# GOVERNMENT LOAN SUBSIDI



A study prepared for the
Economic Council of Canada

Sylvester Damus

## Erratum

Page 21

Delete sentence: (para. 2) "As this function is homothetic..... are the same."

# Government Loan Subsidies

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The findings of this study are the responsibility of the author and, as such, have not been endorsed by the Members of the Economic Council of Canada.

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# Contents

# Preface

This is one of the background papers for the Economic Council's report entitled *Intervention and Efficiency*, which examined the role of government as a financial intermediary in helping the private sector to achieve the various economic and social objectives of government.*

Government financial intervention takes the form of loan subsidies, loans and guarantees. In this background study we attempt to quantify the effects of the former. The task is necessarily technical, and the results are subject to numerous qualifications. These are pointed out throughout the text, and we hope that the reading of the more technical parts will be facilitated by the occasional pause for some nontechnical explanations and examples. The main conclusions are repeated in Chapter 4; they are to be regarded as only tentative and should not be read as a final evaluation of government credit programs, especially since the main concern here is with some of the allocative and distributional consequences of those programs. These leave out many social aspects and do not represent final government objectives; rather, they are only stepping stones on the way towards achieving the ultimate economic and social objectives. The relationship between the ultimate objectives and the more immediate ones that are examined in this paper remains unexplored. The reader must judge whether or not – in the light of theses conclusions – those stepping stones are as firm as he would like them to be.

This background study would never have been published had it not been for the encouragement, advice, and assistance of numerous persons. Thanks are due especially to André Ryba for his patient advice throughout this study; to Patrick Robert and three anonymous referees for their generous and helpful comments on the final draft; to David Backus, Ronald Bodkin, Marcel Dagenais, François Delorme, Jean-Marie Gagnon, and Neil Swan for their discussions and comments on different parts of the text; to Bobbi Cain, Brian Eyford, and Someshwar Rao for advice on CANDIDE; to André Bourdon and H. M. Saiyed for programming; to R. M. Algie, Dorothy Barrette, and Shaila Nijhowne for data; and to Cathy Bothwell and her team for patiently typing the numerous drafts. They must be credited for the results; and any errors that remain are mine.

*The title of this background study was originally cited as "Allocative Effects of Government Financial Intermediation in Canada," in Economic Council of Canada, *Intervention and Efficiency* (Ottawa: Supply and Services Canada, November 1982). The author apologizes for any inconvenience that may have been caused by the subsequent change in title.

# Introduction

The purpose of this background study is to analyse the possible effects of official financial intermediation on financial flows and yields, and on the allocation of real resources such as capital and labour. Such changes in the allocation of financial and real resources are proximate, but not ultimate, objectives of government in the sense that movement towards the latter requires some of the former. For instance, improved housing for middle- and low-income home-owners may require capital to furnish a larger housing stock, and this in turn may require a flow of low-interest mortgage funds to the prospective purchasers of the better-type housing. In other cases, the social objectives of government are unquantifiable, but its financial operations have quantifiable effects that alert one to the costs of the policy and are thus of interest in an eventual evaluation of that policy. Finally, inaccurate diagnosis of economic and social problems may lead to inappropriate intervention in financial markets. The cost of this can also be indicated by the allocative effects of the intervention.

Most of the intermediary activity of governments results in loans and credit insurance or loan guarantees to agriculture, housing, exports, manufacturing, and other business sectors. On March 31, 1980, federal and provincial loans outstanding, as well as investments, in these four sectors amounted to $17.5 billion. Guarantees and loan insurance already in force amounted to another $27.5 billion. The federal government and its agencies held 95 per cent of the guarantees and 74 per cent of the loans and investments. These were principally debt-financed, the agencies (federal and provincial) having either approached the market directly or through their parent government. On March 31, 1980, the debts incurred to finance federal loans and investments represented 25 per cent of the outstanding federal long-term debt. The cost to government of this debt exceeds the return. The subsidies conveyed through loans and loan guarantees during the 1978/79 fiscal year amounted to between $188 million and $906 million, depending on whether ordinary accounting methods are used or whether social opportunity costs are taken into account as well (see Chapter 1 of *Intervention and Efficiency*).

The main objective of this study is to estimate the measurable effects of government-subsidized loans on output and prices, and on the employment of labour and capital.

The effects of subsidies can be analysed in much the same way as the incidence of a tax. Since governments intervene in several directions at once, attempting to draw resources into the many different activities that merit their attention, we carry out a general equilibrium analysis of the possible combined results of assistance to various sectors. The novelty of the technique employed is that it combines a model of debt/equity choice with a model of real resource allocation. Such an analysis also puts the financial assistance in the context of other tax and subsidy measures that affect economic activity and thus facilitates the analysis of policy alternatives.

The above is the subject of Chapter 2. Before embarking on it, however, it is necessary to discuss the ways in which financial assistance can change financial flows and yields or the allocation of financial resources. Furthermore, a bridge must be laid between the financial and the real sides of the economy, connecting changes in the cost of finance with corresponding changes in the cost of capital or the incentive to invest in activities favoured by government financial assistance. This is the subject of Chapter 1.

Both chapters employ modeling techniques that produce results that are sensitive to alternative assumptions and that suffer from biases introduced with necessary simplifications. These will be duly pointed out and tempered by reference to the results that could be achieved by the use of alternative models. As a step in that direction, we have some CANDIDE 2.0 simulations of the effects of federal financial assistance to housing and exports. These simulations are the subject of Chapter 3. The effects of adopting some alternative assumptions will also be indicated.

The main conclusion about government loan subsidies is that their financial effects are uncertain unless government intermediation takes place in an unsophisticated financial system with few financial alternatives or the intervention is buttressed by restrictions on private financial choice. Based on either one of these conditions, government loan subsidies still had a small effect on the allocation of real resources; in 1977 they may have cost between $15 million and $25 million in terms of reduced economic welfare. Their replacement by alternative subsidies of equal amount could have increased economic welfare by between $72 million and $92 million, which would indicate that subsidies may not have to be removed but redesigned.

# Government Loan Subsidies

# 1 The Effect of Government Intermediation on the Allocation of Financial Resources

Government financial intermediaries are involved in direct lending, loan guarantees, loan insurance, interest rate abatement programs, and equity participation. These programs were first introduced to assist in the attainment of some of the economic and social objectives of federal and provincial governments by facilitating the placement of debt (or equity) issued by targeted economic agents. Without questioning the objectives, there are two cases, supported by accepted economic theory, for government intervention in financial markets as a financial intermediary: the existence of a "credit gap"; and/or the existence of externalities that may be found in financial markets but are not taken into account by private decision makers.[1]

When government intervenes to fill a credit gap[2] or to compensate for the externalities created in financial markets, the economy is presumably brought closer to a Pareto optimum. When government intervenes in well-functioning financial markets, an assessment of the overall effect on the economy must weigh the cost of this action (including the distortion in resource allocation) against the benefits expected from it. Moreover, a government may misjudge the existence, or the extent, of gaps and externalities, in which case its actions will have a less positive effect on the resource allocation process. To evaluate the performance of government in its financial intermediary role, it is useful to have as clear a picture as possible of the effect on resource allocation of government loans and guarantees. This chapter analyses the effect of government financial intermediation on financial resource allocation or the extent to which amounts and yields of various securities (bonds, loans, and so on) are affected by government lending and government loan subsidies. It attempts to determine the combined effect on interest rates of government lending and borrowing, when the government must borrow to support its lending. This may provide answers to such questions as: By how much does government lending crowd out private lending; how does it affect the structure of interest rates; and by how much does it change the interest-cost of doing business? The main question, however, is: Under what conditions does financial intermediation affect the employment of real resources? That ground must be covered before moving on to Chapter 2 and estimating real allocation effects.

When asking questions of this sort, we abstract from other characteristics of financial transactions and securities, such as the amount of each individual loan, term to maturity, or collateral. Only yields and total volume are considered. It is assumed that financial markets function well, without externalities or "gaps."

Since firms and individuals issue several kinds of securities in different but interrelated markets, one must follow a general equilibrium approach to discover the effects on all relevant markets of government intervention in any one of them. For instance, a small-business-loan program is likely to have effects on several, if not all, financial markets. A partial equilibrium analysis of the program's effect on the volume and interest cost of small business loans is therefore incomplete. It may overstate or understate the effects of the program, because it does not consider the program's ripple effects on other financial markets or, in turn, their effects on the target program. Even if assisted firms deal in only one financial market, a program directed towards them may have spill-over effects on other financial markets that would affect the cost and effectiveness of the government intervention.

Finally, it should also be noted that government may operate as a financial intermediary in three different ways. It may be just another player in the financial market, purchasing securities as private institutions would. One could call this "direct lending." It could cover part of the interest cost of a private-sector loan – i.e., provide a loan subsidy – or it might combine the two in the form of subsidized direct lending. The model will deal with each of these

options. The analysis of the effects of government intermediation will be conducted with a general equilibrium asset-market model.

This chapter is divided into six sections. The first section describes the financial model employed. The second explains how the model is used to determine the interest-rate effects of direct lending programs. The third discusses the effects of loan subsidies. The effects of direct lending at subsidized rates can be analysed by putting together the results of the latter two sections – i.e., combining the effects of a direct loan at market rates with those of a subsidy. This is done in the fourth section, where the analysis is extended by removing certain simplifying assumptions. The fifth section discusses the effects of financial assistance on real investment. As these are found to be uncertain, financial subsidies are compared with alternative production subsidies in the sixth and final section of this chapter.

## The Model

A model of the financial system will indicate how the market reacts to government intermediation. There are many models of financial behaviour, differing in purpose and scope, and in the assumptions made about the mechanism that determines interest rates; but few have been designed to specifically answer the questions posed here.

This study draws heavily on James O'Brien's (1977) variant of the Tobin-Brainard (1968) model. In his paper, O'Brien explicitly attempted to explain the effects on asset yields of loan-subsidy and direct-lending programs.

The model developed is a multi-sector, multi-asset model. Three sectors are explicitly considered: households, business, and private financial intermediaries. Government is considered as an exogenous factor in the demand and supply equations of the three sectors.

In a theoretical discussion of the model, the assets supplied and demanded do not need to be explicitly characterized, although they would have to be identified for an empirical application. Furthermore, the asset demands and supplies can be derived from a Tobin/Markowitz-type model of portfolio choice, although the author has not explicitly done so [see Markowitz (1952) and Tobin (1958)].

The demand for assets and the supply of liabilities are assumed to adjust costlessly and instantaneously to one-period rates of return. The variances and covariances of rates of return, as well as other characteristics of financial instruments, are assumed to be constant. The allocation of wealth to different assets is supposed to be independent of income, consumption, and investment.[3] Both are features of empirical asset demand models such as those by Parkin (1970) or Aigner (1973) and, to some extent, Backus, Brainard, Smith, and Tobin (1980).

It is also assumed that there is a fixed stock of real capital to be allocated among different uses by firms and households. That is, government programs are viewed as being unable to create real wealth but are able to change its use and distribution.[4] To affect the process of wealth accumulation, given probably small elasticities of saving with respect to the interest rate, loan subsidies would have to be much larger than they are and more along the lines of a reduction in taxes on capital income. The loan subsidies analysed in this study represented about 1.8 per cent of aggregate capital income in 1977 and were estimated to have increased the rate of return to capital by 1.05 per cent or 8 basis points (see Table 2-6).

Firms, households, and intermediaries issue securities to acquire real capital and/or financial assets. Their demands and supplies for assets are constrained within balance sheets such as the one illustrated in Table 1-1. In that balance sheet, the liabilities of one sector ($L$) serve to finance its real capital ($K$) and are held by the other two sectors. Issuers are indicated by subscripts; holders, by superscripts.

