

Effects of Economic Freedom on Growth and the Environment

- Implications for Cross-Country Analysis

By

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Abstract:

The purpose of this paper is to discuss the effects of specific economic freedom categories on both economic growth and the environment, and present some important considerations for cross-country regressions. First, there is a survey of arguments for positive as well as negative effects of economic liberalization. Measurement problems are then considered followed by a number of model specification issues. Sensitivity tests and potential econometric problems are also discussed. The main conclusion is that decomposition is important since different economic freedoms can be expected to have different effects on growth and the environment, and are dependent on different interacting factors. The theoretical insights have a crucial role when it comes to selecting what empirical issues to take into account since there is a limit to the number of issues possible to consider. Due to the complexity of the links, a lot of effort should also be devoted to sensitivity tests.

Keywords: Cross-country regressions, Economic freedom, Economic growth, Environmental quality, Institutions.

JEL classification: C31, E60, N50, O11, P00

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1 INTRODUCTION

Market-based institutions are often mentioned as a crucial component for an efficient resource allocation and economic growth. These institutions are rules, enforcement mechanisms and organizations supporting market transactions, and their purposes are, according to The World Bank (2002), to transmit information efficiently, to enforce property rights and contracts, and to secure competition, which all affect the incentives to participate in a market. Several empirical studies confirm the positive relation between market-based institutions and economic growth (see e.g. Easton and Walker, 1997; De Haan and Sturm, 2000). However, some countries have implemented market-based institutions but the expected growth enhancing effect has been absent, which mainly is explained by the lack of complementary institutions (World Bank, 2002). Moreover, there is a growing concern about the effects of the market-based institutions on other welfare components, such as the environment. The expected effects of market-based institutions on economic growth and the environment are indeed complex, and there is a lack of both theoretical and empirical guidance, especially concerning the environmental consequences.

In this study we will discuss effects of economic freedom, which is often used as a measure of market-based institutions. Increasing economic freedom generally means substitution of public choice for private choice. However, the resulting effects depend on the economic context in which the transformation is done. The public choice may be inefficient due to political failures and the private choice may be inefficient due to market failures, and the trade-off between these failures is far from an easy calculation. Moreover, governments and markets operate in a second best world. The theory of second best tells us that removing one distortion in the presence of other distortions is not necessarily welfare enhancing. The necessary, non-distorted economic context is often taken for granted in economic models but is absent or underdeveloped in a lot of countries - especially in low-income countries. Because of the second best context it is important to look at each economic freedom separately and be aware of the factors interacting with these specific freedoms.

The purpose of this paper is to discuss the effects of different economic freedom categories on both economic growth and the environment, and some important considerations for cross-country regressions. First there is a survey of arguments for positive as well as negative effects of economic liberalization. Second, the empirical implications are presented. Measurement problems are considered, and a number of model specification issues are identified on the basis of the survey of arguments. Sensitivity tests and potential econometric problems are also discussed. The main conclusion is that decomposition is important since different economic freedoms may have different effects on growth and the environment, and may be dependent on different interacting factors. Moreover, theoretical insights have a crucial role in the selection of empirical issues to take into account since there is a limit to the number of issues possible to consider. A lot of effort should also be devoted to sensitivity tests due to the complexity of the economic freedom effects.

The paper is organized as follows. Section 2 introduces the economic freedom data. Section 3 presents the survey of arguments about economic freedom effects on growth and the environment. In Section 4 the empirical implications are discussed and Section 5 concludes the paper.

2 HOW IS ECONOMIC FREEDOM MEASURED?

The evolution of institutional economics was long halted by the lack of relevant data. According to Lin and Nugent (1995), this was due to both a lack of interest in explaining institutions among economists working in high-income countries, where the neoclassical models relatively well describe the growth path, and the fact that institutions are complex, difficult to quantify and change very slowly in many countries. However, since the 80s there has been a growing interest in data on market-supporting institutions, resulting in several measures of economic freedom.¹

In this paper we will discuss the Economic Freedom of the World (EFW) Index 2002 as the measure of economic freedom (Gwartney et al., 2002). This is because the index has been widely used, it contains measures over a longer period (1970 to 2000)

¹ Scully and Slottje (1991) and Hanke and Walters (1997) present the most common indices of economic freedom and show that they are highly correlated.

and has data for more countries than any other measure of economic freedom, and it relies mainly on quantitative measures. The EFW index is constructed out of five categories, or areas, which in turn are aggregations of different measures.² The categories are presented in Table 1.

Table 1: Economic Freedom of the World Index 2002

1 Size of Government: Expenditures, Taxes, and Enterprises

- A General government consumption spending as a percentage of total consumption.
- B Transfers and subsidies as a percentage of GDP.
- C Government enterprises and investment as a percentage of GDP.
- D Top marginal tax rate (and income threshold to which it applies).

2 Legal Structure and Security of Property Rights

- A Judicial independence: The judiciary is independent and not subject to interference by the government or parties in disputes (GCR).
- B Impartial courts: A trusted legal framework exists for private businesses to challenge the legality of government actions or regulation (GCR).
- C Protection of intellectual property (GCR).
- D Military interference in rule of law and the political process (ICRG).
- E Integrity of the legal system (ICRG).

3 Access to Sound Money

- A Average annual growth of the money supply in the last five years minus average annual growth of real GDP in the last ten years.
- B Standard inflation variability in the last five years.
- C Recent inflation rate.
- D Freedom to own foreign currency bank accounts domestically and abroad.

4 Freedom to Exchange with Foreigners

- A Taxes on international trade.
 - i Revenue from taxes on international trade as a percentage of exports plus imports.
 - ii Mean tariff rate.
 - iii Standard deviation of tariff rates.
- B Regulatory trade barriers.
 - i Hidden import barriers: No barriers other than published tariffs and quotas (GCR).
 - ii Costs of importing: The combined effect of import tariffs, license fees, bank fees, and the time required for administrative red-tape raises costs of importing equipment by (10=10% or less; 0=5% or more (GCR).
- C Actual size of trade sector compared to expected size.
- D Difference between official exchange rate and black market.
- E International capital market controls.
 - i Access of citizens to foreign capital markets and foreign access to domestic capital markets (GCR).
 - ii Restrictions on the freedom of citizens to engage in capital market exchange with foreigners - index of capital controls among 13 IMF categories.

5 Regulation of Credit, Labor, and Business

- A Credit Market Regulations.
 - i Ownership of banks: Percentage of deposits held in privately owned banks.
 - ii Competition: Domestic banks face competition from foreign banks (GCR).
 - iii Extension of credit: Percentage of credit extended to private sector.

² The categories and how they are measured have been changed several times, but this paper refers to the 2002 version of the EFW index.

