, compared to an average of approximately 60 percent for France, West Germany and Japan, and 44 percent for Italy.

Figure 5.1: Male and Female Labor Force Participation Rates



Source: OECD, "Labor Force Statistics (LFS) 1977-1997"

Despite the rapid rise of the female labor force participation rates in the G-7 countries, there is still a significant gap between the male and female labor force participation rates. In 1997, France had the lowest gap, with the male labor force participation rate exceeding the female labor force participation rate by just over 12 percentage points, closely followed by the U. S., at 13, Canada at about 14, the U. K. at 16, and Italy and Japan with the highest gap, at 18.5 and 28.5 percentage points

respectively. As recently as the early 1970s, no gap was less than 30 percentage points; and as recently as the early 1980s, no gap was less than 20 points.

It is worth noting that the contemporary U.S. female labor force participation rate has gained parity with the male labor force participation rates in France and Italy, in the low 70 percent range. In the 1960s, the U.S. female rate was half these male rates--in the low 40s compared to the mid-80s.

To estimate to what extent the differences in the female labor force participation rates across the G-7 countries can account for differences in their actual aggregate labor hours, given the working age populations, we rewrite equation (4.1) as:

(5.1) $L = (L/E)\ (E/LF)\ [LF_f/N_f)\ N_f + (LF_m/N_m)\ N_m],$

where $(LF_f\ /N_f\ )$ and $(LF_m\ /N_m\ )$ are the female and male labor force participation rates, respectively and N_f *and* N_m are the male and female working-age populations, respectively. Equation (5.1) can be further rewritten in the form:

(5.2) $L = (L/E)\ (E/LF)\ [(LF_f/N_f)\ (N_f/N) + (LF_m/N_m)\ (N_m/N)]\ N,$

where it is made explicit that the labor force participation rate is an average of the female and male labor force participation rates weighted by the respective shares in the working-age population. We can estimate separately the effect on the outputs of the other G-7 countries if they have the same female labor force participation rate as in the United States, other things being equal.

We perform two hypothetical thought experiments with the female labor force participation rates. In the first thought experiment, we assume that each of the G-7 countries (other than the United States) was given the U.S. rate of female labor force participation, but its own female working-age population, in 1997. For all the countries, this thought experiment would imply a hypothetical increase in the female labor force. By assuming the same rate of employment and the same average labor hours per

employee, we obtain the hypothetical labor hour input for each of the G-7 countries. We ask: What is the impact of this change in the female labor force participation on the real GDP of each country in 1997?

In the second thought experiment, we assume that each of the G-7 countries (other than the United States) had the same ratio of female to male labor force participation rate as the U.S. in 1997. For all the countries, this thought experiment would also imply a hypothetical increase in the female labor force. By assuming the same rate of employment and the same average labor hours per employee, we can also obtain the hypothetical increase in real GDP as a result of such a change in the female labor force participation in each of the G-7 countries[13].

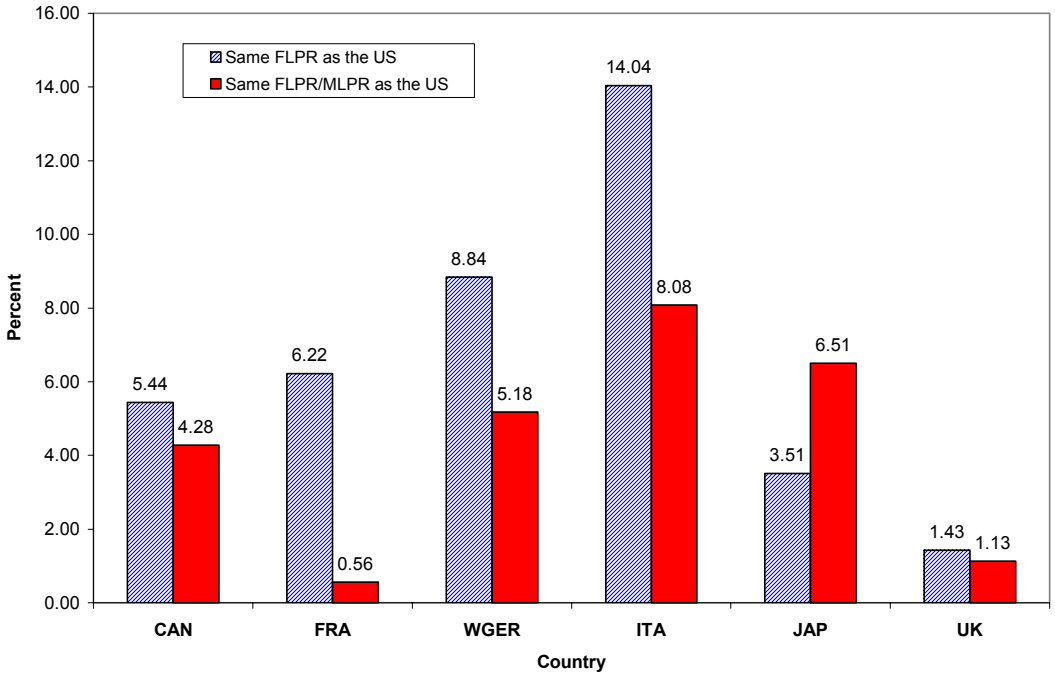
The results of the thought experiments are presented in Figure 5.2. The effects of the same female labor force participation rate as the U.S. are comparable in order of magnitude as the effects of the same labor force participation rate as the U.S. (see Figure 4.3). The largest effect is for Italy (with its large underground economy perhaps disguising some participation), with 14 percent (compared to 20 percent for the total labor force participation case), followed by West Germany with 9 (compared to 11), France with 6 (compared to 11) and Canada with 5 (compared with 5). Thus, one can say that the differential in the female labor force participation rates account for the major part of the effect of differentials in labor force participation. The case of the same ratio of female to male labor force participation rates as the U.S. have somewhat smaller effects.

In recent years, the truly large output differentials generally result from the combination of the various components of labor input, not just female labor force

[13] We make these hypothetical calculations on the assumption that male and female labor are perfect substitutes. While female wages have gained on male wages in the last two decades, they still lag well behind. Whether these differences reflect productivity differentials, discrimination, or other factors is beyond the scope of this paper. Because the effects are small even if somewhat overstated, we make no disaggregate calculations attempting to account for such effects.

participation. Of course, the large increase in female labor force participation in each of the G-7 countries was an important source of growth of real output over this period. To the extent the female labor force participation rate seems to approach an upper asymptote, it will be increasingly difficult for growth to come from this source.

Figure 5.2: The Effects of Differences in the Female Labor Force Participation Rates



6. The Combined Effects of Differential Input and Productive Efficiency Levels

Now that we have separately examined the real output implications of differentials in productive efficiency and of input differentials, it is worth comparing their relative contributions to the real output gap with the United States. While it may be tempting to simply add the two sets of effects and take each individually as a percentage of the total—it is not in general correct to do so, except in special cases, because there will be interactions between the two effects. Recall that with non-Hicks-neutral technical progress, the levels of inputs will affect technical progress and productive efficiency.

However, we can evaluate the effects sequentially and cumulatively, adding the effects of efficiency differentials, conditional on the input differentials.

The non-additivity of the input differential and efficiency differential effects can be illustrated with a simple single-output, single-input example. The difference between the natural logarithms of the real outputs of one of the other G-7 countries and the United States, say the ith, in the tth period, can be expressed as follows:

$$(6.1)\ \ell nY_{it} - \ell nY_{USt} = \ell nA_{io} + a_K(\ell nK_{it} - \ell nK_{USt}) + a_K(\ell n(1+c_i) - \ell n(1+c_{US}))t$$

$$+ B_{KK}((\ell nK_{it})^2 - (\ell nK_{USt})^2)/2$$

$$+ B_{KK}((\ell nK_{it})(\ell n(1+c_i)) - (\ell nK_{USt})(\ell n(1+c_{US})))t\ .$$

$$+ B_{KK}(((\ell n(1+c_i))^2 - (\ell n(1+c_{US}))^2)t^2/2$$

In general, given the values of the parameters, the difference is a function of the efficiency parameters, ℓnA_{i0}, c_i, and c_{US}, as well as the quantities of the inputs of the two countries, and t, time. Holding t constant, the difference in the natural logarithm of output due to the difference in the inputs is given by:

$$(6.2)\ \ell nY_{it} - \ell nY_{USt} = a_K(\ell nK_{it} - \ell nK_{USt})$$

$$+ B_{KK}((\ell nK_{it})^2 - (\ell nK_{USt})^2)/2$$

$$+ B_{KK}((\ell nK_{it})(\ell n(1+c_i)) - (\ell nK_{USt})(\ell n(1+c_{US})))t\ .$$

Holding t constant, the difference in the natural logarithm of output due to differences in the efficiency parameters is given by:

$$(6.3)\ \ell nY_{it} - \ell nY_{USt} = \ell nA_{io} + a_K(\ell n(1+c_i) - \ell n(1+c_{US}))t$$

$$+ B_{KK}((\ell nK_{it})(\ell n(1+c_i)) - (\ell nK_{USt})(\ell n(1+c_{US}))t$$

$$+ B_{KK}(((\ell n(1+c_i))^2 - (\ell n(1+c_{US}))^2)t^2/2 .$$

However, the sum of equation (6.2) and equation (6.3), given in equation (6.4) below, is different from equation (6.1), illustrating the non-additive nature of these differences.

(6.4) $$\ell nY_{it} - \ell nY_{USt} = \ell nA_{io} + a_K(\ell nK_{it} - \ell nK_{USt}) + a_K(\ell n(1+c_i) - \ell n(1+c_{US}))t$$

$$+ B_{KK}((\ell nK_{it})^2 - (\ell nK_{USt})^2)/2$$

$$+ B_{KK}((\ell nK_{it})(\ell n(1+c_i)) - (\ell nK_{USt})(\ell n(1+c_{US}))t$$

$$+ B_{KK}((\ell nK_{it})(\ell n(1+c_i)) - (\ell nK_{USt})(\ell n(1+c_{US}))t$$

$$+ B_{KK}(((\ell n(1+c_i))^2 - (\ell n(1+c_{US}))^2)t^2/2 .$$

We note that equation (6.4) is different from equation (6.1) by the term:

(6.5) $$B_{KK}((\ell nK_{it})(\ell n(1+c_i)) - (\ell nK_{USt})(\ell n(1+c_{US}))t ,$$

the interactive effect between the difference in the levels of inputs and the difference in the efficiency parameters.

In Figures 6.1 through 6.6, we express the hypothetical real outputs of each of the other G-7 countries as a percent of the U.S. real outputs under three different assumptions: (1) real output with own inputs and own efficiency; (2) real output with U. S. inputs and own efficiency; and (3) real output with U.S. inputs and U.S. efficiency. Of course, under (3), we should expect 100 percent.

The results are quite interesting. As seen in the bottom panel of Figures 6.1-6.6, between 1960 and 1999, France, Italy and Canada retained an approximately constant

real output relative to the U.S. For France and Italy, this was despite much lower labor force growth. The German economy (given our best estimate to net West Germany in the post-1994 data) declined by 4 percentage points or 19%, while the U.K. declined by over 6 percentage points or 33%. Japan was the one G-7 economy that grew substantially relative to the U.S., more than doubling in this period, mostly accomplished by the early 1980s. For perspective, as of 1999, in ascending order, Italy, the U.K., France and Germany had real GDP ranging from 13% to 17% of U.S. real GDP, whereas Canada was a little under 9% and Japan a little under 35%.

Turning to the hypothetical additional output achievable with U.S. inputs but own efficiency, the second panel of Figures 6.1-6.6, the continental Europeans not only increase substantially, but at a growing rate over time, reflecting the faster U.S. labor force growth and the deterioration in labor market outcomes in continental Europe. The change over time is small for the U.K., and small but negative for Canada and Japan.

Finally, the third panel of Figures 6.1-6.6 shows the trend over time in the relative efficiency effects, measured as the residual of 100% less the output achievable with U.S. inputs. The relative efficiency effects are quite large (recall they are based on estimates of slightly decreasing returns to scale; estimates imposing constant returns are presented in Section 7 and while smaller, show analogous time trends). They decline from 35-45% to 20-25% from 1960-1999 for France, Germany and Italy, and from over 50% to about 35% for Japan, although the bulk of the efficiency improvement for these countries occurred in the early part of the period. The relative efficiency effects grow slightly over this period for Canada and the U.K., deteriorating from about 30% to 32% and 36% to 41%, respectively.