The balance sheet is drawn up so that households are ultimately the only holders of wealth, which is assets minus liabilities. The wealth of intermediaries and firms is indicated as zero because of the inclusion of retained earnings in shareholders' equity. The balance sheet also shows that, for society as a whole, financial claims cancel. The only wealth of society is its real capital.[5]

Within each sector, the balance sheet may contain $n$ kinds of securities and real capital. Using superscripts to denote sectors and subindices to denote assets, the stock demands and supplies for real capital and for securities may be written as follows:

$$\text{Real capital: } D_0^e\ (y_0, y_1, \ldots, y_n);\ \text{and } S_0. \qquad (e = 1, 2, 3)$$

$$\text{Securities: } D_i^e\ (y_0, y_1, \ldots, y_n);\ \text{and}$$
$$S_i^e\ (y_0, y_1, \ldots, y_n). \qquad (i = 1, 2, \ldots, n)$$
$$(e = 1, 2, 3) \quad (1.1)$$

**Table 1-1**

**Balance Sheet**

| | Households | Intermediaries | Firms | Total |
|---|---|---|---|---|
| Assets: | | | | |
| Financial | $L_2^h + L_3^h$ | $L_1^i + L_3^i$ | $L_1^f + L_2^f$ | $L_1 + L_2 + L_3$ |
| Real | $K_1$ | $K_2$ | $K_3$ | $K$ |
| Liabilities | $L_1$ | $L_2$ | $L_3$ | $L_1 + L_2 + L_3$ |
| Wealth | $L_2^h + L_3^h + K_1 - L_1 = K$ | nil | nil | $K$ |
| Net financial assets | $K - K_1$ | $-K_2$ | $-K_3$ | nil |

$S_0$ is the assumed fixed supply of real capital, which has a constant rate of return $y_0$. The demand and supply for the $i$-th security depend on the return to real capital and on the return to all other securities. The aggregate demand for securities may depend also on real wealth, which includes the present value of all sources of income in addition to capital. But suppose that wealth does not affect portfolio composition; one can then drop it from the demand and supply equations.

Securities are assumed to be gross substitutes, in the sense that wealth-holders will want to hold a smaller stock of one asset when the yield of any other asset rises.[6] Thus

$$D_{ij}^e < 0;\ D_{ii}^e > 0;$$

$$S_{ij}^e > 0;\ S_{ii}^e < 0; \text{and } (i \neq 0, i \neq j)$$

$$(e = 1, 2, 3)$$

$$S_{0j} = 0, \tag{1.2}$$

where the subindex $ij$ denotes the derivation of the $i$-th equation with respect to the yield of the $j$-th asset.

Financial markets clear, or are in equilibrium, when the excess demands for securities and real capital are zero:

$$X_i(y_0, y_1, \ldots, y_n) = \sum_{e=1}^{3} D_i^e(y_0, y_1, \ldots, y_n) - \sum_{e=1}^{3} S_i^e(y_0, y_1, \ldots, y_n) = 0; \text{and}$$

$$(i = 1, \ldots, n);$$

$$X_0(y_0, y_1, \ldots, y_n) = \sum_{e=1}^{3} D_0^e(y_0, y_1, \ldots, y_n) - S_0 = 0. \tag{1.3}$$

The gross-substitutes assumption implies that

$$X_{ii} > 0; X_{ij} < 0.\ (i \neq j;\ i,j = 1, \ldots, n) \tag{1.4}$$

There are $(n + 1)$ excess demand equations; but, because of the balance sheet constraint, only $n$ of them are independent. One can invoke Walras's Law and choose any $n$ equations to solve for the $n$ security yields. Given the assumption of a fixed stock of real capital with a constant rate of return, it is convenient to drop the capital equation and omit $y_0$ from the argument. This means that real capital serves as the unit of account in which stocks of securities are measured.

The effect on security yields of government intermediation is shown by the introduction of a policy parameter $G$ into the excess demand equations. A policy change is then represented by a small change in $G$, or by $dG$. The resulting changes in security yields, $dy_j$, can be found by differentiation of the excess demand equations with respect to $Y_j$ and $G$.

The introduction of the policy parameter applies to both forms of government intervention as a financial

intermediary: government direct lending; and government subsidization. As will be seen below, the difference lies in the way this parameter is introduced in the excess demand equations.

A troublesome feature of government loans and guarantees is that these instruments are firm- or individual-specific as opposed to other government instruments, which are market-specific. Market-specific measures apply indiscriminately to all participants in a specific market. In reality, however, government loans, loan subsidies, and guarantees are granted to particular individuals and firms.[7] To simulate government lending and government guaranteeing, one has to model specific intervention by government or show that the results obtained from a market-oriented model are similar to the results that would have been obtained from specific measures. With respect to excess demand equations, "market-specific" means looking at the excess demand for a *given* security and "firm-specific" means looking at it for a *specific* security issued by a subset of the population.

The excess demand equations $X$ can be thought of as market demands, sector-specific demands, or firm-specific demands. For instance, one can think of bonds in general, of industrial bonds and utility bonds, or of bonds issued by XYZ Ltd. In the theoretical discussions in sections 2 and 3 of this chapter, there is no impediment to the analysis of firm-specific financial policies. In our system of $n$ equations, $n$ can be made large enough to accommodate the demand for and supply of the securities of any individual firm; therefore, the analysis of the next two sections of this chapter is applicable to firm-specific policies. Difficulties arise when one tries to put empirical content into the theoretical analysis. Empirical analysis must often use market data and will therefore be more readily applicable to market-specific than to firm-specific policies.

## Direct Lending

Suppose a government intermediary lends funds in one market that were borrowed in another, as when the Treasury issues bonds to fund an agency that offers small business loans – both operations taking place at market rates. The lending operation increases the excess demand for securities in one market. The borrowing operation decreases excess demand (by increasing the supply) in another market. Let us consider also a third market, and write the general equilibrium conditions as:

$$X_1(y_1, y_2, y_3) + G = 0;$$
$$X_2(y_1, y_2, y_3) - G = 0; \text{ and}$$
$$X_3(y_1, y_2, y_3) = 0, \tag{1.5}$$

where $G$ is the amount of funds transferred by the government intermediary from the second market to the first. When differentiating with respect to the $y$'s and $G$,

$$\begin{aligned} X_{11}dy_1 + X_{12}dy_2 + X_{13}dy_3 &= -dG; \\ X_{21}dy_1 + X_{22}dy_2 + X_{23}dy_3 &= dG; \text{ and} \\ X_{31}dy_1 + X_{32}dy_2 + X_{33}dy_3 &= 0, \end{aligned} \tag{1.6}$$

whence

$$\begin{aligned} dy_1 &= -\frac{\Delta_{11}}{\Delta}dG + \frac{\Delta_{21}}{\Delta}dG; \\ dy_2 &= +\frac{\Delta_{22}}{\Delta}dG - \frac{\Delta_{12}}{\Delta}dG; \text{ and} \\ dy_3 &= -\frac{\Delta_{13}}{\Delta}dG + \frac{\Delta_{23}}{\Delta}dG, \end{aligned} \tag{1.7}$$

where the $\Delta_{ij}$ are the co-factors of elements of $\Delta$, the Jacobian of 1.6. Now, because of the budget constraint, $\Sigma_{i=0}^{n} X_{ij} = 0$. And, given this property and the assumed gross substitutability of assets,

$$\Delta > 0, \text{ and } \Delta_{ii} > \Delta_{ij} > 0. \tag{1.8}$$

For proof, see Brainard (1967), Appendix, Proposition 1, p. 139. Therefore, the interest-rate effects of direct lending are

$$dy_1 < 0; dy_2 > 0; \text{ and } dy_3 \gtrless 0.$$

The first terms on the right-hand side of the solutions for $dy_1$ and $dy_2$ in 1.7 measure the direct effects of the policy. The second terms represent crowding-out effects. The term $\Delta_{21}/\Delta$ measures the extent to which private lenders shift funds out of the first market and into other markets, per dollar injected by the government intermediary. This crowding-out of lenders from the market targeted by the government softens the policy's pressure on $y_1$. The term $\Delta_{12}/\Delta$ measures the tendency of private borrowers to withdraw from the market in which the government is borrowing. Some of those crowded out of the first two markets seek refuge in the third, which stands for any of the other $n$–2 security markets. There is nothing one can say about yields in these other markets, except perhaps that they change so as to preserve a weighted average of yields across all markets corresponding to the assumed constant $y_0$.[8]

The ambiguity in the sign of $dy_3$ – the change in yields in markets in which government does not intervene – raises the possibility that a direct lending program will work at cross-purposes or have undesirable effects. For instance, bankers make business loans and mortgage loans, and they invest in government bonds; thus they operate in the three corresponding markets. Let us assume that the government steps into two of these markets and issues a $1,000 bond to make a $1,000 business loan. The first result of this is an increase in the yield of bonds and a drop in the interest rate on business loans. Bonds are then more attractive as investments than mortgages, and mortgages are more attractive than business loans. Therefore, the second effect of government lending is that banks will make fewer business loans and invest more in mortgages, and they will make fewer mortgage loans and invest more in bonds.[9] The net effect of this policy on the mortgage rate is therefore unclear. The mortgage rate can go either up or down. Suppose it rises, and consider that many businesses are financed in part by mortgage loans. Then the policy has differential effects on businesses, depending on each firm's ratio of mortgage loans to business loans. The total interest expense of some businesses may actually increase. That might be especially true of those about to be financed by mortgages on the owners' principal residences.

Of course, one could also suppose that mortgage rates will fall and thus that the program gives added assistance to small businesses. But, then, more than the cost of a business lending program is shifted onto the bond market, which may be undesirable. The cost includes that of an unintended home-ownership program, as the mortgage market deals in residential as well as commercial loans.

Given the complexity of financial markets, there are many channels through which a direct lending program can defeat its purpose. In the previous example, the program may deprive banks of funds for their own business lending by driving up the yield of bonds, since households and firms can switch their assets out of bank deposits and into bonds. For instance, Kwon and Thornton (1971) found that whenever the American Federal Home Loan Bank (FHLB) sold bonds in the open market to finance advances to savings and loan associations (S & Ls), the FHLB was actually competing with the S & L industry for the same funds. Canada Mortgage and Housing Corporation (CMHC) loans are also completely offset by the private sector, according to CANDIDE 2.0 simulations (see first section of Chapter 3).

The ambiguity of the third-market effects of a change in the government's balance sheet also points to a possibly disturbing effect of government intermediation in regional markets. In the case of provincial government loans, for example, the third market may be out of the province. If yields in that market increased, other provinces would be paying for the local program. If yields in the third market decreased, the provincial government would be assisting the business of nonresidents. Whatever the case, the program may be unsatisfactory to some of the governments and clients involved.

As we have seen previously, government intermediation can generally have an effect on yields and therefore on asset demands and supplies. This is certainly the case when government participates in the market in a manner similar to that of a private financial intermediary and when the various securities are imperfect substitutes.

There are, however, two cases where government financial intermediation would have no effect on yields or quantities of securities. First, suppose that two securities are, or could be, regarded as perfect substitutes. This would be the case, for instance, if $X_{21}$ – the effect on the excess demand for bonds of a change in the interest rate on business loans – turned out to be negative and extremely large. Then the government intermediary would be buying and selling what essentially amounted to the same thing, and its transactions would therefore have no effect on anything.[10]

Second, private economic agents may consider the government portfolio an extension of their own. This would be the case if the investing public discounted government revenues and expenditures linked to its portfolio transactions and took them into account in their own financial decisions. In other words, suppose the investing public were "ultrarational," in that they discounted the tax liabilities (real or potential) required to service the public debt, and regarded the loss to holders of business loans as being offset by tax credits equivalent to the government's income from these loans. Then the public looks on the government as its own mutual fund, so to speak; and its demand for securities is not independent of government transactions. The public can maintain its desired portfolio (which includes the government portfolio) by offsetting the government's financial transactions. For example, when the government buys $1,000 of Security 1 and sells $1,000 of Security 2, the public maintains its portfolio equilibrium – including "mutual fund investments" – by selling $1,000 of Security 1 and buying $1,000 of Security 2. Thus there would be no change in excess demands, yields, and amounts of securities outstanding.

This study does not take into consideration this last possibility.[11] Consequently, any effects of changes in the government's portfolio should be considered as maximum effects. In other words, they are the effects of government intervention in financial markets as a financial intermediary upon the yields and amounts of securities outstanding, assuming that there is a complete divorce of government and private portfolios. If the truth were somewhere in between, the effects would, in reality, be less than the ones depicted by the model and equally uncertain with respect to third markets. One cannot dismiss, however, the possibility that the securities in which government deals are close substitutes. In a sophisticated financial system, the modern portfolio manager can duplicate one security or substitute for it with a suitable combination of two other securities.

## Loan Subsidies

In this section we consider the effect of loan subsidies in the form of an interest abatement program, free guarantees,[12] or a subsidized loan insurance premium. The subsidy is supposed to be financed by lump-sum taxes whose effect on the wealth of taxpayers is cancelled by the subsidy's effect on the wealth of security holders. Thus the subsidy is not supposed to increase wealth but merely to reallocate financial resources.

A subsidy is a wedge between the demand for, and the supply of, the subsidized asset. This wedge is the same, regardless of which side of the market qualifies for the subsidy. If holders of Security 1 receive a subsidy proportional to their return, the after-subsidy interest rate on an asset is

$$y_1^a = y_1 + y_1 g,$$

where $g$ is the subsidy rate expressed as a fraction of the rate paid by the borrower.

