Annex 7 - Does deregulation in factor markets affect the path of long term growth?

According to modern growth theories, policy and institutional settings have an impact on the path of long term economic growth. Rodrik, Subramanian and Trebbi (2002) have claimed that institutions trump everything else. To some extent, regulation is necessary to ensure the functioning of market economies, for example in the areas of competition, consumer protection, property rights and environment. Institutions can increase efficiency by correcting market failure. On the other hand, overregulation might worsen resource allocation and the incentives for innovation, thereby exerting adverse effects on long term growth.

Institutional reforms change the overall framework of economic activities. They operate through different channels, see Ahn (2002) and Blanchard and Giavazzi (2003). First, a higher degree of competition forces prices to converge to marginal costs. Factor inputs are used more efficiently, and the allocation of goods and services is improved. Companies are encouraged to reorganize work and reduce slack. Lower entrance barriers move market shares from firms with lower productivity to more competitive ones. Second, incentives to research and innovate may be improved, see Aghion and Howitt (1996). The absorptive capacities of firms to learn about advances in the leading edge and to move the technological frontier are extended, see European Commission (2004).

Advances in the allocation of resources and output are static, as they represent one-time changes in the productivity level. Thus, the acceleration of productivity growth is limited to a relatively short period. In contrast, gains from innovation are dynamic and can boost productivity over a longer period of time. Innovation involves complementarity of goods, positive spillovers to other industries, and the diffusion of new ideas. Apart from private returns, high macroeconomic returns on R&D and education are expected, see Krueger and Lindahl (2001), Temple (2002), and Sianesi and van Reenen (2003). According to de la Fuente (2003), an extra year's schooling of the adult population in the EU would lead to a 4-6 percent increase in labour productivity, plus an indirect effect of 3 percent because of faster TFP growth.

Properly designed institutions support economic growth mainly through these channels. While this fact is well established by sound theoretical models, empirical evidence is (not so clear-cut. Thus, the paper focuses on the empirical link between institutions and growth. Due to data availability, regulations on factor (labour, capital) markets are considered. The framework of convergence regressions is used to assess their impact on GDP per capita growth. For robustness issues, different estimation techniques are applied. The paper is organized as follows: in the next section (section 1), the theoretical framework is discussed. In section 2, the empirical evidence on the impact of institu-

tions on the economic performance is reviewed (section 2). Results are presented in section 3. Finally, section 4 concludes.

1 Growth accounting and convergence of per capita growth rates

The main drivers of economic growth can be identified by growth accounting. The starting point is a production function with constant returns to scale:

(1) $$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}$$

where Y, K, L and A is output, capital, labour and the technological or TFP level, respectively. The parameter α denotes the elasticity of output to capital and due to linear homogeneity, also the capital income share. Equation (1) may be re-written in per capita terms

(2) $$y_t = A_t k_t^{\alpha}$$

where $y=Y/L$, and $k=K/L$. Growth of output per capita is the sum of TFP growth and α times growth in capital intensity, that is capital deepening. Factors that affect these drivers also affect output per capita growth. The neoclassical growth model assumes diminishing returns to capital. Thus, the importance of capital deepening is limited to an adjustment period. In the long run, growth will be solely driven by advances in TFP.

Because of diminishing returns to capital, convergence of per capita income is implied. On the average, countries are expected to grow faster the larger the distance from their steady state. This pattern of absolute convergence presumes a set of homogeneous countries. If steady state positions differ markedly, the concept of conditional convergence is more appropriate. Here, the determinants of steady state incomes, i.e., the savings rate, the depreciation rate, population and TFP growth, are taken into account. Output growth evolves according to

(3) $$\log\left(\frac{y_t}{y_0}\right) = (1-e^{\lambda t})\frac{\alpha}{1-\alpha}\log(s) - (1-e^{\lambda t})\frac{\alpha}{1-\alpha}\log(n+\delta+g) - (1-e^{\lambda t})y_0$$

where s, n, δ, and g are the savings rate, population growth, capital depreciation, and TFP growth, respectively. Average growth in the [0,t] period depends positively on the savings rate and negatively on the sum of population growth, depreciation and TFP growth. The parameter λ is expected to be negative, thereby exhibiting convergence. See Barro and Sala-i-Martin (1995) for a derivation of this equation, which is based on a first order Taylor approximation around the steady state. The basic setup can be extended in several ways. For example, investments in human capital can be included, see

Mankiw, Romer and Weil (1992). Equation (1) may be enhanced by a knowledge production function, including the determinants of TFP, see Jones (2002). Moreover, if institutions enter the convergence regression, they can be interpreted as additional determinants of steady state incomes.