- iv Avoidance of interest rate controls and regulations that lead to negative real interest rates.
- v Interest rate controls: Interest rate controls on bank deposits and/or loans are freely determined by the market (GCR).
- B Labor Market Regulations.**
 - i Impact of minimum wage: The minimum wage, set by law, has little impact on wages because it is too low or not obeyed (GCR).
 - ii Hiring and firing practices: Hiring and firing practices of companies are determined by private contract (GCR).
 - iii Share of labor force whose wages are set by centralized collective bargaining (GCR)
 - iv Unemployment Benefits: The unemployment benefits system preserves the incentive to work (GCR).
 - v Use of conscripts to obtain military personnel.
- C Business Regulations.**
 - i Price controls: Extent to which businesses are free to set their own prices.
 - ii Administrative conditions and new businesses: Administrative procedures are an important obstacle to starting a new business (GCR).
 - iii Time with government bureaucracy: Senior management spends a substantial amount of time dealing with government bureaucracy (GCR).
 - iv Starting a new business: Starting a new business is generally easy (GCR).
 - v Irregular payments: Irregular, additional payments connected with import and export permits, business licenses, exchange controls, tax assessments, police protection, or loan applications are very rare (GCR).

Note: GCR = *Global Competitiveness Report*; ICRG = *International Country Risk Guide*

Source: (Gwartney et al., 2002)

The concept of institutions in this paper is broad, following the wider approach of for example Sala-i-Martin (2002).³ Some of the EFW categories, such as security of property rights or regulations of business, are fairly straightforward as institutional measures. Other categories may be perceived as having more of a “policy” character, but should be interpreted as proxy variables of actual institutions. International trade reforms, for example, can be seen as institutional changes since they change the rules of the games for those affected (Rodrik, 2000a), and access to sound money is a measure of macroeconomic “rules” of stabilization. Nevertheless, it is important to consider the different characters of the measures, since they differ not only when it comes to the possibilities of changing them and the time lags between the changes and effects in the economy.

³ By institutions Sala-i-Martin (2002) means “... various aspects of law enforcement (...), the functioning of markets (...), inequality and social conflicts (...), political institutions (...), the health system (...), financial institutions (...) as well as government institutions (...).”

3 A SURVEY OF ARGUMENTS

In this section important arguments for positive as well as negative effects on growth and the environment are presented.⁴ Note that we only consider the *direct* effects and will not discuss *indirect* effects.⁵ The purpose of this section is not to give clear-cut answers about the effects of economic freedom. The purpose is to give a broader perspective than most previous literature, and thereby highlight the potential problems that must be considered in a cross-country analysis using the index.

3.1 Size of Government

This category is constructed to reflect to what extent a country relies on individual choice and markets rather than on the political process to allocate resources, goods and services. What is considered to be the optimal size of the government depends largely on the perception of how well the government pursues its tasks, which in turn is largely dependent on the assumed underlying motives of the policy makers. If one accepts a standard public-choice perspective where the government is seen as consisting of purely selfish individuals, it is natural that the conclusion will be rather different compared to the conclusions made from the view of a benevolent government that tries to maximize an ethically grounded social welfare function.

According to public choice arguments, the government is an inefficient institution for resource allocation. Olson (1982) argues that the state redistributes money according to the pressure from interest groups, i.e. resources are allocated to rent-seeking activities instead of production. Olson also argues that due to the lack of competition in public enterprises, the principle will be budget maximization instead of profit maximization. This slows down society's capacity to adopt new technologies and reallocate resources in response to changing conditions. Assuming socially optimal prices, privatization would hence reallocate resources so that, given the same

⁴ For social consequences, see for example Bourguignon and Morrisson (1992), and for income inequality, see Berggren (1999).

⁵ The environment may for example be indirectly affected by changes in the income level due to changes in economic freedom, but this is not the focus of this paper. The impact of income on the environment has been investigated extensively in the literature of the environmental Kuznets curve (see e.g. Grossman and Krueger, 1995).

production, less resources would be used and less waste (and pollution) would be created. The extent of government inefficiency presented by the public choice theory is influenced by the level of corruption, bureaucracy and other factors that affect the quality of governance (Mauro, 1995; La Porta et al., 1999b).

There may also be efficiency-reducing effects in the private market by a large government size. First, the tax structure imposed on the private market creates dead-weight losses. Second, the decreased competitive pressure created by the smaller size of the private market decreases incentives for firms to reduce costs and to innovate (Scherer, 1992; Vickers, 1995). Moreover, competition is not only an efficient way to allocate resources given the institutional context prevailing, but it also modifies existing institutions. Since institutions affect relative prices, a demand among firms and lobby groups for new, more efficient institutions will be created (World Bank, 2002, Ch.7).

However, most economists agree that the government does have some efficiency-enhancing roles, even though what these are, and the extent of them, is disputed. According to a standard public finance perspective (see e.g. Atkinson and Stiglitz, 1980) it is efficiency improving if the government provides goods with public-good character, such as the judiciary, schools, hospitals, sanitation facilities and recreation areas. However, this effect depends on the response from the private (domestic and foreign) capital if the public investments were absent, which might be assumed to differ depending on the type of good. A second often mentioned efficiency-enhancing role of the government is to correct market prices that do not reflect the social costs by, for example, using taxes or subsidies. These taxes or subsidies may increase allocation efficiency, as in the case of environmental taxes on pollution, but may also increase growth, as in the case of subsidies to research.⁶ Still, there are of course many examples of the opposite, where regulated prices reduce efficiency and are bad for the environment. Third, the redistributive role of the state may increase

⁶ However, as noted by Coase (1960), in a situation with no transaction costs between agents and well-defined property rights, a free market still implies efficient resource allocation. A tax on the externality would then reduce efficiency. In reality, however, transaction costs are often very high. Note also that even if there are government interventions these must not, depending on the type of intervention, imply a significantly increased government size. For example, if the solution to the socially sub-optimal prices is regulations or tradable pollution permits instead of a tax, the government size category will only increase due to the enforcement costs these solutions may imply.

efficiency indirectly by increasing social stability, which otherwise may consume large parts of the society's resources (Rodrik, 1999). There are also arguments for direct effects on efficiency through, for example, expenditures on job matching and education for the unemployed. If this increases the tightness of the labor market, it might increase productivity and catalyze structural changes (Pissarides, 1990). Hence, the government may provide some goods more efficiently than the private firms, and for the government to undertake these efficiency-enhancing actions it needs resources which makes a certain level of taxes necessary.

However, given that the most basic efficiency-enhancing functions of a market economy are the first priority of governments, then at higher levels of government spending the marginal productivity of the government's projects is lower. At the same time, government investments crowd out private firm investments, which may be more productive when the government invests outside its core functions. We may therefore expect a hump-shaped relation between government size and economic growth (Barro, 1990). The expected form of this hump-shaped relation, and hence the expected effect from changes in the government size at a certain initial level, is determined by the underlying view of government efficiency relative to market efficiency.

