11. A Robinson Model for Argentina

James Lovinsky and Bill Gibson[1]

1. Introduction

Several chapters in this volume argue that Robinson opposed "equilibrium theory" on the grounds of its lack of realism. Harris, Skott, Bhaduri, Palley and Dutt provide analytical models along lines that Robinson would have presumably approved of. But the proof of the pudding is in the eating. In this chapter we address a real-world question, using a realistic Robinsonian model to see if there are in fact any practical advantages that derive from her iconoclastic approach. We see that there are.

The chapter shows that equilibrium models can indeed be calibrated to growing economies, so long as growth proceeds smoothly; when things go wrong, the equilibrium model is silent about what might have been the cause. The principal conclusion is that substituting "history," that is the actual series for the fiscal and foreign deficits, in a model that closely follows Robinson in other respects, produces a very realistic image of the economy. The chapter also concludes that the long-run steady state is essentially irrelevant to the effort. Thus, if equilibrium is interpreted as a steady state, equilibrium has little practical value.

The chapter is organized as follows: section 2 provides a brief background of the Argentinian economy, followed by a description of the neoclassical and Robinson models in section 3. In the fourth section, the models' simulation results are compared. A final section concludes. The social accounting matrix (SAM) to which the model is calibrated is available on the author's web-site.[2]

2. Overview

By the first decade of the 20th century, Argentina had become the richest nation in Latin America. But its economy was not immune to the swings

[1]Department of Economics, University of Vermont, Burlington, VT 05405. E-mail: james.lovinsky@uvm.edu and bill.gibson@uvm.edu. We wish to thank Diane Flaherty and especially Alan Cibils for his extensive comments, corrections and suggested improvements.

[2]The SAM and detailed results of the model simulations are available at www.uvm.edu/~wgibson.

of the business cycle and despite early prosperity, it suffered several recessions. There was a severe recession in 1890, another immediately following World War I, and finally a serious depression, along with much of the rest of the world, in 1929. Like many Latin American countries, Argentina went through a long period of state control in industry and utilities in the post-war period. This policy went hand-in-hand with the dominant Keynesian economic orthodoxy of the time and Argentina experienced a 30-year period of economic expansion in which GDP grew an average of 3.3 percent per year.[3] Beginning in the mid-1970s and continuing through the 1980s, Argentina experienced serious bouts of hyperinflation, which finally peaked in 1989 at over 3,000 percent. It was accompanied by a steep real appreciation, as shown in Table 11.1.

The economy contracted by an average of 1.9 percent from 1980 to 1989, as seen in the table. The conventional wisdom is that inflation and instability of the 1980s was largely the result of government deficits that were made up by borrowing from international financial markets (Saxton, 2003). The general economic chaos brought on by the high rate of inflation forced political change. In 1989, Carlos Menem was elected president and began a rapid and fundamental transformation of the economy along the lines of the Washington Consensus.[4] Inflation dropped off dramatically, as shown in the table. Initially these policies were successful and were followed by a period of rapid economic expansion throughout the 1990s, with the exception of reverberations from the Mexican "Tequila Crisis".[5] In 1994, an ambitious privatization process began, aimed at reducing growing public debt. The revenue certainly helped and Argentina's debt did not increase between 1989 and 1993 (MECON, 2004). During the 1990s most state-owned enterprises (SOEs) were sold off and unemployment soared (Chisari *et al.*, 1999). After the social security privatization in 1994, fiscal deficits became the norm and it is sometimes argued that the explosion of public debt has its roots in the privatization effort (Baker and Weisbrot, 2002). Interest payments began to dominate the public budget.

The liberalization process was accompanied by a monetary currency board in 1991, the *Plan de Convertibilidad*, which established one-to-one convertibility of the peso to the US dollar (Galiani *et al.*, 2003; Damill *et*

[3]The data is from Heston *et al.* (2004) and Marquetti (2004).

[4]Liberalization had been first attempted under the military dictatorship (1976-1983), although incompletely. Menem came to power with populist campaign rhetoric (promising wage hikes, a productive revolution, etc.). Once elected, he adopted a thorough-going neoliberalism, especially after 1991, reversing the electoral mandate.

[5]After the third quarter of 1998, there was no positive growth until the second quarter of 2002.

Table 11.1. Argentina's macroeconomic performance

	1950-59	1960-69	1970-79	1980-89
Real growth[3]	2.4	4.1	2.8	-1.9
Real exchange rate[4]	–	–	–	1.16
Real wage[5]	–	–	–	80.6
Inflation[3]	–	22.4	132.9	565.7
PSBR/GDP[6]	–	–	2.9	10.2
Govt expenditure/GDP[6]	14.2	12.5	10.9	11.4
Interest payments/GDP[6]	–	–	–	1.4
Current account/GDP[6]	-1.0	-0.4	0.9	2.0
Openness [7]	8.4	8.9	8.5	11.4

	1989-91[1]	1992-94[2]	1995-2000
Real growth[3]	1.9	6.9	2.2
Real exchange rate[4]	1.22	0.52	0.51
Real wage[5]	74.1	142.4	143
Inflation[3]	1,855.1	13.2	0.8
PSBR/GDP[6]	9.3	12.8	12.4
Govt. expenditure/GDP[6]	5.5	11.6	12.3
Interest payments/GDP[6]	0.8	1.1	1.7
Current account/GDP[6]	4.9	-1.9	-0.9
Openness [7]	14.6	17.9	23.1

Source: Damill *et al.*, 2002; MECON, 2004.

