A REFINED INGLEHART INDEX OF MATERIALISM AND POSTMATERIALISM

Oliver Hansen[a] and Richard S.J. Tol[b,c,d]

[a] Institute for Sociology, Hamburg University, Hamburg, Germany

[b] Centre for Marine and Climate Research, Hamburg University, Hamburg, Germany

[c] Institute for Environmental Studies, Vrije Universiteit, Amsterdam, The Netherlands

[d] Centre for Integrated Study of the Human Dimensions of Global Change, Carnegie Mellon University, Pittsburgh, PA, USA

October 21, 2003

Abstract

The Inglehart index of post-materialism is measured by people's priority for low inflation and order. We use regression analysis to correct national averages of the Inglehart index for the effects of observed inflation and (violent) crime rates for selected European, Asian and South American countries. Low inflation and low crime rates significantly increase the Inglehart index, but we also observe a trend towards post-materialistic values. This trend cannot be explained by economic growth alone.

1. Introduction

Ronald Inglehart (1971, 1977, 1981, 1990, 1997; Inglehart and Abramson, 1999) has introduced a measure of the extent to which a society adheres to "post-modern" (i.e. postmaterialistic), rather than modern or "pre-modern" (i.e. materialistic) attitudes. Inglehart's thesis is that advanced industrial societies have been undergoing an almost linear trend from a materialistic to a postmaterialistic value-orientation. This hypothesis, and the associated index have a widespread following (see, among others, Duch and Taylor, 1993; Kasser and Grow Kasser, 2001; Nichols Clark and Rempel, 1997) but also some critiques (see, among others, Witte, 1996; Klein, 1995; Davis and Davenport 1999; Clarke *et al.*, 1999). The measure of the index is based on the World Values Survey (WVS), the Eurobarometer Series and similar surveys. Essentially, the index combines the answers to two questions, the first about people's attitude to inflation, the second about law and order. People, who do think that inflation and crime should be low on the political agenda (i.e. people being attracted to freedom (of speech) and participation in the political process), are deemed post-modern. The average of the respondents' answers measure the attitude towards Postmaterialism of a country.

Acknowledging the intrinsic difficulties in measuring and averaging attitudes, we basically agree with Inglehart and others (among others, Rosengren 1984; Hofstede 1984) that "culture" can and should be measured. However, Inglehart ignores that people may dislike inflation and crime for other reasons than being (pre-)modern or materialistic. Inflation may cause substantial economic pain, and crime may be worse. One would expect that, in countries with high inflation and crime rates, people would put that higher on the political

agenda. Consequently, Inglehart's tendency towards Postmaterialism may simply result from the fact that in the 1970s (when measurements started) inflation was much higher than in the 1990s.

This note corrects Inglehart's index for inflation, crime rates and (un)employment. Our refined index shows the same qualitative behaviour as does the original index, but there are quantitative differences in the way societies are undergoing (cultural) shifts from Materialism to Postmaterialism.

The structure of the paper is as follows. In Section 2, we give a short overview of the Inglehart-index and discuss some of the critiques (Klein, 1995; Davis and Davenport, 1999; Clarke *et al.*, 1999). In Section 3, we present a regression model that refines the Inglehart-index by introducing inflation, crime rates, per-capita income and (un)employment. Section 4 concludes.

2. The Inglehart Index and its Critics

The original index was presented in 1971 in the American Political Science Review. It was created to measure an individual's hierarchy of policy relevant issues (Inglehart 1971, 994). According to Inglehart, culture is a system of attitudes, values and knowledge, widely shared within a society. Culture is learned and may vary between societies (Inglehart 1990, 18). Older people tend to accord to economic security, i.e. to materialistic views, whereas younger people tend towards self-expression and quality of life, i.e. to postmaterialistic views (Inglehart 1971, 991).[1] The so-called Inglehart-index is based on four items, which have been used since 1970 in the Eurobarometer-series and since the early 1980s in the World Values Survey (WVS). The question in the surveys is:

"There is a lot of talk these days about what this country's goals should be in the next ten or fifteen years. Would you please say which one of them you yourself consider most important in the long-run:

    a)   Maintaining the order of nation;

    b)   Giving the people more say in important government decisions

    c)   Fighting rising process; or

    d)   Protecting freedom of speech."