3.2 Legal Structure and Security of Property Rights

This category measures to what extent the citizens and their properties, including the fruits of their own work and their innovations, are protected. First, secure and transferable rights of assets and contracts are investment generating and hence growth enhancing, since owners can be sure that they will receive the benefits of their investments (World Bank, 2002).⁷ The investment costs are often realized on shorter terms, while the long run benefits have to be reduced by a risk premium. The risk reducing effect may also have environmental effects since long-term investments are the nature of many environmental projects. For example, land degradation and resource exhaustion are to a large extent results of badly defined property rights. High risks

⁷ Note that the key word of secure property rights is "control" rather than "ownership" (Rodrik, 2000b). Hence, what this category measures is a strong enforcement mechanism by a reliable legal structure rather than a specific type of ownership.

encourage short-term extraction of natural resources and excessive grazing or harvesting on land, instead of conservation (Mink, 1992).⁸ Second, with secure property rights, the allocation of assets will be efficient and hence growth promoting. Assets will be transferred to the owners with the highest expected profits. Hence, enforced property rights are a precondition for market solutions to the allocation of resources, which also includes the market solution for environmental problems (see e.g. Bromley, 1990). However, many assets, such as the atmosphere and oceans, have no clear boundaries and are therefore “open access” to all countries. Since the judicial authority (that can implement better property rights) works at the country level and the individual country therefore has the incentive to free-ride, there must be an international body to enforce better defined property rights of these assets (Barrett, 1990).

But does stronger property rights always increase productivity or at least welfare? One problem may be that stronger private property rights in general may decrease the government’s ability to impose environmental regulations. Moreover, protection of property is an institution creating a monopoly situation for the economic actor owning the right. This may create inefficiencies if the asset has no rivalry in consumption. For example, an entrepreneur will only have incentives to innovate, or to invest in a recreation area, if he or she can control the returns from the innovation or the investment. However, once these are done, then the efficiency of a society would increase if all producers could use the innovation or all consumers could use the recreation area. One solution is to implement strong intellectual property and land rights, in combination with subsidies to the spreading of new innovations, or visits to the recreation site.⁹

A functioning legal structure and secure property rights are to a large extent a necessary, complementary institution to all the other economic freedom categories

⁸ However, for a short-term extraction to occur, alternative investment possibilities or the possibility to put the money in foreign bank accounts must exist.

⁹ This is however more problematic between countries. In a static perspective, intellectual property rights are sometimes argued to be more beneficial to high-income countries than to low-income countries, which are often net importers of new technology and build a lot of their technological progress on diffusion. High-income countries would in that case profit relatively more from the monopoly pricing, at the expense of low-income countries that are meeting a higher price and seldom profit from the innovation rents (World Bank, 2002, Ch.7). However, in the long run all countries may benefit from the progress of the technological frontier.

(Rodrik, 2000b). For example, without secure property rights the incentives to invest will be low even though the credit market is deregulated. However, the effects of stronger ownership are also conditional on complementary institutions or factors not always present (Lin and Nugent, 1995). For example, higher security of property may not increase growth in the absence of good credit possibilities and access to new technology.

3.3 Access to Sound Money

This category measures the “friction” in the exchange process created by low access to “sound” money. Briault (1995) gives an overview of the costs of inflation, or rather unanticipated inflation, which is the main component of this category. First, instability of prices increases risk and hinders long-term investments, as in the case of insecure property rights. Second, insecure price development has redistributive effects on the present assets. Lenders are adversely affected by inflation, while borrowers profit. This redistributive effect shifts resources from productive to rent-seeking activities which, as in the case of government allocation, create inefficiencies in the economy. Another redistributive effect is when the government prints money to improve its government budget, which erodes the savings, and hence investment possibilities, of the citizens. Access to sound money is also improved by the possibility of owning foreign currency bank accounts, since the adverse effects of inflation are lower when foreign currency with lower risk is available as a substitute (Gwartney et al., 2002).

There are however some potential, but disputed, negative effects of low-inflation strategies to be aware of. First, Keynesians argue that possibilities for expansionary government policy during a shorter period might be what save a country from a deeper depression. However, monetarists would argue that the Keynesian principle of high government expenditures during recession and low government expenditures during a boom would be unsuccessful since individuals and companies adjust their expectations and wage requirements. Hence, according to monetarists the government should always prioritize low inflation and restrict the possibilities of expansionary fiscal policies. Second, it is difficult to identify the true natural rate of unemployment. In a situation where the rate is lower than predicted, a low inflation policy represses the economy and

leads to lower growth than potentially possible. Finally, some inflation is natural and not growth reducing since product quality improves.

Again, complementary institutions matter. For example, the effects of inflation differ depending on the exchange rate regime. Higher inflation compared to other countries may be detrimental if the exchange rate that is fixed. The higher price of export goods affects the country's competitiveness and employment negatively. However, very simplified, with a floating exchange rate, the price increase may be covered by a depreciation of the exchange rate and may therefore not affect the international competitiveness.¹⁰

3.4 Freedom to Exchange with Foreigners

For the same reasons supporting exchange inside country borders, individuals should, according to the EFW index, be free to exchange their property across the borders. First, there are efficiency effects from trade liberalization. The most straightforward efficiency effect is the larger market and the gains for both trading partners if they produce according to their comparative advantages.¹¹ Another benefit is that the interaction with foreigners and their products may ease the diffusion of technology (Edwards, 1997; Frankel and Romer, 1999), and this may in combination with international competition enhance the productivity of the domestic firms (Bigsten et al., 2000). Competition among countries could also lead to institutional changes in order to attract businesses from abroad. If there are inefficient institutions preventing domestic firms from responding to the international competitive pressure, these firms may demand the government to implement institutional reforms that eliminate these inefficiencies (World Bank, 2002, Ch.7). All these mechanisms increase resource efficiency in a country, and, given socially optimal prices, this also includes environmental resources (Heerink et al, 1996). Moreover, since deregulation of the international capital market allocates capital to countries where the marginal product of

¹⁰ However, there is still a cost by an increased price of imports.

¹¹ However, for an exchange to work efficiently there is a need for agreed upon rules and standards (North, 1990). Hence, even if a country's rules work efficiently inside the country, they might not be efficient when trading with partners from other countries with different institutional settings. A system of standards is a common institution created to reduce information and enforcement costs across borders; it therefore increases resource efficiency for all parts.

capital is the highest, the global efficiency increases (Obstfeld, 1998). This may create new markets and technological opportunities for all countries, at least in the long run. However, in a static view, the growth rate might increase in some countries and decrease in others. Given the same investment risks, capital would be floating from high-income countries with a large capital stock (i.e. low marginal product of capital), to low-income countries with a small capital stock (i.e. low marginal product of capital).¹²

Second, trade liberalization results in new terms-of-trade, which in turn affects the input and output composition in a country. For example, the pressure of an exchange rate reform is often created in a situation of overvalued currency, where imports are relatively cheap and exports uncompetitive. An exchange rate reform may therefore be expected to result in a relative increase in the production of export goods. However, there might be a need for institutions supporting the supply response of the export sector if it has a history of low incentives and inefficiency due to the lack of competition. For example, without a proper infrastructure a country may not benefit from openness because of high transport costs (Craft and Venables, 2002). Hence, it might be necessary to complement the new trade opportunities with government expenditures on public goods such as roads, railways and telecommunications, given that the private market does not provide these investments. The exchange rate reform may also affect the environment, but the final effect depends of course on the composition of imports and exports in a country, and the complementary measures to internalize negative externalities. Another example connected to the terms-of-trade effect is the so-called “pollution haven” effect, which may have positive as well as negative effects on the environment depending on the economic and institutional structure of the country. Trade results in specialization, and, according to the pollution haven hypothesis, countries with less strict environmental regulations are more likely to attract capital connected to dirty industries. Hence, export-promoting regimes, in combination with weak preferences for the environment may experience an expansion of pollution and

¹² However, if the capital risk is very high (for example because of a bad legal structure) as in many low-income countries, then the marginal product of capital would be lower for a given capital stock. Liberalization of capital markets could then lead domestic private investors to invest abroad, even if the domestic capital stock were relatively small.

waste intensive production, and vice versa for countries with high preferences for the environment.

