# The impact of ethic formation on individual income

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# THE IMPACT OF ETHIC FORMATION ON INDIVIDUAL INCOME[1]

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**Abstract**

In this paper, the relationships between individual income and ethics formation are studied. Our theoretical model explains what happens to individual incomes when a culture encourages people to devote life-time efforts to establish a virtuous character. Two propositions emerged from the present study. Firstly, if there exists a channel from effforts to income via ethics, individual income begins to increase and reaches a peak as more and more time is devoted to ethics formation. Additional time after the peak becomes detrimental to the individual income. Secondly, time for ethics formation becomes economically useless when the channel from efforts to income via ethics dissolves. Our simulations and econometric findings support the theoretical explanations.

**JEL:** C1, O12, O17
**Keywords:** Growth, Institutions, Ethics, Turkey

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## 1. Introduction

The growth literature suggests that income level of the richest and the poorest of the world do not converge in the long run. This observation is inconsistent with the neoclassical growth theory, which predicts poor countries tend to grow faster than rich countries. According to this theory, there should be an absolute convergence across countries in the very long run, meaning that countries have similar steady-state levels. However, differences in saving rates, population growth rates, and the position of the production functions imply and produce different steady-state levels. That is, if there are differences in those structural preferences, countries approach different staady-state levels, hence no convergence between the poor and the rich is supposed to occur. Convergence is conditional in the sense that countries only having the same steady–state income levels converge in the long run. Pritched (1997:3-5) shows that since 1870, the poorer members of the industrialized group grew faster than the richer members and convergence in absolute income levels within the industrial group appeared as a result. What the particular characteristic was that the industrilized group used to share same structural preferences. Different structural preferences were observed within the second group of countries, often called developing or less developed countries, so no convergence was materialized neither within less developed group nor across groups. New growth theories, AK models of technological diffusion, were also consistent with the conditional convergence hypothesis.

The institutions and the culture views in economic growth literature argue that neoclassical and new growth theories are unable to explain the ultimate sources of income differences across countries. Poor technology and poor capital accumulation only explain income differences among countries which have similar structural parameter preferences, but they do not explain why countries have poor technology and poor capital accumulation. Institutional differences amongst countries produce different levels of capital accumulation and production functions, and therefore, each country may have distinct steady-state levels and approaches its own steady-state. The speed of the approach and the magnitute of the steady-state levels are determined by institutional variations across countries. According to new institutional economics, inefficient institutions not only generates relative backwardness but also widen the income divergence between the richest and the poorest. Therefore, poor countries should devise growth promoting institutions in order to grow faster and catch up the advanced countries. Once the proper institutions are in place then the rest (growing faster and cathing up the advanced) is driven by the forces explained by the neoclassical and the new growth theories.

At this point, it is natural to ask 'what are the institutions that makes the difference in the growth and development processes?' North (1989:1321-1324) points out that institutions are the constrainsts that form political, social and economic interactions of people. These constraints can have either a formal character such as constitutions, laws and property rights or an informal character like customs, traditions, taboos and codes of conduct. When informal and formal constrainsts successfully enforced, institutions have real effects on society. In short, formal rules and informal constraints together with their own enforcements characteristics constitute the term 'institutions'. Soysa and Jütting (2007: 31) argue that informal institutions are considered as the uncodified rules of games in use that shape social interactions in society. They are largely self-enforcing through mechanisms of obligation either in socially or individually.

In this study, we attempt to work on individal level because, as for informal institutions, micro-level studies are better suited to address the importance of culture and institutions on economic growth due to endogeneity and identification problems at aggregate level.

The rest of the paper is organized as follows. The next section introduces an index for the measurement of individuals'ethics. Section three and four discuss theoretically the impact of ethic formation on individual income. Section four tests the theoretical findings and reports the econometric results. Final section concludes the paper.

## 2. What is virtue ethics and how is it related to income?

North (1989:1319) and (2003:1) argue that in the mainstream theory, decision makers instantly and costlessly obtain and process all information relevant to trade, hence, frictions such as strikes, boycotts and sit-ins do not exist. Contracts are complete in the sense that monitoring and enforcing the contracts are carried at absolute precision. All transactions are costless and, therefore, institutions do not exist in the neoclassical frictionless world.

