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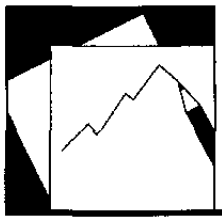

IMF Working Paper

Impact of Structural Reforms on Productivity Growth in Industrial Countries

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Research Department

Impact of Structural Reforms on Productivity Growth in Industrial Countries

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Abstract

This paper investigates the impact of structural reforms on productivity growth. A panel analysis of 20 OECD countries finds that the impact of structural reforms on productivity growth may be weak or negative in the short run, possibly due to adjustment costs and the need for firms to learn how to operate in a less regulated and more competitive environment. In the long run, however, structural reforms are found to have significantly positive effects on productivity growth.

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[1] This paper builds on the empirical research underlying Chapter 1, "Australia: Productivity Growth and Structural Reform," *Australia—Selected Issues and Statistical Appendix* (International Monetary Fund, 1999). The author would like to thank Ray Brooks, Peter Downes, Paul Gretton, Jonathan Ostry, Christopher Towe, and participants at seminars at the Australian Treasury and the IMF Asia and Pacific Department for useful comments and suggestions.

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I. Introduction

In recent years, many industrial countries have undergone fundamental structural changes stemming from microeconomic reforms in trade and in product and labor markets. While a number of these countries have also witnessed an acceleration of output and productivity growth, others have not. This paper examines the impact of reforms on productivity, particularly by studying the dynamic impact of changes in structural policies.

There have been only a few empirical cross-country studies that have examined the macroeconomic impact of structural reforms—mainly because adequate and comparable measures of structural reform on an aggregate level and particularly on a time-series basis are hard to find. These studies, which used a simulation approach or related simple indicators of structural reforms to macroeconomic effects, have generally found a positive impact from reforms on GDP, productivity, and employment, although some of the studies find a negative impact.[2]

This paper extends this analysis by examining not only macroeconomic outcomes because of cross-sectional differences in structural policies but also the dynamic impact of changes in structural policies—particularly, the short-run compared to long-run tradeoffs. It also examines structural indicators not used in previous studies, particularly the price-average cost markup as an indicator of product market reform.

Using a panel analysis of 20 OECD countries during 1965-98, this study finds that the impact of structural reforms on productivity growth may be weak or negative in the short run, possibly due to adjustment costs and the need for firms to learn how to operate in a less regulated and more competitive environment. Indeed these short-run costs may explain the negative macroeconomic impact of structural reform that has been found in some previous studies. In the long run, however, structural reforms are found to have significantly positive effects on productivity growth, with, for example, reforms implemented during 1985 to 1995 potentially increasing total factor productivity (TFP) growth by 0.2 to 0.3 percentage points on average.

II. Measures of Structural Reform

Over the past few decades, many industrial countries have implemented a wide range of structural reforms. These reforms include substantial reductions in tariff rates and nontariff barriers, privatization of public enterprises, deregulation and liberalization of product markets (particularly, telecommunications, utilities, aviation, and financial services), and efforts to decentralize and make labor markets more flexible.

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[2] See Gonenc, Maher, and Nicoletti (2000) and references therein.

To examine the potential impact of these structural reforms, this paper analyzes productivity growth and indicators of structural reforms across OECD countries since the 1960s.[3] Only OECD countries are included in the analysis to maintain a set of relatively homogeneous countries. A variety of structural indicators are examined with the average tariff rate as the primary indicator of trade reform and the average unemployment benefit replacement rate as the indicator of labor market reform.[4] Several indicators for product market reform are used as proxies for product market competition, namely structural change variables and the price-average cost markup. Structural change is defined as half the sum of the absolute value of annual changes in the sectoral share of GDP and is calculated at two- and three-digit industry levels (see OECD, 1996). Price-average cost markups, which are allowed to vary on an annual basis, are defined as the ratio of nominal GDP (excluding net indirect taxes) to total factor cost.[5]

The choice of indicators or proxies for structural reforms is limited by the availability of data for a number of countries, particularly on an annual time series basis. Unfortunately, this means that the proxy measures used in the empirical analysis in this paper may not give true or optimal measures of structural reforms undertaken in a particular country. For example, as an indicator or proxy for trade reform, the average tariff rate does not capture the benefits of removing import quotas or other forms of nontariff barriers to trade. Also, because it is (implicitly) trade weighted (as opposed to production weighted), the proxy does not fully capture the trade protection offered even by tariffs.[6] For some countries, effective rates of protection, a better proxy for trade protection, have been calculated (for example, for Australia, see Industry Commission, 1995), but these measures are not available for most other countries (particularly on a time-series basis).

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[3] See Appendix for data sources and details of variable construction.

[4] Other indicators of trade reform were also examined, including openness, import penetration, and export intensity—the latter two, both for manufacturing industries only and at the aggregate level.

[5] For a similar approach, see Domowitz et al. (1986). Alternative approaches which estimate price-marginal cost margins but assume constant margins over time, include Hall (1988), Domowitz et al. (1988), and Roeger (1995). Morrison (1990) proposes a methodology to estimate time-varying markups using a structural model; however, this procedure is beyond the scope of this paper.

[6] As an example, prohibitive tariff rates afford full trade protection, but the implied protection would not be included in the average tariff rate because sectors with prohibitive tariffs would have no imports.

There is also only limited panel data on indicators of labor market flexibility and reform. Unemployment benefit replacement rate data are perhaps not ideal because the data indicate that labor market flexibility has declined in most OECD countries. While this might indicate less labor market flexibility, other labor market indicators (which are, unfortunately, available only for selected years and therefore, not usable in the empirical analysis below) generally indicate slightly improving or constant labor market flexibility (OECD, 1999).

Nevertheless, these data limitations do not necessarily invalidate the results. The proxy measures will capture some of the effects of reform, and the deviations of these proxies from true measures of reform may be limited and uncorrelated across countries—that is, the deviations may cancel. In addition, the results presented below are tested for robustness using different proxy measures and different specifications.

