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EVSEY DOMAR AND RUSSIA

MAURO BOIANOVSKY

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CENTER FOR THE
HISTORY OF POLITICAL ECONOMY
AT DUKE UNIVERSITY

Evsey Domar and Russia

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Abstract. The paper discusses Evsey Domar's role as a link between economics in the West and in Russia. The Russian heritage he brought with him from Harbin (Manchuria) to the US consisted of an interest in socialism and Russian history. He paid close attention to the 1947 Varga controversy in the USSR. Domar's rediscovery of Feldman's (1928) growth model in 1957 brought it to the attention of Western and Soviet economists alike. Soviet economic development was also discussed in his interpretation of Preobrazhensky's (1926) work on agricultural and industrial sectors. His 1966 seminal article on producer cooperatives called attention to Tugan-Baranovsky's 1915 book on the topic. Domar's interest in history resulted in his 1970 hypothesis about the origins of serfdom and slavery. Soviet economists paid some attention to Domar's growth models, especially those involving depreciation and the time structure of capital goods.

JEL classification. B22, B24, N00

Key words. Domar, Russia, economic growth, socialism, economic history

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1. Domar's Russian Heritage

1.1

In August 1936 Joshua Domashevitsky arrived at the port of Los Angeles to study economics in the U.S., after crossing the Pacific Ocean on a Japanese vessel that had left from Kobe. The point of departure of his journey was the city of Harbin in Manchuria, where his family had settled in 1916 coming from Lodz (now a Polish city, then Russian), where he was born in 1914 to Sarah and David Domashevitsky – a small-scale businessman (importer) who regarded himself a social democrat Menshevik (Domar 1992; Johnson and Ley 2013). Joshua would change his name to Evsey David Domar upon migrating to America, where he received a B.A. in economics at the University of California at Los Angeles (1939), followed by an M.A. in mathematical statistics from Michigan University (1941) and a Ph.D. in economics from Harvard University in 1947.

By that time, under the influence of Alvin Hansen, his Ph.D. advisor and a leading Keynesian economist, Domar was already well known due to his seminal contributions – together with, but independently from, Roy Harrod (1939, 1948) – to the founding of growth economics as a new research field in Keynesian macroeconomics, expressed in the so-called “Harrod-Domar growth model” (Domar [1946] 1957, [1947] 1957; see Boianovsky 2017, 2021a). Domar became an American citizen in 1942; he lived in that country until his ultimate death in Massachusetts in 1997. Domar's main appointments throughout his professional lifetime were held at the departments of economics of Johns Hopkins University from 1948-1958 and of the Massachusetts Institute of Technology (MIT) from 1958 until retirement in 1984, with shorter periods at the Federal Reserve System (1943-46), the department of economics and the Cowles Commission at the University of Chicago (1947-48), and as Visiting Professor at Brandeis University (1986-1990).

Evsey Domar was among interwar period émigrés who “took readily to the American scene” and made key contributions to the creation of a “single international ‘mainstream’ economics” increasingly dominated by American economic research (see Craver and Leijonhufvud 1987: 175). Indeed, Domar was one of the protagonists of the Keynesian avalanche that took the economic profession by the storm in the U.S. and other countries from 1930s-1950s (Domar 1996; Colander and Landreth

1996). Most of his essays on Keynesian growth economics – including one drafted in 1944 on the dynamics of public debt – were collected in Domar (1957).

Nevertheless, that does not mean that Domar did not address Russian or Soviet topics, especially after the early 1950s. In fact, from 1949-1951 he served as Director of Russian Studies, Operations Research Office, at Johns Hopkins University (1949-1951), and from 1951-1955 lectured as Visiting Professor at the Russian Institute of Columbia University. As put by Domar (1950b: 75), “the study of the Soviet Union is a most fascinating task, because it challenges our established set of ideas and gives rise to new ones.” In 1956 Robert Solow invited Domar to come to MIT as Visiting Professor.

We would love to have you teach a graduate course in Russian Economics. It’s something we can’t offer ourselves, and I think there would be a lively interest. It could fit in our Economic Development sequence, or almost anywhere else, depending on what you decide to cover. (Solow 1956)

That was also the year Solow published his neoclassical growth model, which would soon dominate growth economics, a topic he and Paul Samuelson taught MIT graduate students at the time. Domar accepted the invitation and eventually took up a permanent position at MIT. He kept his interest in growth and development economics (which he lectured at MIT at undergraduate level in the 1960s), but it was above all Russian and Soviet economic performances and history that attracted his attention. The shift in Domar’s research agenda is clearly displayed in his second and last collection of essays, which featured papers on comparative economic systems, socialism and Russian 19th century history, written from 1960s-1980s (Domar 1989).

The Cold War context goes a long way explaining the Western demand for economic expertise about the Soviet Union in the post-war period (or even during World War II), which became known as Sovietology (see e.g. Engerman 2010). Many economists involved were Russian (or Ukrainian) émigrés, including Alexander Gerschenkron (1904-1978), Gregory Grossman (1921-2014) and Alexander Erlich (1913-1985). Of course, a number of important Sovietologists were not émigrés (e.g. Abram Bergson), and some prominent Russian émigrés did not produce much about the Soviet Union or Russia throughout their careers (e.g. Jacob Marschak, Simon Kuznets and Wassily Leontief). Gregory Grossman (born in Kiev) spent part of his youth in Manchuria, like Domar, before emigrating to the U.S. in 1937.

Harvard economic historian Gerschenkron was particularly influential as a leading Sovietologist and economic historian of Russia, partly through the Russian Research Centre at Harvard University, which funded the research that resulted in Domar's (1950a) article on the sometime leading Stalinist Hungarian-Soviet economist Eugen (Jenő) Varga. Domar was a member of that network, even if he did not regard himself a Sovietologist (Domar 1989: xi). Indeed, it was G. Grossman (then Gerschenkron's student) who first called Domar's attention in the early 1950s to Soviet engineer and economist Gregorii A. Feldman's (1884-1958) mathematical growth model of 1928, based on Marx's reproduction schemes, intended as a theoretical foundation for the long-range planning of the Soviet economy (Domar 1952: 480, n. 3; 1957b: 223, n. 1). Feldman and his model had fallen into complete oblivion in the USSR and the West after the early 1930s and throughout the Stalinist era, until Domar (1957b) rediscovered and formally restated it.