Supposing that $g$ is initially equal to zero, the increase in yield to the holder of a newly subsidized security is

$$dy_1^a = dy_1 + y_1 dg,$$

where $y_1$ is the interest originally paid by the issuer of the security, and $dy_1$ is the decrease in this rate occasioned by the new subsidy. If the initial subsidy was not zero, the analysis of the effects of a new or increased subsidy would be more complicated. The complication arises from the redistribution of existing subsidy benefits when new or increased subsidies are introduced. For instance, a new subsidy in Market 2 can cause the loan volume in Market 1 to change; and, given a pre-existing subsidy in that market, the subsidy receipts of participants in the first market will change, and this in turn will affect their supplies and demands for Securities 1, 2, and 3.

Now we must substitute $y_1^a$ for $y_1$ in the demand and supply equations of the subsidized investors; and, assuming that the holder of a subsidized security (e.g., Security 1) does not issue such a subsidized security,[13] the excess demand equations are

$$\begin{aligned} &D_1(y_1^a, y_2, y_3) - S_1''(y_1, y_2, y_3) = 0; \\ &D_2(y_1^a, y_2, y_3) - S_2'(y_1^a, y_2, y_3) - S_2''(y_1, y_2, y_3) = 0; \text{ and} \\ &D_3(y_1^a, y_2, y_3) - S_3'(y_1^a, y_2, y_3) - S_3''(y_1, y_2, y_3) = 0, \end{aligned} \tag{1.9}$$

where the supplies by subsidized units are primed and those by unsubsidized units are double-primed.

By differentiating, collecting terms, and remembering that initially $g = 0$, we have

$$\begin{aligned} &X_{11}dy_1 + X_{12}dy_2 + X_{13}dy_3 = -D_{11}y_1 dg; \\ &X_{21}dy_1 + X_{22}dy_2 + X_{23}dy_3 = S_{21}'y_1 dg - D_{21}y_1 dg; \text{ and} \\ &X_{31}dy_1 + X_{32}dy_2 + X_{33}dy_3 = S_{31}'y_1 dg - D_{31}y_1 dg, \end{aligned} \tag{1.10}$$

whence

$$dy_1 = -\frac{\Delta_{11}}{\Delta} D_{11}y_1 dg - \frac{\Delta_{21}}{\Delta}(D_{21} - S_{21}')y_1 dg - \frac{\Delta_{31}}{\Delta}(D_{31} - S_{31}')y_1 dg; \text{ and} \tag{1.11}$$

$$dy_2 = -\frac{\Delta_{12}}{\Delta}D_{11}y_1dg - \frac{\Delta_{22}}{\Delta}(D_{21}-S'_{21})y_1dg - \frac{\Delta_{32}}{\Delta}(D_{31}-S'_{31})y_1dg. \quad (1.12)$$

Because of the balance sheet constraint on purchasers of Security 1 (households and intermediaries),

$$D_1 + D_2 + D_3 - S'_2 - S'_3 = 0;$$

so that

$$-D_{11} = (D_{21} - S'_{21}) + (D_{31} - S'_{31}).$$

This and the previously noted properties 1.8 of the Jacobian and its co-factors implies that

$$dy_1 < 0; \text{ and } dy_2 \gtrless 0. \quad (1.13)$$

Because

$$\begin{aligned}\Delta &= \Delta_{11}X_{11} + \Delta_{21}X_{21} + \Delta_{31}X_{31} \\ &= \Delta_{11}D_{11} + \Delta_{21}(D_{21}-S'_{21}) \\ &\quad + \Delta_{31}(D_{31}-S'_{31}) - \Delta_{11}S''_{11} \\ &\quad - \Delta_{21}S''_{21} - \Delta_{31}S''_{31},\end{aligned}$$

the ratio

$$\frac{\Delta_{11}D_{11} + \Delta_{21}(D_{21}-S'_{21}) + \Delta_{31}(D_{31}-S'_{31})}{\Delta}$$

is less than unity; therefore,

$$\begin{aligned}dy_1^a &= dy_1 + y_1dg \\ &= 1 - \frac{\Sigma_i \Delta_{i1}(D_{i1} - S'_{i1})}{\Delta} y_1dg > 0.\end{aligned}$$

In the expression for $dy_1$ in 1.11, the second and third right-hand terms represent the crowding-out effect, which diminishes the effect of the subsidy on $y_1$. The subsidy's general pressure on yields is shown by the first term on the right-hand side of the expression for $dy_2$. This pressure is exerted by private lendable funds crowded out of the subsidized market. The last two terms in 1.12 measure the tendency of subsidized security holders to reduce their demand for Security 2, for which there is no subsidy.

For instance, suppose the government were to subsidize bankers' loans to farmers. The interest rate on farm loans (Security 1) received by bankers would rise, or at least not fall; the rate paid by farmers would fall, as per 1.11; and the loan volume would increase. The subsidy gives some clear signals: to bankers, to increase farm loans; to farmers, to use more borrowed money. It says nothing, however, about the farmers' unborrowed funds and their off-farm investments. Bankers get no directions to the source of funds for additional farm loans. Thus it cannot be presumed that the subsidized loans will result in agricultural investments. Farmers can also invest in, say, mortgages on urban properties (Security 2), and they would find the opportunity to do so if bankers reduced their mortgage loans to finance the subsidized farm loans. The two shifts of funds between farm loans and mortgages need not be equal; therefore $y_2$ may rise, fall, or stay the same.

Security 2, in this case, represents all other securities except farm loans. Thus the signal of an unambiguous shift in financial resources towards farming is an increase in the after-subsidy yields of all assets. Unless that were the case, the farm-loan subsidy program would also be an unintended housing-loan subsidy program, the unintended part being financed by cheap loans to farmers who invest in mortgages. Even if all after-subsidy yields increased, there would be some slip between the cup and the lip, unless all crowding-out effects were zero. For instance, if the bank were to transfer $1,000 from residential mortgages to farm loans and farmers were to use $900 of this to invest in mortgages, the net transfer to farming would be that much less than the intended $1,000. Such is the case with residential-mortgage-loan subsidies, as simulated with CANDIDE 2.0 (see first section of Chapter 3).

Some of the comments made in the previous section regarding the effects of changes in the government's balance sheet also apply to loan subsidies. For instance, the net effect of assistance to small business and industrial development is uncertain because the target firms do not issue only subsidized securities and because the permeability of financial markets allows the benefits and costs of the program to be diffused in unknown ways over other financial markets in which the target firms are dealing. Undesirable out-of-province effects are equally possible.

There is, however, a potentially important difference between the case of loan subsidies and the case of unsubsidized government loans. The effects of the latter depend only on the slopes of excess demand curves, whereas those of the former depend

also on the slopes of the supply and demand curves that constitute the excess demands. Thus an analysis of loan subsidies requires a more detailed knowledge of the structure of financial markets.

## Subsidized Government Loans

To deal simultaneously with loans and loan subsidies, $g$ will represent, as before, the rate of subsidy and $G$ will stand for the volume of government loans outstanding. At first, government loans and loan subsidies will be combined, and then the assumption that subsidized lenders do not borrow in subsidized markets will be removed.

The excess demand for the $i$-th asset in a three-asset system when government subsidizes the first is:

$$D_i(y_1^a, y_2, y_3) - S_i'(y_1^a, y_1, y_2, y_3) - S_i''(y_1, y_2, y_3),$$

where the lending rate is $y_1^a$, the borrowing rate is $y_1$; and $y_1^a = y_1 + gy_1$. Add government loans of $G$ dollars to the excess demand in one market; subtract government borrowing of $G$ dollars in another market; set all excess demands equal to zero; and differentiate them with respect to yields, the subsidy rate $g$, and credit operations $G$. The total differentials are then

$$(X_{11}-S_{11}')dy_1 + X_{12}dy_2 + X_{13}dy_3 = -(D_{11}-S_{11}')y_1 dg - dG;$$

$$(X_{21}-S_{21}')dy_1 + X_{22}dy_2 + X_{23}dy_3 = -(D_{21}-S_{21}')y_1 dg + dG; \text{ and}$$

$$(X_{31}-S_{31}')dy_1 + X_{32}dy_2 + X_{33}dy_3 = -(D_{31}-S_{31}')y_1 dg.$$

The solutions for $dy_1$, $dy_2$, and $dy_3$ are the sums of the solutions to 1.6 and 1.10 if $S_1' \equiv 0$ – that is, if subsidized lenders do not issue the subsidized security.

The above equations show that the addition of subsidies complicates the analysis of direct government loans as the slopes of some demand and supply curves are separately brought into play. As in the case of loan subsidies, an analysis of subsidized government loans thus requires more detailed knowledge of financial markets. Unfortunately, the type of information that is required is not as yet available in Canada. As will be discussed further below, the study of the effect of yields on asset demands and supplies has been most disappointing.

Further difficulty is caused by the fact that there is a large number of government intermediaries that operate a multiplicity of programs and intervene in several security markets at once. The great extent and variety of their financial interventions force us to abandon the assumption that subsidized asset holders do not issue subsidized securities. When this assumption is abandoned, security supplies are seen to depend on both the borrowing and lending rates ruling in subsidized markets. In terms of the analysis of the section on loan subsidies, the system of excess demand equations also contains an $S_1'$ function, and $y_1$ must be included as an argument in all $S_1'$ equations. For the case of subsidized lending in $m$ markets out of $n$ ($m < n$) and government borrowing in any of the $n$ markets, the total differential of excess demand equations is:

$$X'dy_j = \gamma, \tag{1.14}$$

where the elements of $X'$ are

$$(X_{ij}' - S_{ij}'), S_{ij}' = S_{ij} \text{ for } 0 < j < m; \text{ and } (i = 1, \ldots, n)$$
$$= 0 \text{ for } m \leqslant j < n; \quad (i = 1, \ldots, n)$$

the elements of $\gamma$ are

$$\gamma_i = \sum_{k=1}^{m} (D_{ik} - S_{ik}')\, y_k dg_k - dG_i; \quad (i = 1, \ldots, n) \tag{1.15}$$

and the $dG_i$ are constrained by $\sum_{i=1}^{n} dG_i = 0$. The meaning of this constraint is that government intermediaries borrow, in one or more markets, that which they lend in other markets.

The rate of subsidy in the $k$-th market is $dg_k$; the amount lent in any market is a positive $dG_i$; and the amount borrowed is negative. Nothing can be said about the signs of the coefficients in 1.14; therefore the effect of government-subsidized loans cannot be determined *a priori*.

The system 1.14 could be solved for the $dy_j$ if one had the necessary parameter estimates. Three things could then be done. First, one could tabulate $dy_j/y_j$ to gain an idea of the magnitude of the probable effect of government intermediation on interest rate levels.

Second, one could add the interest effects on excess demand to obtain the shift of financial resources to any $i$-th market; that is,

$$dA_i = \sum_{j=1}^{n} X_{ij}\, dy_j.$$

And, finally, one could take some typical balance sheets of government clients and the population, multiply their outstanding liabilities by the corresponding $dy_j$, and thereby obtain the total change in their interest cost of doing business.

Such an empirical study of the financial system would be interesting in its own right and would provide a solid basis for estimation of the real resource allocation effects of financial intermediation. It would, however, require estimates of demand and supply on the part of households, nonfinancial firms, and intermediaries for a variety of securities as functions of their yields. Attempts to estimate these equations were fruitless for a variety of reasons. The available data are current interest rates and financial flows at book value, whereas market values and expected-holding-period yields would have met the requirements much better. Most interest rates are closely correlated, which makes it difficult to disentangle their separate effects on financial flows and asset levels. The estimated coefficients are unreliable and often have what could be considered to be the "wrong" sign.[14] The number of coefficients to be estimated is very large relative to the size of the data sample. This limits the scope for inclusion of other variables that affect financial choices besides yields and wealth, such as inflation and capital income taxes. If some coefficients were arbitrarily set equal to zero, econometric precision could be increased but at the cost of predetermining the channels through which government can affect the financial system. One such system of asset-demand equations is already embedded in CANDIDE 2.0 and was used in the course of the alternative simulations (see Chapter 3).

Even without such an empirical model, the analysis in this chapter is interesting in that it points out the potential pitfalls in government financial intermediation, as well as some of the conditions for its effectiveness. These conditions are the subject of the next section, and the assumption that they obtain is essential for the real allocation simulations made in Chapter 2.

