ECONOMIA INDUSTRIAL

TEXTO PARA DISCUSSÃO Nº 194

THE CONDITIONS FOR A FOREIGN EXCHANGE CONSTRAINED ECONOMY: A CRITIQUE OF JOSHI'S MODEL

Jorge Chami Batista

Março/1989

UNIVERSIDADE FEDERAL DO RIO DE JANEIRO

INSTITUTO DE ECONOMIA INDUSTRIAL

THE CONDITIONS FOR A FOREIGN EXCHANGE CONSTRAINED ECONOMY: A CRITIQUE OF JOSHI'S MODEL

Jorge Chami Batista

Março/1989

anpec associação nacional de centros de pós graduação em economia

ESTE TRABALHO FOI IMPRESSO NO IEI, COM A COLABORAÇÃO DA ANPEC E O APOIO FINANCEIRO DO PNPE

PROGRAMA NACIONAL DE PESQUISA ECONÔMICA PNPE

FICHA CATALOGRÁFICA

Batista, Jorge Chami
The conditions for a foreign exchange constrained economy: a critique of Joshi's model/ Jorge Chami Batista.- Rio de Janeiro: UFRJ/IEI, 1989.
16p; 21cm. (Texto para Discussão. IEI/UFRJ; n.194)
Bibliografia p.13-14
1. Orçamento - Áreas Subdesenvolvidas. 2. Joshi, V. - Teoria econômica. I. Título. II. Série.

The Conditions for a Foreign Exchange Constrained Economy: a critique of Joshi's Model

Jorge Chami Batista

The main objective of this paper is to provide a more substantive analytical meaning to the notion of a foreign exchange constrained economy, within the bounds of conventional theorizing, by formally establishing the conditions for its existence. We are not concerned with the actual characteristics of a foreign exchange constrained economy (1), but with showing that, even under unfavourable (and often unrealistic) assumptions about how the real economy works, the concept of a foreign exchange constraint remains valid. It is argued that the conditions for the existence of a foreign exchange constrained economy are much less restrictive than has often been assumed in previous formulations.The variable time is also introduced into the model, giving an explicit time horizon to the notion of a foreign exchange constrained economy.

The concept of a foreign exchange constraint, as distinct from a savings constraint, was formalized in the so-called two-gap model developed by Chenery and others in the early 1960s (2). Although the assumptions which underlie the two-gap model have been summed up by Chenery and Strout "as a hypothesis of limited structural flexibility"(3), the way the model has often been set up has tended to be very restrictive, since it has been based on quite rigid assumptions. Indeed, by postulating fixed import coefficients, the model often eliminates the possibility of lowering the import coefficient through import substitution. By assuming an exogenously given maximum export revenue, it does not allow for export expansion. By assuming a constant capital-output ratio, the possibility of improving the efficiency of investment is also eliminated (4).

On these grounds, one of the most influential criticisms of the two-gap model was made by Joshi (1970). He has argued that, although a valid conceptual distinction can be drawn between a savings and a foreign exchange constraint, such a distinction is of very limited uselfulness and that, theoretically, it is based on very extreme assumptions which are unlikely to be realised in practice (5).

The argument is developed within the framework of a standard two-good static model. In this paper, after a brief review of Joshi's argument, a new set of equations will be set up in an attempt to show that, in fact, the necessary conditions for the existence of a foreign exchange constraint are much less restrictive than those resulting from Joshi's analysis and, indeed, from other previous models.

The standard two-good static model considers an economy which produces a consumption good C and an investment good I. Given the structure of demand and of international relative costs, C is the exportable and I is the importable good. At a particular point in time, the domestic production possibility curve, PP'in figure (1), can be traced for given stocks of factors of production. If the economy can engage in trade of C and I with other countries, then its absorption possibility curve (or availability envelope) is assumed to look like QQ' in figure (1).

It is orgued that the point which maximizes welfare would be geometrically represented by the tangency between the availability envelope and the highest indifference curve (6). At this point, the community's desire to save would be balanced with its desire to invest and, therefore, neither a saving nor a foreign exchange constraint could arise.

However, if it is assumed that the utility function to be maximized is specified by "the Planning Commission", then it is possible that the highest indifference curve, ii' in figure (1), requires a level of consumption below what the community is prepared to tolerate, OK in figure (1). In this case, it is said that the economy is facing a pure savings constraint.