III. Cross-country Comparisons of Productivity Growth and Structural Reform

Estimates of labor productivity, capital productivity, and TFP growth for the business sector were derived for 20 OECD countries between 1960 and 1998.[7] Because hours worked are available for only a limited number of countries, labor productivity is calculated as output per worker. TFP is calculated using a Cobb-Douglas production function or under the assumptions of constant returns to scale and perfect competition.[8] Furthermore, labor and capital are assumed to be homogeneous and fully employed.[9] To the extent that these assumptions are incorrect, inputs and output are mismeasured, and hours per worker change over time, TFP growth will be an inaccurate measure of technological progress and improving economic efficiency.

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[7] These countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. While estimates for labor productivity growth can be derived for other OECD countries, the lack of capital stock data for these countries precludes estimating capital productivity or TFP growth. The business sector includes both market and non-market sectors, but excludes producers of government services. The vintages of the data are before September 1999, and thus, the data omits recent historical revisions in a number of countries.

[8] At the aggregate level, most economic studies have found that constant returns to scale cannot be rejected.

[9] For example, labor is not differentiated by level of skill or education while capital is not differentiated by vintage.

With these caveats in mind, the data show that productivity growth in these OECD countries generally slowed down in the early 1970s. Annual labor productivity growth, which averaged over 4¼ percent in the 1960s across the 20 countries, slowed to about half that rate in the 1970s and further during the 1980s and 1990s (Table 1). Average annual TFP growth followed a similar pattern, with a sharp drop from almost 3 percent in the 1960s to about 1 percent in the 1980s and 1990s (Table 2). While average annual capital productivity growth also slowed by half a percentage point between the 1960s and the 1970s, it has since picked up in the 1990s (Table 3). In the latter part of the 1990s, labor productivity and TFP growth appear to have rebounded somewhat on average—and particularly in some countries—but are still below levels reached in the 1960s. Interestingly, capital productivity, which on average has been negative, has increased and turned positive for the first time in the late 1990s.

During the last several decades, many OECD countries have instituted structural reforms. On the trade side, average tariff rates across these countries have declined from almost 9 percent in 1960 to under 2 percent by 1995 (Figure 1 and Table 4). Product markets have also become more competitive, as indicated by price-average cost markups which have declined from a cross-country average of about 20 percent in the 1960s to 11 percent in 1995 (Table 5). However, average unemployment benefits replacement rates have *increased* from 16 percent in 1960 to almost 30 percent in 1995 (Table 6). For product markets, the structural change variables have been relatively volatile with no apparent trend on average (see Figure 1).[10]

IV. Methodology and Results

The short and long-run effects of structural reforms on productivity growth are estimated using pooled and fixed effect distributed lag models. The explanatory variables are the structural indicators (described above) and a term allowing for convergence of productivity levels. For most regressions, lags range from 1 to 10.[11] As the data are annual, ten-period lags may seem long; however, one objective of this study is to estimate the long-run impact of structural reforms, and indeed, the coefficients for the ten-year lagged variables were often found to be significantly different from zero.

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[10] Note that unlike the other indicators, an increase in the structural change variable indicates increased market competition or flexibility.

[11] For the structural change explanatory variables, the lag length is 6, as the coefficients beyond the sixth lag were insignificant. This may reflect the shorter time series (from 1971) available for these variables. Also, regressions (not shown) without the Gap variable (see below for the description of this variable) or with the Gap variable lagged only one period or only ten periods also confirm the main regression results, particularly on the impact of structural reforms.

The estimated equations have the following form:

$$y_{i,t} = \alpha_{i,t} + \sum_{j=n_k}^{m_k} \beta_{i,j}^{T} x_{i,t-j} + \varepsilon_{i,t}$$

where y is the dependent variable, α is the constant term, x is a (kx1)-dimensional vector representing the explanatory variables, β is a (kx1)-dimensional vector representing the coefficients for the explanatory variables (with ^{T} representing the transpose of the vector), ε is the error term, k is the number of explanatory variables (excluding the constant term), i represents the cross-sectional units (in this case, countries), j represents the number of lags, n_k and m_k represent the range of the lags, and t represents time periods. The dependent variables are productivity growth or more specifically, first differences of the log productivity levels. The explanatory variables are in log levels or first differences of log levels (as specified in the Tables). For the pooled regressions, $\alpha_i = \alpha$ and $\beta_i = \beta$ for all i, while for the fixed effects regressions α_i's were not constrained to be equal.

The results are presented in Tables 7-11. In Tables 7-9, the dependent variable is TFP growth, while in Table 10, the dependent variable is labor productivity growth and in Table 11, capital productivity growth. In Tables 7, 10, and 11, the explanatory variables are the ratio of per capita income to per capita income in the United States, the productivity leader (Gap), the tariff rate (Trade), the price-average cost markup (P-AC), and the unemployment benefits replacement rate (Labor).[12] In Table 9, the price-average cost markup is replaced as the proxy for product market reform by the (two-digit) structural change variable (SC).[13] In interpreting these results, it should be noted that for the indicators of structural reform, other than the structural change variables, a negative coefficient implies a positive impact of reform on productivity growth. (For the structural change variables a positive coefficient implies a positive impact). A negative coefficient on the Gap variable implies convergence in productivity.

The estimation results generally indicate that fixed effects matter – that is, there are differences in performance across the countries even after controlling for the effects of the

[12] Similar results (not shown) are found when the relative per capita income term is replaced by the ratio of the TFP level to the TFP level in the United States, although convergence is often rejected.

