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Critiques of standard one-dimensional development indices are gaining momentum. The Human Development Index and the Human Development Index Adjusted for Inequality are two of the most well known multidimensional alternative indices. However, questions arise regarding their usefulness for policy analysis at a macro development level. In this paper, I analyze those questions from the perspective of an applied development policymaker who tries to perform exercises in intertemporal policy analysis. In Sections 1 and 2 I discuss the standard and human development indices of development and inequality. In Section 3 I present the standard goals, models and tools used in applied macro development policy analysis and I analyze some possible extensions toward the Human Development approach. Finally, in Section 4 I discuss some other issues that the Human Development approach should address to compete for a relevant role in the applied development policymaker toolbox.

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1. One and multidimensional development indices

For a long time it has been usual to measure the level of development of a country using as an index per capita income or per capita Gross Domestic Product (GDP). This way of measuring development has been criticized, with increasing emphasis, as narrow and one-dimensional (Stiglitz, Sen and Fitoussi, 2008).

Critiques may be grouped into two broad categories: empirical and theoretical. Empirical critiques point towards everything that GDP does not adequately measure due to shortcomings in the collection or processing of information. For example, environmental pollution externalities, some public goods, or non-market activities such as domestic work are conventionally not counted as part of GDP. Theoretical critiques point to inadequacies of GDP or income as an appropriate concept of welfare. These critiques may be further divided into two types: simplistic and sophisticated.

Simplistic criticism could be assimilated to the popular adage that "money can't buy happiness". It points towards the insufficiency of what is sometimes termed as a narrowly economic view of welfare. This criticism usually takes into consideration a restricted view of the concepts of commodity and price, understanding the first one as a set of "material goods" and the second one as "monetary prices". Certainly, in very general terms GDP is, for a given year, equal to the sum of the product of each good and service (each commodity x) multiplied by its current price p:

1.1 $$GDP = \sum_{i=1}^{n} p_i \, x_i$$

However, standard economic theory used to defend the concept of GDP as an adequate measure of welfare, works with wider concepts of commodities and prices. Roughly speaking, for this theory the level of income or product of a person or country is a measure of purchasing power, the quantity of the various goods and services potentially accessible with that income. Obviously, the conversion of income into a range of goods and services is mediated by their prices. And prices depend on supply and demand, which are in time determined by technology, assets and preferences, that is, "what people value" and the "economic decisions" they make accordingly.

What should be noticed at this point is that standard economic theory uses very broad concepts of goods and services and economic decisions, including within them not only the decisions people make about goods such as food or clothing, or services such as haircuts or banking accounts, but also decisions about education (Schultz, 1963), health (Fuchs, 1998), marriage and family (Becker, 1981), personal identity (Akerloff and Kranton, 2010), and other decisions covering a wide range of human behavior. Thus, from this point of view and beyond measurement imperfections, a country's GDP could in principle fully reflect its level of well-being, since it would encompass the results of the choices made by its people given the constraints they face.

But if this is indeed so, what would be the problem of identifying development and welfare with income or GDP? One of the most sophisticated critiques about it is provided by Nobel Laureate Amartya Sen. For Sen, the important thing is not only the goods and services that a person has or may have, but what a person does or can do, is or may be (Sen, 1989). In Sen's terminology, what is important is the conversion of goods and services in personal achievements or "functionings". For example, two people with the same income level, and therefore the same opportunities of access to food, can achieve different functionings depending on their metabolism, body size, age, sex, activity level, health, access to medical services and ability to use them, nutritional knowledge and education, and weather conditions. Moreover, functionings are conditioned by the "capabilities" of a person, understood as the freedom she has to choose between functionings. The larger the capabilities set, the larger the universe of possible functionings. It goes without saying then that if a person has a high level of income, this will enable her to have a high command over resources, that is, to access more goods and services. But will be the set of capabilities available to such person the one which determines her possible functionings, i.e. the transformation of those goods and services in welfare. From this perspective, then, the fundamental goal of development, beyond the expansion of income or GDP, should be the expansion of people's capabilities.