People exchange goods and services and gain mutually from trade. In the case of impersonal exchange, wealth-maximizing individuals have asymmetric information about the attributes of what is being exchanged, other players and the performance of agents. Problems of enforcing the terms of exhange also make parties vulnerable to probable defections. Clearly, when parties enter trade, there are gains by engaging in activities such as shirking, cheating and opportunism. Cheating, shirking and all forms of opportunism are high in the form of impersonal trade, which people angages in one time transactions with one onother. Knowing parties, having information about the good or the service that is being exchanged requires

elaborate institutional structures so as to lower uncertainies about the possible gains in trade. To avoid being cheated, individuals have to devote resources so as to measure the attributes of trade. So, transacting is a costly process. If the cost of acquaring such information is sufficiently high, exchange will not take place, which is the developmental consequance of improper institutions.

Barriers to trade is related to not only the uncertainty about the possible gains from trade but also to people's moral characteristics. The argument that impersonal trade and one time trade of parties create uncertainities about the outcome of exchange are valid if we assume that individuals potentially posses immoral characteristics. Is it equally true that self-enforcing virtuous characters angaging in trade will also take advantage of one another through cheating, shirking or opportunism in trade? At the outset, it can be said that transaction costs are expected to be low if institutions of virtue ethics are in place in people's daily transactions and if that information is also known to all parties.

A typical utility function of the individual:

$$U = u(I, E(P)), \quad where$$

$$\frac{\partial U}{\partial I} = U_I > 0 \quad \text{and} \quad \frac{\partial^2 U}{\partial I^2} = U_{II} < 0$$

$$\frac{\partial U}{\partial E} = U_E > 0 \quad \text{and} \quad \frac{\partial^2 U}{\partial E^2} = U_{EE} < 0 \qquad \qquad \text{-2}$$

$$\frac{\partial E}{\partial P} = E_P > 0 \quad \text{and} \quad \frac{\partial^2 E}{\partial P^2} = E_{PP} < 0$$

$I = income\ by\ the\ person\ in\ a\ day.$
$E = the\ index\ of\ ethics\ that\ the\ person\ has\ and\ enjoys.$
$P = efforts\ exerted\ by\ the\ individual\ in\ a\ day.$
$T = number\ of\ discretionary\ hours\ in\ a\ day\ to\ be\ allocated\ between\ work\ and$
$efforts.\ So,\ T - P = number\ of\ hours\ worked\ in\ a\ day.$

We define here our new function, which channels efforts into income.
DEFINITION: The ethical function of the individual $E : [0,4] \to \mathbb{R}$ is increasing if for all x, $x' \in [0,4]$ with $x \succ x'$, we have $E(x) \succ E(x')$.

Ibn Hazm (2005:114) points out that the person may have either no ethics (index number 0) or has the combinations of four fundamental ethics: justice, wisdom, generosity and bravery.

When the person has exactly one of them, he/she gets index number 1. Index number increases as the individual tends to be more ethical.[2] Four level of ethics can be represented as follows:

$0 < E \leq 1,$

$1 < E \leq 2,$

$2 < E \leq 3,$

$3 < E \leq 4.$

We assume that T is discretionary. The person predetermines T before allocating it between work and efforts. Income provides satisfaction through by consuming goods and services. The ethics also contribute to the individual's utility. By being more ethical, the person is able to expect returns in the hereafter as well as in the Earth. People tend to become more appreciative to those demostrating the quality of ethical behaivour. The ethics, however, are the function of efforts hours exerted by the person. The more efforts the individual chooses, the lower will be the number of hours worked in a day. Note that the *income* earned by the person and *the ethics* that the person demonstrates are both endogenous variables whereas wage rate, total time and efforts are exogenous variables. More formally:

$U = u(I, E; w, T, P)$

## 3. The Impact of Ethics Formation on Personal Income

We assume that the individual has well-behaved preferences. Suppose *B, e, i* and *y* are the consumption bundles. Following properties hold when the person orders bundles based on his/her preferences:

(A) $(\forall e, i \in B)(e > i \lor i > e \circ e > i \land i > e)$ (Complete).