[13] Regressions (not shown) substituting the three-digit structural change variable instead of the two-digit one produced similar results, except the three-digit structural change variables are almost always insignificant in both the short and long run.

convergence term and the structural indicators.[14] In addition, the labor variable is rarely ever significant – never in the short run and only a few times in the long run. In Table 8, the labor variable is dropped (but the other explanatory variables are the same as in Table 7). As a proxy for product market reform, the price-average cost markup is significant more often in these regressions than the structural change variable. The relative income per capita term indicates convergence in almost all the regressions.

Over the short term, structural reforms appear to have a weak or even negative impact on productivity growth. In general, the short-run coefficient (or the coefficient on the first lag of the explanatory variable) is insignificant or does not have the expected sign. This result holds in almost every regression and may be explained by the short-run costs of adjusting to reform and the need for firms to learn how to operate in a deregulated environment. While this result provides some support for a strategy of phasing or sequencing the introduction of structural reforms, the analysis indicates that the negative effects are generally reversed within two years, and therefore, reforms should not be unduly delayed.

In the longer run, specifically after ten years, the results indicate that trade and product market reforms have a positive impact on productivity growth, as the long-run coefficient (or the sum of the coefficients on all lags) typically has the expected sign and the F-statistic that the coefficients on the lags are different from zero is usually significant.[15]

The result in this study that labor market reforms, in general, do not lead to improvements in productivity growth might be because the unemployment benefit replacement rate, which has increased in most OECD countries, is a poor indicator of labor market flexibility and reform. Therefore, the results may indeed understate the benefits of structural reform on productivity growth. It should be noted, however, that because labor market reforms have often been implemented along with and as a complement to other structural reforms in many of these countries, the positive impact of these reforms may be included in the estimated positive effects of trade and product market reforms.

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[14] Alternatively, significant fixed effects could reflect other factors, including differences in measuring data. Time fixed effects (or dummy variables) are generally significant (not shown); however, the results on the impact of structural reforms generally hold.

[15] For the regressions with log levels, the long-run coefficients can be interpreted as the long-run impact of a 1 unit change in the log level of the explanatory variable. For the regressions with first differences of log levels, the long-run coefficients can be interpreted similarly, except that because the coefficient is calculated as the sum of the coefficients on all of the lags and the explanatory variables are first differences of log levels, the coefficient must be divided by the lag length in order to estimate the impact of a 1 unit change in the log level of the explanatory variable.

An estimate of the long-run impact of the structural reforms can be made by multiplying the long-run regression coefficient (for regressions with log levels) or the long-run coefficient divided by the lag length (for regressions with first differences of log levels) by the change in the structural indicators. For example, for all the countries on average, trade and product market reforms between 1985 and 1995 could be expected to increase TFP growth by between 0.2 to 0.3 percentage points over the long run with trade and product market reforms each accounting for about half the positive impact.[16] Although similar estimates could be made for individual countries, these would be inherently rough because, as discussed above, while the deviations of the proxy measures from the true measures of structural reforms may be washed out across countries, these deviations may not be random for individual countries.

V. Conclusions

In recent years, many industrial countries have undergone fundamental structural changes stemming from microeconomic reforms in trade and in product and labor markets. This paper investigates the potential impact of these structural reforms on productivity performance, using a panel study of 20 OECD countries during 1965-98. In particular, the paper extends the analysis in previous studies by examining not only macroeconomic outcomes because of cross-sectional differences in structural policies but also the dynamic impact of changes in structural policies—particularly, the short-run compared to long-run tradeoffs. It also examines structural indicators not used in previous studies, notably the price-average cost markup as an indicator of product market reform.

The analysis in this paper suggests that structural reforms, particularly trade and product market reforms, could explain improvements in trend productivity growth, even though the impact of structural reforms on productivity may be weak or negative in the short run, possibly due to adjustment and learning costs. For example, trade and product market reforms between 1985 and 1995 could be expected to increase TFP growth by between 0.2 to 0.3 percentage points on average over the long run with trade and product market reforms each accounting for about half the positive impact. The positive impact from structural reforms may indeed be underestimated as the available indicators of labor market reforms are poor. However, because labor market reforms have often been implemented along with and as a complement to other structural reforms in many of these countries, the positive impact of labor market reforms could be included in the estimated positive effects of trade and product

[16] These calculations are based on the fixed effects regressions with first differences in Tables 7 and 8, using the long-run coefficients significant at the 10 percent level. The range for the impact on TFP growth is because of the differences in the coefficients. The approximately equivalent positive impact from trade and product market reforms reflects the greater improvement in the product market indicator compared to the trade indicator offset by the higher coefficient on trade reforms.

market reforms. While the negative impact of structural reforms over the short run may provide some support for a strategy of phasing or sequencing the introduction of these reforms, the analysis indicates that the negative effects are generally reversed within two years, and therefore, reforms should not be unduly delayed.

REFERENCES

Blanchard, O. and J. Wolfers (March 1999), "The Role of Shocks and Institutions in the Rise of European Unemployment: The Aggregate Evidence," mimeo from http://web.mit.edu/blanchar/www/articles.html.

Domowitz, I., R.G. Hubbard, and B.C. Peterson (1986), "Business Cycles and the Relationship Between Concentration and Price-cost margins," *Rand Journal of Economics*, Vol. 17, p. 1-17.

Domowitz, I., R.G. Hubbard, and B.C. Peterson (1988), "Market Structure and Cyclical Fluctuations in U.S. Manufacturing," *The Review of Economics and Statistics*, Vol. 70, p. 55-66.

Gonenc, R., M. Maher, and G. Nicoletti (2000), "The Implementation and the Effects of Regulatory Reform: Past Experience and Current Issues," OECD Economics Department Working Paper 251.

Hall, R.E. (1988), "The Relation between Price and Marginal Cost in U.S. Industry," *Journal of Political Economy*, Vol. 96, p. 921-47.

Hall, R.E. and D.W. Jorgenson (1967), "Tax Policy and Investment Behavior," *The American Economic Review*, Vol. 57, p. 391-414.