Respondents are asked to choose the most important one first, the second important one second. Acquisitive/materialist values reflect physical or economic insecurity, respondents chose items a) and c). Respondents having post-bourgeois/postmaterialist value-orientations choosing b) and d) (Inglehart, 1997, 994). Inglehart later introduces the category "Mixed type" (Inglehart 1977), which is seen as a person being able to swing to either side by choosing only one item from a) and c) and the other from b) and d).

In reaction to early critics, Inglehart (1977) agrees in his book "The silent revolution" that the four-item-index is only a rough indicator for values and value changes. It taps into a wide range of preferences, but is sensitive to short-term influences. Temporarily high inflation or unemployment may lead to decreasing shares of postmaterialists, while high rates of economic growth may enhance the trend towards postmaterialism (Inglehart, 1997, 58-59). To make the index more robust, Inglehart (1977, 39ff.; 1990, 74-75) developed a 12-item-index,

which – unfortunately – was only used in the Eurobarometer-series in 1973, 1978 and 1988, and therefore of little value to wider comparisons in space or time.

The creation of the Inglehart-index was followed by huge controversies about its validity. Based on his case-study on Germany from 1973 to 1992, Klein (1995, 226ff) criticizes the one-dimensional way of measuring value change. In his approach, he ran a multinominal-logit model after building age cohorts to show the effects when an individual swings from materialistic to the mixed type and from the mixed type to postmaterialistic value-orientations. He concludes that there is only a relative change in value-orientation and no general linear trend in absolute value changes towards Postmaterialism. Unemployment rates and inflation are only seen as period effects affecting the index only short-term. Similar to Inglehart, Klein states that the materialistic orientation is due to generational settings, the more postmaterialistic orientation is due to the socialization process (i.e. after reaching physical security) (Klein, 1995, 226).

Clarke *et al.* (1999) and Davis and Davenport (1999) study how economic influences affect the index. They argue that the index only measures current political issues, the remainder being nothing more than noise. A rise in the inflation rate would lead to an increase in observed materialism, while a rise in unemployment would increase the observed number of Postmaterialists and Mixed types; this is because higher unemployment, not included in the index, causes lower inflation (e.g., Samuelson and Nordhaus, 2001). Clarke *et al.* (1999) show similar effects for Canada and Germany. Using a multinominal logit model, Clarke *et al.* (1999, 642ff) show how different covariates like education, gender, income and region affect the index, although only with low Pseudo R^2 of .09 for Germany and .14 for Canada. In their interpretation, respondents worried about unemployment are forced to choose among items that they worry less about. As a consequence, they may be classified as Postmaterialists or Mixed types. Postmaterialism is therefore positively correlated with unemployment (Clarke *et al.,* 1999, 638).

In their study of the USA, Davis and Davenport (1999) report two tests that would show the inadequacy of the index. Firstly, they test whether the interview results differ from random answers. They conclude: "The pattern of individual responses to the postmaterialist-materialist questions does not differ significantly from what is expected by chance alone" (ibid., 662-663) but this conclusion may be biased because they use one-sided tests only, rather than more appropriate two-sided tests. Secondly, they use a multinominal logit model for 1992 and 1994. Inglehart argues that people grow less materialistic as they grow richer; but Davis and Davenport find that richer Americans are not less materialistic than poorer Americans. Although puzzling, this of course does not refute Inglehart's argument. Davis and Davenport (1999) also argue that the Inglehart index cannot be used to predict attitudes toward social or political issues.