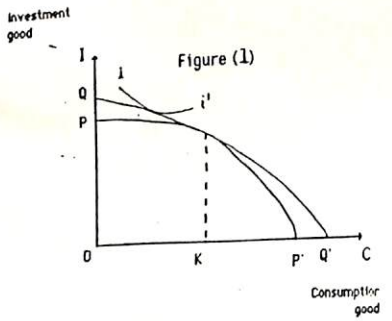


Figure (1)

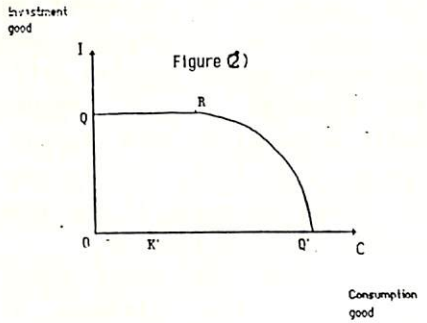


Figure (2)

It is tempting to say that a pure foreign exchange constraint must therefore refer to a situation where the planners are aiming for an investment target which is outside the availabilities envelope. However, it is argued that this can not be the case, since that would reduce the distinction between saving and foreign exchange constraints to the obvious point that some targets are technically feasible while others are not (7). In fact, external finance, if available, would shift the availability envelope outwards, thus making previously infeasible targets technically viable.

However, the concepts of a pure foreign exchange constraint and that of a pure saving constraint must be mutually exclusive. Consequently, it is argued that "we have to envisage a situation in which an increase in investment is impossible although more saving can be enforced (8). This situation can only arise if the availability envelope becomes flat before the minimum tolerable level of consumption is reached. QQ' in figure (2) is such an availibility envelope and OK'is the minimum tolerable level of consumption. In this case, the economy would face a pure foreign exchange constraint at a point such as R. At this point, a reduction in consumption would not increase investment and, hence, welfare would not be improved.

But what are the real conditions for an economy to be facing a pure foreign exchange constraint in this model?

The flat part of the availability envelope curve requires that the underlying rate of transformation in domestic

production (i.e. the capacity to allocate resources released from the domestic production of consumption goods in the domestic production of investment goods)' and the rate of transformation in trade (i.e., the capacity to use resources and/or goods released from domestic consumption into earning foreign exchange) are both equal to zero. Note that, in this model, a pure foreign exchange constraint could not exist if the availability envelope curve were continuously downward sloping.

In addition to the two above conditions, an extra condition is required for the existence of a pure foreign exchange constraint.If planners are optimizing at a point such as R in figure (2), then the marginal utility of consumption must be valueless at this optimum point (the indifference curve must also be flat in the meighbourhood of R). It is argued therefore that "if we make the fairly weak assumption that the marginal utility of consumption to the planners is always positive, then it is impossible that the economy should ever get into a foreign exchange constraint situation if the planners are following optimum policies. This follows from the fact that tangency between a planners indifference curve and the availability envelope must now occur before the rate of transformation along the latter falls to zero. This result, however, depends crucially on the availability envelope being continuously smooth. If the rate of transformation falls from positive to zero at a kink then, there can clearly be a foreign exchange constraint at the kink point, even if the marginal utility of consumption is positive (9).

Therefore, Joshi comes to the conclusion that a pure foreign exchange constraint requires very extreme assumptions that would be unlikely to be found in any economy (10). However, before accepting this conclusion, there are a number of aspects of the above analysis which need to be more carefully examined.

It should be noted that a foreign exchange constraint has been interpreted as the total inability of an economy to transform domestic resources into foreign exchange both in production and through trade, in order to achieve a particular target for investment which is supposed to maximize the planners utility function. The model, therefore, ignores the initial or

short-run costs of attempting to raise the investment rate. In particular, no attempt is made to assess the short-run impact on real income of an increase in the investment rate. However, it can be argued that the planner should be ultimately concerned with the expected real income at the end of a period of time rather than solely with an investment target. In other words, we have to envisage a situation in which, even if more savings can be enforced and investment can be raised, real income at the end of a particular period is not expected to rise.