Industry Commission (March 1995), *Assistance to Agricultural and Manufacturing Industries* (Australia Government Publishing Service: Canberra).

Martins, J.O. and S. Scarpetta (1999), "The Levels and Cyclical Behaviour of Mark-ups across Countries and Market Structures," OECD Economics Department Working Paper No. 213.

Morrison, C. (1990), "Market Power, Economic Profitability, and Productivity Growth Measurement: An Integrated Structural Approach," NBER Working Paper No. 3355.

OECD (1996), OECD Economies at a Glance: Structural Indicators (Paris).

OECD (1999), OECD *Employment Outlook* (Paris).

Roeger, W. (1995), "Can Imperfect Competition Explain the Difference between Primal and Dual Productivity Measures? Estimates for U.S. Manufacturing," *Journal of Political Economy*, Vol. 103, p. 316-30.

Salgado, R. (1999), "Australia: Productivity Growth and Structural Reform," in *Australia—Selected Issues and Statistical Appendix*, IMF Country Staff Report 00/24.

DATA APPENDIX

Data Source

The main sources for the data are OECD databases (data vintages before September 1999), including the Analytical Database (AD), the Economic Outlook Database (EOD), and the Structural Analysis (STAN) industrial database. In addition, tariff rates are calculated based on tariff revenues mainly from the OECD Revenue Statistics and imports from the IMF, *International Financial Statistics* (*IFS*). Unemployment benefit replacement rates are from Blanchard and Wolfers (1999), who derived the rates from the OECD's Database on Unemployment Benefit Entitlements and Replacement Rates.

Data Construction

- **Labor productivity** is calculated as output per employee and provided in the EOD. The series (PDTY) is indexed to 1991. An unindexed series can be constructed as well by calculating labor productivity in 1991 as the ratio of real GDP (GDPV) to total employment (ET).

- **Capital productivity** is calculated as output per capital input using data from the EOD. Specifically, capital productivity is the ratio of business sector real GDP at factor cost (GDPBV) to business sector capital stock (KBV).

- **TFP** is calculated using a Thornqvist-Theil divisia index with TFP growth as the weighted average of labor and capital productivity growth, where the weights are, respectively, labor and capital income shares averaged over consecutive years.

- **Labor income share** is calculated using data from the EOD as the ratio of the product of compensation of employees (WSSS) and ET to the product of dependent employees (EE) and GDP at market prices (GDP) excluding net indirect taxes (TIND-TSUB). **Capital income share** is 1 minus labor income share.

- **Relative per capita income** is calculated using data from the EOD as the ratio of U.S. dollar valued per capita real GDP using 1991 purchasing power parity (PPP) exchange rates (GDPVD/POP) to GDPVD/POP in the United States. **Relative TFP** is also calculated using data from the EOD and using PPP exchange rates.

- **Tariff rate** is calculated as the ratio of Customs and Import Duties (from OECD Revenue statistics supplemented with data from IMF, *Government Finance Statistics*) to imports (from the *IFS*).

- **Openness** is calculated as the ratio of the sum of exports and imports (from the *IFS*) to GDP (from the EOD).

- **Import penetration** is calculated as the ratio of imports to apparent domestic consumption, which is the sum of domestic production and imports less exports, and **export intensity** is the ratio of exports to domestic production. At the aggregate level, the sources for the data are the *IFS* and the EOD, while for the manufacturing sector, the source is the STAN database.

- **Price-average cost markup** is calculated using data from the EOD and AD as the ratio of GDP at market prices less net indirect taxes to the sum of labor income (WSSS*ET/EE) and capital income, where capital income is constructed as the product of the real capital stock, capital price deflator (PIT), and the real rental rate for capital, which (following Hall and Jorgenson, 1967 and Martins and Scarpetta, 1999) is the real interest rate plus depreciation (respectively, IRLRE and RSCRB in the AD).

- **Structural change** is calculated using data in the STAN database as half the sum of the absolute value of annual changes in share of GDP and is calculated at two- and three-digit industry levels.

Table 1. Business Sector Labor Productivity Growth[1]
(Annual averages)

	1960-98	1960-70	1970-80	1980-90	1990-98	1995-98
Australia	1.8	2.7	1.8	0.9	1.8	1.5
Austria	2.9	5.6	3.0	2.1	1.8	2.3
Belgium	2.7	4.2	3.1	1.7	1.6	1.7
Canada	1.2	1.8	1.2	1.0	0.8	0.7
Denmark	2.2	3.4	1.8	1.5	2.2	1.3
Finland	3.2	4.7	2.6	2.5	2.5	2.9
France	2.5	4.6	2.8	2.1	1.5	1.6
Germany	2.4	4.3	2.6	1.7	0.9	2.6
Greece	3.6	8.5	4.0	0.6	0.9	1.9
Ireland	3.9	4.2	3.8	3.8	3.8	4.6
Italy	3.1	6.2	2.5	1.7	1.7	1.7
Japan	4.0	8.6	3.6	2.7	0.9	0.6
Netherlands	2.4	3.8	2.7	1.6	1.3	1.0
New Zealand	0.9	1.1	0.3	1.4	0.4	0.5
Norway	2.7	3.5	3.2	1.8	2.5	1.3
Spain	3.5	6.1	3.8	2.3	1.7	0.8
Sweden	2.2	4.0	1.0	1.4	2.3	2.2
Switzerland	1.4	3.2	1.8	0.2	0.3	0.6
United Kingdom	2.2	2.9	1.8	1.9	1.9	1.7
United States	1.4	2.3	0.7	1.1	1.2	1.6
Unweighted Mean	2.5	4.3	2.4	1.7	1.6	1.7

Sources: OECD (see Appendix).

[1]Labor productivity is calculated as output per employee.