Our approach is different. Firstly, we use aggregate values of the Inglehart index rather than individual values, interpreting the index as a measure of shared rather than personal attitudes. See Hofstede (1984) for a discussion of the statistics of ecological values. Secondly, we look at the Inglehart index for as many countries and times as possible, so that we capture a much wider range of values of both the index and its explanatory variables. Thirdly, we test whether the observed values Inglehart index can be fully explained by unemployment, inflation and crime rates; Clarke *et al.* (1999) and Davis and Davenport (1999) omit crime, although "maintaining order in the nation" may well be interpreted as an issue of individual security. We find that the Inglehart index can only be partially explained, and that a trend towards postmaterialism remains, albeit slower than argued by Inglehart.

3. Results

Table 1 shows the countries and years for which we have observations of the Inglehart index[2]. We decided to remove countries with less than three observations from the data-set. This leaves 133 observations. Inflation, unemployment and income data were taken from the World Resources Database (WRI, 2001). Our measure of inflation is the percent increase in the consumer price index. We use the natural logarithm of inflation because of the very high inflation rates in Argentina. We could match the data on the Inglehart index with inflation data for 130 observations, as deflation was recorded in Germany in 1986, the Netherlands in 1987 and Japan in 1995. We use the natural logarithm of unemployment and per capita income as this fits the data better. Crime data were taken from the National Archive of Criminal Justice Data of the University of Michigan (Burnham and Burnham, 1997). Crime rates are reported as the number of cases per 1000 people. The data-set distinguishes between assault, drug offences, fraud, homicide, rape, robbery and theft. The crime data are reported for different years than the Inglehart index data, so we linearly interpolated the crime rates. The crime data are sparse. We could only match crime data for 47 of the observations of the Inglehart index (55 if we exclude rape). The crime data does not contain observations for Argentina, Belgium, and Germany. Because we want to maintain an internally consistent data-set, we did not try to fill these gaps from other sources.

Table 2 shows regression results for eight alternative models. The results are based on ordinary least squares.[3] In the first model (A), we only include a time trend, as Inglehart suggests. In the second model (B), we add inflation. In the third model (C), we add crime rates. In the fourth model (D), we remove all individually and jointly insignificant explanatory variables. These four models come in two varieties. In the first variety, we use the same constant for all countries. In the second variety, we use different constants.

Country-specific constants explain a substantial part of the variance; see Table 1. This may be due to differences in the surveys, general differences between countries, or differences in the way countries have developed (i.e., "modernity"). If the latter is the case, we should exclude country-specific constants, otherwise, we should include them. Unfortunately, we cannot test this, so we include results with and without country-specific constants. The estimated constants, however, do not show any clear pattern (results not shown), so we prefer the models with county-specific constants to the models without. The estimated dummies are highly significant.

Model A in Table 2 reconfirms Inglehart's conclusion that there is a trend towards post-modernity. We estimate that the index increases by 0.012 per year. The model without country-specific constants puts this number a bit lower, at 0.009; the difference between the estimated trends is significant at the 67% level, but not at the 95% level. GDP per capita is a significant explanatory variable, but it explains neither the trend nor the country dummies.

Model B in Table 2 shows that observed inflation partly explains people's concern about inflation. The sign is as expected: Higher inflation leads to lower scores on the Inglehart index. However, the trend towards post-modernity remains and significantly deviates from zero at the 95% level. It falls, however, to 0.010 (significantly different from model A at the 67% level) with country-specific constants and to 0.004 (significantly different from model A at the 95% level) without country-specific constants. Following Clark *et al.* (1999) and Davis

---

[2] To run the following model, we set the boundaries from 1 (Materialist choosing a) and c) from the Four-item-index) to 3 (Postmaterialist, choosing b) and d) from the Four-item-index), while 2 means the Mixed Type (choosing either a) and c) or b) and d)). The aggregated individual choices form a country's value-orientation, using the average value. All values in-between are possible and will show the trend towards Postmaterialism in the observed countries over the reported years.