3.5 Regulation of Credit, Labor, and Business

This category is intended to represent to what extent regulations restrict entry into markets and interfere with the freedom of individuals to engage in voluntary exchange. The free entry principle is crucial for a market economy to reach the efficient resource allocation, and the category is in this sense a measure of competition. Firms are less likely to enter a market if the production and exit costs are too high, and different sorts of regulations may affect both of these costs (World Bank, 1995).¹³ However, some regulations might increase the market's possibility to grow, or at least be acceptable from a social welfare efficiency point of view, as long as they are not excessively numerous, complex or costly relative to the income level in a country (World Bank, 2002, Ch.7).

Credit. By deregulation of the credit market, a competitive market of risk taking is created, i.e. risk is allocated to those who are willing to bear it. Efficient lending created by the competitive credit market may reduce the information costs between borrowers and lenders, and the cost of money transaction. This lowers the cost of capital and, given secure property rights, promotes investments.¹⁴

Labor. Labor market regulations may have resource efficiency effects. First, entries and expansions of firms, affected by rules of firing employees, might be hindered by high exit costs, obstructing necessary structural changes in society. Second, labor regulations affect the individual's right to use his or her labor "asset." By increasing the price of labor above the marginal cost of the individual, or by forcing people into military training, the input factor available for production decreases below

¹³ The reason for excessive welfare decreasing regulations would, according to the public choice perspective, be a result of interest groups with non-proportional political power. Moreover, since regulations are a source of bribes, corrupt politicians may be favoring the rent-seeking activities related to regulations (Mauro, 1995).

¹⁴ However, the financial system is fragile, since it is in the business of pooling, pricing and monitoring risks. If prudent regulations, such as minimum capital requirements from the credit institution itself, are absent or badly enforced then the risk may be too high, which affects growth negatively (World Bank, 2002, Ch.4).

the potential level. The labor union has in some countries been an influential interest group in the wage-setting process. Gottfries (1992) argues that this has improved the position of the already employed workers, but that the higher costs for firms may have decreased the incentives to invest, and thereby decreased the employment possibilities for the unemployed workers.

There might also be a risk effect from labor regulations. Firing regulations and minimum wages create a safety net among employees and thereby reduce the uncertainty about future incomes. Some would argue that this affects the work incentives, and hence the productivity of the work force, negatively. However, others argue that the higher risk of large income reduction decreases growth-enhancing investments in for example human capital (World Bank, 2001, Ch.8). With short-term employment opportunities without safety nets, these investments may be prevented since the household labor force is needed to generate income when such possibilities exist. The higher risk may also create environmental problems by the increased population pressure. In poor countries, children contribute to the production of the household and hence provide alternative security. Rodrik (2000b) argues that market-oriented development is likely to release people from their traditional social safety nets such as the church, the village hierarchy, lifetime employment, etc., and that it is important for development to complement reforms with alternative social insurances.

Finally, a large part of a country's citizens belong to the labor force, and an economic freedom reform that leads to a short run downturn in production and employment, in combination with relaxed labor regulations, might create social unrest. These conflicts may hurt economic growth much more than keeping the labor regulations, at least until the initial period is over.

Business. Market concentrations normally drive the economy away from the efficient allocation, and reduce potential productivity and economic growth. The purpose of deregulation of businesses is to make it easier for new firms to enter markets, which increases competition and hence resource efficiency. However, regulations such as appropriate health, safety and environmental regulations may also be

beneficial for productivity. A common example is that better worker health may increase labor efficiency, and decrease sick leave.¹⁵

Competition can sometimes serve as a substitute for regulations, since, among other reasons, it makes up an efficient bankruptcy system with its pressure on inefficient firms to go into liquidation (Aghion et. al, 1999). Moreover, competition may in some cases substitute for costly environmental regulations. Instead of imposing a limit on each firm's emissions, it is possible to set a limit for emissions of the whole sector and introduce a competitive market for tradable pollution permits. The firms with the most cost efficient abatement technology would then reduce emissions, since they would be willing to sell the permits at a lower price. However, competition and regulations may also be complements. For example, concentrated ownership may be a consequence of weak anti-trust legislation (La Porta et al., 1999a).

Finally, a certain rate of market concentration might increase growth due to economies of scale, for example in the case of high-risk basic research. Moreover, in a second best world without policies to correct for the distortions, a monopoly or highly concentrated market might be closer to the socially optimal price and quantity. For example, if the price on pollution were too low it would lead to excessive production in a competitive market, while a monopoly would restrict production to a level below the competitive quantity to maximize its profits, independent of the pollution cost.

4 EMPIRICAL CONSIDERATIONS

As is clear from the survey of arguments in Section 3, there are often no clear-cut conclusions regarding the effects of different economic freedom categories on economic growth or environmental quality. A discussion of different arguments is however essential to identify empirical implications, that in turn can be used to clarify the links. This section therefore emphasizes important issues for cross-country research in the

¹⁵ Another, often disputed, argument according to the Porter hypothesis is that environmental regulations might increase productivity since firms are forced to reorganize their production (Porter and van der Linde, 1995).

area.¹⁶ In reality, there is a limit to the number of possible empirical issues to consider, and the theoretical insights have a crucial role when it comes to selecting what issues to take into account.

4.1 Measurement Problems

Before drawing any conclusions about the reliability of empirical studies using economic freedom data, it is important to critically discuss the measurement methods. Many measures of economic freedom rely on qualitative data (Hanke and Walters, 1997). Typically, a sample of knowledgeable persons is included in a survey where they are asked to rank countries according to their perception of the economic freedom component in question. The individual scores are then averaged to produce a “consensus ranking.” This process involves a lot of uncertainties since the expertise, the perception of what is important in determining economic freedom and the relative weight attached to these factors might differ substantially across countries.

The EFW index relies primarily on quantitative measures, even though qualitative measures have been used where there is no quantitative data available, or where the qualitative technique has been judged to be more suitable (for example in the category *Legal structure and security of property rights*). There are several advantages when relying on quantitative measures. First, the risk of subjectivity in the scoring process, as mentioned above, decreases. Moreover, the index can be constructed for a long period. This is crucial for an empirical analysis of institutional effects since it is likely that institutions have effects over a long period of time.