Table 2. Business Sector TFP Growth[1]
(Annual averages)

	1960-98	1960-70	1970-80	1980-90	1990-98	1995-98
Australia	1.2	2.5	1.0	0.6	1.5	1.5
Austria	1.4	3.6	1.4	1.0	0.6	1.0
Belgium	1.3	..	2.1	1.0	0.9	1.2
Canada	-0.1	0.3	0.1	-0.4	-0.3	0.0
Denmark	1.3	2.1	0.6	0.8	1.6	1.0
Finland	2.7	3.9	1.9	2.0	2.3	3.4
France	1.7	3.6	1.8	1.5	0.8	1.2
Germany	1.5	2.6	1.6	1.2	0.6	1.8
Greece	1.5	4.2	1.5	-0.1	0.4	1.3
Ireland	3.7	4.0	3.5	3.4	4.0	5.2
Italy	2.1	4.7	1.8	1.0	0.7	0.8
Japan	2.3	5.7	1.9	1.8	0.0	-0.2
Netherlands	1.6	3.7	2.1	1.3	1.0	0.8
New Zealand	0.6	0.7	0.1	1.0	0.6	0.4
Norway	1.6	2.0	2.1	0.5	2.0	1.3
Spain	1.8	3.2	2.2	1.7	0.6	0.3
Sweden	1.0	2.0	0.0	0.8	1.4	1.6
Switzerland	0.3	1.4	0.6	-0.3	-0.4	-0.1
United Kingdom	1.9	2.8	1.4	1.8	1.4	1.4
United States	1.0	1.7	0.4	0.8	0.8	1.2
Unweighted Mean	1.5	2.9	1.4	1.1	1.0	1.3

Sources: OECD (see Appendix).

[1]TFP growth is calculated using a Thornqvist-Theil divisia index as the weighted average of labor and capital productivity growth, where the weights are, respectively, labor and capital income shares averaged over consecutive years.

Table 3. Business Sector Capital Productivity Growth[1]
(Annual averages)

	1960-98	1960-70	1970-80	1980-90	1990-98	1995-98
Australia	0.0	1.1	-1.0	-0.4	0.8	1.4
Austria	-2.0	-1.9	-2.7	-1.5	-2.0	-1.6
Belgium	-0.9	..	-0.8	-0.9	-1.0	0.1
Canada	-3.0	-3.4	-2.2	-3.8	-3.1	-1.9
Denmark	-1.3	-1.5	-2.5	-1.0	0.0	0.2
Finland	0.6	1.5	-0.3	0.1	0.7	5.0
France	-0.1	1.4	-0.8	-0.1	-0.6	0.4
Germany	-0.9	-1.5	-1.2	-0.3	-0.3	0.1
Greece	-4.4	-9.8	-4.7	-2.1	-1.1	-0.2
Ireland	2.6	3.7	1.8	1.1	4.4	6.5
Italy	-0.1	0.8	0.0	-0.3	-1.1	-0.5
Japan	-2.5	-1.8	-3.7	-1.5	-2.7	-2.6
Netherlands	0.2	1.7	0.0	0.4	0.2	0.3
New Zealand	0.1	-0.1	-0.5	-0.1	0.9	0.1
Norway	-0.3	-0.2	-0.3	-1.8	1.1	1.3
Spain	-2.9	-5.0	-4.7	-0.8	-1.9	-0.6
Sweden	-1.6	-1.5	-3.2	-0.9	-0.9	0.4
Switzerland	-1.8	-1.6	-2.0	-1.2	-2.4	-1.7
United Kingdom	0.8	1.4	0.2	1.4	-0.1	0.6
United States	0.1	0.2	-0.4	0.3	0.2	0.4
Unweighted Mean	-0.9	-0.9	-1.4	-0.7	-0.4	0.4

Sources: OECD (see Appendix).

[1]Capital productivity is calculated as output per capital input.

Table 4. Average Tariff Rates[1]
(Percent)

	1960	1965	1970	1975	1980	1985	1990	1995
Australia	9.5	9.0	11.5	12.2	10.1	9.9	6.7	4.0
Austria	7.9	8.4	6.2	3.9	1.5	1.5	1.7	0.5
Belgium	3.0	3.0	2.2	1.1	1.2	0.9	0.9	0.9
Canada	8.7	7.6	5.6	5.3	4.5	3.7	2.9	1.5
Denmark	3.5	2.9	2.2	1.5	1.0	0.9	0.9	0.8
Finland	13.8	10.0	4.2	2.8	1.8	1.0	1.4	1.0
France	6.0	6.0	2.6	1.4	1.1	0.9	0.9	0.7
Germany	6.5	4.6	3.3	2.3	1.8	1.3	1.4	1.1
Greece	11.7	11.7	9.8	5.5	7.1	4.1	1.2	0.8
Ireland	17.7	1.9	1.6	1.0	0.9	1.1	0.9	1.0
Italy	7.3	5.9	4.6	0.3	0.6	1.0	1.0	0.8
Japan	6.8	7.5	7.0	3.0	2.5	2.4	2.7	3.3
Netherlands	4.7	4.8	2.5	1.4	1.2	1.0	1.3	1.3
New Zealand	15.5	6.3	6.4	4.7	4.1	4.4	3.2	3.9
Norway	4.8	4.0	2.0	1.3	0.8	0.8	0.8	1.3
Spain	13.9	7.7	6.6	4.8	3.8	4.2	3.9	0.9
Sweden	6.4	6.3	6.6	2.4	1.7	2.5	2.6	1.0
Switzerland	15.1	6.9	4.1	2.9	1.6	1.3	1.2	1.3
United Kingdom	6.0	6.0	2.7	2.2	2.3	1.7	1.5	1.5
United States	7.4	6.7	6.1	4.3	3.0	3.6	3.4	2.6
Unweighted Mean	8.8	6.4	4.9	3.2	2.6	2.4	2.0	1.5

Sources: OECD and IMF, *International Financial Statistics* (see Appendix).