1. Stabilization program in effect 1990:4-1991:1.
2. Convertibility plan in effect 1992:2-1994:4.
3. Percent change.
4. Pesos per US dollar.
5. Average wage in constant US dollars.
6. Percent.
7. Exports plus imports as a percentage of GDP.

al., 2002). Besides establishing the peso peg to the dollar, the law also prohibited the printing of money by government unless it was backed by dollars in the Central Bank. Capital outflow could force a reduction in government spending, with contractionary economy-wide effects.

The Menem policies stabilized the economy, restored positive growth rates, and re-established fiscal balance. The recovery was based on

renewed access to foreign capital that covered the shortfall in domestic savings. Investment, buoyed by shared international confidence and credibility of the regime, boomed. From the perspective of Robinson's model, the foreign and fiscal deficits effectively became exogenous variables, controlled by domestic policy and policy-induced expectations.

As a result of the external shocks and privatization of social security, debt began to rapidly increase once more (Cibils *et al.*, 2002). With an overvalued exchange rate, Argentine exports were increasingly uncompetitive in world markets and the growing trade deficit worsened in 1999 when Brazil, Argentina's main regional trading partner, devalued its currency (Stiglitz, 2002). The IMF supplied emergency finance up until October 2001, but thereafter declined, citing a persistent lack of fiscal reform.

In the early 1990s, domestic absorption rose dramatically as a share of GDP. A five-year expansion, beginning in 1990, was followed by a recession in 1995. Conventional wisdom blames the Tequila Crisis in Mexico, since Argentina was second only to Mexico in terms of capital inflow. A second external shock materialized in the third quarter of 1998 with the Asian and Russian financial crises. The devaluation raised the cost of external borrowing and helped to propagate a prolonged bank run and subsequent three-year recession. The economy then contracted again in 2001 and the government began to run primary budget surpluses.

The anchor of the price system in the early 1990s was the rapidly appreciating real exchange rate and this multiplied the vulnerability of the economy to external shock (Damill *et al.* 2002). The privatization effort had helped bring in foreign exchange and the country also benefited from significant support to the public sector from the IMF.[6] The capital inflow to the public sector exceeded its dollar denominated liabilities. The overvalued exchange rate spurred imports and set the stage for a massive capital outflow. The private sector happily borrowed the dollars contracted by the government at a cheap rate. Clearly part of the problem lay in the *success* of the privatization effort, as Argentina's SOEs, the large, vertically integrated natural monopolies that controlled utilities (electricity, water and sewage, and communications), raw materials (minerals, petroleum, and gas), transportation system and banking system were sold off (Galiani *et al.*, 2003). "Many public enterprises were intentionally run down..." argues Cibils, "in order to create a sense of frustration among users of state services that would then lead to public

[6]The gross flows from all sources, the World Bank, IMF and Inter-American Development Bank averaged USD2.2 bn per quarter from 1995 to 2000.

support for privatization."[7] Employment in the public sector (federal, provincial, and municipal levels) fell from 5.1 million in 1991 to approximately one million in 2000. On the other hand, employment in the private sector increased from about 8.1 million in 1991 to more than 12 million in 2000. Despite the rising unemployment, there was essentially no trend in the share of government spending in GDP since the early 1980s.

The trade deficit moved procyclically, achieving surplus only in the recessionary years of 1995 and 2000-01. Since net financial services were in structural deficit, the current account deficit averaged some 3.6 percent of GDP between 1993 and 2000. Net interest payments in the balance of payments increased steadily throughout the convertibility period and until 1998. Except for the recessionary years, capital inflows exceeded the current account deficit for most of the 1990s, allowing for some reserve accumulation. Foreign debt did build rapidly and by 1999 net interest payments were more than 100 percent of total exports. But after 1998, inflows began to decline, setting the stage for the full-blown financial crisis of the 2001-02, as banks began to fail.

Investment on the other hand shows an increasing trend as a share of GDP since the early 1980s. The financing, as already noted, was largely external. As the unemployed drew down domestic savings, foreign savings increased to fill the gap. The public sector only contributed to the problem with the PSBR as a share of GDP increasing from less than 1 percent in the early 1990s to almost 5 percent by 1999 largely due to rising interest payments (Damill *et al.*, 2002, Table 4a). By the end of the 1990s, it had become obvious that the convertibility plan and the currency board were not working, contributing to the instability caused by the overvalued peso. The cost of external borrowing increased as most lenders could see that lending to Argentina was a risky proposition (as indeed it turned out to be).

The devaluation of the currency in 2002 following the default on loans in late 2001 was implemented in a manner that significantly increased the damage done to the economy (Stiglitz, 2002). Strict limitations on cash withdrawals from bank accounts were imposed in December 2001 after a run and were followed in January 2002 by the freezing of almost all dollar-denominated bank accounts.

These accounts were then converted to pesos at an artificially high (as it turned out) exchange rate. Subsequent floating of the peso in February 2002 was followed by a rapid decline in the value of the peso. This, in turn, wiped out the savings of large parts of the middle class.