Likewise, it was through another member of the Russian studies and Sovietology networks – Steven Rosefielde (then Bergson's student at Harvard) – that Domar (1966a: 735, n.3) heard about the Ukrainian/Russian economist M. Tugan Baranovsky's ([1915] 1921) pioneer theoretical and empirical study of producer cooperatives – currently called “Labour-Managed Firms” – a topic Domar (1966a) discussed in detail in his path-breaking article on Soviet collective farms (*kolkhozes*). Moreover, Erlich's (1950) article about Evgeni Preobrazhensky (1886-1937) and the extensive 1920s Soviet industrialization debates brought the work of that Russian economist – which Domar found even more interesting than Feldman's in some respects (Domar 1966b) – to Domar's attention.

1.2

The search for Domar's Russian heritage has focused so far on some formal similarities between Feldman's (1928) and the Harrod-Domar growth models. From the fact that Domar was born in Russia and lived in a Russian town until 1936, some authors have inferred that the similarities were not coincidence, but the result of Domar's familiarity with the Russian 1920s economic literature on growth, supposedly acquired in Manchuria before he emigrated elaborated his 1940s growth models. Hence, Barnett (2008a: 4) has suggested that “Domar's [1940s] growth theory ... owed an important debt to [its] Russian origins.” According to Easterly (2001: 31), “the Soviet experience inspired the Harrod-Domar model.” Similarly,

Boetke (1990: 147) has stated that the formulation of the Harrod-Domar model was “directly influenced by the Soviet [1920s] discussion and later experience.” Screpanti and Zamagnani (2005: 315) went as far as asserting that “Domar was one of the few contemporaries of Feldman who appreciated his work, from which he was inspired to construct his own model” in the 1940s.

Such claims, however, are historically inaccurate and make no sense whatsoever. They disregard the fact that Domar only got to know about Feldman’s model (and the 1920s Soviet industrialization debates in general) around 1952, which led to his 1957b essay with its central point that Feldman (1928) *differed* from Domar’s (1946, 1947) and Harrod’s (1939) models in some key aspects. Domar was a teenager when the industrialization debates took place in Moscow. He did attend for a semester lectures at the Economics Department of Harbin’s State Faculty of Law in 1930-31, when he learned basic statistics, and notions of European history, accounting and law, but no economic theory (Domar 1992; 1996). Domar’s (1946, 1947) and Harrod’s (1939) growth models tackled dynamic issues of capitalist economies from a Keynesian perspective, with no influence of or inspiration from Soviet theoretical debates and planning experiences. Whereas Domar, due to his Russian background, would later become attracted to those 1920s debates in the context of the 1950s/60s development economics, Harrod never showed interest on Feldman and the Soviet literature on growth planning (see Boianovsky 2018).

The Russian heritage that Domar brought with him to America in 1936 should be sought elsewhere, not in some alleged Soviet influences on his 1940s growth models. As Domar (1992; 1996) recollected, during his youth in Manchuria – in the cities of Harbin and Dairen, where he moved to in 1934 to work as an accountant – he became attracted to history as a subject and to socialism as a political-economic system. The “first love of my youth was, and now of my old age is, history” (Domar 1992: 118). Domar’s interest in history, upon reading Russian novelists such as Leon Tolstoy, would take him to economics as the key to understanding society and its history. As for socialism, Domar explained how

To a person of Russian background, socialism has a significance that an American reader may not appreciate. In tsarist Russia, being a socialist made one an automatic opponent of autocracy; it was almost required for maintaining a minimum degree of self-respect ... To my relatives, as to many millions of others, socialism was a secular religion, the great hope for a better

world. Harbin was too close to the Soviet Union to escape its influences. After my graduation from high school, I made good use of the socialist collection that our modern library possessed. My interest in socialism never disappeared, but my serious work dates back to the fifties. (Domar 1992: 126)

Harbin Central Library was directed by Nikolai Ustrialov, a professor at the Faculty of Law, regarded by Domar (1992: 120) as one of his three “great teachers” (the others were J.A. Schumpeter and J. Viner). Ustrialov (1890-1937) was a leading pioneer of National Bolshevism who, after a period of exile in Harbin, returned to the Soviet Union in 1935. In 1937, during Stalin’s Great Purge, he was sentenced to death. Harbin was founded by Russians in 1898, a couple of years after the Russian government obtained permission from the Chinese to build, across Northern Manchuria, a continuation of the Trans-Siberian Railroad to Vladivostok (Domar 1996: 180). It soon became a boomtown that attracted many immigrants, comparable in its growth to St Petersburg or San Francisco during the Gold Rush. By the time of the 1917 October Revolution, its Russian-speaking population reached around 127,000 people (Karlinsky 1989: 284-85). Around 1920, the Chinese took over the administration of Harbin, but it remained well into the 1940s essentially a Russian town from both cultural and economic perspectives, with a high, cosmopolitan standard of living.

The young Domar and his émigré family found in Harbin in 1916 an “almost totally Russian city, populated mainly by people with roots in the south of European Russia” (Karlinsky 1989: 285). Distinguished Russian, Swiss and Italian architects planned its urban landscape. The Domachevitsky family’s expectations when they fled Lodz were confirmed as Harbin escaped such turbulent events as the October Revolution, the civil war and Stalin’s collectivization. Opera and theatre attracted renowned international artists, which, together with a large number of high-quality Russian schools, periodicals, art galleries and libraries, attested to the “outstanding intellectual level of the multinational Harbin community” (Karlinsky 1989: 286) in which Evsey Domar grew up.