Figure 6.1: Canada

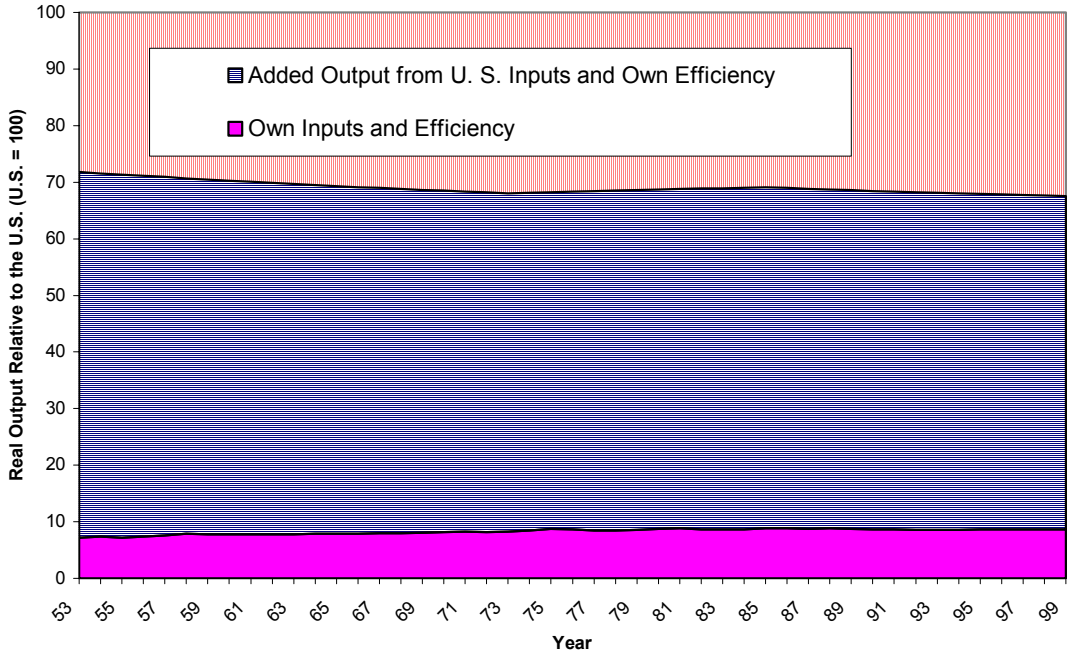


Figure 6.2: France

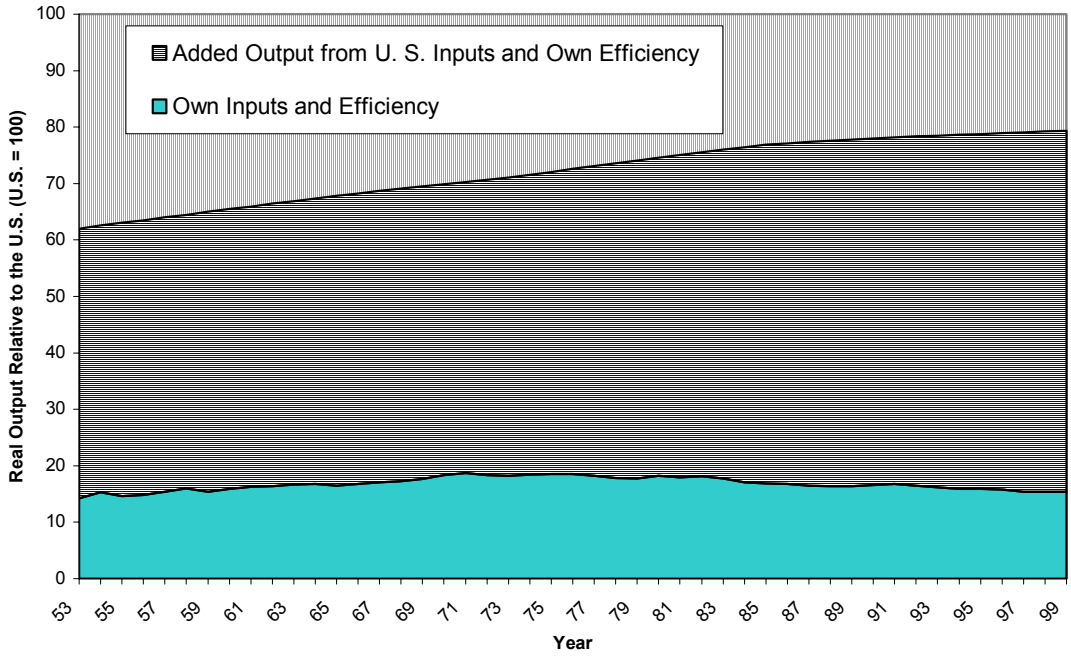


Figure 6.3: Germany

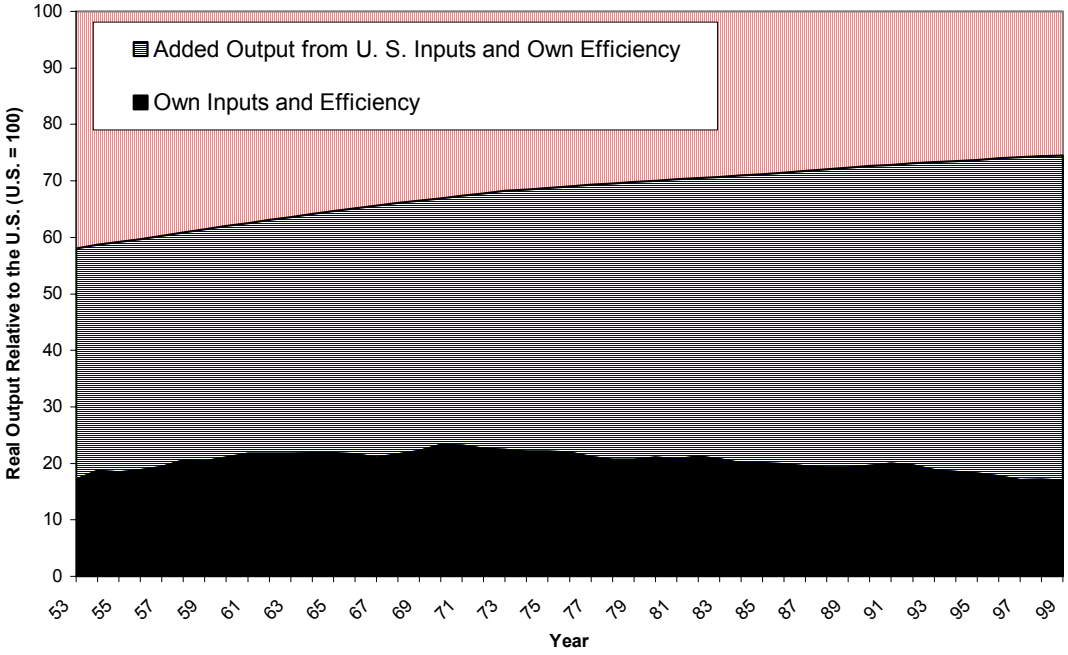


Figure 6.4: Italy

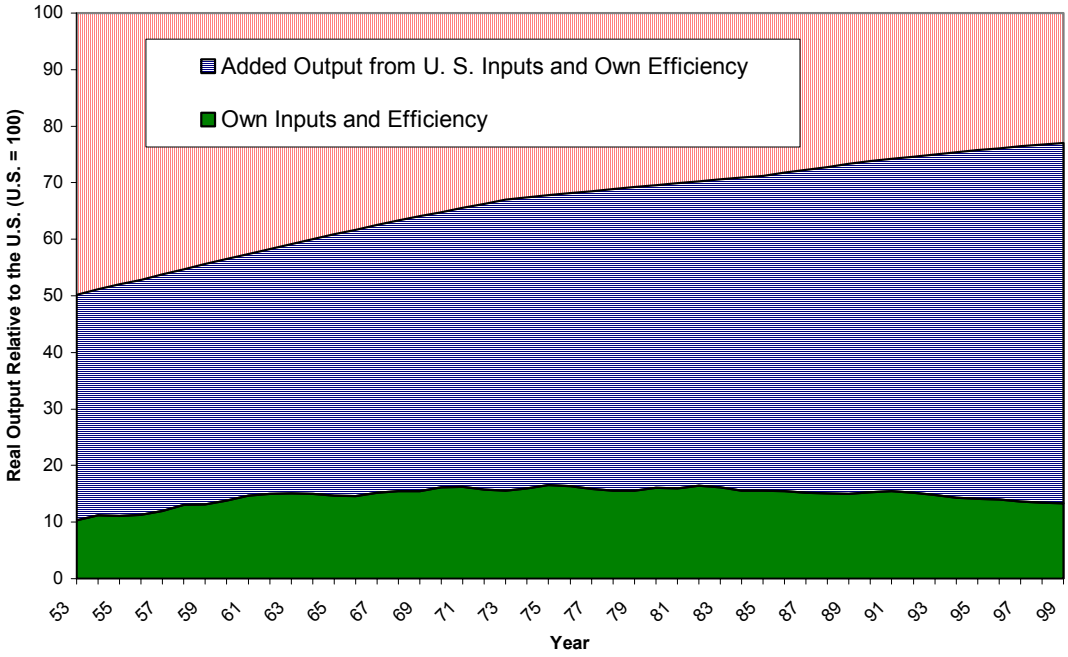


Figure 6.5: Japan

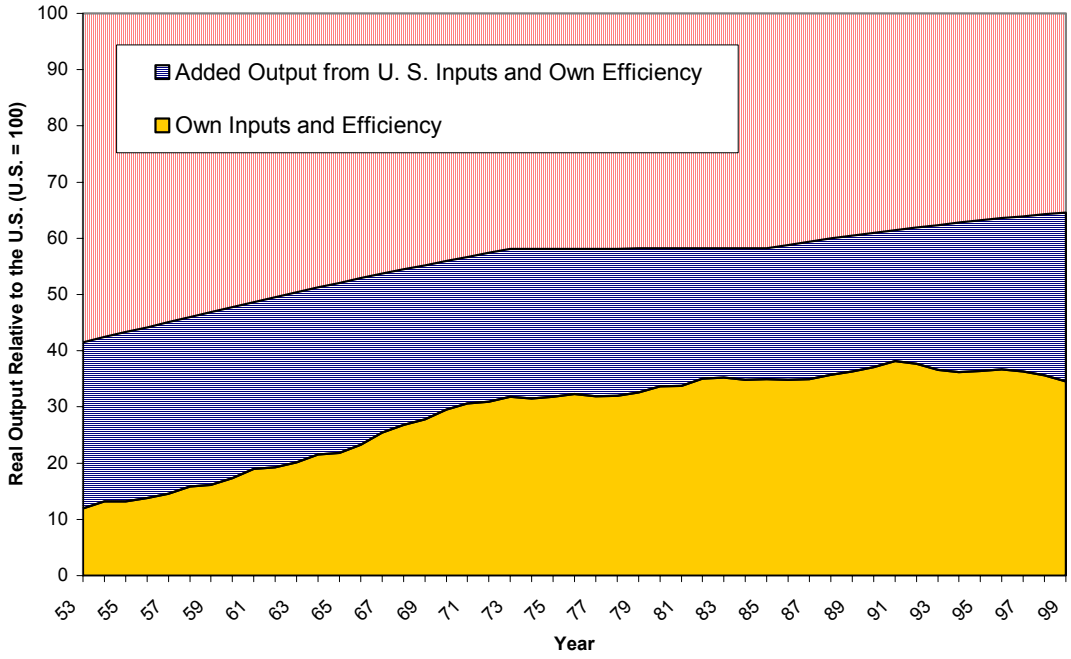
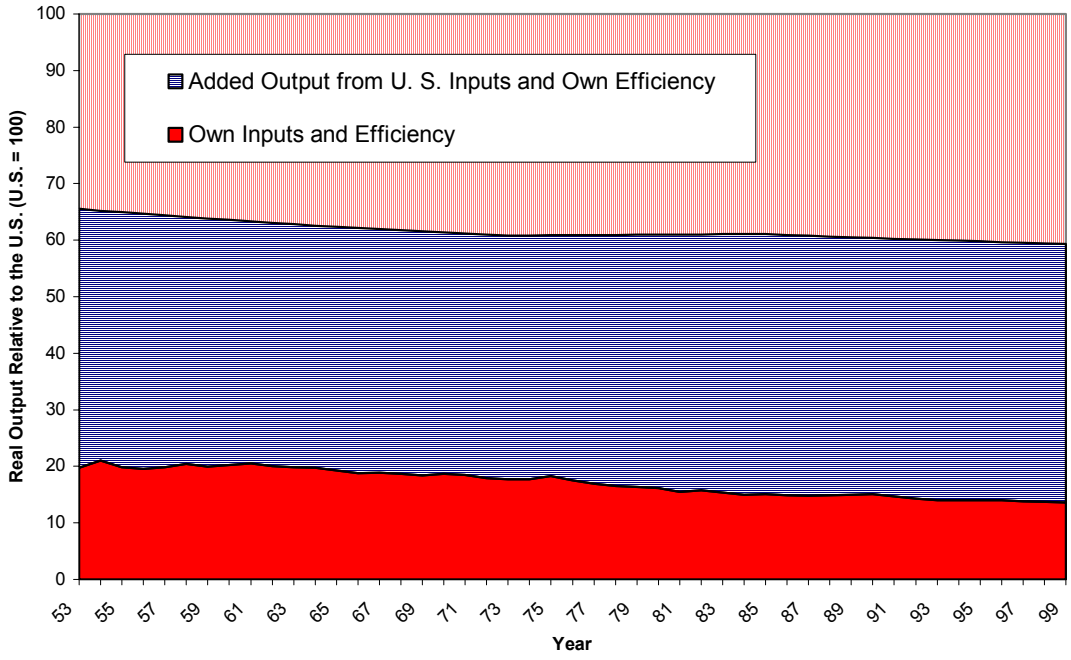


Figure 6.6: U. K.



Between 1960 and 1999, the importance of the efficiency effects (as opposed to the input differential effects) in accounting for the output gap with the U.S. has remained

unchanged for Canada and the U.K., at 30% and 45% respectively. It has declined significantly for the other G-7 countries: France from 40% to 25%, West Germany from 50% to 30%, Italy from 50% to 25% and Japan from 63% to 55%. Correspondingly, the importance of input differentials in accounting for the differences in real outputs between these G-7 countries and the United States has risen.

7. The Results Imposing Constant Returns (CRS)

While the econometric tests in Boskin and Lau (2003) reject constant returns to scale (CRS), and the estimates exhibit slightly decreasing returns[14], for some economists CRS is a strongly held prior (often alluding to a replication argument). It is thus worth examining the results when the assumption of constant returns is imposed and reflecting on their differences from the general case.

In the constant returns case, the corresponding efficiency level parameters from the meta-production function range from 0.63 for Japan to 0.94 for Canada (the difference in scale between the U.S. and Canada is by far the largest, and hence the difference between constant returns and slightly decreasing returns most magnified). For the rate parameters, Canada is the lowest and Japan the highest, at 3.8% and 11.3%, respectively, although the continental Europeans are highest during the oil shock years (Table 7.1). The main differences from the general case of slightly decreasing returns to scale in capital and labor are a somewhat larger human capital elasticity of output and slightly smaller rates of technical progress and elasticities of substitution between (composite) capital and labor (see Boskin and Lau, 2003).

[14] In contrast, Denison (1967, 1973), one of the most widely quoted growth analysts, simply assumed sizeable increasing returns to scale without formal justification, and merely mentioned the fact, which greatly affected his results, in a footnote.

Table 7.1 (CRS): Estimates of the Efficiency Parameters A_{i0} and C_i

Countries	A_{i0}	C_i (~1972, 1986~)	C_i (1973~1985)
Canada	0.94	0.038 (3.073)	0.037 (2.159)
France	0.91	0.079 (4.325)	0.072 (3.147)
West Germany	0.82	0.089 (4.589)	0.061 (2.883)
Italy	0.85	0.102 (4.481)	0.063 (3.175)
Japan	0.63	0.113 (4.193)	0.049 (2.380)
UK	0.75	0.053 (3.718)	0.048 (2.470)
US	1	0.069 (5.193)	0.050 (2.945)

Note: Numbers in parentheses are asymptotic t-ratios.

