A Short-Term Forecasting Model of the Swiss Economy

By John C. Lambelet and Kurt Schiltknecht

"I can't believe that!" said Alice.
"Can't you?" the Queen said in a pitying tone. "Try again: draw a long breath and shut your eyes."
(Alice in Wonderland)

General Approach

This first macro-econometric model of the Swiss economy is of the familiar short-term, Keynes-inspired, demand-oriented variety of which the Wharton-...
EFU model\textsuperscript{3} is perhaps the best-known example. However, it includes a number of special features not found in other short-term models (e.g.: the role of foreign labor imports prior to 1963–4; the magnitude and impact of international capital movements; the generalized use of cyclical, "pressure-of-demand" variables throughout most of the model). The data from which it was estimated are annual figures which mostly were taken from the Swiss national accounts\textsuperscript{4}. In general, short-term models are best estimated from quarterly data but, in the case of Switzerland, quarterly figures go back to the early 1960s only and are of somewhat doubtful quality. (In addition they cover too few variables.)

The structure of this Swiss model is not complicated and, simplifying it somewhat, it can be described in a few words. Basically, the model is divided into four sectors: (1) aggregate supply; (2) aggregate demand; (3) factor shares, prices, and monetary factors; (4) the government.

Considering the familiar real (\( = \) deflated) GDP identity:

\[ GDP \equiv \text{consumption} + \text{investment} + \text{exports} - \text{imports}, \]

the left-hand side, i.e. real GDP, is first determined by a number of aggregate supply equations “explaining” average labor productivity, labor force participation and, up to 1963–4, foreign labor inflow. Secondly, GDP is also determined by a series of familiar demand equations for the different components of consumption, investment and foreign trade which make up the right-hand side of the identity.

Naturally, there is no guarantee that, in any particular year, the demand-determined and the supply-determined estimates of GDP will necessarily coincide and satisfy the identity. This means that “something” in the model must adjust to bring aggregate supply and demand in line. In the present case, this “something” consists of two cyclical, pressure-of-demand variables, that is, unfilled orders\textsuperscript{5} and an index of overtime work. These two variables differ mostly by a somewhat different time-profile (overtime work “leads” unfilled orders\textsuperscript{6}. Consequently, they are linked\textsuperscript{7} so that they can be considered as just one variable.

The linked cyclical variables which operate on both sides of the model are thus determined by the joint action of aggregate demand and supply, which is just an-

\textsuperscript{3} See Klein (1968).
\textsuperscript{4} See Appendix A for a reconciliation of the figures used in the model and national accounting data.
\textsuperscript{5} In the machine-industry, measured in months of production given existing capacity. We wish to thank the F\textit{Verein schweizerischer Maschinen-Industrieller} for permission to use these unpublished figures.
\textsuperscript{6} It is noteworthy that in the United States the series most similar to overtime work (i.e., average actual work week of production workers, manufacturing) is also classified as a “leading indicator” while the series of unfilled orders in the capital-goods industry is considered a “roughly coincident” indicator. U.S. Departement of Commerce, \textit{Business Cycle Developments}, Oct. 1968, pp. 33 + 40.
\textsuperscript{7} By equation (5) below.
other way of saying that the cycle is generated by the interaction of aggregate supply and demand. Or, to be more specific, the cycle is determined by the model's dynamic lag structure\(^8\) which is concentrated on the demand side and is transmitted from the demand to the supply side via the common cyclical variables.

The specific rationale for including such short-term cyclical variables in most structural equations (e.g. labor productivity, consumption of durable goods, etc.) is discussed in the comments on the individual equations. In general, however, one may point out that practically all the familiar structural relationships suggested by economic theory (e.g. a simple demand-and-supply nexus for a given good) are conceptually long-term in nature and determine the equilibrium position of the relevant variable. But, in actual fact, the economy keeps fluctuating around these long-term positions so that a model which aims at giving an accurate description of the short-term movements of the economy must make allowance for short-term deviations from equilibrium positions. In general one would expect the unfilled-order variable to do a better job in equations which are concerned with the behavior of firms while overtime work should be more significant in equations dealing with household behavior. As will be seen presently, this expectation is however not always borne out.

It is also important to note that the two cyclical variables are purely and exclusively cyclical in nature. That is, they play no role in the model other than that of picking up the cycle; for example, overtime work is not added to "normal hours worked" in order to make up a total labor input variable which would then be used in a production function. To repeat, both overtime work and unfilled orders have no other function but to measure the cycle and might just as well be designated by \(X_1\) and \(X_2\).

Next to supply and demand, the model also includes a price-money-factor share sector which is largely dependent on and determined by the other two\(^9\). As it is, this sector determines the income variables as well as other nominal variables, prices (including the interest rates)\(^10\), and the monetary variables such as money stock, "monetary base" and foreign exchange reserves.

\(^8\) Plus, of course, the cyclical impulses originating abroad. In the case of an economy as dependent on the rest of the world as the Swiss economy, these cyclical impulses are likely to be quite strong or even predominant.

\(^9\) Although simulation showed that in this model the "feed-back" from the monetary sector to the "real" sector is quite powerful, which is what one would expect in the case of Switzerland. For reasons of time and space, it unfortunately was not possible to include these simulation results in this paper. They will be published shortly.

\(^10\) This means that the cyclical variables and not prices bear the brunt of the short-term adjustment burden of demand to supply. (It is clear that, in a long-term context, prices should bear the entire adjustment burden.)
Two further general features of the model should be described briefly. First, the present model of the Swiss economy is rather heavily non-linear; this is not only due to a large number of identities in ratio form, but also to the logarithmic specification of the productivity equation as well as to a number of squared variables. Naturally, this means that the model can not be solved by simple matrix inversion and multiplication but that another method, such as successive iteration, must be used.

Secondly, it is usually a fairly straightforward process to decide which variables in a model should be treated as endogenous and which as exogenous. In the present case, it seems that only two groups of exogenous variables require some explanations as to their status. First, all depreciation allowances were taken as exogenous for, as turned out upon close scrutiny, they often include such large and systematic “errors and omissions” that they were found practically impossible to “explain” statistically. Second, government “profit” income is also taken as exogenous on the ground that it is too much of a concatenation of developments abroad (foreign portfolio), policy shifts on the part of the authorities and domestic developments.—Fortunately, the data shows that these variables have progressed rather smoothly in recent years so that it has not been too difficult to project them independently in a forecasting context.

Before turning to questions of statistical estimation, three important caveats are in order.

First, it cannot be emphasized too strongly that the present model is a first attempt and nothing more. It is unfortunately true that, in contrast to most other highly developed economies, the Swiss economy is still largely an econometric terra incognita. In other words, no large body of empirical knowledge exists on which model-builders can draw. It is consequently quite possible and even probable that many equations are more or less seriously misspecified. However this was not considered a sufficient reason for not using the model in a forecasting context. Given that statistical tests are in truth quite weak when one is working with time series (in the sense that many different specifications often seem to fit the data equally well), one must resist the temptation of perfectionism which could easily lead to limitless and in the end sterile expenditures of time and resources. In fact it is only by using the model in practice for forecasting purposes that it will be possible to separate the

11 There are no separate “statistical discrepancy” rubriques in the Swiss national accounts. Since there is really no need to make national accounting figures look better than they actually are, it is hoped that the Bureau Fédéral de Statistique will consider publishing these discrepancies in the future, as most other countries do.

12 Fairly complete bibliographies on modern empirical research on Switzerland such as exists will be found in Lambelet (1968) and Schiltknecht (1970).
chaff from the seeds. If present plans are fulfilled, the Institut für Wirtschaftsforschung (ETH, Zurich) will shoulder the burden of keeping the model alive, testing, expanding and revising it in the context of its other forecasting procedures.

Secondly, it must be stressed that the model is strictly short-term in nature. That is, long-term dynamic adjustment processes have often been given less attention than short-term reactions (for example, by using time trends as proxies for slowly changing long-term factors). This is not due to any lack of enthusiasm for long-term adjustments but follows from the fact that most economic variables in Switzerland have trended so strongly over the sample period that it is not always possible to estimate an equation which does justice to short- and long-term factors. Whenever this was the case, priority was given to short-term mechanisms while long-term influences were either represented in some other way (trends) or even ignored altogether. This means that it would be very hazardous to use this model for forecasting far beyond the sample period—2 years is probably a maximum—which implies that the model must be re-estimated periodically.

Thirdly, it was thought more prudent not to label the present model a „short-term forecasting and policy model”. This is because of the problem of multicollinearity which is almost always present when one is working with time series. Consequently, if a given relationship should include, say, two significant explanatory variables, it may not be possible to estimate more than one parameter from the data (in addition to the constant, of course). This is unlikely to be a serious flaw in a forecasting context as long as the two variables remain highly correlated\(^\text{13}\); but it may seriously reduce the model’s usefulness for policy simulations if the simulation entails the necessity that the two variables move differently. In any case, this limitation of the model ought not to be overdramatized given that both fiscal and monetary policy in Switzerland are still in a state of surprising underdevelopment.

Statistical Estimation

All 54 stochastic equations in the model except one\(^\text{14}\) were estimated by ordinary least squares (OLS) which some may put down as unsophisticated because of the danger of “simultaneous-equation biases”. Naturally, we do not deny the possibility of such biases in a number of equations where the dependent variable and one or more explanatory variables are closely linked by

\(^{13}\) For a less optimistic assessment see a recent article on multicollinearity by Farrar and Glauber [Farrar (1967), p. 97].

\(^{14}\) The one exception is equation (28) which was taken over directly from J.C. Lambelet’s dissertation, op. cit., and was estimated by two-stage least squares.
some other equation or identity in the system. However, stringent limitations on computer facilities stood in the way of our using any one of the several methods which have been developed to cope with simultaneous-equation difficulties. In any case, estimation by OLS is, for a number of reasons, probably less of a blemish on our results than one might think. First, the most popular and "operational" alternative to OLS, namely two-stage least squares (TSLS), relies heavily on the asymptotic property of consistency and, given that really little is known about the small-sample properties of this method, its advisability is far from obvious when working with a sample of less than 20 observations. Secondly, an essential assumption of two-stage least squares is that the exogenous variables used to calculate the instruments should be really exogenous, that is, independent from the error term of whatever equation is under consideration; however, it is clear that this assumption of exogenousness and hence true independence is very questionable for many variables which, for one reason or another, are labelled "exogenous", so that a mechanical application of TSLS is not even likely to assure consistency while the very precious OLS property of least variance is lost. Finally, experience shows that, whenever the data situation is "robust", TSLS yields results that are very close to those obtained by OLS.

All this is not to say that, at some later stage, an effort should not be made to re-estimate the model by some method other than OLS. However, this is in our opinion a task of lower priority than improving the structure of the equations, bringing new data to bear, etc.

The Model

The model's equations will now be listed systematically. However, for reasons of space, explanations and comments have been kept at a minimum; as a result, the reader interested in knowing more about the theoretical underpinnings of any given equation is often referred to some standard source, and sometimes theoretical foundations and implications are left entirely for him to figure out.

15 The IBM 1401 to which we had access at OECD had such a small capacity that even a simple program for OLS stretched it to the limit.

16 As one knows, TSLS is a special case of the general method of instrumental variables.

17 Of course this means that one should always take care to select as instruments those exogenous variables which, on intuitive grounds, are likely to be as independent as possible of the equation's error term. In practice, however, TSLS is very often applied mechanically, for example, by using the first few principal components of the exogenous variables for all equations.
Sector I: Aggregate Supply

(1) Productivity (real output per employed):

\[ \log_{e} PROD_t = 2.391 + .0251 \bar{t} + .000365 \bar{t}^2 - .454 FLF_t + .0042 DOT_t \]

S.E. = .0116 \quad R^2 = .994 \quad \text{D.W.} = 1.6 \quad 1950-1968

\( PROD_t \) = average labor productivity, deflated, i.e., real output per employed, in 1958 SF '000 (see identity 15).

\( \bar{t} \) = time, \quad 1950 = 1.0

\( FLF_t \) = share of foreign labor in total labor force, i.e., foreign workers over labor force (see identity 14)

\( DOT_t \) = short-term cyclical variable (i.e., deviation of index of overtime work from trend) (see identities 36 and 37).

(2) Labor Force Participation:

\[ \text{PART}_t = .657 + .00261 \bar{t} - .00055 P + .465 FLF_t \]

S.E. = .0077 \quad R^2 = .705 \quad D.W. = 1.3 \quad 1950-1968

\( \text{PART}_t \) = participation rate, i.e., total labor force over total population aged 15–64 (see identity 15).

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18 An exogenous variable is indicated by a line over the variable’s symbol (e.g. \( \bar{t} \) = time). The numbers in bracket under the parameters are t-statistics. S.E. = standard error of estimate. \( R^2 \) = squared multiple correlation coefficient corrected for degrees of freedom. D.W. = Durbin-Watson d statistic.

19 Excluding foreign workers with right of permanent residence ("permis d'établissement"); average of February and August figures; since the August series goes back to 1955 only, the figures for the early years were estimated on the basis of the September figures for industrial plants ("fabriques").


21 Identities are listed in Appendix B.
(3) Foreign Migrant Labor:

\[ FW_t = -412.9 + 0.0227 \text{GDP}_t - 0.091 \text{SW}_t + 24.11 \text{UO}_{t-1} \]

\[ (-1.5) \quad (15.8) \quad (-0.6) \quad (6.7) \]

S.E. = 11.5 \quad \bar{R}^2 = 0.994 \quad D.W. = 2.1 \quad 1950-1965

\( FW_t \) = foreign migrant workers\(^{22} \), in '000

\( \text{GDP}_t \) = real (deflated) GDP, in 1958 SF 10\(^6\)

\( \text{SW}_t \) = «Swiss» workers\(^{22} \), in ’000

\( \text{UO}_t \) = short-term cyclical variable, i.e., unfilled orders (in months of production, given existing production capacity).

(4) Link Between the Population Variables:

\[ \text{POP} (15-64) = 395.5 + 0.579 \text{POP}_t + 0.225 \text{FW}_t - 5.981 \bar{t} \]

\[ (.9) \quad (6.1) \quad (1.8) \quad (-1.1) \]

S.E. = 15.5 \quad \bar{R}^2 = 0.997 \quad D.W. = 1.1 \quad 1950-1967

\( \text{POP} (15-64)_t \) = total resident population aged 15-64, in '000

\( \text{POP}_t \) = total resident population, all ages, in ‘000.

(5) Link Between the Two «Cyclical» (Pressure-of-Demand) Variables:

\[ \text{OT}_t = 2.146 + 1.759 \text{UO}_t - 0.965 \text{UO}_{t-1} + 0.54 \bar{t} - 0.0065 \text{DEV2}_t \]

\[ (.9) \quad (5.2) \quad (-2.8) \quad (5.9) \quad (2.9) \]

S.E. = 1.1 \quad \bar{R}^2 = 0.860 \quad D.W. = 1.5 \quad 1951-1965\(^{23} \)

\( \text{OT}_t \) = index of overtime work

\( \text{DEV2}_t \) = deviation of world money income index (see below, foreign trade sector) from trend (see identities 54 and 55).

\(^{22}\) See footnote 19 above.

\(^{23}\) For some unknown reason, the publication of the OT series was suspended after 1965. Consequently figures for the OT and DOT variables used in other equations were calculated from (5). Fortunately word has just been released that the publication of this series will be resumed.
As in practically all short-term models, the aggregate supply sector is substantially smaller than the aggregate demand sector (see below). The two most important supply equations are the productivity equation (1) and the labor force participation equation (2). Although the rationale underlying these two relationships—and in particular the reason for using a productivity equation rather than a production function or demand-for-labor equation—is not very complicated, a complete exposition would take rather too much space. Since this rationale has been fully explained elsewhere\textsuperscript{24}, the following comments are succinct in an extreme.