Even if there is no subjective variation in the scores among countries, there are still subjective influences in the choice of variables, the economic freedom quantification and the weighting process. No economic freedom category is directly observable; each is therefore measured by several proxy variables. The choice of which variables to include to represent a specific economic freedom category, is of course

¹⁶ It is not an exhaustive presentation of all important econometric consideration in cross-country regressions. The empirical analysis should of course include the standard diagnostic checking, for example.

disputable.¹⁷ It is important to be aware of the “distortion” with which the proxy variable mirrors the underlying economic freedom. If this distortion is thought to be larger than the subjective risks of a qualitative measure, then the latter may be preferred.

The transformation of a specific proxy variable into an economic freedom score can be done in several ways. This includes subjective decisions such as the maximum and minimum value, and the number of scores possible. As an example of a continuous variable, take the measure *Transfers and subsidies as a percentage of GDP*. It is transformed into an economic freedom score by taking $(V_i - V_{\max}) / (V_{\max} - V_{\min})$ multiplied by 10. V_i is country i 's transfers and subsidies as a percentage of GDP, and V_{\max} and V_{\min} represent the maximum and the minimum value of the measure during the 1990 base year. In other cases V_{\max} and V_{\min} are simply assigned different numbers - for example 40 and 6 in the case of *General government consumption spending as a percentage of total consumption*. There is no reason to believe that the values V_{\max} and V_{\min} were assigned unrealistic values, but this choice does leave room for subjectivity. Another transformation procedure gives discrete scores according to subjective criteria, for example in the case of *Freedom to own foreign bank accounts domestically and abroad*. The rating 10 was given when there was no restriction on foreign bank accounts domestically or abroad, and 0 when there was. If the accounts were permissible domestically but not abroad, the value of 5 was assigned. For most variables the subjectivity problem arises in the choice of the criteria for different rankings. However, there are examples of measures when there is room for subjectivity in the interpretation of the criteria as well.¹⁸

¹⁷ The question of what economic freedom really means and should measure, i.e. which categories should be included, is not in the scope of this paper. See Sen (1993) for a discussion of the possibilities and limits of individual freedoms in a market economy, and De Haan and Sturm (2000) for a discussion of the economic freedom measures.

¹⁸ An example is the measure *Price controls*. According to Gwartney and Lawson (2002), “Countries were given a rating of 10 if no price controls or marketing boards were present. When price controls were limited to industries where economies of scale may reduce the effectiveness of competition (e.g. power generation), a country was given a rating of 8. When price controls were applied in only a few other industries, such as agriculture, a country was given a rating of 6. When price controls were levied on energy, agriculture, and many other staple products that are widely purchased by households, a rating of 4 was given. When price controls applied to a significant number of products in both agriculture and manufacturing, the rating was 2. A rating of zero was given when there was widespread use of price controls throughout various sectors of the economy.”

Problem of weighing may occur both in the process of aggregating the proxy variables into the different economic freedom categories, and in the aggregation of the categories into a single economic freedom score. The weighing is necessary since the absolute notion of economic freedom becomes meaningless if the absolute score of the category is based on a vector of measures, all having the purpose of measuring different aspects of the same problem. One common procedure is to let experts agree upon the weights, another is to use objective methods such as the instrumental variable (hedonic) approach or the principal component technique (Scully, 1992). In earlier versions of the EFW index, three indices that differed in aggregation techniques were used. One index was weighted by country experts, another by experts in the different categories and the third index, the one finally settled for, applied the principal component technique. The idea of this technique is to construct an index, out of several measures that are proxies for the same variable, by weighting them according to one or several linear functions that account for most of the variance in the measures (see for example Maddala, 2001, for a more detailed description). An important advantage of the principal component analysis is the objectivity. On the other hand, when two components (i.e. measures) are highly correlated, this technique tends to assign low weights to both components. However, including both of these components is desirable in order to offset measurement errors. Therefore, simple averages of the measures have been used in the 2002 issue of the EFW index. This indirectly implies that all measures contribute equally to the determination of the economic freedom category.

Finally, we have the problems of ordinal measures (see Boadway and Bruce, 1984, for a more general presentation). If the economic freedom data is ordinal, it is in principle not possible to compare an increase in one category from one unit of economic freedom to two units, with an increase in the same category from five to six units. Moreover, it is not possible to compare an increase from five to six units in one category with an increase from five to six units in another category. However, if the economic freedom data is cardinal it is possible to compare both levels and changes in economic freedom, within as well as among categories. The underlying measures in the EFW index are, with a few exceptions, cardinal. However, when rescaling the measures into categories, with freedom scores from 0 to 10, there is no longer an absolute scale.

An implication of the ordinal problem would be that an OLS regression is of no use since it assumes cardinal measures. Another implication would be that, even though the result of the OLS regression is accepted, it is not possible to draw any conclusions about the relative marginal effect of the economic freedom categories. It is not possible to say that it is more efficient to change one category than another, even though the coefficient is higher for one category, since the change in one unit of freedom is different between the two categories. However, the categories in the EFW index are scaled so that they represent a reasonable “policy relevant” interval, and assuming strict ordinality of these measures would be too restrictive. Treating the variables as cardinal measures in an OLS regression and discussing the relative effects of different categories is therefore of interest.

To conclude, the EFW index has well developed approximations of different economic freedom categories. Even though the categories are not perfectly cardinal, cross-country regressions do have the potential to produce results of acceptable reliability. However, there are some unavoidable problems such as some degree of subjectivity in the choice of measures included in the categories, the criteria attached to the scores, and the aggregation technique. It is therefore important to test the regression results by using other data sets with different approaches as well.

4.2 Model Specification Issues

4.2.1 Levels or Changes?

Suppose that the dependent variable in the regression is the growth rate, and that *changes* in the economic freedom variables are included as explanatory variables. This would entail an assumption that as long as there are changes in the economic freedom level, there will be effects on the growth rate. If the level of economic freedom is not changing there is no effect on the growth rate, implying that a change has only temporary effects on growth. One way to interpret this is to refer to the neoclassical growth models where higher economic freedom increases the country’s potential production, or the *steady-state income level*, and thus increases the rate of convergence. However, as the country approaches the new steady state, the growth rate decreases to the old rate of productivity growth. Hence, the steady state growth is exogenous, at least

in relation to economic freedom. If the *levels* of the economic freedom variables are regressed on growth, then a higher level of economic freedom is assumed to have a permanent effect on the growth rate. This follows the rationale of the endogenous growth theory where policy variables are assumed to affect the growth of the productivity variable. A higher level of freedom would hence affect the level of *steady-state income growth*, i.e. give a different potential growth rate (toward which the countries converge). In reality both of these interpretations hold; economic freedom has temporary effects on productivity that increase the volume of investments until the marginal return to capital has returned to its initial value, but also permanent effects since many categories affect the incentives for productivity improvements.

