The Over-investment Hypothesis

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Abstract

In his last published work, Albert Ando finds in the Japanese National Accounts data that the rate of return from corporate investment is extremely low and the market valuation of Japanese corporations is far below their reproduction costs. He then argues that there has been excessively large corporate investment, particularly in the 1990s. In this chapter, I corroborate his findings using newly available Japanese National Accounts data and forumlate this over-investment hypothesis in a dynamic general equilibrium model.

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1. Introduction

Albert Ando's last published work (Ando, Christelis, and Miyagawa (2003), henceforth ACM) may well be the most provocative of all his writings. His thesis, which I call the *over-investment hypothesis*, is in stark contrast to the existing hypotheses about the Japanese malaise of the 1990s, all of which claim that corporate investment is less than optimal or just about right. A simple theoretical illustration very briefly described at the end of his paper, meant to explain his empirical findings, forces us to re-examine the sort of models we may wish to rely on to develop our thoughts.

In this chapter, I corroborate his empirical findings about the Japanese economy and formulate his hypothesis in a dynamic general equilibrium framework. In Section 2, I will summarize Ando's thesis and the supporting empirical evidence he assembled in his paper. I will then present, in Section 3, some additional corroborating evidence that became available in the latest release of the Japanese National Accounts. In Section 4, I will place his own theoretical illustration of the over-investment hypothesis in an explicit dynamic general equilibrium model. The concluding section, Section 5, will briefly comment on the relevance of the hypothesis to Japan's lost decade of the 1990s.

2. Ando's Thesis

The hypothesis that Ando puts forth in Ando *et. al.* (2003) (henceforth ACM) is very clear and simple: the Japanese corporations have over-invested for decades. Excessive investment is of course harmful to shareholders. ACM note that corporate governance in Japan is weak for two reasons. First, there is a peculiar feature of Japanese law that encourages corporations to enforce strict majority rule in the election of board members. Second, the extensive cross share holdings between corporations discourages takeovers.

ACM base their over-investment hypothesis on the following facts about the Japanese corporate sector (including financial institutions) that he gleans from the Japanese National Income Accounts.

- Corporate saving (i.e., retained earnings) accumulated over the period 1970-98 is far greater than the increase in the market value of the corporate sector's equity after adjusting for capital gains

and losses on physical and net financial assets (excluding equity) held by the corporate sector. The discrepancy between the accumulated saving and the adjusted increase in the equity value is a whopping 400 trillion yen (about 80% of annual GDP) (see Table 6.7 of ACM). (Incidentally, this low valuation of corporate equity fully accounts for the discrepancy (about 40% of annual GDP) between the accumulated flow of savings by the household sector over 1970-98 and the change in the market value of the wealth (excluding land) of the household sector (see Table 6.1 of ACM).)

- A more succinct way to describe the same phenomena is to examine Tobin's q for the corporate sector (the ratio of the replacement cost of the assets held by the corporate sector to the market value of the sector's liabilities (which are net debt and equity)). Tobin's q is well below unity for Japanese corporations (see Table 6.2 of ACM). Physical assets acquired by the firm and financed by household saving have not produced consummate increases in the value of the firm.

- Net pretax rate of return for the corporate sector (the ratio of net (i.e., after deducting depreciation) operating surplus before taxes to the reproduction cost of tangible assets (which is the sum of the capital stock and land) is about 5% (see Table 6.8 of ACM). ACM deem this rate "amazingly low". The flip side of this fact is a high capital-output ratio. For 1998, the Japanese ratio is 2.06, whereas it is 1.48 for the U.S.[1]

- Nominal dividends paid by Japanese nonfinancial corporations have hardly increased (Table 6.6 of ACM).[2] Retained earnings that otherwise would have gone to shareholders have been wasted in the hands of corporate managers because they did not lead to increased dividends and higher equity value in subsequent years. ACM also note that the dividend yield (the ratio of dividends to the share price) is very low, around 1% in the late 1990s, for those stocks listed on the Tokyo Stock Exchange.

