

Tinbergen on the Theory and Policy of Economic Development

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I. SETTING THE AGENDA

Erwin Dekker's *Jan Tinbergen (1903-1994) and the Rise of Economic Expertise* (2021) is a *tour de force*. It seeks to establish that Tinbergen's main contributions to economics consisted in new techniques for the design of economic policy, not in the formulation of new approaches to economic theory and econometric modelling. As the title of the book indicates, Dekker develops throughout his book the view that Tinbergen played a key role in the rise of 'economic expertise' as a central dimension of the economists' activities in the economic policy realm. Although Tinbergen shifted the focus of his analytical effort from developed (particularly his home country, The Netherlands) to underdeveloped countries, he remained, according to Dekker (262), primarily a policymaker. Hence, Tinbergen's (1958) volume on development planning—written for the International Bank for Reconstruction and Development—extended to developing countries the approach to economic policy modelling he had put forward in his 1956 book, *Economic Policy*. They both featured the word 'design' in their titles.

Dekker's (288-289) main claim—regarding Tinbergen's participation in the new field of development economics that emerged in the post-war period—is that his take was "unique", in the sense that the prevailing concern with *theories* of growth and development was "peripheral" to his work on *decision models*. Dekker is aware that, in principle, a framework for development planning should be based on a theory or model of the development process. However, he argues that Tinbergen's new framework was not linked to a specific development theory, but compatible with a whole set of them—just like in Tinbergen's previous work on business cycles, when Tinbergen supposedly did not commit to a particular theory of economic fluctuations. Instead, the assumption behind

Tinbergen's development planning model was that "certain key policy-making institutions [...] were in place" (288).

Although carefully stated, Dekker's argument for Tinbergen's 'uniqueness' among development economists should be taken *cum grano salis*. The division between the theory of economic development on one side and applied development planning on the other was not at all conspicuous in the burgeoning development economics at the time. Arthur Lewis, for instance—who put forward in 1954 his seminal theoretical model of capital accumulation under unlimited labour supply (see Boianovsky 2019a)—contributed two books on development planning (Lewis 1949, 1966; see Tignor 2006). In Latin America, the United Nations Economic Commission for Latin America (ECLA, known as CEPAL in the region), produced in the mid-1950s, under the leadership of Raul Prebisch and Celso Furtado, an influential document on development planning that attracted the attention of development economists worldwide (UN 1955).

Osvaldo Sunkel, a young member of CEPAL, took advantage of his 1953–1955 European study tour to visit Tinbergen in The Netherlands and inform him of CEPAL's new approach to planning (Boianovsky 2019b). Another prominent development economist, Albert Hirschman (1958, 1963), studied carefully the formulation of economic development policy in theory and practice, although from a distinct perspective (see Chenery 1959 on the similarities and differences between Tinbergen and Hirschman in that regard).

On the other hand, Tinbergen did contribute to theoretical development economics, often with an eye to its implications for development policy. Indeed, Tinbergen's 'uniqueness' as a development economist resided rather in his concern with formal modelling and the quantitative or econometric dimension, which set him apart from most of other pioneers in the field at the time (Hollis Chenery was one of the very few exceptions). Whereas growth economics, especially in Solow's (1956) hands, emerged as part of the increasing formalization of the economic discourse in the post-war era, development economics tended to move in the other direction, in part because of the difficult task of modelling economic divergence and international asymmetries between poor and rich countries. However, Tinbergen (1942), unlike other development economists, had contributed a path-breaking neoclassical econometric growth model that anticipated some central aspects of Solow (1956).

Tinbergen's 1942 paper did not attract a large readership, as it was published in a German journal during the War (it was translated only in 1959) and it did not discuss steady-state solutions as clearly as Solow. However, it was a key paper in the context of the shift of Tinbergen's agenda from the developed full-employment economies (tackled in the 1942 paper) to the underdeveloped economies beset by permanent or structural unemployment—a feature already pointed out by Rosenstein-Rodan (1943), among others—examined in his 1958 book and some of his papers around that time.