2 Review of recent empirical studies

Due to data limitations, the empirical link between institutions and economic growth has not been investigated until recently. The most comprehensive work in the area is conducted by Nicoletti and Scarpetta (2003), CEPR/IFS (2003) and the European Commission (2003). These studies report different, sometimes counter-intuitive conclusions.

Nicoletti and Scarpetta (2003) have examined the impact of product market institutions on TFP growth in a cross section of countries and industries. Privatisation and market entry liberalisation seem to increase TFP. The gains appear to be greater the further a country is away from the technological leader, as the interaction term between the technology gap and product market institutions is highly significant. The levels of specific regulations are not important, apart from the privatisation index. Hence, regulation appears to be less relevant for a shift of the technological frontier. But, these results should be interpreted with caution: among other things, individual fixed effects have been excluded from the analysis. Thus, the institutional variables may also capture country specific characteristics, which are independent from the regulation issue.

In the CEPR/IFS (2003) study, the link between product market reforms and economic performance is investigated by a two step approach. First, the relation between product market institutions and the level of rents is evaluated. Rents approximate the level of competition, and are measured by the excess of prices over marginal costs. Higher competition forces prices more in line with marginal costs, implying that the mark-up is reduced. Second, the mark up is used to explain the economic performance. The mark up is instrumented by the estimated endogeneous variables of the former regression. Due to this strategy, institutional reforms can act only through the mark up channel. As this assumption can be rejected rather often, the institutions have not only an indirect effect through the mark up, but also a direct effect on the economic performance. The results from the mark up regression are as expected: deregulation decreases the mark up, implying allocative efficiency gains due to a higher degree of competition. The results of the regressions explaining economic performance are often counter-intuitive. For example, a higher degree of competition will reduce levels and growth rates of labour

productivity and TFP. Even after accounting for nonlinearities, this finding suggests that stronger regulation tends to support long term growth.

The EU Commission (2003) has linked capital deepening and TFP growth to a number of structural indicators, including overall regulation, human capital endowments, structure of financial markets, market size, and the ageing of the labour force. Regulation is the most important driver for investment in physical capital, especially for foreign direct investment, but not for R&D. In fact, certain forms of protection may be beneficial for R&D activities which yield risky returns. Investment in R&D seems to be more linked to education and the market size. TFP growth is explained by a knowledge production function, using R&D expenditures and education as input factors. The standard specification is augmented by variables for regulation, market size, and financial market structure. R&D and the market size are important in most specifications, while regulation is not. However, there is some impact from the interaction between institutions and new technologies (ICT production). According to these studies, the link between regulation and macroeconomic performance seems to be rather weak, at least for countries at the technological frontier. In addition, static efficiency gains seem to exceed those of dynamic efficiency.

3 The link between institutions and long term growth

The impact of factor market institutions on long term GDP growth is examined for a sample of EU13 countries. Due to data limitations, Greece, Luxembourg and the new member states are excluded. Macroeconomic series are available at the annual frequency from 1979-2001 and have been taken from the University of Groningen Growth and Development Centre (2004) total economy database. The average growth rates needed for the convergence regressions can be computed as the mean rate over the entire sample period, leading to a cross section model. But in this case, the institutional impact cannot be distinguished from country individual characteristics that are independent from the regulation issue. On the other hand, the institutions will affect the growth rate only gradually, and short run or even business cycle fluctuations should be smoothed out. To compromise, 4- and 8-year averages of GDP growth are considered in the analysis. Correspondingly, initial income refers to the log of GDP per capita 4 or 8 years ago, respectively. Per capita variables are preferred. Results from models with variables measured per worker are not straightforward to interpret. For example, stronger regulation in the labour market may increase long term per worker-productivity growth by means of a more rapid substitution of labour input with capital without raising output per capita.