Uncovering these facts from national accounts is harder than it might appear, because of several inconvenient features of the Japanese National Accounts. The following is a list of those features identified in ACM.

[1] Here, the ratio is for the whole economy less agriculture, housing, and government, because (as noted below) the Japanese National Accounts do not report value added for the corporate sector.

[2] The corporate sector in ACM's Table 6.6 does not include financial institutions, contrary to what is stated in their note to the table.

(a) The Japanese National Accounts were on the SNA68 basis (the 1968 United Nations System of National Accounts) until 2000, and on the SNA93 basis thereafter. Therefore, those national accounts series in post-2000 releases are according to the SNA93 definition. For some of those series, the SNA93 implementation by the ESRI (the Economic and Social Research Institute of the Cabinet Office of the Japanese government, which compiles national accounts for Japan) goes back to 1980 and so those series are available for years from 1980, but for other series (including balance-sheet items such as the capital stock) the implementation goes back to only 1990.[3]

(b) The corporate sector in the Japanese National Accounts is divided between nonfinancial and financial corporations, but the corporate sector includes government enterprises (such as Japan Highway Corporation, which is notorious for its gross inefficiency under the management headed by retired bureaucrats, and the Postal Saving System, which is by far the largest financial institution in Japan). The collective size of those government enterprises is substantial.[4] At the time of Ando's writing, there were no separate accounts for private corporations and public enterprises. As a result, the corporate sector in ACM's calculation includes those government enterprises.

(c) ACM note that the implicit depreciation rate (the ratio of replacement-cost depreciation to the capital stock) in the Japanese National Accounts is higher than the standard estimates for the U.S. in Hulten and Wykoff (1981).[5] To remedy this problem, ACM constructed their own capital stock and depreciation estimates using the Hulten-Wykoff depreciation rates and used

[3]This is a problem for dividends paid and received by the corporate sector, because (as argued in ACM) there is a problem with the SNA68 definition of dividends. The statement about corporate dividends in ACM mentioned above is based on SNA93 data, for years only from 1990. All other statements about Japanese National Accounts summarized above are based on SNA68 data.

[4]The latest release of SNA93 data, to be utilized in the next section, show that the capital stock for the entire nonfinancial corporate sector is about 563 trillion yen at the end of 2002. Of that, about 92 trillion yen is the capital stock of nonfinancial government enterprises.

[5]Both in SNA68 and SNA93, depreciation (capital consumption allowances) reported in the flow section was at book value, while the capital stock estimates in the balance-sheet section are at replacement costs. For SNA93, the difference between book value and replacement cost depreciation is displayed in a reconciliation account in the balance-sheet section. So the implicit depreciation rate for the corporate sector can be calculated as the ratio of the replacement cost depreciation (calculated as the book-value depreciation in the flow section minus this item in the reconciliation account of the balance-sheet section) to the value of the corporate capital stock.

those estimates to do the calculations reported in their tables. Their estimate of the corporate capital stock in 1998 is 18 percent larger than the Japanese National Accounts estimate and their depreciation estimate is 16 percent smaller than the replacement cost depreciation. Even with this lower estimate of depreciation, ACM find that the net (i.e., net of depreciation) rate of return for Japan is too low.

(d) The Japanese National Accounts report neither the compensation of employees nor the value added for the corporate sector, making it impossible to do the standard growth accounting for the corporate sector or to calculate TFP (total factor productivity, a measure of over-all production efficiency). It is probably for this reason that ACM do not address the possible inefficiency of the corporate sector when it is suspected corporate investment is excessive due to the weak corporate governance.