Barnett (2008b) has examined a small group of prominent Russian émigré economists who came to the U.S. (J. Marschak, S. Kuznets and W. Leontief) to argue that their intellectual Russian “baggage” and influences played significant roles in the initial stages of their American careers, but not later. In the case of Domar (who, like

Gerschenkron, is not mentioned by Barnett 2008b), on the other hand, his Russian heritage became increasingly relevant as he progressed through the mature stages of his work as an economist. The themes of the working of the Soviet socialist economy and of the origins and role of serfdom in pre-socialist Russia became dominant in his agenda since the mid 1950s (Domar 1957b; 1966a; 1970; 1974; Domar and Machina 1984). As one of the representatives of the new generation of economic model builders in the 1940s (see Boianovsky 2017), Domar would produce some of his most mathematically sophisticated models as part of his treatment of economic growth and efficient allocation under socialism (Domar 1957b; 1966a; 1974).

Domar played a significant role as a link between Russian (or Soviet) and West economics. Those were especially the cases of Domar's (1957b) restatement of Feldman's (1928) two-sector growth model with non-shiftable capital, and of his 1970 well-known thesis that the economic basis for the introduction of coerced labour – serfdom or slavery – was a low land-to-labour cost. Domar (1970) formally elaborated a hypothesis suggested by Russian historian Vasily Kliuchevsky (1841-1911) in his classic [1906] 1937 account of Russian serfdom in the 16th and 17th centuries. Domar was also instrumental in bringing to the attention of Western economists the “Varga controversy” of 1947-1949 as an illustration of the poverty of Stalinist economics (Domar 1950).

Together with the Feldman 1957b essay, Domar's (1966a; 1974) articles on self-management and incentives mechanisms constituted fundamental contributions to the theory of socialist economies (Wagener 1998). Domar (1966a) noticed some similarities between his analysis and Tugan-Baranowsky's ([1915] 1921) work on cooperatives. The starting-point of Domar's 1974 article was Premier Alexey Kosygin's famous announcement on 27 September 1965 of Soviet Economic Reforms, including an emphasis on profits by socialist firms. As discussed below, the consumption of Domar's economic ideas by Soviet economists was generally restricted to aspects of his growth models – particularly Domar's ([1953] 1957) analysis of depreciation and growth, and his 1957b “Soviet model”, which eventually brought Feldman's model to light in the USSR in the late 1960s after decades of silence.

2. The Varga controversy, Soviet economics, and underconsumption

Domar's (1950a) detailed account of the "Varga controversy" was his first foray into Soviet economics, written when he was Director of Russian Studies at Johns Hopkins. Varga – Director of the Moscow Institute of World Economy and World Politics from 1927-1947, a prominent Marxian economist and the Soviet Union's most influential analyst of the capitalist world economy during that period – has been described as the 1930s-40s "Stalin's economist" (Mommen 2011). Varga's 1946 book on *Changes in the economy of capitalism resulting from the Second World War* was subjected to public discussion and criticism in May 1947 in Moscow. The book was charged as anti-Marxist and revisionist. That was followed by several critical articles in the new Soviet economic journal *Voprosy Ekonomiki* – which had superseded the journal edited by Varga – and on the Soviet press, together with discussions in international newspapers and journals.

The controversy turned into a *cause celebre*, as put by Domar (1950: 132). After some resistance and attempts to defend himself, Varga eventually recanted in 1949 his views of post-war capitalism. Domar's 1950 *AER* article became the main contemporary economic source about the Vargas affair. Domar (1950a: 133) focused on parts of Varga's 1946 book, on some other writings by Varga and on aspects of the debate that "may be of particular interest to American economists."

Varga made two main predictions in his 1946 book and in the public debates that followed its publication. He argued that world capitalism would last for at least another decade, when it would be hit by a major overproduction crisis caused by excessive capital accumulation in relation to consumption demand. His second prediction – which partly contradicted the former one – was that the war had brought about significant changes in the ability of capitalist states to engage in economic planning. Both predictions raised criticism from other Soviet economists, who complained about the low theoretical standards, not just of Varga's book, but of Soviet economics in general (Domar 1950a: 143, 150). However, no analysis was provided during the debates about the causes of that "strange intellectual timidity among a people who in other fields, such as mathematics, have achieved most admirable results" (150). According to Domar, the problem came mostly from the requirements imposed on economic theoretical work in the USSR at the time.

It must conform to a theoretical structure whose creator died in 1883, and to the interpretation of this structure by Lenin, now gone some twenty-five years. Further, no statement may challenge any article or pronouncement by Stalin ... These three sets of restrictions do not result in many [degrees of freedom] left. Domar (1950: 143)

Domar would visit the Soviet Union for the first time in early November 1959, when he met a group of economists at the Academy of Sciences, among other appointments (see Boianovsky 2021c). His travel impressions were recorded in a lecture delivered at Amherst University (Mass.) shortly after. “For one time”, he reported, “I talked to a man who did not throw Marxism at me” (Domar 1959). He noticed some positive signs of change, as compared to the poverty of Soviet economics in the Stalinist era (Stalin had died in 1953). “It’s only now that Soviet economists have become interested on linear programming and input-output matters, invented in the USSR.” Domar probably had in mind recent works by L. Kantorovich, V. Novozhilov, among other Soviet mathematical economists. Leontief (1960), who visited the USSR earlier that same year, shared the same opinion (see Campbell 1961 for a contemporary assessment, and Wagener 1998 on the general poverty of Soviet socialist economics). A few years later, Domar attended a conference on Mathematical Techniques and Soviet Planning, held at the University of Rochester in May 1965, which gathered a select group of American – but not Soviet – economists (see Hardt 1965).

