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Discovering Thoughts, Inventing Future

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Consumer's Acceptance Towards Genetically Modified Crops and Growth of the Economy: A Theoretical Approach

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Abstract- This paper develops a three-sector theoretical growth model to capture the role of consumers' acceptance towards the second generation of genetically modified (GM) crops in the long run growth process of the economy. An Acceptance (towards GM crop) parameter is defined as a ratio of consumption of GM to traditional variety of food, whose growth rate is determined by growth rate of human capital. Dynamic stability of the system is ensured provided the value of acceptance parameter is within a certain range. A range of the acceptance parameter is also obtained which ensures not only the dynamic stability of the system but also ensures higher rate of growth of an economy that produces both GM and non-GM crops compared to an economy that does not produce GM crops. The empirical validation of the model through panel data analysis suggests that research and development activity in agriculture is key to the growth process of the economy as it helps to form acceptance towards new technology among consumers.

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Amrita Chatterjee [α] & Arpita Ghose [σ]

Abstract- This paper develops a three-sector theoretical growth model to capture the role of consumers' acceptance towards the second generation of genetically modified (GM) crops in the long run growth process of the economy. An Acceptance (towards GM crop) parameter is defined as a ratio of consumption of GM to traditional variety of food, whose growth rate is determined by growth rate of human capital. Dynamic stability of the system is ensured provided the value of acceptance parameter is within a certain range. A range of the acceptance parameter is also obtained which ensures not only the dynamic stability of the system but also ensures higher rate of growth of an economy that produces both GM and non-GM crops compared to an economy that does not produce GM crops. The empirical validation of the model through panel data analysis suggests that research and development activity in agriculture is key to the growth process of the economy as it helps to form acceptance towards new technology among consumers.

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I. Introduction

The extensive adoption of GM crops since 1996 has provided enough evidence in favor of and against Agricultural Biotechnology. There is no double about the fact that GM crops have been successful in raising production level, reducing cost and therefore been able to provide significant economic benefit at the farm level over the years (Brookes & Barfoot; 2013 and Barrows et al.; 2014). However, Mathiowetz and Jones (2016) have rightly pointed out that even if the scientific community has accepted the safety of Genetically Modified (GM) crops, the consumers are still skeptical about consumption of GM food on factors such as religion, education, socio-economic status, safety, and personal assessment of the risk–benefit ratio.

The first generation of GM crops provided improved agronomic traits such as tolerance of specific chemical herbicides and resistance to pests and diseases (James, 2003), providing direct benefits to the producer through increased profitability by increasing factor input productivity i.e. reducing factor cost (Marra et al, 2002). The A meta-analysis performed by Klumper and Qaim (2014) has showed that *"on average GM technology adoption has reduced chemical pesticide use by 37%, increased crop yields by 22%, and increased farmer profits by 68%. Yield gains and pesticide reductions are larger for insect-resistant crops than for herbicide-tolerant crops. Yield and profit gains are higher in developing countries than in developed countries." USA, Brazil, Argentina, India and Canada are the top 5 countries followed by China and Paraguay in terms of area under cultivation of GM crops. As per James (2014) farmers from developing countries of Latin* America, Asia and Africa together grew 53% of the global biotech hectares compared to industrial countries, which grew 47%, equivalent to a gap of 11 million hectares in favor of developing countries. The 5 leading biotech developing countries Brazil, Argentina, India, China, and South Africa, grew 47% of global biotech crops. However, unlike farmers, who have been benefited and quickly adopted the transgenic plants such as Bt cotton and corn and herbicide-resistant soybeans (Economic Research service, 1999), consumers have reservations about the foods produced from these crops. Introduction of the so-called first generation of GM crops met with consumer resistance on health, environmental, moral and philosophical concerns (Hobbs and Plankett, 1999; Lindner, 2000). This led to a second generation of genetic modification seeking also to improve various attributes of GM crops to provide direct benefit to the final consumer such as enhanced nutritional content, improved durability and less pesticide application (Kishore and Shewmaker. 1999), such as Golden Rice. It is a GM variety, in which beta-carotene (Vit A) synthesizing gene introduced through genetic engineering technique, that may not improve farm productivity but can improve health significantly by providing pro-vitamin A (Dawe, Robertson and Unnevehr 2002. Zimmermann and Qaim., 2004). Thus the distinct benefits provided by the GM food which are not available in non-GM food are going to be critical in forming consumers' preference for GM products (House et al, 2002).

From Smale et al (2006) we find a detailed review of literature in the context of both industrialized and non-industrialized agricultural countries which are

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either based on surveys conducted to examine consumers' concern or evaluation of consumers' willingness to pay for GM food based on stated preference method. The conclusions of the studies are mixed in non-industrialized countries with some consumers being concerned about the consumption of GM Food and some being open to it. In industrialized countries also some consumers are willing to pay price premium for non-GM food (Huffman et al., 2003) or demanding discount for consuming GM food (Grimsrud et al., 2004), though most of the studies conclude in favor of acceptance of GM crops. For more recent studies reference can be made to Nayga et al (2006), Jan et al (2008), Kimenju and Groote (2008) etc. Some studies have also focused on the welfare effect of the labeling policy or information on genetic modification on consumer welfare (Fulton and Giannakas, 2002; Huffman, 2003; Lusk et al, 2005; Carlsson et al, 2007). Later on Colson & Rousu (2013) have provided a nice review of the empirical contribution of researchers over last 15 years towards consumers' willingness to pay for GM food based on survey and experimental methods[1]. They have tried to cover a number of unresolved issues on consumer preferences. Moreover, there are few more studies which have exclusively focused on the consumers' attitude towards GM crops in developing countries; for example, Deodhar et al. (2008); Qiu et al. (2011); Mandal and Paul (2012); Kajale & Becker (2014); Kajale & Becker (2015); Kajale & Becker (2015a); Amin and Hashim (2016); Ma and Gan (2016).

Consumers seem to be more inclined towards GM crops with some beneficial attribute such as higher nutritional content or less allergic. Anderson et al (2004) has captured the essence of enhanced nutritional value of second generation of GM crop. Miles et al (2006) have shown in their survey based study on consumers that intention to purchase genetically modified food with specific benefits such as 'low-allergen food' was higher than intention to purchase an unspecified genetically modified food. Giannakas and Yiannaka (2008) have also introduced consumer-oriented second generation of GM crops in the food system to see the effect of horizontal and vertical product differentiation on heterogeneous consumers. Most recently a study by Hans et al. (2016) provides a systematic review of the literature on consumer acceptance of, and willingness-to-pay for, GM crops with enhanced vitamin levels. This study classifies the key determinants of acceptance and willingness-to-pay into five categories: socio-demographic variables, knowledge, attitudinal and behavioral determinants, and information. Labeling facility also plays an important role in forming consumers' attitude towards adoption of GM crops as that helps them to make an informed purchase (Gruère et al, 2008; Sleenhoff & Osseweijer, 2013; Vecchione et al, 2014). However, the study of existing literature shows that there is dearth of theoretical literature that tries to explain the role of consumers' acceptance towards the consumer-oriented 2nd generation of GM crops in the long run growth process of the economy. This paper attempts to analyze the same through the formulation of a growth model. Here we have avoided any complication arising out of alternative labeling regimes and segregation enforcement regulations.

A three-sector growth model has been considered with one genetically modified food crop producing sector, one traditional agricultural sector (non-GM) and a manufacturing sector. As per Curtis et al (2004) the consumers in developing countries are more inclined towards GM crops than developed countries as benefits like cost reduction, yield-increase and nutritional enhancement dominate their risk perceptions. Thus the highlighting feature of GM crop considered here is higher nutritional content (e.g. Golden Rice), thereby enticing the consumers to put positive value on it, which is captured by a positive acceptance parameter. In the demand side of the economy the role of human capital has been introduced to determine the consumers' acceptance towards GM crop. We have defined an Acceptance parameter as a ratio of consumption of GM to non-GM (traditional variety) food and growth rate of this parameter is determined by growth rate of human capital. The representative consumer maximizes the discounted flow of instantaneous utility over an infinite time horizon to get the growth rates of GM food, non-GM food and Manufacturing goods respectively. As the growth rates of GM and non-GM food depend on the acceptance parameter and also on the growth rate of human capital, we are able to put some restriction on the acceptance parameter for ensuring global dynamic stability. Moreover, we have got a range for the acceptance parameter for which the dynamic stability of the equilibrium is ensured as well as a higher rate of growth of total consumption expenditure is possible in presence of GM crop compared to an economy without producing GM crop. The rest of the present paper is organized as follows. In section two we describe the basic features of the model. The section three is concerned with analyzing the consumer's allocation problem. The steady state solution of the model is analyzed in section four. The stability properties of the model are in section five. In section six we have compared two economies, one with GM food and another without the same. The empirical validation of the theoretical model is done in section 7. Some concluding observations are made in the final section.

II. Model

The economy is composed of three sectors, two agricultural sectors, one producing a Genetically

[1] Also refer to Varzakas and Tzanidis (2016)

Modified (GM) food product and the other producing a traditional variety and one manufacturing sector (does not use any GM product). All the three sectors use labor and the population size of each type of producer is normalized to unity. The production functions of GM and non-GM sectors are given by:

$$Y^{GM} = \mu_1 H.f(L_1, Z_1)$$

and

$$Y^{NGM} = \mu_2 H.f(L_2, Z_2)$$

Here Y^{GM} and Y^{NGM} are the agricultural output using GM seed and traditional variety of seeds respectively. L_i is the labor endowment, Z_i is the composite input other than labor and *H* is human capital. *H* represents a composite variable, which includes scientists who are engaged in research and development activities in the laboratories and the amount devoted to R & D expenditure. μ_i is the parameter which signifies the fraction of human capital going to i th sector. As different sectors require different amount of deployment of Human Capital, this parameter has different values for different sectors.

The representative producers of both GM and non-GM crop consume whatever they produce; hence they do not save or invest. That is why there is no capital accumulation from this productive activity. Hence physical capital does not enter their production function as an input. However, capital accumulation in this model originates from the manufacturing sector. The production function of the manufacturing sector is as follows,

$$Y^{M} = \mu_3 H.f(L_3, K)$$

Here Y^{M} is the output of the manufacturing sector which employs physical capital (*K*) and labor (L_3) Here μ_3 signifies the fraction of human capital going to the manufacturing sector.

In the demand side of the economy, the representative household is assumed to maximize her discounted flow of instantaneous utility over an infinite time horizon. Here we assume that each of the three types of producer consumes all the three commodities. Let the instantaneous utility function[2] be

$$U = \delta_1 \ln c_t^M + \delta_2 \ln c_t^{GM} + \delta_3 \ln c_t^{NGM} \qquad (1)$$

where c_t^M, c_t^{GM} and c_t^{NGM} respectively denote per capita consumption of manufacturing, GM food and traditional food at time t and δ_i the proportion of expenditure spent on i th good, $\forall i = 1,2,3.$ Here we define A_t which is an indicator, suitably constructed showing the degree of acceptance of the consumer towards Genetically Modified crops. A_t is the ratio in which GM and NGM food are consumed i.e.

$$A_t = \frac{c_t^{GM}}{c_t^{NGM}} > 0.$$

Intuitively, A_t is an attribute. Consumer has a perception about the acceptability of GM food which is captured by this attribute. A_t grows over time following a dynamic growth path. Now, it can be assumed that the acceptance of GM product is dependent on scientific investigation of pros and cons of the GM food and the dissemination of the knowledge to the users by the private individuals, the social planners and the personnel working in the extension division of the respective country. Here lies the role of human capital, which can be used in R&D activities to investigate the benefits available from GM food and to spread that information among the consumers. Thus the level of human capital (H) prevailing in the economy will influence the movement of acceptance parameter. As the level of human capital and knowledge increase, the probability of accepting the new GM product increases.

Thus, we assume that the movement of A_t s determined by the accumulation of human capital i.e.

$$\frac{A_t}{A_t} = \frac{\dot{H}}{H} = h \qquad (2)$$

Now, let us assume that the saving propensities of the three types of producers are s_1, s_2 and s_3. As per our model, $s_1, s_2 = 0$ and $s_3 = \dot{K}_t$. Thus the composite budget constraint of the representative consumer of the economy can be given by,

[2] This is an additively separable utility function, which is chosen keeping in mind the allocation of expenditure among the commodities.

$$\frac{r_t.K_t}{P_t^M}+\frac{w_t.L_t}{P_t^M}=C_t^M+\frac{P_t^{NGM}}{P_t^M}.C_t^{NGM}+\frac{P_t^{GM}}{P_t^M}.C_t^{GM}+\dot{K}_t$$

$$\Rightarrow \frac{\dot{K}_t}{K_t}=\left(\frac{r_t}{P_t^M}\right)+\left(\frac{w_t/P_t^M}{K_t/L_t}\right)-\frac{C_t^M/L_t}{K_t/L_t}-P_{1t}\frac{C_t^{NGM}/L_t}{K_t/L_t}-P_{2t}\frac{C_t^{GM}/L_t}{K_t/L_t}$$

$$\Rightarrow \frac{\dot{K}_t}{K_t}=\left(\frac{r_t}{P_t^M}\right)+\frac{w_t/P_t^M}{k_t}-\frac{c_t^M}{k_t}-P_{1t}\frac{c_t^{NGM}}{k_t}-P_{2t}\frac{c_t^{GM}}{k_t}$$

where $r_t'=\frac{r_t}{P_t^M}$, $w_t'=\frac{w_t}{P_t^M}$, $r_t=$ nominal rate of return to capital, $w_t=$ nominal wage rate, n = population growth rate, $r_t'=$real return on capital and $k_t=\frac{K_t}{L_t}=$ capital per capita, $w_t'=$ real wage rate, C_t^{GM}, C_t^{NGM} and C_t^M are consumption of GM, non-GM and manufacturing commodities respectively. P_t^{GM}, P_t^{NGM} and P_t^M are respectively the prices of the three Now,

$$\frac{\dot{k}_t}{k_t}=\frac{\dot{K}_t}{K_t}-\frac{\dot{L}_t}{L_t}$$

$$\Rightarrow \frac{\dot{k}_t}{k_t}=\left(\frac{r_t}{P_t^M}\right)+\frac{w_t/P_t^M}{k_t}-\frac{c_t^M}{k_t}-P_{1t}\frac{c_t^{NGM}}{k_t}-P_{2t}\frac{c_t^{GM}}{k_t}-n$$

$$\Rightarrow \dot{k}_t=r_t'.k_t+w_t'c_t^M-P_{1t}c_t^{NGM}-P_{2t}c_t^{GM}-nk_t \quad (3)$$

$$n=\frac{\dot{L}_t}{L_t}, r_t'=\frac{r_t}{P_t^M}, w_t'=\frac{w_t}{P_t^M}$$

Thus equation (3) gives the dynamic budget constraint of the representative consumer.

III. Consumer Optimization

"The dynamic optimization problem of the representative consumer can be stated as Maximize

$$\int_0^\infty(\delta_1\ln c_t^M+\delta_2\ln c_t^{GM}+\delta_3\ln c_t^{NGM})e^{-rt}dt$$

subject to the dynamic budget constraint given by:

$$\dot{k}_t=r_t'k_t+w_t'-c_t^M-P_{1t}c_t^{NGM}-P_{2t}c_t^{GM}-nk_t$$

The consumer's problem is solved by maximizing the following current value Hamiltonian:

three commodities. Using price of manufacturing good as numeraire we get,

$$P_{1t}=\frac{P_t^{NGM}}{P_t^M}'P_{2t}=\frac{P_t^{GM}}{P_t^M}$$

Per capita consumption and capital stock are given by,

$$c_t^{GM}=\frac{C_t^{GM}}{L_t}, c_t^{NGM}=\frac{C_t^{NGM}}{L_t}, c_t^M=\frac{C_t^M}{L_t}, k_t=\frac{K_t}{L_t}$$

$$H_c=[\delta_1\ln c_t^M+\delta_2\ln(A_tc_t^{NGM})+\delta_3\ln c_t^{NGM}]+$$
$$\lambda_{kt}\,[r_t'k_t+w_t'-c_t^M-P_{1t}c_t^{NGM}-P_{2t}A_tc_t^{NGM}-nk_t]$$

Here c_t^M and c_t^{NGM} are the two control variables, k_t is the state variable whereas λ_{k_t} is the co-state variable.

The first order optimality conditions for maximization of H_c are

$$\frac{\partial H_c}{\partial c_t^{NGM}} = 0$$
$$\frac{\partial H_c}{\partial c_t^{M}} = 0 \quad (5)$$
$$\dot{\lambda}_{k_t} = -\frac{\partial H_c}{\partial k_t} + \rho\lambda_{k_t}$$

It can be shown that equations (5) along with the transversality condition

$$\lambda_{k_t} e^{-\rho t} \to 0 \text{, as } t \to \infty \quad (6)$$

are a necessary characterization of the optimum path solving the consumer's problem. Using (5) we derive the following equations of motion:[3]

$$\frac{\dot{c}_t^{NGM}}{c_t^{NGM}} = [(r_t' - n) - \rho] - \frac{h.A_t}{P_{1t}/P_{2t} + A_t} \quad (7)$$

$$\frac{\dot{c}_t^{M}}{c_t^{M}} = [(r_t' - n) - \rho] \quad (8)$$

$$\frac{\dot{c}_t^{GM}}{c_t^{GM}} = [(r_t' - n) - \rho] - \frac{h.A_t}{P_{1t}/P_{2t} + A_t} + h \quad (9)$$

IV. Steady State

In the steady state the per capita capital stock and the level of consumption per capita of all the three goods are constant. We denote the steady state values of these variables as k^*, c_{GM}^*, c_{NGM}^* and c_M^*.

- The Modified Golden Rule

With $\frac{\dot{c}_t^{GM}}{c_t^{GM}} = \frac{\dot{c}_t^{NGM}}{c_t^{NGM}} = \frac{\dot{c}_t^{M}}{c_t^{M}} = \frac{\dot{A}_t}{A_t} = \frac{\dot{k}}{k} = 0$,

we have the modified golden rule relationship:

$$r_t' = n + \rho \quad (10)$$

This implies that the real interest rate in steady state is equal to the sum of the discount rate and growth rate of population. Thus the taste and population growth determine the real interest rate $(n+\rho)$ and technology then determines the capital stock and level of consumption consistent with that interest rate.

V. Stability Properties

We now analyze the stability properties of the system and describe the regions in the parameter space which yield unique equilibrium.

For computational convenience we redefine our utility function as,

$$U = U(c_t), \text{ where}$$
$$c_t = c_t^M + P_{1t}c_t^{NGM} + P_{2t}c_t^{GM}\ ^4 \quad (11)$$

and

$$\dot{c}_t = (r_t' - n - \rho)(c_t - P_{1t}c_t^{NGM} - P_{2t}c_t^{GM}) +$$
$$P_{1t}\left[(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right](c_t - c_t^M - P_{2t}c_t^{GM}) +$$
$$+ P_{2t}\left[\frac{\dot{A}_t}{A_t} + (r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right](c_t - c_t^M - P_{1t}c_t^{NGM})$$

We consider the reduced system consisting of 2 differential equations described by equations (12) and (3). The system can be represented in matrix form as follows:

$$\begin{bmatrix}\dot{c}_t \\ \dot{k}\end{bmatrix} = \begin{bmatrix}(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} & 0 \\ -1 & r_t' - n\end{bmatrix}.$$
$$\begin{bmatrix}c_t \\ k_t\end{bmatrix} + \begin{bmatrix}C_1 \\ C_2\end{bmatrix} \quad (12)$$

C_1 and C_2 consist of some terms other than the coefficients of the variables concerned and Jacobian matrix or coefficient matrix is given by

$$J = \begin{bmatrix}(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} & 0 \\ -1 & r_t' - n\end{bmatrix}$$

[3] $\frac{\dot{c}_t^{GM}}{c_t^{GM}} = \frac{\dot{A}_t}{A_t} + \frac{\dot{c}_t^{NGM}}{c_t^{NGM}}$

[4] See the Appendix

The necessary and sufficient conditions for dynamic stability are negative trace of the coefficient matrix [J] accompanied by positive determinant of the matrix. Since our system is linear to begin with, the elements of the coefficient matrix are a set of constants. So there is no need to evaluate them at the equilibrium. Since there is no approximation process involved, the stability inferences will no longer be local but will have global validity.

- Condition for Dynamic stability

Trace of the Jacobian matrix is given by
Trace [J] =

$$(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\} + (r_t' - n)$$

For Trace [J] <0, we need,

$$\frac{P_{1t}}{P_{2t}}\left[\frac{(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}h + (r_t' - n)}{P_{1t}h - (r_t' - n - \rho)(1 + P_{1t} + P_{2t}) - (r_t' - n)}\right] < A_t$$

Now, determinant of the Jacobian matrix is given by,

$$|J| = [(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\}](r_t' - n)$$

For $|J| > 0$, either of the following two cases are feasible.

Case 1: Both $(r_t' - n) < 0$ and

$$(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\} < 0$$

The second condition leads us to the following condition;

$$\frac{P_{1t}}{P_{2t}}\left[\frac{(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}h}{P_{1t}h - (r_t' - n - \rho)(1 + P_{1t} + P_{2t})}\right] < A_t$$

Thus combining the two conditions we get:

$$\text{i} > r_t' < n \tag{13}$$

$$\text{ii} > \frac{P_{1t}}{P_{2t}}\left[\frac{(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}h}{P_{1t}h - (r_t' - n - \rho)(1 + P_{1t} + P_{2t})}\right] < A_t \tag{14}$$

Case 2: Both $(r_t' - n) > 0$
and

$$(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\} > 0$$

But if both of these expressions become positive, then their sum can never be negative. Since sum of these two terms is equal to the trace of the J matrix, it cannot be negative for ensuring dynamic stability. Thus if the above two conditions hold the simultaneous fulfillment of Trace [J] <0 and $|J| > 0$ will not be possible. So we discard this case.

Thus simultaneous fulfillment of (13) and (14) ensure the dynamic stability of the equilibrium which in turn put a restriction on the acceptance parameter. Therefore the consumers' acceptance parameter has an important role to play in the dynamic stability of the equilibrium. Here we note that, since GM crops are not very widely consumed all over the world, its demand will not be very high. That is why we are getting a particular range for the acceptance parameter.

VI. Comparison of two Economies: One Producing Both GM and Non-GM Food and the Other not Producing GM Food

Let there be an economy consisting of only two sectors, one producing only traditional agricultural good and another one producing a manufacturing good. Now we define the total consumption $(c_t)_1$ of the representative consumer as:

$$(c_t)_1 = (c_t^M)_t + \tilde{P}_{1t}(c_t^{NGM})_1 \quad (15)$$

where $(c_t^M)_t$ is the per capita consumption of manufacturing good and $(c_t^{NGM})_1$ is per capita consumption of traditional agricultural commodity. $\tilde{P}_{1t}$ is the relative price of agricultural commodity with respect to the price of manufacturing good. Here we assume that all the parameters in this economy are identical with that of the economy described in the earlier sections. However, since it does not produce the GM food, there is no acceptance parameter and human capital. The consumer's dynamic optimization of the utility function

$$U = \delta_1 \ln c_t^M + \delta_2 \ln c_t^{NGM}$$

subject to the dynamic budget constraint,

$$\dot{k}_t = r_t' k_t + w_t' - c_t^M - \tilde{P}_{1t} c_t^{NGM} - nk_t$$

leads us to following growth rates of non-GM and manufacturing good:

$$\frac{(\dot{c}_t^{NGM})_1}{(c_t^{NGM})_1} = [(r_t' - n) - \rho] \quad (16)$$

$$\frac{(\dot{c}_t^{M})_1}{(c_t^{M})_1} = [(r_t' - n) - \rho]$$

Now, differentiating equation (15) we get,

$$(\dot{c}_t)_1 = (\dot{c}_t^M)_t + \tilde{P}_{1t}(\dot{c}_t^{NGM})_1 \quad (17)$$

Dividing (17) by $(\dot{c}_t)_1$ we get the growth rate of total consumption of this economy as

$$\frac{(\dot{c}_t)_1}{(c_t)_1} = \frac{(\dot{c}_t^M)_1}{(c_t)_1} + \tilde{P}_{1t}\frac{(\dot{c}_t^{NGM})_1}{(c_t)_1} \quad (18)$$

Now, differentiating equation (11) we get,

$$\dot{c}_t = \dot{c}_t^M + P_{1t}\dot{c}_t^{NGM} + P_{2t}\dot{c}_t^{GM} \quad (19)$$

Dividing (19) by the (c_t) we get the growth rate of total consumption in the economy producing all the three goods ie manufacturing good, GM food and NGM food as

$$\frac{\dot{c}_t}{c_t} = \frac{\dot{c}_t^M}{c_t} + P_{1t}\frac{\dot{c}_t^{NGM}}{c_t} + P_{2t}\frac{\dot{c}_t^{GM}}{c_t} \quad (20)$$

Now, higher growth rate of total consumption expenditure will also imply higher growth rate of the economy. The growth rate of consumption for the economy with GM food will be greater than the growth rate of consumption for the economy without GM food if, $\frac{\dot{c}_t}{c_t} - \frac{(\dot{c}_t)_1}{(c_t)_1} > 0$, which in turn puts a restriction on the acceptance parameter:

$$\frac{P_{1t}}{P_{2t}}\left[\frac{[(r_t' - n - \rho)\{(\gamma_M - \gamma_{M_1}) + (P_{1t}\gamma_{NGM} - \tilde{P}_{1t}\gamma_{NGM_1}) + P_{2t}\gamma_{GM}\} + P_{2t}h\gamma_{GM}]}{P_{1t}h\gamma_{NGM} - (r_t' - n - \rho)\{(\gamma_M - \gamma_{M_1}) + (P_{1t}\gamma_{NGM} - \tilde{P}_{1t}\gamma_{NGM_1}) + P_{2t}\gamma_{GM}\}}\right] > A_t \quad (21)$$

where,

$$\gamma_M = \frac{c_t^M}{c_t}, \gamma_{M_1} = \frac{(c_t^M)_1}{(c_t)_1}, \gamma_{NGM} = \frac{c_t^{NGM}}{c_t}, \gamma_{NGM_1} = \frac{(c_t^{NGM})_1}{(c_t)_1}$$

and $\gamma_{GM} = \frac{c_t^{GM}}{c_t}$

Thus combining (14) and (21) we get a range for the acceptance parameter which not only ensures dynamic stability but also implies a higher growth rate of the economy in presence of GM food as,

$$\frac{P_{1t}}{P_{2t}}\left[\frac{(r_t'-n-\rho)(1+P_{1t}+P_{2t})+P_{2t}h}{P_{1t}h-(r_t'-n-\rho)(1+P_{1t}+P_{2t})}\right]<A_t<$$

$$\frac{P_{1t}}{P_{2t}}\left[\frac{[(r_t'-n-\rho)\{(\gamma_M-\gamma_{M_1})+(P_{1t}\gamma_{NGM}-\tilde{P}_{1t}\gamma_{NGM_1})+P_{2t}\gamma_{GM}\}+P_{2t}h\gamma_{GM}]}{P_{1t}h\gamma_{NGM}-(r_t'-n-\rho)\{(\gamma_M-\gamma_{M_1})+(P_{1t}\gamma_{NGM}-\tilde{P}_{1t}\gamma_{NGM_1})+P_{2t}\gamma_{GM}\}}\right] \quad (22)$$

However, we also need condition (13) i.e. $r_t'<n$ to ensure dynamic stability. This result reinforces the importance of the acceptance parameter in this analysis.