In the fall of 2004, after ACM was published in 2003, the SNA93 implementation by the ESRI went back to 1980 for many more national accounts series. For many of the series reported in ACM, which are based on SNA68 data and are for years from 1970, can now be constructed from SNA93 data, albeit from 1980. More importantly, it is now possible to separate private corporations from government enterprises for both the nonfinancial corporate sector and the financial sector. In the next section, I will use these newly available SNA93 data to see if the supporting facts about corporate over-investment assembled by ACM and summarized above still hold up.

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3. Does Ando's Thesis Hold Up in New Data?

As of the fall of 2004, enough information is available from the ESRI website[6] to calculate dividends paid, Tobin's q, and the rate of return for the *private* corporate sector (thus excluding government enterprises from the calculation) under the SNA93 definition for years from 1980. This can be done for private financial institutions as well as for private nonfinancial corporations. However, the data for financial institutions seem unreliable. For example, their net debt (financial liabilities including equity less financial assets) is *negative* between 1980 and 1990. I therefore focus on private *nonfinancial* corporations in the rest of this chapter.

[6]The URL is http://www.esri.cao.go.jp/jp/sna/menu.html.

Table 1 reports my calculations for 1980-2002. The sources and definitions of the series reported there are described in the lengthy note to the table.

- Regarding dividends, ACM observed from SNA93 data that dividends paid were essentially constant in nominal terms for 1990-1998. The dividend series in Table 1 (see column 1) confirms this, but for other years there is a fair amount of fluctuations. The next column, however, shows that the dividend yield (the ratio of dividends paid to the market value of equity) is very low, less than 2% since 1983.

- Tobin's q for private nonfinancial corporations is in Column 3. ACM in their Table 6.2 report that Tobin's q for nonfinancial corporations is 0.557 for 1998. Column 3 of Table 1 shows that it is 0.50 for the same year if government enterprises are excluded. It is well below 1 for all years and substantially below 0.5 for many years.

- Column 4 reports the implicit depreciation rate, defined as the ratio of the replacement-cost depreciation for the private corporate sector to the capital stock for the private corporate sector. This is calculated from the Japanese National Accounts (SNA93) as described in footnote 5. As already mentioned, ACM deem the replacement-cost depreciation in the Japanese National Accounts too low relative to the capital stock. Indeed, the Japanese implicit depreciation rate in Column 4 is higher than the U.S. implicit depreciation rate, shown in Column 5, calculated for the U.S. nonfinancial corporate sector (see the note to Table 1 for a precise definition of this series).

- The net rate of return on capital reported in ACM (Table 6.8) is, curiously, before taxes. Column 6 of Table 1 reports the *aftertax* net rate of return for private nonfinancial corporations. It is defined as

$$\frac{\text{gross operating surplus} - \text{replacement-cost depreciation} - \text{taxes}}{\text{capital stock} + \text{land}}.$$

  The replacement-cost depreciation and the capital stock that go into the calculation of this net (i.e., after deducting depreciation) rate of return are from the Japanese National Accounts, as in the calculation of the Japanese implicit depreciation rate in Column 4, which is just shown to be higher than the U.S. rate. It is for this reason that ACM base their rate of return calculations on their own estimate of the capital stock and depreciation. Short of constructing my own estimate of the capital stock and depreciation for private nonfinancial corporations, I reduce the replacement cost depreciation by 16% (so the aftertax net operating surplus is larger) and

increase the capital stock by 18% (so the denominator, the sum of the capital stock and land, is larger as well) for all years (recall that depreciation is less by 16% and the capital stock is higher by 18% for 1998 according to ACM). This adjustment slightly raises the aftertax net return, as seen in Column 7. The average for 1991-98 is 4.0%. The rate of return is lower in the 90s than in the 80s. The aftertax net rate of return for the U.S. is reported in Column 8. Comparing Columns 7 and 8, one sees that the U.S. rate of return, initially substantially below the Japanese rate, has been higher since 1988.

My take from these results is that Ando's thesis is confirmed to a large extent by the newly available national accounts data. In the next section, I construct a simple dynamic general equilibrium model that could account for those findings by Ando.