Table 5. Price-Average Cost Markup[1]
(Percent)

	1960	1965	1970	1975	1980	1985	1990	1995
Australia	..	..	15.9	12.5	22.5	11.6	4.3	6.0
Austria	..	24.7	26.3	17.9	17.2	16.0	15.6	15.9
Belgium	..	..	20.6	16.2	13.4	10.0	12.0	7.6
Canada	..	..	23.4	26.6	29.7	22.4	9.3	4.9
Denmark	..	..	..	..	..	..	-12.8	-6.9
Finland	..	..	6.5	1.6	5.3	2.0	-5.9	-8.1
France	..	21.7	25.4	19.5	18.6	19.0	24.7	24.3
Germany	..	18.5	14.4	9.8	8.4	8.0	11.7	9.0
Greece	..	23.9	23.7	36.3	28.5	17.1	16.4	21.5
Ireland	..	-11.6	-7.7	-2.2	0.5	5.7	7.7	10.8
Italy	23.2	24.9	26.0	25.5	35.3	34.8	29.8	29.0
Japan	..	..	23.0	10.0	9.2	16.1	6.1	3.8
Netherlands	..	..	16.9	10.7	10.2	15.0	9.9	5.6
New Zealand	..	..	..	27.1	18.3	31.3	19.6	14.6
Norway	..	..	30.5	30.6	46.4	34.9	6.1	3.3
Spain	..	..	17.7	15.6	16.2	15.1	23.7	22.5
Sweden	..	..	20.5	18.4	12.2	13.7	4.4	13.3
Switzerland	..	42.3	40.6	30.4	29.4	24.5	20.8	18.1
United Kingdom	..	6.3	6.0	-2.9	14.1	10.6	5.7	8.6
United States	..	25.2	19.3	19.1	18.8	17.6	17.5	20.1
Unweighted Mean	23.2	19.5	19.4	17.0	18.7	17.1	11.3	11.2

Source: OECD (see Appendix).

Table 6. Unemployment Benefit Replacement Rate[1]
(Percent)

	1960	1965	1970	1975	1980	1985	1990	1995
Australia	18.3	15.9	15.6	23.8	22.6	24.2	26.6	27.0
Austria	19.3	17.0	22.5	25.5	27.6	29.0	28.6	25.8
Belgium	39.9	33.8	43.4	46.8	44.3	42.6	40.9	38.7
Canada	21.9	21.2	25.4	27.2	27.3	29.3	28.0	27.2
Denmark	19.8	22.2	34.5	44.3	54.5	51.1	61.0	67.4
Finland	4.6	4.4	17.2	27.0	25.3	34.6	38.7	43.2
France	24.8	25.4	24.0	25.1	31.0	36.5	37.5	37.4
Germany	30.4	30.1	28.7	29.4	29.2	27.8	28.0	26.6
Greece	5.9	5.9	5.9	5.9	6.1	7.6	12.4	14.7
Ireland	20.9	21.2	20.4	25.5	29.8	28.5	29.4	26.3
Italy	3.6	2.5	1.7	1.4	0.6	1.1	9.9	19.3
Japan	11.9	12.0	13.3	10.0	8.9	10.2	10.0	10.2
Netherlands	16.7	47.3	48.0	47.8	48.3	53.6	48.9	45.8
New Zealand	40.0	32.6	27.8	27.4	29.9	32.1	30.0	27.1
Norway	4.0	3.6	6.3	16.5	29.1	38.8	38.8	38.8
Spain	5.6	18.5	13.9	21.3	31.7	34.0	32.6	31.7
Sweden	4.0	5.6	8.3	23.7	26.5	28.9	28.8	27.2
Switzerland	1.5	1.0	0.9	7.8	13.7	21.9	25.7	29.5
United Kingdom	24.7	26.9	24.8	23.8	22.8	18.9	18.0	17.8
United States	8.2	9.5	11.0	13.3	14.0	12.3	11.5	11.9
Unweighted Mean	16.3	17.8	19.7	23.7	26.2	28.1	29.3	29.7

Source: Blanchard and Wolfers (1999).

Table 7. Impact of Structural Reforms on TFP growth[1]

Regression Number	1	2	3	4
Regression Type	Pooled	Fixed Effects	Pooled	Fixed Effects
Levels or differences [2]	Levels	Levels	Differences	Differences
Constant	0.016	..	0.004	..
	(0.000)	..	(0.096)	..
Gap	-0.018	-0.040	-0.020	-0.025
	(0.000)	(0.000)	(0.000)	(0.000)
Trade (Short-run)	0.496	0.414	0.603	0.238
	(0.038)	(0.021)	(0.048)	(0.183)
Trade (Long-run)	-0.115	-0.041	1.105	-1.483
	(0.019)	(0.124)	(0.294)	(0.087)
P-AC (Short-run)	0.040	0.043	0.052	0.039
	(0.049)	(0.028)	(0.010)	(0.024)
P-AC (Long-run)	-0.053	0.001	-0.237	-0.272
	(0.000)	(0.000)	(0.001)	(0.000)
Labor (Short-run)	0.421	0.281	0.346	0.336
	(0.226)	(0.420)	(0.302)	(0.284)
Labor (Long-run)	-0.008	-0.017	-0.220	-0.372
	(0.532)	(0.423)	(0.470)	(0.238)
R-squared	0.286	0.377	0.218	0.401
Adjusted R-squared	0.202	0.265	0.121	0.287
Durbin-Watson Stat.	1.58	1.72	1.45	1.76
Number of observations	382	382	363	363
Sample period	1975-96	1975-96	1976-96	1976-96

[1]Explanatory variables for the regressions are: Gap = Per capita income relative to the United States; Trade = Tariff rate; P-AC = P-AC markup; and Labor = Replacement Rate. Lags from 1 to 10 for all variables and regressions. Short-run is coefficient on first lag, while long-run is sum of the coefficient on all lags. P-values for T-statistic on short-run coefficients and F-statistic (for null hypothesis that all coefficients are zero) on long-run coefficients in parentheses. The underlying standard errors are White heteroskedasticity consistent.