Labor productivity is first of all a function of long-term factors such as capital stock, embodied and disembodied technological progress as well as the long-term trend in hours worked. Since no "gross" capital stock figures exist for Switzerland, and since the measurement of the effect of both types of technological progress raises some very delicate questions, it is assumed that, in a short-term context, these long-term, slowly and smoothly changing factors can be adequately represented by time trends\textsuperscript{25}. This implies that the model makes no allowance for a feed-back of investment on labor productivity, which should not be too disturbing in a short-term model.\textsuperscript{26}—Another long-term but negative influence on productivity is the very large and rapidly growing pool of foreign migrant labor (mostly from Italy and Spain) which has been such a distinctive and dramatic characteristic of the Swiss economy up to 1965–1965 when free imports of foreign labor were curbed. (Foreign labor made up more than 20% of the labor force on the average in the later years). As one knows, foreign workers from Italy and Spain must generally be trained before becoming fully productive\textsuperscript{27}. Mo-
reover, abundant and relatively cheap supplies of foreign labor has allowed at least up to 1963–1965, many firms with slow growing productivity (e.g. hotels, restaurants, small textile plants, etc.) to go on producing a fairly large share of output; had it not been for the availability of abundant foreign labor, it is quite certain that many such firms would have either produced a slightly lower output with substantially less labor or might have had to go out of business altogether. More generally, abundant and relatively cheap foreign labor probably slowed down the shift to more capital-intensive methods of production, thus decreasing the growth of average labor productivity. As it is, the FLF variable in equation (1) implies that a 1% increase in the share of foreign labor in the labor force causes a .4% decrease in labor productivity. Finally, the DOT variable picks up the familiar cyclical fluctuations in labor productivity due first to short-term changes in hours worked and also to the well-known phenomenon of “labor-hoarding” by firms over the cycle. It should be noted that (1) implies a 1968 “point estimate” of the long-term growth rate of labor productivity of 3.8% p.a., that is, significantly higher than the semi-official estimate of 2.8%; however, it is true that equations including an acceleration term often tend to overpredict at both ends of the sample, although this is likely to account for but a fraction of the gap between the two estimates.

Labor force participation, as represented by (2), is also assumed to be a function of long- and short-term factors. In the long-term, labor force participation is influenced by the age structure of the population; the change in the average age of retirement; the changing average length of schooling beyond compulsory education; the housewives’ inclination to take a job, and finally whatever choice there is in modern society between work and leisure. Since these factors are likely to change slowly and smoothly, they are represented by time trends. (Taking population between the ages of 15 and 64 makes some allowance for the changing age distribution of population). Since foreign migrant workers are concentrated in the “prime” age range, and since they generally are not allowed to bring non-working dependents with them to Switzerland, an increase in foreign labor relative to total labor force raises participation; as some simple algebra shows, the coefficient of the FLF variable in (2) implies that an increase

28 The “labor-hoarding” hypothesis rests on the fact that a substantive fraction of employed labor is only very remotely affected by short-term variations in demand and output (e.g. administrative and managerial staff, R & D people, policy-makers who favor a low pressure of demand to curb price inflation, etc.) so that productivity grows faster than its long-term trend on the upswing and vice-versa on the downswing. [See Armstrong and Lambelet, op. cit.] – In addition to these factors, the DOT variable also picks up whatever cyclical variation there may be in the capital stock per worker constraint.

29 If equation (1) is fitted without an acceleration term the exponential growth rate is 3.33% p.a.
of 1 foreign worker causes an increase of 1.25 in the number of employed; consequently the FLF variable in (2) does not only pick up the effect of labor immigration on participation but, given that the inflow of foreign labor is a sensitive measure of the pressure of demand in the labor market, it also expresses the response of the native population to changes in the state of the labor market.

The basic assumption underlying equation (3) is that up to 1963–1965 the supply of foreign labor to the Swiss economy was for all practical purposes completely elastic, which implies the existence of relatively large labor reserves in Southern Europe. Using mid-sample values, the output (GDP) coefficient and the Swiss workers (SW) parameter imply elasticities of about 1.6 and –.4 respectively; since one would expect these elasticities to be in the neighborhood of 1.0, it seems that the coefficients are probably not free of bias. This is due to the fact that the number of “Swiss workers” hardly varied at all over the sample period, a fact also reflected in the low significance of the SW coefficient. There is not much the econometrician can do when, as in this case, the “laboratory” of economic reality has failed to do enough experimentation. The lagged domestic pressure-of-demand variable in (3) implies that the inflow of foreign workers largely responds to last year’s demand, presumably because of an information lag. Equation (3) covers the 1950–1965 period, that is, the period before Federal curbs were imposed on labor imports; when the model is used for later years, (3) is dropped from the model and FW is taken as exogenous.

Given that there are two population variables and two cyclical variables, equations (4) and (5) are needed to “close” the aggregate supply sector. These are purely empirical equations. Population aged 15 to 64 is found to be influenced by total population and foreign migrant labor while the negative time trend expresses the change in the population age structure. As to equation (5), it is based on the observed fact—already referred to—that overtime (OT) “leads” unfilled

31 Assuming that foreign workers bring no non-working dependents with them, and assuming that foreign labor represents 20% of the labor force and that the overall participation rate is 70%, which are values representative of the early sixties.

32 That the domestic labor force is not independent of the pressure of demand in the labor market is a well-documented fact; see for example the article by K. Strand and T. Dernburg [Strand (1964)].

33 It should be noted that these labor reserves are not only made up of unemployed or underemployed labor but also of employed workers earning wages sufficiently below the Swiss level for them to be willing to come to Switzerland if there are jobs available for them.

34 See footnote 19.

35 One solution would be to “plug in” some “reasonable” apriori coefficient for SW, the question being of course what is a “reasonable” coefficient.

36 If the implications of the equation are worked out, it seems that the POP coefficient is somewhat on the low side.
orders (UO); in addition, OT trends while UO does not; finally, it also seems that foreign pressure of demand does not affect the two cyclical variables in the same fashion.

As the reader may easily check by counting equations and variables, the 5 supply equations [plus identities (6), (13), (14), (15), (35), (57), (74) and semi-identities (34) and (36)] form a complete, self-contained sub-model if the pressure-of-demand variable UO is held constant. That is, given any demand level, the supply equations, identities and semi-identities determine real GDP, employment, foreign labor inflow, etc. This has the advantage that if the model is used for forecasting and it yields an estimate of future pressure of demand which does not seem plausible, it is always possible to “plug in” a more “reasonable” value for demand pressure UO into the supply sector and solve for the aforementioned variables. It may be interesting to note that some partial and provisional simulation results (not reproduced here) have shown that the supply sector is very sensitive to changes in the aggregate pressure of demand; that is, GDP as determined by the supply sector responds vigorously to any variation in UO, which, on intuitive grounds, makes better sense than the alternative situation of relative unresponsiveness.

Before turning to the demand sector, it should be added that the present short-term model is really quite unique in that it is an automatic full-employment model; that is, employment = labor force. Naturally this reflects the fact that there has not been in Switzerland any national unemployment worth speaking of since the late 1940s. Compared to any other market economy, such a happy state of affairs would seem to be nothing short of miraculous; in reality, it is largely illusory because of the buffer role of foreign migrant labor which, by absorbing the short-term demand fluctuations in the labor market, has in fact insulated the native labor force from practically all cyclical vicissitudes. (And of course, the foreign workers “pumped out” of Switzerland because of a fall in demand, as in the wake of the 1958 mini-recession, do not show up in national unemployment statistics). Given that the Federal measures adopted in the 1963–1965 years amount to severe limitations on labor imports, it is an open question whether in the future the economy will remain exempt of national unemployment in the face of a severe recession. Should things turn out badly, that is, should the no-unemployment millenium come to an end, the model would have to be adjusted for the possibility of native unemployment on the basis of purely apriori information (= guesses).

37 Identities are listed in Appendix B.
38 To the extent that Swiss workers will remain clustered in “cyclically safe” jobs (e.g. administrative and supervisory occupations), even a serious fall in demand may still in the future be absorbed by foreign labor, at least to a large extent.
Sector II: Aggregate Private Demand

Household Consumption

(6) Non-Durable Goods and Services:

\[ NCON_t = 1.449 + .457 \text{DINC}_2 + 4.099 \text{DEVTAX}_t \]

\[
(50.3) \quad (75.8) \quad (3.7)
\]

\[ \text{S.E.} = .025 \quad \hat{R}^2 = .997 \quad \text{D.W.} = 1.0 \quad 1949-1967 \]

\[ NCON_t \] is deflated per capita consumption of non-durables and services, 1958 SF '000 (see identity 12).

\[ \text{DINC}_2 \] is deflated per capita income, remittances abroad not excluded, 1958 SF '000 (see identity 11).

\[ \text{DEVTAX}_t \] is deviation of the average tax rate from its trend (see identities 55, 54, 55 and semi-identity 56).

(7) Durable Goods:

\[ DCON_t = -.952 + .435 \text{DINC}_2 - .0256 (\text{DINC}_2)^2 + \]

\[
(-11.5) \quad (12.1) \quad (-7.0)
\]

\[ + .0114 \text{UO}_t + 2.540 \text{DEVTAX}_t \]

\[
(6.5) \quad (4.9)
\]

\[ \text{S.E.} = .007 \quad \hat{R}^2 = .998 \quad \text{D.W.} = 2.1 \quad 1950-1968 \]

\[ DCON_t \] is deflated per capita consumption of durables, SF 1958 '000 (see identity 10).

The most striking feature of the household income-consumption-saving nexus in Switzerland is the time profile of saving. As the reader will see if he plots annual changes in household saving against time, odd years are almost without exception years in which saving increased considerably while even

39 "Durables" are here defined as comprising expenditures on transportation (mostly cars) and on household equipment, "non-durables" including all other expenditures. (For durables, see rubriques 6 and 9 in "Comptes nationaux de la Suisse en 1967", in "Vie Economique", September 1968, p. 6.) This definition of durables, which was dictated by the available data, is more narrow than usual.
years are uniformly characterized by much smaller increments. There is little doubt that this pattern reflects the impact of the Federal "National Defense" income tax which follows a curious biennial pattern in the sense that odd years are so-called "low tax-yield" years while even years are so-called "high tax-yield" years. The reader unfamiliar with things Swiss will find in the government section below some brief comments on the taxation system of Switzerland which has the dubious honor of being among the most complicated in the industrial world. For the time being suffice is to say that Swiss taxpayers have the option of paying their Federal income taxes either as one lump sum at the beginning of a two-year tax period or in a number of installments; in the former case they may deduct a premium from their tax bill. As clearly shown by the time profile to Federal income tax proceeds, many and perhaps most households choose to pay their Federal taxes in a lump sum once every second year. But they do this largely by drawing on their savings or, more accurately, by saving less, which is why high tax-yield years are uniform low-saving years. This interaction between saving and tax payments is illustrated, on a purely theoretical level, by the following diagram:

![Diagram showing the relationship between taxation, saving, consumption, and gross income over time.]

One obvious way to allow for the tax-saving interaction effect would be to let consumption be a function not of disposable (after-tax) income but of gross (pre-tax) income. Another would be to aggregate all relevant data on a overlapping two-year basis. However, the first method implies that biennial fluctuations in taxation are entirely absorbed by saving, which may or may not be so, while the second approach might yield an equation correctly describing the sum total of consumption expenditures over two years but hardly suitable for annual forecasts. Consequently a third approach is used in which disposable (after-tax) income is retained as one of the arguments in the consumption equations while explicit allowance is made for the saving-taxation interaction by means

40 Beside Federal income taxes, there are also Cantonal and local income taxes in Switzerland which are not only very large but are often patterned differently from Federal taxes. In order to obscure the argument too much, these other taxes are discussed in the government section.
of an \textit{ad hoc} variable. This is the DEVTAX variable in equations (6) and (7) which is defined as the deviation of the effective average tax rate from its longterm trend. (There is a slight positive trend in the average tax rate)\footnote{Since the premium paid for early lump-sum payment of taxes is linked to the interest rate, it would be tempting to use the latter as an argument in explaining the response of saving to biennial variations in taxation. However, this effect is probably too small to be susceptible of statistical estimation at this level of aggregation.}. As the reader may easily check\footnote{Substitute the relevant identities into (6) and (7) and calculate the partial derivative of NCON and DCON with respect to TH. Given the form of the \textit{per capita} deflated variables, the numerical values of the effects depend on the level of a number of variables. The figures indicated in the text are based on 1967 values.}, some simple algebra shows that, holding the long-term trend in the average overall tax rate constant, an increase in total income taxation of 1 billion francs, that is, a \textit{per capita} increase of 165 francs in 1967, causes a fall in \textit{per capita} consumption expenditures on durables and non-durables of about 100 francs on account of decreased disposable income [i.e. DINC2 in (6) and (7)] and an off-setting DEVTAX increase of approximately 120 francs, for a net increase of about 20 francs, that is, an amount which under the circumstances is not significantly different from zero. We thus conclude that the biennial fluctuations in income taxation are for all practical purposes fully absorbed by saving.

It should be noted that all this does not negate the familiar tax-multiplier approach of text-book macroeconomics since, in order to simulate the multiplier effect of a change in the tax rate on, say, real GDP, one should let the long-term \textit{trend value} of the overall average income tax rate vary. Yet the preceding sheds some interesting light on the short-term responsiveness of saving to a change in taxation, a question which recently has been much debated in the United States in the context of the anti-inflation income tax \textquotedblleft surcharge\textquotedblright.

Before turning to the two individual consumption equations, one should perhaps justify the choice of a \textit{per capita} and real (\textit{deflated}) basis for the variables in (6) and (7). For one thing, \textit{per capita} figures are required in economies like Switzerland's where net immigration is both large and fluctuating over time; for another, it is well known that, if one believes--as we do--that consumers by and large see through the \textquotedblleft veil of money\textquotedblright, taking non-deflated variables will entail an upward bias in the estimated marginal propensity to consume\footnote{For both questions, see Evans (1969), pp. 55–56.}.

It is apparent that the specification of the equation for non-durable consumption (6) is rather simple since the only variable beside the DEVTAX one is current \textit{per capita} deflated disposable income. On the one hand, this is in keeping with the generally accepted empirical finding that other theoretically
conceivable determinants of consumption (wealth, liquidity, income distribution) have a relatively negligible impact on aggregate consumption\textsuperscript{44}. On the other hand, this specification also means that no allowance is made for long-term dynamic adjustment; as mentioned earlier, the strong trend in all relevant variables over the sample period stands in the way of any attempt to estimate this dynamic adjustment process. For example, if the usual Koyck-Nerlove transformation is tried, the lagged dependent variable “catches” most of the variation in the current dependent variable and the resulting very large coefficient means a preposterously low short-term marginal propensity to consume (mpc) and, concomitantly, a ridiculously high long-term propensity. The same finding, i.e. a very low short-term propensity to consume or, if one prefers, a very high propensity to save, obtains if one chooses to explain saving rather than consumption following the elegant Houthakker-Taylor model\textsuperscript{45}; then the estimated short-term propensity to save turns out to be as high as .59...\textsuperscript{46}.

Therefore it is safer to concentrate on the short-term behavior of household consumption of non-durables. Naturally, ignoring long-term effects not only means that the equations must be re-estimated every year, but it may also result in biased estimates of the short-term coefficients; consequently it is important to check the estimated parameters against those found in other models. As it is, equation (6) implies a short-term mpc of .46 for non-durable and services, which at first may seem fairly high given that, in the United States, for example, it is generally considered to lie between .55 and .45\textsuperscript{47}; however, this high value is likely due to a definition of non-durables that is broader than usual\textsuperscript{48}.

As is well known, one major difference between consumption of non-durables and services, on the one hand, and consumption of durables, on the other, is that the latter is characterized by a stock-adjustment process. However, in most studies of durable goods, stock variables either have been ignored or have been found to be non-significant. The reason for this is no doubt that the measurement of stocks of durables is a delicate matter which involves more than simply counting assets of applying some simple straight-line depreciation rule, as is implicit in equations originally specified in level form and then transformed into first-difference form in order to eliminate the stock variable\textsuperscript{49}. Since no data on stocks of durables exist for Switzerland, and since

\textsuperscript{44} See Evans (1969), pp. 59 et seq. and p. 69.
\textsuperscript{45} See Houthakker (1966).
\textsuperscript{46} See Lambelet (1968).
\textsuperscript{47} See Evans (1969), p. 64.
\textsuperscript{48} See footnote 39.
such a series could have been constructed only by using some simple procedure known to be unsatisfactory, no stock variable is included in (7), regrettable though this may be.

Another difference between consumption of non-durables and services and consumption of durables is that the latter may be postponed easily, at least for some time (that is, the purchase of new durable goods may be postponed easily). Thus, it may happen that in relatively “bad times” purchases of durables fall although disposable income does not fall but only stagnates. A “cyclical variable” is generally used to pick this so-called Evans effect; in many economies (e.g. in the American economy) the unemployment rate generally turns out to be a good proxy for consumers’ attitudes over the cycle. Of course, no unemployment variable will do in the case of Switzerland, but one might think that overtime work should be a good proxy of consumers’ attitudes; however, it turned out that the UO variable did a much better job in (7), although this is somewhat surprising.

Conditions on the consumers’ installement credit market are another variable which is often found to affect purchases of durables. We tried to catch this effect by means of an interest rate variable; however, this variable became nonsignificant as soon as the tax-adjustment variable was introduced in the equation and so it was dropped from the final equation.

