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CHILD MORTALITY IN CHINA AND VIETNAM IN A COMPARATIVE PERSPECTIVE

Abstract

This paper analyzes China's and Vietnam's performance in reducing under-five child mortality in a comparative perspective. Under the market socialist model, both countries achieved very high rates of GDP growth, but income distribution and the provision of key public services deteriorated. As a result, child mortality reduction in China and Vietnam was only partially satisfactory. However, although the former grew faster and is more economically developed, Vietnam's record in this area was markedly better than China's. We show that this apparent paradox is due mainly to two reasons. One is related to the relative status of women, which is better in Vietnam than in China. The other stems from the fact that the perverse side-effects of market-oriented reforms (such as worsening income distribution and degradation of essential public services) have reached a more advanced and alarming stage in China than in Vietnam.

Keywords: Child Mortality, China, Vietnam, Socialist Market, Cross Country analysis

1. Introduction

The experience of the XXth century has shown that, due to the high and ever-increasing degree of complexity and reciprocal integration of contemporary economies, simplistic or over-centralized planning solutions to key coordination problems are neither effective nor ultimately sustainable. A high degree of entrusting to the market of the function of coordinating ordinary economic activities on the part of the state is therefore inevitable. Yet, the existence of substantially different economic and social market-based systems constitutes both a logical possibility and a historical reality. These systems can in turn be seen as belonging to a conceptual continuum ranging from quasi-pure free-market capitalism to new types of mixed economies, which are commonly referred to as “market socialist”, and can be compared according to various criteria, describing key structural economic and social characteristics.

Some of the most relevant criteria are positive, as they identify structural features of production relations - such as the relative weight of the State, the ownership structure, and the social groups controlling and determining the joint process of accumulation and technical progress. Other important criteria are normative, and represent the degree of achievement of intermediate (e.g., GDP growth) and final social and humanitarian goals, such as and the universal satisfaction of basic needs and human development. Protection from hunger – i.e., avoidance of malnutrition – is arguably the most essential one among basic needs, Its relevance cannot be overstated: ”malnutrition remains the world’s most serious health problem and the single biggest contributor to child mortality”(World Bank 2005, p.1). The modern approach to nutrition has also showed that income-based poverty is but one factor – albeit surely the most critical one – determining malnutrition, along with others (related to the three dimensions of food security, namely availability of, access to, and utilization of food on the part of each member of the household). Child mortality, in turn, apart from malnutrition, is essentially determined by the sanitary quality of the environment where children live, by the care they receive from their parents, and by the health services to which they have access. Thus, besides the depth and spread of poverty and hunger, it also reflects indirectly the health, social, and educational status of women. Hence, the prevalence of child mortality can also

be seen as a proxy indicator of the level of satisfaction of basic needs and, more broadly, of human development¹ in developing countries.²

This paper focuses on child malnutrition in China and Vietnam.. China is the largest and most advanced "market socialist" country. Notwithstanding the numerous and evident differences between the two countries, Vietnam has also been following a broadly similar market socialist path, although it is presently in a less advanced stage, and its growth record has not been as stellar as its northern neighbour. Yet, Vietnam's performance in reducing child mortality has been unambiguously superior to China's. Our thrust is to investigate in a comparative framework the evolution of the economic and social factors affecting child mortality in China and Vietnam, trying to shed light on this apparent paradox.

2 Economic and social determinants of child malnutrition and mortality

Each individual's nutritional and health status is the outcome of a complex process depending on a number of social, economic, and institutional factors. Social and economic relations of production and exchange, of which the role of the state is a key component, ultimately determine the speed and pattern of economic growth and, through the mediation of trade, national food availability. They also shape income distribution, and hence, along with cultural habits, each household's income-based access to marketed food supplies and basic services (marketed services comprise privately supplied services and publicly-supplied services that can only be accessed paying a fee³). Overall access to food, however, is also influenced, positively, or negatively, by non-market factors (such as the weight of non-marketed, self-consumed food production, the availability of transport infrastructure, or the existence of food aid programs). Food utilization – the process through which access to food is translated into nutritional status – is influenced by two sets of factors. The first one is

¹ We refer to the concept of human development, as a complex and holistic one "based on the priority of human well-being, and aimed at ensuring and enlarging human choices which lead to equality of opportunities for all people in society and empowerment of people so that they participate in - and benefit from - the development process" (source: UNDP 1996). UNDP's Human Development Index is constructed as an unweighted average of other three indicators, measuring life expectancy, education, and income respectively. All of them are negatively correlated with child mortality.

² At higher levels of human development, such those prevailing in high-income countries, it is arguable that the relative weight of the prevalence of child mortality vis a vis other indicators is not as crucial.

³ Partial subsidization of basic services provision partially relaxes this budget constraint for low-income households, but only to a point.

exogenous from the point of view of the household, and it depends mainly on the availability of free or quasi-free health and sanitation infrastructure and services. The second set is endogenous, and it is determined by each household's human capital endowment and by other cultural and behavioral factors⁴. In the case of children, in particular, these factors exert a double impact on mortality. On one hand, indirectly, this impact works – via food utilization - through the prevalence of malnutrition, which is by itself a major cause of mortality. On the other hand, non food-related exogenous and endogenous factors affect the children's access to health and other basic services and the maternal care they receive from other members of the household (see Figure 1).

Markets, along with appropriate infrastructural, sectoral, and trade policies, can contribute to fostering food production and, more broadly, economic growth. Yet, they are of little help in other areas of crucial importance in determining children's nutrition and health (which are measured ex post by malnutrition and mortality rates). The role of public intervention is paramount in influencing income distribution, non-income access to food, access to health and other basic services, and even - in the long run - gender relations and cultural habits.

3. Asian market socialism: strategic control of the surplus, fast growth, and rapid decrease of poverty

In China and Vietnam, the direct and indirect control of the main means of production on the part of public bodies determines social production relations different from those typical of capitalist countries. This key feature is significant at the macroeconomic and systemic levels⁵, and therefore justifies the use of the term "socialism"- to be interpreted in a weak, structural and positive sense, and not one directly related to the normative goals traditionally associated to socialism.

⁴ Household-level endogenous factors are not immutable, and can be modified by public intervention in the long run.

⁵ Conversely, it is scarcely relevant in the domains that are subjectively important for most individuals. Most non-agricultural workers in China and Vietnam, as well as salaried workers in the public or private sector, have a very low degree of control on either wages or working conditions, and many are severely exploited.

In the market socialism framework, the state determines the rate of accumulation to a degree that is significantly higher than in capitalism, as it can count on more and more effective instruments to control the generation and allocation of surplus and the speed and broad patterns of technical progress. These fundamental characteristics of market socialism have contributed to achieve an intermediate goal of decisive importance, especially in poor countries: fast economic growth. Growth is, in the long run, a necessary condition to reduce poverty. China and Vietnam, thanks to rapid GDP growth and to specific policy interventions that contributed to lift the incomes of the rural majority,⁶ have achieved so far an impressive record in poverty reduction. If they were considered jointly as a sort of “Asian market socialist region” (with more than one fourth of the total population of the developing world), it would be the only region to show significant progress in combating poverty. Consistently, China and Vietnam account jointly for the bulk of (income-based) poverty reduction worldwide since the 1980s⁷ (see Edward P., 2006, Chen and Ravallion and 2004a,b; Li and Piachaud 2004; Lin 2003).