VI. Empirical Validation

The empirical validation of role of consumer acceptance of GM food on long term growth process of the economy is done by using data on non-GM crops obtained from FAOSTAT (available in http://faostat3.fao.org) as data on GM-crops are not available. We choose to focus on the research and development activity in the area of Agriculture. If the number of agricultural researchers increases then they can disseminate their knowledge among the farmers through extension services so that the farmers can adopt the new techniques that can not only improve the yield, can also reduce the expenditure on pesticides and fertilizer which indirectly reduces the environmental footprints. Inputs from agricultural scientists, if effectively utilized, can increase GDP from agriculture and therefore can boost the overall growth of the economy as GDP from agriculture is an important component of GDP of the country.

Table 1: Dependent variable: ln(per capita GDP)

Independent variable	Model I		Model II	
	coefficient	robust SE	Coefficient	robust SE
Fertilizer	.0035542*	.0015659	.0032481**	.0017009
Fertilizer^2	-.0000115*	0.00000356	-.000011	0.00000374
Researcher	.0035587*	.001494	.0059917	.0027278
Researcher^2			-.0000114**	0.0000062
constant	6.616918*	.0613572	6.604501	.0573199

**Significant at 5%; ** significant at 10%*

We have made use of a panel data of 42 countries with 3 years of data giving rise to 126 observations. In model I we have taken log of per capita GDP of the countries as the dependent variable whereas fertilizer, square of fertilizer and number of researchers per 10 thousand farmer as the independent variable. Fertilizer[5] is expected to have a positive impact on growth of the economy up to a certain level of usage as it improves the level of production and therefore GDP from agriculture. However, overuse of fertilizer may not be able to improve production rather it will have a negative impact as was the case of Green Revolution in India. It will also harm the environment through ground and water pollution. Thus fertilizer is expected to have a positive sign whereas square of fertilizer is expected to have a negative sign. As far as researchers are concerned it is expected to have appositive impact on driving the growth process of the economy.

As we are using a panel dataset, it may suffer from the problem of Heteroscedasticity as well as autocorrelation. To correct that we have used robust variance estimates. As all the independent variables are time variant we have used Panel Fixed Effect regression. Results reported in table 1 show that in model 1 fertilizer and fertilizer square are significant at 5% level with the former having positive and later having negative sign thereby vindicating our expectations. The marginal effect of fertilizer is positive but this positive effect gets attenuated with increase in fertilizer use; though the marginal effect of fertilizer on growth of the economy evaluated at panel mean of fertilizer is positive (0.0026). That means use of fertilizer initially raises the agricultural production and beyond a certain level it has a negative impact. However, that negative effect is offset by the positive effect as the final marginal effect is positive. The variable Researcher is also having positive and significant impact on growth of the economy. In model II we have added the square of researchers as another independent variable which is having a negative sign but is significant at 10% level. If the number of researchers increases, the research and development activity in agriculture will improve which will help the farmers get proper technical assistance to boost production without harming the environment. Thus it will have a positive impact on the growth process of the economy. However, too many researchers, may be due to involvement of biotech companies, may lead to confusion and conflict thereby reducing the production. The result from Model II reinforces our expectations with a positive and significant coefficient for researchers and

[5] Nitrogen + phosphate fertilizer used in arable and permanent crop area

negative coefficient for square of researchers. In this case also the marginal effect of the variable researcher is positive but gets reduced with increase in number of researchers though at the sample mean of the data it is having a positive value (0.0055). The marginal effect of fertilizer at the sample mean of data in this model is also positive (0.00235).

Table 2: Dependent variable: Production Index Number

Independent variable	Model III	
	coefficient	robust SE
Fertilizer	.8009666*	.2625966
Fertilizer^2	-.0020943*	.0006387
Research expenditure	5.233063**	2.666709
constant	74.49151*	8.193845

**Significant at 5%; ** significant at 10%*

In Model III we have taken Net Per Capita Production Index Number for agriculture (Agricultural PIN) as the dependent variable. As independent variable, apart from fertilizer and square of fertilizer we have taken agricultural research spending.[6] Table 2 reports robust standard errors and coefficients from Fixed Effect Panel Regression which shows that fertilizer and fertilizer square are significant with desired sign whereas Research expenditure has significant positive impact on agricultural production index. Agricultural research expenditure is supposed to encourage further development in agricultural biotechnology and thereby contributing towards improvement in agricultural production. The marginal effect of fertilizer at the sample mean is again positive (0.630445702) which implies that fertilizer usage has a positive effect on agricultural productivity though it gets reduced with overuse of fertilizer. However, fertilizer as an input in agricultural production has a positive contribution as signified by positive marginal effect. We can assume that this analysis will hold good for GM crops as well.

Thus above empirical analysis shows that research activity, both in terms of number of researchers and research expenditure, plays an important role in increasing agricultural production and therefore in the growth process of the economy. If the R & D activities can reduce environmental footprints of agricultural production and can improve yield significantly along with a cost saving mechanism, that will encourage the producers to adopt the GM technology more and more. If all these information about the positive impact of agricultural biotechnology reach the consumers apart from the producers, then obviously their acceptance towards GM food will improve. That in turn will help them consume GM food and therefore will boost the growth of the economy. In this way we can indirectly validate the findings of our theoretical model empirically.

VII. Conclusion

This paper models the environment-friendly second generation of GM crops to analyze the role of consumers' acceptance towards GM crops in the long run growth process of the economy. Here, it is assumed that the movement of the acceptance parameter is driven by the accumulation of the human capital in the economy. The dynamic optimization exercise of the representative consumer in infinite horizon framework shows that the growth rates of the GM and non-GM food depend on the acceptance parameter as well as on the growth rate of human capital. We have obtained the golden rule steady state solution where the real interest rate in steady state is equal to the sum of the discount rate and growth rate of population. Dynamic stability of the system is ensured provided certain restrictions on the acceptance parameter are fulfilled. We have also been able to get a range of the acceptance parameter which ensures not only the dynamic stability of the system but also ensures higher rate of growth of an economy that produces both GM and non-GM crops compared to an economy that does not produce GM crops. These results all the more highlight the importance of the role of consumers' acceptance of GM crops. However, there are certain limitations of this paper which can be incorporated in future. The paper does not incorporate variable like the area under GM crop in a growth maximizing or welfare maximizing framework. Moreover, different modes of financing R & D expenditure by the public sector as well as by the private sector can be incorporated. The effects of these alternative modes of financing can be compared. Another important aspect that could not be taken care of in order to keep our model simple is the issue of labeling policy.

However, we have tried to empirically validate the results of the theoretical model by using data on non-GM crops. Empirical analysis shows that research and development activity in agriculture measured by number of researchers will have a positive and significant impact on growth process of the economy. The agricultural research expenditure also has positive and significant contribution towards improvement of agricultural production. Fertilizer usage, however, will have a positive role up to a certain level and negative impact thereafter. This is in line with conventional wisdom.

[6] Share of Value Added (Agriculture, Forestry and Fishing)

Existing literature has given a detailed description of the impact of Agricultural Biotechnology on output and prices, environment and human health touching upon the issue of intellectual property rights as well. This paper, of course, has taken recourse to the environmentally sustainable and human health enhancing positive attributes of Genetically Modified food crops, though we acknowledge that there is a school of thought which has strong reservation against the commercial production of such crops (Dona & Arvanitoyannis, 2009; Kim, 2014). Even if the environmentalists are concerned about negative effects of trasngenes used to develop genetically modified organisms, Bakshi (2003) has reviewed the literature to show that GM crops available in the market that are intended for human consumption are generally safe and consumption of them does not bring any serious health issue. Thus it is an open debate that requires scientific investigations and therefore has got much attention in the economic literature (Domingo and Bordonaba; 2011; Delaney, 2015). Thus prolonged application on animals and clinical trials are required before the release of GM crops into the environment. Moreover, the approval of GM foods for commercial use by the Government authorities and formulation of relevant policies should be based on strict scientific assessments of benefits and risks of these crops, rather than being influenced by the campaigning of the so called public interest groups. Thus the acceptance of GM product is dependent on scientific investigation of pros and cons of the GM food and the dissemination of the knowledge to the users by the private individuals, the social planners and the personnel working in the extension division of the respective country. It makes the role of human capital all the more significant.

References Références Referencias

1. Amin, L and Hasrizul Hashim 2016. Reasons Analysis of Chinese Urban Consumers Opposing Genetically Modified Food—An Overview. Chapter 8 of *Genetically Modified Organisms in Food: Production, Safety, Regulation and Public Health.* Academic Press. Pages:75-85.
2. Anderson, Kym., L. A. Lackson and C. P. Neilsen. 2004. "Genetically Modified Rice Adoption: Implications for Welfare & Poverty Alleviation", World Bank Policy Research Working Paper No. 3380.
3. Anderson., K., E. Valenzuela and L.A. Jackson. 2008. Recent and Prospective Adoption of Genetically Modified Cotton: A Global Computable General Equilibrium Analysis of Economic Impacts. *Economic Development and Cultural Change;* Vol. 56, No. 2, pp. 265-296
4. Bakshi, A. 2003. Potential Adverse Health Effects of Genetically Modified Crops. *Journal of Toxicology and Environmental Health,* Part B: Critical Review. Volume 6, Issue 3.
5. Brookes, G & P. Barfoot. 2013. "The global income and production effects of genetically modified (GM) crops 1996–2011" *GM Crops & Food*, Volume 4, Issue 1, pages 74-83.
6. Barrows,G; Steven Sexton and David Zilberman 2014, "Agricultural Biotechnology: The Promise and Prospects of Genetically Modified Crops" *The Journal of Economic Perspectives,* Vol. 28, No. 1, pp. 99-119.
7. Carlsson., F., P. Frykblom and C. Lagerkvist. 2007, "Consumer benefits of labels and bans on Gm food- Choice Experiments with Swedish consumers", *American Journal of Agricultural Economics* 89, 152-162.
8. Colson, G. & M.C.Rousu. 2013."What do consumer surveys and experiments reveal and conceal about consumer preferences for genetically modified foods?" *GM Crops Food*. Jul-Dec;4(3):158-65.
9. Curtis, K.R., McCluskey, J.J., & Wahl, T.I.. 2004, "Consumer acceptance of genetically modified food products in the developing world", *Ag BioForum 7* (1&2), 70-75. Available on the World Wide Web: http://www.agbioforum.org/
10. Delaney, B. 2015. "Safety assessment of foods from genetically modified crops in countries with developing economies" *Food and Chemical Toxicology* 86, 132-143.
11. Domingo, José L and Jordi Giné Bordonaba .2011. A literature review on the safety assessment of genetically modified plants. *Environment International*. Volume 37, Issue 4, Pages 734–742.
12. Dona A and Arvanitoyannis IS. 2009. Health risks of genetically modified foods. *Crit Rev Food Sci Nutr.*Feb;49(2):164-75.
13. Dawe D., R. Robertson., L. Unnevehr. 2002, "Golden Rice: What role could it play in alleviation of vitamin A deficiency?" *Food Policy* 27, 541 – 560.
14. Deodhar ., Y. S., and S. Ganesh and W.S. Chern 2008, "Emerging Markets for GM foods: An Indian perspective on consumer understanding and willingness to pay". *International Journal of Biotechnology* 10(6), 570-587.
15. Economic Research Service 1999, "Genetically engineered crops for pest management", Economic Research Service, US Department of Agriculture.
16. Fulton, M. and K. Giannakas. 2002, "Consumption effect of genetic modification: what if consumers are right?" *Agricultural Economics* 27, 97-109.
17. Giannakas K., and A. Yiannaka. 2008. "Market and Welfare Effects of the Second-Generation, Consumer-Oriented GM Products." *American Journal of Agricultural Economics* 90: 152-71.
18. Grimsurd, K. M., J.J. McCluskey, M.L. Loureiro, and T.I. Wahl. 2004, "Consumer Attitudes to Genetically Modified foods in Norway", *Journal of Agricultural Economics* 55 (1), 75-90.

19. Gruère, Guillaume P., Colin A. Carter and Y. Hossein Farzin 2008. What Labelling Policy for Consumer Choice? The Case of Genetically Modified Food in Canada and Europe. *The Canadian Journal of Economics.* Vol. 41, No. 4, pp. 1472-1497
20. Hans De Steur UGent, Dieter Blancquaert UGent, Simon Strobbe UGent, Shuyi Feng, Jeroen Buysse UGent, Christophe Stove UGent, Willy Lambert UGent, Dominique Van Der Straeten U Gent and Xavier Gellynck UGent. 2016. Consumer Acceptance and Willingness-to-Pay for Genetically Modified Foods with Enhanced Vitamin Levels Chapter 18 of Genetically Modified Organisms in Food: Production, Safety, Regulation and Public Health Edited by Ronald Ross Watson and Victor R Preedy. Elsevier Academic Press. Page: 195-206. Available in: http://hdl.handle.net/1854/LU-8024576
21. Hobbs, J.E. and Plunkett. 1999, "Genetically Modified foods: consumer issues and the role of information asymmetry", *Canadian Journal of Agricultural Economics* 47, 445-455.
22. House, L., J.L.Lusk, M.Moore and B.Morrow. 2002, "Consumer Acceptance of and willingness to pay for Genetically Modified Foods in the United States and the European Union: A Review of Recent Findings", Working paper, Food and Resource Economics Department, University of Florida.
23. Huffman., W., J.F. Shoegren, M. Rousu and A. Tegene. 2003, "Consumer willingness to pay for genetically modified food labels in a market with diverse information: evidence from experimental auctions", *Journal of Agriculture and resource economics* 28: 481-502.
24. Huffman., W., 2003, "Consumers' acceptance of (and resistance to) genetically modified foods in high-income countries: effects of labels and information in an uncertain environment", *American Journal of Agricultural Economics* 85 (5), 1112-1118.
25. James.C. 2014, Global Status of Commercialized Biotech/GM Crops: 2014. ISAAA Briefs No. 49. ISAAA: Ithaca, NY.
26. Jan, M.-S., T.T. Fu, and C.L. Huang. 2007, "A Conjoint/Logit Analysis of Consumers' Responses to Genetically Modified Tofu in Taiwan", *Journal of Agricultural Economics* 58(2), 330-347.
27. Kajale, D & Tilman C. Becker .2014. Effects of Information on Young Consumers' Willingness to Pay for Genetically Modified Food: Experimental Auction Analysis. *Ecology of Food and Nutrition,* Vol 53 (3).
28. Kajale, D & Tilman C. Becker .2015. Factors Influencing Young Consumers' Acceptance of Genetically Modified Food in India. *Journal of Food Products Marketing*, vol 21 (5).
29. Kajale, D & Tilman C. Becker .2015a. Willingness to Pay for Golden Rice in India: A Contingent Valuation Method Analysis. *Journal of Food Products Marketing*, vol 21 (4).
30. Kim, T. 2014. Biotechnology: Regulatory Issues. *Encyclopedia of Agriculture and Food Systems.* Pages 153–172.
31. Kimenju., S., and h. Groote. .2008, "Consumer willingness to pay for genetically modified food in Kenya", *Agricultural Economics* 38 (1), 35-46.
32. Kishore, Ganesh M., Christine Shewmaker. 1999, Biotechnology: Enhancing Human Nutrition in Developing and Developed Worlds. Proceedings of National Academy of Sciences of the United States of America, Vol 96, No. 11, PP. 5968 – 5972.
33. Klümper W, and Qaim M .2014. A Meta-Analysis of the Impacts of Genetically Modified Crops. *PLoS ONE* 9(11): e111629. doi:10.1371/journal.pone.0111629
34. Lindner. B. 2000, The future of Frankesnstein Foods: In Proceedings of the paper presented at 44th annual conference of the Autralian Agricultural and Resource Economics Society, Sydney.
35. Lusk., J. L., Lissa O. House, Carlotta Valli, Sara R. Jaeger, Melissa Moore, Bert Morrow, W. Bruce Traill. 2005, "Consumer welfare effects of introducing and labeling genetically modified food", *Economic Letters* 88, 382-388.
36. Ma. Yue and Shaoping Gan 2016. Reasons Analysis of Chinese Urban Consumers Opposing Genetically Modified Food—An Overview. Chapter 42 of *Genetically Modified Organisms in Food: Production, Safety, Regulation and Public Health*. Academic Press.Pages 481–487
37. Miles, Susan, Christine Hafner, Suzanne Bolhaar, Eloina González Mancebo, Montserrat Fernández-Rivas, André Knulst& Karin Hoffmann Sommergruber 2006." Attitudes Towards Genetically Modified Food with a Specific Consumer Benefit in Food Allergic Consumers and Non-food Allergic Consumers" *Journal of Risk Research*. Volume 9, Issue 7.
38. Mandal, S. & Rik Paul .,,2012 ,Consumer Perception of Genetically Modified Food: Empirical Evidence From India. *Journal of International Food & Agribusiness Marketing*, vol 24 (2).
39. Marra, M., Pardey, P. and Alston, J. 2002, "The payoffs to agricultural biotechnology: an assessment of the evidence", *AgBioForum,* 5 (2), 43-50.
40. Mathiowetz, A. and J.M. Jones. 2016. "Genetically Modified Grains and the Consumer", Reference Module in Food Science.
41. Nayga, R., Mary Gillett Fisher and Benjamin Onyango. 2006, "Acceptance of genetically

modified food: comparing consumer perspectives in the United States and South Korea", *Agricultural Economics,* 34 (3), 331 – 341.
42. Qiu, H., Jikun Huang, Carl Pray & Scott Rozelle. 2012." Consumers' trust in government and their attitudes towards genetically modified food: empirical evidence from China. *Journal of Chinese Economic and Business Studies.* Volume 10, Issue .1 pages 67-87
43. Smale, M.,P. Zambrano., J. Falck., G. Gruere. 2006. "Parables: Applied Economics literature about the impact of genetically engineered varieties in developing economies", EPT Discussion paper 158. International Food Policy Research Institute.
44. Sleenhoff, Susanne & Patricia Osseweijer .2013. "Consumer Choice: Linking consumer intentions to actual purchase of GM labeled food products." GM Crops and Food. Special Issue: *Consumer Affairs*. pages 166-171.
45. Subramanian, A. & M. Qaim .2010. "The Impact of Bt Cotton on Poor Households in Rural India". *The Journal of Development Studies Volume 46*, Issue 2.
46. Varzakas. T. and T. Tzanidis.2016. Genetically Modified Foods: Risk Assessment, Legislation, Consumer Behavior, and Ethics. Reference Module in Food Science, from Encyclopedia of Food and Health, 2016, Pages 204-210.
47. Vecchione, Melissa., Charles Feldman & Shahla Wunderlich .2015. "Consumer knowledge and attitudes about genetically modified food products and labelling policy". *International Journal of Food Sciences and Nutrition.*Volume 66, Issue 3.
48. Zimmermann, R., M. Qaim. 2004, " Potential health benefit of golden rice : a Philippine Case Study". *Food Policy*, 29, 147 – 168.

Appendix

1. Consumer's Optimization

The current value Hamiltonian is given by:

$$H_c = [\delta_1 \ln c_t^M + \delta_2 \ln(A_t c_t^{NGM}) + \delta_3 \ln c_t^{NGM}] + \lambda_{kt} [r_t' k_t + w_t' - c_t^M - P_{1t} c_t^{NGM} - P_{2t} A_t c_t^{NGM} - n k_t] \quad (A.1)$$

Applying the maximum principle to the current value Hamiltonian we obtain:
The first order optimality conditions for maximization of H_c are

$$\frac{\partial H_c}{\partial c_t^{NGM}} = 0 \Rightarrow \lambda_{kt} = \frac{\delta_1 + \delta_2}{c_t^{NGM}(P_{1t} + A_t P_{2t})} \quad (A.2)$$

$$\frac{\partial H_c}{\partial c_t^M} = 0 \Rightarrow \lambda_{kt} = \frac{\delta_1}{c_t^M} \quad (A.3)$$

$$\dot{\lambda}_{k_t} = -\frac{\partial H_c}{\partial k_t} + \rho \lambda_{k_t} \quad (A.4)$$

From (A.2)

$$\dot{\lambda}_{kt} = -\frac{(\delta_1 + \delta_2)\dot{c}_t^{NGM}}{(c_t^{NGM})^2 (P_{1t} + A_t P_{2t})} - \frac{(\delta_1 + \delta_2) P_{2t} \dot{A}_t}{c_t^{NGM} (P_{1t} + A_t P_{2t})^2} \quad (A.5)$$

$$\frac{\partial H_c}{\partial k_t} = \lambda_{k_t}.(r_t' - n) = \frac{\delta_1 + \delta_2}{c_t^{NGM}(P_{1t} + A_t P_{2t})}.(r_t' - n) \quad \text{(A.6)}$$

From (A.4) and (A.6) we get,

$$\dot{\lambda}_{k_t} = \frac{\delta_1 + \delta_2}{c_t^{NGM}(P_{1t} + A_t P_{2t})}.\rho - \frac{\delta_1 + \delta_2}{c_t^{NGM}(P_{1t} + A_t P_{2t})}.(r_t' - n) \quad \text{(A.7)}$$

Equating (A.5) and (A.7) we get,

$$-\frac{(\delta_1 + \delta_2)\dot{c}_t^{NGM}}{(c_t^{NGM})^2(P_{1t} + A_t P_{2t})} - \frac{(\delta_1 + \delta_2)P_{2t}\dot{A}_t}{c_t^{NGM}(P_{1t} + A_t P_{2t})^2} = \frac{\delta_1 + \delta_2}{c_t^{NGM}(P_{1t} + A_t P_{2t})}.\rho -$$

$$\frac{\delta_1 + \delta_2}{c_t^{NGM}(P_{1t} + A_t P_{2t})}.(r_t' - n) \quad \text{(A.8)}$$

where, $\frac{\dot{A}_t}{A_t} = \frac{\dot{H}}{H} = h$

From (A.3) we get,

$$\dot{\lambda}_{k_t} = -\frac{\delta_1.\dot{c}_t^M}{c_t^{M\,2}} \quad \text{(A.9)}$$

Since, $\frac{\partial H_c}{\partial k_t} = \lambda_{k_t}.(r_t' - n) = (r_t' - n).\frac{\delta_1}{c_t^M}$ (A.10)

From (A.4) we get,

$$\dot{\lambda}_{k_t} = -(r_t' - n)\frac{\delta_1}{c_t^M} + \rho.\frac{\delta_1}{c_t^M} \quad \text{(A.11)}$$

Equating (A.9) and (A.10) we get,

$$-\frac{\delta_1.\dot{c}_t^M}{c_t^{M\,2}} = -(r_t' - n)\frac{\delta_1}{c_t^M} + \rho.\frac{\delta_1}{c_t^M}$$

$$\Rightarrow \frac{\dot{c}_t^M}{c_t^M} = [(r_t' - n) - \rho] \quad \text{(A.12)}$$

$$\frac{\dot{c}_t^{GM}}{c_t^{GM}} = \frac{\dot{A}_t}{A_t} + \frac{\dot{c}_t^{NGM}}{c_t^{NGM}} \Rightarrow \frac{\dot{c}_t^{GM}}{c_t^{GM}} = \frac{\dot{A}_t}{A_t} + [(r_t' - n) - \rho] - \frac{h.A_t}{P_{1t}/P_{2t} + A_t} \quad \text{(A.13)}$$

Now, we define $c_t = c_t^M + P_{1t}c_t^{NGM} + P_{2t}c_t^{GM}$

Differentiating we get,

$$\dot{c}_t = \dot{c}_t^M + P_{1t}\dot{c}_t^{NGM} + P_{2t}\dot{c}_t^{GM}$$

$$\Rightarrow \dot{c}_t = (r_t' - n - \rho).c_t^M + P_{1t}\left[(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right]c_t^{NGM} +$$

$$+ P_{2t}\left[\frac{\dot{A}_t}{A_t} + (r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right]c_t^{GM}$$

$$\Rightarrow \dot{c}_t = (r_t' - n - \rho)(c_t - P_{1t}c_t^{NGM} - P_{2t}c_t^{GM}) +$$

$$P_{1t}\left[(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right](c_t - c_t^M - P_{2t}c_t^{GM}) \quad \text{(A.14)}$$

$$+ P_{2t}\left[\frac{\dot{A}_t}{A_t} + (r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right](c_t - c_t^M - P_{1t}c_t^{NGM})$$

Derivation of the condition for dynamic stability:

We need trace of Jacobian matrix to be negative where the matrix is,

$$J = \begin{bmatrix} (r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} & 0 \\ -1 & r_t' - n \end{bmatrix}$$

Now, Trace of

$$|J| = [(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} +$$

$$P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\}](r_t' - n) \quad \text{(A.15)}$$

After algebric manipulation of (A.15) we get, trace of J matrix will be negative if,

$$(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) - \frac{P_{2t}.\dot{A}_t}{P_{1t} + P_{2t}A_t}[P_{1t} + P_{2t}] + P_{2t}\frac{\dot{A}_t}{A_t} + (r_t' - n) < 0$$

$$\Rightarrow (r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}\frac{\dot{A}_t}{A_t} + (r_t' - n) < \frac{P_{2t}.\dot{A}_t}{P_{1t} + P_{2t}A_t}[P_{1t} + P_{2t}]$$

$$\Rightarrow (r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}.h + (r_t' - n) < \frac{P_{2t}.A_t.h}{P_{1t} + P_{2t}A_t}[P_{1t} + P_{2t}]$$

After some more algebric manipulation we get,

$$\frac{P_{1t}}{P_{2t}}\left[\frac{(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}h + (r_t' - n)}{P_{1t}h - (r_t' - n - \rho)(1 + P_{1t} + P_{2t}) - (r_t' - n)}\right] < A_t$$

Now, determinant of the Jacobian matrix is given by,

$$|J| = [(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\}](r_t' - n)$$

For $|J| > 0$, either of the following two cases are feasible.