In the constant returns case, the contemporary productive efficiency ratios, relative to the U.S., range from 66% in Japan and 68% in the U.K. to the mid-80% range in Canada, Germany and Italy and 91% in France. Canada and the U.K. have declined relative to the U.S., while the other countries show continued improvement, more rapid through 1980 and decelerating thereafter (Table 7.2), and once again, there is little difference in our two measures of efficiency, E1 and E2.

Table 7.2 (CRS): Productive Efficiency Relative to the United States, Selected Years

Country	1960	1970	1980	1990	1999
France:					
E1	84.3	87.2	90.9	93.4	94.1
E2	72.7	76.6	83.2	86.7	88.9
M	78.3	81.7	87.0	90.0	91.5
Italy:					
E1	73.8	81.7	85.5	88.9	91.9
E2	57.7	65.9	71.7	76.8	80.6
M	65.3	73.4	78.3	82.6	86.1
West Germany:					
E1	75.1	80.0	82.5	84.7	86.5
E2	67.8	72.9	76.8	80.3	82.7
M	71.4	76.3	79.6	82.5	84.6
Canada:					
E1	107.3	98.1	93.7	89.8	86.3
E2	97.8	90.4	87.0	83.3	83.0
M	102.5	94.2	90.3	86.5	84.6
Japan:					
E1	53.9	61.3	63.1	65.4	68.5
E2	46.8	56.2	58.4	61.2	64.1
M	50.2	58.7	60.7	63.2	66.2
U.K.:					
E1	79.2	75.7	74.6	73.4	72.0
E2	68.3	64.2	63.2	63.4	63.5
M	73.6	69.7	68.7	68.2	67.6

In the constant returns case, the human capital effects are somewhat larger, but still mostly modest. The “no growth in human capital since 1960” effect ranges from about -4% in the U.S., Germany and Japan to almost –7% in Canada (Figure 7.1). Likewise, the “U.S. human capital levels” effect ranges from 4% in Germany to 18% in the U.K. (Figure 7.2). For believers in constant returns to scale in capital and labor, it would appear that the more widespread access to higher education in the U.S. in the aggregate more than makes up for any deficiency in some part of secondary education,

while the purportedly higher quality U.K. secondary education is not sufficient to offset the restricted access to higher education.

Figure 7.1: Hypothetical Output Losses in 1999 under the Assumption that Average Human Capital Has NOT Grown Since 1960 (Percent of Real GDP)

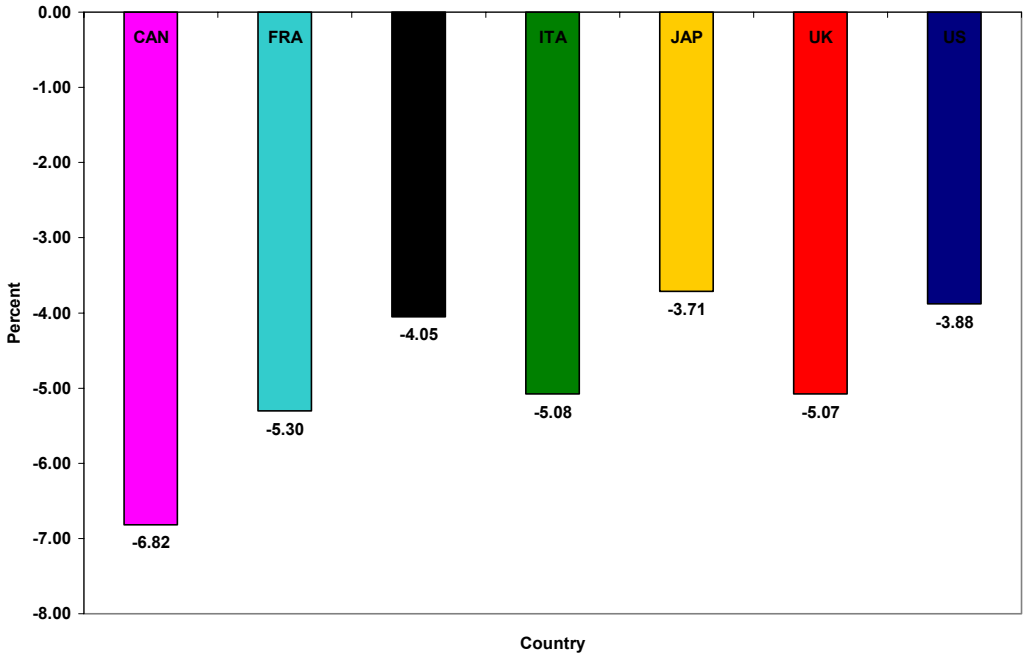
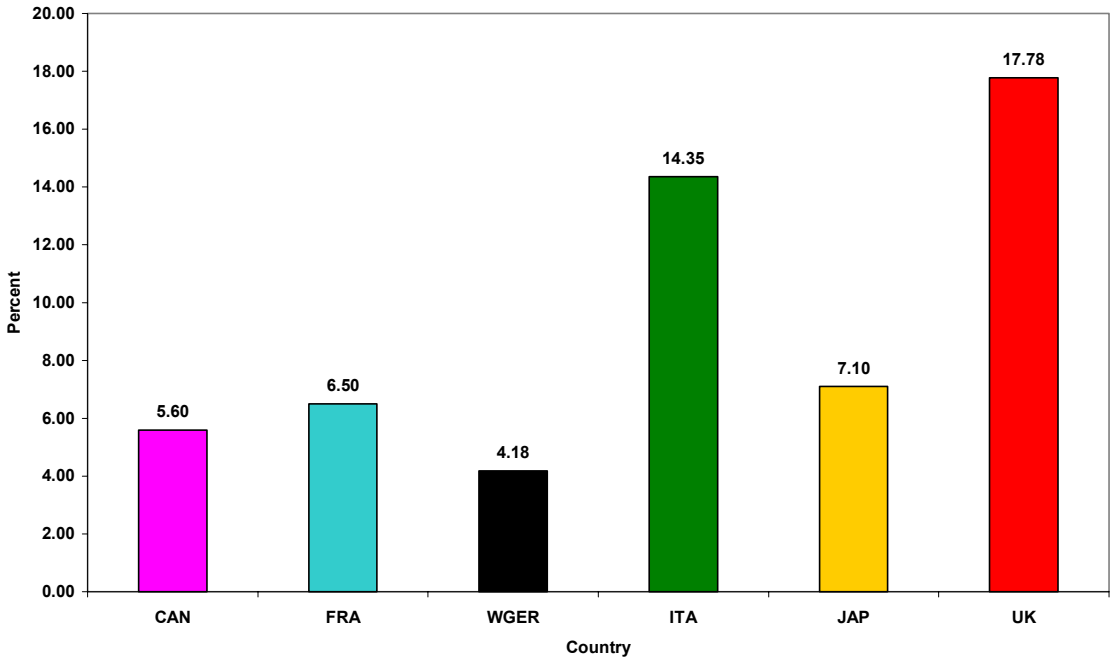
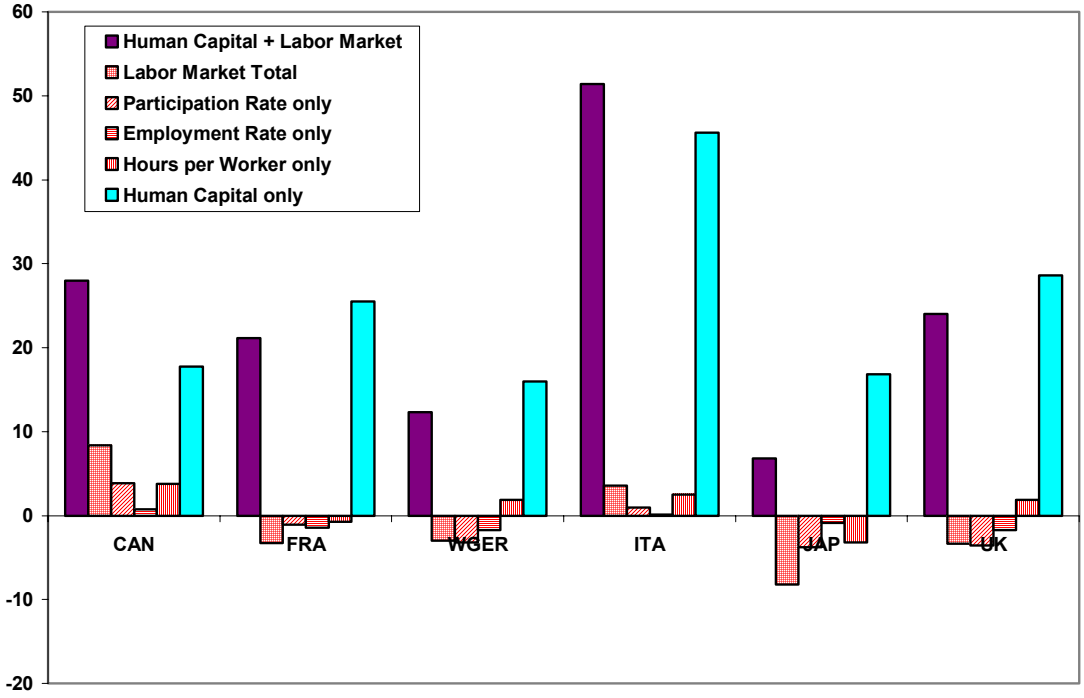


Figure 7.2: Hypothetical Output Gains in 1999 under the Assumption that All Other G-7 Countries Have the Same Average Human Capital as the U.S.(Percent of Real GDP)



In the constant returns case, the larger human capital elasticities of output combine with larger human capital differentials to dominate the 1960 hypothetical output effects, by themselves ranging from between 15% and 20% in Canada, West Germany, and Japan to over 25% for France and the U.K. and 45% in Italy (Figure 7.3). Indeed, at the time, France, West Germany, Japan and the U.K. had total labor market conditions that resulted in greater labor input than the U.S., adjusted for the size of the working-age population. For example, the unemployment rates in France, West Germany, Japan and the U.K. were 1.5%, 1.0%, 1.7% and 1.5%, respectively, whereas in the U.S. it was 5.5%, although somewhat different measures were used. The output effects of labor market outcome differentials are generally small, similar to the general case.

Figure 7.3: Hypothetical Output Gains (or Losses) in 1960 under the Assumption that U.S. Labor Market Conditions and Human Capital Prevail in the Other G-7 Countries (Percent)



By 1980, the human capital effects are smaller, but still sizeable, ranging from just over 10% for Canada, France, West Germany and Japan to the high 20% range for Italy and the U.K. But by 1980, U.S. labor market conditions would result in modest output gains everywhere but Japan (Figure 7.4). Again, the labor input effects are positive, except for Japan, generally in the 5-10% range, and quite similar to the non-CRS case.

Finally, by 1999, the human capital differentials have declined enough so that even when combined with the larger human capital elasticities of the CRS case, the output effects of U.S. human capital levels are small except for the U.K. and Italy. For labor market outcomes, the effects are again quite similar to the general case; they range from trivial in Japan to modest, 6% in the U.K. and 11% in Canada, to large in the continental European countries – the high 20% range in France and Germany and over 45% in Italy (Figure 7.5).

Figure 7.4: Hypothetical Output Gains (or Losses) in 1980 under the Assumption that U.S. Labor Market Conditions and Human Capital Prevail in the Other G-7 Countries (Percent)