To the extent that an increase in investment may result in a fall in real income, it can be argued that an increase in investment does not necessarily imply in an increase in real income at the end of a certain period of time. Therefore, an economy may be said to be facing a foreign exchange constraint, if an attempt to increase the investment rate, while maintaining trade balance, results in a fall in the expected real income at the end of a particular period of time. In other words, although more savings can be enforced, a particular target for the average rate of growth cannot be achieved within a certain period of time. Note that we are assuming, for the sake of the argument (11), that there is full employment of the factors of production and, therefore, ruling out the Keynesian possibility of a fall in consumption demand not being converted into investment.

The conditions under which a foreign exchange constraint may arise can be seen more clearly within the framework of the following model which considers a two good - consumption good (Cd) and investment good (I) - and one factor of production (K) economy:

$$Y_o = p_e C + p_i I + p_e E - p_i I_f \quad (1)$$

$$p_e E = p_i I_f \quad (2)$$

$$C_d = f_c(p_e), dC_d/dp_e = fc' > 0 \quad (3)$$

$$p_e = f_p(E), dp_e/dE = fp' < 0 \quad (4)$$

$$C_d = C + E \quad (5)$$

$$I_d = I - I_f \quad (6)$$

$$C = g_c(K_c), dC/dK_c = g_c' > 0, g''_c < 0 \quad (7)$$

$$E = g_e(K_e), dE/dK_e = g_e' > 0, g''_e < 0 \quad (8)$$

$$I_d = g_i(K_i), dI_d/dK_i = g_i' > 0, g''_i < 0 \quad (9)$$

$$K_c + K_e + K_i = K \quad (10)$$

Y_o is real income, C is domestic consumption, I is investment, E is exports of consumption goods, I_f is imports of investment goods, C_d is domestic production of consumption goods, I_d is domestic production of investment goods, K_c is the total quantity of domestic factors of production allocated for the production of consumption goods to be consumed domestically, K_c is the total quantity of domestic factors of production allocated for the production of consumption goods to be exported, K_i is the total quantity of domestic factors of production allocated for the production of investment goods, P_e is the international price of consumption goods, p_i is the international price of investment goods and K is the total stock of domestic factors of production.

It is assumed that the international price of the investment good (p_i) is fixed, the total stock of factors of production (K) is given at a particular point in time and that consumption (C) is an exogenously controlled variable. Equation (1) is the national income identity and equation (2) is the trade balance equation. The domestic production of consumption goods is assumed to be positively related to the international price of these goods in equation (3). In contrast with the normal assumption of price-taking for small countries, equation (4) assumes that an increase in the export volume adversely affects the terms of trade (since p_i is fixed, this equation also determines the world's offer curve). Equations (5) and (6) are simple identities, and equations (7), (8) and (9) are the three production functions with decreasing marginal productivity. Equation (10) guarantees full employment of factors of production.

We can now work out the effect of a change in consumption (C) on real income (Y). Differentiation of equations (1) and (2) with respect to (C) leads to:

$$dY_o/dC = p_e + C dp_e/dC + p_i\, dI/dC \quad (11)$$

Thus, the effect of a change in (C) on (Y_o) consists of the combination of three separate effects: the actual change in the volume of consumption, the change in the price of consumption goods and the change in investment.

Differentiation of equations (3), (4) and (5) gives:

$$dC_d = f'_c\, dp_e \quad (12);$$
$$dp_e = f'_p dE \quad (13);$$
$$dC_d = dC + dE \quad (14) \text{ and thus,}$$
$$dE/dC = 1/(f'_c f'_p - 1) < 0 \quad (15);$$
$$dC_d/dC = f'_p f'_c/(f'_c f'_p - 1) > 0 \quad (16) \text{ and}$$
$$dp_e/dC = f'_p/(f'_c f'_p - 1) > 0 \quad (17).$$

Therefore, a fall in domestic consumption leads to a rise in the volume of exports, and hence a fall in the international price of consumption goods (i.e., the terms of trade deteriorates) - which causes the production of consumption goods to be lower.

Consequently, the first two terms on the right hand side of equation (11) are positive, which implies that they both tend to reduce real income as consumption falls.