Case 1: Both $(r_t' - n) < 0$ and

$$(r_t' - n - \rho) + P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}\dot{A}_t}{P_{1t} + P_{2t}A_t}\right\} + P_{2t}\left\{(r_t' - n - \rho) + \frac{\dot{A}_t}{A_t} - \frac{P_{2t}A_t}{P_{1t} + P_{2t}A_t}\right\} < 0$$

$$\Rightarrow (r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}.h < \frac{P_{2t}.\dot{A}_t}{P_{1t} + P_{2t}A_t}[P_{1t} + P_{2t}]$$

$$\Rightarrow \frac{P_{1t} + P_{2t}.A_t}{P_{2t}.h.A_t} < \frac{P_{1t} + P_{2t}}{(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}.h}$$

After some simplifications we get,

$$\frac{P_{1t}}{P_{2t}}\left[\frac{(r_t' - n - \rho)(1 + P_{1t} + P_{2t}) + P_{2t}h}{P_{1t}h - (r_t' - n - \rho)(1 + P_{1t} + P_{2t})}\right] < A_t$$

2. Comparison of two economies:

$$\frac{(\dot{c}_t)}{c_t} - \frac{\dot{c}_{t\ 1}}{(c_t)_1} > 0$$

Using the set of equations from (15) to (20) we get,

$$\left[\frac{\dot{c}_t^M}{c_t} - \frac{(\dot{c}_t^M)_1}{(c_t)_1}\right] + \left[P_{1t}.\frac{\dot{c}_t^{NGM}}{c_t} - \tilde{P}_{1t}.\frac{(\dot{c}_t^{NGM})_1}{(c_t)_1}\right] + P_{2t}\frac{\dot{c}_t^{GM}}{c_t} > 0$$

$$\Rightarrow (r_t' - n - \rho)\left[\frac{c_t^M}{c_t} - \frac{(c_t^M)_1}{(c_t)_1}\right] +$$

$$\left[P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}.\dot{A}_t}{P_{1t} + P_{2t}.A_t}\right\}.\frac{c_t^{NGM}}{c_t} - \tilde{P}_{1t}(r_t' - n - \rho).\frac{(c_t^{NGM})_1}{(c_t)_1}\right] + P_{2t}.\frac{\dot{c}_t^{GM}}{c_t^{GM}}.\frac{c_t^{GM}}{c_t} > 0$$

$$\Rightarrow (r_t' - n - \rho)[\gamma_M - \gamma_{M_1}] + \left[P_{1t}\left\{(r_t' - n - \rho) - \frac{P_{2t}.A_t.h}{P_{1t} + P_{2t}.A_t}\right\}.\gamma_{NGM} - \tilde{P}_{1t}(r_t' - n - \rho).\gamma_{NGM_1}\right]$$
$$+ P_{2t}\left[h + (r_t' - n - \rho) - \frac{P_{2t}.h.A_t}{P_{1t} + P_{2t}A_t}\right].\gamma_{GM} > 0$$

After certain algebric manipulation we get,

$$\frac{P_{1t}}{P_{2t}}\left[\frac{[(r_t' - n - \rho)\{(\gamma_M - \gamma_{M_1}) + (P_{1t}\gamma_{NGM} - \tilde{P}_{1t}\gamma_{NGM_1}) + P_{2t}\gamma_{GM}\} + P_{2t}h\gamma_{GM}]}{P_{1t}h\gamma_{NGM} - (r_t' - n - \rho)\{(\gamma_M - \gamma_{M_1}) + (P_{1t}\gamma_{NGM} - \tilde{P}_{1t}\gamma_{NGM_1}) + P_{2t}\gamma_{GM}\}}\right] > A_t$$

where,

$$\gamma_M = \frac{c_t^M}{c_t}, \gamma_{M_1} = \frac{(c_t^M)_1}{(c_t)_1}, \gamma_{NGM} = \frac{c_t^{NGM}}{c_t}, \gamma_{NGM_1} = \frac{(c_t^{NGM})_1}{(c_t)_1} \text{ and } \gamma_{GM} = \frac{c_t^{GM}}{c_t}$$

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Global Political Economy in Context of Evolution of Political-Economic Thought

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Abstract- Globalization of economic processes requires an adequate transformation of the economic Sciences. In the modern world the globalization of factors and results of production leads to the formation of global relations of ownership and governance. It modifies the subject field of General economic theory, and generates the global political economy. The essence of its subject is the relationship of the global ownership and the resulting global economic contradictions. The methodological toolkit of global political economy reflects the particularities of contemporary scientific knowledge due to the new phenomena of globalization. Global political economy is the methodological-theoretical basis of all Sciences, studying global economic system. At the same time it is a special branch of the modern system of economic Sciences, characterizing by the spatio-temporal specificity of subject and method.

The proposed approach is an alternative to the common preceding scientific interpretations of global political economy as, in fact, the international economic politology.

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I. Introduction

The essential parameters of the economic processes of the modern world are determined by the factors and patterns of globalization, affecting all the main sides, elements and qualities of objective social processes and their subjective reflections in the sphere of scientific knowledge. In the system of economic sciences it's manifesting in the modification of the subject of the general economic theory and different branches of special economic disciplines. There emerge new areas of economic science, reflecting the intrinsic qualities, dependencies and regularities of the new phenomena of economic reality posed by economic globalization.

In the system of modern world economy it takes place "inversion" of dominance of domestic and foreign economic dependencies and regularities. Domestic economic processes lose their inherent for many preceding centuries and millennia quality of the primary over the foreign ones. Earlier the "points of growth" of world economic civilization were formed on localized areas in separate countries or regions, afterwards they spatial spread, conquering and displacing by competition historically preceding economic structures and systems, which either destroyed or transformed into marginal forms of activity in the background of the quantitatively and qualitatively dominant new economic models. Similar processes can be also observed today, but only in regard to economic-geographical mechanism; in context of substantial transformation of the mode of production the key important fact is that the primal-essential regularities of occurrence and functioning of a new mode of production are originally formed at the global level, so the substantive side of this method of production can be defined as globally-informational one. The primacy of the global regularities and the derived, secondary nature of economic interactions on the descending levels of social organization distinguish the contemporary global mode of production from the preceding trends of the genesis of globalization (Gilpin, 2001). In the system of international competition it leads to the fact that essential importance get the competition between countries and firms not in relation to some goods offered on the world market, but in relation to the place occupied in the global added value chains. Under the conditions of formation of information production and knowledge-based economy, the key importance becomes the control over the links of these chains, which provide scientific design and innovative options for new products.

The manifestation of the globalization trends in the functioning of international economic relations and particularly in the mechanisms of the world market is the object of study of many branches of modern world economic science. Herewith the subject of special economic sciences correlated with the level of regularities of the economic mechanism. As for research into the causes, necessity, essence, contradictions and prospects of the processes, transforming the social nature of modern economic civilization, - this kind of study is possible only in the subject field of general economic theory, performing the function of "philosophy of economy" (Global Political Economy…, 2008; Global Political Economy: Contemporary theories…, 2013; Issues and Actors…, 2016).

II. Methodology Essence of the Subject Determination of the Political-Economic Approach to the Study of Reality

The development of the economic system of society at a certain stage of this development made possible and necessary a holistic, generalized characteristic of this system within the framework of

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some concepts and scientific works. Researches of classics of political economy, focused on the study of "the wealth of society generally", had universal character; works of J. Steuart, A. Smith, J.-B. Say, J.S. Mill can be defined as "summa oeconomia" (if using the terminology of the medieval tradition) or "encyclopedia of economic sciences" (in the terminology of the Enlightenment). However, this universalism had historical ultimacy both in aspect of the objective economic system development and in context of the scientific knowledge differentiation, reflecting the increasing complexity and differentiation of economic practices. Already D. Ricardo noted, in a famous letter to T. Malthus: "Political Economy, you think, is an enquiry into the nature and causes of wealth.

I think it should rather be called an enquiry into the laws which determine the division of produce of industry amongst the classes that concur in its formation" (Ricardo, 2005). Meanwhile, objective logic and causality of the economic relations between members of society are that the distribution of labour results due to the distribution of factors of production; in turn, the distribution of factors of production – isn't that other, as system of relations of ownership on these factors. Thus, we can assume that, starting with David Ricardo, it begings the exarticulation of the political-economic aspect from the universal economic-theoretical knowledge, and this exarticulation is due to the correlation of the subject of political economy studies with relations of ownership.This approach was then circumstantially elaborated by K. Marx and subsequent marxist tradition of XIX-XXI centuries. "It is always the direct relationship of the owners of the conditions of production to the direct producers — a relation always naturally corresponding to a definite stage in the development of the methods of labour and thereby its social productivity — which reveals the innermost secret, the hidden basis of the entire social structure and with it the political form of the relation of sovereignty and dependence, in short, the corresponding specific form of the state" (K. Marx. Capital, v.3. – Marx, 2005).

On the other hand, the emergence of the marginalistic discourse and neoclassical paradigm, based on it, had moved the center of gravity of the theoretical analysis on the problem of pricing and, in a broader context, on the problems of a market economic mechanism. It made possible to significantly deepen the analysis of market economic practice, but, at the same time, transformed the contents of the theoretical studies in the direction of specific economic knowledge, limiting or even eliminating the politico-economic aspect of these studies. Thus, these studies have lost the status of a General economic theory; focusing on the questions "how, what and for whom to produce", the representatives of this scientific direction left aside the key for the General economic theory question "why" - why the economic systems occur, develop and replace each other, what are the essential features and contradictions of these systems. Not accidentally, the founders of the neoclassical tradition W. Jevons and A. Marshall proposed to change the name of the General economic theory - instead of the term "political economy" they offered a "neutral" term "Economics". Meanwhile, in the times of A. Montchrestien term "political" was used in the context of the ancient Greek concept of "Polis", i.e. in relation to the current terminological convention, this meant a focus on the study of economic relations in scales of the State, or even of social system generally, not only of political relations in the modern sense of the word. For the representatives of early political economy, "political" or "social" aspect of the analysis was a form of overcoming the ancient tradition that stems from Xenophon and Aristotle, who understood "economy" as a science that studies the laws of "oikos" - separately existing, predominantly natural, non-market economic unit.

Unilateralism and asocial bias of neoclassical interpretation of the subject of general economic theory were, as it's known, criticized by the representatives of institutionalism. Early institutionalists noted the wrongness of reducing the theoretical economic research to the issue of "the point, sliding along the curves of supply and demand" and the nature of the economic entity – to "calculator of pleasures and deprivation". Neo-institutionalism chose the property rights as the most important area of its research, considering the traditional political-economic problematics in the context of the wider spectrum of social interactions.

Thus, the subject certainty of the political-economic approach can be defined in the context of the "basic question" (or "principle problem", "fundamental issue") of the science – the question of ownership, of the ownership relations conformity to the task of increasing efficiency of economic system. Based on the analysis of the relationship between workers and owners about the factors of production, political-economic approach further develops and concretizes the research of system of production relations, including forms of economic relationships between different owners, taking into account historical features and functional mechanisms of the organization of different economic systems. The issue of ownership is thus the backbone basis of the political economy's subject in general and, along with it, defines the specifics of political-economic knowledge in relation to "subject field" of other economic sciences, the number of which to the present time, in connection with ongoing differentiation, has reached several hundred names. Despite a substantial upgrade of the research object in the context of globalization, the preservation of the terminological tradition in designation of science is not only justified, but also logical, since in these conditions the "subject core" of

political economy remains too. The need to study the property relations has today the direct urgency. The most important essential feature of the present stage of the evolution of economic civilization is the globalization of ownership relations. Alongside this, that is an objective basis of modification of the subject of political economy and the emergence of its new branch, now gradually taking a leading role in the substantive body of general economic theory, - the global political economy.

III. Problem Statement the Subject of Political Economy in the Spatio-Temporal Coordinates

High dynamism and uncertainty of the development vectors of modern civilization have raised the issue of the spatio-temporal characteristics of political-economic models, which reflect, by means of mental abstractions, the essential features and laws of development of objective economic systems. Simplifying the question, we can formulate it as follows: what the time (epoch) and space relate to those or other political-economic concepts and theoretical systems? The logic of the analysis further leads on to the need to identify the relationship between the abstract conditional relativistic social time and space of the theoretical models, on the one hand, and real physical time and geographical territory of the functioning of actual economic systems, on the other.

History of political economy shows different options for the spatial-temporal "binding" of theoretical models to the socio-economic practice. Scientific directions, schools and researchers, guided by the methodology of the concept of "natural order", with attribute for it non-historical axiomatics, relate (often implicit) temporal determinacy of their models with abstract "time of ideal". Economic systems, located outside the area of localization of the natural, in their opinion, economic order, either are not analyzing or are interpreting as insignificant, or as the subject of transformation, in some indefinite future, in the direction of approach to the same "natural order". The previous development of economic systems, in the context of this methodological paradigm, is also presented as unimportant, because everything that happened in the past, appears only as a non-essential "preparatory phase" for approval of the "true", "genuine", "correct" natural economic order. This approach was characteristic for mercantilism, for leading representatives of the classical school of political economy, for marginalism and neoclassicism; today, the same approach continues its guide being for many areas of the self-proclaimed "mainstream". Such the most well known examples of this embodiment of the spatio-temporal positioning of political-economic models are the teachings of F. Quesnay about the "sick" and "healthy" state of economic organism, and theoretical system of D. Ricardo («The bourgeois form of labour is regarded by Ricardo as the eternal natural form of social labour. Ricardo's primitive fisherman and primitive hunter are from the outset owners of commodities who exchange their fish and game in proportion to the labour-time which is materialised in these exchange-values. On this occasion he slips into the anachronism of allowing the primitive fisherman and hunter to calculate the value of their implements in accordance with the annuity tables used on the London Stock Exchange in 1817. Apart from bourgeois society, the only social system with which Ricardo was acquainted seems to have been the "parallelograms of Mr. Owen» - K. Marx. Critique of Political Economy. – Marx, 2005).

Another kind of ahistorical abstraction in the methodology of the "natural order" is, in spirit of Hesiod's tradition, the correlation of the "time of ideal" not with modernity, but with the bygone eras, and, as a consequence, - the contraposition of the ugly present times to the perfect past, as well as the statement of the problem of rebirth in the future certain ideal forms, previously supposedly inherent in the "Golden age". It is obvious that the degree of abstraction of mental constructions, formed on a similar methodological basis, is much higher than of the concepts relating the social time of theoretical models with the present, and it's no coincidence, for example, S. Sismondi believed that political economy "sets or needs to set a goal of happiness of people". The importance of this goal, of course, is undoubted, but the same apparently can be said of almost any other science, so such degree of abstraction leads, in particular, to the erosion of subject definiteness of the scientific knowledge branches.

In contrast to the above-noted approaches, an attribute of the methodology of national-historical school was the definition of temporal and spatial vectors of the analysis as initial essential parameters of the subject of political economy; this was objectively due, firstly, to the emergence of the phenomenon of catch-up development within the market-capitalist economic system and led to the formulation of the question of the relationship between the abstract universal and the concrete-particular regularities in the historical development of individual countries and world economy as a whole. Representatives of the historical school explicitly emphasised the dependence of the contemporary state of economic systems on the previous evolution of these systems, and linked the tasks of the future development of lagging regions to the mechanisms of overcoming the backlog and, as a consequence, the inclusion in the spatial area of the functioning of the avant-garde economic systems. The rationale for the role of spatio-temporal vectors of analysis as attributes of the essential certainty of the subject of political economy made the everlasting scientific importance of the contribution of F. List and

historical school in the development of the world political economy; and it's quite natural that representatives of just this school explicitly recognized the need to create a political economy of the present and the future (Hildebrand, 2006). And although the extreme settings of the "new historical school" were subjected, during the "debate on method", convincing criticism by the leaders of marginalism- C. Menger noted the obvious inadequacy of converting political economy to "the science about variety, depending on time and place, "empirical laws" (observed regularities in the sequence) of economic phenomena" – however, the proven by historical school spatial-temporal attributiveness of the subject of political economy, will have not only retrospectively-scientific, but also directly-actual methodological importance until, firstly, the issue of "catching up development" will be relevant and, secondly, the instrumentation concepts of "path dependence" will develop.

Marxist phase in the development of political economy characterized by a radical deepening and comprehensive specification of the spatio-temporal parameters of the theoretical modeling of economic systems. The Marxist concept of the natural historical process, the analysis of the dialectics of general and special economic laws can be considered as a social-science interpretation of the principles of actualism, which applying to natural processes were already developed by representatives of natural sciences (J. Hutton: "the Present is the key to the Future"; Ch. Lyell: "the Present is the key to the Past" – K. Marx: "human anatomy is the key to the anatomy of the monkey"). In the substantive case of the concepts of K. Marx and F. Engels, there quantitatively dominate the theoretical models of their contemporary state of the economic system of the avant-garde countries, especially England, but this state is considered as a result of the natural-historical process of development of the preceding economic forms and is based on the concepts of historical materialism, theories of modes of production and socio-economic formations. Actual theoretical model of the capitalist mode of production spatially correlated by Karl Marx mainly with a geographical area of British capitalism, but given the fact that "the country that is more developed industrially only shows, to the less developed, the image of its own future" (K. Marx. Capital, v. 1. Preface.- Marx, 2005). At the same time, the "supertask" of the analysis was that, based on exhaustive identification of essence and regularities of the functioning of actual economic system, to model in theory its future evolution and to provide prognostic characteristics of basic essential traits of the future mode of production. In this context, the temporal vector of analysis aimed to the future, and, simultaneously, evaluation of modernity from the point of view of the mentally modeled future implicitly constitute the main feature of the methodology of K. Marx and determine the content characteristics and assessments of the present. Theoretical modeling of the past and present is carried out by means of domination of the circumstantially elaborated positive approach, at that time as the predictive models of the future drastically increase the installation of normativity. In conditions of the marked rating of modernity through the "glimpse from the future" it imposes a tangible imprint of normativity also to the study of current economic forms.

To an even greater extent the impact of normative settings, determined by predictive models of the future, on a positive analysis of the past and present can be traced in the theoretical elaborations of bolshevism, and, above all, in the works of V. I. Lenin. Analysis of prior development of capitalism in Russia and the monopoly stage of world capitalism was performed with the dominance of the positive method, but, since the assessment of monopoly capitalism as the eve of socialist revolution and, especially, while formation the theoretical models of the socialist economy, normative "view from the future" becomes the dominant. Herewith the futuristic normativity had not become an obstacle for the scientific status of theoretical models. The development of today's China, west-european countries of "functional socialism", the practice of "social market economy" and "social state" in many countries demonstrate the truth of the key ideas of the theory of the mixed economy, modeled in the concept of the NEP ("New Economic Policy").

There are no scientific grounds for rejection of the theoretical estimates of the post-market stage of economic civilization, albeit in the context of a much longer time interval. It's quite obvious that the current trends of transformation of the social nature of economic relationships, especially due to informational-financial globalization of the production costs accounting, demonstrate the growing formalization of commodity-money mechanisms of interaction of economic agents and rising role of plan-regulating forms of economic processes on macro-, meso- and micro-levels. Another thing is that the attempt of formation of the post-market economy through the practices of "war communism", as in the whole practice of socialist transformations in the conditions when capitalism in Russia not only didn't realize the inherent potential of the development of the productive forces, but, in essence, only begun its evolution, was clearly premature. From the point of view of marxist theory this attempt was in clear contradiction with the fundamental postulates of historical materialism that "no social order is ever destroyed before all the productive forces for which it is sufficient have been developed" (K. Marx. Preface to A Contribution to the Critique of Political Economy.–Marx, 2005) and "society ...can neithe rleap over the_natural phases of its development nor remove them by decree" (K. Marx. Capital, v. 1. Preface.–Marx, 2005). In the context of the methodology

of the system approach theoretical model of the "weak link in the chain of imperialism" characterized by logical validity–indeed, in conditions of increasing interdependence of the major centers of world economy at the stage of monopoly capitalism, revolution in one of the great powers could trigger a chain reaction of global socialization. But the identification of abstract social time and space of the "weak link" model with specific Russian realities of the early twentieth century was clearly erroneous.

The subsequent development of the economy of avant-garde countries in the twentieth century confirmed that capitalism as a socio-economic system is the adequate social shell of industrialism and that on the industrial technological base there are possible only fragmentary elements of socialization. As for the systemic post-capitalist transformations – they involve qualitative transformation of productive forces and their transition to the postindustrial stage of development.

IV. Analysis of the Results Particularities of Subject and Method of the Global Political Economy

a) The specifics of the subject of the global political economy

The content and structure of the subject of the global political economy are determined by the objective logic of functioning and development of economic system of society in conditions of globalization (McGrew, 2008). The global transformation of ownership relations is due to the globalization of the productive forces, that requires study the influence of factors and mechanisms of modification of the modern technological base on the productive relations system. The genesis of a new quality of this system core - globalizing relations of ownership - is a long and diverse by levels and forms of manifestation, controversial process. Adequately to this objective logic, the study of the stages of the evolution, forms of manifestation and contradictions of the development of global ownership determines the formation of relevant sections and elements of the subject of global political economy. However, strictly speaking, on the planetary level the relationships of global property today haven't yet emerged as a holistic system, there is only the formation of this system, therefore, given current realities, it is more correct to speak not of a global, but of the globalizing ownership (Eletsky, 2016).

Corresponding to the classic tradition, interpretation of the main issue of political economy as a problem of ownership identifies the systemic subject definiteness of global political economy as the science of the genesis, content and structure of global relations of ownership.

Constituting an essential basis of the subject of global political economy, the actualizing question of global ownership is structured further in the elements of science content through studies of the mechanisms of global economic governance and the realizing of interests of the global interactions' actors (Ardalan, 2010). Thus, the status of the global political economy is determined not as the "sub-discipline", but as a methodological-theoretical base of the entire system of economic sciences.

Globalization of ownership relations has a plurality of preconditions and forms of genesis, variability of spatio-temporal and functional forms of implementation. The key importance, in line with the general logic of political-economic discourse, belongs to the globalization of the productive forces (Thun, 2008). The global-informational mode of production, based on the information resources and forms of wealth, is originally characterized by global scales and mechanisms of economic activities. Information factors of production and forms of wealth genetically embody qualities of universality, which receive organizational and economic forms of embodiment in mechanisms of global governance, attribute to them. Alongside this, the new mode of production can't arise except on the basis of the preceding, and for a sufficiently long historical interval coexists with him, relying on its resources and gradually subordinating and transforming the previous technological and socio-economic elements, settings, and structures of the production process. Trends of global informatization and neoindustrialization are dialectically interrelated, that reflects the characteristics of the transition state of the productive forces, when the development of industrial technology in modern industries is possible only by means of the globalizing informational-communication technologies and mechanisms of economic governance. The globalization of economic management reflects the contradictory interaction of the latest communication elements of the productive forces of the information society and the need for regulation, centralized in planetary scale, of use declining traditional production resources (Global Economic Governance Programme, 2016).

In recent decades, there emerged clear shapes of the genesis and establishment of global ownership, related with direct use of various forms of resources on a global scale. The direct recognition of certain objects as property of all mankind and the legal sanctioning of such recognition are expanded in the form of treaties between the major actors of the global interactions with simultaneous or subsequent accession to these agreements of the majority of other subjects of international relations. The most famous examples of such a mechanism are the system of agreements on the regime of use of shared resources of the World Ocean, the Antarctic Treaty, the Outer Space Treaties, agreements to protect the global environment. The subjects of such treaties or agreements usually are the States, while in some cases an additional factor of

international legitimacy is the conclusion of agreements under the auspices or with the participation of recognized global organizations, primarily, UN.

In contrast to the relations regulated by the international treaties expressly defining certain objects of global significance as a heritage of all mankind, technically more complex and indirect mechanisms for the formation the global ownership arise when negotiating agreements with functional or branch specificities. The activities of the global industry structures (e.g., OPEC and other similar) shows the dynamics of the dialectics of the formation of the global ownership and mechanisms of its interaction at the stage of formation with other pre- and socially descending proprietary relationships. Elements of the actual use of the resource as a global ones tricky combined with the assignment of revenues at public and private levels.

The manifestation of the transitional nature of economic relations in the process of the formation of global property, can be observed also in the activities of the largest TNCs, transforming into a Global Corporations (GCs), and intercorporate alliances. These corporations carry out the assignment of a particular type of resources and the production of certain types of products on a global scale. They also set the prices of the world market and the criteria of profitability in the relevant sectors and sub-sectors of the world economy, form the technological and consumer standards, conduct the globally significant scientific developments and determine strategic directions of the global development. Along with that, the assignment of income is undertaken by these corporations on the basis of traditional principles and mechanisms of private property; the processes of global and private-corporative assignment of income are equated.

In the "new economy" the role of the main resources and the main forms of wealth passes to the phenomena of informational nature; both objective and subjective structure of ownership relations are changing. Meanwhile, in the early stages of a new method of production, the impact of traditional forms of realization of property that existed in the previous era, remains, in this connection, mechanisms for the protection of the incomes of owners of information resources and, in particular, intellectual property rights are the subject of developing. However, as the development and strengthening of the role of information forms of wealth, it becomes more and more obvious the qualitatively new nature of these social forms and, above all, the nature of the information as a universal resource and wealth, "trickle-down" character of the information, the universality of its distribution, application and use. The possibility of free use of huge arrays of the information, contained in global information networks, and use free or for a nominal fee, reflects a new social phenomenon – the emergence of the global system of property on information with the identification of all mankind and all the descending levels of social subjectivity, up to the individual person, as subjects of ownership.

Thus, the subject specificity of the global political economy is determined by the tasks of investigation the objectively emerging global property relations and connected with its genesis global contradictions due to the impossibility of "instantaneous" emergence of the social system in formed and expanded shape. New social phenomena in the process of their genesis and evolution initially originate and operate within and through the prior, previously formed social shells and mechanisms. An important fact is also the immaturity of the object-subject structure global property. Abstract concepts of global resources and wealth as objects, and all mankind as the subject of global ownership of the achieved level of the development of civilization relate to the realities of considerable socio-economic heterogeneity and hierarchy of the modern world and the confrontation between private economic interests of different levels and forms – to the interests of humanity. But the further development of relations of the global ownership and adequate system of global economic governance, the implementation of their own internal intrinsic social nature implies a more complete realization and achievement of all humanity's interests and corresponding overcoming the limitations due to the initial dependence of emerging institutions of global governance on private economic interests.