[7]From private communication; see Cibils *et al.* (2004).

Unemployment soared as a result of the foreign shock. GDP fell by 20 percent between 1999 and 2002, but recovery began in the second quarter of 2002. By 2003, the outlook was brighter. Exports rose 17 percent in the first seven months of 2003, thanks to improved terms of trade for agricultural commodities. Imports rose 41 percent in the first seven months after declining 56 percent in 2002. The official unemployment rate dropped below 16 percent in late 2003.[8]

While the multiple shocks of the last two decades were arguably of foreign origin, it is difficult to maintain that domestic policy miscalculation was not an important factor. However one sees this, it is clear that the foreign and fiscal deficits moved together and more or less independently of the rest of the macroeconomy. Since the early 1980s, the Argentinian economy has largely responded to changes in these two variables, buffeted about from one crisis to another. Modelling the process would seem to be a challenging task, no matter what the theoretical perspective.

3. The models

In what follows we present two explanations of the trajectory of the Argentinian economy; one relies on the insights of Robinson and Keynes, which hold that ultimately the paths of these two deficits determine the path of the economy through their interaction with the rest of the macrostructure. By contrast, the neoclassical model says that deficits do not much matter and that there are more fundamental determinants responsible for the growth path of the economy.

The neoclassical model used here is a replica of that described in the chapter by Harris. There is a homogeneous capital, an aggregate Cobb-Douglas production function and marginal productivity determines distribution of the product. Savings drives investment. This very small applied neoclassical model is remarkably easy to simulate. Since it is the factors of production that drive the model, the required parameters are few and are shown in the first panel of Table 11.1. The growth of the labor force, n, is taken as exogenously given at 1.54 percent on average. The share of labor $1-\beta$ in post-war Argentina is on average about 41.5 percent, while depreciation is taken as 4 percent. This is a full employment model so that the real wage rate w adjusts endogenously; over the simulated period, it grows by about 1.7 percent, equal to productivity

[8]The official unemployment datum is only partially correct: In order to improve appearances, the government decided to include those receiving transfer payments as *employed*. When this benefit is excluded from the count, official calculations put unemployment at 19% currently, more than 20% in late 2003.

Table 11.2. Parameters of the model

Neoclassical		
Population growth	n	1.54
Capital share	β	0.585
Labor share	$1-\beta$	0.415
Capital-output	κ	3
Depreciation	δ	0.4
Savings out of profits	s	0.04
Imported factor share	η	0.04
TFP growth	ϕ	0.007
Constant in production function	A	0.76
Robinson		
Tax rate on capitalists' income	t_c	0.15
Tax rate on workers' income	t_w	0.08
Savings rate	s_r	0.39
Wage adjustment coefficient	θ	0.1
Labor productivity growth	ξ	0.01
Accumulation function parameters		
Autonomous (intercept)	α_0	0.005
Coefficient on capacity utilization	α_1	0.023
Coefficient on expected profit rate	α_2	0.01

growth.[9] Savings, s, is a constant share of profits, which are in turn calculated as output less payments to labor and foreign factor payments ηX. The share of the latter is guesstimated to be around 4 percent of total GDP.

The model is calibrated to the real wage of unity at the beginning of the period. The constant in the Cobb-Douglas production function, A, is set to produce this real wage, with an initial capital-output ratio of three. Thereafter, the savings rate is adjusted until the model's dynamic trajectory replicates the historical data. A savings rate of 0.4 or 40 percent of profits produced the fit shown in Figure 11.1.

Note that this is clearly a subjectively determined "best fit." Robinson never specified *which* history was to be better than equilibrium and

[9]These numbers are all derived from "actual" data as reported in Marquetti (2004).

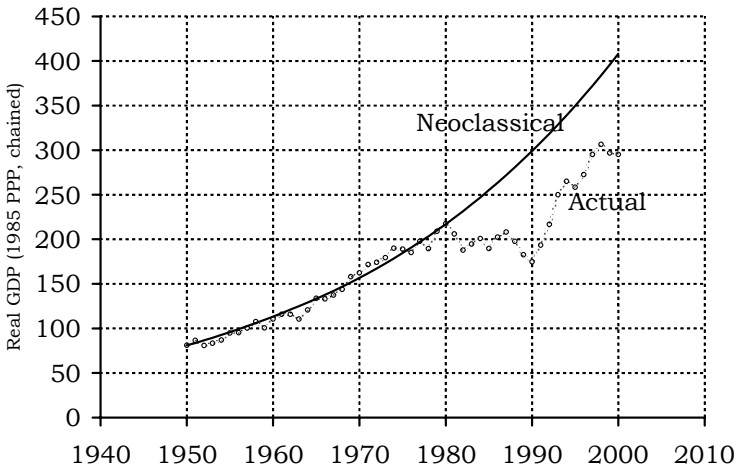

Figure 11.1. The neoclassical model

so judgement ultimately enters into the matter. A higher labor share $(1-\beta)$ would raise the savings rate required to produce this fit, as would a higher rate of imported inputs or depreciation. On the other hand, higher total factor productivity, ϕ, would reduce required savings or allow for more imports, or a higher labor share.