The effect of a change in consumption (C) on investment (I) depends on how resourses are allocated. Note that a fall in domestic consumption of consumption goods (C) would release resources (dK_c) which could, in principle, be used for either the production of investment goods (I_d) or the production of export goods (E). Therefore, at the margin, we could write that:

$$dK_c = -dK_i \quad (18), \text{ and thus, } dI/dC = dI_d/dC \quad (19),$$
$$\text{or } dK_c = -dK_e \quad (20), \text{ and thus, } dI/dC = dI_f/dC \quad (21)$$

In the first case, the effect of a change in consumption (C) on investment (I) is given by:

$$dI/dC = dI_d/dC = -g'_i/g'_c \quad (22)$$

This effect reflects the rate of transformation in production of the economy. The more negative is this effect, the more positive the rate of transformation in production will be. Therefore, the rate of transformation in production will be positive as long as the marginal productivity of capital in the production of investment goods (g'_i) is greater than zero. Note that, to the extent that the marginal productivity of capital in the production of investment goods (g'_i) falls, as more capital which was designed to produce consumption goods

are reallocated to the production of investment goods, the rate of transformation in production may be expected to approach zero as consumption falls to lower levels (12).

In the second case, the effect of a change in consumption (C) on investment (I) is given by.

$$dI/dC=dI_f /dC=1/p_i (p_e dE/dC + Edp_e /dC) \quad (23).$$

This effect refers to the ability of the economy to transform consumption into investment through trade (i.e., the rate of transformation through trade). This ability is greater than zero when the effect of a change in consumption on imports of investment goods is negative (i.e., a fall in consumption leads to a rise in imports).

Note that this effect depends upon the price elasticity of exports (dEp_e /Edp_e). The effect would be negative if the absolute value of the elasticity were greater than one. However, since it has been assumed that the effect of a change in consumption (C) on the domestic production of investment goods (I_d) can never be positive (i.e., a fall in consumption can never reduce the domestic production of investment goods), it is logical to assume that resources are never allocated to the production of exports if they lead to a fall in imports (13). Therefore, a fall in consumption (C) will increase or, at least have no effect on investment (I).

Therefore, adding up the three terms of equation (11), we can come to the conclusion that initial real national income can decrease as a result of a fall in consumption ($dYo/dC > 0$), even when the rate of transformation in production ($-dI_d /dC$) and through trade ($-dI_f /dC$) are both positive.

In order to find the effect of changes in consumption (C) on expected real income at the end of a period of time(Y_t), we can write that:

$Y = (1+g)^t Yo$ (24), where g is the rate of growth of real income. Differentiating equation (24) with respect to changes in consumption, we have.

$dY_t /dC=(1+g)^t dYo/dC + Yot(1+g)^{t-1} dg/dC$ (25), where $(dg/dC)=f_g$ and $(dYo/dC)=f_y$.

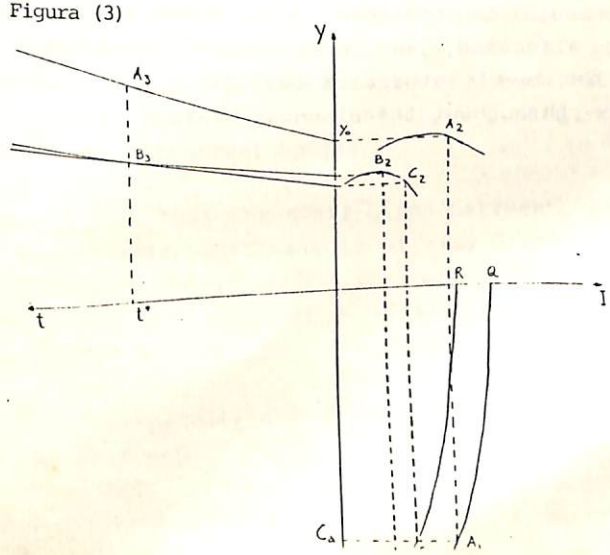
Assuming that dg/dC is negative (14) but dYo/dC is positive, the sign of the effect of a fall in consumption at time t=0 on expected real income at time t=t will depend upon the time horizon (t). This effect will be zero for:

$$t = -f_y (1+g)/Yof_g (26) \quad (15)$$

Therefore, a foreign exchange constraint will exist, if the planning horizon is equal to a time $t < -f_y (1+g)/Yof_g$ Hence, contrary to Joshi's argument, as long as there is a finite planning horizon, a foreign exchange constraint does not necessarily require that the rates of transformation in production and through trade both be equal to zero.