The conceptions of the global political economy theoretically model the processes, characterized by global scale in terms of spatial parameters, and focused on temporary vector from today to the future state of the world ownership system, that will ensure implementation of the economic interests of all humanity as an integrative subject of the assignment of production resources and consumer goods. The historical interval of the formation, the quantitative expansion and qualitative improvement of the world of ownership, resolution of contradictions between modifying actors of the world of property and subjects of descending social levels of ownership relations is the interval of preservation by general economic theory the political-economic quality in its new historical modus of the global political economy.

The essence of property relations manifests itself in the process of its implementation. In this regard, the structural logic of the subject of the global political economy is determined by the overall objective logic of the implementation of ownership. From the point of view of the production process, the implementation of ownership is the managing it to ensure economic benefit; from the point of view of the outcome of the economic process it's realizing in the assignment of income. Accordingly, genesis and mechanism of global

economic governance becomes an essential element of the subject of the global political economy.

Herewith, such structural and hierarchical features of global governance in today's global capitalism, as the priority of interests internally deeply integrated global finance capital and the transformation of the State apparatus of even the largest countries to the committee on administration of personifying this capital global financial oligarchy, are becoming more apparent. A lot of new types of socio-economic contradictions arise both within individual countries and in international economic relations (Wade, 2008; Odezah, 2016).

The transition from monopolistic and state-monopolistic capitalism to the stage of global finance capital has become the socio-economic shell of the transition from late-industrial technological mode of production to the early stages of the global-informational one. But as its further development, more and more important intrinsic objective of the research program of the global political economy will become the analysis of the emerging elements of a post-capitalist socio-economic structures and their subsequent system integration in the direction of global community.

From the point of view of tier structure, the system of economic relations involves two main levels: primary, deep, essential level of ownership relations, and a secondary, outer – level of manifestation of the essence of ownership in the relations of the economic mechanism. The second one determines the contents of object of specific economic disciplines, but the formation of theoretical-methodological foundations of their subject is the task of political economy and, thus, one of the sides of its subject. In the subject structure of the global political economy it's reflected through the need of analysis of the world market mechanisms, international trade and global financial system as the main forms of manifestation and realization of the globalizing relations of ownership at the level of world economic mechanism.

One of the attributes of the movement of social relations is an organizational component. Accordingly, the analysis of implementation of property relations requires the identification of organizational forms of this implementation. In the modern world, it arises the process of intensive formation of a variety of global organizational structures, including the structures providing organisational parameters of formation and development of globalizing ownership, resolution of conflicts, generated by its genesis. The most important of these include the contradictions between the organizational structures of global governance and the structures that ensure the sovereignty of national States (Hay, 2008), between the globalizing apparatus of TNCs and other global, regional and national organizational structures.

Objective dialectics of basic and superstructure relationship gives rise to the interconnection and interdependence of economic realization of property relations and superstructure's ensure of its implementation through political, legal and ideological instruments. The formation of a global component of these tools is one of the key directions of transformation of modern society. The analysis of the mutual conditionality of basic and superstructure tools of realization of global ownership is also, in this regard, a mandatory aspect of the subject of global political economy and requires the involvement of the results of neoinstitutional research as an empirical basis for the political-economic generalizations.

b) Features of the method of the global political economy

Global political economy, like any other science, uses universal methods of thinking and general scientific methods of knowledge, fleshed out by specifics of the subject of theoretical-economic research. Alongside this, its method has features, due both to the novelty of the object of cognition, and modern trends of the development of general scientific methodology.

Initial and general methodological setting for global political economy is the setting of comprehension of the **essence** of processes and phenomena occurring in the system of the world economy in conditions of globalization. The comprehension of the essence involves identifying regularities that embody the essential underlying causal relations in the functioning and development of world economic system. Axiomatic setup for the cognition entity includes a representation of hierarchically-tiered structuring of the processes of economic practices in the global economy, which requires the detection of objective trends and patterns behind the flux of observable phenomena, facts and events, diverse and contradictory in their movement. The detection of regularities is possible by a generalization of the entire array of empirically observed facts, their grouping and logical sequencing with subsequent structuring. This is achieved through the method of abstraction, by creation a hierarchical system of causal dependencies that allow moving from the external, superficial appearances to deeper levels of theoretical modeling of the necessary internal laws.

Articulated installation on the knowledge of essence and laws would be of a trivial nature (it's obvious that the task of any science is to cognize the essence of its object), if in the last decades it wasn't the widespread of the methodology of "postmodernism" with an attribute inherent "anti-essentialism", i.e. a fundamental rejection of the concept of the entity, of recognizing the distinction between the essence and the external forms of its manifestation. The task of the science in this approach comes down to a situational external reflection of the kaleidoscopic flow of facts,

each of which is treated as a self-sufficient, essentially equal to anyone else. Accordingly, the notion of regularity disappears from the totality of the phenomena of the mental reflection of the objective world, including from the system of scientific thinking. «There are nearly disappeared the notions of "materialism", "idealism", "rationalism," "irrationality," "sophistry", "eclecticism", "dialectic," "contradiction", "essence", "phenomenon", "opportunity", "reality", "necessity", "accident", "true" "false" – in short, all those philosophical terms and categories, without which the philosophy is inconceivable... It also lost all sorts of scientific criteria and conclusiveness» (Gobozov, 2015).

From a theoretical point of view, anti-essential "strangeness" of postmodernism could be classified as a kind of now numerous pseudoscientific fictions, curiosities, which are beyond of the modern scientific knowledge. However, the problem is greatly complicated by the fact that, becoming a fashionable trend, a postmodern installation, as supposedly embodying the new achievements of scientific methodology, can influence the mentality of the politicians and other agents of social power. But what could be the practical results of the activities of the policy, perceived such methodological postulates: "is it, indeed, the need of being tasked with such challenges as establishing the content of epoch? Is there such a thing?", and thinking that answering these questions is the task "feasible is that only God himself"? (World Economy…, 1990). The inevitable consequence of the abandonment of the search for the essence of social phenomena is also becoming the rejection of goal-setting and planning of the practical activities. After all, if the era doesn't have the content, then there is no need to comprehend your position and your goals within the framework of this era – it's just enough "to go with the flow", passively sensing the external and independent from the social subject sequence of events and not related to each other paintings of the surrounding world.

It's easy to understand that social facilities (the States, scientific and economic structures, regional and international organizations), don't seeking to know the essence of what is happening in the world, become, in the context of globalization, not the social actors but passive objects of manipulations, performed by centres of global influence. These centres, on the one hand, spread illusions about the alleged "modernity" and "depth" of postmodern approaches; they advertise the respective authors and their publications, and, on the other, themselves don't abandon scientific research of the globalization's patterns and mechanisms to achieve their goals in view the changes happening in the world under globalization.

Once more consequence of the proliferation of the postmodern paradigm is an idea of the alleged normality of incompetence, amateurism in all spheres of human activities, including the sphere of economic management. In fact – if there is no fundamental difference between externally observed empirical facts and essence of economic processes, then there is no objective basis for differences between activity, including management actions, of any casual participant of economic processes, on the one hand, and of a professional manager, on the other. "In the epoch of postmodernism everything is simplifysed, primitivized: economy, politics, culture, spiritual work in general do not seem to be as complex, demanding and hard work, but as something that everyone can do. Look at the economy itself. Clearly, in order to engage in economic activity or to lead economic institutions some special knowledge is required. But now, it turns out, it isn't necessary... Incompetent, mediocre people on high economic positions simplify the most complex processes of production activities that are the basis of all human activity" (Gobozov, 2015).

Additional factors hindering the cognition of scientific truth in the study of economic processes, become at present the features of thinking caused by the fragmentary incoherent, heterogeneous and multilevel data presented in the flow of modern communication systems. A large array of these data creates the illusion of high awareness, and equitable neighborhood of the facts of "news feed" - a sensation of the equivalence of these facts. Meanwhile, without comprehension the facts through the analytical abstraction and tier differentiation, the flow of heterogeneous empirical information acquiring excessive in nature, leads not to the identifying the truth, but rather to its distortion and turning into something inessential. Most of the negative practical consequences of this so-called "twitter-mindset" is manifest, when it becomes inherent to the political and economic leaders.

The need for understanding the essence of processes of globalization of ownership, and on this basis – the entire system of economic relations, also leads to the actualization of the special role of such parties and elements of the method of global political economy, as the principles of dialectics, system approach, holism and synergetics.

A dialectical approach requires consideration of the globalization of economic relations as a developing contradictory processes, passing a series of stages, combining periods of relatively stable, steady and gradual evolution with drastic changes, quality jumps, intervals of uncertainty and destabilization. Gradual maturation and accumulation of quantitative changes in the technological, institutional and socio-economic realms, reaching the limiting, in some measure, condition, lead to qualitative transformations of the system of the world economy. The origin, development and resolution of global contradictions contribute to the emergence and diffusion of new, more effective forms of international economic relations. New global institutional

and socio-economic structures are formed for regulation of contradictions and their resolution. The dialectical approach reflects, in addition, the objective possibility of the diversity of manifestation forms of a single entity. In particular, the essence of globalization can also manifest itself in different forms, and is especially important for individual States and civilizational systems, whose interests may be with varying degrees implemented under various forms of essentially uniform processes of globalization. Of particular importance today is the fact that the americanization associated with suppression of the interests of many States, is not the only possible and universal form of globalization. The study of the mechanisms of globalization also necessarily involves the study of dialectics of its economic foundations and superstructure's (political, legal, ideological) aspects.

There is also a clear relationship between the described above principles of essentialism and the dialectics, and the methodology of the *system approach*. The understanding of objects of study as a system entities; the theoretical response of the system's quality; identification the "core" of the system, of its strategic elements; the hierarchical structuring of the system's tiers; analysis of the mechanisms of the system's quality distribution on all the elements, and the formation of the missing elements, mechanisms of tiers' interaction; the study of the evolution of the system, the study of relationship of its functioning and development; analysis of the contradictions of system and the ways to resolve them – all of these methodological attributes of systematic approach are essential tools of scientific knowledge of the modern world economy as a system in which the processes of globalization of ownership relations are the essential system factors of transformation of international economic relations.

The principle of holism stands out as one of the actual concretization of the system approach, reflecting the mechanism of the dialectical interaction between the whole and the parts within the system. For the global political economy it's of particular importance due to the fact that the current stage of globalization is characterized by formation of a primary, intrinsic laws of functioning and development of world economic system initially on a planetary level. Embodying the emerging system unity and integrity of the modern world economy (and, above all, - the emergence of the globalizing property relations), these laws become the primary in comparison with the economic processes occurring at all the descending levels of social structure. This primacy is implemented both in the downward territorial levels of the world economy (transcontinental and regional associations, individual States), and in its functional, organizational and industry structures (international institutions, organizations and firms). Even leading States and their associations, the institutions of global governance and the world's leading TNCs are objectively subordinated in their activity to the prime regularities of globalization and implement these laws through their activities. This is the phenomenon that distinguishes the modern globalization (or, in some interpretations, its current stage) from the preceding stages of world economy development, when the primary laws have initially developed within a geographically and functionally limited areas, and then spread to the rest of the world due to the higher efficiency of the economic phenomena encountered in these areas.

Methodology of *synergetics* focuses theoretical research on the necessity of studying economic globalization as a self-organizing process. Objective factors and mechanisms of self-organization of the globalizing economy act independently of subjective desires and preferences. Moreover – practical actions of anti- or alterglobalists can turn into factors of approximation of the self-organizing globalization to the attractor states in the same way as the actions of its conscious supporters. The most important aspect of the significance of the synergetic approach today is understanding the responsibility of the decisions and actions of social actors in conditions of the bifurcation alternatives. At bifurcation points there are the equal possibilities of implementing different alternatives of the subsequent movements, but this equality combined with the subsequent divergence of the trajectories of the systems movement; in some cases - with very large discrepancy, until the mutually exclusive forms of alternatives. So, there were sufficient objective prerequisites for different options for the development of the Soviet Union in the late twentieth century. Some of them could lead to another mode of modern world, and there would be other forms of manifestation of the essential patterns of globalization. In fact, however, it implemented a different option caused by a combination of random and originally not inevitable factors, specific to the point of bifurcation.

Feature of the functioning of the system in the approximation of the bifurcation points is also the increased degree of uncertainty of its status and development prospects. At the present stage of globalization, the world economy took the form of "economy of uncertainty". Its essential attribute is the necessity of making economic decisions on the basis of the current incomplete, inaccurate and limited information. Furthermore, the consequences of these decisions will manifest themselves in the process of continuous changes in external and internal conditions of activity, so the final effects may differ significantly from the original objectives, and in some cases contradict them. Even the formal achievement of the original goals, can lose meaning and lead to a meaningful opposite effect if within the period of time required to achieve the objective, external economic and social environment had undergone essential qualitative

modifications. This requires continuous monitoring and adjustment of goals of economic activity and means of their achievement and essentially distinguishes the modern economy not only from the traditional economic systems with a constant reproduction of the same assumptions and results, but also from the routine algorithms of traditional market. These objective factors contribute to the substantial increase of the role of conscious implementation of the principles of scientific methodology not only in theory but also in practice.

V. Conclusion. GLobal Political Economy and the Scientific Studies of Economic

a) Globalization

Globalization of the productive forces and relations of production constituted the objective basis of the changes in the world economic system, theoretical generalization of which became new directions in global economic science, defining as global, international political economy, geoeconomics etc. (Global Political Economy…,2008; Global Political Economy: Contemporary theories…, 2013; Issues and Actors…, 2016). The relevance of the development of these scientific directions, including methodological aspects, is constantly increasing. At the same time, variability, vagueness, looseness of terminology and lack of generally accepted conventions reflect both the system immaturity of object, and epistemological specificity of the subject of political economy on the qualitatively new stage of its evolution.

Methodological commonality of the named and other, adjacent them on problematics, areas of the world of economic science, essentially, up to now is limited by the recognition of axiomatically the principle of holism and by the understanding of the impossibility of explaining the key trends and development prospects of the global economy on the basis of previous mapping of the subject of political economy with the scales of the national state or other parts and sides of world economic system.

As for the interpretation of the subject of study, it's observed wide range of approaches, tending, in general, to the nexus of economic and political factors in global interactions, to the role of economic interests in the global power relations, as well as to the issues of efficiency of financial interactions and international trade. The fragmentation and fuzziness of the subject certainty lead to the secondariness of the role of these research directions in the paradigmatic structure of "mainstream" and to recognition them, at best, as borderline subdisciplines in the subject field of the theory of international economic relations. However, the objective role of property relations as the core of the system of productive relations determines an objective status of the world political economy as a backbone kernel of a set of economic sciences in the context of the increasing impact of globalization of ownership and economic governance on the development of the world economy.

The objective processes in global economy also lead to transformation of the subject of the traditional for economic theory areas of micro and macroeconomics. It is evident the necessity of modifications of the models of microeconomics in view of the transformation of transnational (and in the leading sectors, global) corporations into the main modern form of primary economic link (complex) and the necessity of corresponding modification of the mechanisms of pricing, formation and distribution of global (worldwide) income and taxation.

With regard to macroeconomic concepts, their modern specification requires a transition from understanding the economic system as a phenomenon, the essential laws of which are formed within the borders of individual States, to the cognition these laws at the level of global economic system (Hay, 2008). Accordingly, the role of the main macroeconomic subject is transferred from individual State to the various international entities and to the institutions of global economic governance.

At the same time, even in case of successful modification of the subject of micro- and macroeconomic research, their subject-level differentiation with the concepts of the global political economy will retain its character. Recorded at the empirical level trends of globalization of market relations are only the outward manifestation of the deep transformation of the very essence of economic civilization, and for the system characteristics of the global cardinal changes, it isn't sufficient the toolkit of different directions of "economics", subject matter of which is correlated with the level of regularities of market economic mechanism. In general it can be noted that, besides the level differentiation with the disciplines studying the field of economic mechanism, characteristics of the subject specificity and the structural logic of the global political economy implies the concretization of its relationship to the subject fields of such disciplines as "international political economy", "geopolitical economy", "world economy", "international economic relations", "geo-economics," "economic globalistics" and several others (Aggarwal and Dupont, 2008; Desai, 2013; Ravenhill, 2008; Review of International Political Economy, 2016; Watson, 2008). The dynamism of the object and subject of sciences, a partial intersection of their subject fields, of objects, of levels and aspects of the analysis; the "borderline", interdisciplinary nature of many problems and the relativity of the current conventions of defining the subject specificities, inevitably lead to a ambiguity of differentiation and continuous changes of the ratio of their subject, structure and perspectives. At some extent, with regard to these scientific branches we can

talk about competing research programmes and discourses.

Simultaneously, actually existing traditional conceptual and methodological approaches and research programs define the role of such disciplines as "world economy" and "international economic relations" as tools for the systematization of empirical facts, reflecting the functioning of the world economy. In fact, today's discourse of "international political economy" is close to content of the subject matter of these sciences. "Geo-economics" and "geopolitical economy" act as the elements of dialectical pair with "geopolitics" and, as a rule, examine the economic mechanisms to achieve geopolitical goals. "Economic globalistics" is focused on the study of the empirical regularities that are initially and primarily formed at the level of the modern whole-planetary economic system. For each of these Sciences, the political-economic approach, revealing the contents, role and contradictions of property relations is the methodological-theoretical basis. Alongside this, being detached, generalized and systematized as a distinct research direction, this approach forms the subject of special branch of modern scientific knowledge - the global political economy.

References Références Referencias

1. Aggarwal, V. and Dupont, C. (2008). Collaboration and Co-Ordination in the Global Political Economy. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 67-94.
2. Ardalan K. (2010). Globalization and Global Governance: Four Paradigmatic Views. *American Review of Political Economy, Vol. 8(1),* 6-43.
3. Desai, R. (2013). *Geopolitical Economy: After US Hegemony, Globalization and Empire. The Future of World Capitalism*. London: Pluto Press, and Halifax: Fernwood Publishing. - 313 pp.
4. Eletsky, N. (2016). Contradictions of Formation of the Global Economic Governance System. *International Journal of Management Science and Business Administration, Vol. 2, Issue 10,* 7-16.
5. Gilpin, R. (2001). *Global Political Economy: Understanding the International Economic Order*. Princeton: Princeton University Press. – 440 pp.
6. Global Economic Governance Programme (2016). *Research*. http://www.globaleconomicgovernance.org/research
7. Global Political Economy (2008) / ed. by John Ravenhill. New York: Oxford University Press.
8. Global Political Economy: Contemporary theories (2013) / 2-nd ed., ed. by Ronen Palan: Routledge, L & NY. – 238 pp.
9. Gobozov I.A. (2015). Postmodernism is the era of mediocracy. *Problems of Philosophy, №12,* 41-53 (Translated from Russian: *Вопросы философии, 2015, № 12,* с. 41-53).
10. Hay, C. (2008). Globalization's Impact on States. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 314-345.
11. Hildebrand, B. (2006). *Die National-Oekonomie der Gegenwart und Zukunft.* http://www.worldcat.org/title/nationalokonomie-der-gegenwart-und-zukunft/oclc/15350248
12. Issues and Actors in the Global Political Economy (2016). http://www.academia.edu /5123463/Issues_and_Actors_in_the_Global_Political_Economy
13. Marx, K. (2005). *Karl Marx and Frederick Engels: Collected Works*. London: Lawrence & Wishart.
14. McGrew, A. (2008). The Logics of Economic Globalization. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 277-313.
15. Odezah, S. (2016). The Paradox of the American War on Poverty. *Journal of US-China Public Administration, Vol. 13, No. 1*, 41-54.
16. Ravenhill, J. (2008). The Study of Global Political Economy. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 3-26.
17. Review of International Political Economy (2016). http://www.researchgate.net/journal/1466-4526_Review_of_International_Political_Economy
18. Ricardo, D. (2005). *The Works and Correspondence of David Ricardo* / ed. Piero Sraffa with the collaboration of M.H. Dobb. Indianapolis: Liberty Fund. Vol. VII, 278-279.
19. Thun, E. (2008). The Globalization of Production. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 346-372.
20. Wade, R. (2008). Globalization, Growth, Poverty, Inequality, Resentment, and Imperialism. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 373-409.
21. Watson, M. (2008). Theoretical Traditions in Global Political Economy. *Global Political Economy* / ed. by John Ravenhill. New York: Oxford University Press, 27-68.
22. World Economy and International Relations (1990). (Translated from Russian: *Мировая экономика и международные отношения, 1990, № 5,* с. 59).

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The Factors Affecting the Net Income of the Households for Mono Rice Production, Rice- Upland Crop and Rice-Aquaculture in the Mekong Delta of Vietnam

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Abstract- The study on the factors affecting the net income of the households for mono rice production, rice-upland crop and rice-aquaculture in the Mekong Delta was conducted in July, 2013 which aimed to (1) Assess the main resources of the households; (2) Analyze factors impacting the net income and (3) Propose solutions for improving the net income for rice production, rice-upland crop and rice-aquaculture of households in the Mekong Delta. The analysis method was based on the descriptive statistics, and the multiple linear regressions. The study results showed that: (1) The educational levels of the household heads were low; (2) The farmland was large with 1.95 hectare per household; (3) There are three groups of household having the main net income from agricultural production, and the second net income from the non-agricultural activity; (4) The net income of the mono rice production households was affected by the participation association of the household heads and the farmland area;

Keywords: household, mekong delta, mono rice production, net income, rice - aquaculture, rice –upland crop.

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Keywords: household, mekong delta, mono rice production, net income, rice - aquaculture, rice –upland crop.

I. Introduction

The land of the Mekong Delta occupied 4.000.000 hectares in which the farmland accounted for 65%. The Mekong Delta has contributed at 56% of rice production, 70% of fruit production and 57% of aquaculture production of whole country (General Statistics Organization, 2012). However, there are several difficulties of the limitation of human resource for the human development in the Mekong Delta (Duong Ngoc Thanh and Pham Duc Thuan, 2016).

In recent years, to adapt with the change of the natural, economical and social conditions, the households have used suitably resources, improved production capacities and changed the suitable farming systems such as the systems of mono rice production, rice_upland crop and rice_aquaculture which have contributed in improving the income and the life of households. However, the social life of the households has slowly changed, the natural resources have negatively changed which have influenced the environmental ecology systems in the process of the economical development of the region (Le Quang Tri and Vo Thi Guong, 2006).

Therefore, the theme titled: "The factors affecting the net income of the households for mono rice production, rice-upland crop and rice-aquaculture in the Mekong Delta of Vietnam" was conducted to find out the solutions for improving the net income of the households.

II. Objectives of Study

There are three specific objectives of study such as (1) Analyzing the main resources of the households; (2) Analyzing the factors affecting the net income of the households; and (3) Recommending the solutions for improving the net income of the households for mono rice production, rice-upland crop and rice-aquaculture in the study site.

III. Methodology of Study

a) Methods of choosing study site and sampling

- The households who are in An Giang, Kien Giang and Dong Thap provinces selected the mono rice production and rice-upland crop.
- The households who are in Vinh Long province, Cantho city and Hau Giang province selected the rice-upland crops and rice-aquaculture.
- The rice-aquaculture were chosen by the households in Bac Lieu province.
- Total sampling of 220 households was distributed by 53 households for rice-upland crops ; 85 households for mono rice production; and 82 households for rice-aquaculture production.

b) Methods of data collection and analysis

The secondary data were collected beside the primary data, which were interviewed from 220

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households through the structured questionnaires, related to the objectives of study in 2013.

Descriptive statistics and the multivariate linear regression were used in the study.

IV. Results of Study

a) The analysis of the main resource of the farm households

i. *Educational level*

The educational level of the householders obtained the primary and the secondary school which was low in the three production groups in 2013.

Table 1: The educational level of the householders in the three production groups

Education of householders	Rice-Upland crops		Mono Rice crops		Rice-Aquaculture		Total	
	Number of householders	%	Number of householders	%	Number of householders	%	Number of householders	%
Illiterate	0	0	2	2,4	4	4,8	6	2,7
Primary school	16	30,2	36	42,3	29	35,4	81	36,8
Secondary school	29	54,7	34	40,0	29	35,4	92	41,8
High School	8	15,1	12	14,1	18	22,0	38	17,3
College	0	0	0	0	1	1,2	1	0,5
University	0	0	1	1,2	1	1,2	2	0,9
Total of householders	53	100,0	85	100,0	82	100,0	220	100,0

Source:Household interviewed in 2013

ii. *Farm land*

In 2013, the farm land was over 2 hectares per household obtained at the highest proportion while the farm land under 1 hectare per household ranged the lowest one. For the Rice-Aquaculture production group and Rice-Upland crop production group with the 1- 2 hectare farm land per household accounted for the highest proportion while the Mono Rice production group with the farm land was over 2 hectares per household occupied at the highest proportion. The average farm land per household in the three production groups was quite big; it was in round of 2 hectares in 2013.

Farm land was considered as the basic resource for the livelihood activities of the farm households. Moreover, the farm land was also a property of farm households to access the credits from the banks for the production works or their life.

Table 2: Farm land of the farm households in three production groups

Farm land	Rice-Upland crops		Mono Rice crops		Rice-Aquaculture		Total	
	No. of households	%	No. of households	%	No. of households	%	No. of households	%
<1 ha	15	28,3	23	27,1	19	23,2	57	25,9
1- 2 ha	20	37,7	22	25,9	38	46,3	78	35,5
>2 ha	18	34,0	40	47,1	25	30,5	85	38,6
Household total	53	100,0	85	100.0	82	100,0	220	100,0
Average of landarea (ha)	1,68		2,25		1,93		1,95	

Source:Household interviewed in 2013

iii. *Net income of the farm households*

The main net income (NI) of the farm households was from doing farming, and from non-farm activities. Livestock's NI was an additional part in the farm households' livelihood. Net income total per Mono Rice crop household obtained the highest in the three production household groups, then, NI total per Rice-Aquaculture household reached the second range while NI total per Rice-Upland crop household achieved the lowest. Net income total per Mono Rice crop household was higher than those of Rice-Aquaculture household and Rice-Upland crop household because NI of doing farming and livestock per Mono Rice crop household contributed more than those of Rice-Aquaculture household and Rice-Upland crop household in 2013.