Jones (1995) argues that theories relating a stationary variable to a non-stationary variable should be rejected, and is thereby questioning the endogenous growth theory. Hence, regressing for example secondary school enrollment on growth would in that case be inappropriate. He argues that it is unreasonable to assume that a positive trend in the stationary variables would predict a continuing acceleration of the growth rate. The same critique can be used on growth regressions including the level of economic freedom. According to Jones it is still possible to say that the reason one country has a higher growth rate, or faster change in environmental quality, than another country depends on the different levels of economic freedom in the two countries. On the other hand, it is not possible to say that increasing economic freedom in one country would permanently increase the growth rate in that country.

Hence, according to this view, using the change in economic freedom seems to be the most appropriate specification. However, the Jones critique does not have to be that severe in our case. First of all, there is a natural upper limit of economic freedom and therefore also an upper limit of the effect on the steady state growth rate. If constant effects still seem unreasonable, then it is possible to include non-linear specifications so that improved institutions may have a declining effect on the growth rate (see Section 4.2.2). Second, one might of course argue that the results from a level specification are only valid for the studied period and that the result can then reflect both temporary convergence effects and permanent steady-state effects. Even if the mean economic freedom of the countries in the sample remains, the level effect on the growth rate may

be lower in a later period when the temporary effect is reduced. Note also that the choice of specification is subject to causality problems. For example, regressing growth on changes in economic freedom in the same period is problematic (see Section 4.4.3). For this reason one might still prefer a level specification of economic freedom, despite the above mentioned interpretation problems.

4.2.2 Non-linearities

The functional form of the economic freedom categories is another issue that is important to consider. The functional form can to a certain extent be determined by using econometric tests, but should as far as possible be based on economic theory. It is not evident that the relation between economic freedom and growth, or the environment, is linear as often assumed, and the appropriate specification may differ among categories. For example, as we have discussed, there could be a hump-shaped relation between the size of government and growth. Moreover, a certain economic freedom category may only have a small effect on growth at low degrees of freedom, but a large effect at high degrees of freedom, or only have an effect if a critical level of freedom is reached. For example, increasing access to sound money from a very low level might not have an impact on the agents in the economy since their trust in the government, based on previous behavior, is still low. However, there may also be cases where the opposite holds, i.e. where the effects of increasing economic freedom from very low degrees of freedom have larger impacts than increases at higher degrees of freedom. Trade liberalization, for example, may have a diminishing effect on both growth and the environment. Opening an economy from a very low level of trade freedom would probably change the structure of production drastically due to the possibilities to concentrate on the comparative advantages. At higher levels of trade liberalization, a further increase might still increase growth by increasing the scale of the market, but the structural effects have probably diminished.

4.2.3 The Time Dimension

Another important question when discussing the relevance of market-based institutions is the time dimension. First, there might be a problem of output response heterogeneity. The EFW index is a mix of more “basic” institutional variables (with higher

transformation costs) such as security of property rights, and more “flexible” institutional variables (with lower transformation costs) such as free trade. The time span between the institutional change and the output effect depends on the ability of the economic structure and people’s minds to adjust to the new economic conditions, and this may differ considerably among economic freedom categories. In a regression the appropriate lag length can therefore be assumed to differ among the categories. For example, the time lag of the growth effect from increased trade liberalization is probably shorter than for the growth effect from increased security of ownership.

The problem of determining the appropriate lag structure is also related to the path-dependent mechanism in institutional building. It creates a friction of institutional change depending on historical institutions and norms. An efficient institution for growth or the environment complements the institutional framework, as it is today and how it is assumed to evolve in the conceivable future. Hence, it is important to decide if it is the short-run or the long-run consequences that are of interest, since they might differ substantially. One example is the liberalization of the credit market, where the first reaction might be to put the savings in a foreign bank account (even though the capital stock is lower in the domestic market). However, as the accountability improves and the risks decrease, the capital flow may turn in the other direction, and in the long run the domestic investments may have increased.

Second, the optimal pace of change of the economic freedom variables may be different. Some theories suggest that a drastic reform is the most efficient in the long run, while others argue for a gradual reform for the best long-run results. As mentioned, it may take time for the rest of society to adjust the underlying institutional structure to the new economic freedom level, and there might be reasons for why this recession should be avoided. Privatization of public enterprises may for example create unemployment before private investors have responded to the new opportunities. If the change is too drastic, social unrest might be created affecting growth negatively. It

could therefore be relevant to interact the number of years the reforms were conducted with the category in question.¹⁹

Third, the sequence in which reforms are made may be crucial.²⁰ One example is the importance of reducing energy subsidies before trade liberalization to avoid energy intensive industry to establish, only to be forced to shut down after a price correction (Munasinghe, 1996). Suppose that we look at how changes in economic freedom during a ten-year period affected the change in environmental quality the following ten years. There might have been a greater environmental quality improvement in a country that implemented more secure property rights before a trade regime change, than in a country where the trade regime change came first, even though the changes were the same in the countries when looking at the entire ten year interval. The order of the reforms can be controlled for with dummy variables. Another way is to identify the exact years of the reforms and if, for example, the trade reform preceded the legal reform, then the trade freedom variable should be interacted with the property right level in the initial year.

Finally, it may not be the degree of a specific institutional variable that is important for growth or the environment, but the stability of that variable over time. An example is the effect of the enforcement of property rights on both growth and the environment. The effects probably do not depend exclusively on the level of the enforcement mechanisms but also on the stability since the effects are created by trust in the legal system. Hence, by including the number of years the economic freedom categories have been at certain levels, the variance, or the frequency of change, of the economic freedom categories might in some cases be more revealing.

4.2.4 Interactions

As mentioned, disaggregating the economic freedom index is important since the categories may have different effects on growth or the environment, but also because their effect depends on different interacting factors. The efficiency and the possibility of

¹⁹ If this is troublesome to identify, then a possible proxy could be to measure the total change and the number of changes, during the time span in question. The larger the change and the fewer the jumps, the more drastic the reform.

²⁰ This has been studied to some extent when it comes to the relation between economic freedom and growth (see e.g. Edwards, 1994; Kaminski and Schmukler, 2002).

an institutional change may be dramatically different depending on the surrounding complementary institutions or on the economic, social and ecological context (Lin and Nugent, 1995). The success is hindered or catalyzed depending on whether the new institution supplements or undermines the present structure.

First, the categories can be both complements and substitutes to one another, and may also increase or decrease each other.²¹ For example, increasing the security of property rights (higher freedom) may lead to a larger government size due to the increased expenditures on the judiciary (lower freedom). Low economic freedom in one category can therefore be a sign of successful development of another economic freedom variable. However, economic freedoms may also enforce each other. For example, trade liberalization (higher freedom) and the resulting pressure from international competition, may force the government to decrease regulations (higher freedom). Moreover, categories can be substitutes to one another. For example, in the case of the environment, improved property rights (higher freedom) ease negotiations between the affected parties and the government may therefore choose to decrease environmental taxes (even lower freedom). The empirical solution is to include the categories separately but also interacted with each other. If the interaction terms are significant, the marginal effects of the categories are then dependent on the level of the other categories.

Second, the importance of institutions may vary with the development level.²² For example, the ability to pay for public services (and probably also the goals of the government) changes with the income level. Another example is that if the positive growth effect of openness is due to technological diffusion, the closer the country is to the technological frontier, the smaller the growth effect of decreased trade restrictions.