In the framework of market socialism, it might also be possible to extend the public control of a large share of the surplus to the area of final consumption, minimizing the superfluous consumption of privileged social groups, to earmark it to various forms of public and social consumption. In fact,, this potentiality is not presently realized. On the contrary, the perverse spiral towards an ever-worsening income distribution pattern has largely gone out of hand, with severe consequences also in terms of basic needs satisfaction, as is shown by the high inequalities in under-5 mortality rate among households belonging to different income classes (see table 1.7.) . Moreover, essential public services have been largely abandoned to market forces, so that access to them is based on income and wealth instead of being free and universal.

⁶ Among them, agricultural de-collectivization (notwithstanding its multiple negative and uneven side effects), agricultural pricing policies, and targeted antipoverty programs. These interventions partly compensated the negative impact on poverty of deteriorating income distribution.

⁷ Chen and Ravallion (2004a), in a milestone study, showed that worldwide reduction in headcount poverty (using the conservative 1\$-a-day poverty line) was 390mn between 1981 and 2001. Out of them, only 30 million took place outside China (in net terms: poverty increased in some countries and decreased in other countries). According to Edwards 2006, these figures show that “the only really significant impact on poverty that occurred in the world was in China.”(p.1682). We agree, although observing that the sentence should be completed with the words “and Vietnam”, suggesting that such a large-scale poverty reduction was attributable to unique features of Asian market socialism, rather than of China alone.

The factors behind the increase in income inequality in China and Vietnam (starting from a very low initial level) have been the object of numerous studies⁸. The focus of the following section is on the underdevelopment of social services.⁹

4. Relative underdevelopment of social services under market socialism

Under the socialist centrally-planned economic regime, the Chinese and Vietnamese states strived to provide social services free of charge to all the population. As the resources available for that purpose were quite scarce, actual was in fact extremely limited both in quantity and in quality. Nevertheless, basic social services provision was very egalitarian and, on the whole, distinctively superior to that of most countries with a similar level of economic development. As result, China and Vietnam's human development indicators were also significantly better than other poor countries with similar levels of economic development (see Ministry of Health 2005, Gabriele 2006)).

Since the inception of the market-oriented economic reform process, provision of basic social services seriously deteriorated in both countries. Moreover, they lost what was previously their most valuable feature – their egalitarian nature – that had allowed virtually free and universal access to the (modest indeed) services made possible by the very low level of economic and technological development prevailing at the time.

After recovering from an initial disruption caused by the transition to new forms of financing, basic public services infrastructure has been further expanded and strengthened. Yet, the amount of resources channeled to public services has been

⁸ See, among others, Ravallion 2005a,b; Perloff and Wu, 2005, 2004a,b; Chen and Ravallion 2004, 2001; Gustafsson and Shi, 2002; Jalan. and [Ravallion, 2001](#); Masina (ed.) 2002;; Swinkels and Turk 2003; Trin Duy Luam, 2003; Xuan Nam P., 2002; Brandt L. and Benjamin D., 2002. Chen and Ravallion 2004 is a particularly illuminating contribution on the key issue of evaluating the poverty-inequality trade off in China. The authors shows that Chinese provinces with a lower initial level of rural inequality achieved the best record in poverty reduction, due both to faster growth and higher growth elasticity of poverty reduction.

⁹ Of course, the two negative social phenomena are mutually reinforcing. Taking into account the disproportionate weight of health and nutrition disbursements in the poor's expenditure, and the dramatic impact on their well-being of the inability to cover them adequately, the underdevelopment of social services strongly aggravates the human suffering caused by income inequality.

insufficient. The overall inadequacy of social services policies in China and Vietnam had an uneven impact in the various areas that affect nutrition, directly and indirectly.

The area of health was the most jeopardized. Since the beginning of economic reforms, public health systems almost collapsed in the countryside, along with rural communes, and deteriorated seriously even in urban areas (see Zhao 2006). By the early 2000s, China's and Vietnam's share of expenditure on public health was exceedingly low (see Table 1.5.)

To a lesser extent, the introduction of fees and the increased cost of books and other education material also slowed (and , in some circumstances, reverted) the progress towards universal access to primary education in rural areas¹⁰. These mistakes in basic education policies (common to China and Vietnam) are likely to have negatively affected nutrition as well, albeit indirectly, weakening the virtuous impact of mothers' basic education status on their ability to provide their children with improved care, besides negatively affecting rural productivity growth.

On the bright side, China and Vietnam kept increasing the provision of basic infrastructural services affecting nutrition and health status (such as sanitation services and – less so – provision of drinkable water), and expanding immunization and specifically nutritional programs(see Table 1.3.).¹¹ Finally, there is another factor – difficult to quantify – that induces to expect social services to perform better in China and Vietnam than in most other countries at similar levels of economic development. In both countries, the construction of the socialist state has implied a sustained build-up of collective human, institutional and organizational capital, and the extension of basic state and public structures to the most remote areas at village and communal levels. Therefore, it is logical to assume the overall “cost effectiveness” of social services in China and Vietnam to be rather high.

¹⁰ WB 2005 figures reported in Figure 1.8. appear to show a decrease in female primary education completion rate in China.

¹¹ Immunization is a basic preventive action directly affects children's health status, and can therefore be considered also a nutrition service. On targeted nutrition programs in China and Vietnam see Zhai et al. 2002; World Bank 2006;; Dickey et al 2002;;Dung et al 2003; Pachon et al 2002; Schuftan C. and Le Dinh Cong 2001; Sripaipan et al 2002; Tuan et al 2003.

5. Poverty, malnutrition and child mortality in China and Vietnam

The contradictory trends in the economic and social domains briefly sketched in the preceding paragraphs jointly shaped the evolution of social and human development indicators in China and Vietnam.

Rapid economic growth, the low level of initial inequality, and the expansion of essential infrastructure, on one hand, were major positive factors. The progressive worsening of income distribution and the deterioration of basic social services, on the other hand, acted as brakes for social and human development. The balance was tilted in a virtuous direction by the overwhelming weight of the two positive factors. Rapid and broad-based¹² economic growth and the low level of initial inequality¹³ jointly allowed for exceptional progress in reducing poverty in both countries (see Table 1.1., 1.6., 1.8. and, among others, Masina 2006, UN Country Vietnam Team 2003a, 2005).

The domain of nutrition was no exception. Thanks mainly to income-related factors stemming from poverty reduction, major gains were recorded both in China and in Vietnam. Yet, malnutrition is still a severe mass phenomenon, hitting hundreds of millions in China and tens of millions in Vietnam, most of them poor farmers (see Table 1.2.). For China, this was confirmed recently by the China Health and Nutrition Survey (CHNS) national survey carried out by the Beijing-based Institute of Nutrition and Food Safety.¹⁴ 29 percent of children younger than 5 and living in poverty-stricken regions were malnourished. By contrast child malnutrition in urban areas stood at only 1 percent. The prevalence of growth retardation and low body weight in children has diminished, yet they still make 17.3% and 9.3% nationwide and 29.3% and 14.4% in rural areas¹⁵.