Table 3: Structures of the net incomes per farm household between different production groups in a year

Source of net income (NI)	Rice-Upland crops household		Mono Rice crops household		Rice-Aquaculture household		Total	
	Amount (MillionVND)	%	Amount (MillionVND)	%	Amount (MillionVND)	%	Amount (MillionVND))	%
Farming	58,64	67,47	88,36	77,09	61,46	63,27	69,49	69.87
Livestock	4,98	5,73	9,49	8,28	6,27	6,45	6,91	6,95
Non-farm	23,30	26,80	16,77	14,63	29,41	30,28	23,05	23,18
NI total	86,92	100,00	114,62	100,00	97,14	100,00	99,45	100,00

Source:Household interviewed in 2013

b) *Analysis of the factors affecting the net income of the households for mono rice production, rice-upland crop and rice-aquaculture production group*

For the Mono Rice crop production group, the NI of the household participating in the local associations correlated positively. For instance, the NI of the household who participated in the local associations increased 33.5 millions VND. Moreover, the farmland area was also correlated with the NI of the household. It showed that the NI of the household increased 40.4 millions VND when the farmland was enlarged by one hectare which could be interpreted that the total of production cost reduced from discounting prices of the material inputs when the household bought with a large amount in 2013. Therefore, the more farm land area got more NI.

In the Rice-Upland crop production group, the family labors correlated positively with the NI of the household. It showed that the NI of the household increased 0.1 million VND when the increment of the family labor was added by one man-day. Investment for material inputs was also correlated with the NI of the household. It illustrated that the NI of the household increased 0.35 million VND when the household increased one million VND for the material inputs in 2013.

In Rice-Aquaculture production group, the educational level of the householder correlated well with the NI of the household. It showed that the NI of the household increased 10.37 millions VND when the education of the householder raised one level in 2013. It could be explained that the householder could access with the advanced techniques in the process of farming to produce the good products when he or she reached a certain level of education. Besides, the NI of the household increased 0.09 million VND when the increment of the family labor was supplied by one man-day and the NI of the household also increased 27.99 millions VND when the farm land area was enlarged by one hectare in 2013.

Table 4: Analysis of the factors affecting the net income of the households for mono rice production, rice-upland crop and rice-aquaculture production in 2013

Independent variables	Mono rice household		Rice-upland crops household		Rice-aquaculture household	
	Regression Coefficient	Value P	Regression Coefficient	Value P	Regression Coefficient	Value P
Constant	-33.354	0.170	25.238	0.275	-0.451	0.980
X1: Educational level of householder	13.167	0.232	¯6.172	0.516	10.375	0.089
X2: Participating in union (yes, no)	33.511	0.096	8.047	0.541	-14.440	0.256
X3: Family labors (man-day)	0.074	0.106	0.108	0.000	0.090	0.000
X4: Livestock (yes, no)	5.936	0.792	10.612	0.480	2.771	0.810
X5: Investment for material inputs (million VND)	0.012	0.928	0.350	0.000	0.027	0.733
X6: Farm land (ha)	40.494	0.000	4.300	0.358	27.991	0.000
Observation number	85		53		82	
Sig.F	0.000		0.000		0.000	
R	0.769		0.733		0.769	
R^2	0.591		0.538		0.591	
Durbin-Watson	2.025		2.219		2.118	

Source: Household interviewed in 2013

c) The solutions for improvement of the household net income

Based on analyzing the main resources of the households and the factors affecting the net income of the households, the solutions for improving the NI of three household groups including the mono rice production, rice-upland crop and rice-aquaculture production groups were recommended such as:

The mono rice production households should participate in the local associations and enlarge the farm land area to increase their net incomes.

The rice-upland crop production households should optimize using their family labors and invest the material inputs in the production to improve their net incomes.

In the rice-aquaculture production households, the educational level of the householders and the family members should be strengthened, the family labors should be used appropriately and the farm land area should be enlarged enough to improve the net incomes of the households.

V. Conclusion

The educational and training level of the householders were still low and the farmland area of the households was quite high in three production household groups, in which the farmland per rice-aquaculture production household ranged from one to two hectares occupying the highest rate, while the farmland per mono rice production household occupied over two hectares accounting for the highest rate. The main NI of three production household groups was from the agriculture, then, from the non farm activities. The mono rice production households reached the highest in the total of the net income.

The householders participating in the local associations and the large scale of the farmland did the increment of the net income in the mono rice production households.The man-day number of the family labors and the investment of the material inputs in the production increased the NI in the rice-upland crop production households. The educational level, the participation of the family labors in the production and the farmland scale helped increasing the NI in the rice-aquaculture production households.

References Références Referencias

1. Duong Ngoc Thanh and Pham Duc Thuan (2016). Transfering the economic structure, the labors and the rural employment. *In:* Dương Ngọc Thành (Editor). Employment Labor and Rural Occupation Training in the Mekong Delta (Situation and Orientation). Cantho University Publication House. Cantho, pp. 36-63 (in Vietnamese).
2. Koos Neefjes (2003). Environment and Livelihood. National Political Publication House, Hanoi, p. 334 (in Vietnamese).
3. Le Quang Tri and Vo Thi Guong (2006). Study on the transfered model of the animal crops structure in the acid soil of Vinh Loc and Ninh Thanh Loi villages, Hong Dan district, Bac Lieu province. Research Paper. College of Agriculture and Applied Biology. Cantho University (in Vietnamese).
4. General Statistics Office (2012). Results of Investigation on Rural, Agriculture and Aquaculture in 2011 (in Vietnamese).

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On the Heterogeneity in Longe vity among Socioeconomic Groups: Scope, Trends, and Implications for Earnings-Related Pension Schemes

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Abstract- Heterogeneity in longevity between socioeconomic groups is increasingly documented for developed economies and is reviewed in the paper. Heterogeneity in life expectancy disaggregated by main socioeconomic characteristics – such as age, gender, race, health, education, profession, income, and wealth – is sizable and has not declined in recent decades. The prospects for future decline are not strong, either; perhaps even to the contrary. As heterogeneity is closely linked to income or earnings (i.e., the contribution base of earnings-related retirement income programs such as social security benefits and private sector life annuities) and as heterogeneity is empirically sizable, the result is major implicit taxes for some groups –particularly the less educated and low earners –and major subsidies for other groups – particularly highly educated individuals and high-income earners. The implications for retirement income reform and scheme design are substantial as taxes/subsidies counteract the envisaged effects of (i) a closer contribution-benefit link, (ii) a later formal retirement age to address population aging, and (iii) more individual funding and private annuities to compensate for reduced public generosity.

Keywords: *life expectancy, gender, life annuities, lifetime income, implicit tax, implicit subsidy.*

GJHSS-E Classification: *JEL: D9, G22, H55, J13, J14, J16*

Strictly as per the compliance and regulations of:

On the Heterogeneity in Longevity among Socioeconomic Groups: Scope, Trends, and Implications for Earnings-Related Pension Schemes

Mercedes Ayuso [α], Jorge Miguel Bravo [σ], & Robert Holzmann [ρ]

Abstract- **Heterogeneity in longevity between socioeconomic groups is increasingly documented for developed economies and is reviewed in the paper. Heterogeneity in life expectancy disaggregated by main socioeconomic characteristics – such as age, gender, race, health, education, profession, income, and wealth – is sizable and has not declined in recent decades. The prospects for future decline are not strong, either; perhaps even to the contrary. As heterogeneity is closely linked to income or earnings (i.e., the contribution base of earnings-related retirement income programs such as social security benefits and private sector life annuities) and as heterogeneity is empirically sizable, the result is major implicit taxes for some groups –particularly the less educated and low earners –and major subsidies for other groups – particularly highly educated individuals and high-income earners. The implications for retirement income reform and scheme design are substantial as taxes/subsidies counteract the envisaged effects of (i) a closer contribution-benefit link, (ii) a later formal retirement age to address population aging, and (iii) more individual funding and private annuities to compensate for reduced public generosity.**

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I. Introduction

Increased longevity of individuals has become the pride of policy makers across the world, evidence of the successes of health care and other public programs, but it is also a major element of concern as it puts pressure on the financial sustainability of age-related public and private programs such as pensions, health care, and long-term care.

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Data on longevity developments, typically measured by changes in mortality rates across the age spectrum or through changes in life expectancy at specific ages (e.g., at birth or retirement), are now available in essentially all countries and are well documented (see United Nations 2013 and 2015). These data typically indicate for the total population a reduction in mortality rates across most or all ages or, equivalently, an increase in (remaining) life expectancy at most or all ages. This creates the basis on which policy reforms are developed and proposed, the most prominent of which is an increase in retirement age for pension programs to address the rise in longevity.

Improved data availability in a rising number of countries suggests that changes in mortality/life expectancy are not homogenous across populations but instead characterized by often stark heterogeneity in scope and trends across socioeconomic groups. Such heterogeneity – if confirmed and sustained – risks putting in doubt the effectiveness of key policy proposals to address longevity challenges that assume homogeneity in longevity.

Longevity heterogeneity impacts the outcomes of social programs such as pension schemes, which in turn risks affecting major reform avenues, such as a move toward defined contribution (DC) schemes or an increase in retirement age concomitant with increasing life expectancy. Of particular relevance is the link between longevity and income/earnings/contribution base, as both ultimately determine the level of benefits assigned. If the two are highly correlated, actuarial neutrality is strongly violated if the same rules are

♣ The Spanish version of the paper was produced in our capacity as Members of the Expert Forum of the BBVA Pension Institute (Madrid) and can be accessed at https://www.jubilacion defuturo.es/es/blog/foro-de-expertos.html. This paper was written in our personal capacity and none of the institutions we are involved with can be held accountable for the content. Any errors are our own doing.

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applied to all individuals; doing so in the presence of income-correlated life expectancy amounts to a tax on lower-income groups and a subsidy for high-income groups.

Exploring and estimating the size of the longevity-income link is important to understand the size of the actuarial distortion and to guide new policy design to compensate for it. While new and improved data for some countries enable a much better understanding of the phenomenon within countries, little systematic comparison across countries has been made to date on scope and trends across socioeconomic groups.

Against this background the structure of the paper is as follows: Section 2 highlights the socioeconomic dimensions of heterogeneity in longevity/life expectancy and the scope of heterogeneity emerging from available national and international data. Section 3 presents past trends in heterogeneity for these same socioeconomic dimensions and speculates about their future prospects. Section 4 explores the data options for heterogeneity with the aim of establishing income-related or multi-dimensional socioeconomic links. Section 5 builds on these links to offer first estimates of the magnitude of the tax/subsidy effects of heterogeneity in life expectancy; explore the labor market implications; and sketch the pension policy consequences of such distortions. The paper ends with conclusions and next steps in Section 6.

II. Main dimensions, Indicators, and Scope of Heterogeneity in Longevity

Section 2.1 provides an overview of the main dimensions of heterogeneity in longevity and discusses their selected indicators for which data are available, at least for some countries. Section 2.2 presents data on the scope of heterogeneity by various dimensions. The sources cited use mortality rates at different ages or life expectancy at selected ages (typically at birth and at retirement age) as an indicator for longevity, when appropriate and available.

a) Main socioeconomic dimensions for which heterogeneity data are available

In addition to gender and age,4 a range of other socioeconomic characteristics may affect the probability that an individual lives longer or shorter, thus impacting his or her longevity. Level of income, type of work exercised during working life, marital status, education, and health status are some key variables typically presented in the scientific literature and in analyses by international organizations, in addition to sociodemo graphic variables such as place of residence and race/ethnicity.

Table 1 summarizes some of the studies that have analyzed the influence of different socioeconomic characteristics on longevity. The purposes of this table are to list the primary available socioeconomic characteristics and selected indicators for which differentiation by longevity is available; present the basic idea behind the link; and offer selective references to key data sources or papers.

Table 1: Heterogeneity in longevity: Main indicators

Indicator	Principal idea	Selective references
1. Age	Longevity can result from reduction in mortality of different age segments in the population, which may happen to different age cohorts at different moments in their lifecycle. Historically, most progress was made by first reducing pre-natal and infant mortality; more recently, astonishing advances in advanced-age mortality reductions have occurred. As mortality rates at younger ages in advanced economies are already very low, future advances in longevity will largely result from reduced mortality after current retirement age. In some countries mortality rates for some subgroups of the population have deteriorated in recent decades (e.g., for middle-aged white men and women in the United States between 1999 and 2013, and for women and particularly for men in Russia after 1988).	Oeppen and Vaupel (2006) Case and Deaton (2015) WHO (2015a) Wikipedia (2016)

2. Gender	Women across all countries exhibit a much higher life expectancy than men albeit the differences at birth and at retirement between countries differ substantially. The highest difference is recorded for Russia, where it was over 12 years in 2014. While it is generally expected that the gender gap in life expectancy will decrease over time (in some advanced countries it has reduced to a few years), there is no indication that it will disappear soon.	Deeg (2001) Eurostat (2015) Gómez-Redondo and Carl Boe (2005) Wikipedia (2016)
3. Health status and lifestyle	The objective or subjective health status of individuals has a major bearing on remaining life expectancy for individuals, with differentiated outcomes for men and women. Some studies differentiate the impact of health on life expectancy without disability. E.g., in Spain the remaining life expectancy without disability for men aged 65 is 7 years below the male average, for women with disability it is 10 years below the female average (INE 2015). This indicates that women live longer but have more disabilities. Health status as an outcome is, of course, not independent of individual lifestyle choices (inputs) such as smoking, drinking, type of diet, and type and frequency of physical exercise. The link to longevity may be exerted through the objective or subjective health status or directly through the inputs.	Crimmins, Hayward and Saito (1994) Chande (2001) Monteverde (2004) Ayuso and Guillén (2011) Bolancé, Alemany, and Guillén (2013) INE (2015) WHO (2015b)
4. Level of education	Various studies present a close link between level of education and longevity – typically individuals with more years of education have a higher life expectancy. E.g., in Central and Eastern European countries, men aged 65 with a low level of education live 4 to 7 years less than men with a high level of education (OECD 2014). Years of education is clearly a proxy for many other variables that impact longevity such as socioeconomic background (e.g., country of residence and family status, as input) and market income (as outcome). But education – as an outcome – is likely to also directly affect longevity through knowledge about lifestyles (see item 3) and other channels that are little explored.	Borrell et al. (1999) Brønnum-Hansen et al. (2004) Doblhammer, Rau, and Kytir (2005) Lleras-Muney (2005) Castelló-Climent and Doménech (2008) Miech et al. (2011) Steingrímsdóttir et al. (2012) Kaplan, Spittel, and Zeno (2014)
5. Marital status	An individual's marital status can influence longevity. E.g., in Spain the survival probability for a married person is superior to that of a widowed person aged 65 and above, for both men and women.	Kaplan and Kronick (2006) Rendall et al. (2011) Alaminos and Ayuso (2015)

	Like education, this characteristic is likely a proxy for other characteristics but may have its own impact on longevity. E.g., being married changes one's social embeddedness and thus influences happiness and outlook on life (Holzmann 2013).	
6. Type of labor activity	Various studies suggest a relationship between type of economic activity and life expectancy – for individuals at birth through father's profession, or at retirement age through one's own profession. E.g., in England in observation period 2002-06, having had a father in liberal professions* led to a life expectancy advantage at birth of 6 years over individuals with a father with a manual profession; for individuals at age 65, the difference for own profession was 3.5 years. Type of professional activity may serve as a proxy for other channels such as income but may also have a direct impact on longevity, e.g., via professional satisfaction.	National Statistics (2011)
7. Geographical area	Various studies indicate that region of residency in a country has an impact on life expectancy. E.g., people in the northeastern part of the United States can expect to live longer than those in the south. Similar differences exist in England, France, Italy, and Spain. Region may serve as a proxy for income level, health infrastructure, and other inputs but may also have an impact on its own that in some cases moves in the opposite direction.	Chang et al. (2015) Herce (2015) Eurostat (2015)
8. Income level	The impact of income on longevity can be assessed on two levels: relative position among countries and relative position within a country. Cross-country data clearly indicate that income per capita is correlated with longevity (WHO 2015a) but not in a 1:1 relationship. Similarly, an increasing number of studies suggest that major differences in life expectancy can depend on position within a national (lifetime) income distribution. U.K. data suggest that individuals from rich boroughs live, on average, 6 years longer than those in poor ones. U.S. estimates suggest that a person born in 1960 and in the highest income quintile at age 50 has a projected life expectancy of some 13 years above a similar person in the lowest income quintile. Income level is an indicator for access to health care and other survival-relevant infrastructure, is closely linked to other variables discussed (such as education), and is quite likely important for survival-relevant own actions such as lifestyle. It is	Judge (1995) Borrell et al. (1997) Von Gaudecker, Martin, and Scholz (2007) Dowd and Hamoudi (2014) WHO (2015a, 2015b) National Academies of Sciences (2015) Chetty et al. (2016) OECD (2016)

	a key variable as it determines the level of retirement income.	
9. Combination of factors: age, gender, race, income level, geographic zone, marital status	A few studies disaggregate heterogeneity in longevity by more than one of the indicators outlined above (or by others not presented, such as race). Such disaggregation allows insights into the joint distribution of heterogeneity-affecting indicators and thus the magnitude of effects that strengthen or weaken longevity. E.g., while women have a higher life expectancy, their income level is often lower than that of men, attenuating both effects. On the other hand, individuals with the "wrong" gender (male), profession (manual), and race (black) may end up with a life expectancy at retirement that is a small fraction of that of an Asian woman with a high-paying profession. Data that allow wide disaggregation by all relevant indicators and for longevity at birth, at entry into the labor market, and at retirement do not yet exist and thus need to be approximated for analyses.	Duleep (1989) Crimmins, Hayward Saito (1996) Lin et al. (2002) Singh and Siahpush (2006) Duggan, Gillingham, and Greenlees (2007) Meara, Richards, and Cutler (2008) Geruso (2012) Olshansky et al. (2012) Kalwij, Alessie, and Knoef (2013) Pijoan-Mas and Ríos-Rull (2014) Chang et al. (2015) Solé-Auró, Beltrán-Sánchez, and Crimmins (2015)
Selected databases 1) World Health Organization (WHO): Global Health Observatory data repository (http://www.who.int/gho/database/en/) 2) Instituto Nacional de Estadística (INE): Demography. Global demographic indicators by type of indicator and period (www.ine.es) 3) Eurostat: Life expectancy by age, sex and educational attainment (http://appsso.eurostat.ec.europa.eu/nui/show.do) 4) Statistics Canada. Health-adjusted life expectancy at birth and at age 65, by sex and income (http://www80.statcan.gc.ca/wes-esw/page1-eng.htm) 5) Office for National Statistics UK: Life expectancies (http://www.ons.gov.uk/ons/index.html)		
*Notes: * A liberal profession in European use and understanding provides intellectual services that cannot be described as commercial or artisanal. Examples include lawyer, notary, bookkeeper and accountant.*		

The socioeconomic dimensions presented in Table 1 reflect to a large extent the data available to disaggregate longevity measures by socioeconomic indicators. As a result, the disaggregation is patchy and no data set in any country allows for full disaggregation by all relevant individual characteristics. Such data would allow for creation of a joint distribution across all indicators, and The socioeconomic dimensions presented in Table 1 reflect to a large extent the data available to disaggregate longevity measures by socioeconomic indicators. As a result, the disaggregation is patchy and no data set in any country allows for full disaggregation by all relevant individual characteristics. Such data would allow for creation of a joint distribution across all indicators, and thus the determination of correlations and covariance between indicators and the determination of the tails of such distribution – i.e., the weakening and strengthening effects.

But not all of these compensating factors are relevant for our core question: Does heterogeneous longevity create an unfair pension contract that distorts individual behavior and risks countervailing policy intentions (such as an increase in the retirement age)?

The key indicator for our purposes is (lifetime) income (also a proxy for the contribution base, accumulation of savings or acquired rights, and future pension benefit). If for whatever reason income is highly correlated with life expectancy then the contract of any earnings-related scheme will be unfair and will distort and countervail policy goals. Thus the size of the life expectancy gaps (compared to the average) across income strata is critical information for corrective policy design.

Essentially all other individual indicators highlighted in Table 1 that are amenable to individual action (health status, education level, marital status,

[4] These two dimensions were analyzed in Ayuso and Holzmann (2014) and Ayuso, Bravo, and Holzmann (2015).

profession, region of residence, etc.) are closely linked to income. We do not know how much heterogeneity in longevity they add when corrected for the income (wealth) status of individuals and we have limited understanding of how much of this addition could and should be corrected for. Any correction mechanism for amenable individual characteristics risks provoking moral hazard behavior within an insurance contract setting. But it is important to understand the size of the additional life expectancy created by amenable indicators beyond the correlated income effect.

Table 1 also includes a few unchangeable individual indicators such as age, gender, and race and the data suggest that their impact on heterogeneity in longevity can be large. As individuals cannot (easily) change these characteristics, which are mostly easily observed, insurance theory suggests that pricing should happen individually for these pools; i.e., it should be based on their respective group mortality/life expectancy. Any redistributive considerations should happen outside the insurance contract. Still, from a policy perspective it is important to know how much these unchangeable individual indicators add or subtract to heterogeneity in longevity once the impact of income is taken into account.

b) Scope of heterogeneity in life expectancy by socioeconomic characteristics

The prior subsection offered an overview of key socioeconomic dimensions that affect heterogeneity in life expectancy (and for which data exist) and identified socioeconomic characteristics for its measurement. This subsection presents the actual scope of heterogeneity in longevity by each identified socioeconomic characteristic: first with a selection of examples in different countries and with an overview in Table 3 at the end.

- By age group

Life expectancy at birth estimates the years alive and summarizes mortality at different ages, typically classified for children and adolescents, adults, and older persons.

In 2013 the World Health Organization estimated the average life expectancy of the world population at 74 years (WHO 2015a). Not surprisingly, major differences in this value exist across countries, ranging from a minimum of 46 years to a maximum of 84 years, or a gap of around 38 years. Moving forward to life expectancy at age 60, the average value across countries is 18 years, implying an average gain of 4 years from birth for those who survived. The highest (26) and lowest (13) years of remaining life expectancy at age 60 signal an absolute gap reduction but a relative increase.

Much of the difference in life expectancy at birth occurs at early ages. The infant mortality rate (i.e., the probability of dying during the first year of life for each 1000 live births) is 15.3, with the highest country level at 107.2 and the lowest at 1.6. The average under-five year mortality rate is 17.7 per 1000, with a maximum of 167.4 and a minimum of 2.0. These differences across countries are staggering.

Lastly, the mortality rate for adults (i.e., the probability of dying between the age of 15 and 60 per 1000 individuals) was estimated in 2013 at an average 184 for men (with a maximum of 577 and a minimum of 54) and at an average 102 for women (with a maximum of 496 and a minimum of 36).

- By gender

Men and women do not have the same life expectancy, neither at birth nor at any later age, such as retirement. This fact has been demonstrated repeatedly across countries, most recently by the World Health Organization (WHO 2015a). In 2013 the average life expectancy for all women in the world was 77 years, 6 years above that of men (71 years). In Europe these values are even higher (80 years for women, 73 for men), leading to an increase in the gender gap of 7 years. When we regard the levels and gender gap at age 60 for the world as a whole, the differences are reduced in absolute terms but remain unchanged in relative terms: life expectancy at age 60 is 21 for women and 18 for men, for a gap of 3 years. In Europe, the difference in absolute terms is also reduced but increased in relative terms: 24 years for women and 19 years for men, for a gap of 5 years. Similar results emerge from OECD (2015) estimates at age 65 (Figure 1).

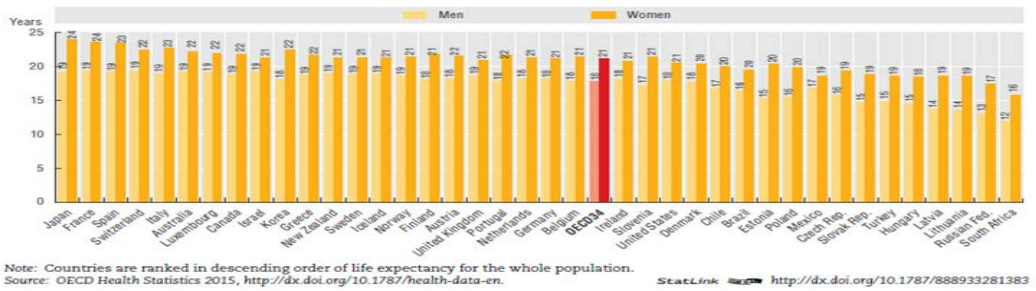
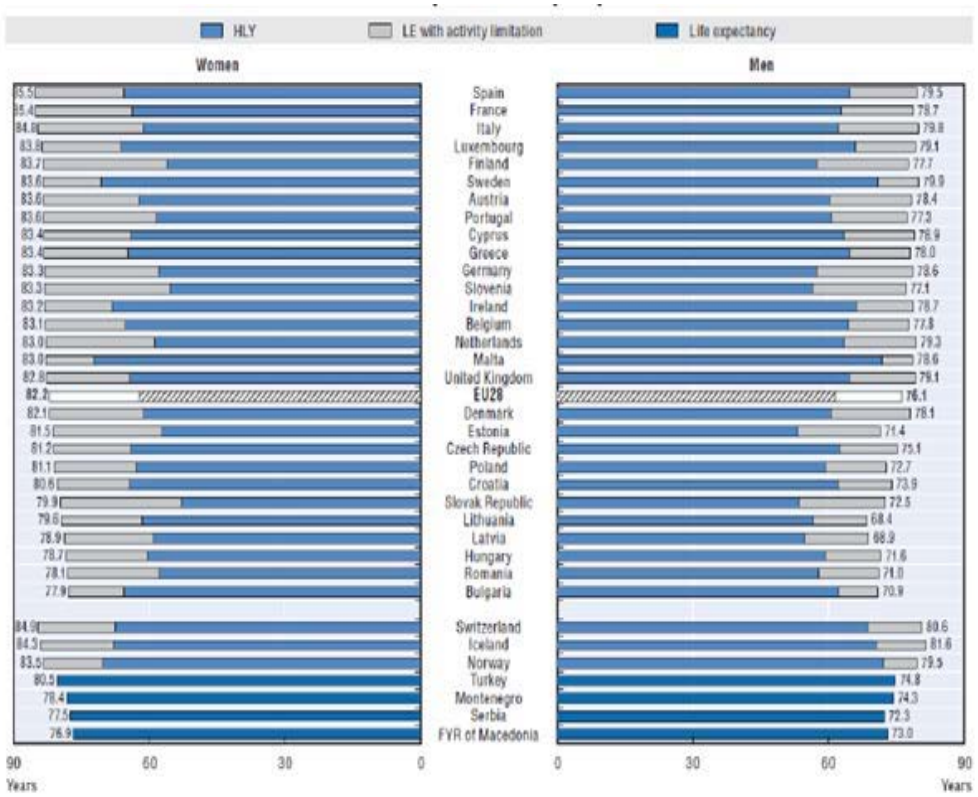


Figure 1: Life expectancy at age 65 by gender, 2013 (or latest year)

➢ By health status

The average number of years that an individual of a given age has left to live is directly related to his health status. According to World Health Organization estimates (WHO 2015a), in 2013 life expectancy at birth to live a life in good health was 63 years worldwide, practically 11 years below total life expectancy. In Europe individuals live 67 years in good health on average, with a total life expectancy of 76; i.e., they face a longer life with a lower number of years in poor health. The gender differences are remarkable, as seen in Figure 2 (Eurostat 2015. While in the European Union (EU) women live, on average, some 6 years longer than men, the difference in the length of healthy life expectancy is only 1 year.

