Economic Structural Change and Cancer Incidence

Fabrizio Ferretti ♪, *

Facoltà di Bioscienze e Biotecnologie, Dipartimento di Scienze Sociali,
University of Modena and Reggio Emilia,
Viale Allegri, 9 - 42121 Reggio Emilia, Italy.

After heart disease, cancer is the most common cause of death in many developed countries. Understanding how the overall cancer incidence evolves during economic growth can help macroeconomic attempts to forecast the economic impact of cancer and to manage resources allocation in planning health services. In this paper, we discuss the relationship between economic growth and cancer incidence. The purposes of the paper are to describe and measure the influence of an increasing real per capita income on the overall incidence of cancer. Using worldwide cross-sectional data for 162 countries, regression results with crude and age-standardised rates, allow us to measure the elasticity of cancer incidence with respect to per capita income, and to decompose the elasticity coefficient into two components: age-effect and lifestyle-effect. Finally, we try to develop a basic framework in order to explain how economic structural changes on the demand-side can affect the evolution of cancer incidence. **JEL codes: O110, I190.**

1. Introduction

In every human society, quality of life is the outcome of many different variables. Some of these variables, however, show a positive and significant correlation with per capita income, usually measured by the ratio of real gross national income (GNI) to population. This is why the real GNI per capita is often used as the first and basic indicator of standard of living.

Health is a fundamental dimension of quality of life. In fact, almost all indices of

economic and social well-being contain at least one variable for measuring health conditions. There are some important exceptions, but in the long-run, higher values of real per capita income usually correspond to better hygiene and sanitary conditions. During growth, however, each society undergoes several important changes in both demand and supply of health care. Thereby, the process of economic growth modifies the composition and order of importance of the main population health problems.

This paper analyses one of the foremost of these changes in society's health problems, and focuses on the relationship between economic growth and cancer incidence. In particular, we explore this relationship at the macroeconomic level, using worldwide cross-sectional data for 162 countries in 2002. First, we attempt to collect some empirical regularities concerning how an increasing real per capita income influences the overall incidence of cancer. Second, we use these results to introduce some basic hypotheses about how the demand-side economic structural changes can affect the evolution of cancer incidence in a given population.

Understanding and measuring how cancer incidence evolves during economic growth can be useful for forecasting the economic impact of cancer and for governing the process of resources allocation in planning health services. However, it is necessary to emphasise that this is not a study about social and economic factors causing cancerous diseases. This paper simply highlights some basic empirical regularities and theoretical insights to be considered for further research in order to develop an economic theory of cancer incidence.

The remainder of the paper is organized as follows. Section 2 briefly introduces three essential measures of cancer frequency. Section 3 is devoted to quantitative analysis. Section 4 contains a sketch of a theory of cancer incidence within a structural economic dynamics framework. Section 5 concludes the paper with some suggestion for further research.

2. Basic measures of cancer frequency

In order to describe and measure the frequency of cancerous diseases, epidemiology utilises three main indicators: incidence, prevalence and mortality. Incidence and mortality are flow variables. They indicate the number of new cancer cases and the number of deaths due to cancer, respectively, which occur in a specific population over a given period (usually 1 year). Prevalence is a stock variable. It indicates the number of cancer cases in a specific population at a given point in time (Last, 2001).

Data on incidence, prevalence and mortality are usually expressed as absolute numbers or as rates. Rates can be crude or age-standardised. A crude rate is calculated by dividing the absolute number of new cases, cases or deaths by the corresponding number of people in the population at risk. An age-standardised rate is a weighted average of the age-specific crude rates, where the weights are the proportion of people in the corresponding age groups of a specific standard population. These age-adjusted rates are calculated to allow comparison between populations with different age structures, and they are particularly useful in making international comparisons. In this case, the most frequently used standard population is the world standard population (WHO, 2003) and the results are usually presented as annual rates per 100,000 persons at risk.

Where raw data are regularly collected by local cancer registry, these basic measures of cancer frequency can be computed for each type of cancer, usually classified according to the International Classification of Diseases (ICD) or for all cancerous diseases as a whole (WHO, 2005). In this latter case, epidemiologists usually refer to the overall

prevalence rate as a measure of society's cancer burden. In the same way, since incidence is regarded as a useful approximation to the average risk of developing any type of cancer, the overall incidence rate is considered as an index of the level of cancer risk factors that exist in a given society, during a given period. Finally, the overall mortality rate provides an approximation to the average risk of dying from some type of cancer.

3. Some international evidence

Economic growth can affect cancer incidence, prevalence and mortality in various ways. In this paper we focus on the influence of a long-term increase in real per capita income on the overall incidence rate of all types of cancer.

Using data from the World Bank (WB) and the World Health Organization (WHO), we develop an empirical analysis of the relationship between economic growth and cancer incidence. For this purpose, we use cross-sectional data on per capita income and cancer incidence in 2002, for 162 countries included in WB and WHO statistical databases, and for a subset of these 162 countries, which consist of a more homogeneous group of 41 countries, that are characterised by a "Western lifestyle". In this subset there are 36 European countries plus Australia, Canada, New Zealand and the USA (from now, we simply refer to the whole set as the World group and to the subset as the Western group).