If equation (7) is estimated without the (DINC2) variable, the residuals strongly point to non-linearity; hence the squared income variable whose negative coefficient implies that the marginal propensity to consume durables falls as income increases. This is surely not a theoretical impossibility and in fact is in accord with Keynes’ original hypothesis. However, it is possible that in reality this variable serves as a proxy for the missing stock variable which, if true, would mean that (7) is more or less seriously misspecified.

<table>
<thead>
<tr>
<th></th>
<th>1951</th>
<th>1962</th>
<th>1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mpc, non-durables</td>
<td>.457</td>
<td>.457</td>
<td>.457</td>
</tr>
<tr>
<td>Mpc, durables</td>
<td>.243</td>
<td>.164</td>
<td>.116</td>
</tr>
<tr>
<td>Mpc, total</td>
<td>.700</td>
<td>.621</td>
<td>.573</td>
</tr>
</tbody>
</table>

The above annual short-term mpc’s for durables are not implausible when compared to other estimates although they tend to be in the lower range, no doubt because of the restrictive definition of durables already mentioned.

Ibid., p. 164 et seq.

For example, see Evans (1969), pp. 168–169 where the total mpc for durables in the U.S.A. is given as .292 and .222 respectively depending on whether an index of attitudes and buying plans is included or not.
Looking at the total annual short-term mpc's, it appears that the above estimates are not inconsistent with other existing estimates. For example, the short-term total mpc in the Brookings quarterly model of the U.S. economy is .531 in the Suits-Sparks version and .544 in subsequent revisions by the model's editors. On the other hand, the total mpc is .67 in Suits' annual U.S. model. The former two mpc's are somewhat lower than ours, but this is not unexpected since they were estimated from quarterly data. The latter mpc is based on annual data; it is relatively higher than ours which, as the following table suggests, may be due to a genuinely stronger inclination to thriftiness of Swiss households:

<table>
<thead>
<tr>
<th>Household Saving as % of Disposable Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>U.S.A.</td>
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<tr>
<td></td>
</tr>
<tr>
<td>1964</td>
</tr>
<tr>
<td>8.0</td>
</tr>
<tr>
<td>6.0</td>
</tr>
</tbody>
</table>

Because of the organization of Swiss national accounts, the above figures seriously underestimate the higher saving ratio of Swiss vs. American households.

Private Investment

Private investment is broken down into equipment, business construction, residential construction, and inventory investment. This division is standard except for the distinction between equipment, on the one hand, and business construction, on the other. The reason why these are kept separate is our belief that external financing (bond issues, mortgages) looms significantly larger in the case of business construction than in the case of equipment investment.

52 See Brookings (1965).
55 The source of underestimation is the separate account for private insurance companies; consequently, the saving component of life insurance is not counted as household saving as it should be. For the purpose of the model, saving by private insurance companies is aggregated to household saving (see Appendix A).
(8) Equipment Investment:

\[ \text{INVE}_t = -2,159.9 + .0895 \text{GDP}_t + 108.14 \text{UO}_t + .5524 \text{INVE}_{t-1} \]

\[ (-5.1) \quad (4.3) \quad (5.0) \quad (2.3) \]

S.E. = 98.0 \quad R^2 = .992 \quad D.W. = 1.3 \quad 1951-1967

\( \text{INVE}_t \) = deflated expenditures on new equipment, 1958 SF \( 10^6 \) (see identity 48)

\( \text{GDP}_t \) = real output, i.e. deflated gross domestic product, 1958 SF \( 10^6 \) (see identity 9).

(9) Business Construction:

\[ \text{ICD}_t = 5,675.2 + .1461 \text{GDPAV}_t - 1,820.7 \text{HYPAV}_t \]

\[ (6.5) \quad (17.7) \quad (-8.6) \]

S.E. = 105.8 \quad R^2 = .975 \quad D.W. = 2.1 \quad 1951-1967

\( \text{ICD}_t \) = deflated expenditures on new industrial and industrial construction, 1958 SF \( 10^6 \), (see identity 61)

\( \text{GDPAV}_t \) = weighted average of real GDP in 3 most recent years, 1958 SF \( 10^6 \) (see identity 60)

\( \text{HYPAV}_t \) = weighted average of mortgage rate (\( \text{HYP}_t \)) over 5 most recent years, \% p.a. (see identity 59).

(10) Residential Construction:

\[ \text{IRD}_t = 1,207.6 + .1742 \text{DINCAV}_t - 1,078.02 \text{INTAV}_t \]

\[ (5.1) \quad (12.1) \quad (-5.2) \]

S.E. = 184.4 \quad R^2 = .945 \quad D.W. = 1.7 \quad 1951-1967

\( \text{IRD}_t \) = deflated expenditures on residential construction, 1958 SF \( 10^6 \) (see identity 67)

\( \text{DINCAV}_t \) = weighted average of deflated household disposable income over the 5 most recent years (see identities 64 and 65)

\( \text{INTAV}_t \) = weighted average of “pure” interest rate (= \( \text{INT} \) = interest rate on selected Federal bonds) over 5 most recent years, \% p.a. (see identity 66).
(11) Inventory Investment:

\[
IDD_t = -8,354.7 + 0.0266 \text{SALD}_t + 390.2 UO_t - 0.7233 \text{KIDD}_t
\]

\[\begin{align*}
(-6.4) & \\
(5.3) & \\
(7.9) & \\
(-5.6) & \\
\end{align*}\]

\[
\text{S.E.} = 215.6 \quad R^2 = .808 \quad \text{D.W.} = 1.2 \quad 1951-1967
\]

\[\text{IDD}_t = \text{deflated inventory investment, 1958 SF 10}^6 \quad \text{(see identity 43)}\]

\[\text{SALD}_t = \text{total deflated sales, 1958 SF 10}^6 \quad \text{(see identity 72)}\]

\[\text{KIDD}_t = \text{stock of inventories, beginning of the years, 1958 SF 10}^6 \quad \text{(identity 73)}\]

The theory underlying equation (8) for equipment investment is the familiar “flexible accelerator” theory which states that gross investment is a positive function of the level of output and a negative function of the capital stock. The GDP variable in (8) is of course the output variable. As to the capital stock variable, things are somewhat less straightforward since no “gross” capital stock series is published for the Swiss economy. Capital stock is consequently proxied by unfilled orders measured in months of production given existing capacity. In Switzerland it is likely that, because of a very elastic supply of labor, “capacity” depends essentially on existing equipment, that is, on the capital stock. Hence, an increase in capital stock holding total unfilled orders constant will lower the UO ratio variable and have a negative effect on investment, as required by the flexible accelerator theory. As to total unfilled orders—that is, the numerator of the UO variable—these stand for a short-term investment plan realization or investment plan modification variable, that is, they express the short-term effect of fluctuations of demand on investment.

Naturally, it would be better if data problems did not make it necessary to combine the capital stock effect and the short-term demand effect into one variable with one parameter. However, it is not at all sure that the bias entailed by this roundabout procedure is necessarily larger than the bias produced by the explicit use of existing capital stock series in other countries, for, as is becoming clearer by the day, even the best existing capital stock series (like the OBE estimates in the United States) are affected by extremely large and systematic errors of measurement.

56 See Evans (1969), Chapter 4. In general the main fixed business investment theories—“accelerator”, “capacity”, “stock adjustment”—are all closely related.

57 At least this was so up to the 1965-1965 restrictions on the free inflow of foreign migrant labor.

58 The definition of UO implies that this variable is really in ratio form, i.e. total unfilled orders are the numerator and capital equipment the denominator.

59 For example, see Gordon (1969).
As one knows, the lag structure of investment is a question of crucial importance. In equation (8) this lag structure is expressed by the well-known Koyck-Nerlove transformation. In general, the asymptotically declining weights implied by this transformation are held to be less appropriate in the case of investment than some distributed lag scheme of the general Pascal type (first increasing, then peaking and decreasing). However, this finding rests on quarterly investment functions which usually show a lagged peak between the fourth and sixth quarter; more important, this result has been found to hold generally for economies which, like the American economy, are to a large extent closed economies. But, in the case of Switzerland, there are good reasons to believe that the lags affecting investment, and in particular the so-called “production lag”, are substantially shorter; given that Switzerland is very closely linked with the world economy, a large fraction of new equipment is in effect imported from abroad, and since there are of course many foreign sources of supply, it may often be possible for Swiss firms to “shop around” and acquire their new equipment from sources where it is most readily and speedily available (e.g. where existing inventories are large). This is why the relatively short lag structure implied by the coefficient of INVE$_{t-1}$ in (8) does not appear implausible. As will be seen in the section on foreign trade, this particular feature of Swiss investment is also allowed for in the model’s equations which deal with Swiss imports.

Equation (9) for business construction differs from the equipment equation in that it makes no allowance for any capital-stock adjustment process. Instead an interest rate variable is introduced to express short-term financial and supply conditions. Second, no Koyck transformation is applied, but the weights of the lag structure appear explicitly in the semi-identities defining GDPAV and HYPAV. These weights were determined by separate regressions under the constraint that they add up to 1.0. Naturally, it would have been more elegant if these weights had been estimated simultaneously with the other parameters of (9) by means of some appropriate statistical procedure like the so-called Almon lags; but this could not be done due to limitations of time and computing resources. On first sight, the lag structure used may seem rather too short; it should however appear more plausible if it is remembered that, under national accounting definitions, the value added to structures which have not reached completion during the current year is imputed to current construction investment and not to inventory investment.

60 It is generally known that the Koyck-Nerlove transformation is a statistically very dangerous procedure on account of the very likely “serial correlation bias”, and we have tried to avoid it whenever possible. However, the size of the lagged INVE variable implies a reasonable speed of adjustment.
As in the case of business construction, the weights of the lag structure for the residential construction equation (10) were determined by separate regressions under the constraint that they add up to one. As is well known, both demand and supply factors are important in the determination of residential construction. In (10) the DINCAV variable is of course the demand variable. It is sometimes stated that, in the case of housing, population and not income is the appropriate long-term demand variable\(^{61}\). However, it is important to see that this is just another way of saying that the demand for housing is completely inelastic with respect to income, a proposition which, if true, would mean that housing is a very special good indeed. In reality, casual observation and common sense suggest that the demand for housing does have some elasticity with respect to income so that it is quite possible that the finding of zero elasticity is restricted to the American economy where it is granted that the data apparently support it.

The INTAV variable is the short-term supply variable; it accounts for an important part of the total variation in residential construction. (The same is true for HYPAV in the business construction equation). This is quite in line with the importance of mortgage-financing in Switzerland. It is interesting to note that, whereas the mortgage rate was found to be the most significant rate in the business construction equation, the “pure” interest rate (that is, the interest rate on riskless Federal bonds) turned out to do a much better job in the residential construction equation. In the long run the two interest rates move in a parallel fashion; in the short term, however, the bond rate “leads” the mortgage rate\(^{62}\). This suggests that whenever there is a tightening of credit and financing conditions, residential housing is affected first, that is, before industrial and commercial construction.

As one knows, the so-called “counter-cyclical” or “residual factor” theory of residential construction is a rather popular one. As the time profile of IRD shows, the evidence seems to support this theory in the case of Switzerland too: housing peaks a first time in 1955, that is, about 3 years before the trough of the 1957–1958 recession and well before other variables; its second peak is in 1964, that is, also 3 years before the 1967 slow-down and well ahead of other demand components. In equation (10) these movements are accounted for by the influence of the interest variable, suggesting that credit and financing conditions are the operating factor which causes residential construction to be “squeezed” fairly early in the cycle.

As the reader may know, one of the most frequent problems with estimated construction equations is that the coefficient of the financial variables often turn out to have the wrong sign or to be too small and/or insignificant; consequently it


\(^{62}\) This will be discussed explicitly in the money and credit section (“Link Between Credit Markets”).
would seem a cause for satisfaction that both the HYPAV and the INTAV parameters in (9) and (10) have the right sign and are both significant and quite large. In fact, they are so large that, as future testing and use of the model may well show, it is not impossible that they wrongly pick up some other influence on construction.

The specification of equation (11) for inventory investment is not unusual and in fact is quite similar to the inventory functions in the Wharton-EFU model, for example. As it is, the equation allows for the so-called "transactions motive" (the SALD variable), the stock-adjustment effect (the KIDD variable) and the short-term "backlog-of-demand" motive (the UO variable). However, the "speculative inventory accumulation" effect is not taken into consideration, which should not be too surprising given that this is an annual function. (It is true that a complete analysis of the behavior of inventory investment generally necessitates quarterly data). Moreover, equation (11) makes no allowance for the so-called "buffer stock" effect. This is because inventory investment is by definition equal to the excess of production over sales (see identity 72); hence, holding output constant, an increase in sales is necessarily absorbed by a fall in inventories, and vice-versa when holding sales constant.

As shown by the "standard error of estimate" and the plotted residuals, the fit of (11) is really quite good given the well-known difficulty to account for inventory investment. In actual fact we cannot help wondering if inventory figures in the Swiss national accounts are not perhaps adjusted to some extent so that they make "better" sense.

The Foreign Sector

The crucial importance of the foreign sector in an economy as small and trade-dependent as Switzerland's needs no emphasis. Consequently, it would be desirable to give this sector a fairly detailed treatment and in particular distinguish as many separate components of exports and imports as would turn out to be meaningful. Unfortunately this raises a very serious data problem: following the adoption of a completely new set of foreign tariffs, Swiss foreign trade statistics changed completely in the early 1960s and only in a few cases is it possible to link the new series to the old ones. Thus the only feasible distinctions are: energy and agricultural imports, on the import side, and tourism on both the import and the export side.

See Klein (1968).

For example, the $R^2$ of (11) is significantly higher than that of the two inventory functions in the Wharton-EFU model.
(12) Energy Imports:

\[ M_{ENER_t} = -60.5 + 0.0236 GDP_t + 8.811 \overline{SPEC}_t \]
\[ \begin{array}{ccc}
(-.9) & (12.2) & (4.1) \\
\text{S.E.} = 63.1 & R^2 = .908 & \text{D.W.} = 1.2 \\
\end{array} \]

1949–1966

\[ M_{ENER_t} = \text{energy imports, volume (import deflator used), 1958 SF 10^6} \]

(see identity 8)

\[ \overline{SPEC}_t = \text{proxy for effects of anticipated changes in duties on energy imports (see below).} \]

(13) Agricultural Imports:

\[ M_{AG_t} = .525 + .030 DINC_{1_t} - .634 AGOUT_t \]
\[ \begin{array}{ccc}
(3.6) & (4.8) & (-2.2) \\
\text{S.E.} = .019 & R^2 = .554 & \text{D.W.} = 1.7 \\
\end{array} \]

1949–1966

\[ M_{AG_t} = \text{per capita imports of agricultural products, deflated}\footnote{Deflated by the household consumption price deflator. Data are from the following sources: 1947–1966: Annuaire Statistique de la Suisse, 1968, p. 187 ("Importations de denrées alimentaires et fourrages"); 1960–1967: Statistique du Commerce Extérieur de la Suisse; commentaires annuels, 2e partie ("Denrées alimentaires, produits de jardinage", etc.) Discrepancies between the 2 series in overlapping years are small.}, 1958 SF 10^3 \]

DINC_{1_t} = \text{per capita real disposable income of households, 1958 SF 10^3} \]

(see identity 7)

AGOUT_t = \text{per capita domestic agricultural output}\footnote{"Rendement brut de l'agriculture" (in current francs) deflated by "nombre-indice des prix à la production des produits agricoles" (Source: annuaire statistique de la Suisse).}, deflated, 1958 SF 10.3

(14) Swiss Tourism Abroad:

\[ M_{TOUPC_t} = -11.78 + .0608 DINC_{3_t} - .0023 (DINC_{3_t})^2 \]
\[ \begin{array}{ccc}
(-13.6) & (18.4) & (-7.8) \\
\text{S.E.} = .002 & R^2 = .998 & \text{D.W.} = 1.5 \\
\end{array} \]

1950–1968

\[ M_{TOUPC_t} = \text{per capita expenditures of Swiss tourists abroad, non-deflated, SF 10^3} \]

DINC_{3_t} = \text{per capita disposable income, nondeflated, SF 10^3} \]
(15) Other Imports:

\[
\text{MOTH}_t = -8,269.1 + .4712 \text{GDP}_t + .2591 \text{DCONST}_t + 1.0867 \text{DINVE}_t
\]

\[
(\text{S.E.}) = 278.5 \quad R^2 = .995 \quad \text{D.W.} = 1.1 \quad 1949-1967
\]

\[
\text{MOTH}_t = \text{other imports, deflated, 1958 SF 10^6 (see identity 52)}
\]

\[
\text{DCONST}_t = \text{deviation of total consumption from its trend, 1958 SF 10^6 (identities 49, 50, 51)}
\]

\[
\text{DINVE}_t = \text{idem for equipment investment (identities 46, 47, 48)}.
\]