(B) $(\forall e \in B)(e \geq e)$ (Reflexive).

(C) $(\forall e, i, y \in B)(e \geq i \land i \geq y \rightarrow e \geq y)$ (Transitive).

(D) $(\forall i \in B)(\{e : e \geq i\} \land \{e : e \leq i\}$ are closed sets) (Continuity).

(E) *If* $e \geq i \land e \neq i \rightarrow e > i$ (Monotonicity)

(F) $(\forall e \in B)(\forall \alpha > 0)(\exists i \in B, |e - i| < \alpha, i > e)$ (Local Nonsatiation)

(G) $(\forall e, i, y \in B)(e \geq y \land i \geq y \rightarrow \theta e + (1 - \theta)i \geq y \ \forall \ 0 \leq \theta \leq 1)$ (Convexity).

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[2] Normative theories of ethics generaly have three variants in philosophy: consequentialism (utilitarianism), deontological ethics and virtue ethics. Virtue ethics emphasize the moral character of the person, and is about 'being' rather than 'doing'. For more information, see Hursthouse (1999).

Again, positive and diminishing marginal utilities for all positive levels of income and ethics are assumed. The person's utility increases as the possession of the endogenous variables grows. However, the incremental additions to the utility are diminishing.

**PROPOSITION 1.** Let $u(E,I)$ be the utility function of the individual, where $u$ increases at decreasing rate. Given the constraints: $I = w \cdot E \cdot (T - P)$ and $E = e(P)$, there exists an amount of time spent in efforts $(P)$, which income attains at maximum.

**PROOF 1:** Our proposition can be proved based on the assumptions, 4 and A through G. The constrained utility-maximization problem is:

Maximize $U = u(I,E)$, subject to $I = w \cdot E \cdot (T - P)$ and $E = e(P)$.

The langrangian function and its first order conditions are:

$$\ell(\lambda, \alpha, I, E) = u(I,E) + \lambda \cdot (w \cdot E \cdot (T - P) - I) + \alpha \cdot (e(P) - E)$$

$$\frac{\partial \ell}{\partial I} = \frac{\partial U}{\partial I} - \lambda = 0$$

$$\frac{\partial \ell}{\partial E} = \frac{\partial U}{\partial E} + \lambda w (T - P) - \alpha = 0$$

$$\frac{\partial \ell}{\partial \lambda} = wE(T - P) - I = 0$$

-3

$$\frac{\partial \ell}{\partial \alpha} = e(P) - E = 0$$

The implicit function theorem allows us to perform comparative statistics by totally differantiating the first order conditions evaluated at the critical points, $(\lambda, \alpha, I, E)$. That is,

The equations below which are in the form of $F(E, I, \lambda, \alpha; w, T, P) = 0$ can be solved for $E, I, \lambda, \alpha$.

$$wE(T - P) - I = 0$$
$$e(P) - E = 0$$
$$U_I(\bar{I}, \bar{E}) - \lambda = 0$$

-4

$$U_E(\bar{I}, \bar{E}) + \lambda w (T - P) - \alpha = 0$$

After totally differentiating and arranging in matrix notation, we get the following:

$$
\begin{bmatrix}
0 & 0 & -1 & w(T-P) \\
0 & 0 & 0 & -1 \\
-1 & 0 & U_{II} & U_{IE} \\
w(T-P) & -1 & U_{IE} & U_{EE}
\end{bmatrix}
\begin{bmatrix}
d\lambda \\
d\alpha \\
d\overline{I} \\
d\overline{E}
\end{bmatrix}
=
\begin{bmatrix}
-dwE(T-P)-wE(dT-dP) \\
-\dfrac{de}{dP}dP \\
0 \\
-\lambda dw(T-P)-\lambda w(dT-dP)
\end{bmatrix}
\qquad \text{-5}
$$

Solving for $\dfrac{d\overline{I}}{dP}$, we have

$$
\frac{d\overline{I}}{dP} = \frac{wE - \dfrac{de}{dP}w(T-P)}{|H|} = \frac{-}{-1} = + > 0 \qquad \text{-6}
$$