The main source for the institutional data is provided by the Fraser Institute, which offers a comprehensive dataset across countries, see Gwartney, Lawson and Emerick (2003). The Fraser indices are obtained at the 5-year-frequency, except for 2001, where annual data are reported. To match with the annual frequency of the macroeconomic variables, the Fraser series are linearly interpolated. As indicators for product market (business) regulation are reported only for a very short time span (1995-2001), the analysis focuses on factor market regulation. Composite indicators are available for the capital and labour market. Each category holds subaggregates, and they cover specific areas of the institutional framework. In case of labour market regulation, the series include the impact of minimum wages, hiring and firing practices, labour force share with wages set by centralized collective bargaining, unemployment insurance, and the use of conscripts. All indices are ranged from 1 to 10, with 1 indicating the lowest and 10 indicating the highest level of deregulation.

However, the regulation indices are not easily comparable over time, as the underlying data has changed over the years, see Gwartney, Lawson, and Emerick (2003). Variations in the ratings may not imply a change in the degree of regulation, but rather the fact that some components of the index are missing in some years and in others not. This problem is also important in the study conducted here: most subindices of labour market regulation are not available before 1990. For this reason, the overall index of economic freedom is also considered as an alternative. This index is unbiased, as it has been computed backwards in a consistent way. However, it is not limited to regulation. The overall index includes the government size, the legal system and security of property rights, the access to sound money and freedom to trade with foreigners as additional series. As these series do not differ very much across the EU countries, the overall index can be considered as a proxy for regulation.

To enhance degrees of freedom, the convergence regression is estimated by paneleconometric methods. Both fixed and random effects models are considered. In the former, country specific determinants of GDP per capita growth are treated as constants, while in the latter, they are embedded in the residual process and are not correlated with the regressors. Random effects models are estimated using the Swamy-Arora method, see Baltagi (1995). The impacts of capital and labour market institutions on 4 and 8 year GDP per capita growth are shown in table 1. To increase efficiency, insignificant regressors have been dropped.[1]

[1] In principle, the results could be biased due to the overlapping nature of the data. In order to control for this issue, the regressions were re-run with non-overlapping data. The outcome taken from this exercise is broadly similar to the one reported in the tables.

-Table 1 about here-

Apart from lagged per capita income, the models include indicators of the institutional setting in the capital and labour market. In the random effects specification, the income variable exhibits a negative sign, which is consistent with the finding of convergence of per capita incomes. In addition, deregulation of the labour market is supportive for long term growth, irrespective of whether 4 or 8 year averages are considered. In contrast, deregulation of capital markets is not important at all. The average Fraser index for capital market deregulation is 8.3 in 2001, compared to 4.5 on the labour market. Thus, the lack of reforms is most noticeable on the labour market. Capital markets are already highly deregulated. Similar evidence can be found in cross section and pooled regression models (not shown).

However, the random effects results are not confirmed by the fixed effects specification, as both lagged income and institutions turn out to be insignificant or ill-signed. This different finding might be explained by the fact that institutions do not show sufficient variation over the sample period. They behave almost like constants, implying multicollinearity problems in the fixed effects setting. Furthermore, measurement errors in the regulation indicators are suspected to bias the results. To investigate this issue, the chain index of overall economic freedom is employed. As the index is obtained consistently over time, measurement problems should be less relevant here. The results are displayed in table 2.

-Table 2 about here-

If measurement errors are controlled for, the random and fixed effects models lead to similar results. Lagged income exerts a stronger negative impact on average GDP per capita growth, and advances in deregulation will improve the macroeconomic record. Therefore, the insignificant or reversed findings in most previous studies are likely due to measurement errors.

To investigate the impact of institutions on the drivers of growth, capital deepening is modelled in terms of a convergence regression, where average growth of capital intensity depends on the intensity level 4 or 8 years ago, and deregulation. Due to the discussion above, the latter is proxied by the index of economic freedom. In contrast to the

GDP per capita growth regressions, investment rates are highly significant for capital deepening and have to be included. As institutions can affect capital deepening, they may also have an impact on investment rates, see European Commission (2003). Therefore, investment rates have to be explained by the institutional framework in advance. This is done in a first step by regressing investment rates on lagged values and institutions. Secondly, the explained investment rates are employed as instruments in the capital deepening regressions. According to this strategy, the indirect and direct effects of institutions on capital deepening can be separated. Overall, the results show that institutions affect growth through the capital deepening channel, where both indirect and direct effects are relevant, see table 3. Convergence of capital intensity is limited to fixed effects models, while deregulation is significant in all specifications with the expected sign.