Overall food availability nationwide has ceased to be a problem, and the quantity and quality of food supply has improved enormously. Notwithstanding increasing income inequalities, all social groups have strengthened their energy and protein intake, which is now basically satisfactory. Food insecurity – a condition

¹² China and Vietnam exhibit a very good record in terms of growth of the agricultural sector and of food production in particular (Table 1.1.).

¹³ The low level of initial inequality implied a high, though declining, growth elasticity of poverty reduction.

¹⁴ See the website <http://www.cpc.unc.edu/projects/china>

¹⁵ Source: Xinhua News Agency October 10, 2005

measured by various indicators, that measures the risk of not having enough food – improved, with 350 counties (most of them in rural areas of central and western provinces) identified as “vulnerable” in the latest (2003) survey, against 450 in the previous (2000) one (WFP/IFAD 2003).

However, numerous studies have shown that – due to the speed and unevenness of economic, social, behavioral, and dietary patterns, and to the inadequacies of nutrition policy programs¹⁶ – different social groups in China are now experiencing various forms of malnutrition typical of both poor and rich countries, such as inadequate vitamins and micronutrients intake, excessive consumption of fats, and obesity (see Zhai et al. 2002; Mendez M.A. and Popkin B. M., 2004).

Vietnam is much poorer than China, and hence the dietary transition in Vietnam is at a much earlier stage, notwithstanding the remarkable progress achieved so far. The prevalence of underweight and stunted children has been halved over the last two decades, but sheer undernourishment is still widespread in the countryside and constitutes the core of a malnutrition problem that remains severe (see Table 1.2., 1.8.). In the early 2000s, thanks mainly to the halving of poverty rates in little more than a decade, malnutrition rates¹⁷ fell to around 30% (down from 50% in 1990), and the share of households unable to meet minimum dietary energy consumption was about 11% (30% in 1990). Undernutrition is particularly acute among ethnic minorities and rural households in which women are less educated (see U.N. Country Team Vietnam 2005; DFID 2006).

With respect to the progress achieved so far towards achieving the Millennium Development Goals, China’s and Vietnam’s record is broadly positive vis a vis most other developing countries. Focusing on under-five mortality, in particular, both China’s and Vietnam’s record in 2003 was much better than the average for low and middle income countries. However, it is striking to observe that China’s rate was much higher than Vietnam’s. Moreover, China’s performance in reducing under-5 mortality in 1990-2003 was better than that of most other developing countries, but worse than the average for the East Asia and Pacific region. Conversely, Vietnam achieved an extremely good result, having reduced this indicator by more than 50% over little more than a decade. Also Cuba, which started from a very low base and experienced

¹⁶ This is not to say that no efforts have been carried out. Awareness on improper nutrition patterns and interventions aimed at improving dietary patterns are on the rise in China, some of which are very effective (see Zhai et al 2002)

¹⁷ For the population as a whole.

negative GDP growth during the 1990s, managed to reduce under-5 mortality much faster than China (see table 1.9.).

Table 2 presents China's and Vietnam's relative ranking among developing countries, for a number of economic and social variables¹⁸. Part a reports rankings in levels for 2002. In terms of GDP per capita, China's ranking is intermediate, while Vietnam is still very poor. The GINI score shows that the deterioration of income distribution has gone much further in China (where it is by now more unequal than most of other developing countries) than in Vietnam. China and Vietnam score well in terms of female primary schooling.. However, both countries perform very poorly in terms of public health expenditure and are not particularly impressive (even taking into account their modest level of economic development) in terms of water, sanitation, and immunization¹⁹ The ratio of female/male expectancy (RATIO), an indicator of women's relative status, confirms that gender problems are much more severe in China than in Vietnam. Scores in undernourishment²⁰, stunting and wasting show China performing quite well, and much better than Vietnam. Yet the opposite is true in the case of infant and under-5 mortality,²¹ where Vietnam's score is very good (as usual, taking into account it is still a very poor country), while China's is only moderately better than average. Besides the role of the gender factor, the lackluster record of China is likely to be due to the fact that some aspect of social underdevelopment that have accompanied so far market-oriented reforms (such as geographic and class inequalities, the decay of public health services, and even, probably, the lack of access to basic education on the part of poor peasant girls in some rural areas) have been more dramatic and have been operating for a longer time than in Vietnam. This interpretation is confirmed by part B of Table 2, which shows rankings in terms of annual growth rates, over the 1990s and early 200s. China's and Vietnam's performance in terms of per capita GDP growth are exceptionally good, especially so in the case of China... Both countries did well in the expansion of

¹⁸ Source: World Bank 2005. For each variable, rankings refer to all low and middle income countries for which data are reported.

¹⁹ In the area of immunization, Vietnam's score is rather good, while China's one is poor.

²⁰ Prevalence of undernourishment is a measure of basic access to food estimated by FAO, with a particular methodology that renders it difficult to compare it on one hand with macroeconomic income and distribution variables, and, on the other hand, with anthropometric malnutrition indicators. We did not use it in our econometric analysis as we focused on the social and economic factors determining income-based market access to food.

²¹ The most recent (2004) data on under-5 mortality in China, reported by UNICEF 2006 and mentioned in the note to table 1 is more favourable, yet it is still not as good as Vietnam's.

sanitation facilities, less so with respect to the access to clean water (especially in the case of Vietnam)²². Yet, Vietnam clearly outperformed China both in terms of expansion of immunization and female education²³, and in terms of gains in the areas of undernourishment, infant and under-5 mortality. Actually, Vietnam's record in reducing child mortality is among the best in the world, while China's is just about average.

6. Data and methodology

According to the conceptual framework sketched in section 2, we attempted to explore quantitatively the main social and economic factors determining child mortality, and to discuss China's and Vietnam's record in a comparative perspective.

Our basic model is a cross-country one, including all developing (i.e., low and middle income) countries for which essential data are available. Our core database is constituted by the World Bank World Development Indicators 2005(WB 2005).²⁴ It is estimated by OLS, with a few adaptations and specifications aimed at capturing specific features of the causal chain leading to child mortality in developing countries. The model comes in two basic forms: in levels and in growth rates. The form in levels was estimated for the years 2002/2003²⁵. Its results can be interpreted both as static ones (what are the factors determining malnutrition at the present time) and as the product of a very long historical process, which led over time to a different evolution

²² The interpretation of the rankings for the annual growth of rate of sanitation, water and immunization must take into account that some countries show zero or negligible growth simply because they already reached total or quasi-total coverage.

²³ Data on primary female primary school completion in Vietnam in 1990 are not available in WB 2005. However, data on another indicator of female education, the gross enrolment ratio of girls in secondary school, show a much faster improvement in Vietnam than in China.

²⁴ Data on Cuba's GDP growth are from CEPAL 2003.