More particularly, real per capita income is measured by the ratio of GNI to population and it is expressed in current international dollars, using purchasing power parity (PPP) rates (World Bank, 2004). Cancer incidence is measured by the crude and the age-standardised rates of all types of cancer ("all sites, but non melanoma skin", according to the ICD classification) provided by the WHO within *Globocan project* (Bray *et al.*, 2004). In fact, International Agency for Research on Cancer (IARC) publishes free

software with worldwide estimation of cancer incidence, prevalence and mortality. For cancer incidence, these data include absolute numbers of new cancer cases, and crude and age-standardised rates, in both the male and female population.

Table 1 contains a short description and some basic descriptive statistics of all variables for the two groups of countries (the complete database is available from the author).

As a useful starting point to highlight this issue, in Figures 1 and 2, the crude rate of incidence of all types of cancers within the total population (TCR) is plotted against the per capita income (Y) for all 162 countries and for the subset of 41 countries. Both scatter plots seem to suggest a strong influence of real per capita income on the average risk of developing some type of cancer.

In order to measure the magnitude of this influence, Tables 2 and 3 show the results of ordinary least square (OLS) estimations of the relationship TCR = f(Y) in three different specifications: linear, quadratic and double-log. The goodness of fit is fairly high in all equations. The crude rate shows a strong positive and significant relationship with per capita income, but it tends to increase less than proportionally with respect to Y. In other words, during economic growth the crude rate of cancer incidence increases, but it evolves drawing approximately the early stage of an inverted U-shaped curve. Indeed, the quadratic and double-log forms are the two specifications that best fit data for the World and Western groups, respectively.

This analysis, however, neglects the powerful influence of sex and age on cancer incidence. Thus, it is necessary to repeat OLS estimation using crude and age-standardised rates (ASR), in both the male and female populations (again in linear, quadratic and double-log specifications).

The simple decomposition of crude rate by sex does not alter the previous results (as shown in Tables 2 and 3). Instead, using age-standardised rates there is a slight reduction in the goodness of fit. Changes in per capita income, however, continue to explain an important part of the change in cancer incidence. This effect is not due to the positive influence of economic growth on the average duration of life.

In particular, a straight line best describes the relationship between real per capita income and cancer incidence within the female population in both groups of data, while quadratic and double-log forms provide a reasonably close approximation to data for the male population in countries within the World and Western groups, respectively. All this seems to confirm a relevant negative effect of economic growth on the presence of cancer risk factors in different populations.

3.1. Income elasticity of cancer incidence

These results suggest that economic growth has a negative influence on cancer incidence, but they also indicate that in some cases cancer incidence tends to rise less than proportionally with respect to the increase in real per capita income. Moreover, the negative effect of economic growth on the overall rate of cancer incidence seems to be only partially related to the implications of an ageing population. Results of our regressions on crude and age-standardised rates indicate that there are both a *gross* and a *net* effect of economic growth on cancer incidence, respectively.

Regression models using the double-log specification allow us to easily calculate the elasticity of cancer incidence with respect to real per capita income. These coefficients provide an idea of the dimensions of both *gross* and *net* effects of economic growth on cancer incidence.

As shown in Table 4, all elasticities are positive but less than one. On average, the coefficient is about 0.4 for countries within the World group and 0.2 for those within the Western group. Differences in elasticity between these two groups, however, are mainly due to the effect of economic growth on the average life expectation at birth. As a matter of fact, using the age-standardised rates cancer incidence increases, on average, by 0.23 and 0,16% in the World and Western groups, respectively, for each 1% increase in real per capita income.

Finally, using regression results from the quadratic specification, we can calculate the average hypothetical threshold level of Y (that is, the real per capita income beyond which cancer incidence starts diminishing, Y*). As shown in Table 4, in a long-run perspective, the process of economic growth may tend to exhaust the strong *net* negative effect on cancer incidence. However, our results within the male population indicate that this threshold level of real per capita income is extremely high (about $33,000 and $35,000 for the World and Western groups, respectively).

4. Economic growth, structural change and cancer incidence

At the microeconomic level, many studies have examined how personal income and wealth can influence individual exposure to cancer risk factors. On the contrary, macroeconomic analysis of this issue seems to be a relatively underdeveloped area of research. Previous studies in this field have highlighted that the evolution of cancer incidence in a growing economy is a very complex subject that should be approached in an interdisciplinary framework (Ukraintseva and Yashin, 2005). To contribute to this aim, here, we develop a very basic economic model that can provide some insights into building a more realistic and complex theory (Bosanquet and Sikora, 2006).

As in other stock–flow relationships, for a given average duration of the disease prevalence is a function of the incidence and

mortality rates. In the following discussion, this kind of stock–flow relationship allows us to simply focus on cancer incidence and mortality, in order to develop an elementary framework where, *ceteris paribus*, changes in mortality and incidence rates during economic growth are primarily due to structural changes operating on the supply and demand sides of the economy, respectively.