(16) Foreign Tourism in Switzerland:

\[
\text{XT}_t = -719.8 + .3031 \overline{\text{WINC}}_t + .2071 \text{CWINC}_t + 55.973 - 2.43 (t5)2
\]

\[
(\text{S.E.}) = 46.4 \quad R^2 = .997 \quad \text{D.W.} = 1.7 \quad 1951-1967
\]

\[
\text{XT}_t = \text{expenditures of foreign tourists in Switzerland, undeflated, SF 10^6 (identity 3)}
\]

\[
\overline{\text{WINC}}_t = \text{weighted "world" money income index}
\]

\[
\text{CWINC}_t = \text{change in } \overline{\text{WINC}}_t \text{ (identity 45)}
\]

\[
(t5) = \text{time trend, } 1951 = 1.0.
\]

(17) Other Exports:

\[
\text{XO}_t = -16,047.5 + 2.1053 \overline{\text{WINC}}_t + 12,213.6 (\text{PX}/\text{PI})_t
\]

\[
(\text{S.E.}) = 187.0 \quad R^2 = .998 \quad \text{D.W.} = 2.4 \quad 1950-1968
\]

\[
\text{XO}_t = \text{other Swiss exports, undeflated, SF 10^6}
\]

\[
\text{PX}_t = \text{export price deflator (1958 = 1.0)}
\]

\[
\text{PI}_t = \text{investment price deflator (1958 = 1.0)}.
\]
(18) Household Transfers Abroad:

\[ \text{REMIT}_t = 0.566 + 0.1187 \text{WR}_t - 0.664 \text{DUM3}_t \]

\( (2.0) \quad (7.1) \quad (-5.8) \)

\[ \text{S.E.} = 0.170 \quad R^2 = 0.927 \quad D.W. = 1.2 \]

1949–1967

\[ \text{REMIT}_t = \text{household remittances per foreign worker, undeflated, SF 10^3} \]

(identity 25)

\[ \text{WR}_t = \text{average annual money wage rate, undeflated, SF 10^3 per worker} \]

(identity 26)

\[ \text{DUM3}_t = \text{dummy variable for break in REMIT series (}=1.0 \text{ up to 1953, .5 in 1954, .0 thereafter).} \]

Regarding equation (12) for energy imports, our first impulse was to "explain" these imports by means of a general production and income variable (GDP) and an index of average winter temperature\(^{67}\). However, although the temperature variable had the right sign, it failed to pass the usual significance test \((t = -0.8)\); and an inspection of the import figures showed that, out of two exceptionally cold winters in recent times (1956 and 1965), imports of energy were unusually high in 1965 only; and, as will be seen presently, this can be explained by the effect of an anticipated rise in duties on energy imports (particularly oil).

If energy imports are made a function of GDP only, the equation does a rather poor job and the residuals suggest that some other systematic and large influence is at work. This influence is very likely speculative imports in anticipation of changes in duties on energy imports\(^{68}\). These duties (especially the one on oil) were increased several times, particularly in the 1960s. To test this speculation hypothesis, the following variable was tried:

\[
\left( \frac{\text{Duties on Energy}}{\text{Imports of Energy}} \right)_{t+1} - \left( \frac{\text{Duties on Energy}}{\text{Imports of Energy}} \right)_{t}
\]

But, if such speculative buying takes place in one given year, it is natural to expect imports to be lower in the following year, that is, the first year with

\(^{67}\) Industrial production would be a better production variable than GDP; however, the Swiss index of industrial production does not nearly go back far enough.

\(^{68}\) It must be said that substantial speculative imports of energy (mostly oil) are made possible because there is in Switzerland a storage capacity which, on account of national defense policy, is quite large by the standards of some other Western European countries like France, for example.
higher import duties. Consequently the following variable was also tried in addition to (a):

\[
(b) \quad \left( \frac{\text{Duties on Energy}}{\text{Imports of Energy}} \right)_t - \left( \frac{\text{Duties on Energy}}{\text{Imports of Energy}} \right)_{t-1}
\]

Both variables turned out to have the expected sign and were significant (t = 2.6 and —2.5 respectively). Moreover, the two coefficients were quite close (in absolute value): 8.4 and —7.6, which is also consistent with expectations. Consequently, it was decided to combine the two variables so that:

\[
\text{SPEC}_t = (a) - (b)
\]

This procedure improved the fit of the equation considerably. Naturally the \((\text{duties on energy})/(\text{imports of energy})\) components of (a) and (b) are assumed to be proxies for the tariff rate on energy imports which is clearly an exogenous variable.

However, if the proxies were poor ones and if the components of (a) and (b) showed some systematic movements other than those in tariff rates, there would be a clear and serious danger of simultaneous-equation bias in (12). Hence this equation might be improved in the future by gathering the necessary data to construct an index of "posted" tariff rates on energy imports.\(^{69}\)

Agricultural imports as explained by equation (13) are assumed to be dominated by two major influences:

1. The disposable income of households (DINC1) which expresses the final demand of households;\(^{70}\)
2. The domestic production of import-competing agricultural products (AGOUT).

The estimated equation (13) produces very large residuals in 1950, 1951, 1957 and 1964. Examining the components of the MAG variable, it appears that the very high imports of agricultural products in 1950 and 1951 are due to unusually large imports of coffee and sugar. This no doubt reflects the impact of the Korea crisis which led to substantial food hoarding by households (to an extent such hoarding was prompted by official policy).

As to the high agricultural imports in 1957, they were largely due to unusually high imports of fruit following adverse climatic conditions in the late winter of 1956/1957.

The fairly large discrepancy in 1964 is due mostly to large imports of meat (in the form of foreign cattle). In turn these imports were prompted by un-

\(^{69}\) For reasons of convenience, the (small) imports of electricity were aggregated with "other imports".

\(^{70}\) The case of fodder is ignored.
usually low domestic production of meat. For some reason this fall in domestic production of meat is not reflected in the AGOUT variable\textsuperscript{71}.

Looking at equation (13), it is seen that an increase in real \textit{per capita} disposable income of SF 1.0 produces an increase in imports of SF .050, which does not seem unreasonable. As to the constant term, that is, the inelastic part of \textit{per capita} agricultural imports, it seems fairly high at first glance since it means that the "rock-bottom" agricultural imports of a 3-person household is of the order of SF 1,575.00. However, it must be remembered that agricultural imports do not consist of food only but include large quantities of other goods of vegetal origin such as tobacco and beverages (this is an often forgotten detail). Even so, the fact remains that, if one multiplies equation (13) through by population, the constant term becomes the coefficient of the population variable in an equation which now explains total rather than \textit{per capita} imports. This is a procedure which is often dangerous for, if the sample is clustered far away from the origin, it means that a small error in the estimated slope will produce a large error in the constant term. Fortunately, in the present case, the observations are grouped fairly close to the origin.

The coefficient of the AGOUT variable gives an idea of the substitutability between foreign and domestic agricultural products; as expected, this substitutability appears as limited since a SF 1.0 increase in domestic production produces a \textit{ceteris paribus} decline in imports of SF .63 only\textsuperscript{72}.

Equation (14) for Swiss tourism abroad is a very simple one since expenditures of Swiss tourists abroad are seen as depending on disposable income only. If (14) is estimated without the squared income variable, the residuals give strong evidence of non-linearity. The negative sign of the squared income variable is however somewhat surprising since it means that the marginal propensity for foreign tourism declines as income increases. This may be due to the increasing cheapness and hence popularity of organized group-vacationing abroad; if true, it would mean that the squared income variable in fact picks up a price effect. Naturally, it would have been better, at least from the policy simulation point of view, to make explicit allowance for this price effect but no adequate price data could be found\textsuperscript{73}.

Equation (15) for "other imports" is an important one since these imports represent the bulk of total Swiss imports. The GDP variable is a general long-term activity-income one while DCONST and DINVE are the customary short-

\textsuperscript{71}Cattle-breeding is included in the AGOUT variable.

\textsuperscript{72}Since a (small) fraction of agricultural imports consists of inputs to domestic production (e.g. fodder), this coefficient may however somewhat underestimate substitutability.

\textsuperscript{73}Published data on tourism go back to 1954 only, but the Kommission für Konjunkturfragen was kind enough to supply us with data for earlier years.
term, "pressure-of-demand" variables which express the fact that when aggregate demand presses too hard against domestic production capacity it tends to "spill over" into higher imports. It is interesting to note that excess demand in the investment sector (equipment) spills over entirely into higher imports (the DINVE coefficient is not significantly different from 1.0) while only about one fourth of excess demand for consumption goods and services is absorbed by imports. This means that the domestic supply of capital goods is seen as much more inelastic than the supply of consumption goods and services, which is not unreasonable especially if services are considered. By contrast, excess demand in construction and in government services is assumed not to spill over at all.

It is noteworthy that none of the preceding import equations includes a relative price variable. Looking at the time profile of the import price deflator (PM), it is seen that this deflator varies little and rather erratically over time so that there does not seem to be a measurable price effect in the case of imports. It may be that a true import price index—as opposed to the "unit-value" deflator series—would lead to another conclusion.

Foreign tourism in Switzerland—equation (16)—is seen as depending on "world income" (about which more in the context of the following equation), the CWINC variable being a short-term, "pressure-of-demand" variable. In addition, the time trends are thought of as proxies for long-term price effects. (No appropriate price figures could be found.)

The specification of equation (17) for "other exports" is somewhat unusual in that it combines in one equation a demand element—the "world income" variable—and a supply factor—the relative price term. Ideally one should have two separate functions, one for demand and one for supply; however, the latter is beyond feasible estimation due to the lack of appropriate data so that the model includes but a set of general, aggregate supply functions for all production categories. If one looks at the time profile of the export price PX, one sees that it varied rather erratically up to the early 1960s when it started to rise at a steeper angle than in practically any other OECD country—a price trend to which Swiss firms in the export business responded by expanding their exports vigorously. The reason for taking PI (the investment price def-

The long-term marginal propensity to import implied by the GDP variable in (15) is quite high and, taking 1962 figures, it implies an import elasticity of about 1.69; as one knows, high import elasticities are characteristic of many import functions; in the Wharton-EFU model, for example, the overall elasticity is 1.54 [see Evans (1969), 225–226]. It is possible that such high elasticities reflect the historical recovery of foreign trade following World War II and the Great Depression.

The WINC coefficient implies an elasticity of Swiss exports with respect to foreign demand of about 1.4 (1.45 in 1962); this fairly high elasticity reflects the vigorous expansion of Swiss exports since World War II.
flator) as the denominator in the relative price variable is that exports of capital goods (e.g. machinery) loom very large in Swiss exports so that PI is most likely a better proxy for the price level on export-competing domestic markets than other available price deflators such as the consumption one (PC).

The nature of the “world income” variable WINC must be explained. As it is, WINC is a fixed-weight index of the money GNP (in $ at the current exchange rate) of 22 OECD Member countries, with the weight for each country being its average propensity to import from Switzerland. These 22 OECD countries account for the bulk of Swiss exports; if all that mattered were as comprehensive an index as feasible given the available data, it would have been possible to include at least twice as many countries. However, an index restricted to OECD countries has the decisive advantage of being highly operational in a forecasting context, in the sense that GNP forecasts for OECD Member countries are easily available at the time they are needed since a complete set of projections is presented to and discussed at the meeting of OECD’s “Economic Policy Committee” on a routine basis in October of each year. Given that the Swiss economy looms quite small on an international scale (Swiss foreign trade represents 2–5% of world trade), the feed-back of Swiss economic activity on the income of other countries is small enough to be practically negligible so that WINC is taken as exogenous. Considering that, on the average, exports represent about one third of Switzerland’s GDP, it is clear that WINC is by far the most important exogenous variable in the model, in the sense that a good WINC forecast is sure to be a necessary—if not a sufficient—condition for the model to generate good forecasts. As the record shows, OECD forecasts are far from being always accurate; however, it is clear that, at least at this stage, it would be difficult for Swiss forecasters to produce their own, supposedly better projections.

Household remittances abroad—equation (18)—are seen as depending essentially on foreign workers. Consequently annual remittances per foreign worker are “explained” by the average annual money wage rate since, in the present state of Swiss statistics, there exists no separate wage rate series for foreign workers. Looking at the data on household remittances, it appears that these were seriously underestimated in the early 1950s and then adjusted upwards in a step-wise manner. To account for this quasi-certain flaw in the data a special dummy variable is used in (18).

Before turning to the model’s next sector, it must be added that when the model is solved, equation (11) for inventory investment is re-normalized so that it determines the cyclical, pressure-of-demand variable UO whilst inventory investment is determined “residually” by the GDP identity (9).
Sector III: Income (Factor Shares), Prices and Money

(19) Labor Income (The Wage Rate):

\[ RWR_t = -4.014 + 0.856 \text{PROD}_t - 0.0091 \text{CFW}_t + 0.2581 \text{UO}_t \]
\[ (-7.2) \quad (28.2) \quad (-3.3) \quad (5.1) \]
\[ \text{S.E.} = 0.216 \quad R^2 = 0.986 \quad \text{D.W.} = 1.0 \quad 1950-1967 \]

\( RWR_t \) = real gross wage rate per employed, 1958 SF 10^3 (identities 26 and 57)

\( \text{CFW}_t \) = annual change in foreign workers, '000 persons (identity 58).

(20) Paid-Out Profits:

\[ YP_t = -79.7 + 0.546 \text{GDPRO}_t + 0.1965 \text{DEGRP}_t + 0.571 \text{YP}_{t-1} \]
\[ (-1.1) \quad (4.6) \quad (5.7) \quad (4.5) \]
\[ \text{S.E.} = 50.0 \quad R^2 = 0.999 \quad \text{D.W.} = 2.1 \quad 1949-1967 \]

\( YP_t \) = household property income,

\( \text{GDPRO}_t \) = paid-out profits, SF 10^6

\( \text{GPRO}_t \) = \( YP_t \) + retained (undistributed) profits

\( \text{DEGRP}_t \) = deviation of \( \text{GPRO}_t \) from its trend, SF 10^6 (identities 58 and 59).

(21) Private Consumption Price Deflator:

\[ PC_t = 0.2815 + 0.672 \text{ULC}_t + 0.2404 \text{ULC}_{t-1} + 0.0562 \text{INT}_{t-1} \]
\[ (10.4) \quad (2.4) \quad (8) \quad (3.3) \]
\[ \text{S.E.} = 0.0117 \quad R^2 = 0.989 \quad \text{D.W.} = 1.1 \quad 1951-1967 \]

\( PC_t \) = private consumption price deflator (1958 = 1.0)

\( \text{ULC}_t \) = unit labor cost, 1958 SF 10^6 (identity 68).

(22) Government Consumption Price Deflator:

\[ PG_t = 0.3591 + 0.0731 \text{WR}_t \]
\[ (55.0) \quad (72.9) \]
\[ \text{S.E.} = 0.0127 \quad R^2 = 0.997 \quad \text{D.W.} = 1.5 \quad 1950-1967 \]

\( PG_t \) = government consumption price deflator (1958 = 1.0).
(23) Investment Price Deflator:

\[ PI_t = -0.146 + 1.603 ULC_t + 0.0131 UO_{t-1} - 0.011 DUM7 \]
\[ S.E. = 0.0167 \quad R^2 = 0.992 \quad D.W. = 1.2 \quad 1951-1967 \]

\( DUM7 \) = dummy variable to account for Korea War boom (= 1.0 in 1950 and 1951, = 0 thereafter).

(24) Export Price Deflator:

\[ PX_t = 0.2890 + 0.6802 PC_t + 0.000554 DEVI_t + 0.00875 UO_{t-1} \]
\[ S.E. = 0.0157 \quad R^2 = 0.974 \quad D.W. = 1.4 \quad 1950-1968 \]

\( DEVI_t \) = deviation of “world money income” from trend (identities 51 and 32).

(25) International Private Capital Flows:

\[ FK'_t = -5,800.6 + 771.7 \text{INTDI}_t + 1.946 CGDPC_t + \]
\[ + 1,007.1 DUM4 + 713.7 UO_t \]
\[ S.E. = 469.0 \quad R^2 = 0.865 \quad D.W. = 1.8 \quad 1950-1968 \]

\( FK'_t \) = net private capital inflow\(^76\), SF 10\(^6\) (identity 27)
\( \text{INTDI}_t \) = differential between Swiss “pure” interest rate and similar rate in United States (identity 28)
\( CGDPC_t \) = annual change in gross domestic product, undeflated, SF 10\(^6\) (identities 29 and 50)
\( DUM4 \) = dummy variable for (a) inflow of speculative funds into Switzerland following revaluation of German mark and expectations that Swiss franc would be revalued too, and (b) the subsequent outflow of these funds (= 1.0 in 1961, −1.0 in 1962, .0 otherwise)

\(^76\) This series is described in Schiltknecht (1970).
\( \text{(26) Money Supply:} \)

\[
\text{MON}_t = -4,555.6 + 1.855 \text{MOB}_t + 720.5 \text{INT}_t
\]

\[
(-4.9) \quad (20.7) \quad (1.6)
\]

\[
\text{S.E.} = 595.1 \quad R^2 = .988 \quad \text{D.W.} = .9 \quad 1950-1968
\]

\( \text{MON}_t = \) money stock, SF 10\(^6\)

\( \text{MOB}_t = \) “monetary base”, SF 10\(^6\) (identity 42; source: *Monatsberichte der schweizerischen Nationalbank*).