²⁵ Few mutually comparable data are available for a sufficient number of developing countries for more recent years. For some variables, we used the latest available figure in WB 2005, or – when reported by the same source – an average for the early 2000s. they were From a substantive point of view, moreover, to calibrate the analysis on 2002 has an additional advantage. Since the 16th congress of the Chinese Communist Party, held in November 2002, the new president, Hu Jintao has been progressively taking over more and more political power, along with a new generation of leaders. Hu's line is very different from that of his predecessors, as he explicitly stresses the urgency of building an "harmonious socialist society" and the correction of the present social and ecological distortions are the Party's utmost priorities (see, for instance, CPC 2006, Zhao 2006). Hu's success so far in achieving his declared goals has been modest at best, and it is impossible at this stage to gauge to which extent the traditional market socialist system will eventually be transformed. Nevertheless, it is fair to acknowledge that a distinctively new historical cycle has begun.

of various malnutrition–affecting factors, and thus to different outcomes in terms of malnutrition and child mortality in different countries. The form in growth rates attempts to single out a few basic factors common to all countries, explaining trends in child mortality over the 1990s and early 2000s (seen both as a proxy for children malnutrition and as its more severe consequence).

Our dependent variables is the prevalence of under-five child mortality. With respect to the explanatory variables, we introduced them in two stages, according to the interpretative framework proposed in Section 2. First, we introduced per capita GDP, and thereafter a few other variables, which represent the main factors different from economic growth which affect child mortality in developing countries. They are: the Gini coefficient (an indicator of income distribution); one or more variables, some of which constructive in an additive fashion, indicating the level of development of basic public services (including women’s education); and the ratio of female to male life expectancy,

7. Results

We first ran tentative regressions with linear specifications, starting with models in levels, that shed light on the main factors causing malnutrition and children mortality in the early 2000s. The first series had stunting as dependent variable, starting with a very simple model that only includes the 2002 GDP per capita (GDPPC) and the (latest available) Gini coefficient (GINI) (Table 3, part a, model 3.1.). Both were highly significant and exhibited the expected sign, and jointly explained about 40% of inter–country variability in the prevalence of stunting. The coefficient of GINI was quite high (0.33), indicating that income inequality is a powerful cause of hunger: this is a first finding of general relevance, that was confirmed invariably also by all the other models.

Models 1 and 2 in levels have GDP per capita in 2002 (GDPPC) as the only explanatory variable, and under-five child mortality (U5) as the dependent variable²⁶:

$$(1) \quad U5 = \alpha + \beta \text{GDPPC} + \varepsilon$$

$$(2) \quad \log U5 = \alpha + \beta (\log \text{GDPPC}) + \varepsilon$$

²⁶ Data for U5 refer either to 2002 or to the latest available figure.

Model 2 fits much better than model 1, showing that the relationship between economic development and child mortality is not a linear one²⁷. Graph 1 illustrates the logarithmic relation between the two variables. At low levels of development, very poor countries exhibit quite different levels of child mortality, while at higher levels the opposite is true, with middle- and higher-income countries sharing similar levels of child mortality.

In model 3, we added four other explanatory variables in logs, plus a dummy. The first additional explanatory variable, LOGGIN, is the log of the Gini coefficient, indicator of income distribution, (the log of the Gini coefficient);²⁸ The second, LOGSERV, is an indicator of the country's propensity to invest in the development of basic services. It is an additive variable, constructed as the sum of four indicators, all divided by the level of GDPPC²⁹: the child immunization rate against measles³⁰, access to an improved water source³¹, access to improved sanitary facilities³², and the female primary school completion rate³³. LOGHPMEAN is the log of the share of public health expenditure in GDP.³⁴ LOGRATIO³⁵ is the log of the ratio between female and male life expectancy³⁶. MIDDLE is a dummy with value 1 for middle income countries and 0 for all other (low-income) countries. The model is thus:

$$(3) \log U5 = \alpha(\text{LOGGDPPC}) + \beta(\text{LOGGINI}) + \gamma(\text{LOGSERV}) + \delta(\text{LOGHPMEAN}) + \lambda(\text{LOGRATIO}) + \varphi(\text{MIDDLE}) + \varepsilon$$

All variables are significant either at the 1% or the 5% level, and the R-squared increases noticeably with respect to model 2, reaching 0.86 and thereby

²⁷ Model 1 does not pass the RESET test, suggesting the existence of non-linearities in the relationship between per capita income and child mortality. Non-linearities have also been found in the relationship between income per capita and other hunger and deprivation indicators (see, for instance, IFPRI 2006).

²⁸ Latest available figure

²⁹ This procedure allows to deplete the social indicators from the influence of economic development per se, so that they reveal ex post their respective governments' willingness and capability to invest in this area.

³⁰ Percentage for children ages 12-23 months.

³¹ Share of population.

³² Share of population

³³ Percentage of relevant age group, average of available data for the period 1988-2004. For this indicator, the average was preferred to the latest indicator as primary education affects mother's child care abilities only after a certain time lag.

³⁴ It is also an indicator of each national government's policy stance in a key services area, and is therefore conceptually similar to the previous variable,

³⁵ Latest available figure.

³⁶ See Smith and Haddad 2000.

suggesting that most of the inter-country variation was captured by this specification. These results show that child mortality is negatively correlated with economic development, national governments' propensity to invest in basic services (including female education³⁷), and the status of women, while it is positively correlated with income inequality³⁸. Moreover (consistently with model 2 and Graph 1), even after taking into account these factors, child mortality is particularly high in low-income countries.

Models in growth rates attempt at capturing the main determinants of progress in reducing child mortality over the 1990s and early 2000s. The dependent variable is the rate of reduction of under-five child mortality over the 1990-2002 period (U5R)

In model 4, the only explanatory variable is the growth rate of GDP over the same period (GDPPCR):

$$(4) \text{ U5R} = \alpha + \beta (\text{GDPPCR}) + \varepsilon$$

However, this specification explains very little and does not pass the RESET stability test, suggesting that the relationship between GDP growth and child mortality reduction is not linear. Such a non-linearity is confirmed by model 5:

$$(5) \text{ U5R} = \alpha + \beta (\text{GDPPCR}) + \gamma(\text{GDPPCR}^2) + \varepsilon$$

where GDPPCR² is the square of GDPPCR.. This quadratic polynomial relationship between GDPV and U5R is represented in Graph 2. The function is strongly concave (CHECK), but is also heavily influenced by two outliers, Equatorial Guinea and China. Excluding from the sample Equatorial Guinea (a scarcely representative country with less than 1 million inhabitants, where GDP growth was exclusively determined by the recent discovery of oil), the function is still concave (Graph 3). However, if also China is excluded,, the function becomes convex (Graph 4). These results show that in China the elasticity of child mortality reduction

³⁷ Trial regressions (not reported) run with each services variable taken individually showed that female primary school completion was the most significant one, followed by the immunization rate.

³⁸ The coefficients of LOGGDPPC and LOGGINI, in particular, which can be interpreted as elasticities, are almost of the same magnitude, showing that a 1% increase in GDPPC accompanied by a 1% increase in the Gini coefficient would leave almost unchanged the level of child mortality.

with respect to GDP growth tended to decrease markedly with growth acceleration, while this was not the case for most other countries (including Vietnam³⁹).