Third, market-based institutions are embedded in a country specific set of non-market institutions, formal or informal, and other country specific factors. Factors such as religion, social capital, legal origin, ecological fragility, natural resource dependence, inequality, etc., are often left to be captured by the error term in cross-country regressions. However, even if they are not expected to have a direct effect, they might

²¹ See Section 4.4.2 on the multicollinearity problems that these interactions might create.

²² See Section 4.4.3 for the potential causality problems this might create.

interact with the effects of the economic freedom categories. For example, if the informal institutions, such as the social capital stock, work as substitutes for the economic freedom in question, the marginal effect may be lower the higher the level of the informal institution.

4.2.5 Relative Performance

Since capital is important for growth, the assumptions of the behavior of the worldwide capital flows are crucial when looking at cross-country growth regressions. Capital flows to the country where the marginal return is the highest, and this return can be affected by, for example, institutional improvements. Hence, it may only be the *relative* performance of a country's institutions that is important. If all countries reform, there may not be an effect on growth or the environment.

Several questions arise with this approach. Is it in relation to the world leading country or a sub-set of countries that the relative institutional level matters? We may for example expect the level relative to the competing countries' level to be the crucial one. Which countries these are is determined by several factors affecting the transaction costs among countries, such as geographic distance and cultural differences. Moreover, is the relative performance more relevant for some economic freedom categories than others? If the extent of foreign investments is mainly related to the capital risk level in a country, it may be argued that the crucial variables are *Legal structure and security of property* and *Access to sound money*. It is indeed an interesting topic for further research to study whether it is the absolute scores of economic freedom or the relative scores that matter for growth and the environment, even though the effects are empirically difficult to separate.

4.3 Sensitivity Tests

In order to identify a correct model specification it is, as mentioned, important to have a theoretical intuition about the channels through which economic freedom works. However, because of the complexity of the links, there should be an emphasis on sensitivity tests of the result with respect to the model specification. This is also true with respect to extreme points, or changes in the sample. Due to the strong path

dependence and the difficult task of identifying and measuring all relevant variables, extreme points tests might be in order to eliminate or weigh down the countries that have a very special economic and institutional setting. The robustness tests of the model specification and the sample can also serve as indications of the severity of some potential econometric problems (see Section 4.4).

4.3.1 Model Specification Tests

One useful method to test the model specification is the extreme bound analysis or variants of it (Leamer, 1983; Levine and Renelt, 1992; Sala-i-Martin, 1997).²³ With an extreme bound analysis the robustness of the result is tested by estimating a number of different regressions on a varying conditioning set of explanatory variables. If the significance of the variable of interest (in our case an economic freedom category) is sensitive to the conditioning set, one may, among other things, suspect a poorly specified functional form, or multicollinearity.

Another technique that can be useful to deal with model uncertainty in cross-country regressions is the Bayesian Model Averaging (BMA) method (see e.g. Doppelhofer et al, 2000; Fernandez et al, 2001). No specific model or key variables (as in the extreme bound case) are advocated. Instead all interactions are averaged over potential models with weights according to their posterior probabilities. Given the number of variables that might influence growth and the environment, and the difficulties of identifying these, this approach may be fruitful, at least as a start. However, the lack of theoretical assumptions about the underlying model in BMA analysis draws attention from specification problems (such as non-linearities and interaction terms) other than which variables should be included.

4.3.2 Extreme Points Tests

Methods such as bootstrapping are used to study the robustness of the result to the sample in general (see e.g. Greene, 1997). With bootstrapping, new samples are created

²³ See, for example, De Haan and Sturm (2000) for the sensitivity of a summary index of economic freedom to the inclusion of other growth variables, and Carlsson and Lundström (2002) for the sensitivity of a specific economic freedom category to the inclusion of other categories.

by drawing, with replacement, from the original sample. The distribution of the new coefficient estimates can then be analyzed.

There are several ways to identify specific outliers or influential observations (see Chatterjee and Hadi, 1998, for an overview). Without going into any details, it is important to note that only identifying large residuals (i.e. outliers in relation to the fitted regression equation) is not enough. Observations that are isolated in the space of the explanatory variables values have a high leverage, and may therefore have a strong influence on the fitted regression equation.²⁴ Hence, a point with a high leverage value may very well have a small residual and can in that case not be identified as an outlier. There are several summary statistics based on an index, increased both by a large residual and a high-leverage point.²⁵ If extreme points that may influence the basic regression are identified there might be reasons to use robust regression techniques to see whether or not the basic result changes significantly.²⁶ Different robust regressions use different techniques to weight the observation according to their extreme point character.

A problem with the traditional single-case outlier detection methods is the so-called “masking-effect,” which means that they are likely to miss an outlier if there are other outliers in the neighborhood. Deleting one of the extreme points would in that case not affect the regression results, even if the group is far from the rest of the data. By, for example, using the robust regression technique by Rousseeuw and Leroy (1987), it is possible to identify the most coherent part of the data set and thereby identify the outliers.²⁷

4.4 Potential Econometric Problems

4.4.1 Parameter Heterogeneity

The problem of heterogeneous parameters is valid for more or less all cross-section regressions (see e.g. Brock and Durlauf, 2001; Kenny and Williams, 2001). The indirect

²⁴ Note that a point has a high leverage if the observation of the independent variable is far from the rest of the data of independent variables. However, the point can still be perfectly in line with the trend set by the rest of the data, which means that it does not affect the fitted regression equation.

²⁵ Examples are the Cook’s Distance or the Welsch-Kuh’s Distance.

²⁶ An example is the biweight procedure. Another, more drastic, option is to delete the extreme points.

²⁷ See Sturm and De Haan (2001) for an application on economic freedom and growth.

assumption of parameter homogeneity in OLS cross-country regressions implies that all parameters describing the dependent variable should be the same for all countries. Hence, the effect of increasing economic freedom in one country is assumed to be the same as the effect in another country. Because of the heterogeneous nature of countries and the complexity of their economic, social and ecological structure (making it difficult to identify all possible control variables), this assumption may seem inappropriate (Temple, 1999).²⁸ It might therefore be reasonable to divide the initial sample into sub-samples (as long as the number of observations is reasonable) and analyze countries that are assumed to obey the same growth model.²⁹ This approach is more flexible than controlling for differences by including dummy variables for different country characteristics, but at the same time there is a loss in degrees of freedom with smaller samples.

We might also want to reconsider the model specification, since it may capture part of the parameter uncertainties (Temple, 2000). What is actually done when, for example, allowing for non-linearities or interactions terms, is allow countries to have different slopes, depending on the current level of economic freedom or the levels of other important factors in the country. However, there might be a natural restriction when it comes to the degrees of freedom, which makes it impossible to include all relevant specifications.