[2]Differences for structural indicators only. Gap is always in log levels.

Table 8. Impact of Structural Reforms on TFP Growth (Excluding Labor Variable)[1]

Regression Number	5	6	7	8
Regression Type	Pooled	Fixed Effects	Pooled	Fixed Effects
Levels or differences [2]	Levels	Levels	Differences	Differences
Constant	0.014	..	0.004	..
	(0.000)	..	(0.092)	..
Gap	-0.017	-0.050	-0.019	-0.040
	(0.000)	(0.000)	(0.000)	(0.000)
Trade (Short-run)	0.474	0.401	0.549	0.211
	(0.041)	(0.024)	(0.057)	(0.240)
Trade (Long-run)	-0.100	-0.025	1.114	-1.226
	(0.043)	(0.204)	(0.229)	(0.155)
P-AC (Short-run)	0.045	0.044	0.056	0.041
	(0.035)	(0.030)	(0.008)	(0.021)
P-AC (Long-run)	-0.052	-0.010	-0.225	-0.304
	(0.000)	(0.000)	(0.001)	(0.000)
Labor (Short-run)	..	..	..	..
	..	..	..	..
Labor (Long-run)	..	..	..	..
	..	..	..	..
R-squared	0.268	0.361	0.192	0.378
Adjusted R-squared	0.207	0.271	0.120	0.284
Durbin-Watson Stat.	1.59	1.74	1.46	1.75
Number of observations	388	388	369	369
Sample period	1975-98	1975-98	1976-98	1976-98

[1]Explanatory variables for the regressions are: Gap = Per capita income relative to the United States; Trade = Tariff rate; P-AC = P-AC markup; and Labor = Replacement Rate. Lags from 1 to 10 for all variables and regressions. Short-run is coefficient on first lag, while long-run is sum of the coefficient on all lags. P-values for T-statistic on short-run coefficients and F-statistic (for null hypothesis that all coefficients are zero) on long-run coefficients in parentheses. The underlying standard errors are White heteroskedasticity consistent.

[2]Differences for structural indicators only. Gap is always in log levels.

Table 9. Impact of Structural Reforms on TFP growth (with Structural Change Variable)[1]

Regression Number	9	10	11	12
Regression Type	Pooled	Fixed Effects	Pooled	Fixed Effects
Levels or differences [2]	Levels	Levels	Differences	Differences
Constant	0.015	..	0.009	..
	(0.031)	..	(0.000)	..
Gap	-0.007	-0.041	-0.004	-0.027
	(0.003)	(0.000)	(0.006)	(0.000)
Trade (Short-run)	0.269	0.245	0.471	0.253
	(0.319)	(0.185)	(0.093)	(0.133)
Trade (Long-run)	-0.130	0.022	0.515	-1.258
	(0.017)	(0.512)	(0.193)	(0.027)
SC (Short-run)	0.001	0.004	0.003	0.003
	(0.702)	(0.130)	(0.268)	(0.154)
SC (Long-run)	0.002	0.015	0.035	0.039
	(0.500)	(0.052)	(0.090)	(0.016)
Labor (Short-run)	0.138	0.130	0.030	-0.120
	(0.626)	(0.579)	(0.924)	(0.656)
Labor (Long-run)	-0.002	0.071	-0.043	-0.564
	(0.638)	(0.058)	(0.516)	(0.048)
R-squared	0.164	0.336	0.189	0.377
Adjusted R-squared	0.068	0.217	0.090	0.258
Durbin-Watson Stat.	1.51	1.74	1.49	1.78
Number of observations	351	351	333	333
Sample period	1977-96	1977-96	1978-96	1978-96

[1]Explanatory variables for the regressions are: Gap = Per capita income relative to the United States; Trade = Tariff rate; SC = Two-digit structural change; and Labor = Replacement Rate. Lags from 1 to 10 for all variables and regressions. Short-run is coefficient on first lag, while long-run is sum of the coefficient on all lags. P-values for T-statistic on short-run coefficients and F-statistic (for null hypothesis that all coefficients are zero) on long-run coefficients in parentheses. The underlying standard errors are White heteroskedasticity consistent.

[2]Differences for structural indicators only. Gap is always in log levels.

Table 10. Impact of Structural Reforms on Labor Productivity Growth[1]

Regression Number	13	14	15	16
Regression Type	Pooled	Fixed Effects	Pooled	Fixed Effects
Levels or differences [2]	Levels	Levels	Differences	Differences
Constant	0.018	..	0.010	..
	(0.000)	..	(0.000)	..
Gap	-0.017	-0.031	-0.019	-0.031
	(0.000)	(0.000)	(0.000)	(0.000)
Trade (Short-run)	0.269	0.225	0.416	0.111
	(0.194)	(0.169)	(0.124)	(0.518)
Trade (Long-run)	-0.114	0.068	0.919	-1.308
	(0.076)	(0.167)	(0.383)	(0.171)
P-AC (Short-run)	0.021	0.026	0.029	0.020
	(0.312)	(0.172)	(0.217)	(0.390)
P-AC (Long-run)	-0.033	0.012	-0.232	-0.204
	(0.000)	(0.013)	(0.015)	(0.016)
Labor (Short-run)	0.425	0.365	0.361	0.421
	(0.235)	(0.309)	(0.292)	(0.198)
Labor (Long-run)	-0.002	-0.004	-0.100	-0.145
	(0.704)	(0.673)	(0.532)	(0.395)
R-squared	0.279	0.347	0.241	0.365
Adjusted R-squared	0.194	0.230	0.147	0.244
Durbin-Watson Stat.	1.72	1.80	1.65	1.86
Number of observations	382	382	363	363
Sample period	1975-96	1975-96	1976-96	1976-96

[1]Explanatory variables for the regressions are: Gap = Per capita income relative to the United States; Trade = Tariff rate; P-AC = P-AC markup; and Labor = Replacement Rate. Lags from 1 to 10 for all variables and regressions. Short-run is coefficient on first lag, while long-run is sum of the coefficient on all lags. P-values for T-statistic on short-run coefficients and F-statistic (for null hypothesis that all coefficients are zero) on long-run coefficients in parentheses. The underlying standard errors are White heteroskedasticity consistent.