Model 6 is a more comprehensive one, which is structured in a fashion similar to model 3 in levels. SERPRIMWR is an additive variable constructed as the (unweighted) average of growth rates in the immunization, water, sanitary, and female primary completion rate original variables over 1990-1992, minus the growth rate of GDPPC. It is thus an indicator of the evolution of each country's propensity to invest in basic services. For the other variables, it was not possible to construct such a dynamic indicator, and therefore they are included in levels form, as in the previous models. This amounts to assume that income inequality, public health expenditure, and the status of women have also an impact on the evolution of child mortality, even if they do not change over a given period of time. The best fitting specification resulted to be one where the health policy variable is represented by HPMIDDLE (the product of HPMEAN by the MIDDLE)⁴⁰, and the square of the Gini coefficient (GINI2) was also included.

$$(6) \text{ U5R} = \alpha (\text{GDPPCR}) + \beta(\text{SERVR}) + \gamma(\text{GINI}) + \delta(\text{GINI2}) + \lambda(\text{HPMIDDLE}) + \varphi(\text{RATIO}) + \varepsilon$$

In model 6, R-squared improves dramatically with respect to models 4 and 5, showing that the regression explains about 2/3 of inter-country variability in child mortality reduction. The additive services variables is highly significant, and its coefficient is similar to that of GDP growth. The negative impact of income distribution is non-linear, and becomes relevant only when the Gini coefficient reaches the mid-30s (Graph 5). The public health variable is significant only in middle income countries.⁴¹ The latter two findings have a particular bearing on China, a country that during the 1990s became a middle income one thanks to its exceptional growth performance, and where in the same period the Gini coefficient increased progressively and entered the critical zone identified in graph 6. They also

³⁹ In Graph 4, Vietnam is represented by the last point on the right (the fastest-growing country after equatorial guinea and China), which lies practically on the curve.

⁴⁰ In a trial regression, the variable HPMEAN turned out as not significant.

⁴¹ The status of women also exerts a recognizable impact.

contribute to explain why Vietnam, which followed a similar development path, performed much better than China in reducing child mortality.

8. Conclusions

The results of our econometric analysis confirmed that child mortality is caused chiefly by two classes of economic and social factors. The first one is constituted by (personal) income-based factors affecting households' ability to purchase food and basic services on the market, which depend essentially on the level and distribution of purchasing power. They are synthetically represented by two indicators, GDP per capita and the Gini coefficient. Both of them were showed to be significant both in static terms (as determinants of the present level of child mortality in each developing country) and in dynamic terms (as determinants of the evolution of the dependent variables since 1990). The impact of income inequality on child mortality reduction, however, was relevant only for countries with a Gini coefficient in the mid-30s or higher. The second class is constituted by non-income factors related to the availability and access to basic health, sanitary, and education services, and to women's relative status. All of them are amenable to state intervention, albeit to very different extents and with different time lags, and implying different degrees of freedom on the part of national governments. In a medium-term time horizon, governments, can be assumed to enjoy a relatively ample degree of policy discretion to earmark higher shares of GDP to public health expenditure, immunization services and water and sanitation facilities. In the long run, governments can also promote primary education for girls and implement policy initiatives aimed at improving the status of women.

Our analysis has demonstrated the relevance of non-income factors, some of which represented as governments' propensities to invest in basic services, as important (static and dynamic) determinants of child mortality. It also showed that public health expenditure becomes key beyond a certain threshold of income. The latest findings show that non-income factors, and especially public expenditure on health and other key basic services, become even more crucial determinants of child nutrition and mortality in countries at an intermediate levels of economic development – and thus, among others, in the cases of present-day China.

How did China and Vietnam fare ? Their overall results so far are good, yet less so than what could have been achieved with an optimum policy mix. Thanks to the structural characteristics of their market socialist economies, they embarked on an exceptionally rapid path of economic growth. Income distribution deteriorated steadily, but as it started from a very egalitarian level the impact of growth on the incomes of the people was broad-based, albeit progressively less so. As a result, absolute poverty shrank dramatically and both China and Vietnam made enormous steps forward in improving people's access to food, and therefore in combating income- and food-based factors affecting child malnutrition and mortality. However, as China's income distribution has worsened so far much more than in Vietnam, the negative impact of income inequalities on child mortality reduction was much worse in China than in Vietnam.

China's and Vietnam's performance in terms of tackling non-income factors was more mixed. Immunization and sanitary infrastructure expanded – a progress made possible by economic growth, but also by the maintenance of a satisfactory degree of priority for these types of social expenditure. Non (econometrically) quantifiable scattered evidence on the expansion and effectiveness of targeted nutrition and sanitary programs is also positive, suggesting that virtuous policy and institutional forces (partly identifiable with legacies from the pre-reform period) are still at work in China and Vietnam, helping the overall progress in combating child malnutrition and mortality. Conversely, China's and Vietnam's performance was very bad in the area of public health policies.

In sum, China and Vietnam experienced an extraordinary economic development, yet a relative underdevelopment in the social area (due to the deterioration of income distribution and the inadequate provision of basic public social services). These contradictory trends were reflected in their path of progress towards reducing child mortality. Vietnam's performance was very good, in spite of having still relatively high rates of undernourishment. China fared very well in reducing undernourishment, less so in decreasing child mortality – in spite of its exceptional rate of economic growth. This divergence is to be attributed mainly to two factors. First, gender discrimination is a serious problem in rural China, but not in rural Vietnam. Second, the perverse social effects of ill-conceived market-oriented reforms have gone much further in China than in Vietnam.

Taking also into account the size of their populations, it is fair to acknowledge that the scale of the progress already realized in China and Vietnam in combating child hunger and deprivation is historically unprecedented.. Yet – as our analysis has showed – the level already achieved by the Gini coefficient, the continuing trend towards a further deterioration of income distribution, and the underfunding of public health (an area of increasing centrality for countries at an intermediate level of development) are persistent and increasingly worrying negative factors⁴². If unchallenged, they would inevitably imply that future economic growth will deliver progressively diminishing returns in terms of reducing child malnutrition and mortality. The urgency of fighting social underdevelopment is strengthened by the mounting evidence on the multiple virtuous synergies linking nutrition, health, and economic growth, showing that trade-offs between social and economic development are much smaller than what could be assumed still 10–15 years ago⁴³. To tackle the severe contradictions of their presently-existing market socialist systems, both China and Vietnam would require profound policy changes aimed at combating inequalities and prioritizing public social expenditure.

⁴² See Zhao 2006.

⁴³ In China, taking into account the structural imbalances leading to an excessive accumulation of foreign exchange reserves, there are also strong macroeconomic reasons militating in favour of shifting resources from savings to social services (see Blanchard and Giavazzi 2005).

TABLES

Table 1.
China's and Vietnam's basic economic and social indicators in a comparative perspective

1.1. Growth of GDP, agriculture and food production

	Vietnam	China	Cuba*	Middle Income	East Asia & pacific	World	Low Income	
GDP 80-90	4.6	10.3	na		2.8	7.9	3.3	4.4
GDP 90-03	7.5	9.6	-1		3.5	7.6	2.8	4.7
AGR 80-90	2.8	5.9	na		3.6	4.9	2.7	2.8
AGR 90-03	4.2	3.5	na		2.2	3.1	1.9	3
Food production	67	68	na		83	77	84	82
(index 1999-2001=100)	115	110	na		110	111	105	103

* The figure for GDP growth is from CEPAL and refers to 1990-2002. WB 2005 reports for 1990-2003 a figure of 3.9; it is obviously incorrect and therefore it was not utilized. WB 2005 also reports data on Cuba's agricultural and food production growth but we did not consider them to be sufficiently trustworthy.