-Table 3 about here-

In contrast, TFP evolves largely independent from the institutional setting, see table 4. TFP growth rates have been computed by inversion of equation (2) with an exogenous value for the income share of capital . The latter has been calculated with data from the University of Groningen Growth and Development Centre (2004) growth accounting database. Due to the neoclassical growth model, TFP is the only engine of growth, once per capita income and capital intensity are at their steady state levels. Hence, TFP growth is more associated with a shift of the technological frontier, rather than with the process of convergence. Thus, the regressions include only the institutional variable, which appears to be insignificant on the 0.05 level. This does not necessarily imply that deregulation has no effect, if a country is a technological leader. The link between institutions and steady state growth might be more complex and may be transmitted through the determinants of TFP, including R&D and human capital accumulation.

-Table 4 about here-

4 Conclusion

The paper has investigated the role of institutions for long term growth in a sample of EU13 countries. The evidence depends on the estimation method employed. For random effects models, the results suggest that stronger deregulation is supportive for long term

growth, if reforms take place on the labour market. The effect is lost, when fixed effects models are considered. The different outcome is likely due to measurement errors, as the composition of the regulation indicators on capital and labour markets has been changed over time. Results obtained with the chain version of the overall index of economic freedom appear to be straightforward. In particular, stronger deregulation will foster long term growth, and the impact is expected to materialize through the capital deepening channel.

Table 1: Impacts of factor market deregulation on income per capita growth

A. Random effects specification

	Constant	Y(-t)	CMR	LMR	R-squared
4-year averages	0.126	-0.007	0.001		0.16
	(0.081)	(0.005)	(0.001)		
	0.152	-0.009		0.003	0.15
	(0.072)	(0.004)		(0.001)	
8-year averages	0.262	-0.014	-0.001		0.46
	(0.079)	(0.005)	(0.001)		
	0.306	-0.018		0.002	0.45
	(0.071)	(0.004)		(0.001)	

B. Fixed effects specification

	Constant	Y(-t)	CMR	LMR	R-squared
4-year averages	Individual constants	0.011	-0.000		0.20
		(0.007)	(0.002)		
		0.015		-0.003	0.21
		(0.007)		(0.002)	
8-year averages		0.002	-0.005		0.49
		(0.006)	(0.002)		
		0.002		-0.003	0.49
		(0.006)		(0.002)	

Regressions explain the average growth rate of GDP per capita, where the average is computed either over a 4- or 8-year period. Y(-t) is log per capita income t=4 or t=8 years ago, respectively. CMR, LMR= labour, capital market deregulation, R-squared is the adjusted coefficient of determination. Standard errors in parantheses.

Table 2: Impacts of the economic freedom index on income per capita growth

A. Random effects specification

	Constant	Y(-t)	EFI	R-squared
4-year averages	0.445 (0.100)	-0.029 (0.007)	0.009 (0.002)	0.23
8-year averages	0.620 (0.098)	-0.040 (0.006)	0.009 (0.002)	0.52

B. Fixed effects specification

	Constant	Y(-t)	EFI	R-squared
4-year averages	Individual con-stants	-0.043 (0.016)	0.014 (0.004)	0.25
8-year averages		-0.060 (0.015)	0.015 (0.004)	0.53

Regressions explain the average growth rate of GDP per capita, where the average is computed either over a 4- or 8-year period. Y(-t) is log per capita income t=4 or t=8 years ago, respectively. EFI= index of economic freedom, chain version, R-squared is the adjusted coefficient of determination. Standard errors in parantheses.