We expect a positive sign even though we are unable to sign the impact of efforts on the personal income beforehand. Depending on the numerator, the result could actually be one of the following:

$$
\text{If } \frac{de}{dp}w(T-P) \; = \; wE, \text{ then } \frac{d\overline{I}}{dP} = 0 , \qquad \text{-7}
$$

$$
\text{If } \frac{de}{dp}w(T-P) \; < \; wE, \text{ then } \frac{d\overline{I}}{dP} < 0 , \qquad \text{-8}
$$

$$
\text{If } \frac{de}{dp}w(T-P) \; > \; wE, \text{ then } \frac{d\overline{I}}{dP} > 0 . \qquad \text{-9}
$$

Suppose that the wage rate $(w)$ and the total time $(T)$ are not changing. As the time of efforts increases, number of hours worked and marginal ethics of efforts both decrease; however, the amount of ethics increases. It is important to note that a relative strength between the amount of ethics $(E)$ and marginal ethics of efforts $(de/dP)$ determines the final impact. If marginal ethics of efforts is larger than the amount of ethics, then efforts augments personal income. If the reverse is true, then efforts is associated with a reduction in personal income. There is in fact *a certain threshold point* which switches net impact of efforts on personal income. For example, the individual may start with no ethics at all. Then net impact is zero. When the individual begins to make an effort (work a lot, make an effort little), marginal ethics of efforts is at first expected to be bigger than the total ethics the person has. The net impact is therefore positive, and efforts increases personal income. However, if the individual continues to devote more and more time to be a virtueous, and to devote less and less time to working, a

threshold point on the way is reached. Once the individual crosses this threshold, further time devoted to efforts begin to reduce the invidual income. Therefore, more efforts, after the threshold, becomes demaging in the sense of income level.

In general, two types of effect are present: Direct effect and indirect effect. A reduction in the number of hours worked directly decreases income because wage rate is multiplied by a less working hours now. At the same time, an increase in the efforts time augments the amont of ethics, which rises income; hence, indirect effect. Both effects are contrary to one another. If direct effect dominates, then the amount of efforts decreases income; otherwise efforts rises income.

### 3.1. An Illustrative Example

The Cobb-Douglas utility function, $U(I,E) = I^{\alpha} E^{1-\alpha}$, can be a function of the representative individual, whose characteristics were outlined in the previous section. When we monotonically transform this function and maximize it subject to the constraints, we get the following:

$$Maximize \quad U(I,E) = \alpha \cdot Log(I) + (1-\alpha) \cdot Log(E)$$
$$subject\ to \quad I = W \cdot E \cdot (T - P) \quad and \quad E = \sqrt{P} \qquad \text{-10}$$

After solving the problem, the indirect utility function becomes the function of all exogenous variables:

$$U(I,E) = \alpha \cdot Log(W \cdot \sqrt{P} \cdot T - W \cdot P^{3/2}) + (1-\alpha)Log(\sqrt{P}) \qquad \text{-11}$$

Table 1 displays changes in the endogenous varibles as well as in the utility function as a result of variations of the time spent in efforts. Exogenous variables and parameters, $w$, $T$, $a$ and $(1-a)$, are chosen to be fixed at arbitrary levels. As the individual begins to spend time in efforts, his income and utility levels increase at first. The individual's income level attains a maximum at 11 labor hours (at 5 efforts hours); however, the individual's utility reaches the maximum at 8 labor hours. If the individual continues to increse the time spent in efforts, $P$, after these maximums, income and utility levels begins to decrease.

[TABLE1 HERE]
[FIGURE 1 HERE]
[FIGURE 2 HERE]

Figure 1 and 2 exhibit variations in ethics, marginal ethics and marginal ethics of total labor. In figure 1, the individual marginal ethics of total labor is larger than the level of ethics of the individual. As the time spent in efforts increases, the marginal ethics of total labor diminishes while the amount of ethics grows. In this region, efforts is beneficial to income level. They crosses at a certain level (around 5.3 efforts hours in the function) and the maximum attainable level of income is reached. Thereafter, the relative sizes alter and income level decreases. After this threshold, the time put in efforts is detrimental to the income level of individual. Figure 2 displays the similar pattern between marginal ethics and the amount ethics.