As discussed by Domar (1950a: 136-139), Varga based his thesis that capitalism was moving towards its end on two Marxist laws: the effect of the (relative) impoverishment of the proletariat on underconsumption, and the declining rate of profit. However, Domar contended, Varga did not maintain those “laws” consistently. Domar wrote the definition of the rate of profit as $\pi = P/K$, where P and K are total profit and capital stock. P is a fraction γ of national income Y , so that:

$$\pi = P/K = \frac{Y}{K/Y}$$

A decline in π would result from either a lower γ , a higher K/Y or both. However, γ was supposed to rise because of the “impoverishment” of workers. Hence, a falling π must depend on a rising K/Y due to marginal diminishing returns (or to increasing organic composition of capital for a Marxist economist). However, due to technical

progress, Varga denied the existence of the law of diminishing returns to capital accumulation. Domar agreed that capital deepening had not been an observed feature of the American economy. But, then, if K/Y is stable, a rising γ should bring about an increasing π , against Varga's hypothesis. Again, American data indicated that γ had remained stable in the long run – and, consistently with Domar's accounting identity, so had the rate of profit (Domar 1952: 492).

Varga's notion of over-accumulation of capital in relation to consumption was close to Paul Sweezy's (1942, chapter X) theory of underconsumption as the cause of the upper turning point, as Domar (1950a: 136) noticed. Domar probably had attended Sweezy's lectures on Marxian economics at Harvard in the early 1940s. He would discuss Sweezy's Marxian underconsumptionist model in some detail a few years later (Domar [1948] 1957, section IV). Sweezy's (1942) model was an attempted demonstration of the flaws of Mikhail Tugan-Baranovsky's well-known argument – developed in the first chapter of his 1901 *Studien*, a revised German version of the first Russian edition of 1894 – about the logical impossibility of underconsumption crises. Curiously enough, Domar did not refer to Tugan-Baranovsky (1901), although he was certainly aware of it, from Sweezy's (1942, chapter X) long quotations and critical assessment, and probably from Sweezy's Harvard classes as well. Nevertheless, one may surmise that Domar ([1948] 1957: 109-10) was implicitly addressing Tugan's point when rejecting Frank Knight's (1944) similar assumption that the possibilities of capital deepening were unlimited and its corollary that profitable capital accumulation was unbounded.

Tugan-Baranovsky (1901) deployed, for the first time after Karl Marx, the expanded reproduction schemes in order to argue that “capitalist production creates its own market” – in the sense that, no matter how low consumption is, the supply of goods cannot exceed demand, provided correct “proportions” are kept between the various sectors of the economy. Hence, crises can only arise from partial overproduction, not from general excess supply (Tugan-Baranovsky [1901] 2002: 26). Domar did not have time for Tugan's “anarchy of the market”. He probably agreed with his Harvard professor J.A. Schumpeter's (1954: 1126, n. 9) assessment that the first chapter of Tugan-Baranovsky's *Studien* was a “distinctly poor performance.”

However, Domar did share with Tugan-Baranovsky (1865-1919) the rejection of the notion that the purpose of all production is consumption. In a growing economy, investment for further investment is the rule (Domar [1948] 1957: 123;

1957b: 235). Hence, the capital-output ratio, instead of the capital-consumption ratio as in many accelerator models and in Sweezy's (1942: 182) formulation, should be the relevant variable. Domar parted company with Tugan (and Knight), however, by assuming that capital deepening was limited and that the "capital coefficient" between output and capital was relatively stable. If that coefficient could be "anything", there could be no over-accumulation of capital, as in Knight and Tugan, Domar [1948] 1957: 111) maintained.

Domar's ([1948] 1957: 122-128) correction and reformulation of Sweezy's (1942, appendix to chapter X) model "salvaged" underconsumption theory from Tugan's previous attack (Howard and King 1992: 121). Domar achieved that by deploying the (stable) capital-output ratio and applying the general framework of his 1946-47 growth model to show that a rising propensity to save (as assumed by Sweezy) was not necessary to produce excess increase of capacity in relation to the path of aggregate demand, which was Domar's sense of "underconsumption". Excess capacity resulted from an actual growth rate below the required equilibrium rate given by the output-capital ratio (σ) times the saving ratio (α), as expressed by Domar's famous formula $r = \sigma \alpha$ (see Boianovsky 2017; 2021a). Hence, from Domar's standpoint, underconsumption provided an important link in the history of macroeconomics, despite its often-imprecise formulation (see Boianovsky 2021b).

3. Feldman, Preobrazhensky, and economic development

3.1

Domar ([1946] 1957: 70; 1950b: 74; 1952: 480) often praised Marx and Marxian economists for their concern with economic growth and the relation between capital accumulation and employment. However, the development of a "substantial theory of economic growth" along Marxian lines had been delayed by the "time and effort" wasted by Marxian economists in "defending their master's virtue" (Domar 1952: 480). Domar (1957a: 12), in the foreword to his 1957 collection, described Marx as a "great sage" but a "poor theorist" and model-builder. That situation would change – at least temporarily – by the appearance of some "highly elaborate and interesting models" in the 1920s Soviet economic literature, especially by Feldman (1928). Such

multi-sector growth models (based on Marxian reproduction schemes), Domar (1952: 480, n. 1) pointed out, were “more fully developed than similar attempts made in the West, with the exception of Leontief’s works.”

Before he got to know about Feldman’s 1928 model around 1952, Domar (1950a: 140) had described Marx’s reproduction schemes, with their division of total output into producer goods (Department I) and consumption goods (Department II), as “logical monstrosity” and “stone axe”. The main problem, from Domar’s perspective, was the confusion between variable capital (a stock) and the payroll (a flow), and between constant capital (a stock) and gross investment and depreciation (flows). Sweezy (1950) reacted by pointing out that no stocks are involved in Marx’s schemes; all items are flows. Domar (1950c) accepted Sweezy’s point, but insisted that the results obtained from the schemes – such as the equilibrium condition that the demand for consumption goods coming from Department I must equal the demand for capital goods by Department II – may have been significant in the 19th century, but were “hardly so” in the 1950s. Moreover, once the apparatus was applied to the theory of value and profit rate, the stock-flow issue came back, as witnessed by difficulties involving rates of turnover and production periods.