Table 3: Impacts of the economic freedom index on capital deepening

A. Random effects specification

	Constant	C(-t)	IR(t)	EFI	R-squared
4-year averages	-0.081	0.000	0.321	0.006	0.58
	(0.015)	(0.001)	(0.034)	(0.001)	
8-year averages	-0.059	0.000	0.148	0.005	0.68
	(0.022)	(0.001)	(0.025)	(0.001)	

B. Fixed effects specification

	Constant	C(-t)	IR(t)	EFI	R-squared
4-year averages	Individual constants	-0.019	0.338	0.014	0.59
		(0.006)	(0.033)	(0.002)	
8-year averages		-0.047	0.128	0.020	0.75
		(0.006)	(0.023)	(0.002)	

Regressions explain capital deepening, that is the average growth rate of capital intensity, where the average is computed either over a 4- or 8-year period. C(-t) is the log capital intensity t=4 or t=8 years ago, and IR(t) the investment ratio, averaged over the 4 or 8 years period. Lagged investment rates and institutions have been used to instrument the investment rate in a first step. EFI= index of economic freedom, chain version, R-squared is the adjusted coefficient of determination. Standard errors in parantheses.

Table 4: Impacts of the economic freedom index on TFP growth

A. Random effects specification

	Constant	EFI	R-squared
4-year averages	-0.005 (0.008)	0.002 (0.001)	0.15
8-year averages	0.008 (0.010)	0.001 (0.001)	0.49

B. Fixed effects specification

	Constant	EFI	R-squared
4-year averages	Individual con-stants	0.002 (0.001)	0.15
8-year averages		0.002 (0.002)	0.49

Regressions explain the average of the TFP growth rate, where the average is computed either over a 4- or 8-year period. EFI= index of economic freedom, chain version, R-squared is the adjusted coefficient of determination. Standard errors in parantheses.

References

Aghion, Philippe, Howitt, Peter, 1996. Research and development in the growth process. Journal of Economic Growth 1, 49-73.

Ahn, Sanghoon, 2002. Competition, Innovation and Productivity Growth: A Review of Theory and Evidence. OECD Working Paper 317.

Baltagi, Badi H., 1995. Econometric Analysis of Panel Data. Wiley & Sons, New York.

Barro, Robert J., Sala-I-Martin, Xavier, 1995. Economic Growth. McGraw Hill, New York.

Blanchard, O., Giavazzi, F. (2003): Macroeconomic effects of regulation and deregulation in goods and labour markets; Quarterly Journal of Economics 118, 897-907.

Centre for Economic Policy Research (CEPR), Institute for Fiscal Studies (IFS), 2003. The link between product market reform and macroeconomic performance. European Commission DG Economic and Financial Affairs, No. E/2002/002.

De la Fuente, Angel, 2003. Human capital in a global and knowledge-based economy. European Commission DG Employment and Social Affairs.

European Commission, 2003. The EU economy: 2003 review. Chapter 2: Drivers of productivity growth, 63-118.

European Commission (2004): The EU Economy: 2003 review, Chapter 3: Education, Training and Growth, 159-203.

Groningen Growth and Development Centre and The Conference Board, 2004. Total Economy and Growth Accounting Database, http://www.ggdc.net.

Gwartney, James, Lawson, Robert, Emerick, Neil, 2003. Economic Freedom of the World: Annual Report of the Fraser Institute, Vancouver, http://www.freetheworld.com.

Jones, Charles I., 2002. Sources of US economic growth in a world of ideas. American Economic Review 92, 220-239.

Krueger, Alan B., Lindahl, Mikael, 2001. Education for growth: Why and for whom?. Journal of Economic Literature 39, 1101-1136.

Mankiw, N.Gregory, Romer, David, Weil, David N., 1992. A contribution to the empirics of economic growth. Quarterly Journal of Economics 107, 407-438.

Nicoletti, Guiseppe, Scarpetta, Stefano, 2003. Regulation, productivity and growth: OECD evidence. OECD Economics Department, Working Paper 347.

Rodrik, Dani, Subramanian, Arvind, Trebbi, Francesco, 2002. Institutions Rule: The primacy of institutions over geography and integration in economic development. NBER Working Paper, 9305.

Sianesi, Barbara, van Reenen, John, 2003. The returns to education: macroeconomics. Journal of Economic Surveys 17, 157-200.

Temple, Jonathan, 2002. Growth effects of education and social capital in the OECD countries. OECD Economic Studies 33, 57-101.