Pending empirical results pertaining to financial resource allocation, one can conclude from the theoretical analysis that the effect of government-subsidized loans to the private sector is essentially unpredictable and potentially perverse because of "third-market effects." The reader should remember that the analysis assumed the absence of market imperfections.

Of course, an applicant for a government loan operates on the assumption that he will benefit from the loan. Such an applicant would act as a price-taker, however, with no regard to the general equilibrium effects of government intermediation. His perception of a benefit in no way conflicts with our conclusion that government lending, as a whole, may not benefit him, and could even be harmful to him.

## The Effect of Government Loans and Loan Subsidies on Real Investment

The asset-demand model of this chapter can be expanded to encompass also the demand for real assets in addition to financial assets. The model was presented in its very abstract form precisely to permit this more general use. The equations in 1.1 can be used to represent demand and supply for different kinds of real capital, such as industrial machinery and equipment, farm lands, housing, and so on. The *numéraire* asset ($X_0$) can be "human capital." The yields of financial and real assets ($y_1, y_2, \ldots, y_n$) would then be measured relative to the yield of human capital ($y_0$). In this context, financial intervention by government would be deemed effective if, given the amount and yield of human capital, it increased the demand for, and yield of, other real capital items. For instance, one might ask: What happens to housing when government intervenes with direct mortgage loans. This question was answered in the second section of this chapter. It will be recalled that in the case of direct lending without subsidies it was found that if government intervened in two markets – as lender in one and borrower in the other – there was nothing one could say about the consequences of that action for a third market. That third market, however, could be the real estate, or housing, market in the case of bond-financed government mortgage loans. The yield of housing as an asset held by the private sector, together with mortgages and bonds, could rise or fall, or stay the same, if government were to issue new bonds to make new mortgage loans. The mortgage rate would tend to fall, and bond yields would tend to rise; but nothing could be said *a priori* about the rate of return to capital invested in housing or, for that same reason, about the demand and supply of housing.

Demand for housing depends on the simultaneous changes in the mortgage rate, the bond yield, and the returns to housing and other assets. The mortgage-rate effect is positive; the bond-yield effect is negative; and the rate-of-return effects are uncertain. The

total effect on the demand for housing must therefore also be uncertain.

In the case of an intervention in the mortgage market with a loan subsidy, housing would rest in the position of the second market, where the rate of return may rise, fall, or stay the same. Thus the effect of government financial assistance of this kind on the demand for a real asset is, once again, uncertain. As in the case of direct loans, it can vary from time to time, depending on the precise values of certain critical parameters (the $D_{ij}$ and $S_{ij}$).

More definite answers could be obtained if the troublesome parameters could be eliminated by more drastic simplification of the model. In the case of housing assistance, it could be supposed that housing capital and mortgage funds circulate in a stagnant pool that has no connection with the rest of the financial system or with investment in nonhousing capital. In particular, bond yields might not be an argument in the excess demands for mortgages, housing, and home-owners' human capital. There would then be three equations for the excess demands for mortgages ($X_1$), houses ($X_2$), and the human capital of home-owners ($X_0$), as functions of their yields ($y_0$, $y_1$, and $y_2$). Dropping the equation for the *numéraire* and remembering that, because of the budget constraint, $-D_{11} = D_{21} - S'_{21}$, the effects of a mortgage subsidy are as follows:

$$dy_1 = \frac{\Delta_{21} - \Delta_{11}}{\Delta} D_{11} y_1 dg < 0; \text{ and}$$

$$dy_2 = \frac{\Delta_{22} - \Delta_{12}}{\Delta} D_{11} y_1 dg > 0.$$

Correspondingly, the changes in the demand for mortgage loans ($S_1$) and for houses ($D_2$) are as follows:

$$dS_1 = S_{11} dy_1 + S_{12} dy_2 > 0; \text{ and}$$

$$dD_2 = D_{21} dy_1 + D_{22} dy_2 > 0.$$

This positive result of government intervention supposes an implausibly primitive condition of the markets or severe restrictions on the portfolio choices of home-owners and their creditors. Collateral requirements may be one such restriction. It would seem that the requirement of suitable collateral for a subsidized loan would force the investment of mortgage funds in housing and thus restrict the portfolio choices of the assisted. This would not generally be the case, however, if private intermediaries or affluent home-owners were involved, as the requirement of home-owner collateral will not block rearrangement of the portfolios of affluent home-owners and intermediaries in response to changes in asset yields. For financial interventions to affect the allocation of real capital, there would have to be tighter restrictions on the use of funds than those implied by collateral requirements.

In fact, the eligibility requirements for government assistance can be very complex. Generally, however, they do not seem to go so far as to restrict the use of unborrowed funds and the choices of the private intermediaries that may be involved. Thus the effectiveness of government financial intermediation remains doubtful, and it would be advisable to investigate alternatives. Production subsidies are one such alternative. They are compared with financial subsidies in the following section.

## A Comparison of Loan Subsidies with Production Subsidies

Already we have seen that a policy of government intervention in financial markets will not unambiguously shift financial resources towards favoured uses, since some of the policy's effects are dissipated by a reshuffling of investor portfolios and because the policy can have opposite effects on the liabilities of either target firms or households. Let us now compare this with the effects of a production subsidy as an alternative development assistance program. (In the case of housing, the production subsidy may be replaced by a shelter allowance, which would be its closest substitute.) The production subsidies are assumed to be financed (like the alternative loan subsidies) by lump-sum taxes devoid of wealth and allocative effects.

A production subsidy is an intervention in commodity markets, with financial effects equivalent to those of a financial market intervention aimed at all securities issued by the favoured entities (firms or households). Being aimed at all securities issued by the subsidy recipient, the production subsidy avoids the ambiguities noted in the previous sections. The following paragraphs analyse the production subsidy and show how it can be converted into a general financial subsidy and why it yields more definite results than the types of financial assistance considered previously. Consider, first, that profit is the difference between gross revenue and all factor payments, including interest paid and accrued on all of the entity's liabilities and the opportunity cost of its equity. Gross revenue is equal to the product price ($p$) times the output of capital ($K$) and labour ($L$), so that profit ($\pi$) is defined as follows:

$$\pi = pf(K,L) - wL - \sum_i y_i S_i; \; \sum_i S_i = K,$$

where $wL$ is the expenditure on variable services of labour, and $S_i$ is the amount outstanding of the $i$-th security, including equity.

Other variable inputs in addition to labour could also be considered, but their inclusion would not change the results. In the case of housing assistance, the analysis would apply equally well to rental housing, although some concepts would have to be interpreted differently for application to home-owners. Their imputed income from home-ownership is the "gross revenue." "Product price" can be set at unity if the product is considered to be "one home per period of time." The input of labour can be dropped without loss of generality.

The first-order condition for equilibrium of the entity's balance sheet, from which the supplies of securities are derived, is

$$d\pi = pf_K dK + pf_L dL - wdL - \sum_i \partial (y_i S_i)/\partial S_i = 0.$$

The last term on the right-hand side is a differentiation of $y_i$ times $S_i$, because the $y_i$ and the $S_i$ change simultaneously; and it is partial because an $S_i$ depends on all $y_i$.

A production subsidy at the rate $g'$ ($g'$ being a fraction of the product price) makes the first-order condition

$$d\pi = (1 + g')\, pf_K dK + (1 + g')\, pf_L dL - wdL - \sum_i \partial (y_i S_i)/\partial S_i = 0.$$

Multipling through by $(1 + g)\left[= 1/(1 + g')\right]$, one obtains

$$d\pi = pf_K dK + pf_L dL - (1 + g)\, wdL - (1 + g) \sum_i \partial (y_i S_i)/\partial S_i = 0.$$

The intervention parameter $g$ is, here, an input subsidy equivalent to, and at the same rate as, the production subsidy $g'$, if initially $g' = g = 0$, and thus $dg = -dg'$. Since both subsidies have the same effect on the first-order conditions for profit maximization, the input subsidy has similar effects on security supplies as the production subsidy.

To get the effect on financial markets of a production subsidy, we replace $y_i$ with $(1 + g)y_i$ as an argument in the security-supply equations of entities supposed to receive the subsidy. The excess demands for securities are then

$$X_i = D_i (y_1, \ldots, y_n) - S_i' (y_1 + gy_1, \ldots, y_n + gy_n) - S_i'' (y_1, \ldots, y_n) = 0, \quad (i = 1, \ldots, n).$$

Letting the initial $g$ equal zero$(dg \neq 0)$,and applying the rule for differentiation of the function of a function ($S$ with respect to $y + gy$), the shifts in excess demands caused by the production subsidy are

$$(\partial X_i/\partial g)dg = -\sum_k (\partial S_i'/\partial y_k)\, y_k dg.$$

Identical shifts would occur if the government bought proportional amounts of all securities issued by the favoured entities. Substituting a column of $(\partial X_i/\partial g)dg$ into the right-hand side of 1.6, we find

$$dy_j = \sum_i \sum_k \frac{\Delta_{ij}}{\Delta} S_{ik}'\, y_k\, dg.$$

The sign of $dy_j$ is found after eliminating the $y_k$ and expressing $dy_j$ in terms of elasticities:

$$dy_j = \sum_i (\Delta_{ij}/\Delta)\, S_i' \sum_k E_{ik}\, dg.$$

Since $\Delta$, $\Delta_{ij}$, and $S_i'$ are non-negative and $|E_{ii}| > \sum_k E_{ik}$, $(i \neq k)$ for gross substitutes, all $dy_j$ are positive. This means that investors will find all securities of the subsidized entity more attractive and there will be an unambiguous shift of financial resources towards it.

Since there is no ambiguity in the sign of $dy_j$, a production subsidy is always more effective than intervention in financial markets for transferring financial resources towards favoured firms or sectors. Some confirmation of this will be found in the next chapter on real resource allocation effects, which includes a comparison of loan subsidies with production subsidies.

# 2 The Effect of Government Financial Intermediation on Real Resource Allocation

The purpose of this chapter is to simulate the effect of government financial subsidies on real resource allocation in the Canadian economy. We are concerned with the effect on employment, output, and factor prices of the subsidies implicit in government loans, guarantees, grants, and other forms of financial assistance to Canadian business.

There are two approaches that one can take in the search for the effects of financial subsidies. One can undertake either a partial equilibrium analysis of government assistance to a specific firm (or industry) or a general equilibrium analysis of the assistance given to that one as well as others. In the first case, one studies the response of a firm to the financial assistance offered, on the premise that whatever its actions, they will have no discernible effect on the economy at large. The individual firm is assumed to be able to change its output and employment without affecting the supply of labour to other firms or the product prices received by its competitors. In this chapter, the second approach is followed, based on the premise that a very large number of firms receive financial assistance from a multitude of federal and provincial agencies and departments and that the sum-total of the governments' programs – and the firms' responses to them – can have wide-ranging effects on the Canadian economy.

The analysis of subsidies can be carried out in the same manner as that of taxes since – arithmetically speaking – a subsidy is simply a negative tax. From the point of view of economics, a subsidy gives the recipient a comparative advantage and puts all nonrecipients at a disadvantage, exactly as in the case of a discriminatory tax. This analogy between taxes and subsidies enables one to draw on the public finance literature, which provides an ample precedent in the analysis of the general equilibrium effects of taxes that is transferable to this study of subsidies.

The type of analysis followed here was pioneered by A. C. Harberger (1962) in his study of the incidence of corporate income tax. His two-sector model was able to show the effect on factor and product prices, as well as on output, employment, and incomes, of a subsidy to the employment of capital in one sector. Although he focused on the effects of the tax on corporate business income, this is analytically equivalent to a subsidy on the employment of capital by unincorporated business. Harberger's model makes the effect of such a subsidy depend on the ease with which each sector can substitute capital for labour in production and on the response by consumers to a change in the relative prices of the products of both sectors. The behaviour of the unsubsidized sector influences the result of the subsidy, because this sector furnishes the labour and capital employed by the subsidized sector. Consumers have a role to play, because their response to changes in production costs and prices determines the extent to which the subsidized sector can grow. The subsidy is spent partly on changing wages and net returns to capital in both sectors and partly on changing the product prices charged to consumers. These price changes provide incentives for the reallocation of factors of production between sectors, and they facilitate the marketing of the product of the subsidized and expanding sector. Whether the subsidy's effect is mainly to change prices or to change sectoral output and employment will depend on how easily factor proportions and consumer budgets respond to price changes.