Dekker (269) mentions that crucial transition in passing, without discussing it in any detail. Unfortunately, his treatment is marred by some inaccuracies, as the statement that neoclassical growth theory was “pioneered by Harrod and Domar” (291)—when in fact they advanced a Keynesian model of growth and fluctuations featuring unemployment. The so-called ‘Harrod-Domar growth’ model was an adaptation by development economists (including, e.g., Tinbergen 1958) of the original formulation to the study of capital-constrained developing economies (see Boianovsky 2018). Accordingly, the capital-output and saving ratios became central—called ‘instrumental variables’ in Tinbergen's system—to the strategy of development planning. Moreover, Dekker's (198) description of Tinbergen's (1942) Cobb-Douglas growth model as assuming a “constant proportion of labour and capital” is incorrect—such constant proportion is a property of the steady-state solution (in the absence of technical progress), not of the production function.

Again, that contrasted with the Tinbergen-Solow neoclassical model's result that the rate of economic growth is determined by the (exogenous) rate of technical progress, under the assumption of diminishing returns to capital accumulation—not by “saving and technology” as stated by Dekker (199). Tinbergen's investigation of theoretical models of development and growth culminated in the book with his Dutch colleague and former student Hendricus Bos, *Mathematical Models of Economic Growth* (1962).

Dekker (263–264) describes how Tinbergen led an outstanding research team of growth mathematical economists and planners in The Netherlands in the 1950s, but refers to his book with Bos (1962)—the first ever handbook of its kind—only in a footnote. Among other topics, this book discussed the determinants of the optimal rate of growth and saving, a subject Tinbergen (1956b) pioneered in a paper that confirmed his distinctive status as a theoretician and model-builder among post-

war development economists. Tinbergen's distinctiveness was reinforced by his critical reaction to Paul Samuelson's (1948) famous 'factor-price equalization theorem', which is not mentioned by Dekker. Tinbergen (1949) was the only development economist who criticized Samuelson's powerful theorem—which predicted convergence of the remuneration of workers and other productive factors across countries under free trade—in its own mathematical terms. Samuelson's theorem—as read by development economists, Tinbergen included—was in apparent contradiction with perceived international economic asymmetries (see also Tinbergen 1979, 342; Boianovsky 2021). Tinbergen's engagement in criticism of Samuelson's trade theorem reinforces the technical/theoretical dimensions of his work as a development economist, which Dekker tends to downplay.

II. FROM GROWTH TO DEVELOPMENT

Dekker (197–199, 202–203) provides an insightful account of the context of Tinbergen's (1942, [1942] 1959) article on growth, produced during the Nazi occupation of The Netherlands. Under the Nazi regime, “business cycles were declared a thing of the past” (197), which prompted Tinbergen to shift the focus of his research at the Dutch statistical institute toward the study of long-term growth. Tinbergen's (1984, 315–316) recollection of that episode claimed, instead, that his research on economic growth did not result from an imposition by Nazi occupation, but from the fact that—as The Netherlands was cut off from outside world—he had “plenty of time” to reflect upon issues left open by his work on business cycles carried out in the 1930s. One of those issues was the distinction between cyclical short-run fluctuations and long-run trends featuring full employment, around which business cycles took place. As a “check on the non-Nazi attitude” of the editors of the *Weltwirtschaftliches Archiv*, Tinbergen (1984, 315n2) quoted in his 1942 article a “considerable number of Jewish authors”. Dekker's account and Tinbergen's recollection are significantly different, though not necessarily incompatible with one another.

Tinbergen (1984, 316) described his 1942 growth model as a theory of economic development in “embryonic state”, a sort of “prelude” to development theory. The only theoretical influence Tinbergen ([1942] 1959, 187) acknowledged was Gustav Cassel's ([1918] 1932, chap. 1, sec. 6) pioneer investigation of the “uniformly progressing state”. Despite—or perhaps because of—the relatively small impact of Tinbergen (1942)