[3] Strictly speaking, the Inglehart index is bounded from below (by 1) as well as above (by 3). A double-censored Tobit regression did not lead to substantially different results, however, because the observed index values are relatively far from their bounds.

and Davenport (1999), we include unemployment as an additional explanatory variable. It is not significant. GDP per capita is significant, reducing but not removing the influence of time and inflation. Higher incomes lead to higher post-materialism.

Models C and D in Table 2 show the effect of including crime rates. The results should be interpreted with caution as the data are crude and the sample is small. We see that an increase in crime leads to a lower Inglehart index as expected, with the exception of drug offences which are positively correlated with Postmaterialism. One explanation is that a drug use could be a sign of Postmaterialism (like self-expression or the "quality" of life), criminalized by a modern legislation. The trend towards Postmaterialism remains and significantly deviates from zero at the 95% level. If falls to 0.010 (not significantly different from model A) with country-specific constants and to 0.004 (significantly different from model A at the 95% level) without country-specific constants. We also include unemployment as an explanatory variable. It is significant at the 67% level. Higher unemployment leads to lower post-materialism. The trend towards post-materialism is not affected, though. The other explanatory variables are affected, as unemployment is correlated to both inflation and crime rates. GDP per capita is significant at the 67% level, but has a negative sign (opposite to expectations). The other explanatory variables, particularly the time trend, are affected by the inclusion of GDP per capita. Table 3 shows the refined Inglehart index, based on Model B4, as also correcting for crime would lead to many missing observations.

4. Conclusions

We therefore conclude that Inglehart's finding that there is a trend towards post-materialism, as measured by people's increasing disregard for inflation and crime, cannot be explained by differences in inflation and crime rates. There seems to be genuine trend towards post-modernity in every observed society. However, the "true" trend is slightly lower than Inglehart originally claimed. The Inglehart index of post-materialism has been criticized for confounding shifts in values with shifts in the issues about which interviewers are asked to express an opinion. In a panel data analysis, we find that although the issues affect the survey results, a trend towards post-materialism can be observed, albeit slight slower than postulated by Inglehart.

Acknowledgements

References :

Burnham, Helen & Burnham R.W. 1997: United Nations World Surveys on crime
     trends and criminal justice systems 1970-1994: Restructured Five-Wave-Data.
     Washington, DC: United States Department of Justice
     (National Institute of Justice).

Clarke, Harold D. & Kornberg, Allan & McIntyre, Chris & Bauer-Kaase, Petra &
Kaase, Max (Clarke et.al.) 1999: The effect of economic priorities
     on the measurement of value change: New experimental evidence.
     In: American Political Science Review 93 (3), 1999.

Davis, Darren & Davenport, Christian 1999: Assessing the validity of the
     Postmaterialism-Index. In: American Political Science Review 93 (3), 1999.

Duch, Raymond M. & Taylor, Michael A. 1993: Postmaterialism and the
     economic condition. In: American Journal of Political Science (37) 3, pages 747-779.

Eurobarometer Series 1970-2000: CD-ROM from Zentralarchiv für empirische
     Sozialforschung Köln, Germany (producer and distributor) and Inter-university
     Consortium for Political and Social Research (ICPSR). Michigan: Ann Arbor.

Hofstede, Geert 1984: Culture's consequences. Beverly Hills : Sage.

Inglehart, Ronald 1971: The silent revolution in Europe. Intergenerational change in
     post-industrial societies. In: American Political Science Review 65 (4), 1971.

Inglehart Ronald 1977: The silent revolution. Changing values and political styles
     among Western Publics. Princeton: Princeton University Press.

Inglehart, Ronald 1980: Zusammenhang zwischen sozioökonomischen
     Bedingungen und individuellen Wertprioritäten. In: Kölner Zeitschrift
     für Soziologie und Sozialpsychologie 32 (1980), Seiten 144-153.

Inglehart, Ronald 1981: Post-Materialism in an environment of insecurity.
     In: American Political Science Review 75 (4), 1981.