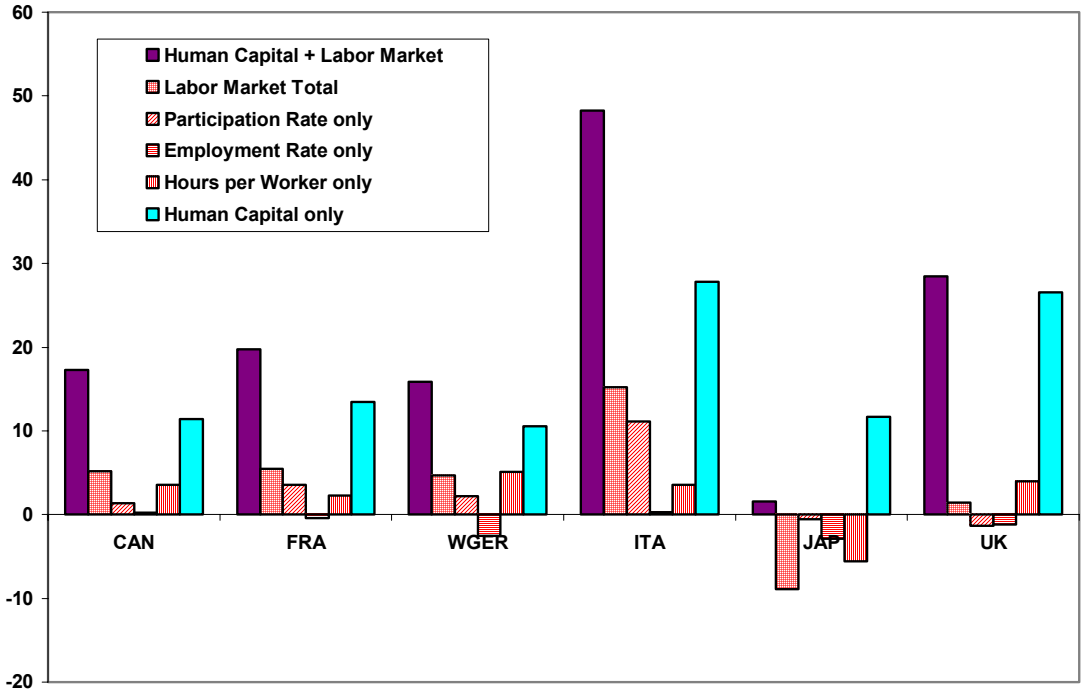
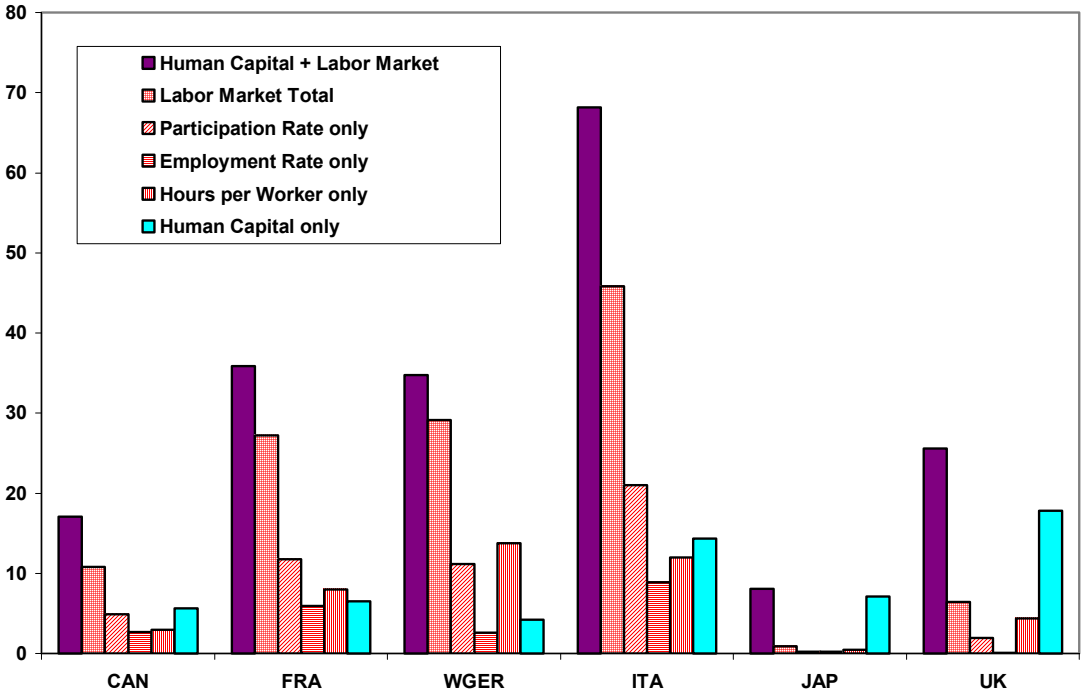
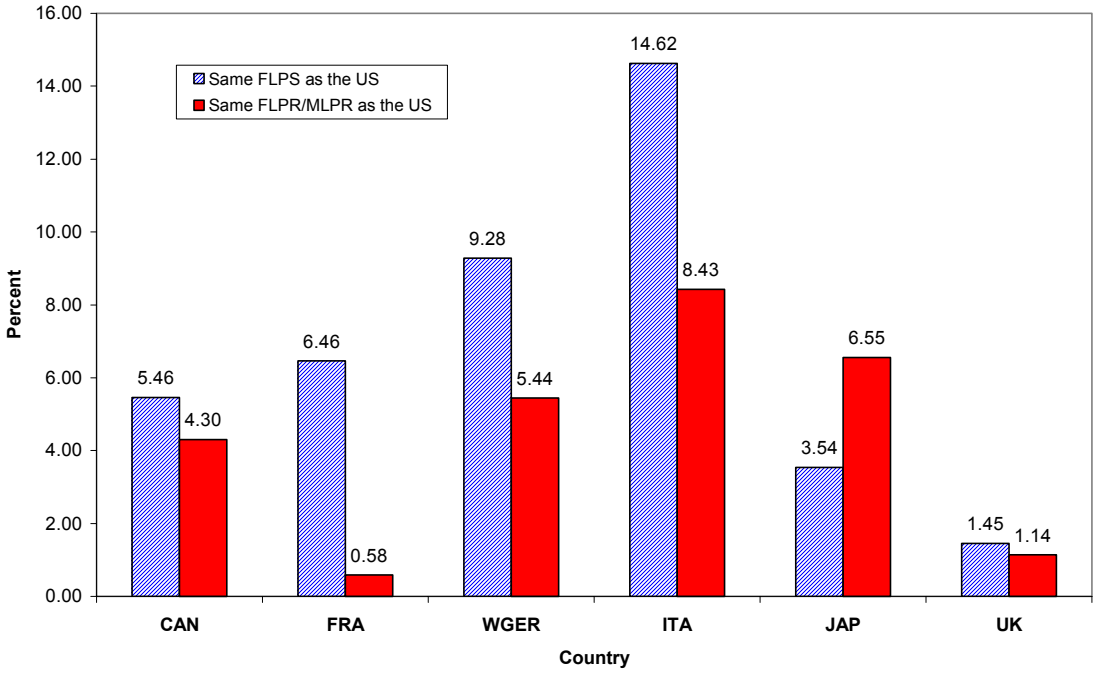


Figure 7.5: Hypothetical Output Gains in 1999 under the Assumption that U.S. Labor Market Conditions and Human Capital Prevail in the Other G-7 Countries (Percent)



For the female labor force participation differences, the results for the constant returns to case are quite similar to the general case: modest except in Italy at 15% and Germany at 9% (Figure 7.6) in the "same female labor force participation as the U. S." case; and Italy at 8%, Japan almost 7% and Germany over 5% in the "same ratio of female to male labor force participation rates as the U. S." case.

Figure 7.6: The Effects of Differences in the Female Labor Force Participation Rates



For the constant returns case, the results on the relative importance of productive efficiency and input level differentials are qualitatively similar but, as discussed above, attribute *relatively* more to input differentials and less to productive efficiency differences. Recall that, with slightly decreasing returns to scale, the larger economies have to overcome the slight disadvantage of scale. Thus, for example, the giant U.S. must be even more efficient with slightly decreasing returns (as opposed to constant returns to scale) to explain the same observed real output differences, given the relative input levels. Hence, imposing constant returns to scale, given real output and input

differentials, compresses the productive efficiency differentials relative to the U.S. or indeed in any pairwise comparison of economies of different size. Recall also that the human capital effects are larger in the constant returns case and, especially historically, add substantially to the input effects.

In the constant returns case, the relative own outputs are quite similar to those reported in Section 6 for the general case. France and Italy are essentially flat over the period 1960-1999, Canada increases slightly, Germany deteriorates slightly, the U.K. decreases substantially and Japan doubles.

Moving to the effect on achievable additional output with U.S. inputs but own efficiency, Japan and the U.K. are relatively flat over the period, France, Italy and Germany all increase significantly, by between 15% and one third, and Canada decreases substantially, by more than 20%.

Finally, the (residual) relative efficiencies are significantly smaller relative to the U.S. in the constant returns case, by 1999 ranging from 6% for France, 8% for Italy and 14% for Canada and Germany to approximately 30% for Japan and the U.K. France, Germany, Italy and Japan improve their efficiency relative to the U.S. by 10-20 percentage points, mostly by the early 1980s, whereas Canada and the U.K. experience relative efficiency declines of 10-20%.