The most influential practical way to make this approach operational has been to consider three basic dimensions of human development, namely: to enjoy a long and healthy life, to acquire knowledge and be creative, and to have a decent standard of living thanks to access to material resources (Anand and Sen, 2000). While the first two dimensions refer directly to people's capabilities, the third refers to their command over resources. Indices of health, education and income are built as empirical approaches to the measurement of

each dimension. For the health dimension, an index (I_{Life}) based on life expectancy at birth; for education, an index $(I_{Education})$ based on average years of education and expected years of education; and for living standards, an index (I_{Income}) based on the national income per capita. The Human Development Index (HDI) is computed as the geometric mean of the indices for each of the dimensions.

1.2 $$HDI = {I_{Life}}^{1/3} \cdot {I_{Education}}^{1/3} \cdot {I_{Income}}^{1/3}$$

By construction, the HDI can take values between 0 and 1. The closer the index is to 1, the higher the level of human development. The HDI is computed annually by the UNDP for almost every country in the world.[1]

There are other multidimensional indices related to overall development or to some aggregate aspects of it. However, most of them are ad-hoc indices.[2] The HDI is particularly interesting since it is considered by many as theoretically grounded in Amartya Sen's capabilities theory.

2. One and multidimensional inequality indices

As GDP is commonly used as a one-dimensional measure of development, the Gini coefficient is commonly used as a one-dimensional measure of inequality, most of the time understood narrowly as inequality in income distribution. The Gini coefficient G measures inequality among the values of a frequency distribution, and is computed as:

2.1 $$G = 1 - 2\int_0^1 L(X)\ dX$$

[1] For details about these indices, which also imply normalization procedures imposing maximum and minimum values, see the Technical Notes in UNDP (2010).

[2] Ravallion (2010a) presents a critical review of some of those indices, including the HDI.

where $L(X)$ is a Lorenz curve, that is, a function where X represents the cumulative portion of the population and where $L(.)$ represents the cumulative portion of income. A Gini coefficient of zero expresses perfect equality, where all values are the same (everybody has the same income). A Gini coefficient of inequality equal to one expresses maximal values (only one person has all the income).[3]

Criticism of the one-dimensionality of GDP as an index of development has also been extended to the one-dimensionality of the Gini coefficient as inequality index. And like the Human Development Index has become the most influential multidimensional index of development, the recently introduced Inequality adjusted Human Development Index (IHDI) would be called to follow the same path, as an attempt to make operational the concept of equality of capabilities developed by Amartya Sen (Sen, 1979).

To compute the IHDI, an index adjusted for inequality I_{I_X} is first computed for each dimension X of human development (*Life, Education, Income*):

2.2 $$I_{I_X} = (1 - A_X).I_X$$

where I_X is the standard index for the X dimension, where A_X is an Atkinson inequality measure (Atkinson, 1970):

2.3 $$A_X = 1 - \frac{\sqrt[n]{X_1 \ldots X_n}}{\bar{X}}$$

and where$\{X_{1\ldots} X_n\}$ is the underlying distribution of the dimension. Finally, the IHDI is obtained as:

2.4 $$IHDI = {I_{I_{Life}}}^{1/3} . \ {I_{I_{Education}}}^{1/3} . \ {I_{I_{Income}}}^{1/3}$$

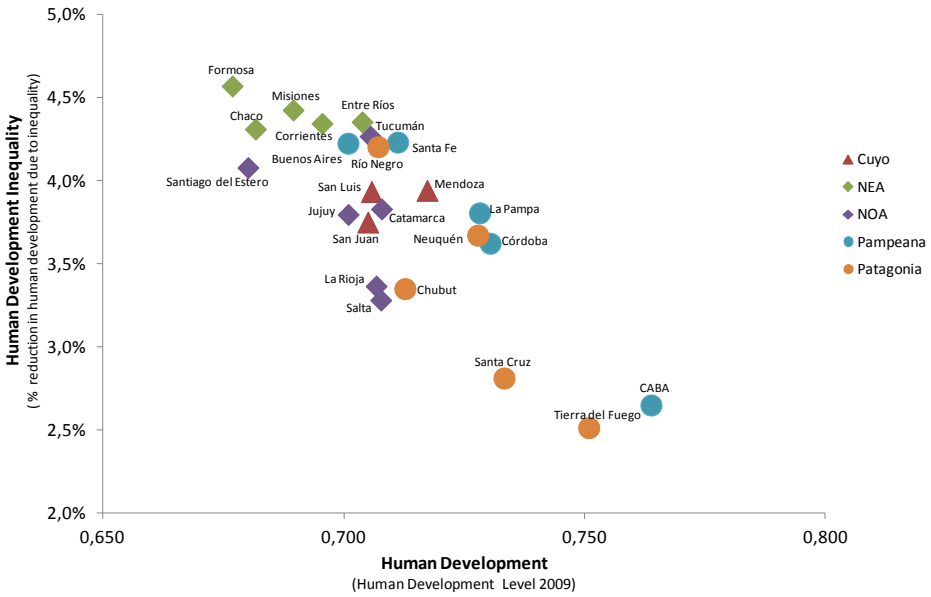
By construction, the IHDI is very sensitive to low values, in a somewhat "Rawlsian" way: the larger the inequality, the larger the reduction in human development, and in more