on the literature, he would often claim its originality as the first ever growth model, encompassing both theoretical foundations and statistical testing—which was his meaning of economic “models” (see Tinbergen 1979, 347; 1967, 231). Under the assumption of a Cobb-Douglas aggregate production function with disembodied technical progress—with productive factors paid their marginal products under perfect competition—Tinbergen (1942, [1942] 1959) found that, for Germany, United States, France, and the United Kingdom over the period 1870–1914, the long-term rate of growth of per capita income was 1.5%, determined by the rate of technical progress. That period was selected because output was then arguably decided by the supply side (the production function) instead of aggregate demand—although there has been some controversy among economic historians regarding the period 1873–1896 (see Saul 1969). Tinbergen came back to that model in his 1962 book with Bos, when they discussed its steady state solution. Tinbergen and Bos showed formally that the capital-output ratio is constant in the steady state (Tinbergen and Bos 1962, chap. 3), a feature of Solow’s (1956) formulation as well.

Tinbergen’s visit to India in 1951, invited by P.C. Mahalanobis to participate at a conference in New Delhi, had exposed him to widespread poverty in underdeveloped countries and led to a substantial shift in his research agenda, as recalled by Tinbergen (1984, 316–317) and documented by Dekker (chap. 12). Tinbergen’s 1953 article about India’s Five-Year Plan, published as the leading article of the first issue of the *Indian Economic Journal*, marked his transformation into a development economist. Dekker (269), unfortunately, mistakenly gives “Journal of Indian Economics” as the journal title and omits Tinbergen (1953) from the bibliography. It is noteworthy that Tinbergen (1953, 2n2) referred to his 1942 German article as a source on estimates of the long-run growth rate, a result he then applied beyond the sample of countries examined in that article.

After distinguishing between capital widening (capital accumulation accompanied by an increased labour force) and capital deepening (an increase of the capital-labour ratio), Tinbergen (1953, 3) argued that, on the basis of the empirical Cobb-Douglas production function, capital deepening had a relatively small impact on output. That is related to the assumption of a diminishing marginal productivity of capital, a key postulate in the neoclassical growth model. Moreover, Tinbergen (1953, 4) expressed scepticism about the notion of the incremental capital-output

ratio deployed in Mahalanobis's formulation of the Indian Five-Year Plan, as it ascribed the whole increase of output to capital accumulation, without accounting for the influence of "knowledge". Nevertheless, Tinbergen, hesitantly, endorsed the Five-Year Plan's emphasis on capital accumulation, which, according to the logic of his 1942 model, should be able to bring about an increase of the *level* of income per capita, but not of its permanent growth *rate*.

However, by the time he published his 1958 book on *The Design of Development*, Tinbergen's original neoclassical approach to growth gave way to a reliance on a fixed-coefficient model associated to the so-called Harrod-Domar growth model as perceived by development economists. Tinbergen never abandoned his neoclassical roots—as shown, for instance in his emphasis that planners should give preference to labour-intensive activities (not to capital-intensive industries as stated by Dekker 269) in India and other developing countries beset by capital scarcity (see, e.g., Tinbergen 1958, 26). His neoclassical credentials were also displayed in his support for Heckscher-Ohlin trade theory and in his misgivings about protectionism, unlike many other development economists at the time (see Tinbergen 1958, 51–52; 1968; 1984, 323). Indeed, in their concluding chapter Tinbergen and Bos (1962, 113–114) criticized what they called "very unorthodox ideas"—by the standards of neoclassical mainstream economics—in economic development theory and policy.

As Dekker (197, 307) shows, overpopulation was a main element of Tinbergen's take on underdevelopment, although (like Lewis) he was no Malthusian. Solow (1956, 90–91) had argued that, by changing some assumptions about the determinants of population growth, his neoclassical growth model was able to generate multiple equilibria and explain a poverty trap (see Boianovsky and Hoover 2014, 204). Tinbergen too introduced overpopulation in his own neoclassical framework, but under another guise. The problem, from Tinbergen's perspective, was that, due to a very low capital/labour ratio, the *marginal* productivity of labour could fall below subsistence, even if the *average* productivity of labour was above that level. Under those circumstances, if minimum wages were kept above or at subsistence by trade unions etc. (as Tinbergen 1958 expected to be the case), that would introduce a wedge between the marginal productivity of labour and real wages, with ensuing unemployment of a 'structural' sort.