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4. The Ando Economy of Over-Investment

Toward the end of their paper, ACM described a model in which corporate managers "wish to finance their entire investment from internal funds every period and view their objective as increasing the size of their firms". They conjectured that such a model could account for the low rate of return on capital. But their model, consisting of two or three equations, is a partial equilibrium one. In this section, I argue that one can indeed construct a dynamic general equilibrium model in the spirit of Ando, to be referred to as the Ando economy, that delivers the desired conclusion.

The household sector of the Ando economy is standard. There is the representative household whose objective is to maximize

$$\int_0^\infty \exp(-\rho t) u(C(t)) \mathrm{d}t \tag{1}$$

subject to the lifetime budget constraint

$$p(t)\,\dot{E}(t) = w(t) + \alpha E(t) - C(t). \tag{2}$$

Here, ρ is the rate of time preference, $C(t)$ is consumption at time t, $u(.)$ is the period-utility function, $p(t)$ is the share price at time t, $E(t)$ is the number of existing shares, $\dot{E}(t)$ is the time derivative of $E(t)$, $w(t)$ is the wage rate, and α, assumed to be constant, is dividends paid per share. This α should *not* be confused with the dividend yield. The assumption that α is constant (together with the assumption, to be introduced later, that the number of shares $E(t)$ is constant)

is consistent with the evidence shown in the previous section that total dividends paid have been fairly constant. The variable under the control of the household is consumption $C(t)$. Purchasing shares is the only way for the household to save. The household's labor income equals the wage rate $w(t)$ because the supply of labor is normalized to be unity.

To derive the optimality conditions for the household sector, define the Hamiltonian as

$$H(t) \equiv u(C(t)) + \lambda(t)\left[\frac{w(t)}{p(t)} - \frac{C(t)}{p(t)} + \frac{\alpha E(t)}{p(t)}\right], \tag{3}$$

where $\lambda(t)$ is the co-state variable. The first-order conditions are

$$u'(C(t)) = \frac{\lambda(t)}{p(t)}, \tag{4}$$

$$\dot{\lambda}(t) = \left(\rho - \frac{\alpha}{p(t)}\right)\lambda(t), \tag{5}$$

$$\text{(transversality condition)} \quad \lim_{t\to\infty} \lambda(t)E(t)\exp(-\rho t) = 0. \tag{6}$$

The firm sector of the Ando economy is non-standard and reflects the spirit of Ando. The firm wishes its dividend payment to be as low as possible. If α is the least socially acceptable dividend payment per share, it is what the firm chooses. Therefore, investment is determined by

$$\dot{K}(t) + \delta K(t) = F(K(t), L(t)) - w(t)L(t) - \alpha E(t), \tag{7}$$

where $K(t)$ is the capital stock, δ is the depreciation rate (so $\dot{K}(t) + \delta K(t)$ is gross investment), $F(K, L)$ is the production function, and $L(t)$ is labor demand. Subject to the minimum dividend payment requirement of α, the firm wishes to maximize investment. Labor input is chosen to maximize the right-hand-side of this equation, yielding the standard marginal productivity condition for labor:

$$F_L(K(t), L(t)) = w(t), \tag{8}$$

where F_L (the partial derivative of F with respect to the second argument) is the marginal productivity of labor. I assume that the firm can neither issue new shares nor repurchase existing shares. If it could, this firm would attempt to issue an infinite amount of new shares to engage in unlimited investment.