These relationships between consumption, investment and real income in the short and medium-run are depicted in figure (3). The bottom quadrant on the right shows again the absorption possibilities with trade balance at a given point in time. Let us assume that the economy is initially at point A_1 in this quadrant. The curve on the top right quadrant gives the value of real income for each point along the availability envelope. The quadrant on the top left side transforms initial real income into expected real income at the end of a period of times (t) on the basis of the investment level (the slope of each line is greater the higher is the level of investment).

Figura (3)



It is assumed that the economy is facing a savings constraint at point A_1 (Ca is assumed to be the minimum tolerable level of consumption). The economy is also expected to reach the target for real income (point A_3) at the end of a period t*, if it operates at point A_1 at t=0. Nevertheless, initial real income (Yo) is not necessarily being maximized at point A_2.

Let us now assume that the economy suffers an external shock (e.g., the world's offer curve changes to the disadvantage of the national economy) which leads to a contraction of the absorption frontier from QQ' to RR'. The corresponding changes are drawn on the other quadrants (the Y curve shifts down to the left).

We assume that the point which maximizes expected Y at the end of the period t=t* is now B_1 (again this may or may not be the same point which maximizes initial real income). For any planning horizon shorter than t=t*, it can be said that the economy will be facing a foreign exchange constraint at B_1 because, although more savings could be enforced (C_{1b} to C_{1a}), expected Y at the end of the period could not be raised above B_3 (in the top left quadrant).

Therefore, to the extent that transformation is possible (downward sloping availability envelope), but costly in terms of real income loss in the short-run, a foreign exchange constraint situation may well arise. If a current account deficit could be financed, then domestic resources could be better allocated, and real income could well be sustained above the levels otherwise possible - i.e., without external finance - throughout the planning horizon.

NOTES:

1. These characteristics are examined in Batista (1989), section (1.3);

2. For presentations of the two-gap model see Chenery and Bruno (1962), Chenery and Strout (1966), Mc. Kinnon (1964), Taylor (1979) & (1983), Bacha (1982), and Williamson (1983);

3. Chenery and Strout (1966), p. 682;

4. Note that there is no reference to the time-horizon over which these assumptions would be valid. "One can accept the proposition that most underdeveloped countries do not have flexible economies..., but the degree of inflexibility assumed in the two-gap model surely is excessive. In the long-run - and the analytical basis of these gaps is a long-run growth model - no economy is so rigid that it can produce neither capital goods, nor export goods nor import substitutes", Griffin (1970), p. 102. Joshi (1970) also makes the same point-pages 123 and 128. However, as Wells (1988) has pointed out, developing countries are continuously vulnerable to external technological developments that tend to work as a sequence of unfavourable external shocks to their economies. Therefore, developing countries may be subject to foreign exchange gap problems on a recurrent basis;

5. "It would seem that the distinction between a saving and a foreign exchange constraint is of very limited usefulness. Theoretically, it is based on very extreme assumptions which reduce its value as a classification of reality". Joshi (1970), p. 128;

6. That is the community's indifference curves, assuming that they can be drawn;

7. See Joshi (1970), p. 114.

8. Idib, p. 114;

9. Ibid, p. 117;

10. See footnote (5);

11. In fact, a fall in the level of capacity utilization would be a much more realistic assumption;

12. In the real world, an attempt to realise such a reallocation of resources through the price mechanism would be very likely to lead to unemployment of the factors of production;

13. I am thankful to Edmar Bacha for pointing out that equation (4) implies that the economy has a monopoly power in the world market. Therefore, to assume that export earnings could be allowed to fall would have meant that the country would not have been taking advantage of its monopolistic position. However, it should be pointed out that the Brazilian experience as a coffee exporter has demonstrated that her monopolistic position in that market has been detrimental to Brazil's capacity to import. In attempting to sustain the international price of coffee under unfavourable demand conditions and growing competition, Brazil has seen a continuous decline in her coffee market share. As a consequence, Brazil's coffee export earnings have shown a long-run declining trend - see Wells (1986);

14. A fall in consumption raises investment and, hence, the rate of growth of real income;

15. I am thankful to W. Fritsch for suggesting equation (26);

REFERENCES:

Bacha, E. (1982) 'Crescimento com Oferta Limitada de Divisas: uma reavaliação do modelo de dois hiatos', PPE, vol. 2 nº 2, August;

Batista, J.C. (1989) 'Foreign Indebtedness and Macroeconomic Adjustment: Brazil's Industrial Strategy and Policy Responses to External shocks in the 1970s and 1980s', Ph.D. dissertation to be submitted to the University of Cambridge, mimeo;