Tinbergen (1958, 76–78) discussed that wedge as the most important form of “fundamental disequilibria” that characterized the economy of developing countries, where part of the population could not be gainfully occupied for “lack of complementary means of production: land and capital”. The Swedish economist Knut Wicksell—whose influence on Tinbergen’s decision to give up physics for economics in the 1920s is mentioned by Dekker (70)—had put forward that hypothesis in some detail at the beginning of the 20th century (see Boianovsky and Trautwein 2003, 422–423). Moreover, Tinbergen’s discussion of ‘fundamental disequilibria’ makes clear how his contributions to development economics fit into a long neoclassical tradition coming from Wicksell, unlike Dekker’s account.

III. OPTIMALITY AND ACCOUNTING PRICES

As put by Tinbergen (1984, 116), his 1951 visit to India made “visible” to him the capital scarcity typical of underdeveloped poor economies. The Harrod-Domar growth model, featuring just one scarce productive factor (capital), provided a ‘didactic’ way to discuss capital accumulation, and, by that, a natural starting-point for Tinbergen and Bos’s (1962, chap. 2) analysis. It was in that context that the book addressed what Tinbergen perceived as the “main problem” of development economics: the determination of the “optimum rate of development” (Tinbergen and Bos 24–31, 115; the term ‘development’ is here used in the sense of ‘growth’). Tinbergen (1956b) had provided the first formal treatment—followed by his 1960 *Econometrica* article—of that difficult analytical issue since Frank Ramsey’s famous 1928 essay on optimal saving. Indeed, by the late 1950s and until the late 1960s the theme of optimal growth attracted much attention, now in the context of the Solovian version of neoclassical growth modelling and of Dorfman, Samuelson, and Solow’s (1958) turnpike theorem, together with some incursions by non-neoclassical economists such as Roy Harrod (see Boianovsky and Hoover 2014, 212–214; Boianovsky 2017).

Bent Hansen (1969, 332)—in a passage quoted approvingly by Boumans and De Marchi (2018, 232) and apparently endorsed by Dekker—argued, on the occasion of Tinbergen’s Nobel Award, that the Dutch economist “took little part in the discussion of topics like optimal growth rules, turnpike theorems and dynamic efficiency”, which he saw as of little relevance for development planning. While Tinbergen was generally concerned with the practical relevance of economic theorems,

it is hardly accurate to describe him as eschewing optimal growth and related topics. True enough, apart from a section in Tinbergen and Bos (1962), his 1960 article was Tinbergen's last contribution to that field, but he did follow developments that took place after that, some of them led by the well-known economist Tjalling Koopmans, his countryman and "intimate friend" (Dekker 2021, 193) since the 1930s (see Koopmans 1965). This is well-illustrated by Tinbergen's 1969 Nobel Lecture on the role of models in economic analysis, which referred to optimizing "dynamic models" for infinite time periods, of the kind put forward by Edmund Phelps and Koopmans, as belonging to the "really fundamental features of economic science" (Tinbergen 1969).

One of Tinbergen's (1958, Annex 2) main innovations was his emphasis on the role of "accounting prices" as dual variables in the design of development planning (see also Tinbergen 1956a, 181; Tinbergen and Bos 1962, 41–45, with reference to Qayum 1960). Such a concept, deployed by Tinbergen and other development economists like Chenery in the 1950s, has become better known by the term 'shadow prices', which became widespread in connection with the literature on linear programming at the time—the terminology and notion of 'shadow prices' in fact go back at least to Hicks's 1939 *Value and Capital*. Tinbergen's deployment of 'accounting prices'—a term that became influential in the 1950s due to Tinbergen's usage in development economics—reflected his discussion of the 'fundamental disequilibria' characteristic of developing countries, in which capital and foreign exchanges are undervalued, while labour is in excess supply (see Chenery 1959). The neoclassical case, featuring a production function with high substitutability between factors—e.g., the Cobb-Douglas production function—implied that production factors were paid their marginal productivities (that is, 'accounting prices'), unlike the prevailing disequilibria conditions of developing countries. Samuelson (1970, 751) singled out Tinbergen as one of the "sophisticated planners" who advocated the application of "shadow prices" or "accounting prices" to labour, capital and imported goods in developing countries.