Assuming that the production function exhibits constant returns to scale, we have $F(K, L) = F_K K + F_L L$ by Euler's theorem and the production function in the intensity form

$$f(K/L) \equiv F(K, L)/L. \tag{9}$$

depends only on the capital-labor ratio. By differentiating both sides of this by K, we obtain

$$f'(K/L) = F_K(K, L), \tag{10}$$

where F_K is the partial derivative of F with respect to the first argument. Combining (8)-(10) with (7), we obtain

$$\dot{K}(t) = K(t)f'(K(t)/L(t)) - \delta K(t) - \alpha E(t). \tag{11}$$

As already assumed, the firm is not allowed to issue or repurchase its shares. Without loss of generality, we can therefore set $E(t) = 1$. Recalling also that the labor supply is normalized to unity, the market equilibrium conditions are

$$L(t) = 1 \quad \text{(labor market)} \quad \text{and} \quad E(t) = 1 \quad \text{(stock market)}. \tag{12}$$

Substitution of this into the capital accumulation equation (11) yields

$$\dot{K}(t) = g(K(t)) - [\alpha + \delta K(t)] \quad \text{with} \quad g(K) \equiv Kf'(K), \tag{13}$$

which, together with the initial condition that $K(0) = K_0$, pins down the equilibrium time path of the capital stock. Also, using the market equilibrium conditions and the marginal productivity condition (8), and noting that $F_L = f(K) - Kf'(K)$, we can easily see that the budget constraint (2) becomes

$$C(t) = f(K(t)) - K(t)f'(K(t)) + \alpha. \tag{14}$$

Therefore, given the path of the capital stock, the equilibrium path of consumption is pinned down. Given the path of consumption, the household first-order conditions (4)-(6) pin down the time path of the stock price $p(t)$ along with the time path of the co-state variable $\lambda(t)$. Thus, the model can be solved recursively, in the order of K, C, and p.

Now consider the function $g(K) \equiv Kf'(K)$ in the capital accumulation equation (13). In the rest of this section, I assume that $g(.)$ is concave, satisfies the Inada condition that $g'(0) = \infty$, and $\lim_{K\to\infty} g'(K) = 0$. This is satisfied if, for example, the production function is Cobb-Douglas (so $f(K) = Ak^\theta$ for $0 < \theta < 1$). The dynamics of capital accumulation can be analyzed by Figure 1, which graphs $g(K)$ and $\alpha + \delta K$ as a function of K. For sufficiently low dividends per share α, the two graphs intersect at two points, labeled A and B. Evidently, point A is stable while B is unstable. So the system converges to its stable equilibrium A where K equals $\bar{K}$; the long-run or steady-state capital stock in the Ando economy is $\bar{K}$.

To study the property of the steady-state capital stock $\bar{K}$, recall that in the standard growth model, the steady-state capital stock, denoted K^* for the standard model, satisfies the modified golden rule:

$$f'(K^*) = \rho + \delta. \tag{15}$$

Turning again to Figure 1, the modified golden rule capital stock K^* is determined by the intersection of the graph of $g(K) = Kf'(K)$ and the straight line from the origin whose slope is $\rho + \delta$. It is then evident that, for sufficiently low α, K^* lies to the left of $\bar{K}$. This implies that the marginal productivity of capital (which equals the gross rate of return to capital under constant returns to scale and perfect competition in factor markets) in the steady-state of the Ando economy is lower than $\rho + \delta$. Hence the net rate of return in the steady state, $f'(\bar{K}) - \delta$, is less than ρ.

Thus, this model formalizes Ando's argument for over-investment: "... the gross rate of return on capital gradually declines, and presumably it becomes near the level of depreciation. At this point, firms must begin to reduce the level of investment and distribute excess funds to holders of equity" (p. 177 of ACM). Ando also argues (see p. 181 of ACM) that that turning point was the early 1990s.