## 4. The Absence of the Link

It is important to note what happens when the link between efforts and income via ethics dissolves.

**PROPOSITION 2.** Let $u(I,E)$ be the utility function of the individual. Given the constraints: $I = w \cdot (T - P)$ and $E = e(P)$, the amount of time spent in efforts ($P$) reduces income.

**PROOF 2:** Our proposition can be proved based on the assumptions, 3 and A through G. The constrained utility-maximization problem is:

Maximize $U = u(I,E)$, subject to $I = w \cdot (T - P)$ and $E = e(P)$.

The langrangian function and its first order conditions are:

$$\ell(\lambda, \alpha, I, E) = u(I,E) + \lambda(w \cdot (T - P) - I) + \alpha(e(P) - E)$$

$$\frac{\partial \ell}{\partial I} = \frac{\partial U}{\partial I} - \lambda = 0$$

$$\frac{\partial \ell}{\partial E} = \frac{\partial U}{\partial E} - \alpha = 0$$

$$\frac{\partial \ell}{\partial \lambda} = w \cdot (T - P) - I = 0 \qquad\qquad \text{-12}$$

$$\frac{\partial \ell}{\partial \alpha} = e(P) - E = 0$$

The implicit function theorem allows us to perform comparative statistics by totally differerantiating the first order conditions evaluated at the critical points, $(\lambda, \alpha, I, E)$. That is, The equations below which are in the form of $F(E, I, \lambda, \alpha; w, T, P) = 0$ can be solved for $E, I, \lambda, \alpha$.

$$w \cdot (T - P) - I = 0$$

$$e(P) - E = 0$$

$$U_I(\bar{I}, \bar{E}) - \lambda = 0 \qquad\qquad \text{-13}$$

$$U_E(\bar{I}, \bar{E}) - \alpha = 0$$

After totally differentiating and arranging in matrix notation, we get the following:

$$
\begin{bmatrix}
0 & 0 & -1 & 0 \\
0 & 0 & 0 & -1 \\
-1 & 0 & U_{II} & U_{IE} \\
0 & -1 & U_{EI} & U_{EE}
\end{bmatrix}
\begin{bmatrix}
d\lambda \\
d\alpha \\
d\bar{I} \\
d\bar{E}
\end{bmatrix}
=
\begin{bmatrix}
-dw \cdot (T - P) - w \cdot (dT - dP) \\
-\dfrac{de}{dP} dP \\
0 \\
0
\end{bmatrix}
\qquad \text{-14}
$$

Solving for $\dfrac{d\bar{I}}{dP}$, we have $\quad \dfrac{d\bar{I}}{dP} = \dfrac{w}{|H|} = \dfrac{+}{-1} = - < 0 \qquad\qquad \text{-15}$

## 5. Econometric Estimation

In this section, we estimate our theoretical model based on a survey sample. The survey questionnaire is distributed to randomly selected individuals via e-mail in Turkey. There are

34 respondents who give an answer to each question, and only those individuals are selected for the sample.[3]

The income function is expressed in its stochastic form as

$$I_i = W_i \cdot E_i \cdot (T_i - P_i) \qquad \text{-16}$$

where

I = Income

W= Wage rate

E= The level of individual ethics

T= Total time available for work and efforts

P= Time spent in efforts

All variables are in daily basis. In the above stochastic income function, the relationship between individual income and inputs is nonlinear. Should we log-transform this model, we get the linear version:

$$LnI_i = LnW_i + LnE_i + Ln(T_i - P_i), \qquad \text{-17}$$

*and then*

$$LnI_i = \beta_1 LnW_i + \beta_2 LnE_i + \beta_3 Ln(T_i - P_i) + \varepsilon_i \qquad \text{-18}$$

*or equivalently,*

$$LnI_i = \beta_1 LnT_i - \beta_2 P_i + \varepsilon_i \qquad \text{-19}$$

We estimate the above log-linear models based on the survey data. Even though these models have theoretically noconstant, we also estimate them with constant in order to compare two specifications. The results are shown in Table I.