Tinbergen chaired the United Nations' (1960) report on development planning. The report assumed a long-run stability of the capital-output ratio (at a value around 3), seen as based on solid empirical grounds, "one of the most useful parameters with a fair degree of stability" (UN 1960, 11). Around that time, the stability of that ratio was listed as one of Nicholas Kaldor's famous 'stylized facts' of economic growth. Tinber-

gen did discuss in passing the restrictive assumption that output is a linear function of capital only. In general, output should be treated as a function of capital and labor and the changing relation between them. To base the projection of national output on the (stable) capital-output ratio implied a “certain type of technical change in the relevant future” (UN 1960, 11). He did mention in passing the neoclassical production function as an econometric model alternative to the adapted Harrod-Domar approach, which could be “usefully applied to some countries”—as he had done in his 1942 model of growth in developed economies (UN 1960, 11n1).

Tinbergen did not deal, in his book with Bos and other sources, primarily with development policy, but “with models that can be used in designing such a policy” (Tinbergen and Bos 1962, 2). The hard core of development planning consisted of mathematical models with empirically estimated coefficients, used through a succession of stages from macro to micro levels. Moreover, growth models themselves did not imply anything about their use by planners, in the sense that “widely different policy devices may sometimes be obtained with the same model” (Tinbergen and Bos 1962, 47). Hence, Tinbergen’s overall focus on model building—in economic theory and econometrics in general—also showed in his approach to development planning, as he attempted to build development policy on the grounds of theoretical and applied models, not just decision models.

IV. SEARCHING FOR THE ECONOMETRICS OF DEVELOPMENT

In the early 1960s, Tinbergen (1961) contributed a methodological paper on “development theory” to the *Festschrift* in honour of Johan Åkerman (Hegeland 1961)—a volume often cited mostly due to Samuelson’s chapter on “A New Theorem on Nonsubstitution”. Tinbergen’s 1961 “econometricist’s view” of economic development is not mentioned by Dekker, even though it represented his main attempt to explain how he believed economic asymmetries between poor and rich countries should be approached. Tinbergen (1984, 321–322) confirmed the importance he attached to this essay in his 1984 autobiographical reflection on his career as a development economist, in a section called “A Philosophical Interlude: The Role of Environment in Its Widest Sense”. By then, it was clear to Tinbergen that the points raised in his 1961 chapter had, against his expectations, neither been answered nor acquired any priority in development economists’ agendas.

Tinbergen's 'econometrist's view' argued for development economics as based on solid empirical foundations. He was critical of Baumol's notion of the "magnificent dynamics" of classical economists, Harrod and Schumpeter, as it lacked strong connections with measurement (Tinbergen 1961, 57; 1979, 347). Tinbergen traced the beginnings of the "scientific" era of growth and development economics, with its mix of theory and measurement, to the Australian economist Colin Clark and to his own German article, both published in 1942 (Tinbergen 1961, 57; 1979 347). As pointed out by Dekker (274-275), Clark's (1942) statistical analysis of international inequalities in the world economy made a big impression on Tinbergen. However, as Tinbergen (1979, 348) acknowledged, his and Clark's theories were "in fact different". A main difference, one may surmise, was that Tinbergen (1942)—just like Solow (1956)—could not satisfactorily explain international divergences of growth rates.

As it has gradually become clear to development economists, there are essentially two ways to explain economic divergence between nations. Per capita income convergence for countries with the same parameters was a corollary of the neoclassical growth model with diminishing returns to capital, as elaborated by Tinbergen (1942), Solow (1956), and Swan (1956). From that perspective, steady-state income divergence resulted from differences in parameters ('fundamentals') such as saving rates and population growth, since the general state of technological knowledge was supposed to be the same across countries.