Can the model account for other facts identified by ACM? By setting $\dot{\lambda}(t) = 0$ in (5), the steady-state level of the stock price can be determined easily as

$$\bar{p} \quad (= \text{steady-state value of the stock price}) \ = \frac{\alpha}{\rho}, \tag{16}$$

so that the dividend yield in the steady state is $\rho = \alpha/\bar{p}$. In the steady state, the market value of the firm is $\bar{p}$ since there is no debt and the number of shares is normalized to unity. Tobin's q in the steady-state of the Ando economy, therefore, is $\bar{p}/\bar{K}$. Noting that $\bar{p} = \alpha/\rho$ and that the steady-state capital stock $\bar{K}$ satisfies $\alpha = \bar{K}f'(\bar{K}) - \delta\bar{K}$ (to obtain this, simply set $\dot{K} = 0$ in (13)), we can see that Tobin's q in the steady state of the Ando economy is

$$\bar{q} = \frac{\bar{p}}{\bar{K}} = \frac{\alpha}{\rho\bar{K}} = \frac{\bar{K}f'(\bar{K}) - \delta\bar{K}}{\rho\bar{K}} = \frac{f'(\bar{K}) - \delta}{\rho}. \tag{17}$$

This is less than unity because, as just observed above, $f'(\bar{K}) - \delta < \rho$.

To summarize, the main empirical findings of ACM, confirmed in the previous section, were that (a) Tobin's q is far less than unity, (b) the net rate of return to capital is low, (c) the capital-output ratio is high (higher than the U.S. ratio), and (d) the dividend yield was low, about 1% to 2% (see Column 2 of Table 1). I have shown that the Ando economy described in this section can account for (a)-(c). Regarding (d), however, the model has difficulty accounting for it if the rate of time preference ρ is about 4% (the value routinely assigned in the real business cycle literature).

5. Conclusion

The provocative paper by Ando and others (ACM (2003)) argued that corporate investment in Japan has been excessive since the early 1990s. This chapter empirically verified this over-investment hypothesis by various measures and formulated it in a dynamic general equilibrium model.

Does Ando's over-investment hypothesis account for the Japanese great recession in the 1990s? My view is that it does not, by itself, for two reasons. First, the hypothesis merely implies that the capital stock is too large. It does not explain why the Japanese growth rate in the 1990s was consistently below the growth rates observed for the U.S. and other advanced countries. Second, if it is entrenched management that is responsible for excess investment, Japanese managers should be engaged in not just furnishing themselves with red carpets and gold executive desks but also hiring secretaries who can't type. That is, the lack of corporate governance must have serious implications for the overall production efficiency (as measured by TFP) of the corporate sector. The over-investment hypothesis is silent on the important issue of how entrenched management impedes TFP growth (if it at all does) and how a decline of TFP growth contributed to Japan's subpar growth.

References

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Table 1: Measures of Over-investment for Private Nonfinancial Corporations

year	(1) dividends paid (trillion yen)	(2) dividend yield	(3) Tobin's q	(4) implicit depreciation rate	(5) implicit depreciation rate (US)	(6) aftertax net return	(7) adjusted aftertax net return	(8) aftertax net return (US)
1980	2.9	2.8%	0.37	10.9%	n.a.	5.8%	6.1%	3.2%
1981	3.2	2.7%	0.37	11.8%	n.a.	5.8%	5.8%	4.1%
1982	3.0	2.5%	0.41	11.6%	n.a.	5.2%	5.6%	4.1%
1983	3.0	1.8%	0.47	11.8%	n.a.	5.3%	5.7%	4.6%
1984	3.1	1.7%	0.48	11.0%	n.a.	5.7%	6.0%	5.4%
1985	3.3	1.5%	0.48	11.3%	n.a.	5.7%	6.0%	5.3%
1986	3.4	1.0%	0.54	11.5%	n.a.	5.5%	5.9%	4.7%
1987	3.7	0.9%	0.51	11.5%	n.a.	4.6%	4.9%	4.8%
1988	3.6	0.7%	0.59	11.4%	n.a.	4.6%	4.9%	5.4%
1989	5.7	0.8%	0.64	11.7%	n.a.	3.7%	4.1%	5.4%
1990	5.0	1.2%	0.47	11.4%	n.a.	3.7%	4.1%	5.2%
1991	5.1	1.2%	0.50	11.7%	n.a.	3.7%	4.2%	5.1%
1992	4.9	1.6%	0.48	11.9%	n.a.	3.5%	4.0%	5.2%
1993	5.0	1.5%	0.50	12.0%	7.5%	3.4%	3.9%	5.7%
1994	4.5	1.1%	0.55	11.8%	7.8%	3.0%	3.6%	6.2%
1995	4.9	1.2%	0.54	11.6%	7.8%	3.6%	4.1%	6.5%
1996	5.0	1.3%	0.55	12.1%	7.8%	3.5%	4.1%	7.0%
1997	5.1	1.5%	0.51	11.8%	7.9%	3.7%	4.2%	7.2%
1998	5.0	1.7%	0.50	12.5%	7.9%	3.0%	3.7%	6.5%
1999	5.6	1.1%	0.64	11.9%	7.9%	3.4%	4.1%	6.2%
2000	5.1	1.2%	0.54	12.1%	8.0%	3.3%	4.0%	5.5%
2001	5.4	1.5%	0.47	12.5%	8.7%	2.7%	3.5%	5.0%
2002	6.9	1.8%	0.49	11.6%	8.6%	4.0%	4.6%	5.5%
2003	n.a.	n.a.	n.a.	n.a.	8.6%	n.a.	n.a.	5.8%