Notice that the model does very well for the first 30 years of the trajectory. As Harris (this volume) notes:

> The neoclassical construction presents a simple and attractive "story." It is useful to lay bare what that story is. Evidently, it conveys a striking image of the accumulation process as the "history" of a smooth and inevitable progression (convergence) towards an equilibrium that, even when disturbed by the supposedly exogenous factors of technical change and population growth, is essentially self-perpetuating. It is sometimes presented as a heuristic device, or a "parable," not intended to be taken literally. Nevertheless, despite such reservations, it has been subjected to widespread adaptation and used as an explanatory device to explain actual historical trends in growth and development, and to provide policy prescriptions, in many different empirical settings.

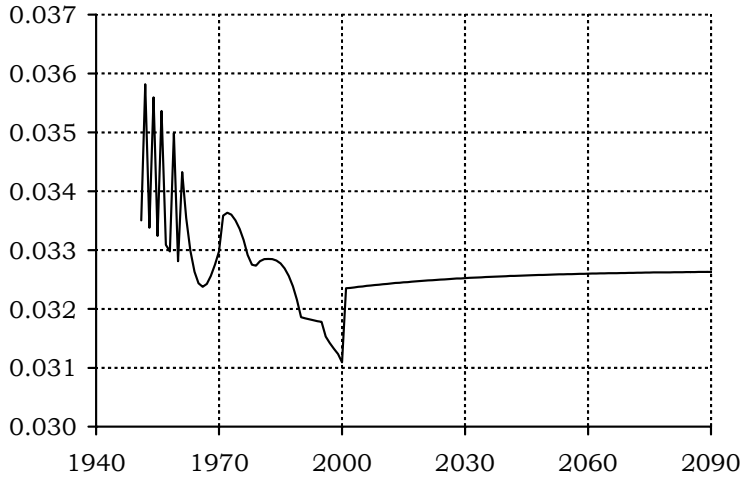

Figure 11.2. Output growth rate

Although the present exercise is also guilty of taking the model "literally," it is still of interest to ask where the model "goes," that is to what long-run equilibrium after the 50-year period shown in Figure 11.1. To answer this question, we simulate the economy for another 100 years. The results for the growth rate are shown in Figure 11.2. There the growth rate converges to approximately 3.26 percent[10] But it certainly takes a while: the grid lines are 30 years apart.

Robinson reasonably ignored long-run computer-driven simulations, since they were not yet in fashion. But given the practical irrelevance of this "long run," the critique of "equilibrium" is less trenchant than would be a critique of the model itself. Since tracking difficulties with the model present themselves long before the steady state is reached, it does not appear that its most objectionable feature is its "equilibrium" but rather the model's own "history."

The orthodox model evidently fits the data well for the first three decades, but then something goes terribly wrong. Whatever it is, it is progressively ignored. Eventually the real economy makes a feeble effort to return to its established growth path, but only in fits and starts, and during the last three years, turns away again. The effect of the debt crisis of the 1980s, for example, is evident in Figure 11.1 and after 1990,

[10]Even longer-run simulations confirm that this is indeed the steady state.

the economy tries to regain lost ground, but the crisis sets in again at the end of the decade. The neoclassical model as simulated here paints a picture of "lost opportunity," with an economy driven substantially away from its potential by some kind of horrific shock to some of the fundamental parameters of the model, such as saving rate, total factor productivity or one of the other parameters in Table 11.1. The question is: *which one*? There is no obvious answer, certainly not one linked to the narrative above. Moreover, it could just as well be a combination of several parameters acting, insidiously, in concert. We have no clue as to what might have gone wrong; for that, we need Robinson.

The Robinson model as employed in this chapter is essentially a one-sector sequential Keynesian apparatus as described in Robinson (1962a) and discussed in many chapters of this book.[11] Like the neoclassical model, it is calibrated to the same (simplified) social accounting matrix. It is dynamic, but the long-run steady state plays no role. Expectations are incorporated in a fundamental way in the investment function

$$g = f(u, r^e) \tag{11.1}$$

where g denotes the rate of accumulation, u is capacity utilization and r^e is the expected future rate of profit on new investment. Both partial derivatives, f_u and f_{r^e} are positive. Capacity utilization, u, is

$$u = \frac{X}{Q} \tag{11.2}$$

where X is current period GDP and Q potential output or available capacity at the beginning of the period. The simulation model employs a linear version of f :

$$g = \alpha_0 + \alpha_1 u + \alpha_2 r^e \tag{11.3}$$

where α_0, α_1 and α_2 are calibration constants. The term α_0 is a catch-all constant, designed to capture the effect of the interest rate and other exogenous variables. The term α_1 is akin to the accelerator and is usually given a simple interpretation, namely when capacity utilization is high, there is a stimulus to more investment and vice-versa. But even with high capacity utilization, the expected profit rate term must validate the urge to invest. The strength of "animal spirits" depends on α_2. All this is standard, essentially the same model as in the other chapters of this

[11] See Taylor *et al.* (1980) for a similar exercise for Brazil. Gibson and van Seventer (2000) compare a multisectoral structuralist CGE with a neoclassical version, calibrated to the same database, for South Africa and find greater fidelity of the latter.