Figure 7.7: Canada

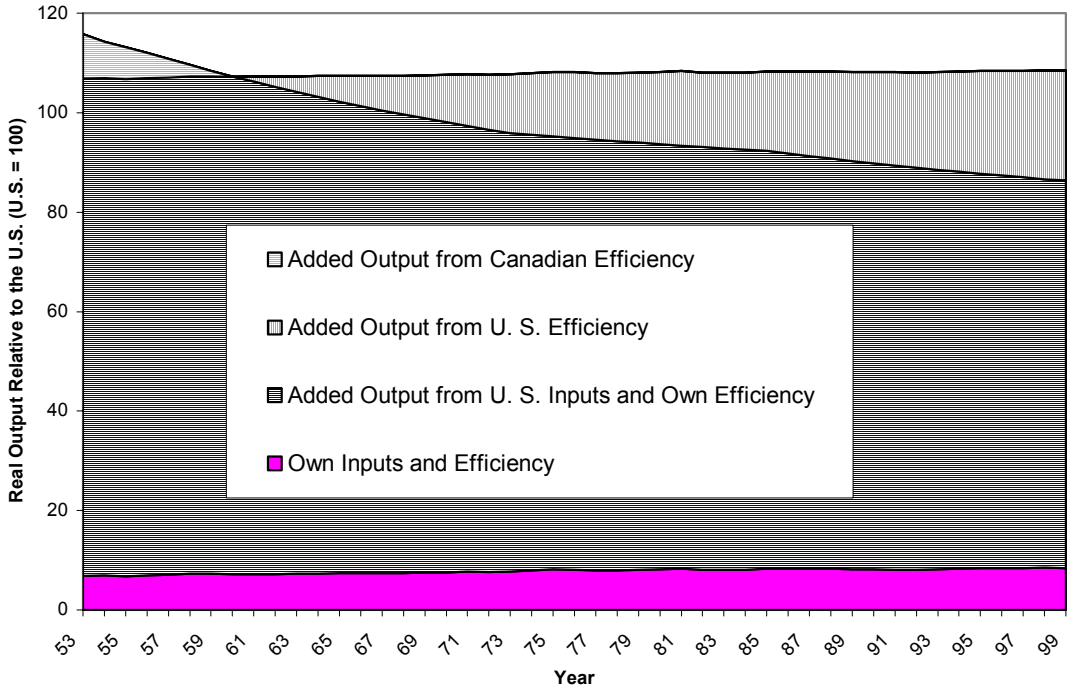


Figure 7.8: France

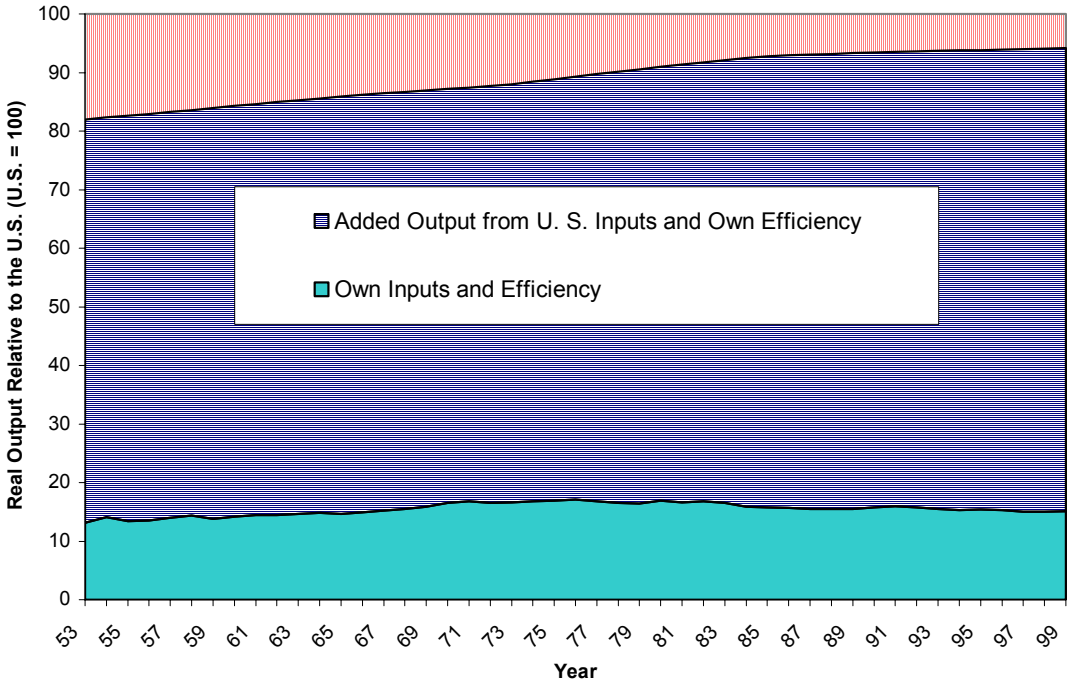


Figure 7.9: Germany

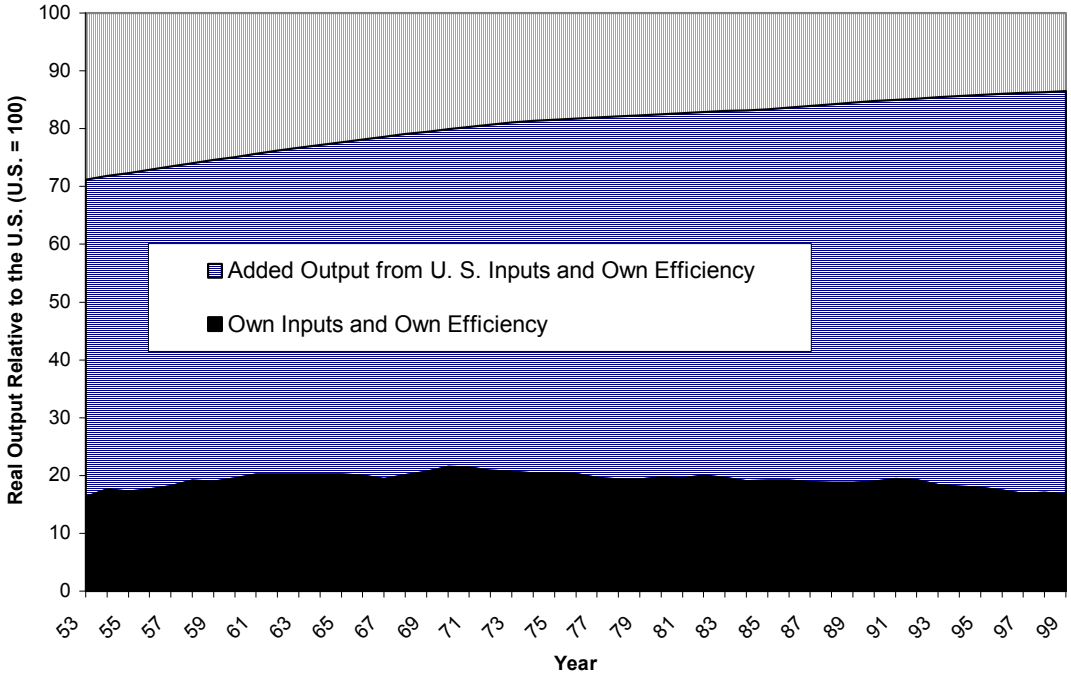


Figure 7.10: Italy

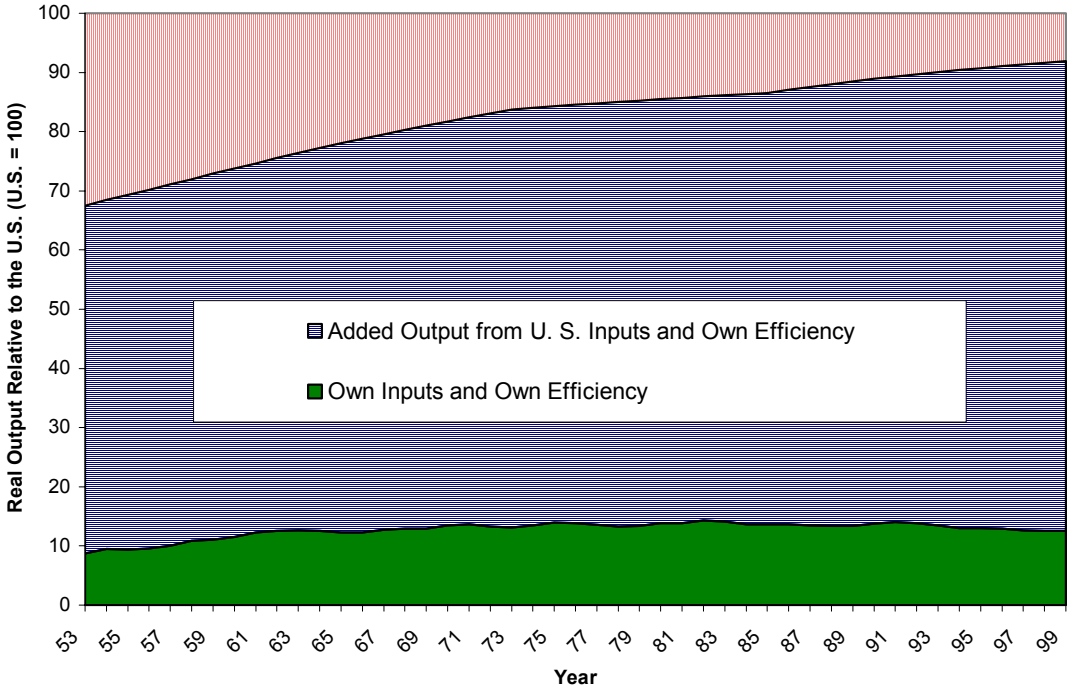


Figure 7.11: Japan

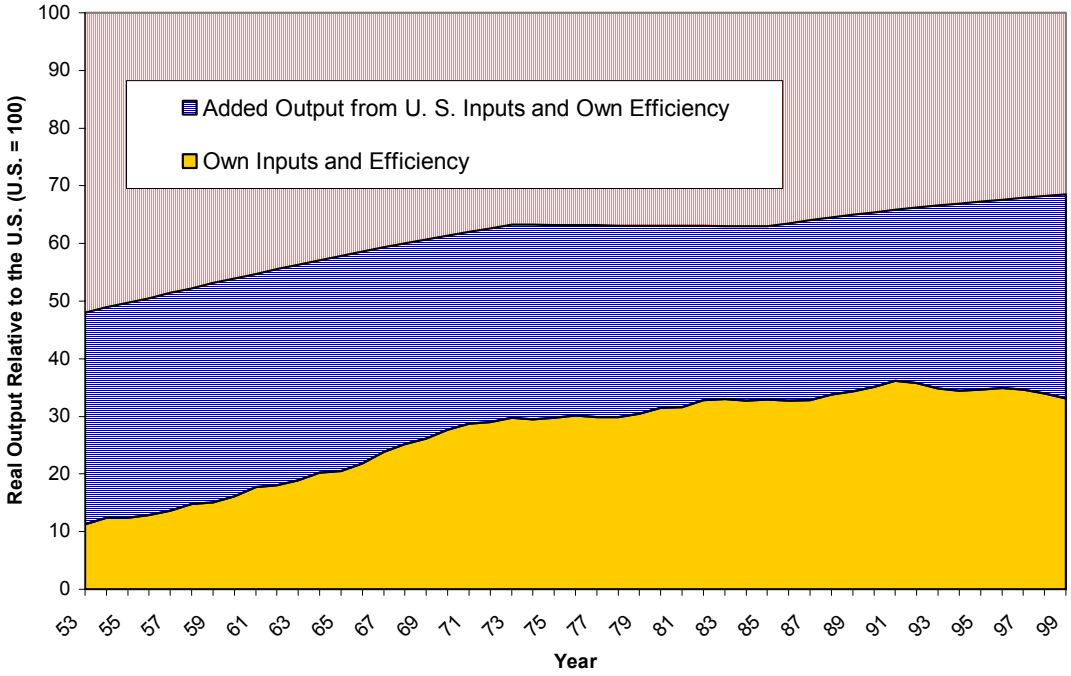
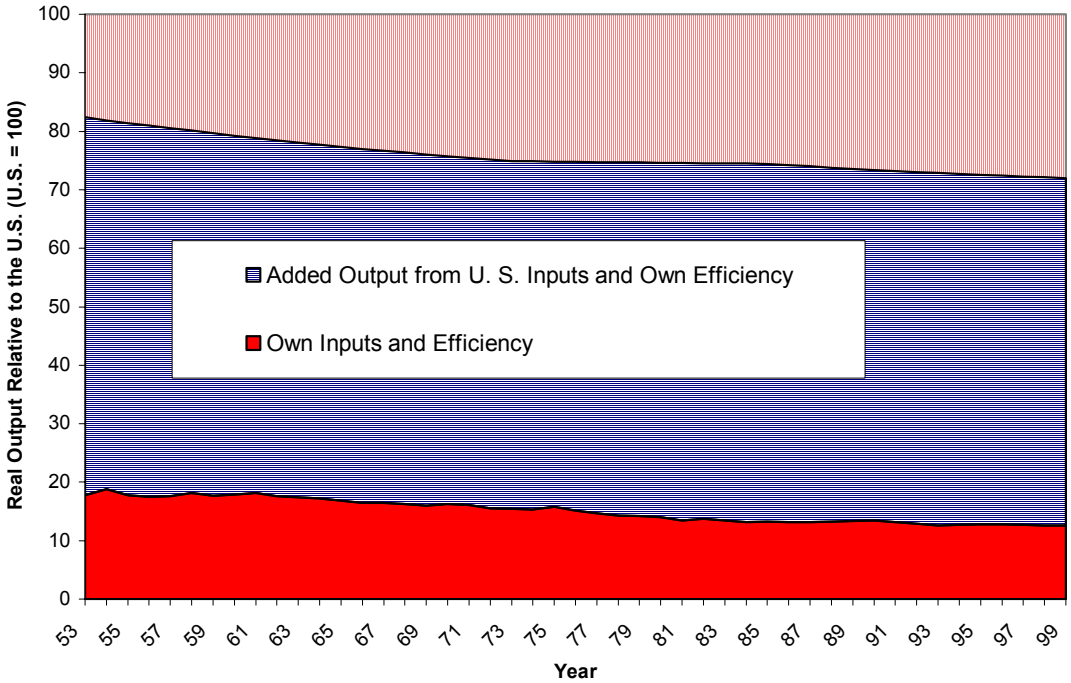


Figure 7.12: U. K.



For the constant returns case, the importance of the efficiency effects (as opposed to the input differential effects) in accounting for the output gap with the U.S.

has diminished considerably. In 1960, efficiency effects account for only 55% of the output gap for Japan, 30% for Germany and Italy, 25% for the U. K., less than 20% for France and -8% for Canada (compared to a range of 30-63% for the general case). As in the general case, the importance of the efficiency effects has also declined significantly in all of the other G-7 countries except Canada and the U.K. By 1999, efficiency effects account for less than 10% of the output gaps of France and Italy, 18% of the output gap of Germany, and 47% of the output gap of Japan.

8. Conclusion

We have examined in detail the two proximate causes of the differences in real GDP per capita among the G-7 countries in the post-World War II period: differences in productive efficiency and the components of differences in the levels of inputs. The results are interesting and informative, both historically and contemporaneously. We develop evidence on the relative productive efficiency of the G-7 countries based on an econometrically estimated meta-production function. The results reveal that the United States has been and continues to be vastly more efficient than the other G-7 countries, even after controlling for differences in labor market outcomes. In 1999, we estimate that the other G-7 countries ranged from about 60-80% as efficient as the United States in transforming given inputs into output (about 70-90% if constant returns to scale are assumed). Over time, there has been substantial improvement in the relative productive efficiency of France, Italy and Germany, most of it accomplished by 1980; a modest deterioration in the relative productive efficiency of Canada and the United Kingdom; and large gains by Japan, most of them evident by 1990. In Boskin and Lau (2003), we noted some tendency of the levels of GDP per capita to converge in the post-World War II period for the G-7 countries other than the United States. The same is not true of efficiency levels. If anything, there has been a slight divergence.

We have also explored the effects that the large differences among the G-7 countries in labor market conditions and outcomes--labor force participation rates, employment rates, average hours of work, human capital levels, and female labor force participation rates--have had on their relative real outputs. The real output losses associated with these labor market differences are enormous in continental Europe, amounting to an entire decade or more of lost economic growth, and large in the U.K. and Canada as well, even more if constant returns are assumed.

Clearly, these vast differences themselves reflect many factors: tax and transfer payment rules, labor market regulations, social customs, and an array of others. They reflect the myriad decisions of households, business firms and governments and their interaction in domestic and global markets. And, of course, individual and societal preferences over such fundamental decisions as how much to work, how much to invest in human capital, how much to save and invest, and the appropriate size and scope of social welfare benefits may well differ and imply that the same levels of various parameters of interest have vastly different welfare theoretic consequences. But it would certainly be interesting to pose the question of whether the trade-offs made more explicit in this study--real income losses approaching 30% or more--would be chosen by the citizens of these countries as the price paid for these labor market policies and social institutions.

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Appendix Table 1.1: Real GDP per Capita of G-7 Countries, Thousands US$ at 1990 PPP Prices							
Year	Canada	France	W. Germany	Italy	Japan	U.K.	U.S.
1950	7.23	#N/A	#N/A	#N/A	#N/A	#N/A	9.68
1951	7.39	5.66	4.40	#N/A	#N/A	#N/A	10.27
1952	7.79	5.79	4.76	#N/A	2.33	6.66	10.48
1953	7.96	5.88	5.11	4.16	2.46	6.96	10.69
1954	7.64	6.06	5.47	4.30	2.56	7.21	10.44
1955	8.16	6.26	6.09	4.59	2.74	7.43	10.98
1956	8.65	6.54	6.48	4.80	2.90	7.52	10.97
1957	8.58	6.82	6.80	5.06	3.08	7.64	10.98
1958	8.73	6.93	6.99	5.43	3.25	7.59	10.70
1959	8.86	7.06	7.44	5.80	3.50	7.86	11.28
1960	8.92	7.44	8.03	6.17	3.90	8.29	11.38
1961	9.00	7.76	8.33	6.63	4.31	8.51	11.45
1962	9.42	8.12	8.65	6.96	4.63	8.52	11.96
1963	9.70	8.39	8.82	7.29	4.96	8.83	12.30
1964	10.12	8.84	9.34	7.41	5.47	9.25	12.84
1965	10.56	9.16	9.75	7.59	5.72	9.43	13.48
1966	11.03	9.55	9.95	7.97	6.25	9.56	14.20
1967	11.13	9.91	9.90	8.45	6.86	9.73	14.40
1968	11.51	10.25	10.41	8.94	7.65	10.07	14.94
1969	11.92	10.88	11.10	9.42	8.50	10.23	15.24
1970	12.06	11.40	11.57	9.85	9.28	10.44	15.09
1971	12.57	11.84	11.83	9.43	9.63	10.61	15.40
1972	13.10	12.26	12.28	10.19	10.29	10.95	16.07
1973	13.88	12.83	12.83	10.78	10.87	11.66	16.83
1974	13.92	13.12	12.85	11.18	10.59	11.50	16.58
1975	14.03	12.97	12.73	10.86	10.78	11.48	16.36
1976	14.60	13.47	13.48	11.50	11.09	11.74	17.11
1977	14.92	13.91	13.88	11.79	11.43	12.00	17.73
1978	15.40	14.24	14.32	12.19	11.93	12.43	18.50
1979	15.85	14.60	14.92	12.85	12.48	12.76	18.88
1980	15.85	14.72	15.03	13.29	12.73	12.53	18.62
1981	16.14	14.73	15.02	13.32	13.04	12.36	18.88
1982	15.46	14.97	14.89	13.33	13.35	12.56	18.32
1983	15.76	15.02	15.19	13.44	13.57	12.99	18.93
1984	16.50	15.14	15.68	13.76	14.01	13.29	20.12
1985	17.23	15.35	16.03	14.10	14.53	13.71	20.72
1986	17.50	15.64	16.40	14.48	14.88	14.28	21.17
1987	17.98	15.91	16.64	14.91	15.42	14.91	21.68
1988	18.61	16.50	17.19	15.46	16.30	15.62	22.37
1989	18.73	17.05	17.67	15.88	17.03	15.90	22.93
1990	18.49	17.36	18.51	16.26	17.84	15.91	23.22
1991	17.93	17.39	19.30	16.44	18.45	15.53	22.86
1992	17.82	17.48	19.49	16.50	18.58	15.39	23.33
1993	18.02	17.17	18.98	16.44	18.59	15.63	23.67
1994	18.53	17.56	19.34	16.76	18.67	16.28	24.41
1995	18.69	17.86	19.43	17.22	18.87	16.66	24.84

1996	18.70	18.04	19.54	17.30	19.56	17.00	25.48
1997	19.18	18.38	19.76	17.52	19.68	17.78	26.33
1998	19.60	18.90	20.13	17.76	19.08	18.09	27.19
1999	20.29	19.39	20.36	17.82	19.10	18.38	28.03
2000	21.36	20.33	21.41	18.74	19.97	19.40	29.76