Note: The Japanese data used for columns (1)-(4), (6) and (7) are from various accounts for the private nonfinancial corporate sector (*excluding* government enterprises) in the Japanese National Accounts downloadable from the ESRI website http://www.esri.cao.go.jp/jp/sna/menu.html. From the income-expenditure account, one obtains: x_1 = dividends paid, x_2 = gross operating surplus, x_3 = consumption of fixed capital, x_4 = current taxes on income and wealth, x_5 = other current net transfer payments. From the balance-sheet account: x_6 = market value of shares and other securities (i.e., equity and paid-in capital), x_7 = non-financial assets (inventories, fixed assets, land, and subsoil assets), x_8 = financial assets, x_9 = liabilities, x_{10} = fixed assets. From the reconciliation account of the balance-sheet section: x_{11} = changes in assets. The figures in columns (1)-(4), (6) and (7) are calculated from these items as follows. Column (1) = x_1, column (2) = x_1/x_6, column (3) = $(x_9 - x_8)/x_7$, column (4) = $(x_3 - x_{11})/x_{10}$, column (6) = $(x_2 - (x_3 - x_{11}) - x_4 - x_5)/x_7$, column (7) = $(x_2 - 0.84*(x_3 - x_{11}) - x_4 - x_5)/(x_7 + 0.18*x_{10})$. The U.S. data for the nonfinancial corporate sector used for columns (5) and (8) are from the U.S. NIPA (National Income and Product Accounts) compiled by the Bureau of Economic Analysis and the *Balance Sheets of the U.S. Economy* by the Board of Governors of the Federal Reserve System. From Table 1.14 of the NIPA, one obtains: y_1 = net operating surplus, y_2 = consumption of fixed capital, y_3 = business current transfer payments, y_4 = taxes on corporate income. From Table 7 of the fixed-assets tables of the NIPA, one obtains: y_5 = fixed assets (i.e., the capital stock) (this is available only since 1993). Data on land are not available from the NIPA, but the *Balance Sheets of the U.S. Economy* have data on "real estate" (which are land plus structures) and "equipment and software" for nonfarm nonfinancial corporate businesses. The difference between nonfinancial corporate business in the NIPA and nonfarm nonfinancial corporate business in the *Balance Sheets* is very minor. Let y_6 = tangible assets at market prices (real estate and equipment and software) from the *Balance Sheets*. Column (5) = y_2/y_5 and column (8) = $(y_1 - y_3 - y_4)/y_6$.

Figure 1: Dynamics of the Ando Economy