\( \text{(27a) Money Demand:} \)

\[
\text{MON}_t = 1,810.4 + .5786 \text{SAL}_1 + 813.0 \text{INT}_t + 286.5 \text{UO}_t
\]

\[
(2.3) \quad (40.7) \quad (-5.2) \quad (4.9)
\]

\[
\text{S.E.} = 280.4 \quad R^2 = .997 \quad \text{D.W.} = 1.5 \quad 1950-1968
\]

\( \text{SAL}_1 = \) total sales, SF 10\(^6\) (identity 41).

\( \text{(27b) The «Pure» Interest Rate:} \)

\[
\text{INT}_t = 2.401 - .000507 \text{MON}_t + .000211 \text{SAL}_1 + .11157 \text{UO}_t
\]

\[
(6.5) \quad (-5.2) \quad (5.8) \quad (1.6)
\]

\[
\text{S.E.} = .2214 \quad R^2 = .844 \quad \text{D.W.} = 1.7 \quad 1950-1968.
\]

\( \text{(28) Link Between Credit Markets:} \)

\[
\text{HYP}_t = .2755 \text{INT}_t + .775 \text{HYP}_{t-1}
\]

\[
(6.1) \quad (19.8)
\]

\[
\text{S.E.} = .074 \quad R^2 = .924 \quad \text{D.W.} = 2.3 \quad 1948-1966.
\]

Together with identities (26) and (57), equation (19) for the wage rate determines the real and money income of labor. Given the absence of any significant unemployment in Switzerland, it is of course not possible to explain the Swiss wage rate in the usual Philipps-curve fashion, and another theoretical structure is needed; in the present case, we drew our inspiration from Kuh’s productivity theory of the wage rate. In (19) the average real wage rate of labor is seen as depending on one long-term, structural factor—productivity—and on two short-term, cyclical factors standing for the pressure of demand in the labor market. As expected, the inflow of foreign migrant workers is shown to

\(^{77}\) See Kuh (1967).

\(^{78}\) Surprisingly, UO turned out to do a better job in (19) than OT or DOT.
have a negative effect on the real wage rate of labor in Switzerland; taking mid-sample values, a 1% increase in foreign migrant labor depresses the wage-rate by about .5%. As is, equation (19) is not very satisfactory: The Durbin-Watson $d$ statistic is low and the PROD coefficient implies an elasticity of the wage rate with respect to labor productivity of about 1.2, which seems too high. Therefore this equation is presumably a candidate for further research.

Since total gross income ($\equiv$ gross product) is determined globally both on the aggregate demand and on the aggregate supply side, and since labor income is determined by equation (19), gross income from property is in effect determined residually by the combined national accounting identities (1) through (5). Hence what remains to be explained is gross vs. paid-out property income (or, if one prefers, business saving, that is, undistributed profits).

Equation (20) determines paid-out profits. These are seen to depend predominantly on gross profits received by firms; in addition, short-term revisions in the firms' dividend policies are accounted for by the DEGRP variable. Finally, it is well known that firms tend to be rather conservative in their dividend payments which they do not like to see fluctuate too much; this is expressed by the familiar Koyck-Nerlove transformation. The coefficient of the lagged dependent variable does not appear to be too high, especially if one considers that part of $YP$ is made up of interest payments to bondholders. Nevertheless, we must register here our impression that the property income figures for Switzerland look rather suspicious. Specifically, it is hard to believe that dividend payments (i.e. $YP$ after excluding payments to bondholders) should have increased but very little in the early 1960s at a time when, by all accounts, demand was very strong and business was thriving. As one knows, this is not a problem particular to Switzerland since the recent revisions of both French and Italian national accounts revealed that property income had been seriously underestimated in the 1960s. In any case, it will be seen that this suspicion of serious underestimation of property income also arises in the context of the business profit tax equation (51).

The Swiss national accounts include 5 price deflators. Given that Switzerland does not loom very large in the world economy, the import price deflator is taken as exogenous; that is, this price index is considered to be determined in "world markets". Thus, four price deflators must be explained endogenously, the first of which is the private consumption price deflator.

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79 Allowing for both the increase in CFW and for the fall in labor productivity PROD induced by an increase in foreign migrant labor (see equation 1).

80 Gross income from property is equal to $YP_t$ plus business saving $SF_t$.

81 A sixth price deflator for the consumption of insurance companies has been "aggregated away" since we have merged the separate insurance account with other accounts; see Appendix A.
Again, the specification of equation (21) for the consumption price deflator is not unusual and is quite close to the Wharton-EFU price equations, for example, except for the absence of a short-term pressure-of-demand variable. This means that consumer prices in Switzerland appear to be mainly cost-determined. A novel feature is the inclusion of the lagged interest rate which expresses the notion that, given that most Swiss households live in apartments and given that mortgage-financing is very widespread, a change in the interest rate eventually will be "passed on" to consumers in the form of higher rents. Despite its low significance the lagged unit-labor-cost variable was kept in the equation to account for the well-known stickiness of Swiss consumer prices when compared to the volatility of prices in some other European countries like France for example. (If this variable is deleted from (21), other coefficients are hardly affected).

As one knows, the bulk of government consumption in Switzerland—about 60%—consists of services rendered by government employees. (This is more true in Switzerland than in some other countries given that in Switzerland military expenditures represent a considerably smaller share of GDP and public expenditures.) Consequently, it is not surprising to find that in equation (22) the money wage rate alone does an acceptable job in explaining the government price deflator.

The coefficient of the unit-labor-cost variable in the investment-price equation (25) seems quite high when compared to the similar coefficient in (21) and probably expresses the greater short-term volatility of capital-good prices. In that context it is interesting to note that, among OECD countries, Switzerland is almost the only country in which investment prices increased at a faster pace since World War II than consumer prices. Contrary to what was found for consumer prices, it appears that the prices for capital goods also respond to the pressure of demand, although with a lag.

Swiss export prices as determined by equation (24) are seen to depend on the general price level in Switzerland (PC), on short-term fluctuations in the...
pressure of demand in export-competing domestic markets (UO), as well as on world activity, that is, foreign demand (DEV1).

Turning to monetary matters, it is commonly known in and out of Switzerland that international capital movements play a non-negligible role in the Swiss economy. Therefore capital movements would seemingly warrant more than the single equation (25). Unfortunately published data are rather scant, and all that could be compiled so far is a series of net private flows. However, the situation is not hopeless, for the general causal nexus governing capital movements to and from Switzerland seems sufficiently straightforward to be described adequately by a single equation.

In the matter of capital movements to and from Switzerland and their impact on the domestic economy, one may first discount the very volatile movements of hot money. Speculative capital flows of this type as a rule move very rapidly in and out of the country so that they are unlikely to show up in annual figures unless they happen to straddle the end of the year. In the sample period, significant speculative capital movements straddling the end of the year seem to have taken place only once so far, i.e. in 1961–1962 when, following the revaluation of the German mark, many speculated that the Swiss franc would be revalued too. In equation (25) this is expressed by a special dummy variable (DUM4) which takes the value 1.0 in 1961 and −1.0 in 1962 (zero in other years). The size of the DUM4 coefficient suggests that the 1961–1962 speculative wave on the Swiss franc was of the order of one billion francs.

But, of course, not all capital movements affecting Switzerland are as volatile as hot money flows. For example, it may be that, because they lack confidence in the political and/or monetary stability of their country, the property-tied and monied classes of a number of countries judge it more prudent to transfer part of their funds to Switzerland. Such a state of affairs may be more or less permanent (e.g. in countries suffering from chronic monetary and/or political instability) or it may follow a relatively sudden confidence-shattering upheaval. The 1968 mini-revolution in France is an example of the latter; another example is the 1964 capital flight out of Italy following the nationalization of the electric power industry. When such longer-term capital movements occur the question is of course: what will the Swiss banks do with these

86 The "end of the year" here means the end of November, for taking end-of-December official reserve figures to compute capital movements yields a spurious series on account of end-of-year "window-dressing" operations by commercial banks. Net private capital movements are calculated residually from the balance of the foreign account in the national accounts, the official reserves of gold and foreign exchange, and government capital movements.

87 It seems that a similar flight of capital out of Italy and into Switzerland has just recently happened again.
funds? The answer to this question implicit in equation (25) is that it largely depends on the demand for funds in Switzerland which is itself assumed to be a function of the general state of demand in the country. Suppose, for example, that in a given year demand in Switzerland is "low"; it is then assumed that most of these funds will be promptly re-invested abroad (typically on the New York stock exchange); if however domestic demand in that year is high, a fraction of these funds will be retained and invested in Switzerland itself.

Naturally, foreign capital inflows of this type are essentially exogenous, that is, they may show considerable independent fluctuations from one year to the next. One may consequently wonder what happens if in a given year domestic demand is high but the inflow of longer-term foreign capital is low. In this case it is assumed that Swiss banks (which have reasons to prefer investing at home rather than abroad) will draw on the very large liquid assets they hold abroad in order to meet the domestic demand for funds. (These assets were recently estimated to be in the SF 15 billion range as compared with a GDP in the 50–70 billion range). In equation (25) this "domestic demand effect" on net international capital flows is expressed by the change-in-GDP and the UO cyclical variables, the latter variable being of a more short-term nature than the former one.

But this "demand effect" is not the whole story since there also is a very important "price effect". In equation (25) this price effect is represented by the interest rate differential between Switzerland and the United States; as seen from the size of the coefficient of the INTDI coefficient, this effect appears to be quite large\textsuperscript{88}. In summary, then, the theory underlying (25) is that longer-term flows of foreign funds to Switzerland will be retained and invested domestically depending both on the state of demand in the economy and the relative interest rates; furthermore, Swiss banks are also assumed to smooth out fluctuations in foreign capital inflows by drawing on their very substantial liquid masse de manoeuvre\textsuperscript{89}.

Equation (25) does a pretty good job explaining international capital movements in the sample period. As will be seen below in the context of the 1970 forecasts generated by the model, there is some question whether this remains true in the years after 1967–1968. The reason is that recent years witnessed the rapid emergence of a large and extremely lucrative international market for Euro-dollars. And, since the interest rates in this market and in the U.S.

\textsuperscript{88} The U.S. interest rate is taken as exogenous. Although funds from Switzerland loom quite large amongst foreign flows of funds to and from the U.S., this is probably justifiable given the size of the American economy. It must be added that the INTDI variable is in fact the second difference between the Swiss and the American rate so that it really measures a short-term price effect.

\textsuperscript{89} It must be added that the same mechanism combining a demand and price effect governs capital outflows originating within Switzerland. (There is some evidence that "structurally" Switzerland is a net capital exporter).
do not seem to move together, there is a serious danger that when the equa-
tion is used for forecasting, it will fail to account for the attraction exerted by
the Eurodollar market and will overpredict net capital inflow. Should this be
confirmed, equation (25) will have to be revised.

The money supply as determined by equation (26) is seen to depend on the
monetary base and the domestic interest rate. Via the National Bank balan-
ce-sheet identity (42) and the foreign account/capital movement identities
(3) and (27), the monetary base depends predominantly on the foreign sector or,
to be more precise, on the balance of payments. (The other items in the Na-
tional Bank’s balance sheet—credits and liabilities vis-a-vis commercial banks,
deposits of the National Bank’s private clients, the Bank’s own capital, other
assets and liabilities—are quite small in Switzerland and are taken as exoge-
nous). This means that the present model makes considerable allowance for
the possibility of “imported inflation” (or, for that matter, “imported deflation”); for example, if there is a large trade surplus and/or a substantial
inflow of capital, this will inflate the monetary base, boost money income and
aggregate demand, and presumably drive up prices.

Nevertheless, equation (26) is no doubt too rudimentary and is likely one of
the model’s weak equations (notice the low Durbin-Watson d statistic). This
is surely due to the fact that the banking sector probably differentiates be-
tween domestic and foreign deposits when expanding the credit pyramid. Un-
fortunately, it is not possible to allow for this, given that no sufficiently long
series of non-resident deposits is available.

The sales variable in the money demand equation (27 a) stands for the fa-
miliar “transactions demand” for money and the interest variable for the
“speculative demand” for money. The latter variable’s large coefficient and
its relatively high significance are particularly noteworthy. Finally the UO
variable is a proxy for short-term cyclical fluctuations in money demand.

When solving the model, the money-demand equation is re-normalized so
that it determines the interest rate INT. However it was found that when the
equation is estimated directly with the interest rate as the dependent varia-
ble, somewhat better results obtain although (27 b) shows that the coefficients
are affected to some extent by this transformation.

MON in (27 a) is the nominal stock of money. If one believes that there is no
“money illusion”, which implies that the money demand relationship is homogenous of
degree one in prices, it would be better to use the deflated money stock as the dependent
variable and deflated sales on the right-hand side. As in the money supply equation, it
would also be better—if the data allowed it—to distinguish between the domestic and
foreign deposits which make up MON. Finally, the interest rate in (27 a) should theoreti-
cally be the “real” and not the nominal rate; but, as one knows, adjusting the nominal
rate for price change expectations is a delicate matter involving time horizons so that it is
ignored in practically all models.
There are two interest rates in the model: the average rate on mortgages and the "riskless" rate on bonds of the Federal government. For the model to be complete, these two rates or, if one prefers, these two credit markets must be linked. This is done in equation (28) which is based on the well-known fact that, whereas the interest rate on bonds is a highly volatile one, the rate on mortgages tends to be very sticky. In other words, a tightening of general credit conditions tends to affect the bond rate first while it takes time for the mortgage rate to respond. Equation (28) implies that $HYP = 1.23 \times INT$ in static equilibrium, the difference being presumably a measure of the risk differential.

*Sector IV: The Government*

By contrast with many other models in which total taxation and government transfers are taken as exogenous, this model includes a number of empirical tax and transfer equations. Government expenditure variables, however, are kept exogenous which is quite in line with accepted macro-econometric practice; the implication is of course that when the model is used for forecasting, government expenditures must be projected independently on the basis of budgetary documents, official policy pronouncements, past trends, etc.

(29) Household Income Taxation:

$$\text{TAX}_t = -254.2 + 0.0677 \text{YAV}_t + 0.0097 \text{YAVSQ}_t + \frac{(-1.8)}{(5.8)} + \frac{143.4}{(4.8)} \text{DUM}_1 + \frac{54.59}{(2.2)} \text{UO}_t$$

$S.E. = 63.6 \quad R^2 = .998 \quad D.W. = 1.5 \quad 1950-1968$

$\text{TAX}_t =$ household income taxes, SF $10^6$ (identity 17)

$\text{YAV}_t = [\text{(household income}^{91})_{t-1} + (\text{ibid.})_{t-2}] / 10,000.0$ (identities 16 and 18)

$\text{YAVSQ}_t = \frac{\text{YAV}_t}{10,000.0}$(identities 16 and 18)

$\text{DUM}_1 = $ dummy for time profile of national defense tax ($= 1.0$ in even years, $0.0$ in odd years).

$^{91}$ Government transfers to household are not included in taxable income because only a small fraction of these transfers is subject to taxation (mainly the pensions of civil servants). Transfers from public insurance schemes are included because they are generally taxable. Household contributions to public insurance schemes are excluded for they are not subject to income taxation. In certain Cantons payments by households to private in-
(30) Indirect Taxation:

\[
TC_t = -65.6 + .04505 \text{SAL}_t - 65.001 \text{ICHA}_t - \\
(-2.8) (50.0) (-2.8)
- 158.6 \text{TBRE}_t + 8.405 \text{DOT}_t \\
(-4.0) (2.4)
\]

\[
\text{S.E.} = 27.2 \quad R^2 = .998 \quad \text{D.W.} = 1.5 \quad 1950-1967
\]

\(TC_t\) = total indirect taxation, SF 10^6 (identity 4)

\(\text{SAL}_t\) = total final sales, SF 10^6 (identity 20)

\(\overline{\text{ICHA}_t}\) = dummy for cut in «impôt sur le chiffre d'affaires/Warenumsatzsteuern» in 1959 (= .0 until 1958, = 1.0 thereafter).

\(\overline{\text{TBRE}_t}\) = dummy for suppression of «droit de timbre/Stempelsteuer» (= .0 up to 1966, = 1.0 thereafter).