[2]Differences for structural indicators only. Gap is always in log levels.

Table 11. Impact of Structural Reforms on Capital Productivity Growth[1]

Regression Number	17	18	19	20
Regression Type	Pooled	Fixed Effects	Pooled	Fixed Effects
Levels or differences [2]	Levels	Levels	Differences	Differences
Constant	0.008	..	-0.008	..
	(0.243)	..	(0.013)	..
Gap	-0.015	-0.019	-0.014	0.035
	(0.060)	(0.029)	(0.088)	(0.001)
Trade (Short-run)	0.961	0.782	0.950	0.453
	(0.018)	(0.015)	(0.028)	(0.152)
Trade (Long-run)	-0.154	-0.367	1.464	-1.893
	(0.013)	(0.017)	(0.256)	(0.020)
P-AC (Short-run)	0.126	0.132	0.137	0.125
	(0.044)	(0.040)	(0.014)	(0.024)
P-AC (Long-run)	-0.050	0.034	-0.087	-0.173
	(0.000)	(0.000)	(0.003)	(0.000)
Labor (Short-run)	0.273	-0.060	0.338	0.034
	(0.586)	(0.901)	(0.468)	(0.939)
Labor (Long-run)	-0.019	-0.008	-0.714	-1.245
	(0.258)	(0.036)	(0.174)	(0.009)
R-squared	0.243	0.416	0.195	0.438
Adjusted R-squared	0.154	0.311	0.095	0.331
Durbin-Watson Stat.	1.12	1.40	1.03	1.37
Number of observations	382	382	363	363
Sample period	1975-96	1975-96	1976-96	1976-96

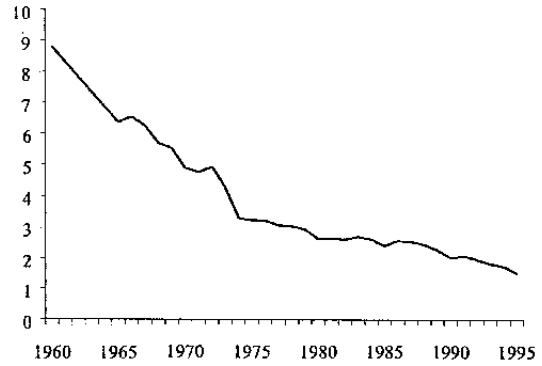
[1]Explanatory variables for regressions are: Gap = Per capita income relative to the United States; Trade = Tariff rate; Product = P-AC markup; and Labor = Replacement Rate. Lags from 1 to 10 for all variables and regressions. Short-run is coefficient on first lag, while long-run is sum of the coefficient on all lags. P-values for T-statistic on short-run coefficients and F-statistic (for null hypothesis that all coefficients are zero) on long-run coefficients in parentheses. The underlying standard errors are White heteroskedasticity consistent.

[2]Differences for structural indicators only. Gap is always in log levels.

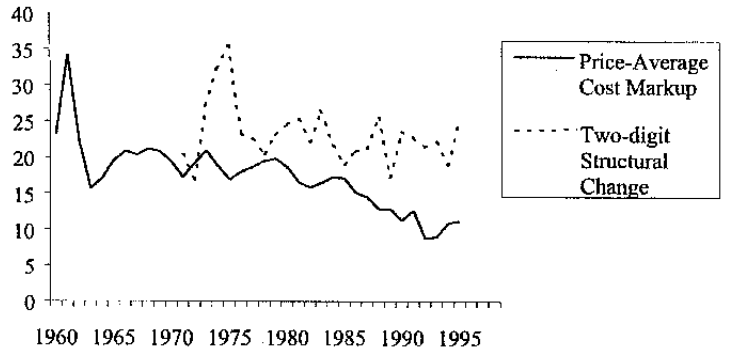
Figure 1. Indicators of Structural Reform [1]

(In percent)

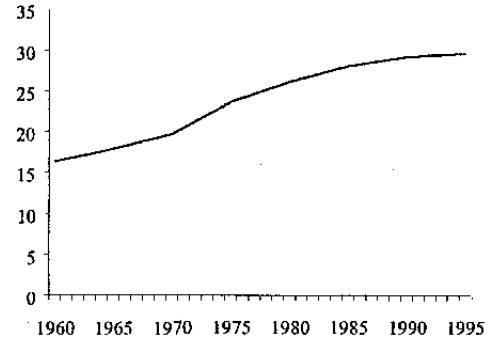
Average Tariff Rate



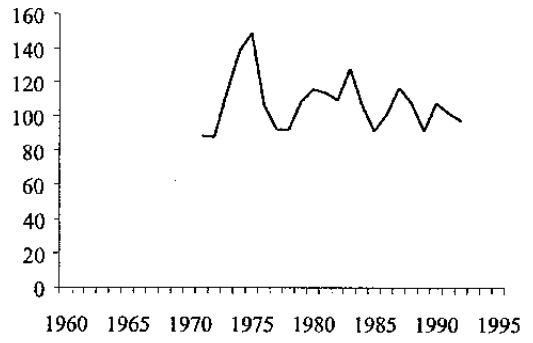
Product Market Indicators



Replacement Rate



Product Market Indicators (Three-digit Structural Change)



Sources: Blanchard and Wolfers (1999), OECD, and IMF *International Financial Statistics*.

[1] Unweighted mean for industrial countries. For explanation of construction of indicators, see Appendix.