Inglehart, Ronald 1990: Culture shift in advanced industrial society.
     Princeton: Princeton University Press.

Inglehart, Ronald 1997: The trend towards postmaterialist values continues.
     In: Clark Nichols, Terry & Rempel, Michael (ed.) 1997: Citizen Politics
     in post-industrial societies. Boulder and Oxford: Westview Press.

Inglehart, Ronald & Abramson Paul R. 1999: Measuring Postmaterialism.
     In: American Political Science Review 93 (3), 1999.

Inglehart, Ronald, et al. 2000: WORLD VALUES SURVEYS AND EUROPEAN VALUES SURVEYS, 1981-1984, 1990-1993, and 1995-1997:

[Computer file]. ICPSR-version. Ann Arbor, MI: Institute for Social

Research [producer]. Ann Arbor, MI:

Inter-university Consortium for Political and Social Research [distributor].

Kasser, Tim & Grow Kasser, Virginia 2001: The dreams of people high and low

in materialism. In: Journal of Economic Psychology 22 (2001), pages 693-719.

Klein, Markus 1995: Wieviel Platz bleibt im Prokustesbett?

Wertewandel in der Bundesrepublik Deutschland zwischen 1973 und 1992

gemessen anhand des Inglehart-Index. In: Kölner Zeitschrift für Soziologie

und Sozialpsychologie 47 (1995), pages 207-230.

Nichols Clark, Terry & Rempel, Michael (ed.) 1997: Citizen Politics in

Post-Industrial Societies. Boulder (Colorado): Westview Press.

Rosengren, Karl-Erik 1984: Cultural indicators for the comparative study of culture.

In: Melischek, Gabriele & Rosengren, Karl-Erik & Stappers, James 1984:

Cultural indicators: An international symposium.

Vienna: Verlag der Österreichischen Akademie der Wissenschaften.

Samuelson, Paul A. & Nordhaus, William D. 2001: Economics (17th edition). Boston:

McGraw-Hill.

Witte, Erich H. 1996: Wertewandel in der Bundesrepublik Deutschland zwischen 1973

und 1992. Alternative Interpretationen zum Inglehart-Index.

In: Kölner Zeitschrift für Soziologie und Sozialpsychologie 48 (1996), pages 534-541.

Table 1. Observations of the Inglehart index.

Country	Year
Argentina[a]	1981, 1990, 1995
Belgium[b]	1970, 1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Denmark[b]	1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
France[b]	1970, 1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Germany[b]	1970, 1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Greece[b]	1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Ireland[b]	1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Italy[b]	1970, 1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Japan[a]	1981, 1990, 1995
Netherlands[b]	1970, 1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997
Portugal[b]	1986, 1987, 1989, 1991, 1992, 1994, 1997
South Korea[a]	1981, 1990, 1995
Spain[b]	1986, 1987, 1989, 1991, 1992, 1994, 1997
United Kingdom[b]	1976, 1978, 1980, 1982, 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1997

[a] Source: World Value Survey.

[b] Source: Eurobarometer.

Table 2. Regression results.