volume. *New*: The expected rate of profit is defined as last period's after-tax rate of profit plus a random error term

$$r_t^e = \bar{r}_{t-1} + \varepsilon$$

where $\varepsilon \backsim N(0, \sigma^2)$ and the bar indicates that the profit rate is after tax. The variance, σ^2, of the error term determines the volatility of the modeled economy. Substituting

$$g = \alpha_0 + \alpha_1 u + \alpha_2(\bar{r}_{t-1} + \varepsilon). \tag{11.4}$$

The nominal income-expenditure balance is taken from the SAM as

$$(wl + \pi + ep^*m)X = p(C_w + C_k + I + I_g + G + E) - ep^*M \tag{11.5}$$

where w is the nominal wage rate, l is the labor coefficient, π is profits per unit of output, e is the nominal exchange rate, $p^*$the foreign price of imports and m is the non-competitive intermediate import coefficient. Worker and capitalist consumption are given by C_w and C_k, while private investment is denoted by I and public investment by I_g. Current government expenditure on goods and services is denoted by G. Exports are given by E and competitive imports by M. Price, p, can then be expressed as

$$p = (1 + \tau)(wl + ep^*m)$$

where τ is the fixed and given mark-up. Consumption of workers on the right-hand side of equation 11.5 is given by

$$pC_w = (wlX + w_g)(1 - t_w) \tag{11.6}$$

where w_g is government wages, t_w is the tax rate on labor income. Capitalist consumption C_k is

$$pC_k = (\pi X + J)(1 - t_c)(1 - s) \tag{11.7}$$

where J is domestic interest payments on government debt and s is their savings propensity. Note that workers do not save in the simplified SAM; this is obviously unrealistic.[12] The fiscal balance is

$$pG + S_g + w_g + J + eJ^* = (\pi X + J)t_c + (wlX + w_g)t_w \tag{11.8}$$

where J^* is foreign interest payments and S_g is public sector savings on the current account. Finally, the foreign balance is

$$pE + S^* = ep^*(mX + M) + eJ^* \tag{11.9}$$

and where S^* is foreign savings.

[12]This is obviously more realistic for a country like Argentina than more advanced, industrialized countries. For a similar model in which workers do save, see the chapter by Palley in this volume.

Combining 11.5, 11.6, 11.7, 11.8 and 11.9 produces the savings-investment balance

$$s(\pi X + J)(1 - t\!\!/_c) + S_g + S^* = pI + pI_g.$$

The next step to convert this scheme into something manageable is to normalize by the gross value of production, $Y = pX$. The PSBR ratio is given as

$$\rho = \frac{pI_g - S_g}{Y}.$$

Normalizing foreign savings

$$\rho^* = \frac{S^*}{Y}$$

and the ratio of after-tax interest payments to GDP

$$j = J(1 - t\!\!/_c)/Y$$

we have

$$s\pi X(1 - t\!\!/_c)/Y + sj + \rho^* = I/X + \rho.$$

Next, note that since $I = \Delta K + \delta K$, with δ as the rate of depreciation of the capital stock, we can write

$$I/K = g + \delta$$

where g is the growth rate of the private capital stock $\Delta K/K$ in equation 11.3. Denoting the ratio of capacity to capital stock as $q = Q/K$, we can write

$$I/X = (g + \delta)/qu.$$

We then have

$$s\pi X(1 - t\!\!/_c)/pX + sj + \rho^* = (g + \delta)/qu + \rho$$

Define the *after-tax* profit rate (not including interest payments) as $\bar{r} = \pi X(1 - t_c)/pK$, and then write the savings-investment balance as

$$g = s\bar{r} + (sj + \rho^* - \rho)qu - \delta.$$

Note that if there is no foreign or government sector (and the rate of depreciation is ignored) this reverts to the standard Cambridge equation $g = sr$ seen throughout the volume. From the price equation, the after-tax rate of profit can be expressed

$$\bar{r} = \frac{\tau(1 - t_c)}{(1 + \tau)}qu = \bar{\tau}qu \tag{11.10}$$

where $\bar{\tau} = \tau(1 - t_c)/(1 + \tau)$ for notational simplicity. Setting this equal to g in equation 11.4

$$\left[(s\bar{\tau} + sj + \rho^* - \rho)q - \alpha_1\right] u = \alpha_0 + \delta + \alpha_2(\bar{\tau}qu_{t-1} + \varepsilon) \tag{11.11}$$

With q constant, this would be a stochastic process for u of the form:

$$y_t = \phi_0 + \phi_1 y_{t-1} + \varepsilon_t$$

with $\varepsilon_t = \alpha_2 \varepsilon$ and

$$\begin{aligned} \phi_0 &= \frac{\alpha_0 + \delta}{[(s\bar{\tau} + sj + \rho^* - \rho)q - \alpha_1]} \\ \phi_1 &= \frac{\alpha_2 \bar{\tau} q}{[(s\bar{\tau} + sj + \rho^* - \rho)q - \alpha_1]}. \end{aligned}$$

The condition for convergence is $\phi_1 < 1$, or

$$(s - \alpha_2)\bar{\tau} > sj + \rho^* - \rho - \alpha_1/q. \tag{11.12}$$

Hence, if foreign savings just covers the PSBR, and there is no autonomous growth ($\alpha_1 = 0$) or domestic interest payments, the condition reduces to the standard stability criterion for the simple model as discussed in the chapters by Harris, Bhaduri, Skott, Dutt and Palley. On the other hand, if the PSBR ratio is high or foreign capital inflow is inadequate, the model is more likely to diverge in the short run. A large α_2 can also cause the model to become explosive, but this is well known.