Domar (1950c: 407) claimed that problems with the Marxian schemes had prevented their general use. E. Preobrazhensky’s 1931 attempt was an exception, but he got lost in “hopelessly involved numerical examples” as he tried to incorporate into the schemes the corresponding allocation of output by expenditures (investment and consumption) in a growing economy (see also Domar 1957b: 225, n. 5). Surprisingly, Domar did not mention Tugan-Baranovsky’s (1901) early numerical exercises with the schemes, even though Tugan’s results were not much better. Domar’s low opinion should dispel any notions that he was influenced by the Marxian scheme of expanded reproduction of capital when formulating his own 1946-47 growth models.

Nevertheless, upon studying carefully Feldman’s 1928 Soviet growth model in the mid 1950s, Domar changed his mind about the usefulness of the Marxian schemes. Stock-flow problems persisted in computations of the rate of profit, but that was not a matter of concern for Feldman (1928) or Domar (1957b: 226, n. 5). For the first time, according to Domar, mathematics was applied to the reproduction schemes, which resulted in the first ever Marxian growth model. The Soviet engineer-economist modified the schema so that Department I included all activities that enlarged productive capacity, while Department II encompassed all activities that

sustained the level of output, a division not always feasible to implement (Domar 1957b: 225-227). Moreover, along Marx's original schema, the existing capital stock could not be shifted from one sector to another, although the division of the investment flow between the two sectors was flexible. Therefore, the proportion of consumption and investment in total output was determined not by the propensity to save, but by the respective capital stocks and capital coefficients in each category. The choice of the current composition of output was dependent on the inherited structure of capital. The key variable determining economic growth was the capacity to produce capital goods in Department I, as determined by the fraction of total investment retained by that sector. If such capacity were low, the *potential* propensity to save cannot be turned into investment and would be wasted.

Domar was attracted to the ability of Feldman's model to illuminate the planning of capital accumulation as part of the economic development process. Unlike Domar's (and Harrod's) growth model, Feldman assumed a perfectly elastic labour supply, absence of effective demand constraints and business cycles in a planned socialist economy with two sectors. Again, differently from Domar and Harrod, that model was designed for the formulation of development *policy*. It led naturally, especially through Domar's (1957b) reconstruction, to the study of optimal growth paths. Feldman's (1928) formulation was long and often hard to follow. Domar (1957b) demonstrated rigorously Feldman's point that an increase of investment in Department I at the expense of investing in Department II will generate a permanently higher level and growth rate of consumption in the long run (= rate of growth of investment), after a gradual increase of the rate of growth of consumption in the transition. Feldman's model was discussed and mentioned in Russia for the last time by N.A. Kovalevskii (1930), Feldman's colleague at Gosplan, the Soviet State Planning Commission (Domar 1957b, section V).

Domar's thorough restatement of Feldman's two-sector growth model with non-shiftable capital became quite influential, especially at MIT, the main centre of research of growth economics in the 1950s and 1960s. Ronald Findlay (1962: 85), for instance, thanked Domar for his MIT lectures on Soviet economics, which brought Feldman and Preobrazhensky to Findlay's attention. Domar (1957b) would soon be combined with new mathematical techniques – such as the Soviet mathematician Pontryagin's (1962) maximum principle – in the then new literature on optimal growth. That is well illustrated by highly formal articles on optimal growth in multi-

sector economies with non-shiftable capital, based on MIT PhD theses, such as Weitzman (1971) and Bose (1968), with references to Domar (1957b) and to Feldman's model. Surely, the Marxian origins of Feldman's original model all but disappeared in those optimal growth approaches. The Marxian flavour was kept by a different group of authors influenced by Domar's (1957b) rediscovery, e.g. Maurice Dobb (1967).

It helped to spread the model the fact that the Indian planner P. Mahalanobis (1953) had independently developed a brief discrete-time version featuring some similarities with the Domar-Feldman continuous-time version, as Domar (1957b: 230, n. 16) noticed. References have sometimes been made to a "Domar-Feldman-Mahalanobis model" (e.g. Findlay 1966). The eventual translation of Feldman's original article (Feldman [1928] 1964) made it better known in the West, but that did not diminish interest in Domar's (1957b) restatement. Indeed, Nove and Nuti (1972) chose to reproduce Domar (1957b) in their collection of readings about socialism, instead of Feldman ([1928] 1964). Likewise, Jones' (1975, chapter 5) careful textbook rendition of Feldman's growth model was based on Domar (1957b).

3.2

As Engerman (2010) has pointed out, Domar's 1957 essay on Feldman, as well as Sovietology in general, should be read in the context of the intense interest in development economics and economic development at the time. Domar (1967: 636), as part of a discussion on the occasion of the centenary of Marx's *Capital*, praised the reproduction schemes, as modified by Feldman, as a main contribution for development planning of countries beset by limited capacity of the capital goods industry, such as the USSR in the 1920s-1930s and developing countries in general. Besides Feldman (1928), there was another contemporary Soviet development model of Marxian extraction, articulated but not formalized by Preobrazhensky ([1926] 1965). It was also a two-sector model, but of different sort: a socialist industrial sector drawing on the surplus of the peasant-owned agriculture, a situation Preobrazhensky called "primitive socialist accumulation" after Marx's "primitive capitalist accumulation". Domar (1967: 636) found Preobrazhensky's 1926 implicit model "more interesting" than Feldman's formulation.