Harberger's model has received substantial refinement and widespread application. C. E. McLure, Jr. (1970) investigated the interregional incidence, and the effects upon industrial location, of taxes levied in one region. John B. Shoven and John Whalley (1972) applied an algorithm to compute equilibrium prices without Harberger's linearity assumptions, and they extended the model to encompass a larger number of industrial sectors. J. Gregory Ballentine (1978) produced a simpler method of computing equilibrium

prices in a two-sector model shocked by substantial tax changes superimposed on pre-existing distortions. Robin Boadway and John Treddenick (1978) disaggregated the Harberger model and computed the allocative effects of Canadian customs duties and their interaction with other market distortions. Ballentine and Wayne R. Thirsk (1979) modeled the effect on the distribution of personal incomes of the replacement of part of the local property tax by federal and provincial personal and corporate income taxes. Finally, Ballentine and McLure (1980) introduced explicit consideration of the debt/equity choice in the analysis of corporate income tax.

The studies just mentioned provide valuable insight into the effects of financial subsidies, but they also suggest problems that will be encountered in our study of government intermediation. These problems can be classified under the headings of "firm specificity" and the "link between the financial and real sectors," which will be discussed in the first of the four sections into which this chapter is divided. The second section contains the model. This is dressed with appropriate statistical information in the third section. Following that, some tentative conclusions are reached on the resource allocation effects of financial subsidies. The subjects of income distribution and interregional impact, however, must await further study.

## The Problems of Firm Specificity and the Link between Financial and Real Subsidies

Dan Usher observed that "firm-specific policies may be contrasted with general policies . . . . The setting of the rate of corporation income tax is a general policy in that it affects all firms in more or less the same way . . . . A firm-specific policy is one where the government attempts to achieve its objective. . . by. . . subsidies to specific and identifiable firms, without at the same time treating all similarly-situated firms in exactly the same way" [Usher (1980), p. 3]. Thus a "firm-specific program of investment grants [and other capital subsidies] is like an arbitrary corporation income tax in its effects on the economy" [Usher (1980), p. 13]. This means that one cannot identify subsidized and unsubsidized sectors in the same way as, for example, Harberger could identify a heavily taxed corporate or a lightly taxed unincorporated sector. The pattern of subsidy distribution does not seem to correspond to an identifiable industrial classification. This compounds a similar problem that has already plagued tax incidence studies – namely, that there is no classification of consumer demands that clearly corresponds to the outputs of heavily and lightly taxed industries.

The firm-specificity of financial subsidies has potentially devastating consequences for the economic analysis of government grant and credit programs. This is so, because what matters is not only the subsidies themselves but the *differential subsidization* – that is, the fact that some get more than others; hardly any two firms are subsidized at the same rate. But economic analysis must necessarily rely on data averaging, and this averaging obliterates most of the differentials. It does not seem practical to disaggregate the economy into as many sectors as there are rates of subsidy. Instead, one has to constrain oneself to an analysis of the effects of some average rate of subsidy granted to a rather broadly defined industrial sector. This has two important consequences. First, since – as Harberger (1959) has shown – the welfare cost of subsidies depends on the square of differentials and increases with the level of disaggregation employed to measure them, an averaging of firm-specific into sectoral subsidy rates will cause the welfare cost of financial subsidy programs to be underestimated. Second, a subsidy is as likely to cause reallocations within an industry as between industries. It may be partly spent on increasing the output and employment of one firm at the expense of impairing the prosperity of other firms in the same industry, leaving little with which to change industrial structure or with which to expand one sector relative to other sectors. But by averaging – that is, by assuming a rate of subsidy common to all firms in a sector – one eliminates the within-sector effects *ex-hypothesi* and artificially throws the entire effect of a subsidy onto between-sector adjustments. In this way, the employment and output effects of subsidies are likely to be exaggerated. Therefore, it must be remembered that the analysis in this chapter exaggerates the output and employment effects and underestimates the welfare cost of government financial intervention. Any conclusions reached in that manner contain an interventionist bias.

Regarding the link between the employment of real capital and financial subsidies, it was shown in the previous chapter that financial subsidies have no definite effect on the demand for real capital unless the financial system is somewhat primitive or unless the financial aid is delivered with restrictions on portfolio choice and investment alternatives. Indeed, government credit usually involves eligibility standards, limits on the dollar amount of loans, use requirements, and features that differ from the price and other conditions of commercial loans.

It is assumed in this chapter that government loan subsidies are firmly tied to investment of borrowed funds in eligible activities. The subsidized firms and

households, however, employ equity funds, in addition to debt, and respond to subsidies by increasing their debt and their total investment, but not necessarily by increasing their equity in the subsidized activities. Loan and equity capital can be transferred from unsubsidized to subsidized activities, but whether equity capital is actually transferred will depend on whether loan subsidies increase the demand for capital by more than the amount by which they increase the demand for loans.

The demand for real capital will ordinarily not change by a larger amount, and not even by the same amount, as the demand for loans, since a loan subsidy does not have the same effect on the cost of capital as it has on the cost of debt. A loan subsidy reduces the cost of finance, but this cost may not change by the amount of the subsidy. The offer of a loan subsidy can be expected to increase the debt/equity ratio. A rise in this ratio may in turn increase risk and the cost of finance.[1] Therefore, the cost of finance may not fall by the whole amount of the subsidy. This would be especially so if financial risk depended on the book value of debt and not on its market value. A subsidized loan may not worsen a debt/equity ratio of market values by very much, since the subsidy will be reflected in a greater market value of the equity, and the loan suffers a discount from its nominal value. In case of bankruptcy, however, the nominal debt would have to be honoured before any equity distributions were made; thus nominal debts affect shareholder risk. This risk factor is more specific to households, firms, and industries than the market forces and demand characteristics that were shown in Chapter 1 to cause loan subsidies to have uncertain effects on the yield of equity.

## The Model

To estimate the effects of loan subsidies, an input-output model is used to take into account various taxes and tariffs and the type of financing (debt or equity). An open economy is modeled to facilitate a study of export subsidies and to allow for the possibility that foreign investment in Canada will respond to loan subsidies.

It is assumed throughout that the economy is in full employment or that employment is at a level that could be considered as "full." It is supposed that monetary and fiscal policies are at all times adjusted to maintain full employment. This assumption is not made in Chapter 3, but in this chapter financial subsidies are not regarded as a tool of economic stabilization similar to monetary and fiscal policy. Indeed, as Dan Usher observed, there is no evidence that they are used as such and correspondingly increased in recession and removed in prosperity [see Usher (1980), p. 19]. Instead, financial subsidies have to be judged in a full-employment context, as a tool to modify the balance between investment and consumption or to change the sectoral composition of investment and employment. An alternative to the full-employment assumption would be to add labour-supply equations to the model. One would then have to specify the macroeconomic policies that were being pursued at the time the loan subsidies were disbursed and study the macro effects of government loans. François Delorme (1982) recently completed such a study for the Economic Council of Canada.

Given the full-employment assumption, subsidies can be financed in basically two ways: 1) by reductions in government spending on other goods; or 2) by increasing some taxes. Whenever changes in government expenditures are involved it is assumed, as is commonly done in this case, that government spends in the same manner as private individuals. One pretends that there are no changes in expenditure patterns when government taxes the people's money and spends it on their behalf. There are, in fact, no separate input-output data on the intermediate and final use of commodities by governments and the private sector.

Should government borrow to finance a subsidy program, private individuals would be buying securities and cutting their consumption expenditures to do so. Since government and its people are assumed to have the same tastes, the effect of borrowing is the same as if government had reduced its consumption, not the people's, to finance the subsidy program. Thus the effect of subsidies with borrowed funds can be analysed as a balanced budget exercise.

The resources of the country are represented by fixed endowments of real domestic capital $\overline{K}$, and labour $\overline{L}$, assisted by a stock of foreign capital $K^f$. The assumption that the Canadian residents' sources of income are fixed means that – by assumption – the personal income tax cannot affect the choices between labour and leisure or between consumption and saving; in other words, personal income tax effects need not be considered. Saving and investment equal the output of capital goods, but the period of analysis is kept so short that there is insufficient time for new capital goods to be installed in production. Therefore, saving and investment are not supposed to change $\overline{K}$. But the total amount of capital employed can be varied by foreign investment. Factor prices are assumed to be fully flexible and to thus ensure full employment of the available labour and capital. The model determines relative factor price changes, independently of what may happen to the general price level.

Firms are assumed to be perfectly competitive profit-maximizers. Owners of real capital seek to maximize their after-tax incomes. Capital is assumed to be perfectly mobile among industries, so that it earns the same after-tax income in all industries characterized by the same business risk. Foreign capital is imperfectly mobile across the national boundary; but once in Canada it is assumed to be indistinguishable from domestic capital and equally mobile within the country. Physical capital is more mobile in the long run than in the short run. Consequently, simulations on the assumption of perfect mobility overstate the possible short-run effects of loan subsidies on the employment of capital.

All production processes are characterized by constant returns to scale. This is another simplifying assumption that makes it easier to relate changes in factor inputs to changes in output and one that has some support in empirical studies of production. Factor inputs are measured in efficiency units, which are the amounts required to earn $1 of after-tax income.[2] Intermediate inputs are supposed to be separable from capital and labour, and to be used in fixed proportions to output. Export prices are set in the world market and may depend on Canadian supplies. Final demands for domestic products have unitary price and income elasticities, as if derived from Cobb-Douglas utility functions.

The variables and parameters involved are listed in Table 2-1. There it will be noted that the analysis also contemplates the effects of pre-existing distortions, such as income and sales taxes, as well as some subsidies. The model must include these to permit differential-taxation analyses. The welfare and allocation effects of financial subsidies will depend on these other taxes. A proper evaluation of financial subsidies will therefore require a separation of their pure effects from those caused by their interaction with taxes and subsidies. For example, it may be that a particular financial subsidy is found to have generally beneficial effects on the economy; yet it could also be that such effects arise not from the subsidy itself but from its interaction with income taxes. A subsidy on the employment of financial capital can, for example, effectively reduce the burden of a capital income tax. One would then have to judge the contributions of income tax and the subsidy to the general welfare and might find that in such a case the beneficial effect of a subsidy is due to the fact that it diminished the discriminatory impact of an excessive rate of tax on capital income. The subsidy would then be quite unnecessary to produce those beneficial effects; they could be obtained more efficiently by removing the discriminatory elements of taxation and equalizing the rates of tax on the income from capital in all sectors.

## Table 2-1

## List of Variables and Parameters

Variables:

| | |
|---|---|
| $B_i$ | Debt of firms in the $i$-th industrial sector |
| $E_i$ | Equity invested in the $i$-th sector |
| $e$ | Exchange rate in Canadian dollars per unit of foreign currency |
| $F_i$ | Exports by the $i$-th sector |
| $K_i$ | Real capital employed by the $i$-th sector |
| $K^f$ | Foreign capital employed by Canadian industry |
| $L_i$ | Labour employed in the $i$-th sector |
| $M_i$ | Imports of the $i$-th good for intermediate and final use |
| $M_{ji}$ | Imports of the $j$-th commodity used as input by the $i$-th industry |
| $p_i$ | Canadian-dollar producer price of the $i$-th good |
| $q_i$ | Net-of-duty domestic price of imports $(=e\bar{p}_i/(1-t_i^m))$ |
| $Q_i$ | Final demand for domestic products |
| $r$ | Rate of return to real capital after tax and industry-specific risk |
| $r_i^b$, $r_i^e$ | Net of tax yield of debt and equity in the $i$-th sector |
| $w$ | Wage rate |
| $W_i$ | Imports for final (not intermediate) use in Canada |
| $X_i$ | Output of the $i$-th industry |
| $X_{ji}$ | Output of the $j$-th industry used as input by the $i$-th industry |
| $Y$ | National income and expenditure |
| $1 + T_i$ | Ratio of the gross return to capital to the net rate of return after tax and after industry-specific risk premium |

Parameters:

| | |
|---|---|
| $a_{ij}$ | Technical input-output coefficient (amount of $X_i$ put in per unit of $X_j$) |
| $\gamma$ | Elasticity of supply of foreign capital |
| $\epsilon_i$ | Proportion of income spent on the $i$-th good |
| $\eta_i$ | Foreign elasticity of demand for Canadian exports |
| $\bar{K}$ | Domestic capital endowment |
| $\bar{L}$ | Fixed supply of labour |
| $m_{ij}$ | Imports of good $i$ for intermediate use by industry $j$, per unit of $X_j$ |
| $\bar{p}_i$ | World price of good $i$, in foreign currency |
| $s_i$ | Export subsidy rate |
| $\sigma_i$ | Technical elasticity of substitution of capital for labour |
| $t_i$ | Rate of ad-valorem tax on final demand |
| $t_i^m$ | Import duty rate |
| $t_i^b$, $t_i^e$ | Ad-valorem rates of tax on interest and equity income earned in the $i$-th sector |
| $\theta_{ki}$, $\theta_{li}$ | Factor shares of capital and labour in the income of industry $i$ |
| $t_{ij}$ | Rate of ad-valorem tax on sales of intermediate products of industry $i$ used by industry $j$ |
| $v_i$ | Other value added by industry $i$, in dollars per dollar of output |
| $z_i$ | Proportion of final demand for the $i$-th good that is directed to domestic producers. |

The equations of the model are numbered 2.1 to 2.17 and are defined below. The industrial sectors are represented by their production functions in equation 2.1. The firms in these sectors employ capital and labour in such amounts that their marginal revenue products equal the factor costs, as in equations 2.2 and 2.3. In the case of capital, this cost is gross of tax and differential risk. Factor supplies are given by equations 2.4 and 2.5. Final demand for domestic use – including also the demand for capital goods and the demands by governments – is represented by functions of income ($Y$) and prices inclusive of sales taxes and customs duties (see equations 2.6 and 2.9). World market prices for exports are translated into Canadian currency at an equilibrium exchange rate and depend on the quantities exported. The price paid can be reduced by an export subsidy (equation 2.7). Import prices are also determined abroad. These prices move in direct proportion to the exchange rate. Total imports for final demand and intermediate use are given by equation 2.10. Canadian production for final demand, exports, and intermediate input is given by equation 2.8.