	A1	A2	A4	B1	B2	B3	B4	C1	C2	D1	D2	D3	D4
Trend	0.009***	0.012***	0.008***	0.007***	0.010***	0.010***	0.007***	0.005*	0.015**	0.004*	0.010**	0.012***	0.025**
LnInflation	-	-	-	-0.054***	-0.034***	-0.034***	-0.022*	-0.096***	-0.008	-0.091***	-0.032*	-0.026*	-0.017
Assault	-	-	-	-	-	-	-	-0.001	-0.022**	-	-0.012*	-0.016**	-0.002
Drugs	-	-	-	-	-	-	-	0.070**	0.081*	0.065**	0.098**	0.117***	0.116***
Fraud	-	-	-	-	-	-	-	-0.008	-0.055**	-	-0.034**	-0.026*	-0.023*
Homicide	-	-	-	-	-	-	-	-0.949*	0.601	-0.981*	-	-	-
Rape	-	-	-	-	-	-	-	0.045	-1.111*	-	-	-	-
Robbery	-	-	-	-	-	-	-	-0.029	0.091	-	-	-	-
Theft	-	-	-	-	-	-	-	0.002*	-0.001	0.001*	-	-	-
lnUnemployment	-	-	-	-	-	-0.001	-	-	-	-	-	-0.103*	-0.161**
lnGDP/capita	-	-	0.199***	-	-	-	0.214***	-	-	-	-	-	-0.521*
Country	no	yes	no	no	yes	yes	yes	no	yes	no	yes	yes	Yes
R^2	0.16	0.72	0.72	0.28	0.75	0.75	0.73	0.71	0.93	0.68	0.89	0.89	0.90
N	133	133	119	130	130	130	117	47	47	55	55	55	55

Table 3. The original and refined Inglehart index of post-materialism.

Country	Year	Inglehart index	Refined Inglehart index
Argentina	1981	1.79	1.69
	1990	1.94	1.77
	1995	2.11	2.08
Belgium	1970	1.81	1.78
	1976	1.84	1.79
	1978	1.76	1.73
	1980	1.76	1.72
	1982	1.71	1.66
	1984	1.70	1.66
	1986	1.76	1.75
	1987	1.73	1.72
	1989	1.91	1.88
	1991	1.88	1.85
	1992	1.84	1.81
	1994	1.78	1.76
	1997	1.84	1.83
Denmark	1976	1.73	1.68
	1978	1.82	1.77
	1980	1.65	1.59
	1982	1.87	1.82
	1984	1.83	1.79
	1986	1.90	1.87
	1987	2.00	1.97
	1989	2.04	2.01
	1991	2.17	2.15
	1992	2.19	2.17
	1994	2.21	2.19
	1997	2.22	2.20
France	1970	1.72	1.68
	1976	1.72	1.67
	1978	1.80	1.75
	1980	1.72	1.66
	1982	1.78	1.73
	1984	1.74	1.70
	1986	1.75	1.72
	1987	1.83	1.81
	1989	1.93	1.90
	1991	1.94	1.91
	1992	1.97	1.95
	1994	1.95	1.94
	1997	2.00	2.00
Germany	1970	1.65	1.62
	1976	1.70	1.67
	1978	1.74	1.72
	1980	1.70	1.66
	1982	1.89	1.85
	1984	1.97	1.95
	1986	2.05	
	1987	2.08	2.12
	1989	2.00	1.98
	1991	1.98	1.95

	1992	1.85	1.82
	1994	1.86	1.84
	1997	1.89	1.88
Greece	1982	1.77	1.70
	1984	1.69	1.62
	1986	1.59	1.52
	1987	1.69	1.63
	1989	1.73	1.67
	1991	1.78	1.71
	1992	1.76	1.70
	1994	1.73	1.68
	1997	1.76	1.72
Ireland	1976	1.59	1.53
	1978	1.57	1.52
	1980	1.57	1.50
	1982	1.70	1.64
	1984	1.63	1.58
	1986	1.68	1.65
	1987	1.75	1.72
	1989	1.86	1.83
	1991	1.85	1.82
	1992	1.88	1.85
	1994	1.83	1.81
	1997	1.81	1.80
Italy	1970	1.78	1.74
	1976	1.70	1.64
	1978	1.67	1.61
	1980	1.47	1.40
	1982	1.67	1.61
	1984	1.67	1.62
	1986	1.75	1.70
	1987	1.69	1.66
	1989	1.81	1.77
	1991	1.89	1.85
	1992	1.81	1.77
	1994	1.93	1.90
	1997	1.82	1.80
Japan	1981	1.69	1.65
	1990	1.81	1.78
	1995	1.81	
Netherlands	1970	1.71	1.68
	1976	1.82	1.77
	1978	1.92	1.87
	1980	1.76	1.72
	1982	1.97	1.93
	1984	1.89	1.86
	1986	2.01	2.06
	1987	1.96	
	1989	2.18	2.18
	1991	2.10	2.07
	1992	2.10	2.07
	1994	2.03	2.01
	1997	2.15	2.13