More particularly, on the supply side, as real GNI per capita income increases, better medical and surgical treatments become available, and notably, better techniques for early diagnosis. All these technical changes can dramatically reduce cancer mortality. This is why, other things being equal, for a given incidence rate, economic growth implies a notable increase in prevalence rate (Capocaccia *et al.*, 2002). In contrast, on the demand side of the economy, long-run increases in real per capita income tend to raise the average life expectation at birth. Since the average risk of developing any type of cancer is strongly influenced by age, economic growth may lead to an increase in the overall incidence rate of cancerous diseases.

In this paper we focus only on the demand-side effects of economic growth on cancer incidence. Economic and social structural changes that characterise the processes of economic growth deeply modify the population's habits and lifestyles. Studies on cancer aetiology point out the multifactorial nature of these types of diseases and the great importance of habits and lifestyles as risk factors (Nasca, 2007). As a result, economic growth tends to modify population exposure to cancer risk factors (such as, nutritional and environmental risk factors).

Considering these structural changes from the demand side of the economy, an Engel's function may be a simple, but very useful tool for analysing how cancer incidence changes during economic growth. From this perspective, exposure to cancer risk factors can be thought as the consequence of the characteristics of goods and services that enter the average consumption bundle demanded by the representative consumer at each stages of economic growth.

If there is something that we do positively know about expansion of per capita demand when real income increases, it is that per capita demand for each commodity usually does not increase proportionally (Pasinetti, 1981). This is a well-known generalisation of Engel's law: it simply states that the proportion of income spent on each type of goods and services changes as real per capita income increases, because consumers increase consumption along a hierarchy of needs. Therefore, during economic growth the composition of the average consumption bundle demanded by the representative consumer changes continually over time.

For our purposes, it is useful to think of a consumption bundle of goods and services (Q^{AC}) that reflects a lifestyle characterised by a low risk of developing any type of cancerous diseases (i.e., an *anti-cancer lifestyle*). In the presence of a hierarchy of needs (determined by biological, cultural and social factors), even the demand for the Q^{AC} consumption bundle does not increase proportionally. With regard to how the demand for an anti-cancer lifestyle consumption bundle increases in a growing economy, it seems reasonable to introduce some basic hypotheses (Figure 3). In the early stages of economic growth, the demand for a healthy lifestyle is likely to be close to zero and it may tend to increase less than proportional with respect to real per capita income (Y). However, in the subsequent stages of growth, as real per capita income increases demand and income may be linearly related. Finally, after real per capita income reaches a threshold level (Y''), the demand for an anti-cancer lifestyle may tend to increases more than proportionally.

Epidemiological data on tobacco consumption, for example, seems to support this hypothesis. In Figure 4, the age-

standardised prevalence of current tobacco smoking among adults is plotted against the real per capita income, for a set of 118 countries (WHO, 2007). The scatter plot confirms that anti-cancer lifestyle behaves like a luxury good. At lower per capita income, economic growth pushes up tobacco consumption. Prevalence rate of current tobacco smoking is positive related to economic growth until about $15,000. After this threshold level, tobacco becomes an inferior good and the age-standardised prevalence of current tobacco smoking starts declining.

From the Engel's curve depicted in Figure 3, we can derive a function that describes how, *ceteris paribus*, the overall cancer incidence evolves in a growing economy. Figure 5 shows a possible general form of this relationship, in which cancer incidence is measured by the age-standardised rate (ASR) and economic growth is measured, again, by the real per capita income (Y). It is interesting to note that the relationship assumes the form of a type of Kuznets curve (Kuznets, 1955).

Increases in real per capita income have a more-than-proportional negative effect on the overall cancer incidence only in the early stages of economic growth. During growth, as a result of the expansion of demand for the anti-cancer lifestyle consumption bundle this more-than-proportional relationship tends to disappear. In particular, if a healthy lifestyle is a luxury good, after the early stages of economic growth the overall incidence rate will increase, but less than proportional with respect to Y (there also can be an interval of the growth process where the age-standardised rate of cancer incidence rises approximately linearly with per capita income).

Furthermore, the relationship between overall cancer incidence and real per capita income has a positive intercept on the y-axis and a turning point. In particular, ASR° measures the autonomous component of the incidence rate (namely, the component that is independent of income, because it is weakly influenced by exposure to risk factors, such as in the type of cancer with an important genetic and/or infective aetiology) and Y* is the threshold level of per capita income beyond which cancer incidence starts diminishing.

5. Conclusions

Describing and measuring the relationship between cancer incidence and real per capita income constitutes the first step in understanding how the process of economic growth affects population exposure to cancer causing factors.