Appendix Table 2.1: Measures of Relative Productive Efficiency (U.S.=100)																		
	CANADA			FRANCE			WEST GERMANY			ITALY			JAPAN			U.K.		
Year	E1	E2	M	E1	E2	M	E1	E2	M	E1	E2	M	E1	E2	M	E1	E2	M
60	75.7	75.9	75.8	66.1	65.1	65.6	62.6	62.0	62.3	57.7	56.6	57.2	44.4	41.6	43.0	64.2	64.4	64.3
61	75.2	75.4	75.3	66.5	65.5	66.0	63.1	62.5	62.8	58.5	57.7	58.1	45.4	42.9	44.1	63.9	64.1	64.0
62	74.6	74.8	74.7	66.9	66.0	66.4	63.6	63.0	63.3	59.4	58.6	59.0	46.4	44.1	45.2	63.5	63.8	63.6
63	74.0	74.3	74.2	67.3	66.5	66.9	64.0	63.6	63.8	60.2	59.5	59.9	47.4	45.3	46.3	63.2	63.4	63.3
64	73.5	73.7	73.6	67.7	66.9	67.3	64.5	64.1	64.3	61.0	60.4	60.7	48.4	46.5	47.4	62.9	63.1	63.0
65	73.0	73.2	73.1	68.1	67.3	67.7	64.9	64.6	64.8	61.8	61.3	61.6	49.3	47.6	48.5	62.7	62.8	62.7
66	72.5	72.7	72.6	68.4	67.7	68.1	65.4	65.1	65.2	62.6	62.1	62.4	50.3	48.8	49.5	62.4	62.5	62.4
67	72.1	72.3	72.2	68.8	68.2	68.5	65.8	65.5	65.7	63.4	63.0	63.2	51.2	50.0	50.6	62.1	62.2	62.2
68	71.6	71.8	71.7	69.1	68.6	68.9	66.2	66.0	66.1	64.1	63.8	63.9	52.0	51.1	51.6	61.9	61.9	61.9
69	71.2	71.3	71.3	69.5	69.0	69.2	66.6	66.4	66.5	64.8	64.6	64.7	52.9	52.2	52.5	61.6	61.7	61.6
70	70.8	70.9	70.9	69.8	69.4	69.6	66.9	66.8	66.9	65.5	65.3	65.4	53.8	53.2	53.5	61.4	61.4	61.4
71	70.4	70.5	70.4	70.1	69.8	69.9	67.3	67.2	67.3	66.2	66.0	66.1	54.6	54.2	54.4	61.2	61.2	61.2
72	70.0	70.0	70.0	70.4	70.2	70.3	67.7	67.6	67.7	66.8	66.8	66.8	55.4	55.2	55.3	60.9	60.9	60.9
73	69.7	69.7	69.7	70.8	70.5	70.6	68.1	68.0	68.0	67.5	67.5	67.5	56.2	56.1	56.2	60.7	60.7	60.7
74	69.6	69.6	69.6	71.3	71.1	71.2	68.4	68.3	68.3	67.8	67.8	67.8	56.3	56.2	56.3	60.8	60.8	60.8
75	69.6	69.6	69.6	71.8	71.7	71.7	68.6	68.6	68.6	68.1	68.1	68.1	56.4	56.4	56.4	60.8	60.8	60.8
76	69.6	69.6	69.6	72.3	72.3	72.3	68.9	68.9	68.9	68.5	68.5	68.5	56.5	56.5	56.5	60.8	60.8	60.8
77	69.6	69.6	69.6	72.8	72.8	72.8	69.2	69.2	69.2	68.8	68.8	68.8	56.6	56.6	56.6	60.9	60.9	60.9
78	69.6	69.6	69.6	73.3	73.3	73.3	69.5	69.5	69.5	69.1	69.1	69.1	56.7	56.7	56.7	60.9	60.9	60.9
79	69.5	69.5	69.5	73.8	73.8	73.8	69.7	69.8	69.7	69.4	69.4	69.4	56.8	56.8	56.8	60.9	60.9	60.9
80	69.5	69.5	69.5	74.3	74.3	74.3	70.0	70.0	70.0	69.7	69.7	69.7	56.9	56.9	56.9	61.0	61.0	61.0
81	69.5	69.5	69.5	74.8	74.8	74.8	70.3	70.2	70.3	70.0	70.0	70.0	57.0	57.0	57.0	61.0	61.0	61.0
82	69.5	69.5	69.5	75.2	75.2	75.2	70.5	70.5	70.5	70.2	70.2	70.2	57.1	57.1	57.1	61.0	61.0	61.0
83	69.5	69.5	69.5	75.7	75.6	75.6	70.7	70.7	70.7	70.5	70.5	70.5	57.2	57.2	57.2	61.1	61.1	61.1
84	69.5	69.5	69.5	76.1	76.0	76.1	71.0	70.9	70.9	70.8	70.7	70.7	57.3	57.3	57.3	61.1	61.1	61.1
85	69.4	69.4	69.4	76.5	76.4	76.5	71.2	71.1	71.2	71.0	70.9	71.0	57.4	57.4	57.4	61.1	61.1	61.1
86	69.1	69.1	69.1	76.7	76.5	76.6	71.5	71.3	71.4	71.5	71.4	71.4	58.0	58.1	58.1	60.9	60.9	60.9
87	68.8	68.8	68.8	76.8	76.7	76.8	71.7	71.5	71.6	72.0	71.8	71.9	58.6	58.7	58.7	60.8	60.8	60.8
88	68.6	68.6	68.6	77.0	76.8	76.9	71.9	71.7	71.8	72.4	72.1	72.3	59.2	59.3	59.2	60.6	60.6	60.6
89	68.3	68.3	68.3	77.1	76.9	77.0	72.1	71.9	72.0	72.8	72.5	72.7	59.8	59.8	59.8	60.4	60.4	60.4
90	68.0	68.0	68.0	77.2	77.0	77.1	72.3	72.1	72.2	73.2	72.8	73.0	60.3	60.3	60.3	60.3	60.3	60.3
91	67.8	67.8	67.8	77.4	77.1	77.2	72.5	72.2	72.4	73.6	73.1	73.4	60.8	60.8	60.8	60.1	60.2	60.1
92	67.5	67.6	67.6	77.5	77.2	77.3	72.7	72.4	72.5	73.9	73.4	73.7	61.3	61.2	61.2	60.0	60.0	60.0
93	67.3	67.4	67.4	77.6	77.3	77.4	72.9	72.5	72.7	74.3	73.6	74.0	61.7	61.6	61.6	59.9	59.9	59.9
94	67.1	67.2	67.2	77.7	77.3	77.5	73.0	72.6	72.8	74.6	73.8	74.2	62.1	61.9	62.0	59.7	59.8	59.8
95	66.9	67.0	67.0	77.7	77.3	77.5	73.1	72.7	72.9	74.8	73.9	74.4	62.4	62.2	62.3	59.6	59.7	59.6
96	66.7	66.9	66.8	77.8	77.4	77.6	73.3	72.8	73.0	75.1	74.1	74.6	62.8	62.4	62.6	59.5	59.6	59.5
97	66.5	66.7	66.6	77.9	77.4	77.7	73.4	72.8	73.1	75.3	74.2	74.8	63.1	62.6	62.8	59.4	59.5	59.4
98	66.3	66.5	66.4	78.0	77.5	77.7	73.5	72.9	73.2	75.6	74.3	74.9	63.4	62.7	63.1	59.3	59.4	59.3
99	66.2	66.3	66.2	78.0	77.5	77.8	73.6	72.9	73.3	75.8	74.4	75.1	63.6	62.7	63.2	59.2	59.3	59.2

Appendix Table 3.1: Average Schooling Years per Person of the Working Age Population							
Year	Canada	France	W. Germany	Italy	Japan	U. K.	U. S.
60	8.34	7.91	8.75	6.56	8.84	7.59	10.55
61	8.48	7.97	8.83	6.68	9.03	7.67	10.68
62	8.61	7.93	8.88	6.74	9.09	7.66	10.74
63	8.73	7.96	8.95	6.83	9.18	7.70	10.83
64	8.85	8.07	9.03	6.90	9.25	7.75	10.93
65	8.96	8.21	9.08	7.01	9.35	7.82	11.04
66	9.05	8.36	9.17	7.09	9.44	7.88	11.15
67	9.14	8.53	9.35	7.16	9.55	7.94	11.25
68	9.26	8.71	9.51	7.22	9.66	8.01	11.36
69	9.39	8.82	9.58	7.36	9.76	8.07	11.47
70	9.53	8.92	9.62	7.42	9.85	8.15	11.56
71	9.68	9.04	9.64	7.55	9.96	8.20	11.65
72	9.82	9.18	9.70	7.64	10.10	8.26	11.73
73	9.96	9.33	9.75	7.73	10.11	8.31	11.82
74	10.05	9.48	9.85	7.77	10.21	8.37	11.91
75	10.14	9.65	10.02	7.87	10.26	8.45	12.01
76	10.24	9.80	10.20	8.01	10.35	8.51	12.09
77	10.32	9.95	10.35	8.21	10.44	8.58	12.17
78	10.41	10.09	10.50	8.33	10.53	8.66	12.25
79	10.51	10.23	10.63	8.47	10.61	8.73	12.33
80	10.56	10.33	10.73	8.64	10.69	8.81	12.42
81	10.63	10.40	10.83	8.79	10.81	8.88	12.47
82	10.67	10.47	10.93	8.87	10.88	9.00	12.53
83	10.73	10.54	11.06	8.95	10.94	9.09	12.60
84	10.78	10.62	11.21	8.99	11.01	9.15	12.66
85	10.84	10.73	11.40	9.10	11.09	9.27	12.71
86	10.88	10.86	11.56	9.24	11.11	9.37	12.76
87	10.96	10.99	11.71	9.40	11.13	9.45	12.84
88	11.05	11.10	11.81	9.46	11.33	9.54	12.91
89	11.08	11.17	11.87	9.66	11.43	9.62	13.01
90	11.14	11.30	11.82	9.78	11.49	9.70	13.09
91	11.25	11.37	11.93	10.01	11.59	9.76	13.17
92	11.43	11.51	12.03	10.08	11.71	9.88	13.23
93	11.63	11.64	12.16	10.13	11.79	9.97	13.30
94	11.88	11.77	12.26	10.19	11.88	10.11	13.36
95	12.09	11.89	12.37	10.33	11.94	10.24	13.42
96	12.23	12.01	12.48	10.48	12.04	10.30	13.48
97	12.38	12.14	12.60	10.64	12.14	10.41	13.58
98	12.49	12.26	12.71	10.77	12.23	10.51	13.66
99	12.60	12.38	12.83	10.91	12.32	10.61	13.73

Appendix Table 4.1: Gains and Losses in Real Output due to Differences in Labor Market Outcomes
(Percent)

Labor Market Outcome	CAN	FRA	WGER	ITA	JAP	UK
			1960			
Human Capital + Labor Market	12.91	3.44	1.25	16.23	-4.66	3.87
Labor Market Total	7.52	-3.29	-3.06	3.67	-8.98	-3.39
Participation Rate only	3.46	-1.14	-3.28	0.98	-4.28	-3.57
Employment Rate only	0.63	-1.44	-1.72	0.11	-1.04	-1.72
Hours per Worker only	3.36	-0.72	1.95	2.57	-3.61	1.92
Human Capital only	4.88	7.06	4.50	11.94	4.94	7.60
			1980			
Human Capital + Labor Market	8.10	9.00	7.46	23.04	-6.15	8.07
Labor Market Total	4.97	5.31	4.58	14.91	-8.91	1.42
Participation Rate only	1.29	3.45	2.12	10.85	-0.52	-1.29
Employment Rate only	0.20	-0.39	-2.43	0.33	-2.93	-1.17
Hours per Worker only	3.44	2.21	4.94	3.44	-5.60	3.93
Human Capital only	2.94	3.45	2.72	6.79	3.11	6.54
			1999			
Human Capital + Labor Market	12.38	28.46	29.24	49.39	2.54	10.83
Labor Market Total	10.86	26.43	27.90	44.37	0.86	6.34
Participation Rate only	4.92	11.34	10.67	20.20	0.21	1.91
Employment Rate only	2.66	5.73	2.46	8.47	0.23	0.08
Hours per Worker only	3.00	7.72	13.12	11.48	0.42	4.28
Human Capital only	1.33	1.51	0.98	3.12	1.66	4.15

Appendix Table 5.1: Male and Female Labor Force Participation Rates

Year	Male							Female						
	Canada	France	W. Germany	Italy	Japan	U.K.	U.S.	Canada	France	W. Germany	Italy	Japan	U.K.	U.S.
1960	89.7		93.3	91.0		96.1	87.1	32.0		49.3	36.7		48.5	42.5
1961	88.9		93.5	89.8		96.2	86.7	33.0		49.3	36.6		49.2	43.1
1962	88.1		92.7	89.7		94.6	84.9	33.4		49.2	38.5		47.2	42.6
1963	87.6		92.3	88.3		95.2	84.6	34.0		49.3	36.5		47.4	43.1
1964	87.2		91.9	88.2		94.7	84.2	35.0		49.0	35.5		48.1	43.6
1965	87.1		91.6	87.3		94.7	84.0	36.0		49.0	34.6		48.9	44.3
1966	86.3	84.4	91.3	86.2		94.3	83.0	39.6	46.3	48.5	33.4		49.9	45.4
1967	85.7	84.3	90.5	86.1		93.8	82.6	40.9	46.7	47.5	33.4		49.5	46.3
1968	85.0	83.5	90.3	85.2		93.2	82.1	41.6	47.1	47.7	33.6		49.8	46.8
1969	84.7	83.5	90.2	84.2		92.8	81.9	42.7	47.5	48.0	33.6		50.3	48.1
1970	84.3	83.4	89.9	83.5		92.3	82.1	43.2	48.4	48.0	33.5		50.6	48.8
1971	84.0	82.6	88.6	83.2		91.6	82.1	44.4	48.9	48.5	33.5		50.5	48.9
1972	84.2	81.9	87.4			91.1	82.6	45.3	49.4	49.3			51.2	50.0
1973	85.0	81.7	86.9			91.0	82.8	47.2	50.1	50.3			53.1	51.0
1974	82.5	81.6	85.8			90.0	83.0	47.3	50.5	50.6			54.4	52.2
1975	82.3	80.8	84.6			90.3	82.4	48.9	51.0	50.8			55.0	53.1
1976	84.3	80.4	83.6		89.7	90.5	82.2	51.2	52.0	51.0		51.9	55.5	54.3
1977	84.5	80.3	82.8	80.4	89.2	89.8	82.5	52.5	52.9	51.2	37.6	53.0	56.2	54.9
1978	85.0	79.8	82.5	79.9	89.0	89.4	82.8	54.6	53.4	51.6	37.6	54.1	56.7	57.5
1979	85.6	79.3	82.2	79.7	89.0	88.8	83.0	56.1	54.1	52.2	38.7	54.6	57.9	58.7
1980	85.6	78.4	81.7	79.7	88.9	88.8	82.7	57.7	54.4	52.8	39.6	54.8	58.2	59.5
1981	85.8	77.5	81.1	79.3	89.2	88.4	82.4	59.4	54.4	53.1	40.0	55.1	57.2	60.4
1982	84.3	76.7	80.7	78.3	88.8	87.5	82.1	59.5	54.6	52.9	39.8	55.7	57.0	61.2
1983	84.1	75.3	80.0	77.6	88.8	85.9	82.1	60.5	54.3	52.5	40.3	57.0	57.1	61.7
1984	84.1	74.4	79.8	76.4	88.1	86.2	82.2	61.7	54.6	52.3	40.7	57.0	59.0	62.6
1985	84.4	73.7	79.8	76.1	87.6	86.8	82.1	63.1	54.7	52.9	41.0	57.1	60.4	63.8
1986	84.6	73.2	80.1	76.1	87.3	85.9	82.5	64.2	55.0	53.8	42.3	57.3	61.2	64.9
1987	84.5	72.6	80.0	75.9	86.9	85.5	82.8	65.4	55.4	54.6	43.4	57.6	62.3	66.0
1988	84.6	72.1	79.7	75.6	86.8	85.4	83.0	66.7	55.4	55.4	43.7	58.2	63.6	66.9
1989	84.4	71.9	79.1	75.7	87.0	85.0	83.6	67.1	55.7	56.0	44.3	59.2	64.7	68.1
1990	83.7	72.5	78.2	76.9	87.9	84.5	84.4	67.7	57.5	57.4	45.9	60.3	65.4	68.6