[3] However, a value greater than one may occur if some persons have negative income or wealth.

than proportional terms. Comparing the value of the IHDI against the value of the HDI for a given country, we obtain the "reduction in human development" due to inequality.[4]

The graph below displays, in the horizontal axes, the level of human development, and in the vertical axes, the reduction in that level due to inequality for the Argentine provinces.[5] There is a clear inverse correlation between human development and inequality.[6]

Human Development and Inequality
Argentine Provinces, 2009



Source: PNUD Argentina (2010)

[4] In general terms, that index can be seen as a particular case of the "general mean of general means" proposed by Foster, Lopez-Calva and Szekely (2003), with inequality aversion parameter equal to one. For a table with GNP, Gini Coefficients, HDI and IHDI for most countries in the world, see UNDP (2010).

[5] The first empirical application of the IHDI at a sub-national level was made in Mexico and reported in PNUD Mexico (2004), followed by the empirical application, also at a sub-national level, made in Argentina and reported in PNUD Argentina (2009). Starting in 2010, the Human Development Report began to report the IHDI at national level for most countries in the world. Due to differences in available data sources at the national and sub-national levels, the corresponding indices are not comparable.

[6] However, correlation is not causation and the true causality, or the feedback mechanisms, between human development and inequality is something to be determined. Strictly speaking, interpreting the percentage reduction obtained by comparing the HDI against IHDI as a reduction "due" to inequality, or as the potential increase that would obtain in human development if inequality was eliminated, may be misleading.

Facing the Graph above, a benevolent development policymaker would try to reduce regional inequality in human development, for instance, by means of the redistribution of fiscal resources. To take a first step towards the complexity of this challenge, let's assume that the policymaker's country has only three Provinces (A, B and C), each of them with two Regions (1 and 2). Hypothetical initial conditions in terms of human development are shown in the Table below, where Province A displays high levels of human development indices of income, health and education; Province B medium levels, and Province C low levels. The Base Case column shows the IHDI corresponding to the values of the income, education and health indices shown in the Table.

		Income Index	Education Index	Health Index		IHDI Base Case	IHDI Policy 1	IHDI Policy 2
Province A	**Region A1**	0,75	0,75	0,75		0,75	0,70	0,70
	Region A2	0,75	0,75	0,75				
Province B	**Region B1**	0,5	0,5	0,5		0,50	0,50	0,50
	Region B2	0,5	0,5	0,5				
Province C	**Region C1**	0,25	0,25	0,25		0,215	0,270	0,274
	Region C2	0,25	0,25	0,1				
Country						0,43	0,45	0,46

Assume now that, in a first policy experiment, health fiscal expenditure is redistributed from the highest human development regions to the lowest human development region, so that the health index in Regions A1 and A2 is reduced by 0.15 units (going from 0.75 to 0.6 in each region) while the health index in Region C2 is increased by 0.30 units (going from 0.1 to 0.4).[7] Remember that an increase in the IHDI is an improvement in welfare. We can see that the IHDI in Province A falls from 0.75 in the Base Case column to 0.7 in the Policy 1 column. This is due to the loss of health, and also due to the increase in inequality because of the imbalance that is now evident between health on the one hand, and income and education on the other hand. At the same time, the IHDI in Province C increases from 0.215 in the Base Case column to 0.270 in the Policy 1 column. This is due

[7] The underlying assumption here is that there is a perfect correlation between units of fiscal expenditure and health, education or income indices units.

to the gain in health, to the decrease in inequality between Region C1 and Region C2, and to the reduction in the imbalance between health, education and income in Region C2. Notice also that the country IHDI increases from 0.43 in the Base Case column to 0.45 in the Policy 1 column, showing that the "redistribution of health" from the richest to the poorest is not neutral for the IHDI.