1.2. Nutrition

		Vietnam	China**	Cuba	World	Low income	Low and middle	East Asia and Pacific***	
Undernourishment (% prevalence)	1990-92		31	16	8	20	27	20	17
	2000-02		19	11	3	16	25	17	12
	Reduction (%)		38.7	31.3	31.3	20.0	7.4	15.0	29.4
Child malnutrition% (Stunting)	Latest		36.5	14.3	4.6	na	43.1	na	15
	1992-93		49.5	31.4	na	na	na	na	19
	1987-89		56.5	na	na	na	na	na	na
	1983-84		59.7	na	na	na	na	na	na

* For Vietnam, the latest figure for stunting refers to the 2003 survey

** For China, the latest figure for stunting refers to the 2002 survey, and the one for 1992-93 to the 1992 survey.

*** For East Asia and the Pacific, the earlier figure refers to surveys conducted between 1989 and 1994

1.3. Disease prevention

		Vietnam	China	Cuba	World	Low income	Low&middle
Access to an improved water source (% of population)*	90	66**	70	na	75	64	72
	2002	79***	77	91	82	75	79
	Increase(%)	19.7	10.0	na	9.3	17.2	9.7
Access to improved sanitation facilities	1990	22	23	98	43	20	50
	2002	41	44	98	54	36	76
Child immunization rate		86.4	91.3	0.0	25.6	80.0	52.0
	Measles	93	84	99	77	65	76
	DPT	99	90	71	78	67	77
Consumption iodized salt	Latest	83	93	83	67	53	17
Vitamin A Supplementation	2002	55	na	na	na	na	56

*Data on access to an improved water source are only tentatively comparable among different countries

** 1992-93

*** 2000

1.4. Educational, behavioral and gender variables

		Vietnam	China	Cuba	World	Low income	Low and middle
Exclusive breastfeed		15	67	41	na	na	na
Primary completion rate females	1988/89	na	99	93	na	57	88
	1993/94 - 2000/01 - 2003/4	95	95	94	na	66	94
Youth literacy rate good	1990 female	94	93	99	87	73	87
	male	94	97	99	79	55	78
Adult literacy rate		1.000	0.959	1.000	1.101	1.327	1.115
	1990 female	87	69	95	63	38	73
	male	94	87	95	74	60	62
		0.926	0.793	1.000	0.851	0.633	1.177
Life expectancy at birth 2003	female	72	73	79	69	59	66
	Male	68	69	75	65	57	63
	ratio	1.059	1.058	1.053	1.062	1.035	1.048

1.5. Health expenditure

	Vietnam	China	Cuba	World	Low income	Low&middle
Total % GDP 2002	5.2	5.8	7.5	10	5.5	6
Public % GDP	1.5	2	6.5	5.8	1.5	3
% of total	29.2	33.7	86.5	60	27.8	49.4
Out of pocket % of private	87.6	96.3	75.2			

1.6. Poverty

	Vietnam	China	World
% below 1\$ line	1981	70*	63.8
	2001	24.1	16.6
% below 2 \$ line	1981	na	88.1
	2001	na	46.7
Population below national poverty line %**	1998	37.4	4.6
	2003-4	19.5	3.1

* Source: World Bank, quoted in <http://perso.wanadoo.fr/patrick.guenin/can Tho/vnnews/poverty1.htm>

** Source: Wikipedia

(http://en.wikipedia.org/wiki/List_of_countries_by_percentage_of_population_living_in_poverty)

1.7 Under 5 mortality rate by quintile and Gini index

	Vietnam	China
Under 5 mortality rate		
Poorest quintile	63	
Richest quintile	23	
Gini (latest)	37	44.7

1.8 Eradicate extreme poverty and hunger

	Vietnam	China	Cuba	East Asia&Pacific
Eradicate extreme poverty and hunger	7.5	4.7	na	
Share poorest quintile %	45	17	na	19
Underweight % children under 5	34	10	4	14.7
Reduction (% , early1990s-early2000s)	24.4	41.2		22.6

1.9 Millennium Development Goals

		Vietnam	China	Cuba	World	Low income	Low and middle	East Asia Pacific
Achieve universal primary education	1988/89-1993/94	na	105	94		65	81	97
Primary completion rate	2000/1-2003/4	95	98	94		71	84	97
Promote gender equality								
Ratio male/female enrolment ratio	1990-91	na	87	106		74	84	89
	2003-4	93	97	97		84	91	97
Reduce child mortality*								
Under 5 mortality rate/1000	1990	53	49	13	95	149	103	59
	2003	23	37	8	86	123	87	41
Reduction (%)		56.6	24.5	38.5	9.5	17.4	15.5	30.5
Improve maternal health								
Maternal mortality ratio/100000	2000	130	56	33	407	689	444	116
Birth attended by skilled health staff	2000-03	85	97	100	na	na	na	91

* UNICEF 2006 reports a more favorable figure for under-5 mortality in China in 2004 (31/1000)
Source : WB 2005 (unless differently specified)

Table 2 – Ranking of economic and social indicators: China and Vietnam vis a vis other developing countries

a) 2002*	No. of observations	CHINA	VIETNAM
GDPPC	144	76	92
GINI	98	65	39
RATIO	148	106	52
HPMEAN	150	112	123
IMM	151	83	44
SANIT	139	95	98
WATER	141	88	95
UN	118	48	68
SCOLFEM	112	39	39
WASTING	89	29	78
STUNTING	78	22	63
IM	149	65	47
U5	147	63	40

b) Annual growth rates (1990/early 1990s-2002)

	No. of observations	CHINA	VIETNAM
GDPPCR	137	2	3
IMMR	126	109	49
SANITR	95	10	11
WATR	78	40	69
UNR	91	31	14
IMR	148	82	15
U5R	146	77	11

* Or latest available figure in WB 2005

Legend

GDPPC	GDP per capita
GINI	Gini coefficient
RATIO	Female to male life expectancy ratio
IMM	Child immunization rate (measles, % of children 12-23 months)
WATER	Access to an improved water source, % of population
SANIT	Access to improved sanitation facilities
SCOLFEM	Primary completion rate, females
UN	Prevalence of undernourishment (% of total population)
WASTING	Prevalence of wasting (%of children under 5)
STUNTING	Prevalence of stunting (%of children under 5)
IM	Infant mortality rate
U5	Under-5 child mortality rate
GDPPCR	Growth rate of GDPPC
IMMR	Growth rate of IMM
SANITR	Growth rate of SANIT
IMR	Growth rate of IM
U5R	Rate of reduction of U5

Note to table 2. The ranking in the growth rate of SCOLFEM for China and Vietnam could not be computed due to lack of available data in WB 2005.