Preobrazhensky's ideas on development had been introduced into Western economics by Erlich (1950) and, at MIT, by Domar's classes. The 1965 translation of

his 1926 book added to the interest. In an insightful review-essay, Domar (1966b: 252) remarked that “for all its virtues”, Feldman’s model had “one basic defect: it was concerned with capital only and completely excluded labour”, as Feldman did not regard labour as a scarce limiting factor. Even under the assumption of unlimited supply of labour – a concept later turned into the backbone of development economics by W.A. Lewis; see Boianovsky 2019 – “workers had to be fed, clothed and housed” (Domar 1966b: 253). Like many other developing countries, modern industry in 1920s Soviet Union was “but an island in a peasant sea”. The inter-relations between the industrial and agricultural sectors comprised a main economic issue that could be tackled in ways analogous to the terms-of-trade problem between a domestic (industry sector) and a foreign (agriculture sector) country (255). Every extra ruble obtained from peasants, in exchange for manufactured goods, could be used to feed a larger industrial labour force and speed up capital accumulation. The essence of Preobrazhensky’s problem was, according to Domar (1966b: 253), to decide how the Soviet government should deal with the peasants in order to maximize industrial output.

Domar (1957b: 229, 245) had already observed that “production is independent of consumption” in Feldman (1928), who excluded the effect of consumption standards on the “ability and incentive” of people to work and on their “willingness to obey”. Analytically, whereas the Domar-Feldman model was an “open” model – in the sense that consumer goods only play a role as component of final demand – Preobrazhensky’s formulation pointed to a “closed” model – meaning that consumer wage goods are treated as inputs that determine labour supply, as in classical economics. Rigorous “closed” multi-sector models, such as von Neumann’s well-known model, do not feature primary production factors. Arthur Lewis (1954) shared that notion, although only implicitly (see Feldman 1966; Boianovsky 2019). Preobrazhensky did not develop a formal model; Domar (1966b: 253) indicated how such a model should be built, referring to Findlay (1966).

Models incorporating Feldman’s and/or Preobrazhensky’s assumptions were “popular” among Domar’s MIT graduate students in the 1960s (Domar 1967: 636). Dixit (1969) provided a first formalization of the problem of the marketable surplus and growth in dual economies, partly under Preobrazhensky’s inspiration. Domar’s lectures and writings on the 1924-1928 Soviet industrialization debates continued to bear fruits later on. Another former MIT student from the 1960s would take up the

issue again in the 1980s: in articles with R.K. Sah, Joseph Stiglitz discussed in detail under what conditions Preobrazhensky's proposition, that the socialist state should increase its surplus and capital accumulation by turning the terms of trade against the peasants, was valid (Sah and Stiglitz 1984; 1986).

4. Cooperatives, incentives, and efficiency under socialism

The Soviet policy of fast industrialization, through intense capital accumulation and transfer of peasants into industry, suggested by Feldman and Preobrazhensky, could be deduced from Marx. After the end of the stage of "primary socialist accumulation", further economic growth of the USSR depended on the planning of efficient resource allocation. But here, Domar (1967: 637) pointed out, "there is practically nothing that the Russians can take from Marx". He anticipated that Russian economists would continue to "venerate [Marx] in word and disregard him in deed", a process that had already begun in the mid 1960s as they increasingly managed the Soviet economy by means of prices and profit. Domar was implicitly referring to Premier A. Koyngin's announcement of the 1965 economic reforms, a process led by Russian economist E.G. Liberman (see e.g. Liberman 1965).

The central issue, according to Domar, was the incentives mechanism to induce managers of socialist quasi-monopolistic companies to achieve efficiency. Inspired by the Soviet reforms, Domar (1974) would put forward a bonus plan formalized in a detailed mathematical model. He did not mention Liberman or other Russian economists, but instead referred readers to Felker's (1966) overview of the economic discussions preceding the reforms. From Domar's standpoint, the main theoretical reference was Oscar Lange's (1936-37) classic essay on socialist planning. Domar (1949) had been long attracted to that topic. He accepted Lange's result that socialist managers should be instructed to equate marginal costs to prices in order to produce optimal quantities of goods. But, "what incentives will society offer to make them behave in this manner? And what method will be used to determine that they so behave?" asked Domar (1949: 174). Lange and economic theory in general did not provide an answer to that. It took Domar (1974) some time to provide – as provoked by the Soviet reforms – a first full-fledged model showing that the dependence of

price-setting managers' bonuses on a weighted sum of profits and revenue pushes monopolies towards marginal cost pricing through an iterative process (see Persky 1991; Tam 1981).

Apart from his 1974 piece, Domar produced yet another microeconomic paper related to allocative efficiency under socialism. Instead of monopolistic behaviour as in 1974, Domar (1966a) tackled the economics of producer cooperatives in a competitive environment. His mathematical model was supposed to apply, under ideal conditions, to the working of Soviet collective farms, which he had visited in 1959 (Domar 1959). He was inspired by Benjamin Ward's (1958) pioneer essay on theoretical aspects of the Yugoslavian experience with cooperatives (based on Ward's PhD thesis supervised by G. Grossman). Apart from Ward, Tugan-Baranovsky ([1915] 1921) was the only theoretical work on the topic mentioned by Domar (1966a). Tugan's long book on the *Social basis of cooperation*, although a classic, has never been discussed in any detail in the literature, probably because it is only available in Russian (Rapoport's 1918 review is informative but not strong on the analytical side).

Domar (1966a: 735, n. 3) informed that a "very interesting book on cooperatives was published by Tugan-Baranovsky. His conclusions were very similar to mine..." Apparently, Domar had a better opinion about Tugan as an expert on cooperatives than as a macroeconomist (see section 2 above). Domar's (1966a) article – an influential contribution to the economics of property rights in general – effectively launched the new field of "Labour-Managed Firms" (LMF) (see Bonin and Putterman 1987; Putterman 2008). Domar followed Ward in assuming that the objective of LMF was to maximize revenue per worker net of other charges. Ward (1958) had established the surprising result that, with labour as the only variable input, the LMF would respond to a price increase by reducing optimal employment and output level. Domar (1966a) generalized Ward's analysis for any number of inputs and outputs, but proved that a perverse reaction by a cooperative to higher prices was unlikely. Domar's results followed from his investigation of the effects of the incorporation of labour supply in the model, as well as of the presence of other variables inputs besides labour and of the reallocation of labour between different outputs of the LMF.