Assume now that in a second policy experiment, the health index in Regions A1 and A2 is reduced in the same way as in the first experiment (that is, by 0.30 units), while the health index in Region C2 is increased by 0.2 units only, and the education and income indices in the same region are increased by 0.05 units each. We can see in the Policy 2 column that the IHDI in Province C increases even further to 0.274 while the country IHDI increases to 0.46. Thus, an application of the resources transferred to Region C2 so that the region profile in terms of health, education and income is more balanced, improves the IHDI.

Policy exercises with multidimensional indices like the ones performed above could be taken as reference by policymakers at the national level, or by provincial governments in a federal system, to discuss alternative fiscal redistribution schemes to improve human development. However, these exercises rely on very strong assumptions. Indeed, they assume that the human development dimensions (income, education and health), as well as regions and provinces, behave in a relatively independent way, with low or no feedback mechanisms among them. This is the risk we ran into when we play with multidimensional indices of development as if they were models of development processes. But they are not.

So far I have presented the main features of the most influential indices of development and inequality: GDP, the Gini coefficient, the HDI and the IHDI. As such, they are purely descriptive of the main results or goals of development. The situation becomes more complex when we try to move from results, or policy goals, to the dynamic structural processes that constraint their achievement, and to the appropriate use of the policy instruments necessary to reach those goals.

3. Applied development policy analysis

Assume now that the target for a benevolent applied development policymaker is to maximize the welfare of her country, understanding this as the maximization of "development" and the minimization of "inequality". For a "standard policymaker", the main policy goal would be the maximization of per capita GDP (or, more or less equivalently, of per capita income or consumption) and the minimization of income, consumption or assets inequality. While for a "human development policymaker", the main policy goal would be the maximization[8] of the capabilities of individuals and the minimization of the inequality in their distribution among them.[9]

3.1 The standard approach

From the standard viewpoint, development and growth are many times taken as synonyms, and today's canonical form of structurally analyzing and modeling growth processes is by means of Ramsey-Cass-Koopmans type models (Acemoglu, 2008; Barro and Xala-i-Martin, 2003). In these models, a benevolent policymaker is supposed to maximize an intertemporal welfare function subject, as a constraint, to an aggregate representation of the structural dynamics of the economy given by a production function, a balance equation, a set of capital accumulation equations, and suitable initial and transversality conditions. An example of this kind of models, useful for our discussion since it includes not only physical capital but also two specific forms of human capital (health and educational capital), is the following one (Barro, 1996):[10]

3.1 $$\text{Max } W = \int_0^{\infty} u(c)\, e^{\rho t}\ dt \quad \text{subject to:}$$

[8] As we will discuss later, this maximization assumption may be controversial for the Human Development approach.

[9] This is, of course, a highly stylized representation of the normative and instrumental aspects of applied development policymaking. Anyone who ever engaged in practical macro development policymaking knows that this picture is far from the reality of the political, interests groups and even interpersonal conflicts populating that practice. But also knows that the policymakers engaged in that practice are, in the back of their minds, always tributary to one (or to more than one at the same time!) normative and instrumental view of the process of development.

[10] Time sub-indices are not shown to save notation.

3.2 $$y = a\, f(k, h, e, l)$$

3.3 $$y = c + i_k + i_h + i_e$$

3.4 $$\dot{k} = \delta\, k + i_k \qquad \dot{h} = d\, h + i_e \qquad \dot{e} = d\, e + i_e$$

where W is welfare, u is instantaneous utility, c is consumption, ρ is the time preference, y is income, a is technological progress, k is physical capital, h is health capital (measured, for instance, by life expectancy), e is educational capital (measured, for instance, by school enrolment), i is investment, l is labor, δ is the depreciation parameter for physical capital, d is the depreciation parameter for human capital, and where the model is subject to suitable initial and transversality conditions. While the depreciation parameter of physical capital is standard, the depreciation parameter for education and health depends on the mortality rate and the burden of disease (since high mortality and disease burden rates will deteriorate the stock of health and educational capital more quickly), and could also be modeled as a decreasing function of the stock of health capital.