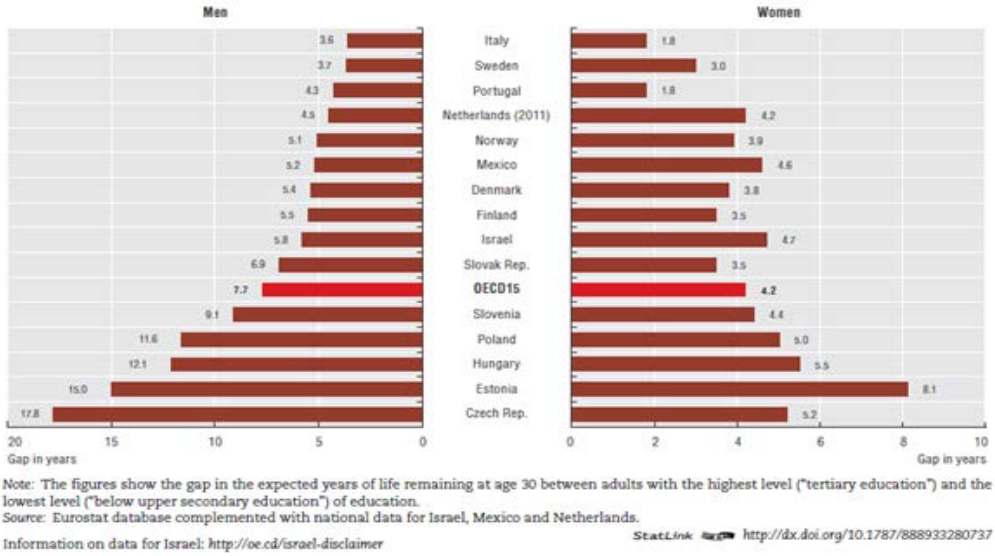


source: Eurostat Statistics Database

Figure 2: Life expectancy at birth by gender: Total, in good health, and in poor health, 2012

➢ By education level and type of work

A number of studies suggest that the scope and development of life expectancy depends on other factors in addition to the ones already outlined, such as level of education, type of work, and individual and country income level. Based on estimates by WHO (2015b), Figure 3 presents differences in life expectancy at age 30 for individuals with a high education level (tertiary education) and a low education level (inferior to secondary education), differentiated by gender. Across all 15 countries considered in the study, those with a high degree of education have a life expectancy of 53 at age 30 while those with a low degree of education have a life expectancy of 47 years – i.e., 6 years fewer. The differences by education level are much more pronounced for men (8 years lower for low-educated men) than women, for whom the difference is roughly halved. In the Czech Republic, the differences between high- and low-educated men reaches a staggering 12.1 years, while the difference for women is still 5.2 years.

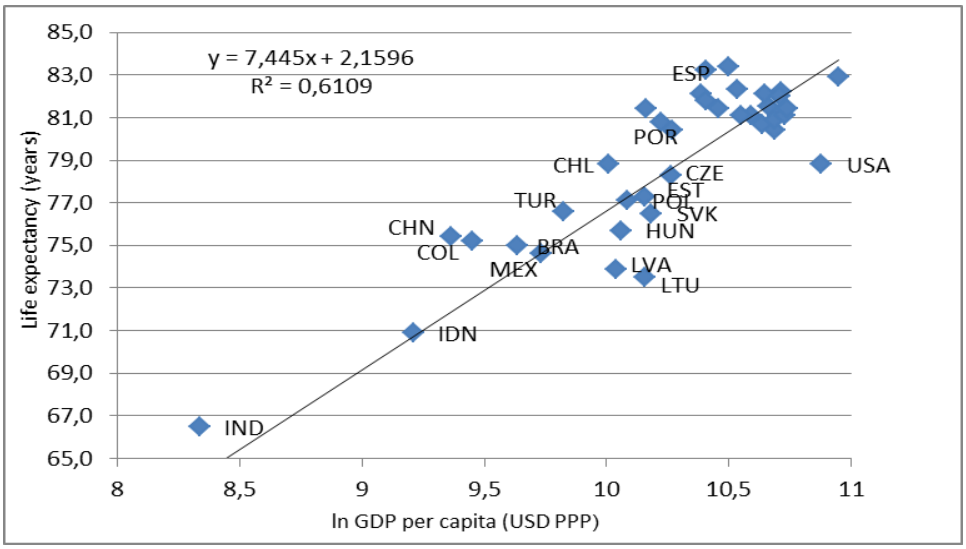


Note: The figures show the gap in the expected years of life remaining at age 30 between adults with the highest level ("tertiary education") and the lowest level ("below upper secondary education") of education.
Source: Eurostat database complemented with national data for Israel, Mexico and Netherlands.
Information on data for Israel: http://oe.cd/israel-disclaimer
StatLink http://dx.doi.org/10.1787/888933280737

Figure 3: Differences in life expectancy for individuals at age 30 by gender and education level, 2012 (or latest year)

➢ By level of wealth or contemporary income

Individuals in countries with higher wealth or income level exhibit, in general, a higher life expectancy at birth. The relationship between life expectancy and GDP per capita for a set of richer countries is clearly visible in Figure 4 (OECD 2015). This positive relationship is quite strong but not perfect, as demonstrated by the position of the United States, which has a high GDP per capita but a below-projected life expectancy. In contrast, countries with a GDP per capita similar to that of the United States, such as Spain and New Zealand, have an above-projected life expectancy, which may be due to other factors. One such factor could be public and private expenditure on health, although OECD (2015) estimates suggest that the link between life expectancy and health expenditure is not strong. Countries like South Korea and Greece have low health expenditure but a relatively high life expectancy similar to that of Spain and Portugal, both of which spend much more on health.



Source: OECD Health Statistic 2015.

Figure 4: Life expectancy at birth and GDP per capita, 2013 (or latest year)

➢ By lifetime income

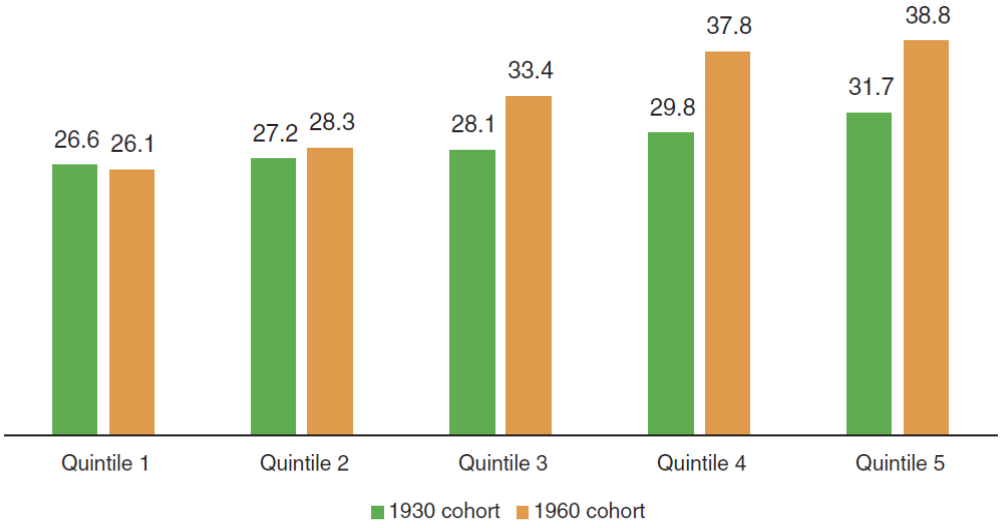
While data linking life expectancy and gender are typically available, the link to lifetime income is mostly nonexistent and must be created from administrative and other data with a number of assumptions. Most of such data links have been created

in the United States, including in the most recent joint study by the National Academies of Sciences (2015). This study confirms prior studies' findings on the importance of heterogeneity in longevity and of the trend that the gradient in life expectancy by income has risen over time, implying a rising gap in life expectancy between the lowest (and least educated) income group and the highest (and most educated) income group.

The National Academies study uses Social Security earnings history data linked to the Health and Retirement Study to estimate mortality patterns based on life expectancy at age 50 for men and women in two different generations by quintile of lifetime earnings. Their "lifetime earnings" measure is the average nonzero earnings as reported to the Social Security Administration between the ages of 41 and 50. The study compares mortality at ages above 40 for generations born in 1930 to the mortality regimes it projects for the generation born in 1960.

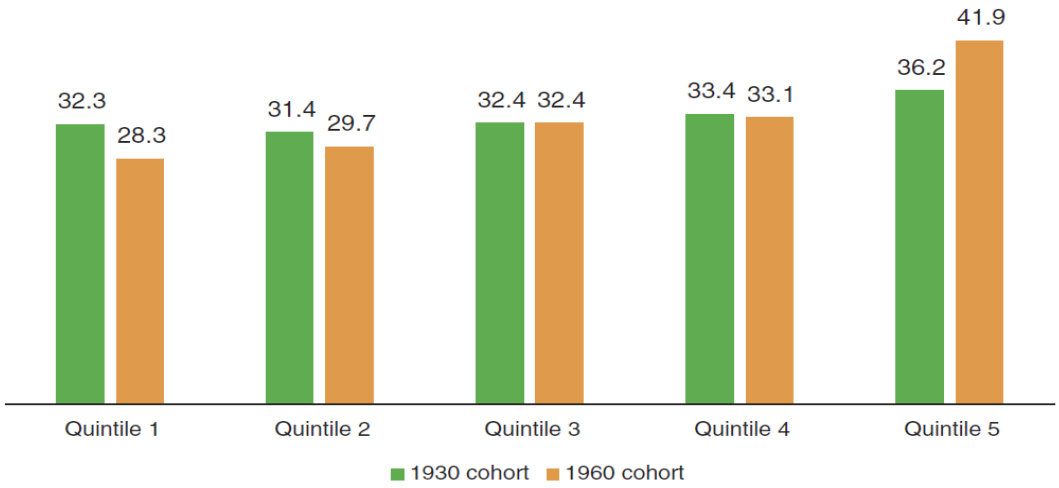
Key results are highlighted in Figures 5a and 5b, which present life expectancy at age 50 by income quintile and by cohort and gender, respectively. For both birth cohorts and for both genders, the life expectancy gap increases with income quintile (except in one case). Furthermore, and as conjectured, the gap increased between birth cohorts for the fifth quintile compared to the first quintile, from 5.1 to 12.7 years for men and from 3.9 to 13.6 years for women. These gaps are large and the trends frightening.

To our knowledge no similar data are available for other OECD countries, particularly those in the EU, to confirm or reject these scopes and trends in longevity heterogeneity. While one may conjecture that both the scope and trend are less drastic in most other countries, the situation will not be homogenous and awaits relevant studies.



Source: National Academies of Sciences 2015.

Figure 5a: Male life expectancy at age 50 by age cohort and lifetime income quintile, United States



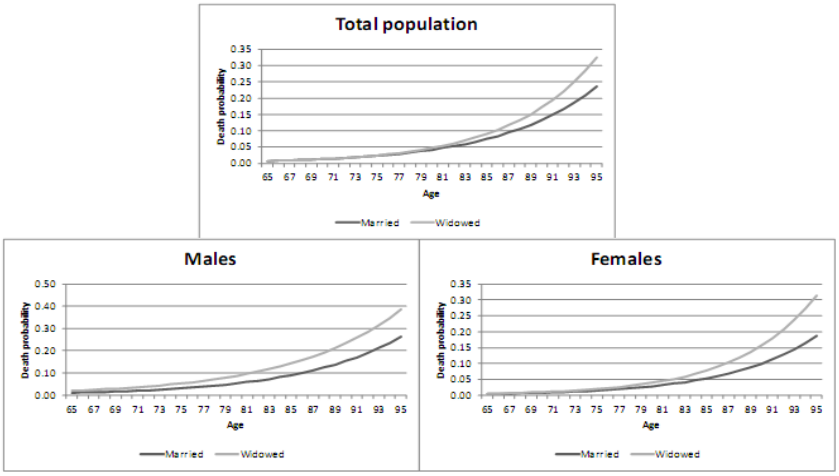
Source: National Academies of Sciences 2015.

Figure 5b: Female life expectancy at age 50 by age cohort and lifetime income quintile, United States

➢ *By marital status*

Various country studies suggest that the probability of death for married individuals (and consequently their survival probability and thus life expectancy) is different from that of singles and widowed individuals. Figure 6 offers an example of such differences for Spain, based on the population census of 2011, as estimated in Alaminos and Ayuso (2015).

The probability of death for widowed individuals is higher than that for married men and married women but the gap is more pronounced for men. The difference in mortality in both cases increases markedly with age. This has a bearing on actuarial neutrality and thus individual pension design. It has an additional bearing when a person can receive a survivors pension in addition to his or her own pension.



Source: Alaminos and Ayuso 2015.

Figure 6: Probability of death by marital status at age 65 and above, total and by gender, Spain, 2011

➢ Other factors that influence life expectancy

Other factors that affect differences in life expectancy across individuals include the geographic zone or area where individuals are born or live in, or the race to which they belong. The latter is widely studied in the United States, where public statistics differentiate across a whole spectrum of races (including White, African-American, Latino, Asian-American, and Native American). Table 2 offers a glimpse of the magnitudes.

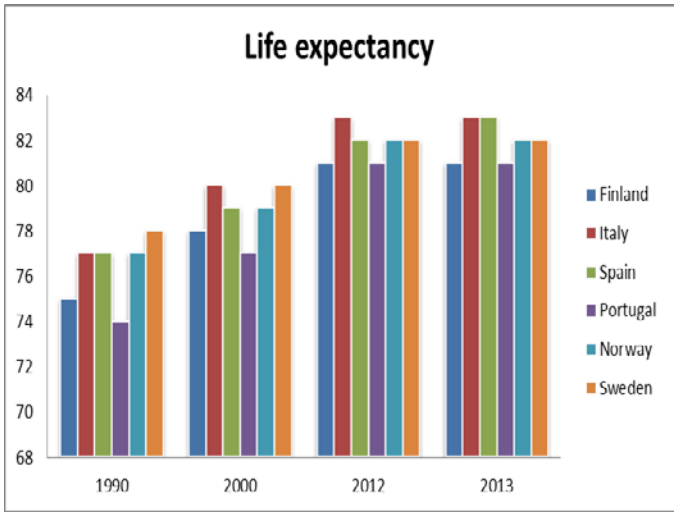
Even from these selective data it is evident that diversity across states is not symmetric for ethnicities and differences between white and Afro-American populations can be sizable but are dominated by differences with and between other ethnicities. Given Europe's (so far) ethnically more homogenous population, such statistical differentiation by ethnic background has not yet been done.

Table 2: Life expectancy at birth (in years) by race/ethnicity, United States, 2009

Location	White	African-American	Latino	Asian-American	Native American
United States	78.9	74.6	82.8	86.5	76.9
Alabama	76.0	72.9	nsd	85.3	nsd
District of Columbia	84.3	71.6	nsd	nsd	nsd
Minnesota	81.2	79.7	87.3	83.5	70.2
Oklahoma	76.0	72.8	85.0	nsd	73.8
West Virginia	75.4	72.8	nsd	nsd	nsd
Wisconsin	80.3	74.0	86.0	86.4	nsd

Note: See http://kff.org/other/state-indicator/life-expectancy-by-re/ for notes and sources. nsd = not sufficient data.
Source: Kaiser Family Foundation (http://kff.org/other/state-indicator/life-expectancy-by-re/#).

Differential life expectancy by geographical area of residence is widely studied in Europe and includes differentiation within EU member countries (for Spain, see Herce 2015), and in publications by national statistical offices and international organizations (such as Eurostat and OECD). Figure 7 presents an example of the evolution in life expectancy for a set of EU countries between 1990 and 2013.



Source: Eurostat 2015.

Figure 7: Scope and trend in life expectancy across EU countries, 1990-2013

Table 3 summarizes the scope in gaps in longevity across selected socioeconomic characteristics for countries in an easily comparable manner. The key message is that the gaps are mostly high and sometimes surprising.

Table 3: Scope in heterogeneity in longevity with selective indicators and country examples Socioeconomic

Socioeconomic dimension	Gap in years of LE	Country	Year	Comments (re: column 2)
Gender[a]	3.0/6.0	World	2013	at birth/age 60
	5.0/7.0	Europe		
	4.0/5.9	Spain	2013	at birth/age 65
	4.0/6.4	Portugal		
	3.0/4.8	United States		
	3.0/6.9	Hungary		
Level of wealth[b]	15.0	Norway-India	2013 (India,2009)	at birth
Level of income[c]	4.8/2.3	Canada	2005-2007	at birth (men/women)
	2.0/0.6			age 65 (men/women)
	5.1/3.9	United States	Cohort 1930	age 50 (men/women)
	12.7/13.6		Cohort 1960	
Health status[d]	15.9/21.0	EU(28)	2012	at birth (men/women)
	14.7/19.7	Spain		
	12.8/21.0	Portugal		
	7.6/13.1	Norway		
	12.4/18.2	Hungary		
	18.3/24.3	Estonia		

Education level[e]	4.3/1.8	Portugal	2012	at age 30 (men/women)
	3.6/1.8	Italy		
	5.1/3.9	Norway		
	12.1/5.5	Hungary		
	15.0/8.1	Estonia		

Note: a Difference between men and women. bDifference between high and low GDP per capita (OECD 2015). C Difference between 5th (highest) and 1st (lowest) income quintile. D Difference between total life expectancy and healthy life expectancy. E Difference between adults with high and low levels of education.
Source: Authors based on numerous studies

III. Past Trends and Perspectives on Heterogeneity of Longevity

Heterogeneity in longevity is not constant but evolves across key indicators within and between countries. Past trends may inform about future developments but nothing is more difficult than to predict the future. Section 3.1 offers information about trends in longevity heterogeneity by selective indicators for which data are available. Table 4 presents a summary of the main changes observed over time. Section 3.2 speculates about future developments in or likely prospects for heterogeneity in longevity.

a) Past trends in heterogeneity in longevity

- By age group

The trends observed in reported periods of 1990 and 2013 continued the developments of much of the 20th century, with an increase in life expectancy at birth and at age 60, a fall in infant mortality, and improvements for almost all age intervals. Worldwide life expectancy at birth increased by about 6 years, or about 3 months for every year (WHO 2015a); the most progress was made in Africa and South-East Asia, which started from lower levels. In Europe the increase in life expectancy at birth during this period was 4 years while the increase in life expectancy at age 60 was above the world average (3 years versus 2 years for the rest of the world). This reflects the fact that mortality rates at younger ages in Europe were already quite low, so improvements in life expectancy at birth (some 1.5 months per year) come increasingly at higher ages only.

The dramatic improvement in mortality rates at younger ages in the developing world is reflected in the marked decrease in infant mortality and the under-five halved, from 0.037 per 1000 live births in 1990 to 0.015 in 2013; the same happened to the under-five year mortality rate, which decreased from 0.047 per 1000 in 1990 to 0.018 in 2013. This development was supported by heavy emphasis on progress in this area under the Millennium Development Goals during this period. But the mortality rate for adults (aged 15 to 60) also more than halved, from 0.246 per 1000 adults in 1990 to 0.102 in 2013.

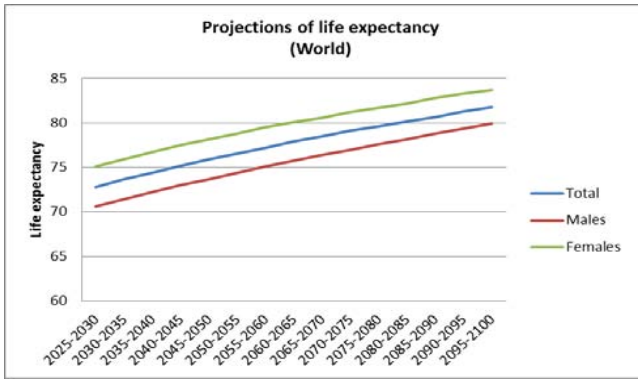
- By gender

The increase in life expectancy over the last 200 to 250 years was a phenomenon new to mankind, and was seen first in industrializing countries (Holzmann 2013). For the last 160 years, the frontier of life expectancy increase worldwide has been linear (Oeppen and Vaupel 2002), with an increase of some 3 months every year. The estimated slope of this linear line is 0.243 for women, slightly larger than that for men (at 0.222). The latest estimates indicate that both slopes show signals of a slight flattening and a reduction in the difference between men and women (see Ayuso and Holzmann 2014 for details).

According to WHO data (2015a), the difference in life expectancy at birth by gender worldwide remained approximately constant at 6 years between 1990 and 2013 (with female/male averages of 71/65 years in 1990 and 77/71 years in 2013). In Europe the gender difference during this period also remained approximately constant at 5 years.

For life expectancy at age 60 and the period under investigation, the difference worldwide remained broadly constant at 3 years (with female/male averages of 19/16 years in 1990 and 21/18 years in 2013). In Europe life expectancy at age 60 increased more for women, increasing the gap from 4 to 5 years (with female/male averages of 21/17 years in 1990 and 24/19 years in 2013).

Figure 8 presents the assumptions in the international demographic projections – medium variant. The gender gap in life expectancy at birth is assumed to remain constant at 4.5 years until 2050 and to reduce thereafter until 2100, when the gap reaches 3.8 years (INE 2015).



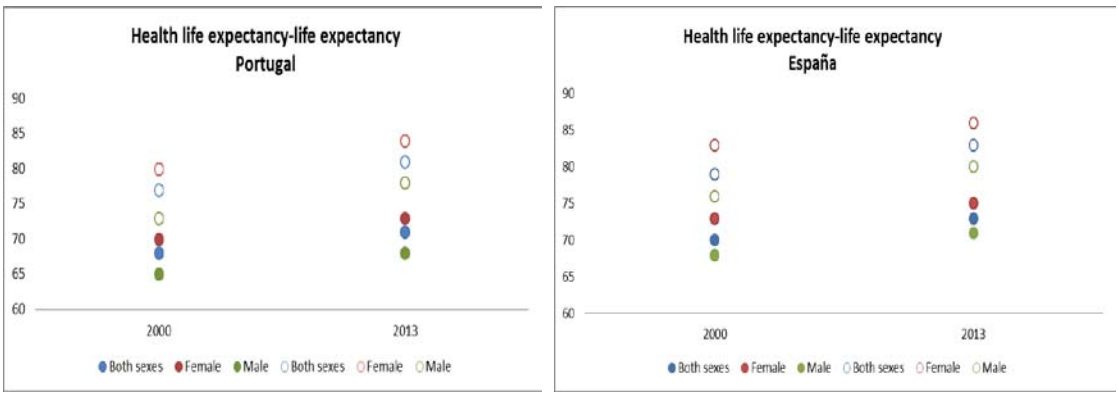
Source : A utho rs' elaborations based on INE 2015.

Figure 8: Projections of life expectancy at birth worldwide, total and by gender

➢ By health status

Life expectancy in good health has increased over the years but this growth has not been homogenous across countries. Common reasons explain the changes but so do differences such as tobacco consumption, alcohol consumption, and the prevalence of overweight. Recent estimates published in *Health at a Glance* (OECD 2015) point out the important reduction since the 1990s in mortality attributed to reduced cardiovascular problems.

Figure 9 presents the development in total life expectancy and life expectancy in good health in 2000 and 2013 in Portugal and Spain. In Portugal the difference between the two indicators increased by +1 year for women and + 2 years for men; in Spain the difference increased by + 1 year for both genders. Thus the increase in total life expectancy of a few years during the period was accompanied in both countries by more years of poor health.



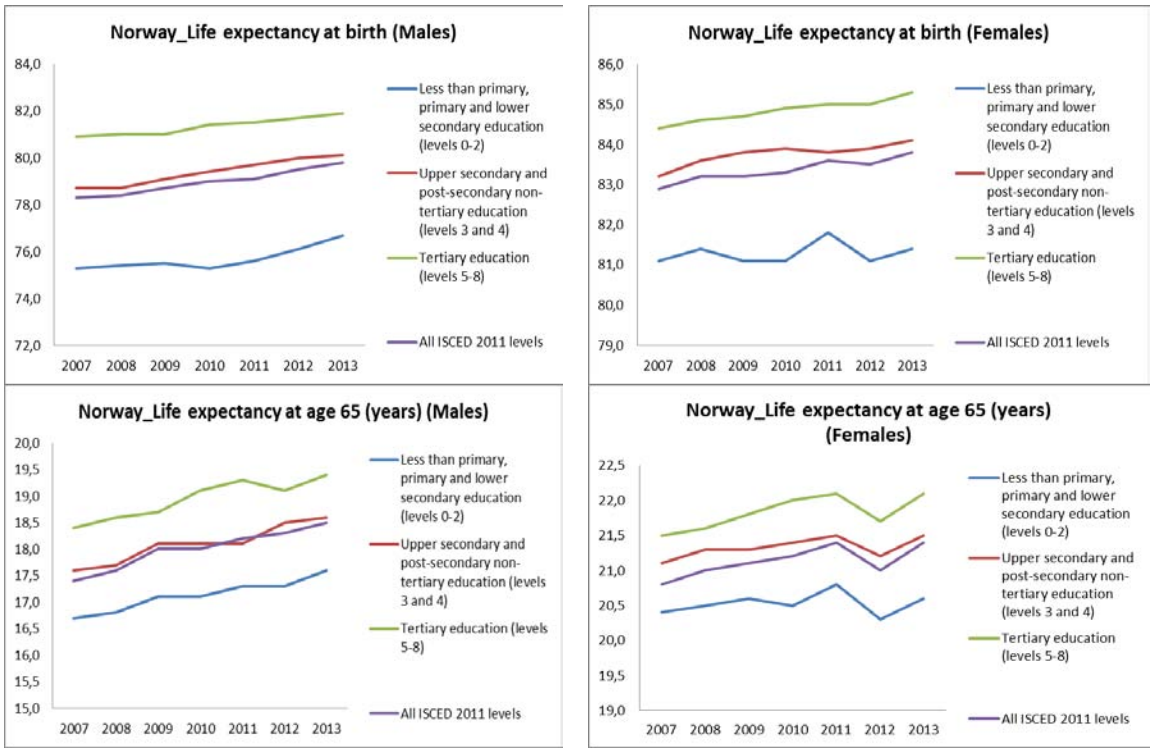
Source: Authors' elaborations based on WHO 2015a.