Portugal	1986	1.52	1.46
	1987	1.52	1.47
	1989	1.61	1.55
	1991	1.62	1.57
	1992	1.61	1.56
	1994	1.57	1.53
	1997	1.65	1.63
South Korea	1981	1.66	1.59
	1990	1.65	1.60
	1995	1.59	1.56
Spain	1986	1.60	1.55
	1987	1.68	1.64
	1989	1.73	1.69
	1991	1.95	1.91
	1992	1.87	1.83
	1994	1.76	1.72
	1997	1.87	1.85
UK	1976	1.71	1.65
	1978	1.68	1.63
	1980	1.68	1.62
	1982	1.88	1.83
	1984	1.91	1.87
	1986	1.88	1.85
	1987	1.96	1.93
	1989	2.01	1.96
	1991	1.94	1.90
	1992	1.93	1.90
	1994	1.96	1.94
	1997	1.95	1.94

Working Papers

Research Unit Sustainability and Global Change

Centre for Marine and Climate Research, Hamburg University, Hamburg

Hansen, O. and R.S.J. Tol (2003), *A Refined Inglehart Index of Materialism and Postmaterialism*, **FNU-35** (submitted)

Heinzow, T. and R.S.J. Tol (2003), *Prediction of Crop Yields across four Climate Zones in Germany: An Artificial Neural Network Approach,* **FNU-34** (submitted)

Tol, R.S.J. (2003), *Adaptation and Mitigation: Trade-offs in Substance and Methods,* **FNU-33** (submitted)

Tol, R.S.J. and T. Heinzow (2003), *Estimates of the External and Sustainability Costs of Climate Change*, **FNU-32** (submitted)

Hamilton, J.M., Maddison, D.J. and Tol, R.S.J. (2003), *Climate change and international tourism: a simulation study,* **FNU-31 (**submitted**)**

Link, P.M. and R.S.J. Tol (2003), *Economic impacts of changes in population dynamics of fish on the fisheries in the Barents Sea*, **FNU-30** (submitted)

Link, P.M. (2003), *Auswirkungen populationsdynamischer Veränderungen in Fischbeständen auf die Fischereiwirtschaft in der Barentssee*, **FNU-29** (forthcoming in *Essener Geographische Arbeiten*)

Lau, M. (2003), *Coastal Zone Management in the People's Republic of China – An Assessment of Structural Impacts on Decision-making Processes*, **FNU-28** (submitted)

Lau, M. (2003), *Coastal Zone Management in the People's Republic of China – A Unique Approach?*, **FNU-27** (*China Environment Series,* Issue 6, pp. 120-124; http://www.wilsoncenter.org/topics/pubs/7-commentaries.pdf)

Roson, R. and R.S.J. Tol (2003), *An Integrated Assessment Model of Economy-Energy-Climate – The Model Wiagem: A Comment*, FNU-26 (submitted to *Integrated Assessment*)

Yetkiner, I.H. (2003), *Is There An Indispensable Role For Government During Recovery From An Earthquake? A Theoretical Elaboration*, **FNU-25**

Yetkiner, I.H. (2003), *A Short Note On The Solution Procedure Of Barro And Sala-i-Martin for Restoring Constancy Conditions*, **FNU-24**

Schneider, U.A. and B.A. McCarl (2003), *Measuring Abatement Potentials When Multiple Change is Present: The Case of Greenhouse Gas Mitigation in U.S. Agriculture and Forestry*, **FNU-23** (submitted)

Zhou, Y. and Tol, R.S.J. (2003), *The Implications of Desalination to Water Resources in China - an Economic Perspective*, FNU-22 (forthcoming in *Desalination*)

Yetkiner, I.H., de Vaal, A., and van Zon, A. (2003), *The Cyclical Advancement of Drastic Technologies*, **FNU-21**

Rehdanz, K. and Maddison, D. (2003) *Climate and Happiness*, **FNU 20** (submitted)

Tol, R.S.J., (2003), *The Marginal Costs of Carbon Dioxide Emissions: An Assessment of the Uncertainties*, **FNU-19** (submitted).