Dynamic properties of this kind of models are well known, and intra and intertemporal tradeoffs among the model variables can be precisely quantified. As a central planner model, these trade-offs are implicit as shadow prices. Alternatively, if the model is interpreted as capturing the dynamics of a decentralized market economy, tradeoffs can be seen as relative prices, derived in time from a theory of exchange value based on a utilitarian or revealed preference axiomatic.

Policy analysis can be modeled introducing explicitly such variables as government expenditure and taxes, and also modeling health and education services as publicly subsidized private goods or as public goods. Also, a number of well known methods and results from a long tradition of dynamic optimal macro policy analysis relating policy goals and tools can be applied to these type models or to linearized versions of them (Kendrick, 1981; Holly and Hughes-Hallett, 1989). And the impact on growth of different institutional arrangements at the government level, such a centralized versus federal systems, can be analyzed within the model linking those arrangements to some policy variables or to specific parameters (Feld and Schnellenbach, 2009; Hartfield, 2006)

A number of additional features characteristic of developing countries such as poverty traps, structural imbalances, or the significant role played by natural resources can be accommodated within the model. Poverty traps can be generated using production functions with increasing returns to scale; renewable resources can be incorporated as fixed factors in the production function, while non renewable resources can be represented with depletion equations; and structural imbalances can be modeled using multi-sectoral and multi-stage production functions.

The model solution yields growth paths for income, consumption and capital stocks. As an aggregate representative agent model, it says nothing about inequality. However, postulating some kind of agents' heterogeneity, inequality can be introduced into the model in a number of ways, allowing studying the evolution of the distribution of consumption, income and assets (Caselli and Ventura, 2000). Also, if the policymaker is concerned not only about maximizing growth but also about minimizing inequality, the welfare function could be substituted by:

3.5 $$W = \int_0^{\infty} u(c, I)\ \mathrm{e}^{\rho t}\, dt$$

where I is an inequality index derived from the distributions of n agents' assets, income or consumption:

3.6 $$I = f(x_1, \ldots, x_n) \text{ and } x_i = k_i, h_i, e_i, c_i \text{ or } y_i$$

and where instantaneous utility would be increasing in consumption and decreasing in inequality:

3.7 $$u_c' \geq 0 \text{ and } u_I' \leq 0$$

While analytical results for this kind of models may well be difficult or impossible to obtain, computational simulations with today's tools may not present a very serious challenge for an applied development policymaker (Kendrick, Mercado and Amman, 2006).

3.2 Human Development: an alternative or a complement to the standard approach?

Let's move now to the realm of a hypothetical applied policymaker trying to engage in macro (country) development policy analysis from a human development perspective. From her point of view, the standard approach to applied development policymaking could be subjected to at least two main critiques.

A first criticism comes out from the fact that, from the Human Development approach, health and education, as proxies for sets of capabilities, are not only means to achieve human development, but also goals with intrinsic value. And that is not reflected in standard models such as the one presented earlier, where health and education are only means to make possible higher levels of consumption and income, which for the human development perspective are just proxies for the command over resources. In principle, this criticism could be taken care of by adding health (h) and education (e) as arguments into the intertemporal welfare function:

3.8 $$W = \int_0^{\infty} u(c, h, e, I)\ \mathrm{e}^{\rho t}\ dt$$

While this may well change the trade-offs implicit into the model and complicate the well known analytical results for standard models, once again it would not imply difficult challenges from computational point of view.[11]

A second criticism would point straight to the issue of trade-offs, claiming that capabilities can't/shouldn't be measured/compared. This is a strong statement, and it seems to contradict the existence of the HDI and the IHDI. If we assume that capabilities shouldn't be measured, it is clear that there is no point in building an HDI. However, even when it is accepted that the HDI could be considered as a quantitative proxy for capabilities, any kind of calculus of opportunity costs (tradeoffs) of a given capability or capability set in terms of another is sometimes rejected, mostly at the level of moral philosophy (Nussbaum, 2000). Finally, it is sometimes claimed that even if capabilities' and functionings' measurement and trade-offs analyses are meaningful, policy optimization