However, if Domar's analysis solved the problem Ward's paradoxical conclusions, it reaffirmed the puzzle of why, if cooperatives were democratic efficient

arrangements, were they relatively rare. Tugan-Baranovsky ([1915] 1921) had anticipated as much. “Has Tugan-Baranovsky’s pessimistic prognosis (of 1921) been vindicated? Does co-op democracy interfere with efficient management?” asked Domar (1989: xvi) when his 1966 article was reprinted. According to Tugan-Baranovsky ([1915] 1921: 249-250), successful cooperatives have an incentive to substitute non-members hired workers for retiring members, leading to a concentration of profits by a reduced member group, until it collapses to a capitalist firm with just one member (the owner):

The better the business of the producer cooperative, the more numerous becomes the group of hired wage labourers. This process comes to its conclusion when the members of the cooperative ... stop working themselves and become shareholders of the enterprise. Absolutely nothing remains of the producer cooperative – in its place grows a capitalist enterprise. (Tugan-Baranovsky [1915] 1921: 249; quoted from Ben-Ner 1984: 249).

Domar brought Tugan’s analysis and forecast to the attention of Ben-Ner (1984: 249), who formalized the cooperatives instability process. After that, references to Tugan-Baranovsky ([1915] 1921) have become common in the LMF literature, although his book, due to linguistic barriers, has remained largely unread in the West.

5. Russian serfdom and factor endowments

The central institution in the history of pre-socialist Russia was agricultural serfdom. Although serfs were emancipated in 1861, serfdom continued to influence the Russian economy and society until much later. In 1970 Domar put forward a path-breaking model of coerced labour, applicable not just to serfdom but to American slavery as well. Domar (1970) became one of his most influential papers, second only to his 1946-47 pieces on growth economics. That paper represented the culmination of Domar’s passion for history, born during his days in Harbin. Domar (1970) resulted from reading Kliuchevsky’s ([1906] 1937) analytical historical account of Russian serfdom. He started working on the ideas for the paper and teaching on the topic shortly after his wife presented him in the 1950s with the 5 volumes of Kliuchevsky’s

“Course of Russian History”. Domar (1970) brought Kliuchevsky – whom he regarded as “the greatest Russian historian” – to the attention of economic historians worldwide (Domar 1992: 125).

As brilliant and suggestive as Kliuchevsky’s description of serfdom was, the Russian historian (“being a historian and not an economist”, as put by Domar 1992: 125), did not elaborate a model to explain its causes, which was the task performed by Domar (1970). From a broad perspective, Domar’s 1970 paper shared with his 1966a and 1974 analytical pieces on socialism a concern with general aspects of property rights. Summing up Kliuchevsky’s account, Domar (1970: 18-19) noted that after mid 16th century, “as the central areas of the [Russian] state became depopulated because of peasant migration into the newly conquered areas in the east and southwest ... under the pressure of the serving class ... the government gradually restricted the freedom of the peasants ... to move ... [until] they became ensnared by the middle of the 17th century.”

That was the starting-point of Domar’s well-known hypothesis that both serfdom and slavery alike are caused by an abundance of land relatively to labour. The scarce factor of production in Russia or in the American South was not land but labour. If non-working landowners were to obtain a rent, it had to come from the ownership of a scarce factor, that is, labour, with its relatively high marginal productivity. Hence, the assumption was that the net return of enslaving a fraction of the population rises with the land-to-labour ratio. As put by Domar (1970: 21), one could not have simultaneously free land, free peasants and an aristocracy of landowners – only two elements, but never all three, could be found in reality. Domar’s (1970: 23) model predicted that, as population increases and the economy turns Malthusian, labour becomes abundant with a falling marginal product toward subsistence level, which brings about the end of coerced labour. Interestingly enough, both Domar (1970) and Lewis (1954) were concerned with the implications of factor endowments for underdeveloped economies. However, they focused on symmetric cases: labour scarcity and land abundance by Domar, and labour surplus and land scarcity by Lewis (see Engerman and Sokoloff 2012: 50).

Domar’s (1970) verbal model about the origins of serfdom has been formalized (e.g. Conning 2004; Acemoglu and Wolitzky 2011). Moreover, it was an important element of Domar’s course on Russian economic history at MIT over the years (see Temin 2014, who was Domar’s graduate student in the mid 1960s and

colleague from 1970s-80s at MIT). Domar's graduate students in the 1970s (some of them from neighbour Harvard) included a number of Brazilian researchers who wrote papers and PhD theses about Brazil's long extensive experience with slavery – the most important one globally, together with the American South – partly based on Domar (1970) (see e.g. Reis 1974; Camargo 1977; Lago 1978). And, of course, Domar's model has been extensively deployed in the study of American slavery, even if critically at times (e.g. Fogel and Engerman 1974).

Clearly, Domar's 1970 hypothesis about serfdom, inspired by Kliuchevsky, became fruitful as a building block of historical studies about slavery in the West. Domar's last venture into the theme was a joint paper with Mark Machina (Domar and Machina 1984) about the end of Russian serfdom. Again, a Russian historian (Mikhail Pokrovskii 1934) was at the centre of the argument, but this time critically. Domar and Machina disputed theoretically and empirically Pokrovskii's claim – endorsed by Soviet Marxian historians and some Russian-American economic historians as well, such as Gerschenkron 1965 – that Russian serfdom became unprofitable for landowners before the emancipation of serfs in 1860s. Domar's attempt to understand Russia centred on what he regarded as key aspects of its economic history, taking Russian historians as reference points.