Figure 9: Life expectancy at birth (empty circles) and in good health (filled circles) by gender, Portugal and Spain, 2000 and 2013

➢ By education level

Figure 10 presents the evolution of life expectancy at birth and at age 65 in Norway for different education levels (Eurostat 2015). Based on the International Standard Classification of Education (ISCED), the analysis was performed for three education levels plus jointly for all levels. The following main points stand out:

- Higher education levels are undoubtedly linked with higher life expectancy, both at birth and at age 65.
- The development over time was neither uniform nor steady. It is not clear whether this represents stochastic variations, cohort specificities, or data issues.
- Comparing data at the end-points of 2007 and 2013, the increase in life expectancy for lower-educated men was higher than that for higher-educated men (1.9 percent compared to 1.2 percent).
- For women, the result was the opposite –those with the highest education level had an increase in life expectancy of 1.1 percent, well above the gain for those with the lowest level of education (0.4 percent).

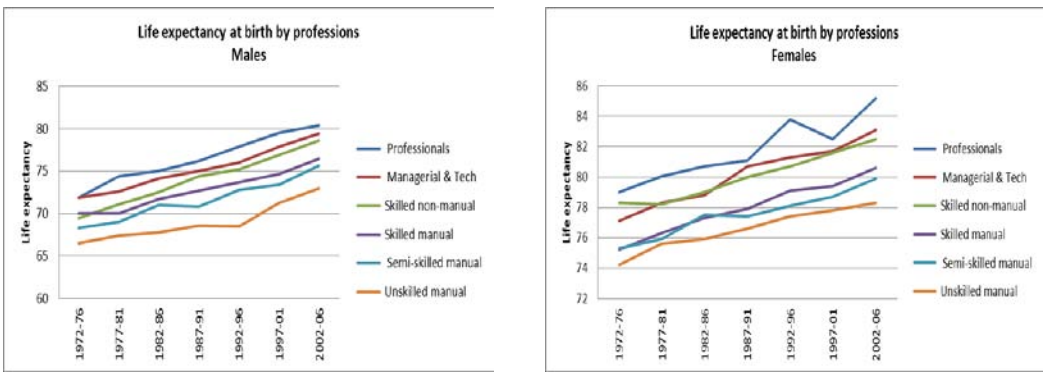


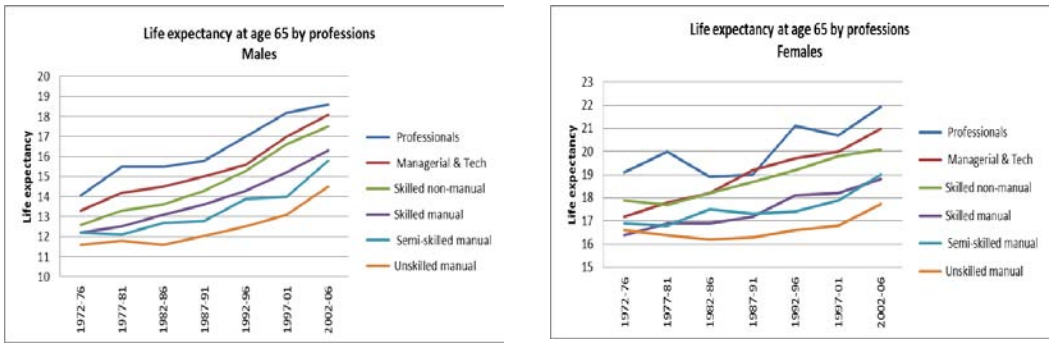
Source: Authors' elaborations based on Eurostat 2015.

Figure 10: Life expectancy at birth and at age 65 by education level and gender, Norway, 2007–2013

Figure 11 offers a similar elaboration based not on profession. The analysis was undertaken by the *Office for National Statistics* (2011) for England and Wales for a longer period, covering the years 1972/76 to 2002/06. The following main points stand out:

- For all professions, life expectancy at birth and at age 65 increased across the investigated period.
- The development over time was neither uniform nor steady. Again, it is not clear whether this represents stochastic variations, cohort specificities, or data issues.
- Those in liberal professions achieved stronger growth in life expectancy at birth, for both men (11.8 percent) and women (7.8 percent), compared to those in more manual professions (9.8 percent for men and 5.5 percent for women).
- A similar but more differentiated picture emerges when changes in life expectancy at age 65 are considered. Those in liberal professions showed stronger growth in life expectancy at age 65, for both men (32.4 percent) and women (14.9 percent), compared to those in more manual professions (25.1 percent for men and 6.8 percent for women).





Source: Authors' elaborations based on Eurostat 2015.

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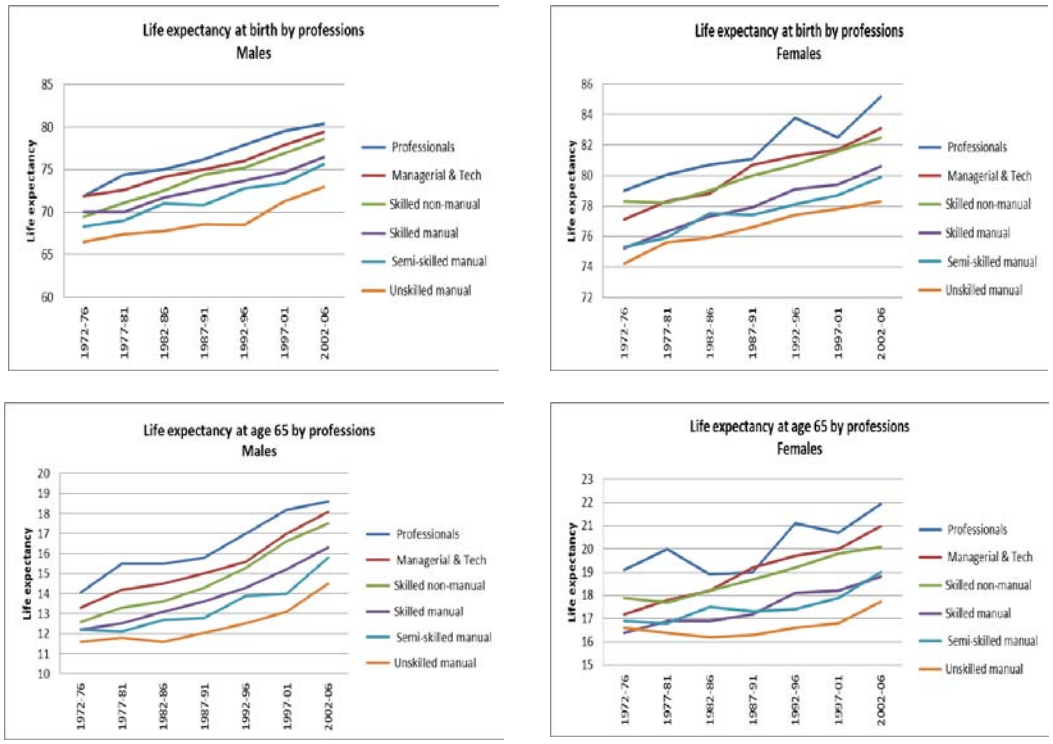


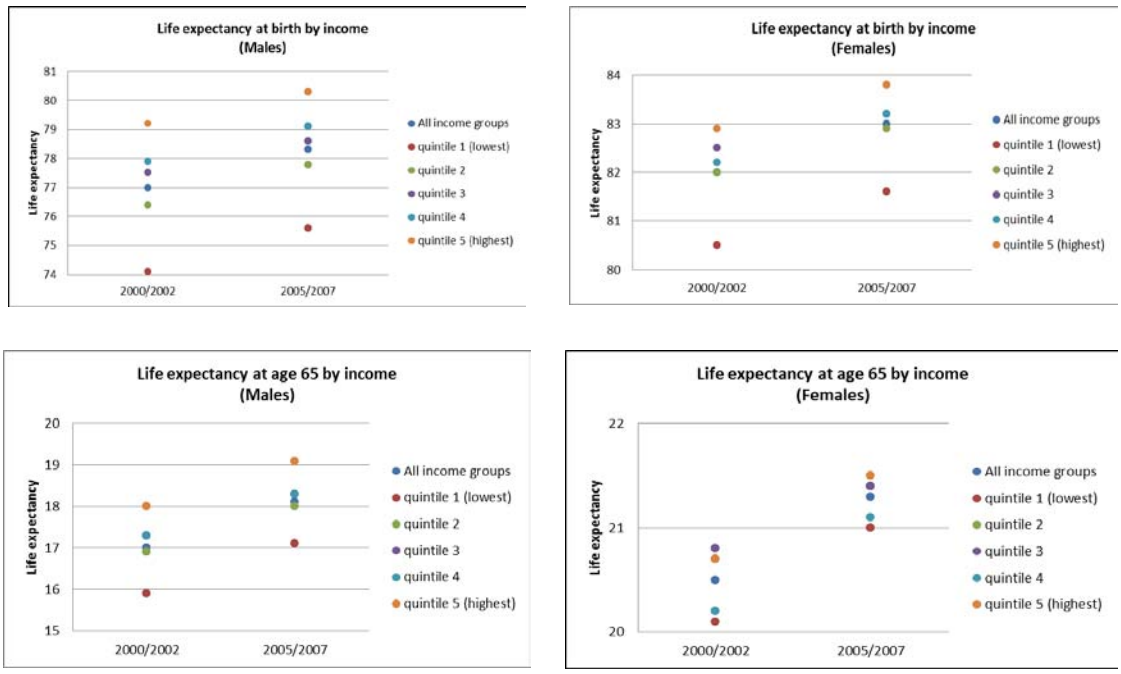
Source: Authors' elaborations based on Office National Statistics 2015.

Figure 11: Life expectancy at birth and at age 65 by profession and gender, England and Wales, 1972/76 to 2002/06

➢ *By income level*

Last but not least, Figure 12 offers the evolution of life expectancy at birth and at age 65 in Canada by income quintile for the data points 2000/02 and 2005/07. The following main points stand out:

- Despite the short time interval analyzed, all income quintiles exhibited an increase in life expectancy.
- Men in the highest income quintile experienced an increase in life expectancy at birth of 1.4 percent, while men in the lowest income quintile increased life expectancy by 2 percent.
- For women, the difference between the increase in life expectancy between those in the highest and lowest quintiles was closer, at 1.1 percent and 1.4 percent, respectively.
- For life expectancy at age 65, the relative ranking between highest and lowest income quintile and gender was more pronounced: 6.1 percent versus 7.5 percent for high-and low-income men, respectively, and 3.8 percent versus 4.5 percent for high-and low-income women, respectively.



Source: Authors' elaborations based on Statistics Canada, Canadian Vital Statistics, Birth and Death Databases, and population estimates.

Figure 12: Evolution of life expectancy at birth and at age 65 by income level and gender, Canada, 2000/02 and 2005/07

Table 4 summarizes the observed trends in life expectancy by socioeconomic dimensions.

Table 4: Trends in heterogeneity of longevity: Selective examples by socioeconomic criteria and countries

Socioeconomic dimension	Changes in life expectancy differences in years	Country	Period	Comments (column 2)
	constant/constant constant/+1	World Europe	1990–2013	at birth/ at age 60
Gender[a]	-1/+0.1 -0,5/+0.1 -1.2/-0.7 -1.5/+0.1	Spain Portugal Norway Hungary	2002–2013	at birth/at age 60

Health status[b]	+1/+2 +1/+1	Portugal Spain	2000–2013	at birth (women/men)
Education[c]	+0.6/-2.5 +0.1/-0.7 +1.1/+0.6	Norway Italy Sweden	2007–2013	at birth (women/men)
	+1.2/+2	Portugal	2010–2013	at birth (women/men)
Labor activity[d]	+2/+2.1	England/Wales	1972–2006	at birth (women/men)
Income[e]	-0.2/-0.4	Canada	2000/2002 to 2005/2007	at birth (women/men)
	+7.6/+9.7	United States	Cohorts 1930/1960	at age 50 (women/men)

Note: [a]Change in difference in life expectancy between women and men along the period. bChange in difference between total life expectancy and healthy life expectancy along the period. cChange in difference in life expectancy between individuals with high and low levels of education along the period. dChange in difference in life expectancy for individuals with liberal profession and unqualified labor jobs along the period. eChange in difference in life expectancy for individuals with high and low levels of income (5th vs 1st quintile) along the period.
Source: Authors based on quoted references.

b) Prospects for heterogeneity in longevity

To motivate policy actions to contain or neutralize the effects of heterogeneity in longevity, it is not only important to know the current levels and gaps between socioeconomic groups but also to understand past trends to assess future prospects. Projected diminishing gaps would make the issues less important, while increasing gaps would make them even more so. As the prior subsection suggests, there are very limited indications for a past gap reduction. This subsection offers some brief considerations of future prospects with a focus on income and gender as these are the most critical socioeconomic dimensions for pension policy design.

The prospect of heterogeneity by income indicator is guided by two considerations, both of which suggest a further increase. First, income inequality has increased in recent decades and is likely to remain high for some time (OECD 2011; Cingano 2014). As this process takes some time to affect lifetime income and the pension base, lifetime-relevant income inequality is likely to increase. Ceteris paribus, this will increase heterogeneity in longevity. Second, for a given (lifetime) income inequality, the correlation between (lifetime) income and longevity heterogeneity may further increase, at least at the tails of the distribution. The more precarious work conditions in recent decades and higher cyclical and structural unemployment may put downward pressure on both income and longevity for the lowest income groups. On the other hand, the highest period and lifetime income groups are likely to continue profiting from better access to health care, better nutrition decisions, and other life-extending factors.

Regarding the prospects of heterogeneity vis-à-vis gender, past trends and projected societal developments suggest the following: On one hand, the observed mild reduction in the gender gap for most countries in recent decades is likely to continue in coming decades; as a result the gap will shrink but remain sizable and will not disappear in most countries. On the other hand, the gender gap may not follow a smooth decline in some countries but re-increase as the result of socioeconomic shocks, as seen in Russia and other countries during economic transition.

For other socioeconomic indicators, too little information exists to offer informed prospects. We can only formulate two research questions for attention in the years to come: First, what is the scope of the supplementary heterogeneity delta for other relevant socioeconomic dimensions above the income indicator, and is it going to rise due to economic and social developments (such as more heterogeneous societies, greater prevalence of overweight/obesity, environmental challenges, etc.)? Second, what other relevant indicators have been omitted so far in the analyses due to lack of data?

IV. Data options and Data Needs

The prior two sections offer strong indications on the scope of heterogeneity in longevity for a diverse set of socioeconomic indicators and their broad past and possible future trends. The reviewed studies are based on available data typically collected for other purposes; thus the indicators used for the socioeconomic dimensions analyzed are only proxies for the true indicators we would like to measure. Against this background, this section presents three issues for further attention: (i) identifying what relationship between longevity and with what kind income variable we ideally want to establish; (ii) estimating the beyond-income heterogeneity delta for other socioeconomic dimensions; and (iii) proxying income data via other socioeconomic dimensions.

i. *With what income variable do we want to associate longevity heterogeneity?*

To establish a wish list of indicators for income and other socioeconomic variables, we go back to our basic concern and objective of analysis: to identify the key distortions created by heterogeneous longevity that risk impacting the functioning of social security programs (particularly pensions) and the effectiveness of key reform options (particularly the move toward DC-type schemes and an increase in retirement age). Such distortions will emerge if the contribution effort or perceived acquired rights are not matched by concomitant pension payouts.

Against such considerations the favored income variables are suggested to be accumulated contributions (AK) under a DC scheme – whether notional or financial – or acquired rights under a defined benefits (DB) scheme (i.e., pension wealth PW) – measured under the relevant population average survival probability – with both AK and PW measured at identical retirement age(s). The relevant heterogeneity indicator for longevity is life expectancy at retirement or, in some considerations, the vector of survival probabilities at retirement.

While empirical data that can establish a statistical link between individuals' "income" (i.e., actually the wealth variables AK or PW) and their ex-post life expectancies would be great progress in data precision, the complete data arrive only 40 years or more after the income variable has been generated. Such a time lag puts into doubt the operational usefulness of such an approach, albeit it is conceptually useful as analytical benchmark.

This calls for approximations in the establishment of the heterogeneity link through other data, such as proxying the cohort approach via cross-section data for survival probabilities/life expectancy or some mixed approaches. Under some considerations, the pension wealth under DB schemes may not be the appropriate indicator to establish the potential distortions of heterogeneity but to calculated hypothetical contribution assets for individuals at retirement (i.e., some measure of contributions actually paid). Last but not least, the question emerges as to the extent to which period income differences in selected broad income measures can be used to proxy differences in lifetime income.

ii. *Establishing the beyond-income heterogeneity delta*

For our purposes, establishing the (lifetime) income/longevity heterogeneity link is of fundamental importance as the accumulated amount to be annuitized and the survival probabilities are the basic ingredients for any life annuity contract. As highlighted throughout the prior sections, other socioeconomic dimensions are closely linked with income – as input for longevity or as outcome, such as education and health. But we do not know how much each of these dimensions singly or all together adds to the income effect once we control for income and endogeneity (and differentiate by age, gender, and perhaps even race).

Establishing the heterogeneity delta puts significant demands on the required data and on the estimation approaches. The ideal database would include the joint distribution of survival probabilities across all socioeconomic dimensions considered relevant, at least from the age of retirement onward; for deeper heterogeneity considerations, this would be required from the age of entry into the labor market or even birth. Much less demanding would be data on life expectancy across relevant socioeconomic dimensions, but even such data do not (yet) exist. Consequently, operational approaches must borrow and match data from different countries.

To quantify socioeconomic mortality differentials, alternative methods may be used such as generalized linear models (Madrigal et al. 2011), survival models (Richards 2008), or multiple population extensions of the Lee-Carter model (Lee and Carter 1992), including the use of relational models based on modeling mortality in socioeconomic subpopulations alongside the mortality of a reference population (Li and Lee 2005; Russolillo, Giordano, and Haberman 2011). Some of the associated challenges are presented in Box 1.

iii. *Proxying income data via other socioeconomic dimensions*

For many countries, even the data needed to explore heterogeneity by income dimension do not (yet) exist or are not exploited. Social security institutions with complete electronic storage would, in principle, have the database to sort longevity outcomes by contribution accumulations/benefit levels/pension wealth at retirement. If these data are not available or are incomplete, then one needs to find alternatives, such as

proxying income data via other socioeconomic dimensions – e.g., education (years of school or highest level achieved), health status, etc. Estimated longevity profiles by socioeconomic indicators from own and similar countries would offer a possible starting position.

V. Implications of Longevity Heterogeneity for Labor Market Outcomes and Pension Scheme Designs

This section sketches some of the key implications of the heterogeneity in longevity for labor market outcomes and pension system design. A companion paper under preparation elaborates on each of these and other points and presents policy designs to correct for heterogeneity effects.

a) The tax-subsidy character of heterogeneous longevity

The first point to make is that heterogeneous life expectancy acts like a tax for some participants in a pension scheme and as a subsidy for others. Compared to the average of participants in a scheme, an individual with a below-average life expectancy receives a lower annuity value for his contributions. This is akin to a tax on his contributions whereby the tax rate is higher the lower his life expectancy relative to the pool's average. For an individual with an above-average life expectancy, this amounts to a subsidy for his contributions, whereby the subsidy rate is higher the higher his life expectancy above the pool's average.

Box 1: Some Challenges to Modelling Mortality

The simplest approach for modeling mortality in a set of subpopulations is to use independent, unrelated Lee-Carter models for each subpopulation. The independent modeling approach is straightforward to implement but has several shortcomings. The main one is that it assumes no interdependence among the mortality of subpopulations, a very unrealistic assumption for socioeconomic subpopulations within a country, which are likely to follow similar mortality trends. The assumption of complete independence among subpopulations can be relaxed by using multivariate time series methods. An alternative approach for modeling mortality differentials is the joint time trend model proposed by Lee and Carter (1992).

Many of these statistical methods were specifically proposed to assess baseline (level) mortality differentials, neglecting (to some extent because of lack of appropriate data) differences in improvements by socioeconomic characteristics and the modeling of their possible future evolution. Provided that data requirements are met, an appropriate model should allow for both level and trend differentials in mortality, as well as the projection of their future evolution.

Additional desirable features of an approach for modeling and forecasting mortality in a group of socioeconomic subpopulations include: consistency of subpopulation-specific mortality forecasts with national mortality forecasts; ability to forecast mortality rates that preserve the inverse relationship between socioeconomic circumstances and mortality; transparency for understanding level and improvement differentials in mortality; and the ability to produce interval forecasts of mortality differentials.

The level of the tax or subsidy rate resulting from the life expectancy gap can be easily formalized and calculated under assumptions that are not very restrictive.

Consider individuals who have all accumulated the same savings amount at retirement to be converted into an annuity. Assume they retire at the same age and face the same interest rate, but have different life expectancies.

Let t (s) be the implicit tax (subsidy) rate. AK is the accumulation at retirement, **α** is the annuity rate, p is the pension, and PW is pension wealth. The subscript i denotes individual values and subscript a the average values of these variables.

The pension for each individual is the annuity rate applied to the identical wealth accumulation:

$$pi = \boldsymbol{\alpha}.AK \qquad (1)$$

Each individual's PWi is different from everyone else's to the extent that his/her life expectancy (LE) differs. PW can be written in this simple form if the interest rate equals the growth rate (indexation) of pensions:

$$PWi = pi.LEi = \boldsymbol{\alpha}.AK.LEi \qquad (2)$$

With these elements we can easily define the tax (subsidy) rate as the difference in pension wealth compared to the average:

$$t(s)i = (a.AK.LEi - a.AK.LEa) / a.K.LEa = LEi/ LEa - 1 \qquad (3a)$$

with negative values representing the tax rate and positive values the subsidy rate.[5]

As pension wealth is homogenous of degree 1 in both accumulation as well as life expectancy at retirement, differences in life expectancy are equivalent to a tax (subsidy) on contributions during active life or a tax (subsidy) on pensions during retirement.

5 The expression is equal to the "money worth ratio" minus 1, a measure of actuarial fairness of an annuity contract.

Table 5 offers the magnitudes of implicit taxes and subsidies that emerge in the calculation of pension benefits for men and women in Portugal and Spain.

As pensions are calculated for male and female participants in the general public scheme using a single formula that does not take into account differences in life expectancy, implicit taxes for men and implicit subsidies for women emerge. At the age of 50, the tax for men in Portugal amounts to 8.28 percent while for women the subsidy is 7.13 percent; in Spain the equivalent rates are 7.60 percent and 7.23 percent, respectively. Using the available survival probabilities from an age onward, one can calculate how the tax/subsidy develops with age. The tax for men increases to over 10 percent by age 75 in both Portugal and Spain; the subsidy for women increases first and then returns roughly to the initial level in both countries. Estimates generated using equation [3a] are actually a boundary for the effective tax (subsidy) rate on heterogeneity in life expectancy. Allowing for deviations between the pension indexation rate and interest rate strengthens or weakens the tax (subsidy) effect depending on the sign of the rate differences.

Table 6: Implicit tax and subsidy rates in the calculation of lifetime annuities by gender in Portugal and Spain, 2014[a/]

	PORTUGAL		SPAIN	
Age	Men	Women	Men	Women
50	-8.28%	7.13%	-7.60%	7.23%
51	-8.42%	7.21%	-7.76%	7.36%
52	-8.54%	7.28%	-7.91%	7.48%
53	-8.63%	7.31%	-8.06%	7.60%
54	-8.76%	7.38%	-8.22%	7.73%
55	-8.87%	7.42%	-8.39%	7.86%
56	-8.99%	7.47%	-8.54%	7.97%
57	-9.10%	7.50%	-8.71%	8.10%
58	-9.19%	7.51%	-8.87%	8.22%
59	-9.32%	7.55%	-9.04%	8.34%
60	-9.43%	7.57%	-9.19%	8.43%
61	-9.55%	7.59%	-9.34%	8.51%
62	-9.69%	7.62%	-9.50%	8.60%
63	-9.82%	7.63%	-9.64%	8.66%
64	-9.99%	7.66%	-9.78%	8.72%
65	-10.13%	7.66%	-9.93%	8.77%
66	-10.26%	7.64%	-10.05%	8.80%
67	-10.40%	7.63%	-10.16%	8.80%
68	-10.59%	7.65%	-10.31%	8.83%
69	-10.75%	7.64%	-10.43%	8.82%
70	-10.90%	7.60%	-10.58%	8.84%
71	-10.98%	7.46%	-10.71%	8.83%
72	-11.21%	7.45%	-10.84%	8.79%
73	-11.46%	7.43%	-11.00%	8.78%
74	-11.64%	7.32%	-11.13%	8.71%
75	-11.84%	7.19%	-11.21%	8.60%

Source: Author's calculations.

Note: [a/] Calculated from remaining life expectancy; i.e., assuming the annual pension indexation rate equals the discount/interest rate.

Generalizing equation [3a] to allow for pension indexation differently and below or above the interest/discount rate r yields a weighted life expectancy in which the weights wx to the annual survival probability px are smaller or larger than 1 and equal to the period product of the ratio of indexation to discount rate [(1+ d)/(1 + r)]t. Thus the revised equation [3b] is:

$$t(s)_i = \frac{\sum_{\tau=0}^{R-x} p_{\tau+1,i}\left(\frac{1+d}{1+r}\right)^{\tau}}{\sum_{\tau=0}^{R-x} p_{\tau+1,a}\left(\frac{1+d}{1+r}\right)^{\tau}} - 1 = \frac{\sum_{\tau=0}^{R-x} p_{\tau+1,i} w^{\tau}}{\sum_{\tau=0}^{R-x} p_{\tau+1,a} w^{\tau}} - 1 \qquad [3b]$$

where R is the maximum retirement span, x the age of the individual, and t the time index for the retirement period.