[11] The model uses a time discount factor in the intertemporal welfare function, something that may be a matter of controversy, as in fact it is since the early classic discussion by Ramsey.

taking them into account is not from a Human Development point of view. All of which comes as a surprise for an applied development policymaker, since measurement is explicit in the HDI variables, tradeoffs are implicit in the mathematical construction of the HDI as a geometric mean, and some form -explicit or implicit- of policy optimization is at the hearth of almost any kind of policy analysis.[12]

So far the included variables and the mathematical forms of the HDI and the IHDI since their inception in the first Human Development Report in 1990, seem to have been mostly related to information availability, easiness of communication to a wide audience, and some idiosyncratic points of view. However, some formal work that could lead towards a more rigorous derivation as well as toward a clearer discussion of the differences and analogies with standard welfare and development policy analysis has taken place over the years (Basu and Lopez Calva, 2011).

An early effort was made by Sen (1985). His formalization goes from commodities to characteristics, from characteristics to functionings, and from functionings to capabilities. The first step is to define $\boldsymbol{q}_i$ as a vector of commodities chosen by person *i*, and Q_i as the entitlement set or constraint for person *i*, so that $\boldsymbol{q}_i \in Q_i$. Next define $c(\boldsymbol{q}_i)$ as a function that transforms commodities into characteristics. Then define $f_i[c(\boldsymbol{q}_i), \boldsymbol{z}_i]$ as a personal utilization function, a function that converts commodities characteristics into a person's activities or states of being (that is, a person's functionings $\boldsymbol{b}_i$), given a vector $\boldsymbol{z}_i$ of personal characteristics and societal and environmental circumstances:

3.9 $$\boldsymbol{b}_i = f_i[c(\boldsymbol{q}_i), \boldsymbol{z}_i]$$

From this we obtain the set of functioning vectors feasible for person *i*:

[12] When the geometric mean formula was adopted for the HDI in 2010 instead of the previous arithmetic mean, it was argued that the geometric mean was an improvement since it allowed for imperfect substitution between the components of the HDI (UNDP, 2010). For a discussion of the tradeoffs in the HDI, see Ravallion (2010b) and Zambrano (2011). See also the discussion that took place in 2010 and 2011 in the UNDP's Internet site named "Let's Talk Human Development" (http://hdr.undp.org/en/humandev/lets-talk-hd/).

3.10 $$P_i(Q_i) = \{\boldsymbol{b}_i | \ \boldsymbol{b}_i = f_i[c(\boldsymbol{q}_i), \boldsymbol{z}_i] \quad \forall \ f_i \in F_i\}$$

where F_i is the feasible set of utilization functions for person *i* so that $f_i \in F_i$. We can see that a person's functioning reflects the state of a person, what a person has achieved, using the commodities she has access to and choosing a personal utilization function. Finally, the capability set X_i can be defined as the set of potential functionings of a person:

3.11 $$X_i(Q_i) = \{\boldsymbol{b}_i | \ \boldsymbol{b}_i = f_i[c(\boldsymbol{q}_i), \boldsymbol{z}_i] \quad \forall \ f_i \in F_i \quad and \quad \forall \ \boldsymbol{q}_i \in Q_i\}$$

Thus, the capability set reflects the effective freedom of a person as depending from her entitlements (command over resources) and her feasible functionings.

At this point, it is interesting to notice that standard welfare economics and social choice theory distinguish between outcomes and opportunities, while the capabilities approach seems to make an analogue distinction between realized welfare (functionings) and potential or feasible welfare (capabilities). Moreover, the capabilities set could be seen as an individual's choice set or budget set. Pointing and exploiting these seemingly analogous traits, Kuklys and Robeyns (2005) explore up to what point the capabilities approach could be seen as an extended version of standard modern welfare analysis.