6. Domar's Soviet readers

Whereas Domar's Russian background affected his research agenda on socialism and economic history, the readership of his papers in the Soviet Union was restricted to some reactions to his 1940s growth papers, 1953 depreciation model and a delayed interest on his 1957 restatement of Feldman (1928). Google Scholar search indicates that his papers on socialist efficiency (Domar 1966a; 1974) and Russian serfdom (1970) did not elicit reactions in the USSR. Unlike Harrod's 1948 *Dynamics* (see Harrod 1959), Domar's 1957 collection of essays was not translated into Russian. The reason probably was the chapter on Feldman, whose growth model was still censored in the USSR at the time, a restriction that continued until about 1968. Indeed, by 1966 Domar (1966b: 252, n. 3) still complained that Feldman's work "has been recognized

in many countries ... but not in the Soviet Union.” Despite Kovalevskii’s (1930) report on the planned long-run development of the USSR, Feldman’s model did not influence Soviet planning, even though the observed acceleration of the production of machinery was consistent with that model (Domar 1957b, section V; Domar 1965; Spulber 1964, chapter 2).

Due to Domar’s (1957b) rediscovery, Soviet economists eventually acknowledged Feldman’s growth model as a landmark contribution (see e.g. Vainshtein and Khanin 1968). Feldman had left Gosplan in 1931. He was presumably in prison or labour camp in the 1940s-50s. It was only in 1953 that he was released and allowed to return to Moscow. He died in 1958, most likely with no knowledge of Domar’s (1957b) essay about him. Around 1968-69 other articles on Feldman came out in the Soviet journal *Problems in Economics*, formed by English translations of articles by Soviet economists, started in the late 1950s. Belianova (1969: 53), as part of an overview of Soviet growth planning models of the 1920s, pointed out that Feldman’s models “did not gain the acceptance they deserved and were forgotten for a long time.” Belianova did not refer to Domar (1957b), but another article in that same journal, by Al’ter and Pochkin (1969), did. After discussing Feldman (1928) in some detail, Al’ter and Pochkin (1969: 12) observed that the “most complete evaluation of the model by a bourgeois economist has been made by E. Domar.” However, they regarded Domar’s assessment of the model “frequently prejudiced and superficial”, as indicated particularly by Domar’s (1957b: 236) side remark that Feldman’s model exaggerated “the rigidities of the real world.” Al’ter and Pochkin’s charge was unwarranted, as they did not engage with Domar’s (1957b) restatement as a whole.

Al’ter (1962) provided a first detailed critical discussion of the Harrod-Domar growth model by a Soviet economist, with emphasis on Domar’s version. Al’ter (31) quoted from Domar’s (1952: 481) assertion that the post-war interest in growth was explained to a large extent by “the present international conflict which makes growth a condition of survival.” Al’ter could have also quoted from Domar’s (1957: 15) statement that “when an aggressive part of the world is strongly and quite successfully committed to rapid growth the other can disregard this objective only if it is tired of its own existence as a society.” From Al’ter’s (1962: 38) perspective, Harrod-Domar growth theory failed in its “main function, in its attempt to strengthen the position of capitalism in the competition with socialism.” Soviet Union’s high growth rates

indicated that it was ahead in the Cold War against the US. The Harrod-Domar conditions for sustained equilibrium growth could only be achieved in a planned economy, according to Al'ter. Analytically, one of the main flaws of Domar's model was the analysis of capital accumulation "in isolation from the production and distribution of surplus value" (Al'ter 1962: 34).

The misgivings about Domar's growth model were all gone as Soviet economists approached the depreciation problem, building explicitly on Domar ([1953] 1957). Domar's pioneer mathematical discussion of depreciation, replacement and growth brought to the fore the links between the life span of capital goods, factor ratios, propensity to save and economic growth. That study, funded by the RAND Corporation as part of its research agenda on the Soviet economy, included comparisons between the practice and theory of depreciation of real assets in the US and the USSR – one of Domar's incursions into comparative economic systems, a field he helped to create. Among other results, Domar ([1953] 1957) established that in a growing economy replacement falls short of depreciation.

The topic attracted the attention of Soviet planners from 1960s-1980s as part of their concern with the time structure of production. The Soviet interest in Domar's 1953 model, especially during the 1980s, came from the attempt by Soviet theoretical economists to use it as a starting point for the development of a new concept: the notion that a reduction in investment does not necessarily cause a decline in economic growth rates, since the excess of depreciation allowances over annual requirements to replace capital assets can offset the fall in the growth of investment (see Rumer 1984: 261-62 for detailed treatment and references to the Soviet literature).

The publication in the USSR of Irina Osdchaya's 1974 book in English, about the history of macroeconomics since Keynes – with comparisons drawn to Marxian economics – was a key moment in the assessment of Domar's growth economics by Soviet economists. Osdchaya (1974, chapter 2) stressed the significance of Domar's ([1946] 1957) conclusion that dynamic equilibrium required steady growth rate of income. Moreover, she carefully discussed aspects of Domar's ([1953] 1957) model of what she called "the reproductive structure of investment", with references to the Soviet economic literature of the 1960s prompted by that model. In chapter 7, section 3, Osdchaya provided a Marxian view of Feldman's growth model along the lines of the original 1928 articles. She acknowledged that Domar had "discovered" the model, but did not deal with Domar's (1957b) restatement.

In a previous paper, Osdchaya (1959: 51) had described Domar as an “American economist”, with no mention of his Russian background or his status as émigré. That generally applied as well to portrayals in the Soviet literature of other prominent Russian émigrés who had moved to the United States to study and/or work as economists. Domar certainly was an “American economist”, but the links he established between economics in the West and Russia were an important element of his American career. His life span largely overlapped with the period between the beginning and fall of the Soviet Union, whereas his professional life coincided with the Cold War time duration, with significant impacts on his research agenda. Together with Domar’s Russian heritage, that helps to explain his interest on Soviet and Russian economic development, as well as the investigation of analytical aspects of the working of socialist economies.

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