Value-added production functions: $(i = 1, \ldots, n)$

$$X_i = \phi_i (K_i; L_i) = X_{ji}/a_{ji} = M_{ji}/m_{ji} \tag{2.1}$$

Marginal productivity conditions:

$$(1 + T_i)r = p_i \partial \phi_i / \partial K_i \tag{2.2}$$

$$w = p_i \partial \phi_i / \partial L_i \tag{2.3}$$

Supply of capital

$$\overline{K} + K^f = \sum_i K_i; K^f = \psi(r) \tag{2.4}$$

Supply of labour

$$\overline{L} = \sum_i L_i \tag{2.5}$$

Final demand for domestic products, for domestic use

$$p_i (1 + t_i) Q_i = z_i \epsilon_i Y \tag{2.6}$$

Foreign demand for exports

$$(1 - s_i)p_i = e\chi(F_i) \tag{2.7}$$

Domestic output

$$X_i = Q_i + F_i + \sum_j a_{ij} X_j \tag{2.8}$$

Imports for final use

$$W_i q_i (1 + t_i) = (1 - z_i) \epsilon_i Y \tag{2.9}$$

Imports

$$M_i = \sum_j m_{ij} X_j + W_i \tag{2.10}$$

Balance of payments

$$\sum_i p_i (1 - s_i) F_i - \sum_i q_i (1 - t_i^m) M_i - r\psi(r) = 0 \tag{2.11}$$

National income

$$\begin{aligned} Y = {} & w\bar{L} + r\sum_i (1 + T_i) K_i - r\psi(r) + \sum_i q_i t_i^m M_i \\ & + \sum_i t_i p_i Q_i - \sum_i s_i p_i F_i + \sum_i t_i q_i W_i + \sum_i v_i p_i X_i \\ & + \sum_j \sum_i a_{ij} p_i t_{ij} X_j + \sum_j \sum_i m_{ij} q_i t_{ij} X_j \end{aligned} \tag{2.12}$$

Wages are the *numéraire*

$$w \equiv 1 \tag{2.13}$$

Debt and equity finance

$$K_i = B_i + E_i \tag{2.14}$$

Cost of debt and equity capital

$$r(1 + T_i) K_i = (1 + t_i^b) B_i r_i^b + (1 + t_i^e) E_i r_i^e \tag{2.15}$$

Net yields depend on debt/equity ratios

$$r_i^b / r = f_i (B_i / E_i) \tag{2.16}$$

$$r_i^e / r = g_i (B_i / E_i) \tag{2.17}$$

The first-order condition for an optimum debt/equity ratio for the industry.

$$\begin{aligned} & (1 + t_i^b) r_i^b - (1 + t_i^e) r_i^e + r \left\{ (B_i / E_i) + 1 \right\} \bullet \\ & \bullet \left\{ (B_i / E_i) (1 + t_i^b) f_i' + (1 + t_i^e) g_i' \right\} = 0 \end{aligned} \tag{2.18}$$

Equation 2.11 is the balance of payments, where payments for imports and the income of foreign capital are equal to the gross revenue from exports. Given the rate of exchange and a constant rate of return abroad, the stock of foreign capital depends on the after-tax rate of return.[3] Actual payments to

foreign investors are usually less than their income ($rK^f$). But it is assumed here that all accrued income is transferred out, and that the difference between it and actual payments is created by reinvestment. The alternative is to complicate the model by adding a theory of the pay-out ratio for income accrued to foreigners. The difference between the two formulations of the balance of payments is that in one case a subsidy-induced change in the rate of return to capital affects Canadian exports, whereas in the other case it can also affect the demands for domestic goods and imports by the expenditure of foreign income retained in Canada. Equation 2.11 defines a balance-of-payments equilibrium as a situation in which there are no international capital flows. There are, of course, temporary capital flows induced by changes in $r$ that may be caused by financial subsidies. But these temporary flows occur only out of equilibrium, in the adjustment of $K^f$ from one level to another. Thus 2.11 is valid only in equilibrium. Exogenous capital flows that do not respond to subsidies via changes in $r$ are arbitrarily set equal to zero. They could just as well have been set at any other level with no consequences for the operation of the model. This is so, because what matters in this model are differentials of the variables but the differentials of exogenous capital imports are zero, whatever their level.

Equation 2.12 gives gross national income as the sum of gross before-tax domestic factor incomes, plus the government's revenue from import duties; sales taxes, less export subsidies; and other value added. Loan subsidies and corporate income tax are subsumed in the gross capital income.

The first 12 equations, together with 2.13, which defines the unit of account, complete the real block of the resource allocation model. The financial block is composed of equations 2.14 to 2.18. The first of these states that in every sector the gross cost of financial and real capital is the before-tax cost of equity and debt. The after-tax returns to debt and equity include risk premia, which depend on debt/equity ratios. Equations 2.16 and 2.17 make the after-tax rate of return to a security (relative to the average, economywide rate of return) depend on debt/equity ratios. An increase in debt can increase investment risk. Therefore, yield rises relative to the average net rate of return. This average rate ($r$) may also include an allowance for risk; thus we are considering here not absolute but relative risk premia for investment in a particular sector compared with market risk. Consequently, the $T_i$ blend absolute tax with relative risk burdens. The $t_i^b$ and $t_i^e$ represent rates of tax on the income from capital or, if negative, rates of subsidy. Firms adjust to them so as to minimize the total cost of real capital. This adjustment requires a restructuring of the balance sheet. The balance sheet structure is optimized when there is no further change in the debt/equity ratio capable of reducing the total cost of financial capital. This condition is expressed in equation 2.18, where the first derivative of $r(1 + T_i)K_i$ with respect to $B_i/E_i$ is set equal to zero after substituting 2.16 and 2.17 into 2.15.

Equation 2.15 can be written as

$$1 + T = (1 + t^b)\frac{B/E}{1+B/E} f(B/E) + (1 + t^e)\frac{1}{1+B/E} g(B/E),$$

omitting the subindices for simplicity of the present argument. Now, given the rates of net tax on debt and equity income, one can solve 2.18 for $B/E$, insert this value in the above equation, and obtain $(1+T)$, the ratio by which gross capital costs exceed the net after-tax rate of return $r$ on account of taxes, subsidies, and relative risk premia. This solution for $(1+T)$ is then worked into the real block of the model, to find the final effect of taxes and subsidies on real resource allocation.

When working with the financial block, let

$$1 + t^b = (1 + \tau^b)(1 - s^b); \text{ and}$$
$$1 + t^e = (1 + \tau^e)(1 - s^e),$$

where the $\tau$s are rates of tax, the $s$'s are rates of subsidy, and the $t$'s incorporate their interactions ($\tau$ times $s$).

Before completing the discussion of the equations in the model, we count them and the number of endogenous variables to make sure that we have a determinate system. The endogenous variables are $n$ $X$s (where $n$ is the number of industrial sectors), the corresponding $p$s, $n$ each of $K$, $L$, $F$, $Q$, $M$, $W$, $B$, $E$, $T$, $r^b$, and $r^e$; the factor prices $r$ and $w$, income $Y$, the exchange rate $e$, and foreign capital $K^f$. These are $13n+5$ variables, one of which is redundant. For example, given the $K$s, $B$s, and $E$s, one does not need $K^f$. Thus the model has $13n+4$ endogenous variables. There are also $13n+5$ equations. By Walras's Law, any one of these equations can be eliminated, leaving as many equations as endogenous variables.

For the equations in the financial block, we adopt the functional forms employed by Ballentine and McLure (1980). For the real block, however, we prefer not to postulate any specific functional forms

but to follow Harberger's differential approach. His approach is well suited for an analysis of financial subsidies, as these are small compared with taxes and other subsidies. The differential equations for the real sector of the economy are equations 2.19 to 2.30, listed below. The carets in these equations indicate percentage changes (e.g., $x = dx/x$). Units are defined so that the initial values of $r$, $e$, $p_i$ and $\bar{p}_i$ are all equal to unity. With few exceptions, the derivation of equations 2.19 to 2.30 is straightforward. For 2.19 one makes use of R.G.D. Allen's definition of the elasticity of factor substitution under constant returns to scale. Equation 2.20 is obtained by substituting 2.2 and 2.3 into the total differential of $X$. Equation 2.25 is derived from the zero-profit condition that product price equals average and marginal costs, including the gross cost of capital. There are $8n+4$ differential equations that can be solved, after deleting one of them, for the $8n+3$ variables $K_i$, $L_i$, $X_i$, $Q_i$, $F_i$, $M_i$, $W_i$, $p_i$, $e$, $r$, and $Y$ as functions of changes in the parameters, which are $T_i$, $s_i$, $t_i$, $t_{ji}$, and $t_i^m$. The internal consistency of the equations and the data was checked by solving the system three times, each time deleting a different equation. As required by Walras's Law, the three solutions turned out to be identical, and that signified the consistency of the system.

The $T_i$ are obtained from solutions to 2.18 for $t_i^b$s and $t_i^e$s, increased by the elimination or reduction of

$$\hat{K}_i - \hat{L}_i + \sigma_i \hat{r} = -\sigma_i (1 \hat{+} T_i). \qquad (i = 1, 2, \ldots, n) \tag{2.19}$$

$$\hat{X}_i - \theta_{ki}\hat{K}_i - \theta_{li}\hat{L}_i = 0. \tag{2.20}$$

$$\sum_i K_i \hat{K}_i - \gamma\psi(r)\hat{r} = 0. \tag{2.21}$$

$$\sum_i L_i \hat{L}_i = 0. \tag{2.22}$$

$$(1 - a_{ii})\hat{X}_i - \sum_{\substack{j=1 \\ j \neq i}}^{j=n} a_{ij} X_j \hat{X}_j / X_i - Q_i \hat{Q}_i / X_i - F_i \hat{F}_i / X_i = 0. \tag{2.23}$$

$$\hat{Q}_i + \hat{p}_i - \hat{Y} = -(1 \hat{+} t_i). \tag{2.24}$$

$$\begin{aligned} &- \left\{(1 + T_i)K_i/X_i\right\} \hat{K}_i - L_i \hat{L}_i / X_i + \left\{(1 + T_i)K_i + L_i\right\} \hat{X}_i / X_i + \left\{1 - v_i - a_{ii}(1 + t_{ii})\right\} \hat{p}_i \\ &- \sum_{\substack{j=1 \\ j \neq i}}^{n} a_{ji}(1 + t_{ji})\hat{p}_j - \sum_j \left\{m_{ji}(1 + t_{ji})/(1 + t_i^m)\right\} \hat{e} - \left\{(1 + T_i)K_i/X_i\right\} \hat{r} \\ &= \left\{(1 + T_i)K_i/X_i\right\} (1 \hat{+} T_i) + \sum_j \left\{a_{ji} + m_{ji}/(1 - t_j^m)\right\} (1 + t_{ji}) (1 \hat{+} t_{ji}) \\ &- \sum_j \left\{m_{ji}(1 + t_{ji})/(1 - t_j^m)\right\} (1 \hat{-} t_j^m). \end{aligned} \tag{2.25}$$