Robinson defined "equilibrium" of the model as when

$$r - r^e = 0$$

that is, "when the rate of accumulation which is generating just the expectation of profit that is required to cause it to be maintained" (Robinson, 1962a, p. 49). If q were constant, then the stochastic process could conceivably converge to $u_t = u_{t-1}$, which would satisfy the Robinsonian equilibrium in light of equation 11.10 that links the profit rate to capacity utilization.

Even with fixed-coefficient technology, so that there is no change in q, the model will not necessarily converge to the Robinsonian equilibrium so long as there are shocks to the system. An uptick in net exports, as for example occurred in 1970, will cause a rise in capacity utilization, which in turn drives up the current rate of profit. The increase in the gap between expected and realized rates of profits raises the rate of accumulation and the model accelerates, temporarily. As capacity begins to build, the rate of accumulation slows once again. The rate of profit declines with it and there is a second order reduction in investment, as r falls below r^e. But the decline in r then feeds into the formation of expectations, with a random component, and this helps restart investment again in the next period. But by this time, exports have ticked down again so the model begins to seek a new stochastic equilibrium. As the

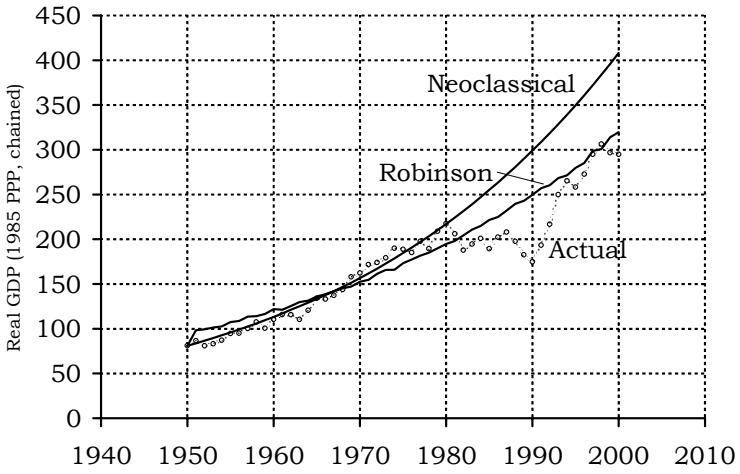

Figure 11.3. The neoclassical and Robinson models compared

structural parameters vary, the model lurches along with no particular place to go.

Indeed, if $\phi_1 = 1$, then u goes on a random walk. Since in the real world, all the terms on the right-hand side of 11.12 can change, there could be some point along the trajectory for which $\phi_1 = 1$. If this occurs, even if only temporarily, the final equilibrium then becomes path dependent as discussed in the chapter by Dutt. Of course, the condition $\phi_1 < 1$ says nothing about the stability of the long-run equilibrium, when q can vary. As capital accumulates, capacity also increases in step. Whether the level of demand, with its random component as just described, keeps pace or not is crucial. A stylized fact of development is that q falls over time, which according to equation 11.12, implies that stability is increasingly difficult to obtain (Foley and Michl, 1999).

4. Comparison

Figure 11.3 shows the results of the calibrated models, with government expenditure, including interest payments, exports and imports taken as growing at a constant, historically observed rate from 1950 to 2000.

As noted above, the neoclassical model does the best job of tracking the actual data through 1980, but fails progressively after that. The random component in the Robinson investment function causes it to

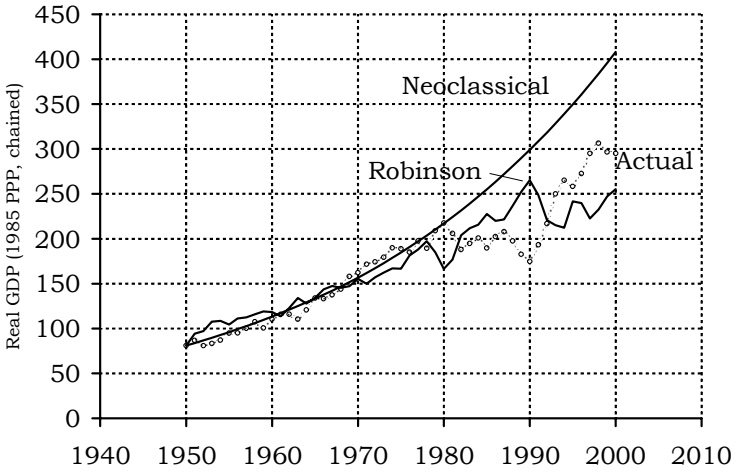

Figure 11.4. Robinson model with "history" for foreign savings

move somewhat more erratically and therefore more realistically. The volatility of the random component is set exogenously and different runs produce different approximations. The run shown in the figure is characteristic of the model's behavior and is quite typical of the results it produces. The Robinson model does an adequate job of approximating the path of the actual economy until 1980, although not as good as the neoclassical model. Thereafter, a bias develops and the Robinson model also over-predicts the actual data, although not as badly as the neoclassical model.