Table 3 – Models' results

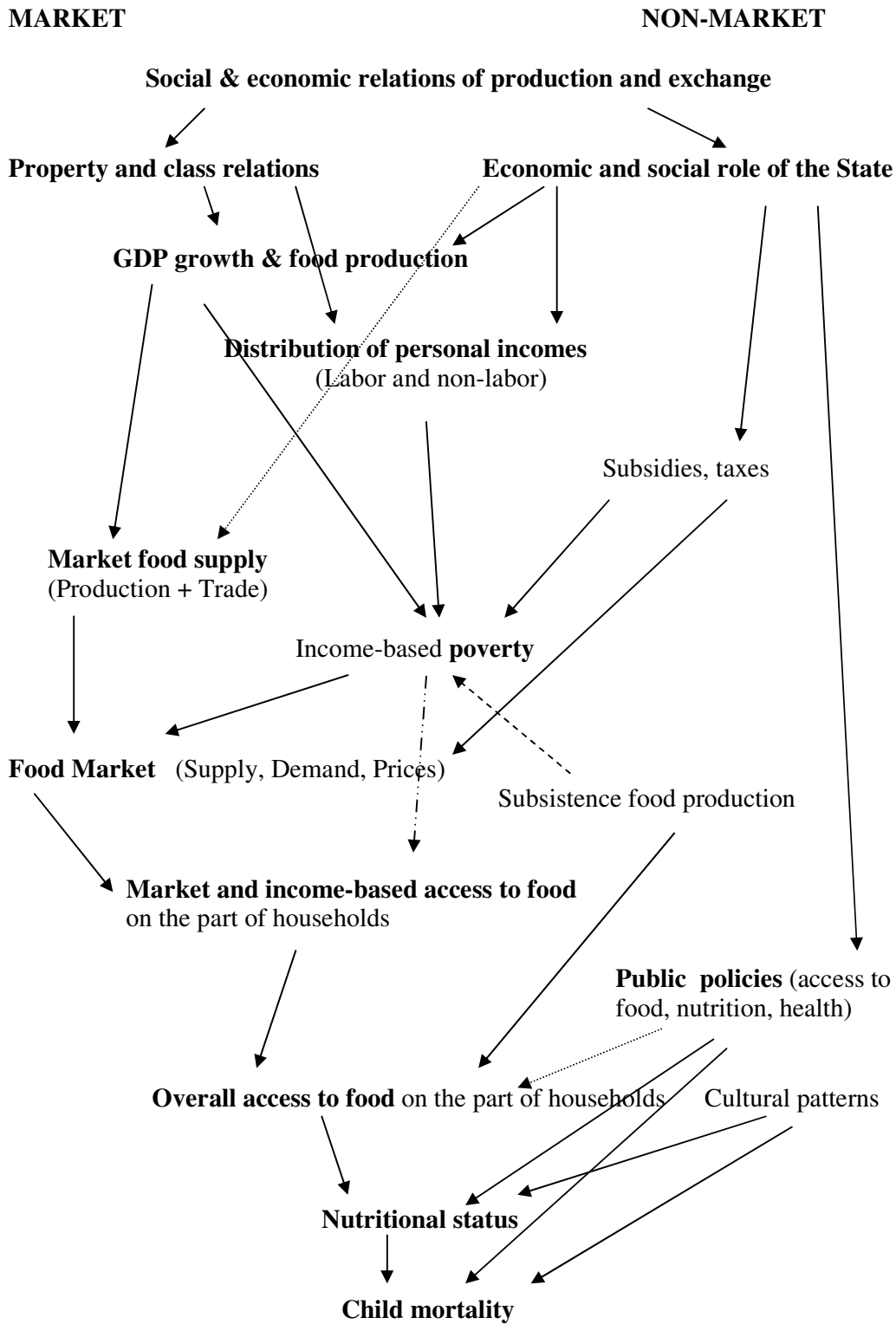
Model	No.Obs	Dep.Var.	Explanatory var.	Coeff.	Std.err.	T-stat.	Signif	Adj.R ²	F-Stat	White C.	Reset T.
1	140	U5	GDPPC	-0.02 109.54	0.00 7.33	-7.87 14.95	*** ***	30.00	60.54	Y	No
2	139	U5	LOGGDPPC C	-0.68 8.64	0.04 0.26	-18.05 33.70	*** ***	0.64	245.5	y	Y
3	61.00	U5	LOGGDPPC LOGGINI LOGSERVPRIMW LOGHPMEAN MIDDLE LOGRATIO C	-1.02 0.98 -0.72 -0.19 -0.44 -4.13 13.66	0.23 0.23 0.24 0.10 0.18 1.46 3.59	-4.37 4.25 -2.98 -2.01 -2.40 -2.83 3.80	*** *** *** ** ** *** ***	0.86	68.87	N	y
4	133.00	U5R	GDPPCR C	0.01	0.00 0.02	2.87 0.00	*** 10.34	0.05 ***	8.253	y	n
5	133	U5R	GDPPCR GDPPCR2 C	0.02 -0.01 0.02	0.01 0.00 0.00	4.16 -2.95 10.30	*** *** ***	0.10	8.72	N	y
6	41	U5R	GDPPCR SERVR LASTGINI GINI2 RATIO HPMIDDLE C	0.4538 0.4403 0.0063 -0.0001 0.4365 0.0042 -0.5770	0.15 0.15 0.00 0.00 0.10 0.00 0.11	3.06 2.95 2.20 -2.63 4.19 2.04 -5.44	*** *** *** *** *** ** ***	0.64	12.91	Y	

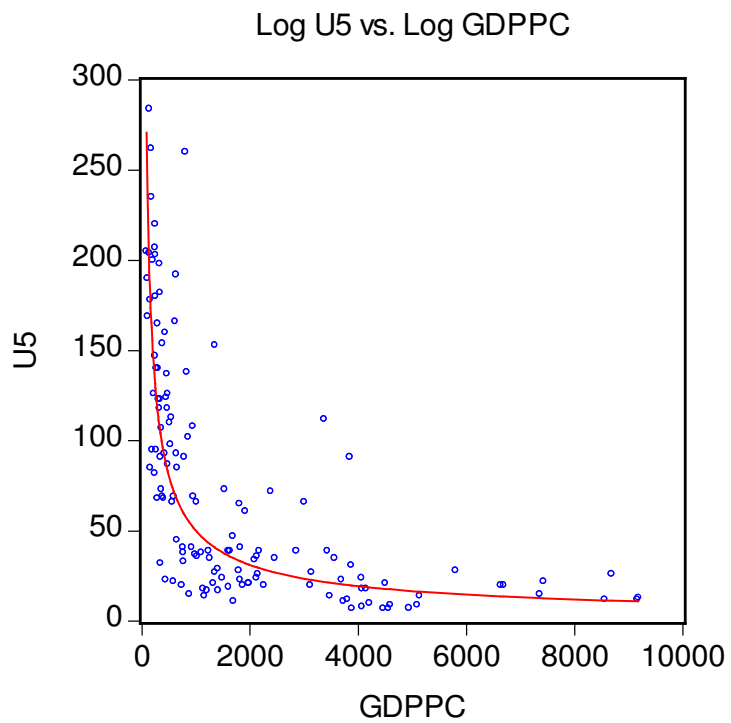
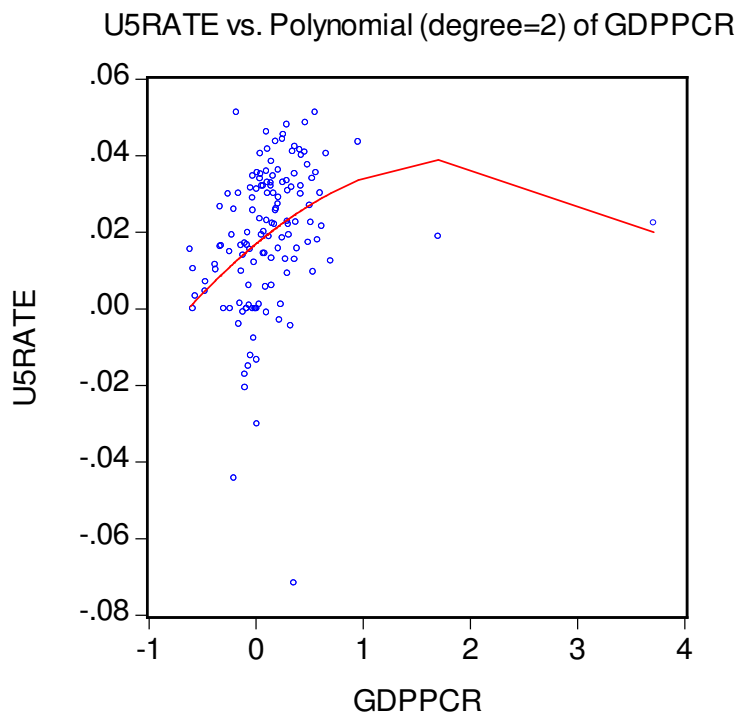
Note 1: In models 1,2, and 4 the White test revealed the presence of heteroskedasticity, and therefore White's heteroskedasticity-consistent estimator was used in place of OLS.