In the alternative view of underdevelopment as a 'coordination failure', advanced by Paul Rosenstein-Rodan, Ragnar Nurkse, and some other development economists in the 1940s and 1950s, countries with the same fundamentals can move along divergent paths. The latter notion—which was behind the 'Big Push' development policy so influential at the time and occasionally mentioned by Tinbergen—was partly based on the assumption of increasing returns, unlike the neoclassical growth model. Tinbergen and Bos (1962, 36-37) referred in passing to some analytical hurdles posed by increasing returns—such as the presence of negative profits if firms under perfect competition charge prices equal to marginal costs—which would be fully solved by the 1980s only, when economists learned how to model economic growth with increasing returns.

Tinbergen's (1961, 49) econometric program may be understood as a suggested investigation of differences in "fundamentals" across countries, which he expressed as the influence of the "environment" formed

by “non-economic parameters”. It is clear from Tinbergen (1961, 49) that he was critical of what he perceived as a lack of attention to measurement by development economists—he referred to Rostow’s (1960) influential concept of development according to stages—able to bring “theory and observation together”. That would help to formulate development theories as “refutable hypotheses” (Tinbergen 1961, 50). The equations explaining the aggregate volume of production should include as well, apart from the amount of productive factors (as in Tinbergen 1942), “environment variables” (formed by indexes indicative of climate, institutions and the state of technology) and “psychological or ‘racial’” characteristics (Tinbergen 1961, 53).

The reference to ‘race’, repeated in 1984, set Tinbergen apart from most—but certainly not all—development economists, as it reminded of the 18th and 19th century notion of ‘national character’. Tinbergen (1961, 55) suggested as well that the volume of savings and population growth, both treated as exogenous in his 1942 model, should be explained in terms of economic variables. By the end of his 1961 essay, Tinbergen (1961, 58) claimed that “it is by no means belittling the work done by [the pioneers] when I conclude that there is a real need for a concerted programme of econometric research in the field of development theory”. However, his plea never went beyond a suggested call, with no real impact on the field or even on Tinbergen’s own research program after that.

In his assessment of Tinbergen’s work as an economist, Niehans (1990, 383–384) stated that although Tinbergen became world famous mostly as a missionary for development planning, his “lasting contributions to economic science [...] were in other areas”, particularly the theory of economic policy. This seems to be broadly compatible with Dekker’s biographical account. However, other commentators, such as Bos (1970) and Bruno (1984), have stressed instead the *scientific* character of Tinbergen’s contributions to development economics through several formal models, some of them discussed above. Hence, according to Bruno (332), Tinbergen’s ‘unique’ contribution to development economics lies in the adaptation of his 1956 *Economic Policy: Principles and Design*, a by-product of his work at the Dutch planning office, to the subsequent *Design of Development*. A formal development plan should be mainly based on a theoretical construct or ‘model’ combined with applied empirical content. Searching for a theory of economic development able to

inform development planning was part and parcel of Tinbergen's endeavour, even if not always successfully.

Dekker's quest for Tinbergen's 'uniqueness' as a development economist has not reached its goal, in the sense that, against Dekker's claim, Tinbergen did not participate in a supposed separation of development economics between 'theoretical' formulations and 'applied' planning.¹ Nevertheless, Dekker's extended research on Tinbergen as a policymaker has opened new vistas on how theory and policy were intertwined in Tinbergen's agenda. Tinbergen's distinctiveness as a development economist—as compared to the rest of the field in the post-war period—was related to the role of his neoclassical background as revealed particularly in his concern with 'optima' throughout his long career as a development economist (see Stone 1964; and, for an illustration, Tinbergen 1968). However—unlike Jacob Viner, Gottfried Haberler, and Peter Bauer in the 1950s, who argued for classical and neoclassical views of development based on the working of the market and opposed development planning and the notion of market failure in general (see Little 1982, chap. 4)—Tinbergen deployed his neoclassical background as a key element of his contributions to development planning and development economics as a whole as part of the formalization of economics, even when advancing his 'econometric' plea for the study of economic development.

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¹ "There was something unique to Tinbergen's approach to development. Whereas many of the other 'pioneer of development' were concerned with theories of economic growth and development, those issues are peripheral in Tinbergen's writings. [Instead,] Tinbergen built decision models and institutional models of how to plan" (Dekker 2021, 288).

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