The principal advantage of the Robinson model over the neoclassical is that it can be used for analysis. When we substitute *actual net export numbers* into the Robinson model in order to see how much the foreign sector influences the economy, we find that the variance of the estimated path increases significantly relative to Figure 11.3. Figure 11.4 suggests that foreign shocks were a major factor driving the economy since 1980, but the sum of squared residuals from the actual path increases somewhat compared with the Robinson trajectory of Figure 11.3. While the output variance in Figure 11.4 is greater, there is an obvious problem with the realism of the simulation. The peaks and troughs seem to be out of phase. It cannot be foreign shocks alone that determine the path of the economy during this period. The Robinson model predicts a recession in 1980, when in fact there was a small boom, and a boom in

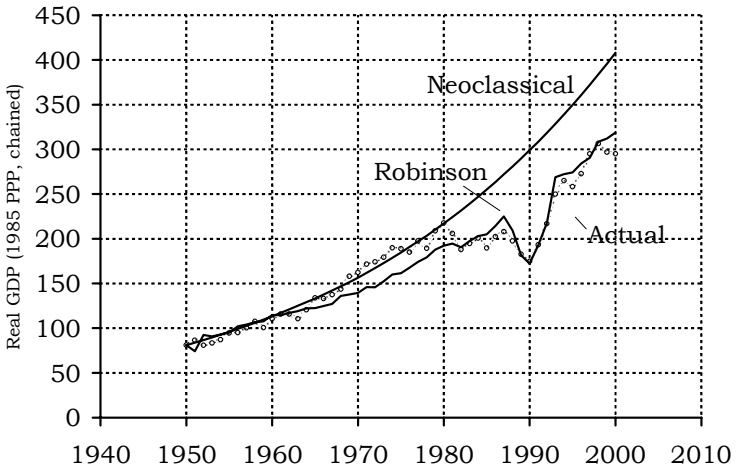

Figure 11.5. Robinson model with "history" for government

1990, while in fact there was a recession. This suggests that other macro variables also strongly influence the cycle. To investigate this hypothesis, we next substitute "history" for government in the model.

Figure 11.5 shows that the recession in 1990 was probably caused by the collapse in government spending that resulted from attempts to combat the hyperinflation, as shown in Table 11.1. The figure illustrates the significantly negative effect that large reductions in government spending can have on GDP. We learn from the Robinson model that, for example, a less violent approach to stabilization might have shielded the economy from a deep recession. In contrast, we were able to learn little or nothing from the neoclassical model about the possible causes of the downturn.

The model with the historical series for the government deficit predicts the 1980s the best, but only by seriously underpredicting the previous 30 years. If the analytical model is correct, the realism of estimate should be improved if we insert more "history." Figure 11.6 shows how GDP growth is tracked by the Robinson model with historical series for both fiscal and foreign deficits. In the run shown, the model over predicts the 1980s, as do all the models, but still does a fairly impressive job over all, given the simplicity of the model.[13]

[13]The model with the historical series for the government deficit predicts the 1980s the best, but only by seriously underpredicting the previous 30 years.

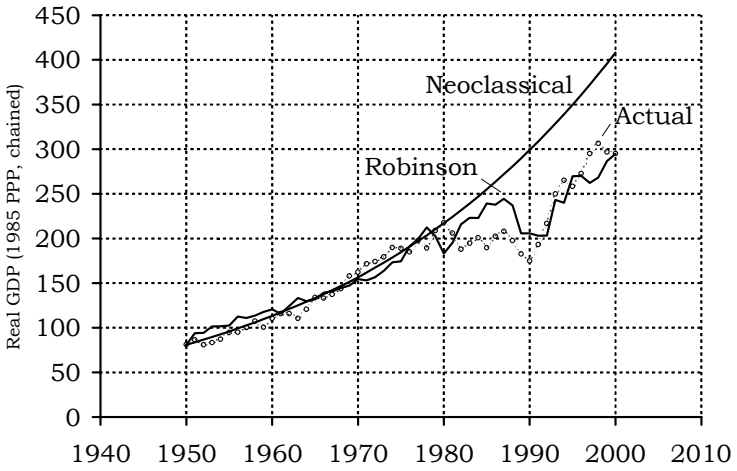

Figure 11.6. Robinson model with fiscal and foreign "history"

Our work, however, is not done. Theoretical growth models of the Cambridge-Robinson tradition should be led by investment, but the results so far strongly suggest that government spending and the foreign sector play a dominant role in determining the observed growth paths. "History," however, can only carry the discussion so far; in particular it can obviously play no role in predicting *future* trends for the simple reason that history has not "happened" yet. We are left with the model itself and the question of interest is whether the model says that variables continue to move or just come to a stop.

Here we extrapolate the Robinson model to see. A number of assumptions are required, of course, to push the model beyond the year 2000. We assume that both the PSBR and foreign borrowing levels continue to grow at their in-sample rates, and then forecast a 20-year extrapolation path of GDP as is done in Figure 11.7.[14]

From the figure, it is evident that the economy recovers, although not as robustly as it does in the neoclassical model. That model converges to a long-run growth rate of 3.27 percent while the Robinson model grows at 3.07 percent throughout the post-sample period. The rate of capital accumulation in the neoclassical model is faster since there is always

[14]The assumptions here ignore the current debt dynamics in Argentina in which the the government has run large primary surpluses since 2002.