(31) Business Taxation:

\[
\text{TF}_t = -23.26 + .0779 \text{AVPR}_t + .00468 \text{AVPRSQ}_t + \\
(-.3) (3.3) (2.7)
+ 95.78 \text{DUM1}_t + 221.21 \text{DUM2}_t \\
(6.8) (8.1)
\]

\[
\text{S.E.} = 29.5 \quad R^2 = .994 \quad \text{D.W.} = 2.5 \quad 1950-1967
\]

\(\text{TF}_t\) = business taxation, SF 10^6 (identity 4)

\(\text{AVPR}_t\) = average gross profits in years \(t-1\) and \(t-2\), SF 10^6 (identity 23)

\(\text{AVPRSQ}_t\) = \((\text{AVPR})^2/1,000.0\) (identity 24)

\(\text{DUM2}_t\) = dummy for possible increase in business taxation after 1960 or, more likely, for serious underestimation of property income in the 1960s (see comments on equation 20), or for both (= .0 up to 1960, = 1.0 thereafter).

Insurance companies are tax deductible; due to lack of uniformity this is however ignored. Since it would be highly unpractical to have payments by firms to private insurance companies on behalf of their employees as an exogenous variable in the model, these payments are considered to be part of taxable income; the error involved is certain to be small.

\[92\text{ Transactions between wholesalers are not subject to indirect taxation.}\]
(32) Foreign Trade Duties:

\[ TM_t = -200.0 + 0.0775 \text{FAS}_t + 152.65 \text{TAR}_t + 1.443 \text{ENER}_t \]

\[ (-9.0) \quad (22.0) \quad (7.1) \quad (8.7) \]

S.E. = 20.6 \quad R^2 = .999 \quad D.W. = 2.3 \quad 1949-1967

\( TM_t \) = duties on imports, SF \( 10^6 \) (identity 4)

\( \text{FAS}_t \) = imports, SF \( 10^6 \) (identity 21)

\( \text{TAR}_t \) = dummy for new general tariff schedule adopted in 1960 (= .0 before 1960, = 1.0 thereafter)

\( \text{ENER}_t \) = see comments on equation.

(33) Social Security (AVS/AHV) Dues Paid by Firms:

\[ \text{AVSPN}_t = -0.0125 + 0.0258 \text{WR}_t + 0.00248 (\text{WR})_t \cdot (\text{DUM5})_t \]

\[ (-2.4) \quad (36.8) \quad (7.3) \]

S.E. = .00356 \quad R^2 = .999 \quad D.W. = 1.4 \quad 1948-1967

\( \text{AVSPN}_t \) = Social security dues paid by firms on account of workers and employees, SF \( 10^3 \) per employed (identity 33)

\( \text{WR}_t \) = money wage rate, SF \( 10^3 \) (identity 26)

\( \text{DUM5}_t \) = dummy for change in rate of contribution (= .0 up to 1959, = 1.0 thereafter)

(34) Household Social Security (AVS/AHV) Dues:

\[ \text{UHWPC}_t = -0.0458 + 0.0463 \text{WR}_t + 0.00306 (\text{WR})_{1960}\text{on}_t + \]

\[ + 0.00171 (\text{WR})_{1966}\text{on}_t + 0.00337 (\text{WR})_{1967}\text{on}_t \]

\[ (-4.2) \quad (53.3) \quad (5.5) \quad (4.1) \quad (7.5) \]

S.E. = .005 \quad R^2 = .999 \quad D.W. = 1.1 \quad 1950-1967

\( \text{UHWPC}_t \) = household social security dues, SF \( 10^3 \) (identities 17 and 44).

To say the least, the different household income tax laws of Switzerland are not simple. First, let us consider the Cantonal laws. In most Cantons, and in the most important Cantons, households generally report their income every
second year only. In a number of Cantons (e.g. Berne), households report the income they have received in the preceding two years; these two annual incomes are then averaged out to make up the tax base. In other Cantons (e.g. Zurich), no such averaging takes place and the tax base is simply the income of the preceding year. The first tax bill is then generally sent out to households in the same year as the income tax report was filed, and the first tax payment takes place either in the same year or early in the following one. The second tax bill will be based on the same income tax report unless a household’s income has changed significantly in which case an intermediary income report must be filed. This picture is likely to be an acceptable approximation of reality in most Cantons, but in some of them, and especially in the smaller ones, the income tax laws may be quite different.

As to the Federal income tax ("national defense tax"), it is also based on the average income received in the two years preceding the reporting year. The payment modalities of this Federal tax and the resulting curious zigzag pattern in the tax proceeds have already been explained briefly in the context of equations (1) and (2).

To complicate things further, income tax receipts of the various Cantons do not follow any uniform time pattern. In certain Cantons (e.g. Berne), tax receipts increase more or less smoothly with household income; in other Cantons (e.g. Zurich) the same two-year zigzag pattern is observed as in the case of the Federal income tax; in others a zigzag pattern is also observed but with peaks and troughs shifted by one year... Finally, there are the not negligible local income taxes which are another maze.

It must be pointed out that not only are these different tax laws bewilderingly complicated in a purely formal sense, but they also mean that household income taxes are automatic destabilizers\(^\text{93}\) because of the various and fairly long time lags involved and because of the absence of a general tax withholding scheme. Given the hairraising complexity of Swiss tax laws, the only possible approach to an aggregate income tax function is a very empirical one. Thus, it was found, after some experimentation, that the best working function—i.e. equation (29)—includes the following explanatory variables: the average household income over the preceding two years \((t-1\) and \(t-2\)); the same variable but squared in order to account for progressivity (all equation pointed clearly to non-linearity); a dummy to account for the biennial nature of the Federal national defense tax\(^\text{94}\). Although all tax rates have not remained immutable over the sample period, it was not found necessary to make explicit allowance for known changes in tax rates. This may be because cuts in certain

\(^{93}\) See Schelling (1956).

\(^{94}\) The size of this dummy’s coefficient is quite consistent with the observed biennial «swing» in Federal income tax receipts.
tax rates (national defense tax) tended to be canceled out by boosts in other rates (Cantonal taxes).

Equation (29) implies that the marginal overall income tax rate was 9.6% in 1951 and 16.3% in 1967; but there is always the danger that a squared variable like YAVSQ will exaggerate the change in the slope of the function, so that overall income tax progressivity may be somewhat overestimated. Even so, it is interesting to note that the Swiss economy managed to forge ahead at a respectable pace and that "full employment of resources" was assured in practically all years despite what, in other countries, would be considered an unbearingly heavy "fiscal drag".

Finally, it appears that household income tax payments are influenced by cyclical variations in income, an effect which is expressed by the UO variable in (29): in years of strong demand, actual tax receipts are ceteris paribus more than predicted and vice-versa in years of weaker demand. One possible explanation is that in years of weak demand, fewer tax-payers choose to pay their taxes at an early date and in a lump-sum, and vice-versa when demand is stronger.

Turning to equation (50) for indirect taxation, the SAL, coefficient implies a marginal rate of taxation over the whole period of 4.3%. Compared to most other countries this is moderate and compared to some (e.g. France) it is very moderate. The two dummies ICHA and TBRE stand for the two most important known changes in indirect taxation over the sample period. If (50) is estimated without the cyclical variable DOT, the residuals show that in years of low demand (e.g. 1958) predicted taxation is higher than actual taxation, and vice-versa in years of high demand. Given that, unlike households, firms have little if any latitude in postponing or advancing tax payments to the government, one fairly plausible explanation is that those consumer goods which are exempted from indirect taxation have a lower income elasticity on the average than consumer goods subject to taxation. Then, total indirect taxation will be proportionally lower in years of lesser demand, even though the nominal rates are unaffected.

Superscript 95 Naturally the concept of "full employment of resources" is vague in Switzerland, even in the short term (inflow of foreign labor; in the longer run, inflow of foreign capital).

Superscript 96 Cooking gas, water, electricity, heating fuels, soap and detergents, food and non-alcoholic beverages, agricultural goods whether input or output, medicine, books etc.

Superscript 97 Some special taxes (on beer, liquor, etc.) entail an effect in the same direction. In the opposite direction, there is the fact that the second most important tax after the "impôt sur le chiffre d'affaires" is the tax on cars which has to be paid annually by all car owners. This should tend to make for actual taxation higher than predicted in years of low demand, and vice-versa. Judging from (30), it seems however that the net effect is in the other direction.
The rationale underlying equation (51) for business taxation is quite similar to that for household income taxation and should not require many extra comments. Suffice it to point out that the marginal rate of business taxation also appears as quite low in Switzerland\(^{98}\). Furthermore the data for business profit taxation confirm an earlier suspicion that property income in the 1960s is seriously underestimated; this is accounted for by a special dummy which conceivably may also pick up a formal increase in the nominal rate of taxation.

Turning to equation (52) for foreign trade duties, the coefficient of the FAS variable seems to indicate that Switzerland’s marginal tariff level on imports is quite moderate (7.8\%). This no doubt reflects reality in the case of non-agricultural, non-energy imports, but not insofar as agricultural imports and energy imports are concerned. Swiss agricultural imports in particular are subject to some of the highest duties in Europe\(^{99}\). The TAR dummy in (52) is assumed to pick up the effect of the introduction of the new schedule of tariffs in 1960. As is explained in the context of equation (12) for energy imports, these imports were characterized by a number of large and sudden fluctuations and counterfluctuations due to speculative buying in anticipation of the several significant increases in the level of the tariff on energy imports which took place over the sample period. These two effects are combined in a multiplicative manner: \( \frac{\text{Energy Imports}}{\text{Total Imports}} \) expresses the changing share of energy in total imports while \( \frac{\text{Duties on Energy Imports}}{\text{Energy Imports}} \) expresses the effect of changes in average tariff level, so that the ENER proxy is defined \( \frac{\text{Duties on Energy Imports}}{\text{Total Imports}} \). The denominator in the latter expression is taken as endogenous while the numerator is considered to be exogenous.

Equation (55) for social security (AVS/AHV) dues paid by firms on account of their employees is quite straight-forward and should not require any particular comments, except for the fact that the increase in the rate of these dues which took place in 1960 is accounted for by a special dummy.

Again, no special comments would seem to be called for in the case of equation (54) for household social security dues, except to point out that three special variables account for known changes in the rate of social security dues (especially “caisse maladie/Krankenkasse” dues paid by workers and employees).

Considering both equations (55) and (54) it is quite remarkable that the empirically estimated social security contribution rates are very close to the

\(^{98}\) This marginal rate is 10.8\% in 1951 and 15.4\% in 1967, with the same proviso as in the case of income taxation.

formal rates, which means that the calculated average wage rate variable (see identity 26)—and, by implication, the labor income and employment series—are quite close to reality. This is comforting given that the calculation of "labor income" from national accounting data involved the separation of proprietors’ income (i.e., self-employed) as between labor and property income (see Appendix A).

Conclusion

Once a model has been set up and estimated, one naturally wants to use it. The first step to that end is to “solve” it. If the model is completely linear, a simple process of matrix inversion and multiplication will yield the desired set of “reduced-form” equations, that is, a set of as many equations as there are current endogenous variables and in which all the right-hand side variables are “pre-determined” (= exogenous + lagged endogenous). This model of the Swiss economy being largely non-linear, another method of solution must be used. One such method would be to linearize the model around recent values. Another, more elegant means of solution would be blockwise iteration which has been used here and which has been fully described elsewhere100. So suffice it to indicate that, in this case, solving the model by iteration has not been easy and that a number of special technical procedures had to be applied before convergence was achieved.

Once a model has been solved, or rather once it has become solvable, it can be used to three ends at least: (a) Forecasting; (b) Policy simulation; (c) General simulation (i.e., calculation of values predicted by the entire model over the sample period; investigation of particular historical episodes; properties of the model as a whole or certain of its blocks of equations).

As indicated earlier, work is currently in progress on (c) while (b) offers but a limited interest in the case of Switzerland where, at least so far, there is really nothing like the type of modern fiscal and monetary policies applied in other countries. This leaves forecasting as the main use to which this model can be put. In the following we summarize the results which we obtain when the model is used to generate forecasts for 1970. Since a complete exposition would take about 60 pages101, the following is but a very brief summary.

The first step when forecasting with a model is to calculate a set of independent projections for the exogenous variables. Altogether there are 56 current exogenous variables in this model which have all been projected up to


101 A complete exposition was circulated privately.
1970 by a combination of methods—such as: other forecasts (foreign demand); official policy documents (budgets); trends—tempered by "judgement". Table 1 below lists our projections for the most important exogenous variables:

Table 1: Projected Exogenous Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Observed</th>
<th>Projected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. World income (WINC)</td>
<td>% Change</td>
<td>5.8 8.4</td>
<td>10.7 8.8</td>
</tr>
<tr>
<td>2. Government investment</td>
<td>% Change</td>
<td>4.0 2.4</td>
<td>8.3 8.7</td>
</tr>
<tr>
<td>expenditures (IB + IG)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Government consumption</td>
<td>% Change</td>
<td>9.5 6.9</td>
<td>9.0 8.5</td>
</tr>
<tr>
<td>expenditures (CG)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Social Security Benefits</td>
<td>% Change</td>
<td>15.2 6.2</td>
<td>11.2 8.9</td>
</tr>
<tr>
<td>(UWH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. &quot;Swiss&quot; Population</td>
<td>'000</td>
<td>5,482 5,558  5,637 5,725</td>
<td></td>
</tr>
<tr>
<td>(POPSW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Import Prices (PM)</td>
<td>'58 = 1.0</td>
<td>1.062 1.068  1.097 1.119</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Factor Income from Abroad</td>
<td>SF 10^6</td>
<td>2,070 2,505  2,427 2,699</td>
<td></td>
</tr>
<tr>
<td>(FY1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Factor Income Paid Abroad</td>
<td>SF 10^6</td>
<td>820 1,005</td>
<td>965 995</td>
</tr>
<tr>
<td>(FY2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Total Depreciation Allow-</td>
<td>SF 10^6</td>
<td>5,123 5,604  5,818 6,180</td>
<td></td>
</tr>
<tr>
<td>ances</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Interest Rate on US Bonds</td>
<td>% p.a.</td>
<td>4.85 5.20</td>
<td>6.40 5.50</td>
</tr>
</tbody>
</table>

---

1 "Swiss" population, as defined here, includes foreigners with the right of permanent residence ("permis d'établissement").
2 = CFED + CFCD + CRD + CB (1958 SF 10^8)
3 Bonds of the Federal government.
4 Series was adjusted starting in 1968.
5 Over previous year.
### Table 2: Forecasts

<table>
<thead>
<tr>
<th>Variables</th>
<th>Units</th>
<th>In Current Prices</th>
<th>In Constant Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. National Accounts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Household Consumption</td>
<td>% Change</td>
<td>5.7</td>
<td>5.4</td>
</tr>
<tr>
<td>2. Government Consumption</td>
<td>% Change</td>
<td>6.9*</td>
<td>-</td>
</tr>
<tr>
<td>3. Total Capital Formation</td>
<td>% Change</td>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td>4. Total Exports</td>
<td>% Change</td>
<td>15.1</td>
<td>12.2</td>
</tr>
<tr>
<td>5. Total Imports</td>
<td>% Change</td>
<td>8.8</td>
<td>6.7</td>
</tr>
<tr>
<td>6. Gross Domestic Product</td>
<td>% Change</td>
<td>7.2</td>
<td>7.1</td>
</tr>
<tr>
<td>B. Prices and Interest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Consumption Deflator</td>
<td>% Change</td>
<td>2.7</td>
<td>2.6</td>
</tr>
<tr>
<td>8. Government Consumption Deflator</td>
<td>% Change</td>
<td>5.0</td>
<td>3.7</td>
</tr>
<tr>
<td>9. Investment Deflator</td>
<td>% Change</td>
<td>1.5</td>
<td>1.6</td>
</tr>
<tr>
<td>10. Import Deflator</td>
<td>% Change</td>
<td>.6*</td>
<td>-</td>
</tr>
<tr>
<td>11. Export Deflator</td>
<td>% Change</td>
<td>3.1</td>
<td>4.6</td>
</tr>
<tr>
<td>12. Mortgage Interest Rate</td>
<td>% p.a.</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>13. &quot;Pure&quot; Interest Rate</td>
<td>% p.a.</td>
<td>4.4</td>
<td>4.3</td>
</tr>
<tr>
<td>14. GDP Deflator</td>
<td>% Change</td>
<td>3.6</td>
<td>3.5</td>
</tr>
<tr>
<td>C. Selected Nominal Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Foreign Balance on Current Account</td>
<td>SF 10^6</td>
<td>2,350</td>
<td>2,477</td>
</tr>
<tr>
<td>16. Net Private Capital Inflow</td>
<td>SF 10^6</td>
<td>-1,916</td>
<td>-510</td>
</tr>
<tr>
<td>17. Government Surplus on Current Account</td>
<td>SF 10^6</td>
<td>3,195</td>
<td>3,061</td>
</tr>
<tr>
<td>18. Total Government Surplus</td>
<td>SF 10^6</td>
<td>-866</td>
<td>-1,000</td>
</tr>
<tr>
<td>19. Household Saving</td>
<td>SF 10^6</td>
<td>7,010</td>
<td>7,195</td>
</tr>
<tr>
<td>D. Cyclical Indicator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Unfilled orders</td>
<td>7.3</td>
<td>7.2</td>
<td>9.1</td>
</tr>
</tbody>
</table>

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Notes to Table 2:

* = exogenous.
1 i.e., calculated by the model.
2 Including private insurance companies.
3 Including Public Insurance Schemes.
4 “Emprunt net à la Suisse”; = FK in model’s notation.
5 i.e., surplus on current account minus government investment.
6 = FK', in model’s notation.
7 In months of production, given existing capacity.
8 Over previous year.