In fact, real per capita income is not an accurate and adequate measure of a country's level of development and it is not possible to summarize in Y a set of economic, social and health features. Further research is needed to include more variables, as for example, those referring to personal income distribution, cultural habits and customs, general sanitary conditions and health policies. It is also necessary to utilise epidemiological data for each type of cancer within more homogeneous genetic populations.

This paper, however, highlights some basic empirical regularities and theoretical insights that may be useful in developing an economic theory of the evolution of cancer incidence in a growing economy.

Table 1 - Variables and Summary Statistics

Description	Variable	Mean	Std. Dev.	Min	Max
World group (n = 162)					
Per Capita Gross National Income	Y	8.166,90	8.937,60	500,00	37.270,00
Total (Female and Male), Incidence Crude Rate	TCR	183,83	139,25	44,70	507,99
Female, Incidence Crude Rate	FCR	178,45	124,30	58,90	496,40
Female, Incidence Age-Standardized Rate	FASR	163,03	53,30	77,90	308,70
Male, Incidence Crude Rate	MCR	190,24	156,56	36,00	585,80
Male, Incidence Age-Standardized Rate	MASR	187,67	80,30	64,90	406,60
Western group (n = 41)					
Per Capita Gross National Income	Y	18.515,00	10.325,70	1.620,00	37.270,00
Total (Female and Male), Incidence Crude Rate	TCR	388,02	85,18	198,09	507,99
Female, Incidence Crude Rate	FCR	359,98	78,71	196,70	496,40
Female, Incidence Age-Standardized Rate	FASR	224,04	40,51	160,60	308,70
Male, Incidence Crude Rate	MCR	419,35	98,78	196,00	585,80
Male, Incidence Age-Standardized Rate	MASR	290,26	47,89	206,50	406,60

Y, Current International Dollars, Purchasing Power Parity - PPP, 2002 (World Bank, 2004)
CR and ASR, Crude and Age-Standardized Rates for all types of cancers: all sites but non-melanoma skin
(C00-C96, but C44, International Classification of Diseases ICD)
Incidence Rates per 100,000 persons, 2002 (International Agency for Research on Cancer, 2004)

Countries in the "Western gruoup": Albania, Austria, Belarus, Belgium, Bosnia and Herz, Bulgaria, Croatia, Czech rep
Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta
Nethederlands, Norway, Poland, Portugal, Rep. Moldova, Romania, Russian Fed., Serbia and Mont., Slovakia
Slovenia, Spain. Sweden, Switzerland, TFYR Macedonia, United Kingdom, Ukraine, Australia, Canada, New Zealand, USA

Table 2 - Regression results, World group

	Dependent variable	Regressor	Coefficient	T-Ratio	Prob	R - Bar Squared	Heteroskedasticy* CHSQ LM Version	Functional Form** CHSQ LM Version	n
Total (Female and male) Crude Rate									
01	TCR	Constant	75,52	9,67		0,72	0,920 [0,337]	9,063 [0,003]	162
		Y	0,132	20,52					
02	TCR	Constant	53,13	5,04		0,74	1,184 [0,276]	0,235 [0,627]	162
		Y	0,020	8,70					
		Y^2	-2,27E-07	-3,06					
03	LogTCR	Constant	0,286	2,45	0,01	0,61	0,010 [0,918]	21,66 [0,000]	162
		LogY	0,508	16,09					
Female Crude rate									
04	FCR	Constant	81,43	11,79		0,73	1,206 [0,272]	7,730 [0,005]	162
		Y	0,012	20,80					
05	FCR	Constant	63,15	6,74		0,74	1,859 [0,173]	0,035 [0,850]	162
		Y	0,017	8,52					
		Y^2	-1,86E-07	-2,82					
06	LogFCR	Constant	0,463	4,38		0,68	0,145 [0,703]	22,52 [0,000]	162
		LogY	0,462	16,19					
Male Crude rate									
07	MCR	Constant	68,76	7,77		0,72	2,610 [0,106]	9,75 [0,002]	162
		Y	0,148	20,33					
08	MCR	Constant	42,48	3,57		0,73	3,000 [0,083]	0,617 [0,432]	162
		Y	0,023	8,78					
		Y^2	-2,67E-07	-3,19					
09	LogMCR	Constant	0,095	0,75	0,45	0,62	0,392 [0,531]	21,17 [0,000]	162
		LogY	0,558	16,21					
Female Age-Standardized Rate									
10	FASR	Constant	127,46	32,74		0,53	0,013 [0,907]	0,830 [0,362]	162
		Y	0,043	13,52					
11	FASR	Constant	124,08	23,00		0,53	0,005 [0,940]	0,117 [0,732]	162
		Y	0,0054	4,56					
		Y^2	-3,43E-08	-0,90	0,37				
12	LogFASR	Constant	1,515	22,43		0,38	0,607 [0,436]	18,28 [0,000]	162
		LogY	0,184	10,06					
Male Age-Standardized Rate									
13	MASR	Constant	132,48	23,41		0,56	0,087 [0,768]	10,63 [0,001]	162
		Y	0,0067	14,43					
14	MASR	Constant	114,93	15,13		0,59	0,003 [0,958]	0,465 [0,495]	162
		Y	0,012	7,28					
		Y^2	-1,78E-07	-3,34					
15	LogMASR	Constant	1,232	14,75		0,47	6,O39 [0,014]	12,98 [0,000]	162
		LogY	0,273	12,08					