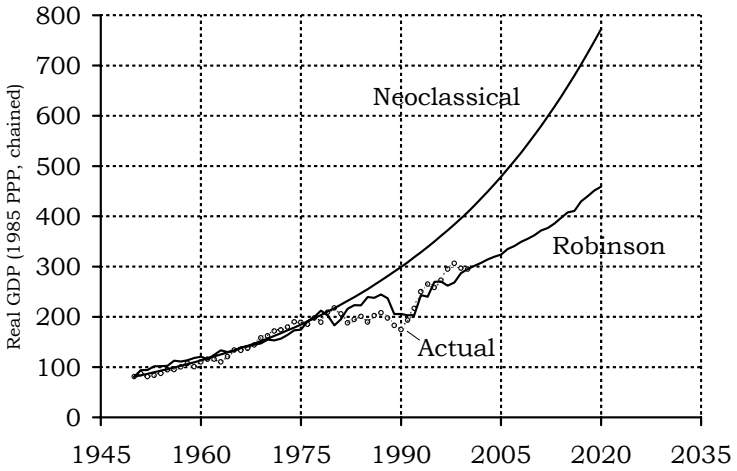

Figure 11.7. A twenty-year extrapolation

full employment and the real wage climbs by 330 percent as opposed to about half that for the Robinson model. The main reason of course is that savings is converted effortlessly into investment in the standard model, independent of what is happening on the demand side. The neoclassical capital stock accumulates to more than twice that of the Robinson model by 2020 and the share of profits in output remains constant. In contrast, the profit share rises steadily in the Robinson model owing to the relatively high levels of unemployment and the depressing effect unemployment has on the real wage in the model.[15]

At a more theoretical level, we conclude that the long-run steady state is essentially irrelevant to the project. Hence, the distinction between history and long-run equilibrium has no practical relevance in the simulation model. First, convergence to the steady-state takes a long time and second, there is no real-world mechanism that would drive the economy in the direction of stable equilibrium. Where the model goes after

[15]While during the boom years from 1950 to the 1970s, Argentina imported workers from neighboring countries, the crisis period of the 1980s and 1990s saw unemployment rise and it remains relatively high throughout the simulated period. The model only shows unemployment relative to the labor supply in the neoclassical model and therefore is not a realistic representation of the actual rate of unemployment.

an arbitrarily large number of periods is largely irrelevant to the ability of the model to track data in the sample period. In some sense an "end driven" or teleological process involves inverse path dependence, the reverse of hysteresis, in which the future path affects the current possibilities. Unstable forecasts are not aesthetically pleasing to most eyes, but in the case of Argentina, much of the post-1970 period seems to be best modeled by an unstable branch.[16] Once the end of the sample period is reached, however, the model turns around, becomes more stable, since there are no exogenous shocks, and ambles on. That the forecast could proceed at right angles to the calibrated phase is perhaps a clear expression of what Robinson often observed about the present, a break between the unalterable past and unknowable future.

5. Conclusion

This chapter illustrates how a Robinsonian model may be used to begin to analyze real policy problems. In order to do so, it must obviously be augmented by a foreign and fiscal sector, especially when applied to an open economy such as Argentina. Still the model retains the fundamental flavor as discussed in many chapters of the book. With just one additional data series for the difference between the PSBR and the current account deficit, both expressed as a share of GDP, the model can address basic questions of causality that are beyond the grasp of the orthodox model Robinson criticized.

The arguments of this chapter make clear that the Robinson model substitutes an analysis of how capitalism actually works for a more idealized version. The equilibrium model so heavily criticized by Robinson is not well-suited to the analysis of causality in macroeconomic systems. It is, on the other hand, useful as a benchmark, demonstrating the consequences of sustained full employment and capacity utilization. In this way, the orthodox model serves to measure "lost opportunities" as a result of external shocks or inadequate internal policy.

If Dutt's argument of Chapter 7 is correct, path dependence is a crucial feature of models in the Robinson tradition. The calibrated model developed here shows path dependence in that the extrapolation converges to a level of income per capita that is affected by the crises of the 1980s and 1990s, history ignored in the neoclassical model. But one can only speculate as to whether Robinson herself would have approved

[16] When it comes to the real-world experience of actual economies, unstable trajectories usually end with a significant change in policy if not institutions. Whether this will happen in Argentina as a result of the recent crisis there, is an entirely open question.

of this particular blend of "history" in the model since she never took such an explicitly numerical approach to the analysis of real economies. Certainly the silence of the neoclassical "equilibrium" approach irritated her, as extensively demonstrated in various chapters of this book. The argument here goes further inasmuch as the equilibrium approach is rejected not merely on theoretical grounds but on practical and empirical grounds as well.

Finally, a note of caution. This model is extraordinarily simplified, so much so that its only real use may be in the quasi-theoretical discussion of this chapter. But that said, the Robinson model provides a more secure foundation for larger-scale computable general equilibrium models that can adequately represent functioning economies.