1991	82.9	72.5	80.1	77.0	88.8	84.7	83.9	67.9	58.1	61.2	46.2	61.4	65.3	68.6
1992	82.0	72.0	79.7	76.4	89.5	84.7	84.2	67.5	58.7	61.6	46.5	61.9	66.1	69.1
1993	81.7	71.7	79.6	74.7	90.2	83.6	84.0	67.6	59.0	61.8	42.8	61.8	66.2	69.3
1994	81.9	71.7	79.3	73.9	90.5	83.4	83.5	67.7	59.3	61.5	42.7	62.1	66.1	70.4
1995	81.1	71.3	79.0	73.2	90.4	82.7	83.3	67.5	59.3	61.7	43.3	62.1	66.0	70.5
1996	81.1	71.9	79.1	72.9	91.2	82.4	83.2	67.8	59.7	62.0	43.8	62.6	66.3	70.8
1997	81.4	72.0	78.6	72.6	92.1	83.6	84.4	67.8	59.7	61.8	44.1	63.7	67.5	71.1

Appendix Table 6.1: Comparisons of Input and Efficiency Effects

Year	Canada Own output /US output	Canada Added output from US input /US output	Canada Added output from U.S. efficiency /US output	Canada % output gap due to inputs	France Own output /US output	France Added output from US input /US output	France Added output from U.S. efficiency /US output	France % output gap due to inputs
53	7.18	64.64	28.18	70%	14.21	47.78	38.01	56%
54	7.36	64.21	28.44	69%	15.27	47.29	37.44	56%
55	7.19	64.16	28.66	69%	14.61	48.42	36.98	57%
56	7.38	63.75	28.87	69%	14.82	48.65	36.53	57%
57	7.53	63.37	29.10	69%	15.38	48.61	36.01	57%
58	7.88	62.81	29.31	68%	16.00	48.45	35.55	58%
59	7.82	62.64	29.54	68%	15.43	49.57	34.99	59%
60	7.76	62.50	29.74	68%	15.84	49.63	34.53	59%
61	7.81	62.25	29.94	68%	16.30	49.62	34.08	59%
62	7.79	62.07	30.14	67%	16.39	50.04	33.57	60%
63	7.80	61.87	30.33	67%	16.64	50.26	33.10	60%
64	7.88	61.60	30.51	67%	16.74	50.61	32.64	61%
65	7.90	61.40	30.69	67%	16.52	51.30	32.19	61%
66	7.90	61.24	30.87	66%	16.73	51.53	31.74	62%
67	7.94	61.02	31.03	66%	17.04	51.63	31.33	62%
68	7.97	60.83	31.20	66%	17.22	51.87	30.92	63%
69	8.04	60.60	31.35	66%	17.62	51.86	30.52	63%
70	8.13	60.36	31.51	66%	18.36	51.49	30.16	63%
71	8.27	60.07	31.66	65%	18.67	51.56	29.77	63%
72	8.17	60.03	31.80	65%	18.29	52.34	29.37	64%
73	8.24	59.82	31.94	65%	18.22	52.79	28.99	65%
74	8.45	59.70	31.85	65%	18.43	53.11	28.46	65%
75	8.73	59.51	31.76	65%	18.53	53.52	27.95	66%
76	8.64	59.70	31.66	65%	18.56	54.03	27.41	66%
77	8.44	59.99	31.57	66%	18.20	54.92	26.88	67%
78	8.48	60.04	31.48	66%	17.83	55.79	26.38	68%
79	8.56	60.05	31.39	66%	17.72	56.39	25.88	69%
80	8.75	59.94	31.31	66%	18.18	56.42	25.40	69%
81	8.86	59.91	31.22	66%	17.91	57.17	24.92	70%
82	8.67	60.19	31.14	66%	18.10	57.46	24.45	70%
83	8.64	60.30	31.06	66%	17.77	58.23	24.00	71%
84	8.61	60.40	30.99	66%	17.06	59.39	23.55	72%
85	8.80	60.29	30.91	66%	16.90	59.98	23.12	72%
86	8.84	60.12	31.04	66%	16.72	60.40	22.88	73%
87	8.77	60.06	31.17	66%	16.45	60.89	22.66	73%
88	8.80	59.90	31.30	66%	16.34	61.21	22.45	73%
89	8.71	59.87	31.42	66%	16.39	61.38	22.23	73%
90	8.69	59.77	31.54	65%	16.59	61.38	22.03	74%
91	8.65	59.70	31.65	65%	16.79	61.37	21.84	74%
92	8.52	59.72	31.76	65%	16.50	61.82	21.68	74%
93	8.55	59.59	31.86	65%	16.17	62.32	21.51	74%
94	8.60	59.44	31.96	65%	15.89	62.76	21.35	75%
95	8.63	59.31	32.06	65%	15.93	62.86	21.21	75%
96	8.62	59.23	32.15	65%	15.76	63.18	21.06	75%
97	8.64	59.12	32.24	65%	15.41	63.67	20.91	75%
98	8.70	58.97	32.33	65%	15.40	63.82	20.78	75%
99	8.65	58.93	32.41	65%	15.37	63.97	20.66	76%

Appendix Table 6.1: Comparisons of Input and Efficiency Effects

Year	W.Germany Own output /US output	W.Germany Added output from US input /US output	W.Germany Added output from U.S. efficiency /US output	W.Germany % output gap due to inputs	Italy Own output /US output	Italy Added output from US input /US output	Italy Added output from U.S. efficiency /US output	Italy % output gap due to inputs
53	17.16	40.88	41.96	49%	10.32	39.83	49.85	44%
54	18.71	39.96	41.33	49%	11.21	39.93	48.86	45%
55	18.37	40.84	40.79	50%	11.10	40.90	48.00	46%
56	18.78	40.96	40.27	50%	11.31	41.52	47.16	47%
57	19.35	40.97	39.68	51%	11.95	41.83	46.23	48%
58	20.50	40.35	39.15	51%	12.99	41.64	45.37	48%
59	20.34	41.13	38.53	52%	13.17	42.46	44.37	49%
60	21.00	40.99	38.00	52%	13.80	42.69	43.50	50%
61	21.74	40.77	37.49	52%	14.67	42.68	42.65	50%
62	21.69	41.39	36.92	53%	14.94	43.33	41.72	51%
63	21.73	41.87	36.39	54%	15.08	44.08	40.84	52%
64	21.82	42.30	35.88	54%	15.01	45.01	39.98	53%
65	21.83	42.80	35.36	55%	14.65	46.22	39.12	54%
66	21.61	43.53	34.87	56%	14.64	47.07	38.29	55%
67	21.00	44.59	34.40	56%	15.21	47.29	37.50	56%
68	21.66	44.41	33.93	57%	15.47	47.83	36.70	57%
69	22.25	44.27	33.48	57%	15.45	48.61	35.94	57%
70	23.27	43.67	33.06	57%	16.10	48.69	35.21	58%
71	23.21	44.17	32.62	58%	16.29	49.25	34.46	59%
72	22.56	45.25	32.19	58%	15.80	50.49	33.71	60%
73	22.40	45.84	31.76	59%	15.58	51.44	32.99	61%
74	22.07	46.43	31.50	60%	15.96	51.44	32.61	61%
75	22.10	46.66	31.25	60%	16.52	51.23	32.24	61%
76	21.89	47.14	30.97	60%	16.39	51.76	31.85	62%
77	21.12	48.17	30.71	61%	15.89	52.63	31.48	63%
78	20.66	48.88	30.46	62%	15.59	53.29	31.12	63%
79	20.62	49.16	30.22	62%	15.60	53.63	30.76	64%
80	21.03	49.00	29.97	62%	16.02	53.56	30.42	64%
81	20.77	49.49	29.74	62%	15.97	53.96	30.08	64%
82	21.21	49.28	29.50	63%	16.48	53.78	29.74	64%
83	20.76	49.96	29.28	63%	16.17	54.41	29.42	65%
84	20.02	50.93	29.06	64%	15.61	55.29	29.10	66%
85	20.02	51.14	28.84	64%	15.58	55.63	28.79	66%
86	19.91	51.57	28.52	64%	15.50	56.27	28.23	67%
87	19.47	52.31	28.22	65%	15.20	57.10	27.70	67%
88	19.30	52.76	27.94	65%	15.06	57.75	27.20	68%
89	19.31	53.03	27.65	66%	14.97	58.34	26.69	69%
90	19.61	53.01	27.38	66%	15.24	58.55	26.21	69%
91	20.00	52.87	27.13	66%	15.47	58.76	25.77	70%
92	19.70	53.41	26.90	67%	15.20	59.44	25.36	70%
93	18.80	54.54	26.66	67%	14.79	60.25	24.95	71%
94	18.50	55.06	26.45	68%	14.31	61.10	24.58	71%
95	18.23	55.53	26.24	68%	14.13	61.63	24.24	72%
96	17.68	56.29	26.04	68%	13.97	62.15	23.88	72%
97	17.06	57.10	25.84	69%	13.65	62.80	23.55	73%
98	17.18	57.17	25.65	69%	13.45	63.32	23.23	73%
99	16.92	57.60	25.48	69%	13.35	63.69	22.96	74%

Appendix Table 6.1: Comparisons of Input and Efficiency Effects

Year	Japan Own output /US output	Japan Added output From US input /US output	Japan Added output from U.S. efficiency /US output	Japan % output gap due to inputs	U. K. Own output /US output	U. K. Added output from US input /US output	U. K. Added output from U.S. efficiency /US output	U. K. % output gap due to inputs
53	11.95	29.58	58.47	34%	19.72	45.83	34.46	57%
54	13.25	29.24	57.51	34%	20.99	44.23	34.78	56%
55	13.19	30.15	56.66	35%	19.88	45.06	35.06	56%
56	13.77	30.40	55.82	35%	19.60	45.08	35.32	56%
57	14.54	30.56	54.91	36%	19.80	44.59	35.61	56%
58	15.86	30.09	54.05	36%	20.47	43.66	35.87	55%
59	16.17	30.74	53.09	37%	19.97	43.87	36.17	55%
60	17.29	30.48	52.23	37%	20.25	43.33	36.42	54%
61	18.98	29.64	51.38	37%	20.57	42.76	36.67	54%
62	19.23	30.30	50.47	38%	20.03	43.05	36.93	54%
63	20.11	30.28	49.61	38%	19.81	43.02	37.17	54%
64	21.51	29.73	48.76	38%	19.71	42.89	37.40	53%
65	21.79	30.29	47.92	39%	19.21	43.16	37.63	53%
66	23.25	29.65	47.10	39%	18.81	43.33	37.85	53%
67	25.39	28.29	46.32	38%	18.83	43.11	38.06	53%
68	26.80	27.66	45.53	38%	18.70	43.03	38.27	53%
69	27.82	27.41	44.78	38%	18.43	43.11	38.47	53%
70	29.58	26.37	44.04	37%	18.71	42.64	38.66	52%
71	30.62	26.07	43.31	38%	18.52	42.64	38.85	52%
72	30.90	26.51	42.58	38%	17.94	43.03	39.03	52%
73	31.84	26.28	41.88	39%	17.74	43.06	39.20	52%
74	31.52	26.60	41.87	39%	17.74	43.08	39.18	52%
75	31.84	26.29	41.86	39%	18.26	42.59	39.15	52%
76	32.27	25.88	41.85	38%	17.53	43.34	39.12	53%
77	31.91	26.25	41.84	39%	16.95	43.95	39.10	53%
78	31.95	26.22	41.83	39%	16.52	44.41	39.07	53%
79	32.58	25.59	41.82	38%	16.36	44.59	39.04	53%
80	33.69	24.50	41.81	37%	16.19	44.79	39.02	53%
81	33.72	24.48	41.80	37%	15.42	45.58	39.00	54%
82	35.02	23.19	41.80	36%	15.74	45.29	38.97	54%
83	35.19	23.02	41.79	36%	15.37	45.68	38.95	54%
84	34.82	23.40	41.78	36%	14.98	46.09	38.93	54%
85	34.96	23.27	41.77	36%	15.06	46.04	38.90	54%
86	34.80	24.02	41.17	37%	14.87	46.07	39.06	54%
87	34.93	24.47	40.60	38%	14.75	46.04	39.21	54%
88	35.68	24.27	40.05	38%	14.88	45.77	39.35	54%
89	36.28	24.21	39.52	38%	14.95	45.56	39.49	54%
90	37.06	23.93	39.00	38%	15.04	45.33	39.63	53%
91	38.18	23.30	38.52	38%	14.72	45.53	39.76	53%
92	37.65	24.28	38.07	39%	14.30	45.82	39.88	53%
93	36.62	25.76	37.62	41%	13.98	46.02	40.00	53%
94	36.18	26.61	37.21	42%	14.01	45.88	40.11	53%
95	36.41	26.76	36.83	42%	14.01	45.76	40.22	53%
96	36.66	26.90	36.44	42%	13.98	45.69	40.33	53%
97	36.28	27.63	36.08	43%	13.79	45.77	40.44	53%
98	35.61	28.65	35.74	45%	13.69	45.76	40.54	53%
99	34.57	30.00	35.43	46%	13.59	45.78	40.63	53%