From a standard point of view, the impact of a policy π on individual welfare can be formalized as:

3.12 $$dv_i = \frac{\partial v}{\partial m_i} \frac{\partial m_i}{\partial \pi} \partial \pi$$

where $v_i = v(\boldsymbol{p}, m_i)$ is the indirect utility function of person i who has income m_i and faces a price vector $\boldsymbol{p}$, and where the indirect utility function results from the individual's problem:

3.13 $$max \ u_i = u(\boldsymbol{q}) \ \ s.t. \ \ \boldsymbol{p}.\boldsymbol{q} = m_i.$$

At the social level, the impact of that policy on overall welfare W is:

3.14 $$dW = \sum_{i=1}^{n} \frac{\partial W}{\partial v_i} \frac{\partial v_i}{\partial m_i} \frac{\partial m_i}{\partial \pi} \, \partial \pi$$

where W is given by the social welfare function:

3.15 $$W = W[v_1(\boldsymbol{p}, m_1), \dots, v_n(\boldsymbol{p}, m_n)]$$

An extension of this standard approach could be obtained following some lines of work used in consumer theory such as the ones pioneered by Becker (1965) and Atkinson and Stern (1981). To do so, Kuklys and Robeyns define a utility function over outcomes $\boldsymbol{o}$, which are in turn function of commodities $\boldsymbol{q}$, and conditioning it on a vector of conversion factors $\boldsymbol{z}$ (personal, societal and environmental factors that affect the conversion of available resources into outcomes) so that the individual's problem becomes:[13]

3.16 $$max\ u_i = u[\boldsymbol{o}(\boldsymbol{q}, \boldsymbol{z}_i)] \ \ s.t. \ \ \boldsymbol{p}.\boldsymbol{q} = m_i$$

and the corresponding indirect utility function:

3.17 $$max\ v_i = v(\boldsymbol{p}, m_i, \boldsymbol{z}_i)$$

while the social welfare function and the policy impact on social welfare become:

3.18 $$W = W[v_1(\boldsymbol{p}, m_1, \boldsymbol{z}_i), \dots, v_n(\boldsymbol{p}, m_n, \boldsymbol{z}_i)]$$

[13] Kuklys and Robeyns also include the following inputs to the utility function: public goods, rationed goods and non-market goods, as well as a "choice" variable to account for the "intrinsic value of choice" emphasized by Sen (1997). In order to keep things simple, and since the HDI and IHDI do not include these inputs, I will not include them.

3.19 $$dW = \sum_{i=1}^{n} \frac{\partial W}{\partial v_i} \frac{\partial v_i}{\partial \pi} \partial \pi$$

Notice that from an aggregate or country level point of view, and given prices, the welfare function 3.18 could be seen as depending on aggregate income m, and also on aggregate conversion factors $\boldsymbol{z}$:

3.20 $$W = W(m, \boldsymbol{z})$$

To see how close these extensions of the standard welfare approach are to the Human Development approach, notice that the outcome function $\boldsymbol{o}$ used in 3.16 and the personal utilization functions f_i defined in 3.9 could be seen as analogous. And notice also that conversion factors in 3.20 could be interpreted, for example, as aggregate levels of health and education. In so doing, the HDI and IHDI could be seen as particular functional forms of the welfare function in 3.20.

An explicit or implicit welfare function is the point of departure and a necessary condition to perform almost any kind of optimal development policy analysis. But it is not a sufficient condition. What is also needed is an explicit model of the dynamic interactions of the structural elements -variables and parameters- generating the time evolution of the target variables included in the welfare function.

From a standard point of view this would take us back to the welfare function formulation presented earlier in equation 3.18, where aggregate income is substituted by aggregate consumption as a proxy for command over resources, and where the policymaker also cares about inequality:

3.21 $$W = \int_0^{\infty} u(c, h, e, I)\ \mathrm{e}^{\rho t}\, dt$$

This would be the intertemporal welfare function for the growth model with health and educational capital also presented earlier in equations 3.1-3.4, which would then become a model of the dynamic interactions between health, education and consumption

(income), and where health and education are not only means but also goals of development.