Lee, H.C., B.A. McCarl, U.A. Schneider, and C.C. Chen (2003), *Leakage and Comparative Advantage Implications of Agricultural Participation in Greenhouse Gas Emission Mitigation*, **FNU-18** (submitted).

Schneider, U.A. and B.A. McCarl (2003), *Implications of a Carbon Based Energy Tax for U.S. Agriculture*, **FNU-17** (submitted).

Tol, R.S.J. (2002), *Climate, Development, and Malaria: An Application of* FUND, **FNU-16** (submitted).

Hamilton, J.M. (2003), *Climate and the Destination Choice of German Tourists,* **FNU-15** (revised and submitted).

Tol, R.S.J. (2002), *Technology Protocols for Climate Change: An Application of* FUND, **FNU-14** (submitted to *Climate Policy*).

Rehdanz, K (2002), *Hedonic Pricing of Climate Change Impacts to Households in Great Britain*, **FNU-13** (submitted to *Climatic Change*).

Tol, R.S.J. (2002), *Emission Abatement Versus Development As Strategies To Reduce Vulnerability To Climate Change: An Application Of* FUND, **FNU-12** (submitted to *Environment and Development Economics*).

Rehdanz, K. and Tol, R.S.J. (2002), *On National and International Trade in Greenhouse Gas Emission Permits*, **FNU-11** (submitted).

Fankhauser, S. and Tol, R.S.J. (2001), *On Climate Change and Growth*, **FNU-10** (submitted to *Resource and Energy Economics*).

Tol, R.S.J.and Verheyen, R. (2001), *Liability and Compensation for Climate Change Damages – A Legal and Economic Assessment*, **FNU-9** (forthcoming in *Energy Policy*).

Yohe, G. and R.S.J. Tol (2001), *Indicators for Social and Economic Coping Capacity – Moving Toward a Working Definition of Adaptive Capacity*, **FNU-8** (*Global Environmental Change*, **12** (1), 25-40).

Kemfert, C., W. Lise and R.S.J. Tol (2001), *Games of Climate Change with International Trade*, **FNU-7** (forthcoming in *Environmental and Resource Economics*).

Tol, R.S.J., W. Lise, B. Morel and B.C.C. van der Zwaan (2001), *Technology Development and Diffusion and Incentives to Abate Greenhouse Gas Emissions*, **FNU-6** (submitted to *International Environmental Agreements*).

Kemfert, C. and R.S.J. Tol (2001), *Equity, International Trade and Climate Policy*, **FNU-5** (*International Environmental Agreements*, **2**, 23-48).

Tol, R.S.J., Downing T.E., Fankhauser S., Richels R.G. and Smith J.B. (2001), *Progress in Estimating the Marginal Costs of Greenhouse Gas Emissions*, **FNU-4**. (*Pollution Atmosphérique – Numéro Spécial: Combien Vaut l'Air Propre?*, 155-179).

Tol, R.S.J. (2000), *How Large is the Uncertainty about Climate Change?*, **FNU-3** (*Climatic Change*, **56** (3), 265-289).

Tol, R.S.J., S. Fankhauser, R.G. Richels and J.B. Smith (2000), *How Much Damage Will Climate Change Do? Recent Estimates*, **FNU-2** (*World Economics, ***1** (4), 179-206)

Lise, W. and R.S.J. Tol (2000), *Impact of Climate on Tourism Demand*, **FNU-1** (*Climatic Change*, **55** (4), 429-449).