Appendix Table 7.1: Gains and Losses in Real Output due to Differences in Labor Market Outcomes (Percent) (CRS)

Labor Market Outcome	CAN	FRA	WGER	ITA	JAP	UK
			1960			
Human Capital + Labor Market	27.98	21.16	12.33	51.38	6.78	24.02
Labor Market Total	8.36	-3.27	-3.03	3.58	-8.20	-3.35
Participation Rate only	3.86	-1.12	-3.24	0.97	-3.80	-3.53
Employment Rate only	0.71	-1.43	-1.69	0.11	-0.91	-1.69
Hours per Worker only	3.75	-0.71	1.90	2.52	-3.19	1.88
Human Capital only	17.73	25.52	15.98	45.59	16.86	28.59
			1980			
Human Capital + Labor Market	17.26	19.77	15.84	48.25	1.56	28.47
Labor Market Total	5.15	5.45	4.71	15.20	-8.91	1.43
Participation Rate only	1.35	3.55	2.18	11.10	-0.52	-1.30
Employment Rate only	0.20	-0.40	-2.51	0.34	-2.92	-1.18
Hours per Worker only	3.57	2.27	5.08	3.53	-5.59	3.96
Human Capital only	11.40	13.44	10.54	27.82	11.71	26.57
			1999			
Human Capital + Labor Market	17.08	35.83	34.74	68.18	8.04	25.57
Labor Market Total	10.76	27.22	29.11	45.83	0.88	6.42
Participation Rate only	4.90	11.74	11.19	21.02	0.21	1.95
Employment Rate only	2.65	5.95	2.58	8.85	0.24	0.08
Hours per Worker only	2.99	8.01	13.74	11.97	0.42	4.34
Human Capital only	5.60	6.50	4.18	14.35	7.10	17.78

Appendix Table 7.2: Comparisons of Input and Efficiency Effects (CRS)

Year	Canada Own output /US output	Canada Added output from US input /US output	Canada Added output from U.S. efficiency /US output	Canada % output gap due to inputs	France Own output /US output	France Added output from US input /US output	France Added output from U.S. efficiency /US output	France % output gap due to inputs
53	6.81	108.95	-15.76	117%	13.17	68.76	18.07	79%
54	6.94	107.34	-14.28	115%	14.05	68.28	17.66	79%
55	6.78	106.37	-13.15	114%	13.39	69.24	17.36	80%
56	6.96	105.08	-12.04	113%	13.53	69.40	17.07	80%
57	7.05	103.72	-10.77	112%	13.95	69.34	16.71	81%
58	7.33	102.32	-9.65	110%	14.41	69.20	16.39	81%
59	7.27	101.10	-8.38	109%	13.84	70.15	16.01	81%
60	7.19	100.11	-7.31	108%	14.14	70.16	15.70	82%
61	7.24	99.04	-6.28	107%	14.48	70.12	15.40	82%
62	7.23	97.94	-5.18	106%	14.50	70.45	15.05	82%
63	7.25	96.91	-4.16	104%	14.69	70.58	14.74	83%
64	7.34	95.85	-3.19	103%	14.81	70.76	14.43	83%
65	7.36	94.87	-2.23	102%	14.65	71.22	14.13	83%
66	7.36	93.97	-1.32	101%	14.91	71.26	13.83	84%
67	7.39	93.08	-0.48	101%	15.24	71.19	13.56	84%
68	7.42	92.21	0.36	100%	15.47	71.24	13.29	84%
69	7.50	91.34	1.16	99%	15.85	71.12	13.03	85%
70	7.57	90.52	1.91	98%	16.52	70.68	12.80	85%
71	7.73	89.61	2.67	97%	16.85	70.61	12.54	85%
72	7.66	88.93	3.41	96%	16.57	71.15	12.28	85%
73	7.76	88.12	4.12	96%	16.58	71.39	12.03	86%
74	7.96	87.59	4.45	95%	16.82	71.59	11.59	86%
75	8.19	87.04	4.77	95%	16.93	71.91	11.17	87%
76	8.12	86.78	5.10	94%	17.04	72.24	10.71	87%
77	7.94	86.64	5.42	94%	16.76	72.95	10.28	88%
78	7.99	86.29	5.73	94%	16.48	73.65	9.86	88%
79	8.07	85.90	6.03	93%	16.44	74.11	9.46	89%
80	8.22	85.46	6.32	93%	16.87	74.07	9.06	89%
81	8.34	85.05	6.61	93%	16.64	74.70	8.66	90%
82	8.11	85.00	6.89	92%	16.81	74.91	8.28	90%
83	8.08	84.76	7.17	92%	16.54	75.55	7.91	91%
84	8.07	84.49	7.43	92%	15.91	76.54	7.55	91%
85	8.26	84.05	7.69	92%	15.81	77.00	7.19	91%
86	8.30	83.47	8.23	91%	15.72	77.22	7.06	92%
87	8.24	83.01	8.75	90%	15.52	77.54	6.94	92%
88	8.28	82.48	9.24	90%	15.47	77.70	6.83	92%
89	8.19	82.08	9.73	89%	15.54	77.75	6.71	92%
90	8.16	81.63	10.20	89%	15.79	77.61	6.60	92%
91	8.13	81.23	10.64	88%	15.98	77.52	6.50	92%
92	8.06	80.89	11.06	88%	15.77	77.81	6.42	92%
93	8.15	80.38	11.47	88%	15.51	78.16	6.32	93%
94	8.27	79.86	11.87	87%	15.31	78.45	6.24	93%
95	8.37	79.39	12.24	87%	15.42	78.41	6.17	93%
96	8.39	78.99	12.62	86%	15.30	78.61	6.09	93%
97	8.43	78.57	13.00	86%	15.01	78.98	6.01	93%
98	8.52	78.12	13.36	85%	15.04	79.02	5.94	93%
99	8.46	77.87	13.67	85%	15.08	79.07	5.86	93%

Appendix Table 7.2: Comparisons of Input and Efficiency Effects (CRS)

Year	W.Germany Own output /US output	W.Germany Added output from US input /US output	W.Germany Added output from U.S. efficiency /US output	W.Germany % output gap due to inputs	Italy Own output /US output	Italy Added output from US input /US output	Italy Added output from U.S. efficiency /US output	Italy % output gap due to inputs
53	16.23	54.96	28.81	66%	8.77	58.68	32.55	64%
54	17.61	54.23	28.16	66%	9.48	59.00	31.52	65%
55	17.26	55.10	27.64	67%	9.37	59.95	30.68	66%
56	17.61	55.26	27.13	67%	9.54	60.61	29.85	67%
57	18.14	55.32	26.54	68%	10.04	61.05	28.90	68%
58	19.17	54.82	26.01	68%	10.89	61.07	28.04	69%
59	18.98	55.61	25.41	69%	11.03	61.91	27.06	70%
60	19.55	55.56	24.89	69%	11.54	62.26	26.20	70%
61	20.19	55.43	24.38	69%	12.27	62.36	25.36	71%
62	20.14	56.04	23.83	70%	12.51	63.02	24.46	72%
63	20.16	56.53	23.32	71%	12.64	63.74	23.62	73%
64	20.21	56.97	22.82	71%	12.57	64.64	22.79	74%
65	20.18	57.49	22.32	72%	12.29	65.74	21.97	75%
66	19.97	58.19	21.85	73%	12.27	66.55	21.18	76%
67	19.45	59.15	21.40	73%	12.74	66.83	20.42	77%
68	20.12	58.93	20.95	74%	12.94	67.38	19.67	77%
69	20.64	58.84	20.52	74%	12.96	68.09	18.96	78%
70	21.54	58.35	20.12	74%	13.49	68.24	18.27	79%
71	21.42	58.88	19.70	75%	13.69	68.74	17.57	80%
72	20.81	59.90	19.29	76%	13.30	69.81	16.88	81%
73	20.65	60.45	18.90	76%	13.14	70.63	16.22	81%
74	20.34	60.97	18.69	77%	13.43	70.60	15.97	82%
75	20.38	61.13	18.49	77%	13.90	70.38	15.72	82%
76	20.29	61.43	18.28	77%	13.86	70.68	15.47	82%
77	19.65	62.28	18.08	78%	13.53	71.25	15.22	82%
78	19.29	62.83	17.88	78%	13.32	71.69	14.98	83%
79	19.32	62.99	17.69	78%	13.39	71.86	14.75	83%
80	19.71	62.78	17.50	78%	13.81	71.67	14.52	83%
81	19.53	63.15	17.32	78%	13.84	71.86	14.30	83%
82	19.99	62.87	17.14	79%	14.31	71.61	14.08	84%
83	19.64	63.39	16.97	79%	14.08	72.05	13.87	84%
84	19.04	64.16	16.80	79%	13.62	72.72	13.66	84%
85	19.16	64.21	16.63	79%	13.65	72.89	13.46	84%
86	19.16	64.50	16.34	80%	13.66	73.40	12.94	85%
87	18.83	65.12	16.05	80%	13.49	74.06	12.45	86%
88	18.72	65.49	15.79	81%	13.40	74.62	11.99	86%
89	18.75	65.73	15.52	81%	13.42	75.06	11.52	87%
90	18.98	65.75	15.27	81%	13.72	75.19	11.08	87%
91	19.42	65.54	15.03	81%	14.05	75.28	10.68	88%
92	19.19	65.99	14.82	82%	13.82	75.87	10.31	88%
93	18.35	67.04	14.60	82%	13.47	76.60	9.93	89%
94	18.12	67.48	14.40	82%	13.05	77.36	9.59	89%
95	17.90	67.88	14.22	83%	12.97	77.76	9.27	89%
96	17.39	68.58	14.03	83%	12.89	78.17	8.95	90%
97	16.81	69.35	13.84	83%	12.66	78.71	8.64	90%
98	16.99	69.34	13.67	84%	12.53	79.12	8.35	90%
99	16.78	69.73	13.50	84%	12.50	79.43	8.07	91%

Appendix Table 7.2: Comparisons of Input and Efficiency Effects (CRS)

Year	Japan Own output /US output	Japan Added output From US input /US output	Japan Added output from U.S. efficiency /US output	Japan % output gap due to inputs	U. K. Own output /US output	U. K. Added output from US input /US output	U. K. Added output from U.S. efficiency /US output	U. K. % output gap due to inputs
53	11.22	36.79	51.99	41%	17.78	64.60	17.62	79%
54	12.42	36.54	51.04	42%	18.84	63.01	18.16	78%
55	12.36	37.38	50.26	43%	17.81	63.61	18.58	77%
56	12.91	37.62	49.48	43%	17.51	63.49	19.00	77%
57	13.60	37.80	48.60	44%	17.64	62.90	19.46	76%
58	14.81	37.40	47.79	44%	18.18	61.94	19.88	76%
59	15.09	38.02	46.89	45%	17.69	61.96	20.35	75%
60	16.14	37.77	46.09	45%	17.87	61.37	20.75	75%
61	17.77	36.92	45.30	45%	18.13	60.73	21.14	74%
62	18.05	37.48	44.47	46%	17.60	60.85	21.55	74%
63	18.91	37.42	43.68	46%	17.37	60.69	21.94	73%
64	20.21	36.88	42.90	46%	17.26	60.43	22.30	73%
65	20.50	37.36	42.14	47%	16.81	60.52	22.66	73%
66	21.87	36.73	41.40	47%	16.44	60.55	23.01	72%
67	23.87	35.44	40.69	47%	16.43	60.24	23.34	72%
68	25.17	34.84	39.99	47%	16.29	60.05	23.66	72%
69	26.10	34.59	39.31	47%	16.03	60.01	23.96	71%
70	27.70	33.64	38.66	47%	16.25	59.49	24.25	71%
71	28.69	33.31	38.01	47%	16.07	59.38	24.55	71%
72	29.02	33.61	37.37	47%	15.57	59.60	24.83	71%
73	29.78	33.47	36.76	48%	15.39	59.51	25.10	70%
74	29.50	33.71	36.78	48%	15.37	59.49	25.15	70%
75	29.73	33.47	36.81	48%	15.79	59.02	25.19	70%
76	30.15	33.02	36.83	47%	15.17	59.60	25.23	70%
77	29.82	33.32	36.86	47%	14.68	60.05	25.27	70%
78	29.87	33.25	36.88	47%	14.32	60.36	25.31	70%
79	30.47	32.63	36.90	47%	14.21	60.44	25.35	70%
80	31.47	31.60	36.93	46%	14.05	60.56	25.39	70%
81	31.61	31.44	36.95	46%	13.41	61.17	25.43	71%
82	32.83	30.20	36.97	45%	13.73	60.80	25.46	70%
83	33.04	29.97	36.99	45%	13.45	61.05	25.50	71%
84	32.75	30.24	37.01	45%	13.16	61.31	25.53	71%
85	32.95	30.02	37.03	45%	13.29	61.15	25.57	71%
86	32.76	30.73	36.51	46%	13.18	61.03	25.79	70%
87	32.82	31.17	36.01	46%	13.13	60.87	26.00	70%
88	33.76	30.71	35.53	46%	13.29	60.51	26.21	70%
89	34.36	30.58	35.06	47%	13.38	60.21	26.41	70%
90	35.08	30.31	34.62	47%	13.48	59.92	26.60	69%
91	36.17	29.63	34.20	46%	13.20	60.02	26.78	69%
92	35.76	30.43	33.81	47%	12.88	60.17	26.95	69%
93	34.80	31.77	33.43	49%	12.63	60.24	27.12	69%
94	34.42	32.50	33.07	50%	12.74	59.97	27.29	69%
95	34.67	32.59	32.74	50%	12.82	59.75	27.44	69%
96	34.96	32.62	32.42	50%	12.81	59.60	27.59	68%
97	34.62	33.28	32.10	51%	12.66	59.59	27.74	68%
98	34.01	34.18	31.81	52%	12.61	59.50	27.89	68%
99	33.07	35.40	31.53	53%	12.56	59.43	28.01	68%