Table 1 shows that income is positively and significantly associated with labor in both model 1 and model 2. Holding other inputs constant, a 1 percent change in labor input causes about 0.34 percent average change in income. Therefore, in both models, 1 percent increase in labor input means 0.34 percent average increse in income of the individual. By the same token, model 2 indicates that that the amount of ethics is an important variable for an explanation in income change. A 1 percent increse in the amount of ethics is associated with 1.17 percent increse in income.

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[3] Survey questionaire is available upon request.

The results in Model 4 are concordant to the results in model 2. The total time available for work and efforts are significantly and positively associated with income. A 1 percent increase in the total time input led on the average to about 1.91 percent increase in income. Similarly, holding total time constant, a 1 percent increse in the time of efforts causes a 0.42 percent increase in income. Therefore, these partial elasticities of ethics and efforts imply that optimal level of efforts time has not been yet reached by individuals. Efforts is beneficial to income.

Table 3 and 4 simulated model 2 and 4, respectively, in the regressions table.[4] In both tables, the mean of the each coefficient has the expected sign, and the means of t-ratios of ethics and total time are significant.

Table 5 and 6 simulated the same models based on the hypothetical sample.[5] The means of all coefficients have their expected signs, and the means of t-ratios of wage rate and total time are significant.

[TABLE 2 HERE]

[TABLE 3 HERE]

[TABLE 4 HERE]

[TABLE 5 HERE]

[TABLE 6 HERE]

## 6. Conclusion

We have introduced insights regarding developmental issues at microeconomic levels. Attempts by countries to be economically a developed country would be seriously thwarted not by poor capital, yet by institutions. People respond incentives. If society values virtuous characters to such an extent that individuals put some efforts in order to become a virtuous person, individual incomes are likely to be effected A country may undervalue the work to be economically prosperous and discourages its individuals to work for the market to the extent that the economic progress of the developing countries is halted or slowed down at the microeconomic level. An individual who strive to be a virtuous character lowers barriers to trade by not engaging all forms of opportunism, shirking and cheating in impersonal trade. Being a virtuous is not costless, and it takes time and efforts in order to conduct ethical behaivors continuously.

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[4] Survey sample is used for sampling with replacement. Shazam command file is available upon request.
[5] The hypothetical sample is formed so that all logically possible numbers for each variable can be selected. Sampling with replacement is used. The sample and the shazam command file are available upon request.

Two propositions emerged from the present study. Firstly, if there exist a channel from efforts to income via ethics, individual income begins to increase and reaches a peak as time for efforts increases. Additional efforts after the peak becomes detrimental to the individual income. Therefore, our model appropriately explains both low and high efforts for ethics formation. Secondly, efforts becomes economically useless when the channel from efforts to income through ethics dissolves.

Our econometric findings and simulations for Turkey support the theoretical explanations. We found that the channel of ethics exists and that time for efforts increases income to such an extent that high efforts do not appear.

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**Table 1. Indirect Utility Function and its Components**