By accepting the possibility of parameter heterogeneity, the possibility of outliers is also accepted, independent of measurement errors (Temple, 2000). Given that an appropriate model has been identified, then outliers can be taken care of by, for example, reweighing the large outliers. However, outliers can also be an indication of parameter heterogeneity. One way to test whether the model is appropriate is to look for group-wise outliers (see Section 4.3.2). The identified outliers can very well be extreme points because they have another institutional set-up than the rest of the data. When

²⁸ If panel data is available, a fixed or random effect model may be one way to approach the problem of parameter heterogeneity, since it allows the intercept to differ between countries (Brock and Durlauf, 2001). If the country specific term is interacted with a variable, we also allow for differences in the effect of this variable between countries. It is also possible to approach the problem with a random coefficient model, which directly allows for differences in the parameter estimations (Hildreth and Houck, 1968).

²⁹ For example high- and low-income countries, or socialist and non-socialist countries.

only this sub-group of countries is regressed, or when including a group-specific dummy, the regression may produce robust results.

4.4.2 Multicollinearity

One of the most obvious conclusions from the survey of arguments is that the different categories may have different effects on economic growth and the environment, both when it comes to the sign and the amplitude of the effect. Relating growth or environmental quality to the general economic freedom index can of course be of interest in itself. In addition, an index reduces some potential problems such as multicollinearity and missing values. However, the possibilities of turning the results into practical policies or further research topics are highly restricted. There is of course a limit to the extent of disaggregation, but it is in principle possible to continue as long as the categories are proxies of separate underlying institutions or do not affect each other considerably, i.e. as long as there is no severe problem of multicollinearity.

As already indicated, economic freedoms may have a self-enforcing element or may be inversely related to one another (see Section 4.2.4). If one of the economic freedom categories is highly correlated with another category, the t -values of these categories will be overestimated. Hence, excluding one category may make another significant, or the joint effect may be significant. There are criteria for detecting multicollinearity: for example the variance inflation factor and the condition number. However, these criteria only look at the correlation structure of the explanatory variables, even though the severity of multicollinearity also increases if the standard errors of the estimated regression coefficients are high, or if the total sum of squares is low. Maddala (2001) concludes that the criteria "... are only measures of how bad things are relative to some ideal situation, but the standard errors and t -ratios will tell a better story of how bad things are." Hence, there is no ideal test to detect multicollinearity. If there are reasons to believe that multicollinearity can cause problems, there should be an emphasis on sensitivity tests such as the extreme bound analysis (see Section 4.3.1). If the problem of interest is multicollinearity among the economic freedom categories, it is possible to get an indication of the severity by choosing one of the categories as the variable of interest and treating the other

categories as potential explanatory variables in the conditioning set. Another consequence of multicollinearity is that the parameters are sensitive to the inclusion and exclusion of observations. Therefore, parameter stability tests such as bootstrapping may be relevant (see Section 4.3.2).

4.4.3 Endogeneity and Causality

The problem of endogeneity caused by the fact that the economic freedom variables may affect the other explanatory variables, is not the main focus of this paper since we look at the direct effects of economic freedom. However, it is important to be aware of the loss of information ignoring the indirect effects implies, since the indirect effects of the variable of interest (in our case economic freedom) may even be larger than the direct effects. The disadvantage with a reduced form is that we lose the ability to distinguish the different channels through which institutions affect growth, although we do capture both the direct and indirect effects. Another potential endogeneity problem, already mentioned in Section 4.2.4, is that there might be endogenous relations among the economic freedom categories, creating multicollinearity.

Causality is related to the question: Do the independent variables cause the dependent variable or is it the other way around? It is easy to think of a situation where economic growth might affect economic freedom. The most straightforward example is perhaps the fact that growth makes the country richer and thereby more capable of covering the transformation costs of a reform. It is also possible that environmental quality affects economic freedom. Take the case when open access land is exhausted and the government implements better ownership rights in an attempt to hinder soil erosion. One way to test for causality is to use the Granger non-causality test.³⁰ The idea is to analyze whether the independent variables precede the dependent variable, or the dependent variable precedes the independent variable (see Maddala, 2001). The test has been criticized and should not be considered as a test giving a complete answer to the causal links (see e.g. Conway et al., 1984).

³⁰ See Heckelman (2000) and Dawson (forthcoming) for the causality between economic freedom and growth.

To minimize the potential problem with causality we could use a multiple equation system or instrument the variables in question (see for example Maddala, 2001). One solution is to regress the initial levels of economic freedom, or changes in economic freedom in a preceding period, on growth or environmental change in the following period. It is when the periods of the independent variable and the dependent variable overlap that we should be cautious. However, a problem connected to the use of lagged economic freedom variables as instruments is that these might as well be subject to reverse causality if they are dependent on expected future growth and environmental quality.

4.4.4 Non-Country Specific Effects

Easterly (2001) argues that factors other than country specific factors play a central role in growth regressions, at least for low-income countries during their 1980-1998 growth slow-down. He mentions factors such as terms of trade shocks, the US real interest rate, capital flows and the growth performance of industrial countries. Another potential explanation is skill-biased technical change that favored already industrialized countries (Acemoglu and Zilibotti, 2001). There are hence arguments that these external factors need to be given more attention relative to national factors (both when regressed on growth and on the environment) even though time period dummies in the cross-country regressions can capture them to some extent. This is especially true in low-income countries, which are often based on primary production and therefore subject to factors such as weather fluctuations and diseases. The proper measure in a growth regression is change in *potential* output and not actual output (Solow, 2001). Hence, external factors influencing the growth *potential*, both in steady state and during convergence, should be included.

5 CONCLUSIONS

The purpose of this paper was to discuss the effects of specific economic freedom categories on economic growth and the environment, and implication for cross-country analysis. The central question is not whether or not countries should undertake economic freedom reforms in general; it is rather a question of what kinds of economic

freedoms should be addressed, in what institutional context, at what pace and in what sequence. This is a very complex task, but if these dimensions are neglected the possible research and policy conclusions become restricted.

There are a number of empirical issues that are important to consider if we want to find reliable research and policy implications. These include awareness of measurement problems and model specification issues such as important interaction terms and non-linear effects. It is not possible to include all the empirical considerations, since it would eliminate the degrees of freedom. Theoretical insights are therefore of crucial importance in the choice of the most relevant issues, depending on the countries included and the variables of interest. Moreover, sensitivity tests should play a central role since the complexity of the links makes it impossible to identify all relevant variables.

The need for further knowledge of the links between market-based institutions and welfare is still very large. Pritchett (2001) states: “The inevitable problem is that the level of specificity at which most growth economists need to work is far greater than can ever be adequately informed by growth regressions,” but concludes that “growth regressions are incredibly useful in providing a general empirical background of stylized facts about the world.” Even though the interactions are very complex there does seem to be room for insights from cross-country regression, not only when it comes to the impacts on economic growth but also on the environment. It is evidently more difficult to find theoretical connections between economic freedom and the environment since the economic freedom institutions are designed to increase growth, but cross-country regressions might reveal some of the more general links. A regression with well-based theoretical hypotheses both when it comes to included variables and the functional form, and that has been shown to be robust to the model specification and extreme points, should give a reliable indication of the market-based institutions of importance. However, general policy conclusions should of course be based on country-specific analysis as well as cross-country regression.

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