“Plugging” these projections into the model yields the 1970 forecasts listed in Table 2 above together with the 1968 “semi-ex post” forecasts102.

1970 is thus forecast to be a fairly strong year. The predicted strong expansion of total investment and the predicted inflationary upsurge in domestic prices are particularly noteworthy.

A close look, however, raises a number of doubts about these forecasts. First, it is seen that the model predicts a very large net private capital inflow in 1970. This induces a very significant easing of domestic monetary conditions—vide the fall in the “pure” interest rate INT—which in turn causes a veritable boom in construction and hence a sharp increase in total investment, aggregate demand and prices. In reality, the attraction exerted by the Euro-dollar market makes it very unlikely that such a large capital inflow will take place. Thus, we conclude that these 1970 forecasts are probably rather too sanguine.

These forecasts have been calculated for purely experimental and illustrative purposes; hence, we stop at this point and do not try to further adjust the model so that it produces a more plausible set of forecasts (for example, by correcting the capital inflow equation or, failing that, by dropping the equation altogether and substituting a “reasonable” estimate for net capital inflow). This type of “mixed” forecasting which combines a formal econometric approach with “judgemental” economics is in fact what is really done in those institutions which routinely use a model as part of their forecasting procedures (e.g.: the Wharton School; the Dutch Central Planning Bureau). Naturally it is also what will be done in the future at the Zurich Institut für Wirtschaftsforschung. In the meantime we thought it interesting to give the reader an idea of how the preceding uncorrected model forecasts while at the same time initiating the process by which this first macro-econometric representation of the Swiss economy will be molded over the years into a true and tried forecasting instrument.

102 These 1968 forecasts are called “semi-ex post” because a number of equations—especially those with squared variables—have been re-estimated on the basis of a sample including 1968.
Bibliography


Appendix A

Transformation of National Accounting Data

The purpose of this appendix is to show how published national account figures have been transformed for use in the model; an interested reader should have little trouble reconciling published figures and figures used in the model.

The numbers in brackets refer to the rubrique numbers in the Swiss national accounts as published in “La Vie économique”, September and October 1968.

National Accounting Identities

(1) \( Y_L + Y_P = CD + CND + SH + UE - UI + TH \)

(2) \( IE + IC + IR + ID + IB + IG = CFE + CFC + CR + CB + SH + SF + SG - FK \)

(3) \( XT + XO + UI + UG + FY1 = MA + MEN + MTOU + MO + FY2 + UE + FK \)

(4) \( YG + TH + UG + TF + AVS - SUB + TC + TM = CG + SG \)

\( Y_L = Y_{fl} + [Y_{fl}/(Y_{fl} + Y_{fp})] \cdot (Y_{prop}) + U_{fv} = 29,448 \)

\( Y_{fl} = (1.1) - (1.1.b) \)

\( 21,675 = 25,940 - 2,265 \)

\( Y_{prop} = (1.2) \)

\( 7,210 = 7,210 \)

\( U_{fv} = (\text{part of (5.7)}) \)

\( 1,470 = 1,470 \)

\( Y_{fp} = (1.5) \)

\( 5,120 = 5,120 \)

\( Y_v = [\text{part of (5.6)}] \)

\( 585 = 585 \)

\( CD = \text{expenditures for transports, communications et aménagement du logement} = 2,810 + 1,770 = 4,580 \)
\[
\begin{align*}
\text{CND} & = (1.13) - \text{CD} + \text{(part of (3.1))} \\
23,295 & = 27,815 - 4,580 + 60 \\
\text{SH} & = (5.8) + \text{(part of (3.5))} \\
5,040 & = 1,440 + 1,600 \\
\text{UE} & = (6.9) \\
960 & = 960 \\
\text{UI} & = (6.4) \\
250 & = 250 \\
\text{TH} & = (2.10) + (2.15) - (2.4) + \text{(part of (3.8))} - \text{(part of (3.2))} \\
2,415 & = 3,180 + 875 - \text{1,005} + 1,340 - 1,975 \\
\text{IE} & = (5.1.2) \\
4,490 & = 4,490 \\
\text{IC} & = 2,765 \\
\text{IR} & = 3,225 \\
\text{IC} + \text{IR} & = (5.1.1.2) \\
2,765 + 3,225 & = 5,990 \\
\text{IB} & = 866 \\
\text{IG} & = 1,294 \\
\text{IB} + \text{IG} & = (5.1.1.1.) \\
866 + 1,294 & = 2,160 \\
\text{ID} & = (5.1.2) \\
1,140 & = 1,140 \\
\text{CFE} & = 2,625 \\
\text{CFC} & = 720 \\
\text{CR} & = 845 \\
\text{CB} & = 205 \\
\text{CFE} + \text{CFC} + \text{CR} + \text{CB} & = (5.3) \\
2,625 + 720 + 845 + 205 & = 4,395 \\
\text{SF} & = (5.6) + (5.7) \\
2,105 & = 1,885 + 220
\end{align*}
\]

\(^{103}\) Unpublished data kindly supplied by the «Bureau Fédéral de Statistique/Eidg. Stat. Amt.». 
\[ SG = (5.4) + \text{(part of 5.5)} \]
\[ 2,665 = 2,040 + 625 \]

\[ FK = (5.2) \]
\[ -1,575 = -1,575 \]

\[ XT^{104} + XO^{104} = (6.1) \]
\[ 2,035 + 11,130 = 13.165 \]

\[ \overline{UT} = (6.4) \]
\[ 250 = 250 \]

\[ \overline{UG} = (6.3) - (6.8) - (6.10) \]
\[ -80 = 5 - 40 - 45 \]

\[ FY1 = (6.2) \]
\[ 1,170 = 1,170 \]

\[ MA^{104} + MEN^{104} + MTOU^{104} + MO^{104} = (6.6) \]
\[ 1,992 + 835 + 825 + 10,820 = 14,470 \]

\[ FY2 = (6.7) \]
\[ 630 = 630 \]

\[ YG = (2.7.a) + (2.7.b) + \text{(part of 3.6)} + (2.7.c) - (2.8) \]
\[ 755 = 355 + 325 + 285 + 375 - 585 \]

\[ TF = (2.11) \]
\[ 1,065 = 1,065 \]

\[ AVS = (\text{part of (3.7)}) \]
\[ 795 = 795 \]

\[ SUB = (2.2) \]
\[ 420 = 420 \]

\[ TC = (2.9) - TM \]
\[ 1,821 = 3,295 - 1,474 \]

\[ TM^{105} = 1,474 \]

\[ CG = (2.1) + (\text{part of (3.1)}) \]
\[ 5,160 = 5,015 + 145 \]

\[ ^{104} \text{Data sources for these variables are described in the comments on equations (12)-(17).} \]

\[ ^{106} \text{Source: Annuaire Statistique de la Suisse.} \]
Appendix B

Identities and Semi-identities

(1)* \( YL + YP = CD + CND + SH + UE - UI + TH \)

(2)* \( IE + IC + IR + ID + IB + IG = CFE + CFC + CR + CB + \)
\( + SH + SF + SG - FK \)

(3)* \( XT + XO + UI + UG + FY1 = MA + MEN + MTOU + MO + \)
\( + FY2 + UE + FK \)

(4)* \( YG + TH + UG + TF + AVS - SUB + TC + TM = CG + SG \)

(5) \( MAG = (MA) / (POP.PC) \)

(6) \( POP = POPS + FW \)

(7) \( DINC1 = (YL + YP - TH + UI - UE) / (PC.POP) \)

(8) \( MENER = (MEN) / (PM) \)

(9) \( GDP = (CD + CND) / (PC) + (IE + IC + IR + ID + IB + \)
\( + IG) / (PI) + (CG) / (PG) + (XT + XO) / (PX) - \)
\( - (MA + MEN + MTOU + MO) / (PM) \)

(10) \( DCON = (CD) / (POP.PC) \)

(11) \( DINC2 = (YL + YP - TH + UI) / (PC.POP) \)

(12) \( NCON = (CND) / (POP.PC) \)

(13) \( PROD = (GDP) / (N) \)

(14) \( FLF = (FW) / (N) \)

(15) \( PART = (N) / (POP15-64) \)

(16) \( YAV_t = \left( (YL + YP + UWH - UHW)_{t-1} + (YL + YP + UWH - \right. \)
\( - UHW)_{t-2} \right) / 2 \)

(17) \( TH = TAX + UHG + UHW - UWH \)

* National Accounting Identity.
\[(18) \text{YAVS\textsuperscript{SQ}} = (\text{YAV})^2/10,000.0\]

\[(19) \text{GNPC} = CD + CND + \overline{CG} + IE + IR + ID + \overline{IB} + \overline{IG} + XT + \overline{IC} + \overline{XO} - \overline{MA} - \overline{MEN} - \overline{MTOU} - \overline{MO} + \overline{FY1} - \overline{FY2}\]

\[(20) \text{SAL} \equiv \text{GNPC} - \text{ID}\]

\[(21) \text{FAS} \equiv \text{MEN} + \overline{MTOU} + \overline{MO} + \overline{MA}\]

\[(22) \text{ENER} \equiv (\text{DUTEN}. \overline{10,000.0})/\text{FAS}\]

\[(23) \text{AVPR} \equiv ((\text{YP} + \text{SF} + \text{TF})\text{t-1} + (\text{YP} + \text{SF} + \text{TF})\text{t-2})/2.0\]

\[(24) \text{AVPRS\textsuperscript{SQ}} \equiv (\text{AVPR})^2/1,000.0\]

\[(25) \text{REMIT} \equiv (\text{UE}/\text{FW})\]

\[(26) \text{WR} \equiv (\text{YL})/\langle N \rangle\]

\[(27) \text{FK} \equiv -\text{FK'} + \text{RT} - \overline{\text{OKM}}\]

\[(28) \text{INTDI}_t \equiv (\text{INT} - \overline{\text{INTUS}})_t - (\text{INT} - \overline{\text{INTUS}})_{t-1}\]

\[(29) \text{GDPC} \equiv \text{GNPC} - \overline{\text{FY1}} + \overline{\text{FY2}}\]

\[(30) \text{CGDPC} \equiv \text{GDPC}_t - \text{GDPC}_{t-1}\]

\[(31)\star \text{WINCT1} = 1927.55 + 464.864 t + 19.558 t^2\]

\[(32) \text{DEV1} \equiv \overline{\text{WINC}} - \text{WINCT1}\]

\[(33) \text{AVSPN} \equiv (\text{AVS})/\langle N \rangle\]

\[(34) \text{WINCT2} \equiv 5166.52 + 95.2445 t + 19.5580 t^2\]

\[(35) \text{DEV2} \equiv \overline{\text{WINC}} - \text{WINCT2}\]

\[(36)\star \text{OTT} = 8.6107 + .52594 t + .52594 t^2\]

\[(37) \text{DOT} \equiv \text{OT} - \text{OTT}\]

\[(38) \text{DEGPR} \equiv - \text{TGPRO} + \text{GPRO}\]

\[(39) \text{TGPRO} \equiv 1984.0 + 372.2 (t^2)\]

\[(40) \text{GPRO} \equiv \text{YP} + \text{SF}\]

\[\star \text{Semi-identity.}\]
(41) \[ \text{SAL1} = \text{GDPC} - \text{ID} \]

(42) \[ \text{MOB}_t = \text{DT}_t + \sum_{z=0}^{t-1} \text{RT}_z + .5(\text{RT})_t \]

(43) \[ \text{IDD} = (\text{ID})/(\text{PI}) \]

(44) \[ \text{UHWPC} = (\text{UHW})/(\text{N}) \]

(45) \[ \text{CWINC} = \frac{\text{WINC}_t - \text{WINC}_{t-1}}{\text{WINC}_t} \]

(46)* \[ \text{TINVE} = 565.0 + 200.72(t^2) \]

(47) \[ \text{DINVE} = \text{INVE} - \text{TINVE} \]

(48) \[ \text{INVE} = (\text{IE})/(\text{PI}) \]

(49)* \[ \text{TCONST} = 13350.0 + 912.4(t^2) \]

(50) \[ \text{DCONST} = \text{CONST} - \text{TCONST} \]

(51) \[ \text{CONST} = (\text{CD} + \text{CND})/(\text{PC}) \]

(52) \[ \text{MOTH} = (\text{MO})/(\text{PM}) \]

(53) \[ \text{DEVTAX} = \text{TAXRAT} - \text{TTAXRAT} \]

(54) \[ \text{TAXDPC} = (\text{TAX})/(\text{POP}.\text{PC}) \]

(55) \[ \text{TAXRAT} = (\text{TAXDPC})/(\text{DINC}^2 + \text{TAXDPC}) \]

(56)* \[ \text{TTAXRAT} = .08041 + .000659(t^2) \]

(57) \[ \text{RWR} = (\text{WR})/(\text{PC}) \]

(58) \[ \text{CFW} = \text{FW}_t - \text{FW}_{t-1} \]

(59)* \[ \text{HYPAV}_t = .5181(\text{HYP})_t + .3401(\text{HYP})_{t-1} + .1418(\text{HYP})_{t-2} \]

(60)* \[ \text{GDPAV}_t = .5181(\text{GDP})_t + .3401(\text{GDP})_{t-1} + .1418(\text{GDP})_{t-2} \]

(61) \[ \text{ICD} = (\text{IC})/(\text{PI}) \]

(62) \[ \text{DINC3} = (\text{YL} + \text{YP} - \text{TH} + \text{U1} - \text{UE})/(\text{POP}) \]

(63) \[ \text{MTOUPC} = (\text{MTOU})/(\text{POP}) \]

* Semi-identity.
\[(64)^* \text{DINCAV}_t \equiv .39311(\text{DINC4})_t + .56789(\text{DINC4})_{t-1} + .23899(\text{DINC4})_{t-2}\]

\[(65) \text{DINC4} \equiv (\text{YL} + \text{YP} - \text{TH} + \text{UI})/(\text{PC})\]

\[(66)^* \text{INTAV}_t \equiv .39311(\text{INT})_t + .56789(\text{INT})_{t-1} + .23889(\text{INT})_{t-2}\]

\[(67) \text{IRD} \equiv (\text{IR})/(\text{PI})^*\]

\[(68) \text{ULC} \equiv (\text{YL})/(\text{GDP})\]

\[(69) \text{CFED} \equiv (\text{CFE})/(\text{PI})\]

\[(70) \text{CFCD} \equiv (\text{CFC})/(\text{PI})\]

\[(71) \text{CRD} \equiv (\text{CR})/(\text{PI})\]

\[(72) \text{SALD} \equiv \text{GDP} - \text{IDD}\]

\[(73) \text{KIDD} \equiv \sum_{z=0}^{t-1} \text{IDD}_z\]

\[(74) N \equiv \text{SW} + \text{FW}\]

* Semi-identity.