* Based on the regression of sqared residuals on squared fitted values
** Ramsey's RESET test using the squares of the fitted values

Table 3 - Regression results, Western group

	Dependent variable	Regressor	Coefficient	T-Ratio	Prob	R - Bar Squared	Heteroskedasticy* CHSQ LM Version	Functional Form** CHSQ LM Version	n
Total (Female and male) Crude Rate									
01	TCR	Constant	268,50	15,44		0,60	0,233 [0,629]	6,305 [0,012]	41
		Y	0,0064	7,85					
02	TCR	Constant	208,45	7,44		0,65	0,039 [0,842]	1,976 [0,160]	41
		Y	0,0156	4,36					
		Y^2	-2,48E-07	-2,62	0,01				
03	LogTCR	Constant	1,449	12,48		0,70	0,615 [0,433]	0,103 [0,748]	41
		LogY	0,270	9,75					
Female Crude rate									
04	FCR	Constant	246,55	16,06		0,64	0,194 [0,659]	3,942 [0,047]	41
		Y	0,0061	8,43					
05	FCR	Constant	204,61	8,00		0,66	0,043 [0,834]	1,177 [0,278]	41
		Y	0,0120	3,83					
		Y^2	-1,73E-07	-2,01	0,05				
06	LogFCR	Constant	1,438	12,62		0,70	1,116 [0,291]	0,122 [0,727]	41
		LogY	0,265	9,75					
Male Crude rate									
07	MCR	Constant	288,21	13,24		0,54	0,028 [0,867]	6,902 [0,009]	41
		Y	0,0071	6,87					
08	MCR	Constant	209,54	6,03		0,60	0,906 [0,341]	1,353 [0,245]	41
		Y	0,0192	4,30					
		Y^2	-3,25E-07	-2,77	0,01				
09	LogMCR	Constant	1,440	10,75		0,65	0,112 [0,737]	0,327 [0,567]	41
		LogY	0,280	8,75					
Female Age-Standardized Rate									
10	FASR	Constant	169,13	19,45		0,56	0,013 [0,907]	0,018 [0,892]	41
		Y	0,0029	7,21					
11	FASR	Constant	170,75	11,21		0,55	0,023 [0,878]	0,030 [0,862]	41
		Y	0,0027	1,39	0,17				
		Y^2	6,71E-09	0,13	0,89				
12	LogFASR	Constant	1,598	13,92		0,51	0,542 [0,462]	3,968 [0,046]	41
		LogY	0,178	6,50					
Male Age-Standardized Rate									
13	MASR	Constant	239,14	18,95		0,34	0,014 [0,906]	1,253 [0,263]	41
		Y	0,0027	4,62					
14	MASR	Constant	219,72	10,09		0,34	0,219 [0,640]	3,911 [0,048]	41
		Y	0,0057	2,05	0,04				
		Y^2	-8,02E-08	-1,09	0,28				
15	LogMASR	Constant	1,847	16,37		0,41	0,055 [0,814]	0,015 [0,969]	41
		LogY	0,146	5,42					

* Based on the regression of sqared residuals on squared fitted values
** Ramsey's RESET test using the squares of the fitted values

Table 4 - Elasticties and Income Turning Points

Variable	World elasticity	World Y*, PPP (2002)	Western elasticity	Western Y*, PPP (2002)
01 - TCR	0,508	44.053	0,270	31.452
02 - FCR	0,462	45.773	0,265	34.642
03 - MCR	0,558	42.697	0,280	29.548
Mean CR	0,510	44.235	0,273	32.095
04 - FASR	0,184	--	0,178	--
05 - MASR	0,273	33.632	0,146	35.532
Mean ASR	0,229	--	0,162	--
All observations				
Mean	0,397	41.539	0,228	32.793
Std. Dev.	0,151	4.845	0,058	2.431

Figure 1

Figure 2

Engel's curve

Figure 3

Economic growth and Tobacco Consumption (118 countries WHO, 2005)
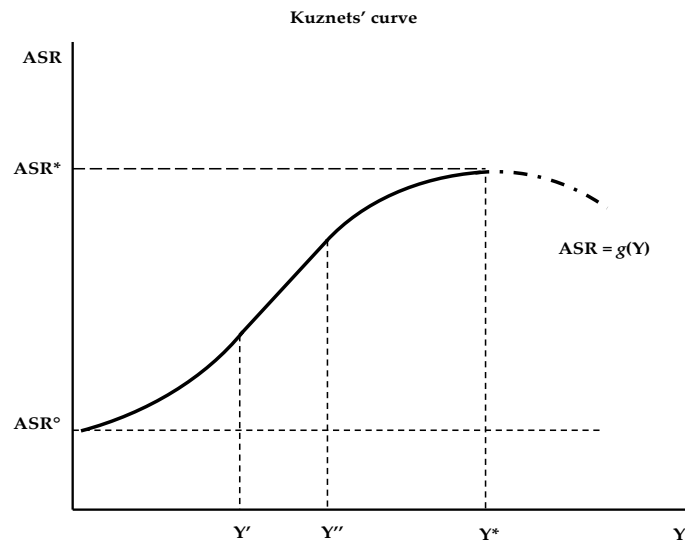