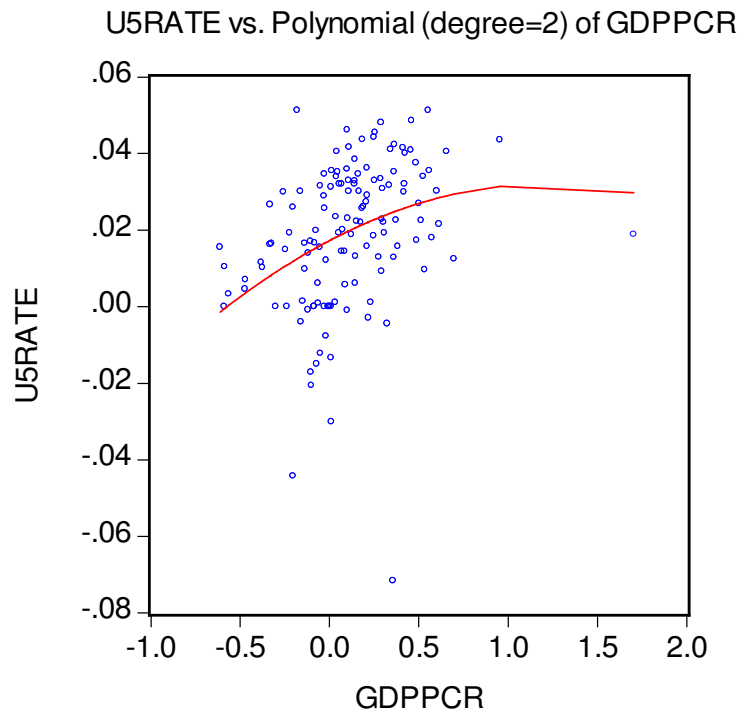
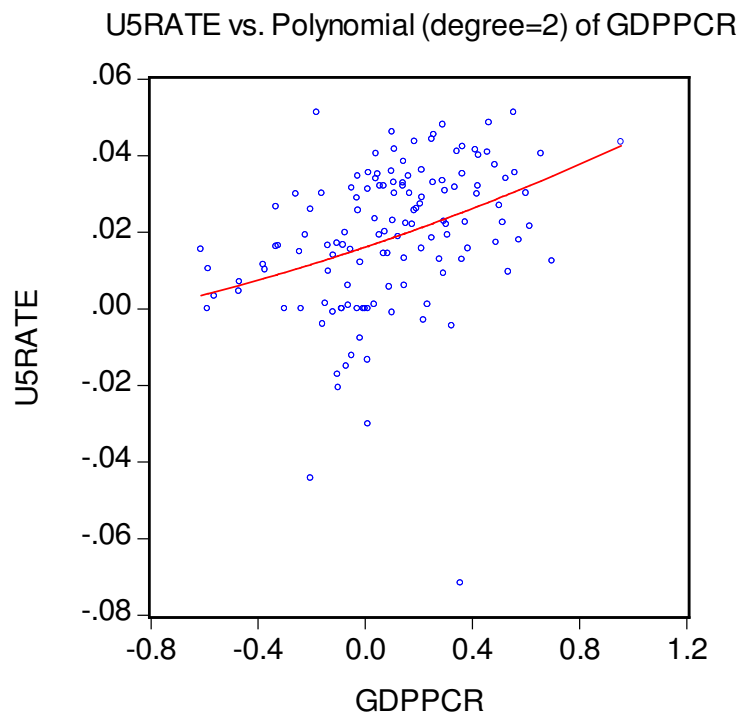
Note 2: In models 1 and 4 Ramsey's RESET test revealed the presence of specification errors

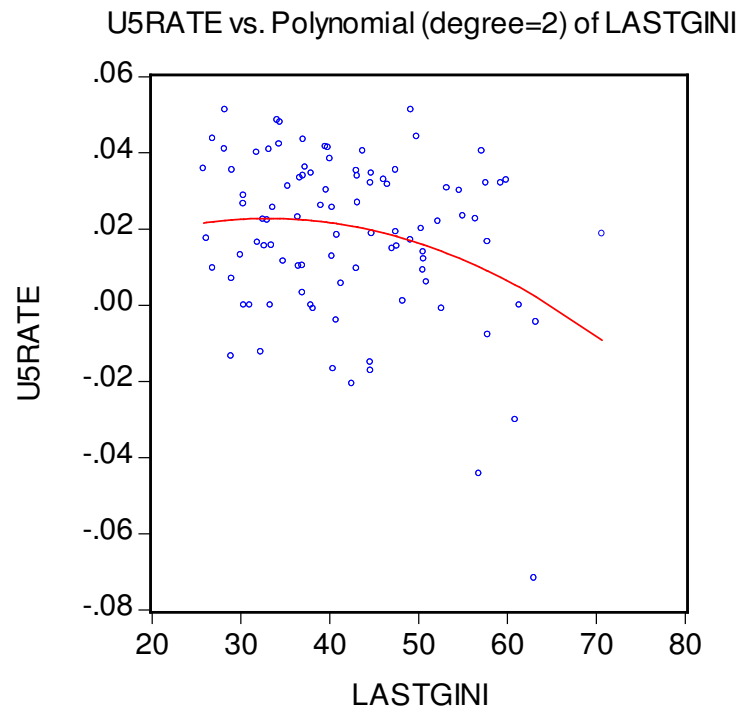
FIGURES and GRAPHS

Figure 1



Graph 1 U5 and GDPPC (all countries)**Graph 2 – U5 RATE and GDPPCR (all countries)**

Graph 3 – U5 RATE and GDPPCR (Equatorial Guinea excluded)**Graph 4 - U5 RATE and GDPPCR (Equatorial Guinea and China excluded)**

Graph 5 U5RATE and LASTGINI (all countries)

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