---

**Appendix C**

**Variables**

(Lexicographic Ordering)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Nature</th>
<th>Value in 1962</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 AVPR</td>
<td>Average gross profits ((t-1, t-2))</td>
<td>6,851</td>
</tr>
<tr>
<td>2 AVPRSQ</td>
<td>((AVPR)^2/1,000.0)</td>
<td>46,936</td>
</tr>
<tr>
<td>3 AVS</td>
<td>Employers' Social Security dues</td>
<td>795</td>
</tr>
<tr>
<td>4 AVSPN</td>
<td>Social Security dues per employed</td>
<td>.294</td>
</tr>
<tr>
<td>5 CD</td>
<td>Expenditures on Durables</td>
<td>4,580</td>
</tr>
<tr>
<td>6 CFC</td>
<td>Depreciation of industrial construction</td>
<td>720</td>
</tr>
<tr>
<td>7 CFE</td>
<td>Depreciation of equipment</td>
<td>2,625</td>
</tr>
</tbody>
</table>

\(^{106}\text{defl.} = \text{deflated}; \text{p.c.} = \text{per capita}; \text{tr.} = \text{trend.}\)
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Nature</th>
<th>Value in 1962</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 CFW</td>
<td>Change in number of foreign workers</td>
<td>96</td>
</tr>
<tr>
<td>9 CGDPC</td>
<td>Change in current nominal GDP</td>
<td>4,515</td>
</tr>
<tr>
<td>10 CND</td>
<td>Expenditures on non-durables</td>
<td>25,295</td>
</tr>
<tr>
<td>11 CONST</td>
<td>Total household consumption, defl.</td>
<td>26,235</td>
</tr>
<tr>
<td>12 CR</td>
<td>Depreciation of residential construction</td>
<td>845</td>
</tr>
<tr>
<td>15 CWINC</td>
<td>Change in world income</td>
<td>609</td>
</tr>
<tr>
<td>14 DCON</td>
<td>p.c. defl. consumption of durables</td>
<td></td>
</tr>
<tr>
<td>15 DCONST</td>
<td>Deviation of total consumption from tr., defl.</td>
<td>157</td>
</tr>
<tr>
<td>16 DEGRP</td>
<td>Deviation of gross profits from tr.</td>
<td>—474</td>
</tr>
<tr>
<td>17 DEV1</td>
<td>Deviation of WINC from tr.</td>
<td>—452</td>
</tr>
<tr>
<td>18 DEV2</td>
<td>Deviation of WINC from tr.</td>
<td>—145</td>
</tr>
<tr>
<td>19 DEV TAX</td>
<td>Deviation of average income tax rate from tr.</td>
<td>0.011</td>
</tr>
<tr>
<td>20 DINC1</td>
<td>p.c. defl. disposable income, excluding remittances</td>
<td>5.140</td>
</tr>
<tr>
<td>21 DINC2</td>
<td>p.c. defl. disposable income, remittances not excluded</td>
<td>5.299</td>
</tr>
<tr>
<td>22 DINC3</td>
<td>Disposable income, p.c., not defl., remittances excluding</td>
<td>5.462</td>
</tr>
<tr>
<td>23 DINC4</td>
<td>Disposable income, defl., remittances not excluded</td>
<td>29,994</td>
</tr>
<tr>
<td>24 DINCAV</td>
<td>Weighted average of DINC4</td>
<td>28.355</td>
</tr>
<tr>
<td>25 DINVE</td>
<td>Deviation of equipment investment from tr.</td>
<td>478</td>
</tr>
<tr>
<td>26 DOT</td>
<td>Deviation of OT from tr.</td>
<td>1.84</td>
</tr>
<tr>
<td>27 ENER</td>
<td>Proxy for changes in energy import duties</td>
<td>258.5</td>
</tr>
<tr>
<td>28 FAS</td>
<td>Total imports</td>
<td>14,470</td>
</tr>
<tr>
<td>29 FK</td>
<td>Total net capital outflow, including changes in monetary reserves</td>
<td>—1,575</td>
</tr>
<tr>
<td>50 FK'</td>
<td>Net private capital inflow</td>
<td>2,046</td>
</tr>
<tr>
<td>51 FLF</td>
<td>Foreign labor as % of labor force</td>
<td>0.202</td>
</tr>
<tr>
<td>52 FW</td>
<td>Total foreign workers</td>
<td>545</td>
</tr>
<tr>
<td>55 GDP</td>
<td>Real GDP</td>
<td>39,721</td>
</tr>
<tr>
<td>54 GDPAV</td>
<td>Weighted average of GDP</td>
<td>58,458</td>
</tr>
<tr>
<td>55 GDPC</td>
<td>Nominal GDP</td>
<td>45,510</td>
</tr>
<tr>
<td>56 GNPC</td>
<td>Nominal GNP</td>
<td>46,050</td>
</tr>
<tr>
<td>57 GPRO</td>
<td>Gross profits</td>
<td>6,717</td>
</tr>
<tr>
<td>58 HYP</td>
<td>Mortgage rate</td>
<td>5.80</td>
</tr>
<tr>
<td>59 HYPAV</td>
<td>Weighted average of mortgage rates</td>
<td>3.795</td>
</tr>
<tr>
<td>40 IC</td>
<td>Expenditures on business construction</td>
<td>2,765</td>
</tr>
<tr>
<td>41 ICD</td>
<td>Business construction, defl.</td>
<td>2,572</td>
</tr>
<tr>
<td>42 ID</td>
<td>Inventory investment</td>
<td>1,140</td>
</tr>
<tr>
<td>43 IDD</td>
<td>ID, defl.</td>
<td>978</td>
</tr>
<tr>
<td>44 IE</td>
<td>Expenditures on equipment investment</td>
<td>4,490</td>
</tr>
<tr>
<td>45 INT</td>
<td>“Pure” interest rate</td>
<td>3.12</td>
</tr>
<tr>
<td>Symbol</td>
<td>Nature</td>
<td>Value in 1962</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>46 INTAV</td>
<td>Weighted average of INT</td>
<td>3.057</td>
</tr>
<tr>
<td>47 INTDI</td>
<td>US-Swiss interest rate differential</td>
<td>.11</td>
</tr>
<tr>
<td>48 INVE</td>
<td>Equipment investment, defl.</td>
<td>5,851</td>
</tr>
<tr>
<td>49 IR</td>
<td>Residential construction</td>
<td>3,225</td>
</tr>
<tr>
<td>50 IRD</td>
<td>Defl. residential construction</td>
<td>2,766</td>
</tr>
<tr>
<td>51 KIDD</td>
<td>Stock of inventories</td>
<td>6,845</td>
</tr>
<tr>
<td>52 MA</td>
<td>Agricultural imports</td>
<td>1,992</td>
</tr>
<tr>
<td>53 MAG</td>
<td>p.c. imports of agricultural products, defl.</td>
<td>.551</td>
</tr>
<tr>
<td>54 MEN</td>
<td>Energy imports</td>
<td>835</td>
</tr>
<tr>
<td>55 MENER</td>
<td>Defl. energy imports</td>
<td>858</td>
</tr>
<tr>
<td>56 MO</td>
<td>Other imports</td>
<td>10,820</td>
</tr>
<tr>
<td>57 MOB</td>
<td>Monetary base</td>
<td>10,786</td>
</tr>
<tr>
<td>58 MON</td>
<td>Money stock</td>
<td>19,202</td>
</tr>
<tr>
<td>59 MOTH</td>
<td>Other imports, defl.</td>
<td>11,142</td>
</tr>
<tr>
<td>60 MTOU</td>
<td>Swiss tourists’ expenditures abroad</td>
<td>825</td>
</tr>
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<td>61 MTOUPC</td>
<td>MTOU p.c.</td>
<td>.146</td>
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<td>62 N</td>
<td>Employment ≡ labor force</td>
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<td>63 NCON</td>
<td>p.c. defl. consumption of non-durables</td>
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<td>64 OT</td>
<td>Index of overtime work</td>
<td>17.29</td>
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<td>65 OTT</td>
<td>Trend value of OT</td>
<td>15.45</td>
</tr>
<tr>
<td>66 PART</td>
<td>Labor force participation rate</td>
<td>.728</td>
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<tr>
<td>67 PC</td>
<td>Household consumption price deflator</td>
<td>1.063</td>
</tr>
<tr>
<td>68 PG</td>
<td>Government consumption price deflator</td>
<td>1.177</td>
</tr>
<tr>
<td>69 PI</td>
<td>Investment price deflator</td>
<td>1.166</td>
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<tr>
<td>70 POP</td>
<td>Total population</td>
<td>5,660</td>
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<tr>
<td>71 POP (15–64)</td>
<td>Total population aged 15–64</td>
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<td>72 PROD</td>
<td>Productivity</td>
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<td>73 PX</td>
<td>Export price deflator</td>
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<td>74 REMIT</td>
<td>Household remittances abroad, p.c.</td>
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<td>75 RT</td>
<td>Net increase in reserves</td>
<td>—124</td>
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<td>76 RWR</td>
<td>Real wage rate</td>
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<tr>
<td>77 SAL</td>
<td>Current final sales</td>
<td>44,910</td>
</tr>
<tr>
<td>78 SAL1</td>
<td>Current final sales</td>
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<td>79 SALD</td>
<td>Defl. final sales</td>
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<td>Undistributed profits</td>
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<td>81 SG</td>
<td>Government saving</td>
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<tr>
<td>82 SH</td>
<td>Household saving</td>
<td>3,040</td>
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<tr>
<td>83 SW</td>
<td>“Swiss” workers and employees</td>
<td>2,158</td>
</tr>
<tr>
<td>84 TAX</td>
<td>Household income taxation stricto sensu</td>
<td>3,180</td>
</tr>
<tr>
<td>85 TAXDPC</td>
<td>TAX p. c. defl.</td>
<td>.529</td>
</tr>
<tr>
<td>Symbol</td>
<td>Nature</td>
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</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------</td>
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</tr>
<tr>
<td>86</td>
<td>TAXRAT Average household income tax rate</td>
<td>.091</td>
</tr>
<tr>
<td>87</td>
<td>TC Indirect taxes</td>
<td>1,821</td>
</tr>
<tr>
<td>88</td>
<td>TCONST Tr. value of CONST</td>
<td>26,098</td>
</tr>
<tr>
<td>89</td>
<td>TF Business taxes</td>
<td>1,065</td>
</tr>
<tr>
<td>90</td>
<td>TGPRO Trend value of gross profits</td>
<td>7,192</td>
</tr>
<tr>
<td>91</td>
<td>TH Household income taxation</td>
<td>2,415</td>
</tr>
<tr>
<td>92</td>
<td>TINVE Tr. value of equipment investment</td>
<td>3,573</td>
</tr>
<tr>
<td>93</td>
<td>TM Import duties</td>
<td>1,474</td>
</tr>
<tr>
<td>94</td>
<td>TTAXRAT Trend tax rate</td>
<td>.090</td>
</tr>
<tr>
<td>95</td>
<td>UE Transfers abroad (household)</td>
<td>960</td>
</tr>
<tr>
<td>96</td>
<td>UHW Household Social Security dues</td>
<td>1,340</td>
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<tr>
<td>97</td>
<td>UHWPC UHW p.c.</td>
<td>.494</td>
</tr>
<tr>
<td>98</td>
<td>ULC Unit labor cost</td>
<td>.742</td>
</tr>
<tr>
<td>99</td>
<td>UO Unfilled orders</td>
<td>10.72</td>
</tr>
<tr>
<td>100</td>
<td>WINCT1 Tr. value of WINC</td>
<td>7,971</td>
</tr>
<tr>
<td>101</td>
<td>WINCT2 Tr. value of WINC</td>
<td>7,684</td>
</tr>
<tr>
<td>102</td>
<td>WR Nominal wage rate</td>
<td>10.89</td>
</tr>
<tr>
<td>103</td>
<td>XO Other exports</td>
<td>11,130</td>
</tr>
<tr>
<td>104</td>
<td>XT Tourists' expenditures in Switzerland</td>
<td>2,055</td>
</tr>
<tr>
<td>105</td>
<td>YAV Income tax base</td>
<td>29,558</td>
</tr>
<tr>
<td>106</td>
<td>YAVSQ (YAV)$^2$/10,000.0</td>
<td>87,565</td>
</tr>
<tr>
<td>107</td>
<td>YL Labor income</td>
<td>29,448</td>
</tr>
<tr>
<td>108</td>
<td>YP Property income (not counting business saving)</td>
<td>4,612</td>
</tr>
</tbody>
</table>

**Exogenous Variables**

1. AGOUT p.c. agricultural production, defl. .556
2. CB Depreciation of government building, defl. 205
3. CFCD Depreciation of industrial plants, defl. 618
4. CFED Depreciation of equipment, defl. 2,252
5. CG Government consumption expenditures 5,160
6. CRD Depreciation of residential housing, defl. 725
7. DT National Bank assets and liabilities other than reserves of banknotes (net) 157
8. DUM1 = 1.0 in even years, = .0 in odd years 1.0
9. DUM2 = .0 up to 1960, = 1.0 from 1961 on 1.0
10. DUM3 1.0 up to 1953, = .5 in 1954, = .0 thereafter 359
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Nature</th>
<th>Value in 1962</th>
</tr>
</thead>
<tbody>
<tr>
<td>DUM4</td>
<td>Dummy for speculation on revaluation of SF</td>
<td>-1.0</td>
</tr>
<tr>
<td>DUM5</td>
<td>Dummy for revision of AVS/AHV</td>
<td>1.0</td>
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<tr>
<td>DUM7</td>
<td>Dummy for Korea War</td>
<td>0.0</td>
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<tr>
<td>DUTEN</td>
<td>Duties on energy imports</td>
<td>374</td>
</tr>
<tr>
<td>FY1</td>
<td>Factor income from abroad</td>
<td>1,170</td>
</tr>
<tr>
<td>FY2</td>
<td>Factor income paid abroad</td>
<td>650</td>
</tr>
<tr>
<td>IB</td>
<td>Government investment in building</td>
<td>866</td>
</tr>
<tr>
<td>ICHA</td>
<td>Dummy for change in ICHA/&quot;Warenumsatzsteuer&quot;</td>
<td>1.0</td>
</tr>
<tr>
<td>IG</td>
<td>Government investment in civil engineering works</td>
<td>1,294</td>
</tr>
<tr>
<td>INTUS</td>
<td>Interest rate on U.S. bonds</td>
<td>3.95</td>
</tr>
<tr>
<td>OKM</td>
<td>Net government capital imports</td>
<td>-595</td>
</tr>
<tr>
<td>PM</td>
<td>Import price deflator</td>
<td>.971</td>
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<tr>
<td>POPSW</td>
<td>Total &quot;Swiss&quot; population</td>
<td>5,115</td>
</tr>
<tr>
<td>SPEC</td>
<td>Proxy for speculative energy imports</td>
<td>2.0</td>
</tr>
<tr>
<td>SUB</td>
<td>Government subsidies to firms</td>
<td>420</td>
</tr>
<tr>
<td>t</td>
<td>Time trend</td>
<td>13.0</td>
</tr>
<tr>
<td>t2</td>
<td>Time trend</td>
<td>14.0</td>
</tr>
<tr>
<td>t3</td>
<td>Time trend</td>
<td>12.0</td>
</tr>
<tr>
<td>TAR</td>
<td>Dummy for new tariff schedule</td>
<td>1.0</td>
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<tr>
<td>TBRE</td>
<td>Dummy for change in &quot;droit de timbre/Stempelsteuer&quot;</td>
<td>.0</td>
</tr>
<tr>
<td>UG</td>
<td>Net government transfers from abroad</td>
<td>-80</td>
</tr>
<tr>
<td>UHG</td>
<td>Net government transfers to households</td>
<td>-150</td>
</tr>
<tr>
<td>UI</td>
<td>Transfers from abroad to households</td>
<td>250</td>
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<tr>
<td>UWH</td>
<td>Social security benefits</td>
<td>1,975</td>
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<tr>
<td>WINC</td>
<td>Weighted world money income index</td>
<td>7,559</td>
</tr>
<tr>
<td>YG</td>
<td>Government &quot;profit&quot; income</td>
<td>755</td>
</tr>
</tbody>
</table>
Summary

A Short-Term Forecasting Model of the Swiss Economy

This first macro-econometric model of the Swiss economy consists of 54 stochastic equations, 9 semi-identities and 65 identities. It is divided into four sectors: (1) aggregate supply; (2) aggregate demand, including the foreign sector; (3) factor shares, prices and monetary factors; and (4) the government. Two particularities of the Swiss economy are given special emphasis: the large in- and outflows of foreign migrant labor from Southern Europe, and the similarly large international capital movements affecting Switzerland. The model is used to generate forecasts for 1970; in the future, it will be further refined and used for forecasting at the Zurich Institut für Wirtschaftsforschung, Federal Institute of Technology. Simulation results will be published later.

Zusammenfassung

Ein kurzfristiges Prognosemodell der schweizerischen Volkswirtschaft


Mit dem Modell werden Vorausschätzungen für 1970 gemacht werden; für die Zukunft wird man das Modell weiterentwickeln und am Institut für Wirtschaftsforschung der ETH in Zürich anwenden. Die Resultate der Simulation werden in einem späteren Zeitpunkt publiziert werden.

Résumé

Un modèle pronostique à court terme de l'économie suisse

Ce premier modèle macro-économétrique de l'économie suisse se compose de 54 équations stocastiques, 9 semi-identités et 65 identités. On distingue entre les 4 secteurs suivants: (1) l’offre agrégée, (2) la demande agrégée, inclus le secteur extérieur, (3) le revenu de facteurs, les prix, les facteurs monétaires et (4) l'état.