| w | T | P | T-P | a | $U(I,E)$ | $\alpha \cdot Log(W \cdot \sqrt{P} \cdot T - W \cdot P^{3/2})$ | $(1-\alpha)Log(\sqrt{P})$ |
|---|---|---|-----|---|----------|------------------------------------------------|----------------------------|
| 5 | 16 | 1 | 15 | 0,5 | 0,938 | 0,938 | 0,00 |
| 5 | 16 | 2 | 14 | 0,5 | 1,073 | 0,998 | 0,08 |
| 5 | 16 | 3 | 13 | 0,5 | 1,145 | 1,026 | 0,12 |
| 5 | 16 | 4 | 12 | 0,5 | 1,190 | 1,040 | 0,15 |
| **5** | **16** | **5** | **11** | **0,5** | **1,220** | **1,045** | **0,17** |
| 5 | 16 | 6 | 10 | 0,5 | 1,239 | 1,044 | 0,19 |
| 5 | 16 | 7 | 9 | 0,5 | 1,249 | 1,038 | 0,21 |
| **5** | **16** | **8** | **8** | **0,5** | **1,253** | **1,027** | **0,23** |
| 5 | 16 | 9 | 7 | 0,5 | 1,249 | 1,011 | 0,24 |
| 5 | 16 | 10 | 6 | 0,5 | 1,239 | 0,989 | 0,25 |
| 5 | 16 | 11 | 5 | 0,5 | 1,220 | 0,959 | 0,26 |
| 5 | 16 | 12 | 4 | 0,5 | 1,190 | 0,920 | 0,27 |
| 5 | 16 | 13 | 3 | 0,5 | 1,145 | 0,867 | 0,28 |
| 5 | 16 | 14 | 2 | 0,5 | 1,073 | 0,787 | 0,29 |
| 5 | 16 | 15 | 1 | 0,5 | 0,938 | 0,644 | 0,29 |
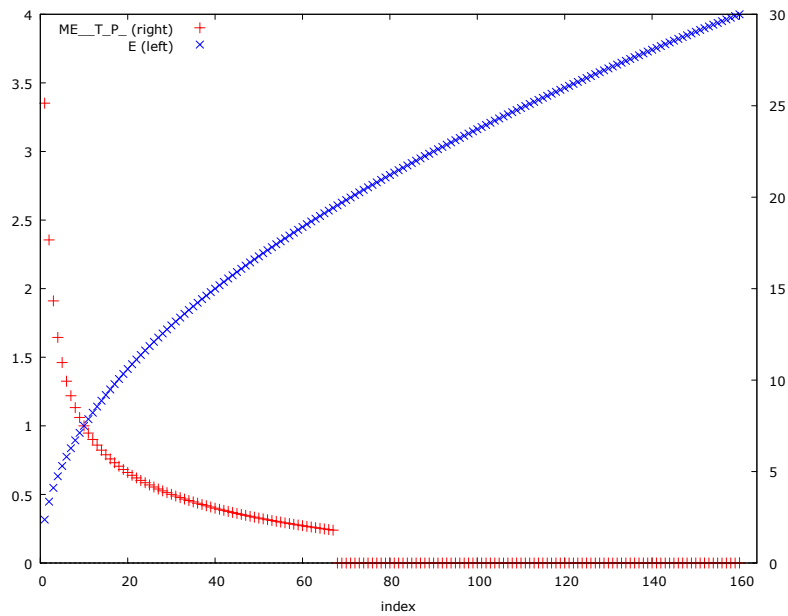


Figure 1. Marginal Ethics of Total Labor (ME_T_P) and Ethics (E)
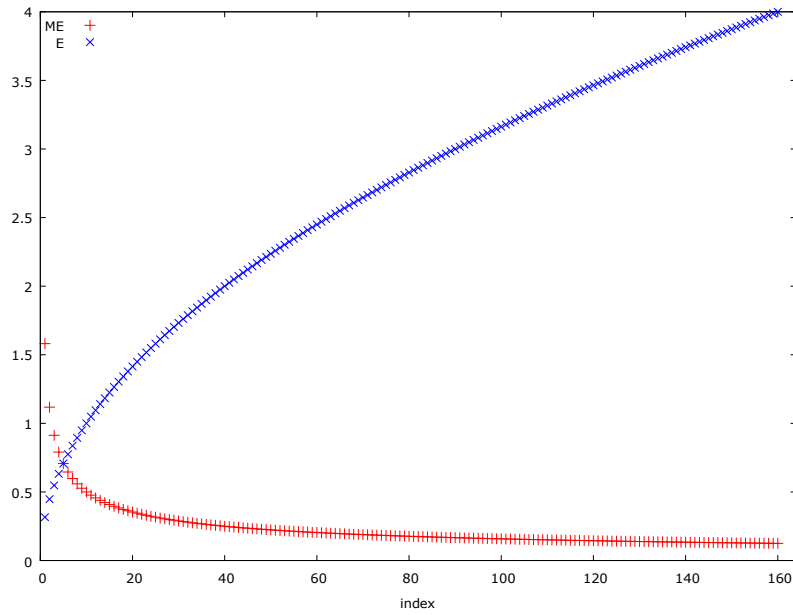
Figure 2. Marginal Ethics (ME) and Ethics (E)