Chenery, H.B. and M. Bruno (1962) 'Developmenet Alternatives in an Open Economy: the case of Israel', Economic Journal 72, p. 79-103;

Chenery, H.B. and A.M. Strout (1966) 'Foreign Assistance and Economic Development', American Economic Review, Vol. LVI nº 4, September;

Griffin, K.B. (1970) 'Foreign Capital, Domestic Savings and Economic Development', Bulletin of the Oxford University Institute of Economics and Statistics, vol. 32 nº 2, May;

Joshi, V. (1970) 'Saving and Foreign Exchange Constraints', Unfashionable Economics, Essays in Honor of Lord Balough; Paul Streeten (ed.) World Development;

Mc.Kinnon, R. I. (1964) 'Foreign Exchange Constraints in Economics Development and Efficient Aid Allocation', The Economic Journal, June;

Taylor, L. (1979) 'Macro Models for Developing Countries', MacGraw-Hill Book Co., New York;

____(1983) 'Structuralist Macroeconomics - Aplicable Models for the Third World', Basic Books Inc. Pub., New York;

Wells, J.R. (1986) 'Evolução do comércio de produtos primários na América Latina no pós-guerra', Contexto Internacional, 2,3 Jan-June, Rio de Janeiro.

Wells, J.R. (1988) 'Latin America at the Cross Roads', forthcoming, London, Croom Helm;

Williamson, J. (1983), The Open Economy and the World Economy, Harper International Edition, Basic Books, Inc., Publishers, New york.

PUBLICAÇÕES DO IEI EM 1989

TEXTOS PARA DISCUSSÃO

	Nº de páginas
183. TAUILE, José Ricardo. Novos Padrões Tecnológicos, Competitividade Industrial e Bem Estar Social: Perspectivas Brasileiras. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 183).	47
184. LIMA, Fernando Carlos G.de Cerqueira; GOMES, Maria Célia. Sistema Financeiro da Habitação: Limites de Expansão de um Sistema Especializado. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 184)	65
185. FERRAZ, João Carlos. A Heterogeneidade Tecnológica da Indústria Brasileira: Perspectivas e Implicações para Política. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 185).	34
186. TIGRE, Paulo Bastos. How Does Latin America Fit Into High Technology?. IEI/UFRJ, Rio de Janeiro, 1989. Discussão, 186)	16
187. RUSH, Howard J. Manufacturing Strategies and Government Policies. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 187)	19
188. MAGALHÃES, Paulo; SILVEIRA, Caio Márcio L.P. da; MAGALHÃES, Maria Alice E. Programas Governamentais de Autoconstrução no Brasil: Um Estudo Comparativo. IEI/UFRJ, Rio de Janeiro, 1989.(Discussão, 188)	43
189. PENA, Maria Valéria Junho. O Estado das Informações Sobre a Mulher no Brasil - uma avaliação. IEI/UFRJ,Rio de Janeiro, 1989. (Discussão, 189)	49
190. TAVARES, Maria da Conceição. A Política Econômica do Autoritarismo. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 190)	15
191. AZEREDO, Beatriz; OLIVEIRA, Pedro Jorge de. Fontes de Recursos para o Orçamento da Seguridade Social.IEI/UFRJ, Rio de Janeiro, 1989. (Discussão 191)	48
192. VIANNA, Maria Lúcia Teixeira Werneck. O Postulado da Obrigação Política e Suas Justificativas Ideológicas na Teoria Clássica. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 192)	43

Nº de páginas

193. LIMA, Fernando Carlos G.C.Lima, FIORI, Jorge; MAGALHÃES, Paulo; TINOCO, Galeno; ZONINSEIN, Jonas; SILVEIRA, Caio Marcio L.P.da; GOMES, Maria Celia e BASTOS, Carlos M. Sistema Financeiro da Habitação e Programas Habitacionais Alternativos: Diagnóstico e Perspectivas. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 193) 49

194. BATISTA, Jorge Chami. The Conditions for a Foreign Exchange Constrained Economy: A Critique of Joshi's Model. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão,194) 16

195. FIORI, José Luís. Brasil: Uma transição democrática com crise orgânica do Estado. IEI/UFRJ, Rio de Janeiro, 1989. (Discussão, 195) 38