$$\sum_i \left\{ (1 - s_i)F_i - M_i \right\} \hat{e} + \sum_i (1 - s_i)F_i \, (1 + 1/\eta_i)\hat{F}_i - \sum_i M_i \hat{M}_i - (1 + \gamma)\psi(r)\hat{r} = 0. \tag{2.26}$$

$$\hat{p}_i - \hat{e} - \hat{F}_i/\eta_i = -(1 \hat{-} s_i). \tag{2.27}$$

$$\hat{M}_i - \sum_j m_{ij} \, (X_j/M_i)\hat{X}_j - (W_i/M_i)\hat{W}_i = 0. \tag{2.28}$$

$$\hat{W}_i - \hat{Y} + \hat{e} = (1 \hat{-} t_i^m) - (1 \hat{+} t_i). \tag{2.29}$$

$$\begin{aligned}
Y\hat{Y} &- \sum_i (1 + T_i)K_i \hat{K}_i - \sum_i L_i \hat{L}_i - \left\{ \sum_i (1 + T_i)K_i - (1 + \gamma)\psi(r) \right\} \hat{r} \\
&- \sum_j \left\{ v_j X_j + \sum_i (a_{ij} + m_{ij}/(1 - t_i^m))t_{ij} X_j \right\} \hat{X}_j - \sum_i t_i Q_i \hat{Q}_i + \sum_i s_i F_i \hat{F}_i \\
&- \sum_i \left\{ t_i W_i/(1 - t_i^m) \right\} \hat{W}_i - \sum_i \left\{ t_i M_i/(1 - t_i^m) \right\} \hat{M}_i \\
&- \left\{ \sum_i (t_i^m M_i + t_i W_i)/(1 - t_i^m) + \sum_j \sum_i (m_{ij} t_{ij} X_j)/(1 - t_i^m) \right\} \hat{e} \\
&- \sum_i \left\{ t_i Q_i - s_i F_i + v_i X_i + \sum_j a_{ij} t_{ij} X_j \right\} \hat{p}_i \\
&= \sum_i (1 + T_i)K_i (1 \hat{+} T_i) - \sum_i s_i F_i \hat{s}_i + \sum_j \sum_i \left\{ a_{ij} + m_{ij}/(1 - t_i^m) \right\} t_{ij} X_j \hat{t}_{ij} \\
&+ \sum_i t_i \left\{ Q_i + W_i/(1 - t_i^m) \right\} \hat{t}_i + \sum_i \left\{ t_i M_i/(1 - t_i^m) \right\} \hat{t}_i^m \\
&- \sum_i (t_i^m M_i + t_i W_i)(1 \hat{-} t_i^m)/(1 - t_i^m) - \sum_j \sum_i \left\{ m_{ij} t_{ij} X_j/(1 - t_i^m) \right\} (1 \hat{-} t_i^m).
\end{aligned} \tag{2.30}$$

financial subsidies other than export loan subsidies. The latter are treated as equivalent to a reduction in export prices, so $s_i$ equals the cost to government of export loan subsidies, divided by the value of exports. The changes in producer prices $p_i$ can be used to calculate the change in a Laspeyres price-index of goods in final demand. After changing its sign, that index would show the change in real wages.

An index of economic welfare can be given by the change in the assumed Cobb-Douglas utility function. As this function is homothetic, there are no income effects of changes in relative prices; the ordinary demand curve coincides with the compensated one; and Hicks's compensating and equivalent variations are the same. Any given percentage increase in utility is thus equivalent to the same proportionate gain in money income. The change in the utility function can therefore be expressed in terms of constant dollars, multiplying the percentage change in utility by the initial amount of income. This product constitutes the measure of welfare change reported in this chapter.

## The Choice of Parameter Values and of the Initial Values of the Variables

The effect of a change in financial subsidies is transmitted to the real block through its effect on the ratios of gross to net returns to capital $(1+T_i)$ in the financial block. This last effect depends on the debt/equity choice of the subsidized sectors of

economic activity considered here – namely, agriculture, manufacturing, and housing.[4] Together with exports, they are the sectors that receive the greater part of government loan subsidies. Export subsidies, however, receive a different treatment in this paper from that accorded to agricultural, manufacturing, and housing subsidies. They are treated as export price reductions, since export loan subsidies are given to foreign purchasers and are thus not directly related to items on the balance sheets of Canadian firms.

The variables in the financial block are the $B_i$, $E_i$, $T_i$, $r_i^b$, $r_i^e$, and $r$. The initial values chosen are those for the year 1977, which is the latest year for which complete data were available at the time that this study was made (1981). The debt and equity in owner-occupied housing were obtained from Statistics Canada's Survey of Home Ownership and Mortgage Debt, 1977, and from the 1976 Census. The survey results with respect to average market value and mortgage debt were applied to the census number of owner-occupied homes. The cost of debt appears as "other operating surplus" in Statistics Canada's 1977 input-output tables. For return to equity, we took the estimate of imputed home-ownership income, or "unincorporated income," of the owner-occupied housing sector from the same source, plus an estimate of expected capital gains at a rate equal to the annual rate of inflation expected in 1977. As a proxy for this, the average 5-year compound rate was chosen, as projected for the seven different scenarios contemplated in the Economic Council of Canada's Fourteenth Annual Review, published in 1977.

The 1977 debt of, and interest payments by, agriculture were taken from Statistics Canada's *Farm Income Statistics*. Equity is estimated as the real capital (at current prices) invested in farm lands and buildings, livestock and poultry, and implements and machinery (from the same source), less farm debt. Farm equity income is farm net income in cash and kind, plus capital gains estimated in the same manner as for housing, less an estimate of the value of self-employed labour. This was obtained by splitting the income of unincorporated farm enterprises into capital and labour income in the proportions revealed by an unpublished Statistics Canada computation of man-years of paid and unpaid farm employment as those which could result from a $1-million increase in final demand for agricultural products, valuing paid and unpaid man-years equally. This computation was done for the Economic Council as a special service by Statistics Canada.

Other sectors, of which there are eleven plus three dummy industries, were classified as in the small aggregation of Statistics Canada's input-output tables, except that finance, insurance, and real estate excludes owner-occupied housing. The book values of the debt and equity of these sectors, as well as their rates of return after corporate income tax, were obtained from the 1977 returns to Statistics Canada under the Corporations and Labour Unions Returns Act. The value for the last variable in the financial block ($r$) is simply the average rate of return on the debt and equity of all sectors, after corporate income tax – namely, 8 per cent in 1977.

The initial values of the variables are supposed to be equilibrium values or to have resulted from successful efforts to minimize the $T_i$. These $T_i$ depend not only on corporate income tax but also on the cost of debt and equity as functions of the debt/equity ratios. For these functions, we adopted the form postulated by Ballentine and McLure:

$$r^b/r = \beta + \alpha(B/E)^\nu;$$

$$r^e/r = b + a(B/E)^\nu;$$

and their estimate of the exponent, which is 1.4.

Substituting the above two equations into the equation for $(1+T)$, one can express $(1+T)$ as a function of $(B/E)$ only. Optimum financing implies that the first derivative of $(1+T)$ with respect to $(B/E)$ is equal to zero, and the second derivative evaluated at equilibrium values of $(B/E)$ is positive. Assuming arbitrarily that the second derivative equals unity, one has four equations (the derivatives and the relative yield equations above) that can be solved for $\alpha$, $\beta$, $a$, and $b$. The solutions should be non-negative so that financial costs will be neither negative nor declining functions of debt. In cases where this condition was not met, we experimented with different values of the second derivative, between 0.1 and 2.0. Larger values would reduce *a priori* the effectiveness of loan subsidies. The larger the second derivative, the larger the effect of financial structure on the cost of finance. The thus-estimated parameter values are shown in Table 2-2. As they differ greatly between sectors, they imply that financial costs could be equalized neither by 100 per cent debt-finance nor by the abolition of the corporate income tax. Consequently, the application of a model of this type would not produce dramatic estimates of tax-induced distortions of investment. The view taken here is that taxes are not the only barrier to the equalization of rates of return by the free flow of capital between sectors. Investors demand different rates of return from different sectors to compensate for industry-specific business risks. Capital mobility does not equalize rates of return after tax; instead, it tends to equalize

rates of return after tax and risk premia.[5] Relative riskiness is indicated by the coefficients of the relative yield equations. The figures in Table 2-2 have some intuitive appeal. In every sector, equity investment is riskier than debt (the coefficients of the equity equation are larger than those of the debt equation) except in transport and utilities, where government ownership is an important factor. Risky agriculture has some of the highest coefficients. Sectors that are regulated, or that are partly government-owned, or that borrow mainly on a short-term basis with the security of movable assets (trade, construction) have relatively low coefficients.

## Table 2-2

### Parameters of Relative Yield Functions,* 1977

| | Debt | | Equity | |
|---|---|---|---|---|
| | $\beta$ | $\alpha$ | $b$ | $a$ |
| Agriculture | .90 | .25 | 1.35 | .47 |
| Forestry | .75 | – | 1.14 | .26 |
| Fishing, hunting, and trapping | .78 | .05 | 1.31 | .25 |
| Mining | .65 | .05 | 1.30 | .59 |
| Manufacturing | .60 | .03 | .99 | .28 |
| Construction | .33 | .05 | 1.12 | .10 |
| Transport and storage | .80 | – | .60 | .02 |
| Communications | .85 | .10 | 1.10 | .06 |
| Utilities | 1.02 | – | .99 | .01 |
| Wholesale trade | .47 | – | .90 | .16 |
| Retail trade | .57 | .03 | 1.87 | .41 |
| Finance, insurance and real estate | .78 | – | .75 | – |
| Owner-occupied housing | .82 | .11 | 1.45 | .22 |
| Services | .73 | .04 | 1.00 | .14 |

*$r^b/r = \beta + \alpha\,(B/E)^{1.4}$; $r^e/r = b + a(B/E)^{1.4}$; $r = 0.0798$

The loan subsidies were estimated by the Economic Council of Canada following the methodology developed by Jack M. Mintz (1981) and represent only subsidies to private-sector borrowers. The data did not permit a fine disaggregation of loan subsidies but only of those subsidies granted by agencies dedicated to the support of broadly defined sectors. In the case of agriculture, it was clear that the farm credit agencies support only that sector, but it would have been impossible to use individual loan data to determine the subsidies granted to different (e.g., hog or dairy) types of farm enterprise. The housing subsidies exclude those for public rental housing. In the case of business-finance agencies, an analysis of their activities showed that they assist mainly manufacturing, with the exception of the Federal Business Development Bank, which also supports service industries with a considerable volume of loans. The percentage rate and volume of subsidies embedded in the loans by this Bank are, however, small, especially when compared with the subsidies granted by other agencies that predominantly finance manufacturing enterprises, such as the Ontario Development Corporation, the Société de développement industriel, or the Nova Scotia Resources Development Board. Consequently, and only for the purposes of the simulations in this study, the loan subsidies granted by business-finance agencies are deemed to be subsidies to manufacturing. The export loan subsidies were all allocated to manufacturing, as this would seem to be consistent with the policy of the major agency involved.[6] Other export subsidies are not explicitly considered.

The initial values of upper-case variables in the real block – $F$, $M$, $Q$, $W$, and $X$ – were taken or calculated from Statistics Canada's 1977 input-output tables. Capital and labour ($K$, $L$) were measured in efficiency units, after splitting unincorporated business income between capital and labour according to Statistics Canada's estimates of the effect on factor demands of an increase in final demand. Capital income is net of corporate income tax and differential risk ($T$). Net foreign capital income ($K^f$) is in the amount that balances the balance-of-payments equation.

Values for the $a_{ij}$, $m_{ij}$, and $t_{ij}$ were supplied by Statistics Canada. The $t_{ij}$ exclude most provincial indirect taxes. These are included in the coefficients for "other value added" ($v_i$), obtained from the input-output tables. The amount of 1977 export-loan subsidies was estimated by Raynauld, Dufour, and Racette (1982). Dividing this by the volume of manufacturing exports gives the subsidy rate.

The elasticities of substitution are set at unity but for mining, manufacturing, and transport higher values are used such as those found in a recent study by P. S. Rao (1981). The elasticity of supply of foreign capital is set at either 7 or 10, following Danny M. Leipziger (1974).[7] The price elasticities of the foreign demands for Canadian exports are assumed to be either –3.6 or –10. The first is a recent estimate by Appelbaum and Kohli (1979). The higher value was used, together with the higher value for $\gamma$, to make alternative simulations supposing a greater responsiveness of economic activity to small changes in prices and subsidies.