**Table2. Regressions for Income**

|  | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Constant | 0.5710 (0.1576) |  | 3.9422*** (7.380) |  |
| LNW | -0.022 (-0.1936) | -O.0217 (-0.1887) |  |  |
| LNE | 1.0054 (0.9737) | 1.1691*** (9.060) |  |  |
| LN(T-P) | 0.3414* (1.748) | 0.3429* (1.757) |  |  |
| LNT |  |  | 0.3357 (1.583) | 1.9391*** (31.66) |
| LNP |  |  | -0.0230 (-0.1416) | -0.4157*** (-2.169) |
|  |  |  |  |  |
| N | 33 | 33 | 33 | 33 |
| R2 | 0.11 | 0.1099 | 0.0726 | 0.0814 |
| DW | 1.97 | 1.98 | 1.93 | 1.9125 |
| F | 906.88 | 1249.95 | 1199.26 | 669.73 |

**Table 3. Regression for Income Simulation, Noconstant**

|  | N | MEAN | ST. DEV | MINIMUM | MAXIMUM |
|---|---|---|---|---|---|
| LNW | 10000 | 0.0142 | 0.1243 | -0.4728 | 0.4874 |
| LNE | 10000 | 1.3379 | 0.1892 | 0.6496 | 2.0350 |
| LN(T-P) | 10000 | 0.0237 | 0.2131 | -0.8116 | 0.9135 |
| TRATIO (LNW) | 10000 | 0.1248 | 1.0410 | -4.1687 | 5.5786 |
| TRATIO (LNE) | 10000 | 7.4015*** | 1.6100 | 2.5005 | 15.545 |
| TRATIO (LN(T-P)) | 10000 | 0.1153 | 1.0302 | -4.1510 | 4.3968 |
| F | 10000 | 1225.6 | 285.90 | 618.33 | 3768.2 |

**Table 4. Regression for Income Simulation, Noconstant**

|  | N | MEAN | ST. DEV | MINIMUM | MAXIMUM |
|---|---|---|---|---|---|
| LNT | 10000 | 0.6057 | 0.0302 | 0.5041 | 0.7343 |
| LNP | 10000 | -0.0704 | 0.1569 | -0.6491 | 0.6456 |
| TRATIO (LNT) | 10000 | 19.067*** | 2.9145 | 9.8914 | 39.090 |
| TRATIO (LNP) | 10000 | -0.4711 | 1.0321 | -4.4596 | 3.7383 |
| F | 10000 | 255.37 | 69.258 | 109.55 | 867.17 |

**Table 5. Regression for Income Simulation, Noconstant (Hypothetical Sample)**

|  | N | MEAN | ST. DEV | MINIMUM | MAXIMUM |
|---|---|---|---|---|---|
| LNW | 10000 | 0.8959 | 0.1722 | 0.2032 | 1.3045 |
| LNE | 10000 | 0.2519 | 0.2511 | -0.3705 | 1.2896 |
| LN(T-P) | 10000 | 0.1806 | 0.2239 | -0.6589 | 1.4630 |
| TRATIO (LNW) | 10000 | 9.5696*** | 4.0745 | 1.1414 | 30.191 |
| TRATIO (LNE) | 10000 | 1.6526 | 1.3965 | -3.8810 | 10.395 |
| TRATIO (LN(T-P)) | 10000 | 1.0548 | 1.2035 | -3.5750 | 6.5283 |
| F | 10000 | 244.07 | 80.19 | 76.262 | 984.61 |

**Table 6. Regression for Income Simulation, Noconstant (Hypothetical Sample)**

|  | N | MEAN | ST. DEV | MINIMUM | MAXIMUM |
|---|---|---|---|---|---|
| LNT | 10000 | 0.3558 | 0.0592 | 0.0418 | 0.5102 |
| LNP | 10000 | -0.0157 | 0.2348 | -1.1938 | 2.0541 |
| TRATIO (LNT) | 10000 | 7.5673*** | 3.9334 | 0.3361 | 26.058 |
| TRATIO (LNP) | 10000 | -0.8095 | 1.0566 | -3.3950 | 8.1311 |
| F | 10000 | 40.547 | 40.501 | 0.3356 | 366.72 |