Alternatively, to perform applied development policy analysis from a Human Development point of view, what would be needed is an explicit representation of the dynamic interactions between command over resources (income) and functionings (health and education). More specifically, a precise quantitative model of the way in which resources and functionings are transformed into resources and functionings, and of the way in which the application of quantitative policy instruments affects those processes. Quite a difficult challenge if it is to be confronted without pricing functionings explicitly or implicitly.[14]

4. Further issues

In section 3 I discussed the standard approach to applied macro development policy analysis from a quantitative point of view and what could be extensions toward the Human Development approach. In so doing, policy interventions were formalized as changes in policy variables (π). Usually, these changes are seen as quantitative changes in a policy instrument such as government spending or taxes or another quantitative macro variable, oriented towards the determination of intertemporal optimal paths for a number of target variables.

Perhaps the Human Development approach is not so much concerned about precise quantitative changes in policy instruments, as it is interested in institutional innovations to expand and equalize capabilities. If this is the case, the Human Development approach should also contend with two significant and newer lines of work -Mechanism Design and Evolutionary Games- which are slowly gaining space within the toolbox of the applied development policymaker.

[14] Notice that in the standard model (equation 3.21 and equations 3.2-3.4), even if health and education were interpreted as conversions factors or as functionings, they would be in fact priced. In the central planner interpretation of the model, they would have an implicit price (a shadow price) and they would be a term in the model's budget constraint, as can be seen in eq. 3.3 where income can be spent in consumption or in investment in health or education. In the decentralized markets version of the model, they would be priced explicitly and treated as commodities.

While standard policy analysis based on the quantitative fine tuning of given policy instruments assumes as given certain institutional frameworks within which to optimize social outcomes, the newer methods are oriented to define or redefine the "rules of the game" by means of the design of institutions to optimize social welfare.[15] In so doing, persons are no longer seen as "price takers" that respond to quantitative stimuli decided by the policymaker, and come to be understood as agents with private information that interact strategically with each other and with the policymaker, anticipating her movements. In this way, Mechanism Design Theory (Maskin, 2007) enter the policymaker's toolbox, who begins to play the role of an Institutional Engineer bringing together insights and methods from Game Theory, Experimental Economics and Computational Economics (Roth, 2002).

While Mechanism Design usually assumes given preferences and technologies, Evolutionary Game Theory tries to go one step further modeling the co-evolution of preferences, technology and institutions and asking, as a policy problem, what institutions to choose to induce the development of socially desirable preferences and technologies (Bowles, 2006).

The scope and potential of the above mentioned modeling and policy design tools is wide, and so far some of the most notorious practical achievements have been made in the design of specific markets and in the engineering of complex public auctions. However, its widespread application in the field of development may perhaps be a matter of time.

Thus, a good deal of work should be done if the Human Development approach is to compete effectively for a space within the applied development policymaker toolbox against the standard tools which are already well grounded and the newer instruments that are making their way inside it.[16]

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[15] The differentiation between standard versus institution building policies was pioneered by Tinbergen (1956). Both types of policies are interested in their quantitative social outcomes. While standard methods focus on the fine tuning of given quantitative policy variables, institution building methods focus on institutional or mechanism design.

[16] It may be the case that the Human Development approach is not interested in occupying space within the applied development policymaker toolbox. Moreover, it may well reject the figure of a benevolent policymaker making decisions about development and policy tradeoffs altogether, as it seems to be implicit in some formulations stressing that the tradeoffs between capabilities is a matter of social choice where

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people have to evaluate explicitly and critically and by means of some kind of deliberative process the tradeoffs they are willing to make (Sen, 2000).

While it is clear, even in the standard approach to policymaking, that the decision about the weights to be attached to capabilities or to any other variable into an index of development may not a be a matter of choice of the policymaker but the result from a deliberative process (be that a form of "direct democracy" or through Congress setting priorities to the Executive Branch of Government), it is not at all clear how this process would continue throughout the steps of policy evaluation, design and implementation from a Human Development perspective.

Somewhat in connection with the issues just mentioned, the Human Development approach has put forward concepts such as "agency" and "empowerment", but so far they seem closer to be human development goals than concrete tools for social and political decision making. Moreover, the connection of these concepts to the body of knowledge of Political Science and to the history and practice of specific forms of political institutions -forms of governments, the State, etc.- is something where a good deal of work should be done from the Human Development approach.

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