Table 6 offers numerical values for equation [3b] using the survival probabilities for Spain weighted under alternative combinations of pension indexation and interest rate assumptions. The diagonal values repeat the results from Table 5 and weights of 1; the border values constitute the result of the combination of extreme assumptions for the pension indexation and interest rates. The other values are somewhere in the middle and are left out of the table for focus and clarity.

As expected, if the weights are smaller than 1 (i.e., d < r), the tax rate as well as the subsidy rate decrease with the difference between indexation and interest rate. If the weights are larger than 1 (i.e., d > r), both tax rate and subsidy rate increase. For relevant and perhaps maximum differences for d-r of some 1.5–2 percentage points, the tax/subsidy rate difference is some 12–20 percent across all combinations; i.e., this is the level of under- or overestimation when tax and subsidy rates are calculated based on unweighted survival probabilities (i.e., life expectancy) instead of weighted ones.

Table 6: Implicit tax and subsidy rates in the calculation of lifetime annuities by gender under alternative pension indexation and discount rates in Spain, 2014

Male population to population average										
			Pension indexation rate								
			0.000	**0.005**	**0.010**	**0.015**	**0.020**	**0.025**	**0.030**	**0.040**	**0.050**
Interest rate		**0.000**	-9.2%	-9.6%	-10.0%	-10.5%	-10.9%	-11.4%	-11.9%	-12.8%	-13.8%
		0.005	-8.8%	-9.2%							-13.3%
		0.010	-8.4%		-9.2%						-12.8%
		0.015	-8.0%			-9.2%					-12.3%
		0.020	-7.7%				-9.2%				-11.8%
		0.025	-7.3%					-9.2%			-11.3%
		0.030	-7.0%						-9.2%		-10.9%
		0.040	-6.4%							-9.2%	-10.0%
		0.050	-5.9%	-6.2%	-6.5%	-6.8%	-7.1%	-7.4%	-7.7%	-8.4%	-9.2%
Female population to population average											
			0.000	**0.005**	**0.010**	**0.015**	**0.020**	**0.025**	**0.030**	**0.040**	**0.050**
Interest rate		**0.000**	8.4%	8.8%	9.2%	9.6%	10.0%	10.4%	10.8%	11.6%	12.5%
		0.005	8.1%	8.4%							12.1%
		0.010	7.7%		8.4%						11.6%
		0.015	7.4%			8.4%					11.2%
		0.020	7.1%				8.4%				10.7%
		0.025	6.8%					8.4%			10.3%
		0.030	6.5%						8.4%		9.9%
		0.040	6.0%							8.4%	9.1%
		0.050	5.5%	5.7%	6.0%	6.2%	6.5%	6.8%	7.1%	7.8%	8.4%

Notes: Calculated from weighted remaining life expectancy at age 60.
Source: Authors' calculations.

The lower tax and subsidy rates in the more relevant case of d<r are due to the stronger frontloading in benefit disbursement. This reduces the implicit tax for those with lower life expectancy as they have relatively larger benefits earlier on while those that have a relatively higher life expectancy have relatively lower benefits at higher ages.

The presented gender differences in life expectancy for Spain and Portugal are relatively small, resulting in tax/subsidy rates of around 10 percent. The literature review in Sections 2 and 3 suggested that differences in life expectancy vis-à-vis other socioeconomic dimensions, in particular education and/or income, may be substantially larger. Using U.S. data from the 2015 study by the National Academies of Science referenced in Section 2 and translating the gaps in life expectancy between the third (assumed to be the pool average) and other income quintiles into tax/subsidy rates for actuarial annuities indeed provides much higher effects.

Table 6: Implicit tax/subsidy rates by lifetime income quintiles in the United States 1/

Male	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Cohort 1930	-5.3	-3.2	0.0	+6.0	+12.8
Cohort 1960	-21.9	-15.3	0.0	+13.2	+16.2
Female	**Quintile 1**	**Quintile 2**	**Quintile 3**	**Quintile 4**	**Quintile 5**
Cohort 1930	-0.3	-3.1	0.0	+3.1	+11.7
Cohort 1960	-12.7	-8.3	0.0	+2.2	+29.3

Note: 1/ Applies for fully actuarial annuity. – signals a tax, and + a subsidy rate. The estimates assume the pension indexation rate is equal to the discount rate. Source: Authors' calculations based on data from National Academies of Sciences 2015.

The estimated tax/subsidy rates for both men and women for the outer quintiles are, indeed, very high and dramatically increase between birth cohorts that are only 30 years apart. The tax rates for men reach 21.9 percent and 12.7 percent for women; the highest subsidy rate is for women, at a rate of 29.3 percent, while for men the highest subsidy rate is 16.2 percent.

The equivalent tax/subsidy rates within the U.S. pension (social security) scheme are smaller but unknown. As the pension formula of the mandated scheme is highly progressive, favoring lower over higher income levels, heterogeneity in life expectancy corrects the progressive feature toward neutrality or even progressivity.

Yet regardless of the benefit formula, the underlying tax and subsidy rates of similar or even lower magnitudes are bound to have an effect on individual behavior, particular on labor market decisions, as discussed next.

b) The tax/subsidy effect on labor market decisions

The economic effect of the implicit tax/subsidy rate on labor market decisions is equivalent to levying an additional tax on social security contributions or mandated savings rates (or offering a subsidy on these retirement savings). Even a 10 percent tax/subsidy rate will impact labor market decisions, and a much higher rate even more so. We do not know of any study that has empirically explored labor market reactions to these implicit taxes/subsidies. Conceptually the reaction should not be too different – if at all – from explicit taxes and three labor market effects are in the forefront: the effect on the informality decision, the effect on contribution density, and the effect on the retirement decision.

Faced with an explicit or implicit tax, an individual has two main options: evasion or avoidance.

All countries offer to some extent opportunities to (illegally) evade taxes by working in the informal sector. Doing so allows evading the social security contribution and furthermore any personal income tax that is added. The higher the tax rate, the stronger the incentive to work informally. On the other hand, a subsidy on contributions tends to increase formal labor force participation, withcountervailing effects emerging from personal income tax implications. These predictions are consistent with the internationally observed lower formal labor market participation of lower-income groups and higher participation for higher-income groups, a tendency that can be strengthened or weakened by other effects, such as liquidity constraints (see, for example, Levy 2008; Ribe, Robalino, and Walker 2013).

Tax avoidance is a legal reaction of individuals against a tax by avoiding actions that lead to the tax liability. In the case of an implicit tax on contributions, one can reduce work effort or not work in areas subject to contribution obligations. For subsidies on contributions, the opposite reaction is to be expected. These predictions are consistent with differences in the contribution density of individuals across the income spectrum; i.e., lower-income groups have a lower contribution effort due to fewer insured hours, days, or months. Again, other effects may strengthen or weaken the tendency.

Last but not least, a tax or subsidy on pension contributions/retirement savings will affect the retirement decision. In the simplest conceptualization, such a tax creates a convex kink in the intertemporal budget constraint for lower-income groups, making them more likely to retire at the earliest retirement age the higher the tax rate. A subsidy creates a concave kink in the intertemporal budget constraint for higher-income groups, reducing their incentives to retire at the earliest possible age. It also incentivizes, however, an earlier retirement age than would otherwise occur, and which is more likely the higher the subsidy rate. As before, other effects may strengthen or weaken such a tendency.

c) Implications for pension reform and scheme design

The empirical importance of these and other labor market effects needs to explored but can be conjectured to be sizable. If correct, this would have major implications for pension reform and scheme design that call for actions of substantial reduction or even elimination. This section briefly discusses the

implications for the DC reform agenda, the retirement increase agenda, and the annuitization agenda.[6]

A main reform movement across the world in recent years was the move from DB schemes to DC schemes, be they funded or unfunded, and within DB schemes to undertake parametric reforms that make them more like DC schemes by increasing the contribution-benefit link (see Holzmann 2012; OECD 2015). A strong contribution-benefit link is motivated by lower labor market distortions and higher equity considerations. But if such a link gets broken by heterogeneity in longevity that is closely linked to income level, then the economic and social rationale for such a reform direction is perhaps not eliminated but very much reduced.

Another main reform movement that has only recently gained traction in developed economies is an increase in retirement age to address population aging. More and more countries are linking the standard retirement age to life expectancy in the expectation that individuals will respond by postponing retirement, as earlier retirement is disincentivized by actuarial decrements. However, faced with lower-than-average life expectancy, many low-income individuals may still have an incentive to retire at the earliest possible age (as discussed above), which makes it politically difficult to increase the minimum retirement age while offering those individuals an ever -lower initial pension benefit. But subsidies for higher-income groups risk dampening the envisaged later retirement effects, as the income effect of higher benefits may dominate.

Lastly, another reform movement in recent years was the move from unfunded to funded schemes in some countries, and in many countries a reduction in public generosity expected to be compensated by voluntary individual savings efforts. While the retirement funding volume across the world has undoubtedly increased in recent decades and years (see Towers Watson 2016), life annuities as a main disbursement form of funded pension provisions received limited attraction or even declined in most countries. Such a trend may have both demand- and supply-side explanations (see Bravo and Holzmann 2014; Holzmann 2015; Reichling and Smetters 2015). For example, heterogeneity in longevity and its increase in recent years may have significantly contributed to this trend (including forced insurance pooling across genders in private annuity contracts in various countries).

VI. Conclusions and Next Steps

The review of data across countries suggests that heterogeneity in longevity by socioeconomic groups is sizable and not likely to decrease in the near future. The available data reveal that heterogeneity measured via mortality rates or life expectancy exists across many socioeconomic characteristics: some are exogenous (such as age, gender, and race), while others are more amenable to individual action (such as health, education, profession, location, and income). All are interlinked and causes and effects are not easily established.

The heterogeneity in life expectancy disaggregated by key socioeconomic characteristics in most countries is stunning. For example in many countries the gender differences in life expectancy at birth are some 5 to 7 years, and still 3 to 4 years at age 60. Differences by education level in some countries may be only a few years for both men and women but reach 15 years (men) and 8.1 years (women) at age 30 in others. These and other longevity gaps show little trend for closure.

The prospects for longevity heterogeneity vis-à-vis income may not improve soon either. Income inequality has increased in recent decades and is likely to remain high in many countries. As this process takes some time to affect lifetime income and the pension base, lifetime-relevant income inequality is likely to increase. Ceteris paribus, this will increase heterogeneity in longevity by income. In addition, for a given (lifetime) income inequality, the correlation between (lifetime) income and longevity heterogeneity may further increase, at least at the tails of the distribution. The more precarious work conditions in recent decades and higher cyclical and structural unemployment may put downward pressure on both income and longevity for the lowest income groups.

As heterogeneity in longevity is closely linked to income (i.e., the contribution base of earnings-related social programs such as pensions), and is empirically sizable, major implicit taxes result for some groups – particularly the less educated and low earners – while offering major subsidies for other groups – particularly highly educated individuals and high-income earners. The implicit tax and subsidy rates on individual contributions are likely to be high, reaching 20 percent and more in many countries, and amounting to up to, perhaps, 50 percent in both directions in some countries.

The implications for such high tax and subsidy rates on pension reform and scheme design are substantial as they counteract the envisaged effects of a closer contribution-benefit link, an increased formal retirement age as a key instrument to address population aging, and more individual funding and private annuities to compensate for reduced public generosity. If unchecked, such high implicit tax and subsidy rates risk also aggravating further informality in countries and sustained low contribution density by lower-income groups, all detrimental to increased pension coverage and equitable pension benefits.

[6] For an early analysis of the implications of socioeconomic heterogeneity in mortality on pension reform policy, see Whitehouse and Zaidi (2008).

To address heterogeneity in longevity and its link to income, various policy options may be envisaged, acting on the benefit design and revenue distribution side. While a number of complex interventions may be imagined to compensate for heterogeneity, the solution should be simple, operational, and transparent. A companion paper under preparation deepens the empirical analysis on the scope of the implicit tax and subsidy, reviews key policy options, models the most prominent policy option to assess the degree to which heterogeneity effects can be reduced, and offers suggestions on how current reform directions need to and can be adjusted.

References Références Referencias

1. Alaminos, Estefanía, and Mercedes Ayuso. 2015. "Una estimación actuarial del coste individual de las pensiones de jubilación and viudedad: Concurrencia de pensiones del Sistema de la Seguridad Social español." Estudios de Economía Aplicada 33 (3): 1-22.
2. Ayuso, Mercedes, and Montserrat Guillén. 2011. "El coste de los cuidados de larga duración en España bajo criterios actuariales: ¿es sostenible su financiación?". En El Estado de bienestar en la encrucijada: nuevos retos ante la crisis, Ekonomi Gerizan, Federación de Cajas de Ahorro Vasco-Navarras: 213-227.
3. Ayuso, Mercedes, and Robert Holzmann. 2014. "Longevidad: un breve análisis global y actuarial," Instituto BBVA de Pensiones – Documento de Trabajo No 1/2014, Septiembre. Madrid: BBVA.
4. Ayuso, Mercedes, Jorge Bravo, and Robert Holzmann. 2015. "Revisión de las proyecciones de población – Parte 1: Más allá de los convenientes supuestos sobre fertilidad, mortalidad y migración." Instituto BBVA de Pensiones – Documento de Trabajo No 10/2015, Marzo. Madrid: BBVA.
5. Bolancé, Catalina, Ramón Alemany, and Montserrat Guillén. 2013. "Sistema público de dependencia y reducción del coste individual de cuidados a lo largo de la vida". Revista de Economía Aplicada 61: 97-117.
6. Borrell, Carmen, et al. 1997. "Widening social inequalities in mortality: the case of Barcelona, a southern European city." *Journal of Epidemiology and Community Health* 51(6): 659-667.
7. Borrell, Carme, et al. 1999. "Inequalities in mortality according to educational level in two large Southern European cities." *International Journal of Epidemiology* 28(1): 58-63.
8. Bravo, Jorge, and Robert Holzmann. 2014. "La fase de percepción de los pagos de los planes de pensiones provisionados: riesgos y opciones de pago." Documento de Trabajo: Nº 6/2014. Madrid: Instituto BBVA de Pensions.
9. Brønnum-Hansen, Henrik, et al. 2004. "Social gradient in life expectancy and health expectancy in Denmark." *Sozial-und Präventivmedizin* 49(1): 36-41.Case, Ann, and Angus Deaton. 2015. "Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century." *PNAS – Social Sciences* September 17.
10. Castelló-Climent, Amparo, and Rafael Doménech. 2008. "Human Capital Inequality, Life Expectancy and Economic Growth". *The Economic Journal* 118: 653-677.
11. Cingano, Federico 2014. "Trends in Income Inequality and its Impact on Economic Growth." OECD Social, Employment and Migration Working Papers, No. 163. OECD Publishing. http://dx.doi.org/10.1787/5jxrjncwxv6j-en
12. Crimmins, Eileen M., Mark D. Hayward, and Yasuhiko Saito. 1994. "Changing mortality and morbidity rates and the health status and life expectancy of the older population." *Demography* 31(1): 159-175.
13. Crimmins, Eileen M., Mark D. Hayward, and Yasuhiko Saito. 1996. "Differentials in active life expectancy in the older population of the United States." *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 51(3): S111-S120.
14. Chande, Roberto Ham. 2001. "Esperanzas de vida y expectativas de salud en las edades avanzadas." *Estudios demográficos y urbanos* 48: 545-560.
15. Chang, Man-Huei, et al. 2015. "Differences in healthy life expectancy for the US population by sex, race/ethnicity and geographic region: 2008." *Journal of Public Health* 37(3): 470-479.
16. Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron, and David Cutler. 2016. "The Association Between Income and Life
17. Expectancy in the United States, 2001-2014." *Clinical Review & Education. JAMA*. doi:10.1001/jama.2016.4226, Published online April 10, 2016.
18. Deeg, D. J. 2001. "Sex-Differences in the Evolution of Life Expectancy and Health in Older Age." In Robin et al. (Eds.) *Sex and Longevity: Sexuality, Gender, Reproduction, Parenthood*, Book Series Research and Perspectives in Longevity, 129-140.
19. Doblhammer, Gabriele, Roland Rau, and Josef Kytir. 2005. "Trends in educational and occupational differentials in all-cause mortality in Austria between 1981/82 and 1991/92." *Wiener Klinische Wochenschrift* 117(13-14): 468-479.
20. Dowd, Jennifer B., and Amar Hamoudi. 2014. "Is life expectancy really falling for groups of low socio-economic status? Lagged selection bias and artefactual trends in mortality." *International Journal of Epidemiology* 43(4): 983-988.

21. Duggan, James E., Robert Gillingham, and John S. Greenlees. 2007. "Mortality and lifetime income: Evidence from Social Security records." Working paper 07/15, International Monetary Fund.
22. Duleep, Harriet Orcutt. 1989. "Measuring socioeconomic mortality differentials over time." *Demography* 26(2): 345-351.
23. Eurostat. 2015. "Mortality and life expectancy statistics". *Eurostat Statistics Explained.*
24. Geruso, Michael. 2012. "Black-White Disparities in Life Expectancy: How Much Can the Standard SES Variables Explain?." *Demography* 49(2): 553-574.
25. Gómez-Redondo, Rosa, and Carl Boe. 2005. "Decomposition analysis of Spanish life expectancy at birth." *Demographic Research* 13(20): 521-546.
26. Herce, José Antonio. 2015. "Las pensiones en las Comunidades Autónomas". Instituto BBVA de Pensiones – Documento de Trabajo No 12/2015, Marzo. Madrid: BBVA.
27. Holzmann, Robert. 2012. "Global pension systems and their reform: Worldwide drivers, trends and challenges." *International Social Security Review* 66(2).
28. Holzmann, Robert. 2013. "A Optimistic Perspective on Population Aging and Old-Age Financial Protection." *Malaysian Journal of Economic Studies* 2013 50(2): 107-137. Updated and revised Chinese translation in 劳动经济研究 (*Studies in Labor Economics* 2(4): 2014: 21-52, Chinese Academy of Social Science).
29. Holzmann, Robert. 2015. "Addressing Longevity Risk Through Private Annuities: Issues and Options." Conference paper presented at the 13th International Workshop on Pension Insurance and Savings Paris Dauphine, 28 May.
30. INE (Instituto Nacional de Estadística). 2015. *Discapacidad (tasas, esperanzas de vida en salud).* Madrid.
31. Judge, Ken. 1995. "Income distribution and life expectancy: a critical appraisal." *British Medical Journal* 311(7015): 1282.
32. Kalwij, Adriaan S., Rob J.M. Alessie, and Marike G. Knoef. 2013. "The association between individual income and remaining life expectancy at the age of 65 in the Netherlands." *Demography* 50(1): 181-206.
33. Kaplan, Robert M., and Michael L. Spittel, and Tia L. Zeno. 2014. "Educational Attainment and Life Expectancy." *Policy Insights from the Behavioral and Brain Sciences* 1(1): 189-194.
34. Kaplan, Robert M., and Richard G. Kronick. 2006. " Marital status and longevity in the United States population." *Journal of Epidemiology and Community Health* 60(9): 760-765.
35. Lee, R.D., and L.R. Carter. 1992. "Modeling and Forecasting U.S. Mortality." *Journal of the American Statistical Association* 87: 659–671.
36. Levy, Santiago. 2008. *Good Intentions, Bad Outcomes*. Washington, DC: Brookings Institution.
37. Li, N., and R. Lee. 2005. "Coherent Mortality Forecasts for a Group of Populations: An Extension of the Lee-Carter Method." *Demography* 42: 575–594.
38. Lin, Charles C., et al. 2002. "A further study of life expectancy by socioeconomic factors in the National Longitudinal Mortality Study." *Ethnicity & disease* 13(2): 240-247.
39. Lleras-Muney, Adriana. 2005. "The relationship between education and adult mortality in the United States." *The Review of Economic Studies* 72(1): 189-221.
40. Madrigal, A., F. Matthews, D. Patel, A. Gaches, and S. Baxter. 2011. "What Longevity Predictors Should be Allowed for When Valuing Pension Scheme Liabilities." *British Actuarial Journal* 16: 1–38.
41. Meara, Ellen R., Seth Richards, and David M. Cutler. 2008. "The gap gets bigger: changes in mortality and life expectancy, by education, 1981–2000." *Health Affairs* 27(2): 350-360.
42. Miech, Richard, et al. 2011. "The enduring association between education and mortality the role of widening and narrowing disparities." *American Sociological Review* 76(6): 913-934.
43. Monteverde, Malena. 2004. "Discapacidades de las personas mayores en España: prevalencias, duraciones e impacto sobre los cuidados de larga duración". Tesis doctoral. Universitat de Barcelona.
44. National Academies of Sciences, Engineering, and Medicine. (2015). "The Growing Gap in Life Expectancy by Income: Implications for Federal Programs and Policy Responses." Committee on the Long-Run Macroeconomic Effects of the Aging U.S. Population-Phase II. Committee on Population, Division of Behavioral and Social Sciences and Education. Board on Mathematical Sciences and Their Applications, Division on Engineering and Physical Sciences. Washington, DC: The National Academies Press.
45. Office National Statistics. 2011. "Trends in life expectancy by National Statistics Socio-economic Classification, 1982-2006, England and Wales." Statistical Bulletin. Newport.
46. _____2015. "Trend in life expectancy at birth and at age 65 by socio-economic position based on the National Statistics Socio-economic Classification, England and Wales: 1982—1986 to 2007—2011." Statistical Bulletin. Newport.
47. OECD. 2011. *Divided We Stand: Why Inequality Keeps Rising*. Paris: OECD.
48. OECD. 2014. *Health at a glance. Europe 2014.* Joint publication of the OECD and the European Commission. Paris: OECD.

49. OECD. 2015. *Health Statistics 2015*. Paris: OECD.
50. OECD. 2016. "Fragmentation of retirement markets due to differences in life expectancy", in OECD Business and Finance Outlook 2016, Chapter 6. OECD Publishing, Paris: 177-205.
51. Oeppen, Jim, and James V. Vaupel. 2006. "The Linear Rise in the Number of Our Days". In Bengtsson and Palmer (Eds.) *Perspectives on mortality forecasting, Social Insurance Studies, 3*. Stockholm: Swedish Social Insurance Agency.
52. Olshansky, S. Jay, et al. 2012. "Differences in life expectancy due to race and educational differences are widening, and many may not catch up." *Health Affairs* 31(8): 1803-1813.
53. Pijoan-Mas, Josep, and José-Víctor Ríos-Rull. 2014. "Heterogeneity in expected longevities." *Demography* 51(6): 2075-2102.
54. Reichling, Felix, and Kent Smetters. 2015. "Optimal Annuitization with Stochastic Mortality and Correlated Medical Costs." *American Economic Review* 105(11): 3273-3320.
55. Rendall, M.S, M.M. Weden, M.M. Favreault, and H. Waldron. 2011. "The protective effect of marriage for survival: a review and update." *Demography* 48(2): 481-506.
56. Ribe, Helena, David Robalino, and Ian Walker. 2012. "From Right to Reality: Incentives, Labor Markets, and the Challenge of Achieving Universal Social Protection in Latin America and the Caribbean." Latin American Development Forum Series. Washington, DC: World Bank.
57. Richards, S. 2008. "Applying Survival Models to Pensioner Mortality Data." *British Actuarial Journal* 14: 257–303.
58. Russolillo, M., G. Giordano, and S. Haberman. 2011. "Extending the Lee-Carter Model: A Three-Way Decomposition." *Scandinavian Actuarial Journal* 2: 96–117.
59. Singh, Gopal K., and Mohammad Siahpush. 2006. "Widening socioeconomic inequalities in US life expectancy, 1980–2000." *International Journal of Epidemiology* 35(4): 969-979.
60. Solé-Auró, Aïda, Hiram Beltrán-Sánchez, and Eileen M. Crimmins. 2015. "Are Differences in Disability-Free Life Expectancy by Gender, Race, and Education Widening at Older Ages?." *Population Research and Policy Review* 34(1): 1-18.
61. Steingrímsdóttir, Ólöf Anna, et al. 2012. "Trends in life expectancy by education in Norway 1961–2009." *European Journal of Epidemiology* 27(3): 163-171.
62. Towers Watson. 2016. *Global Pension Assets Study 2016*. *https://www.willistowerswatson.com*
63. United Nations. 2013. World Mortality Report 2013. Department of Economic and Social Affairs - Population Division, New York.
64. United Nations. 2015. World Mortality Wallchart 2015. Department of Economic and Social Affairs - Population Division, New York.
65. Von Gaudecker, Hans Martin, and Rembrandt Scholz. 2007. "Differential mortality by lifetime earnings in Germany." *Demographic Research* 17(4): 83-108.
66. Wikipedia. 2016. Demographics in Russia.
67. Whitehouse, Edward, and Ashgar Zaidi. 2008. "Socio-Economic Differences in Mortality: Implications for Pensions Policy." OECD Social, Employment and Migration Working Papers, No. 71. OECD Publishing. http://dx.doi.org/ 10.1787/2317-47416062
68. World Health Organization (WHO). 2015a. *World health statistics 2015.* Geneva: WHO.
69. World Health Organization (WHO). 2015b. *World report on ageing and health.* Geneva: WHO.

Education Widening at Older Ages?." *Population Research and Policy Review* 34(1): 1-18.
61. Steingrímsdóttir, Ólöf Anna, et al. 2012. "Trends in life expectancy by education in Norway 1961–2009." *European Journal of Epidemiology* 27(3): 163-171.
62. Towers Watson. 2016. *Global Pension Assets Study 2016*. *https://www.willistowerswatson.com*
63. United Nations. 2013. World Mortality Report 2013. Department of Economic and Social Affairs - Population Division, New York.
64. United Nations. 2015. World Mortality Wallchart 2015. Department of Economic and Social Affairs - Population Division, New York.
65. Von Gaudecker, Hans Martin, and Rembrandt Scholz. 2007. "Differential mortality by lifetime earnings in Germany." *Demographic Research* 17(4): 83-108.
66. Wikipedia. 2016. Demographics in Russia.
67. Whitehouse, Edward, and Ashgar Zaidi. 2008. "Socio-Economic Differences in Mortality: Implications for Pensions Policy." OECD Social, Employment and Migration Working Papers, No. 71. OECD Publishing. http://dx.doi.org/ 10.1787/2317-47416062
68. World Health Organization (WHO). 2015a. *World health statistics 2015.* Geneva: WHO.
69. World Health Organization (WHO). 2015b. *World report on ageing and health.* Geneva: WHO.

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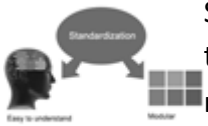

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Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

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The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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