Figure 4

Kuznets' curve
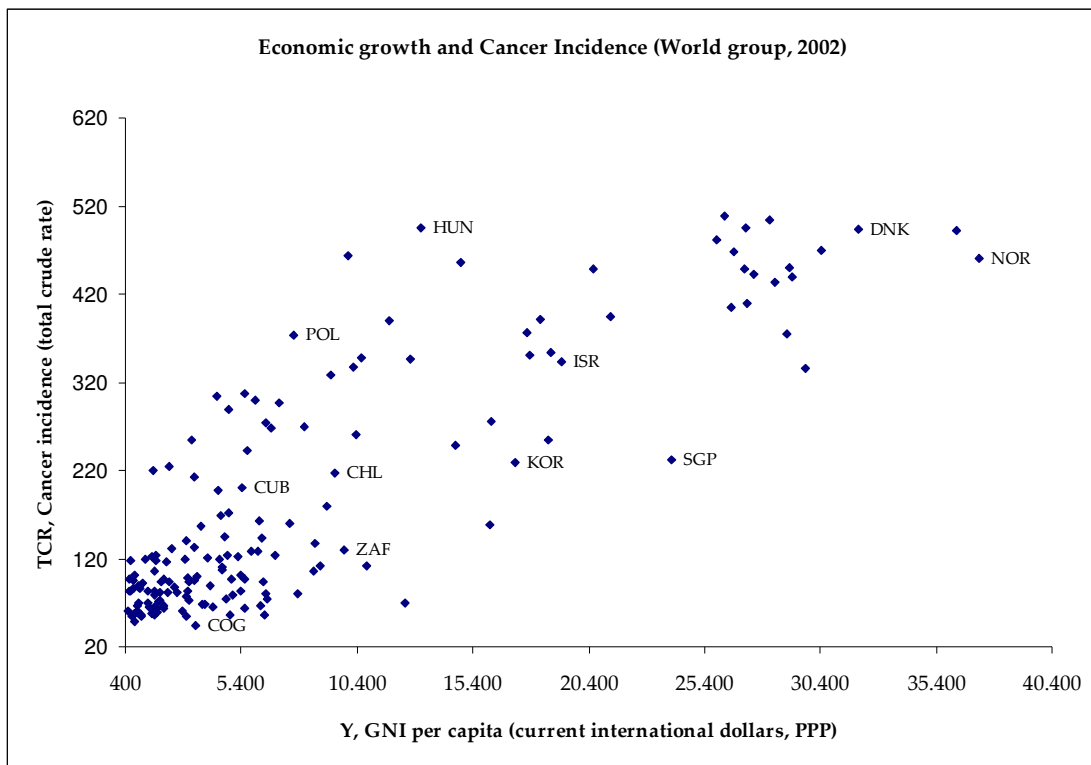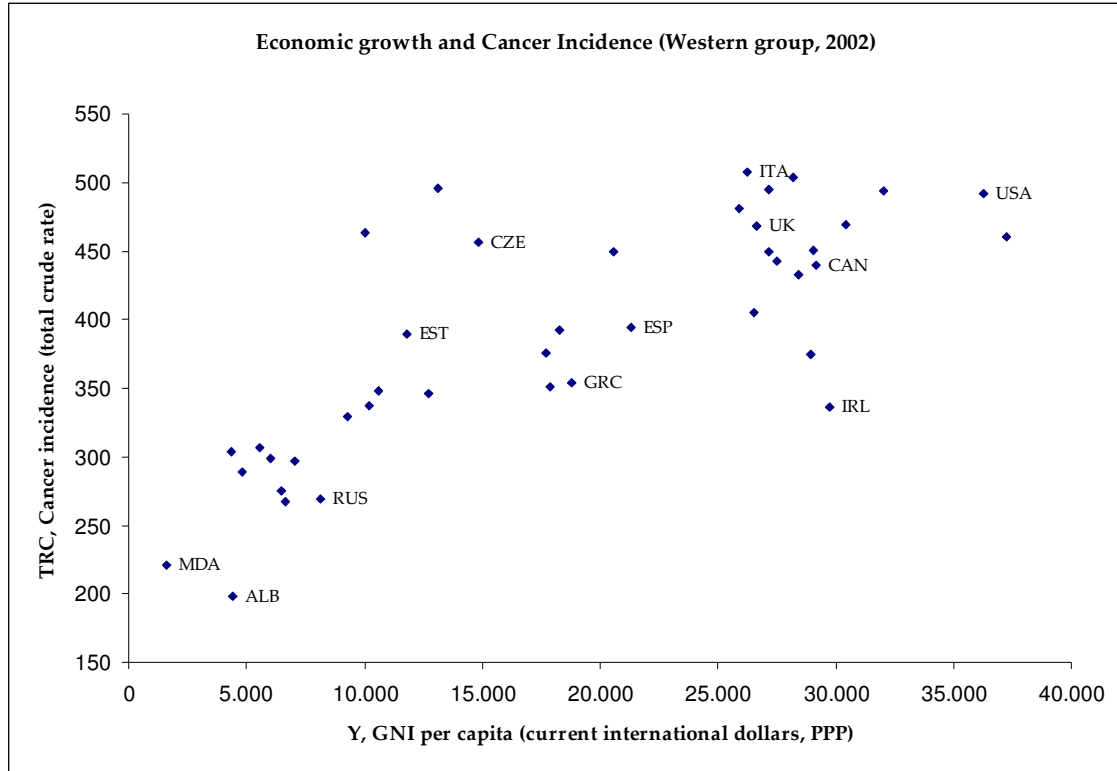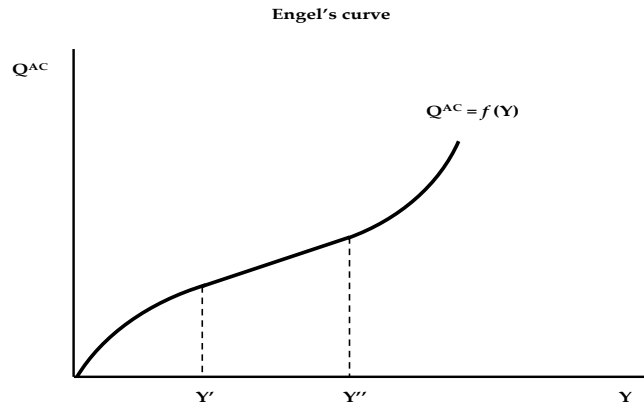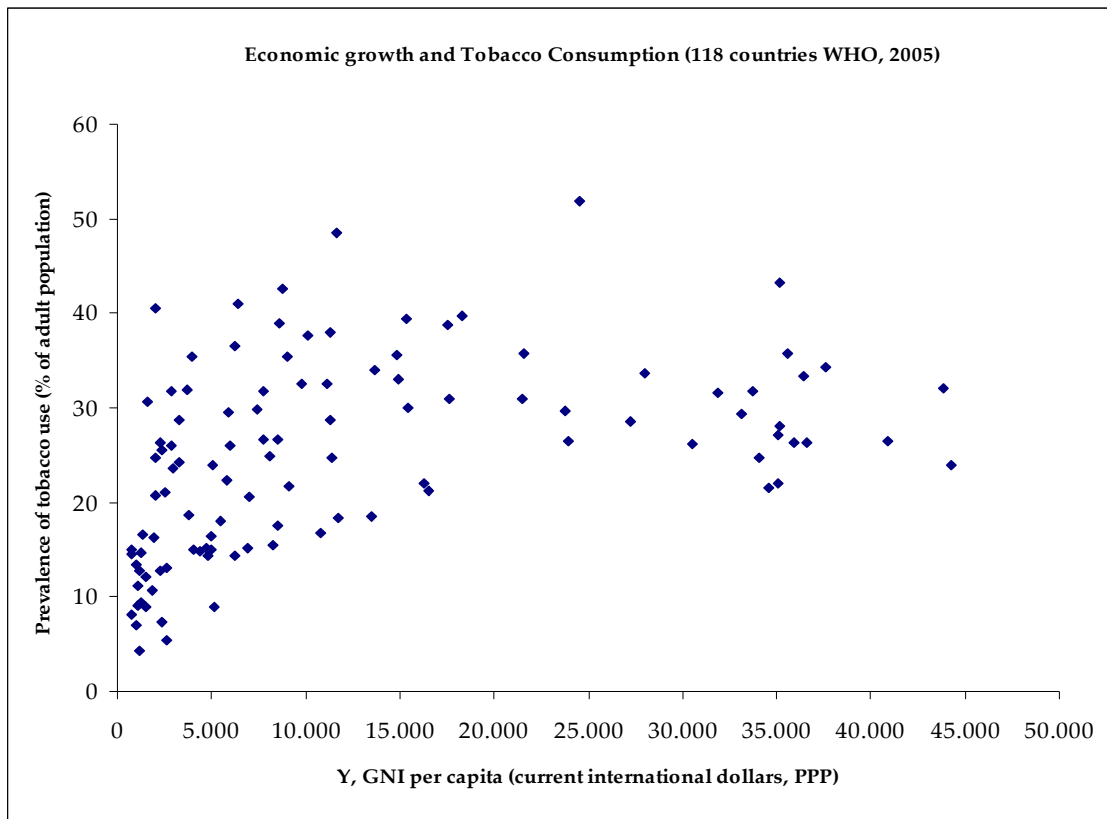
Figure 5

References

Capocaccia R., Colonna M., Corazzieri I., De Angelis R., Francisi S., Micheli A., Mugno E., "Measuring Cancer Prevalence in Europe", *Annals of Oncology*: 13, 831-839, 2002.

Bosanquet N., Sikora K., *The Economics of Cancer Care*, Cambridge University Press, London, UK, 2006.

Bray F., Ferlay J., Parkin D.M. and Pisani P., *Globocan Software 2002,* IARC Press, Lyon, 2004.

International Agency for Research on Cancer, *Cancer Mondial*, IARC, Lyon, 2004.

Kuznets S., "Economic Growth and Income Inequality", *American Economic Review*: 45, (1), 1-28, 1955.

Last, J. A., *Dictionary of Epidemiology*, Oxford University Press, New York, NY, 2001.

Nasca, P. C., *Fundamentals of cancer epidemiology*, Jones & Bartlett Publishing, Sudbury, MA, 2007.

Pasinetti L.L., *Structural Change and Economic Growth*, Cambridge University Press, Cambridge, UK, 1981.

Ukraintseva S.V. and Yashin A.I., "Economic progress as cancer risk factor", M. Planck Institute, WP22, 2005.

World Bank, *World Economic Indicators*, World Bank Press, Washington DC, 2004.

World Health Organization (2003), *World Health Statistics*, WHO Press, Geneva.

World Health Organization (2007), *World Health Statistics*, WHO Press, Geneva.

World Health Organization, *International Classification of Diseases*, WHO Press, Geneva, 2005.

*   **Dr Fabrizio Ferretti** is a Lecturer in Economics at the University of Modena and Reggio Emilia (Italy), where he teaches Microeconomics and Applied Economics. He studied Agricultural Sciences and Economics at the Alma Mater Studiorum - University of Bologna, where he received his Ph.D. in Agricultural and Applied Economics. After spending some years at University of Bologna as a Research assistant, Fabrizio Ferretti joined the Department of Social Sciences of the University of Modena and Reggio Emilia in 2005. His current research interests are focused on Heterodox Economics (post-Keynesian and neo-Ricardian economics), Agricultural Economics (agriculture, economic growth and structural change) and Applied Economics (economics of biotechnology and economic theories of pollution). He recently (in 2008) published 'Patterns of Technical Change: A Geometrical Analysis Using the Wage-Profit Rate Schedule' in the *International Review of Applied Economics,* Vol. 22, No. 5, pp. 565-583.

* * * * * * * * *

The BNE is celebrating the electronic age by disbanding its print copy distribution list. This process began some time ago but is reaching its final stages now. All former print-copy readers are invited to join the electronic mailing alert service by contacting the editor at dabirp@richmond.ac.uk

ABOUT **The Briefing Notes in Economics:**

The current series of the **Briefing Notes in Economics** has been published regularly since November 1992. The series continues to publish quality peer-reviewed papers. As with recent issues, some of those that are forthcoming will include conference listings and other information for anyone with an interest in economics.

As always information on joining the mailing list, submitting a paper for publication consideration and much else besides, appears on the web-site. Should you need more information on any of the above matters please write to *Dr. Parviz Dabir-Alai*, Editor – Briefing Notes in Economics, Department of Business & Economics, Richmond – The American International University in London, Queens Road, Richmond, Surrey TW10 6JP, UK. Fax: 44-20-8332 3050. Alternatively, please send your e-mail to him at: **dabirp@richmond.ac.uk**

For further information please visit the BNE website at the following address: www.richmond.ac.uk/bne/

Previous authors have included:

Mak Arvin (Trent), Mark Baimbridge (Bradford), Alexandre Barros (Oxford), Amitrajeet Batabyal (Utah), William Boyes (Arizona State), Frank Chaloupka (Illinois), E. Ray Canterbery (Florida), Roger Clarke (Cardiff), William DiPietro (Daemon), Jean Drèze (LSE, Delhi), James Gapinski (Florida), Andrew Henley (Swansea), Greg Hill (City of Seattle), Prabhat Jha (World Bank), Geeta Gandhi Kingdon (Oxford), Carmen Li (Essex), Robert Jones (Skidmore), Mehmet Odekon (Skidmore), Ramkishen Rajan (George Mason), Hans Singer (Sussex), Simon Ville (Wollongong), Bob Wearing (Essex), Nobuyoshi Yamori (Nagoya) and many others.

Briefing Notes in Economics

* Call for Papers *

http://www.richmond.ac.uk/bne/

The BNE is always keen to hear from prospective authors willing to write a short, self-contained, and preferably applied, piece for publication as a future issue. The series prides itself on giving the well-motivated author a rapid decision on his submission. The **Briefing Notes in Economics** attracts high quality contributions from authors around the world. This widely circulated research bulletin assures its authors a broad-based and influential readership. The **Briefing Notes in Economics** is indexed with the *Journal of Economic Literature*.