## Simulation Results

The model was used to simulate the effects of 32 alternative policies on sectoral output, employ-

ment, prices, exports and imports, and on the exchange rate, the rate of return, nominal income, a price index, and a welfare index.

The policy alternatives analysed include the elimination of financial subsidies to agriculture, exports, housing, and manufacturing; the substitution of equity subsidies for loan subsidies; the substitution of production subsidies for loan subsidies; an across-the-board reduction in corporate income tax by an amount equal to that of the eliminated loan subsidies; zero corporate income tax; unilateral free trade; and the elimination of all explicitly modeled taxes, duties, and subsidies. For each alternative there are three different simulation results corresponding to different assumptions about certain key parameters. There are three cases, A, B and C, the first of which is perhaps the least unrealistic. The function of the other two is to show the sensitivity of simulation results to some parameter assumptions or to show which qualitative results are most robust. In Case A the elasticities of substitution in some sectors are unity; in other sectors, they have the value estimated by P. S. Rao (1981). The elasticity of supply of foreign capital ($\gamma$) is 7, and the elasticities of foreign demand for Canadian exports ($\eta_i$) are –3.6. In Case B all $\sigma_i$ equal unity, and in Case C the $\sigma_i = 1$; $\gamma = 10$; and $\eta_i = -10$. The differences between the A and B cases are usually not very large, but there are differences between the A and C cases in the signs of simulated changes.[8]

The general conclusion is that the economic gains from any policy change are usually very small when measured in terms of the economic welfare index defined at the end of the second section of this chapter. On the whole, the Canadian economy seems well adjusted to a number of tax and subsidy interventions so that the static welfare losses attributable to them are small. In Case A the economic cost of loan subsidies is $15 million (at 1977 prices), which does not mean that the subsidies are bad but that they are poorly designed. Their replacement by production subsidies, with no change in government expenditures or in the level of support given each sector, would bring a gain of $92 million, showing that subsidies cannot be flatly condemned but can be improved.[9] The result of a substitution of equity for loan subsidies falls in between, producing an estimated gain of $32.6 million.

These and the other results discussed below were obtained after first simulating the effects of loan subsidies on the gross cost of real capital. Given the relative yield equations, the effect of the removal of loan subsidies is obtained by treating this as an increase in the cost of debt by the imposition of a new "tax" on interest payments. Inserting this new "tax" in the zero derivative of $(1+T)$ with respect to $B/E$, solving for $B/E$, and substituting it into the equations for $r^b/r$ and $r^e/r$ one obtains an estimate of the new $1+T$, as explained in the second section. The result is shown in Table 2-3, including also the effect of an alternate equity subsidy, of equal cost to government and providing the same level of support that is enjoyed by each sector with the existing loan subsidy.

## Table 2-3

## Change in Financial Cost Resulting from Removal of Loan Subsidies, 1977

| | Interest paid | Subsidy | Subsidy rate | Value of (1+T) | | |
|---|---|---|---|---|---|---|
| | | | | Actual | Less loan subsidies | Equity subsidy[1] |
| | ($ Millions) | | (Per cent) | ($ per dollar) | | |
| Agriculture | 724.7 | 247.3 | 25.44 | 1.33 | 1.36 | 1.30 |
| Manufacturing | 2,027.7 | 160.0 | 7.31 | 1.22 | 1.24 | 1.22 |
| Owner-occupied housing | 5,712.4 | 282.5 | 4.71 | 1.29 | 1.31 | 1.29 |

1 Equity subsidies are assumed to be substituted for loan subsidies without changing the dollar amount of assistance to any sector.

Table 2-4 shows that financial subsidies generally reduce economic welfare. Subsidies to the housing sector are, however, an exception. Their elimination would not increase, but reduce, economic welfare.[10] The positive contribution of financial subsidies to housing can be linked to the burden of property taxes.[11] The financial subsidies can be said to correct distortions in the allocation of resources caused by property taxes. This, however, does not recommend housing loan subsidies, as these attack the problem

## Table 2-4

## Effects of Alternative Assistance Policies on Economic Welfare, 1977

| | Welfare gain | | |
|---|---|---|---|
| | Case A | Case B | Case C |
| | ($ Millions) | | |
| Alternative policies: | | | |
| Remove financial subsidies; give production subsidies of an equal amount | 92.2 | 93.1 | 72.0 |
| Replace mortgage subsidies with shelter allowances | 75.2 | 74.6 | 62.4 |
| Eliminate financial subsidies to agriculture, manufacturing, and exports | 52.8 | 54.3 | 56.4 |
| Eliminate financial subsidies to manufacturing and exports | 49.5 | 50.8 | 48.5 |
| Substitute equity for loan subsidies | 32.6 | 32.4 | 25.5 |
| Remove financial subsidies to manufacturing and exports; give back an equal amount in production subsidies to manufacturing | 31.6 | 33.0 | 32.6 |
| Substitute manufacturing production subsidies for export subsidies | 27.8 | 27.7 | 25.5 |
| Eliminate financial subsidies | 15.2 | 17.0 | 25.1 |

only indirectly. As indicated in Table 2-4, a direct reduction of the housing expenses by shelter allowances would have a more beneficial effect on economic welfare than financial subsidies. This is a net gain, since the reduction in the coefficient of "other value added" corresponding to the shelter allowance was calculated to cost no more than the financial assistance it was supposed to replace.

The effect of home loan subsidies on the housing stock (measured by the services it yields) is to increase it by about 1 per cent. This is smaller than the comparable effect of subsidies on new starts simulated with CANDIDE 2.0, which was also positive (see Chapter 3). According to the CANDIDE simulations, a subsidy equal to 10 per cent of borrowing cost would increase new starts by 3 per cent whereas, here, a 10 per cent subsidy increases the stock by 2 per cent.

As the supply of labour is held at a fixed level, one can analyse changes in sectoral employment (Table 2-5) but not in total employment. An indication of the

## Table 2-5

## Effect of Loan Subsidies on Employment (Case A), 1977

| | Change in equilibrium values resulting from subsidies to: | | | | |
|---|---|---|---|---|---|
| | Agriculture | Manufacturing | Exports | Housing | All four sectors |
| | | | (Per cent) | | |
| Agriculture | -0.55 | 0.57 | -0.11 | -0.01 | -0.10 |
| Fishing, hunting, and trapping | 0.01 | 0.41 | 0.25 | -0.03 | 0.64 |
| Forestry | -0.04 | 0.48 | -0.09 | -0.02 | 0.34 |
| Mining | -0.06 | 0.63 | -0.30 | - | 0.26 |
| Manufacturing | 0.07 | -0.76 | 0.24 | 0.03 | -0.41 |
| Construction | -0.01 | 0.15 | -0.06 | 0.02 | 0.10 |
| Transport and storage | -0.03 | 0.45 | -0.19 | -0.01 | 0.22 |
| Communications | -0.01 | 0.31 | -0.07 | -0.02 | 0.21 |
| Utilities | 0.01 | 0.46 | -0.08 | -0.02 | 0.37 |
| Wholesale trade | -0.01 | 0.27 | -0.13 | -0.02 | 0.10 |
| Retail trade | - | 0.19 | -0.09 | -0.03 | 0.07 |
| Finance, insurance, and real estate | -0.01 | 0.36 | -0.11 | -0.01 | 0.23 |
| Owner-occupied housing[1] | - | - | - | - | - |
| Services | -0.01 | 0.14 | -0.07 | -0.02 | 0.23 |

1 Owner-occupied housing does not employ labour in any case.

## Table 2-6

## Effect of Loan Subsidies on the Price Index and the Rate of Return to Capital (Case A), 1977

| Subsidies to: | Change in equilibrium values of | |
|---|---|---|
| | Price index | Rate of return |
| | (Per cent) | |
| Agriculture | -0.03 | 0.06 |
| Manufacturing | 0.23 | 0.96 |
| Exports | -0.09 | -0.03 |
| Housing | -0.05 | 0.07 |
| All four sectors | 0.06 | 1.05 |

## Table 2-7

## Effect of Loan Subsidies on Output (Case A), 1977

| | Change in equilibrium values resulting from subsidies to: | | | | |
|---|---|---|---|---|---|
| | Agriculture | Manufacturing | Exports | Housing | All four sectors |
| | | | (Per cent) | | |
| Agriculture | 0.76 | -0.01 | -0.09 | -0.05 | 0.60 |
| Fishing, hunting, and trapping | 0.01 | 0.32 | 0.25 | -0.04 | 0.54 |
| Forestry | -0.06 | 0.17 | -0.08 | -0.04 | -0.01 |
| Mining | -0.12 | -0.32 | -0.27 | -0.06 | -0.77 |
| Manufacturing | 0.01 | 0.32 | 0.28 | -0.04 | 0.57 |
| Construction | -0.01 | 0.06 | -0.06 | 0.01 | - |
| Transport and storage | -0.05 | 0.10 | -0.18 | -0.04 | -0.17 |
| Communications | -0.03 | -0.01 | -0.06 | -0.05 | -0.15 |
| Utilities | -0.04 | -0.21 | -0.06 | -0.06 | -0.37 |
| Wholesale trade | -0.03 | 0.08 | -0.12 | -0.04 | -0.11 |
| Retail trade | -0.02 | - | -0.08 | 0.82 | -0.14 |
| Finance, insurance, and real estate | -0.04 | -0.17 | -0.09 | -0.05 | -0.35 |
| Owner-occupied housing | -0.07 | -0.53 | -0.07 | 1.05 | 0.38 |
| Services | -0.03 | -0.02 | -0.05 | -0.05 | -0.15 |

effect of each policy on total employment is given by wage changes. Wages can change relative to a price index and also relative to the average rate of return to capital. Since a dollar of wages was used as the unit for price measurement, an increase in the return to capital means a reduction in wages and a redistribution of income from labour to capital (see Table 2-6). An increase in the price index means a reduction in real wages and implies that employment would decrease if total employment were allowed to vary. The effects on output are shown in Table 2-7.

Increased manufacturing output is an objective that seems to be shared by many government loan programs. It would appear difficult to achieve, however, without major changes in the entire tax and subsidy system. All industries use domestic and imported manufactured products; thus the demand for manufactured products depends on the tax treatment of all industries. Manufacturing costs are affected by taxes on manufactured and other inputs, as well as by import duties. The study of the Canadian economy by Boadway and Treddenick, using 1969 data, found that the combination of import duties, corporate income tax, and commodity taxes had a negative effect on primary and manufacturing industries and favoured all other sectors. Also, the tax structure appeared to discriminate against export industries. Similar results were obtained with this study. The effect of financial subsidies to manufacturing and exports was to increase the output of manufacturing industries by 0.6 per cent. More radical measures, such as the elimination of all import duties or the elimination of all subsidies and the

corporate income tax, would leave a greater impact on manufacturing output (+1.3 per cent and +1.5 per cent, respectively).

The effects of loan subsidies on export quantities appear in Table 2-8. Of particular interest is the effect of export subsidies; these amounted to $141.3 million in 1977. Compared with this, the increase in manufactured exports of $276 million (0.89 per cent valued at initial prices) is not very large. Whereas the elasticity of demand for manufactured exports was assumed to be equal to 3.6 in absolute value, the general equilibrium effects reduced this percentage increase in exports of manufactures relative to the percentage reduction in their cost to foreigners to only 1.95. Taking into account the induced imports, the effect on the commercial balance is even smaller – namely, $63.9 million if commodities are valued at initial prices and if the balance is converted at the initial exchange rate. Export subsidies, however, have the effect of reducing the export prices received by all sectors. They also cause the Canadian dollar to appreciate by 0.03 per cent. Taking these additional changes into account, one finds that export subsidies would appear to cause a small decrease in the commercial balance (half a million dollars) whereas all loan subsidies as a whole increase the merchandise trade balance by $20.2 million. The balance of trade on current account (including the service of foreign capital) cannot be shown to increase as the solutions to our model assume a zero trade balance within a régime of flexible exchange rates, as per equation 2.11. This serves to highlight the fact that export loan agencies do not have in themselves the power to change the foreign trade position of a country, unless their actions are supported by general macroeconomic policies designed to accumulate foreign exchange reserves or foreign assets.[12] A similar result was obtained with CANDIDE simulations (see the second section of Chapter 3).

While export loan subsidies cannot greatly affect the overall trade position of a country, they can, of course, change the composition of exports. Other factors such as the Canada-U.S. Automobile Products Agreement and more recent measures to reduce exports of hydrocarbons have also had their effects on the composition of exports. Table 2-9 shows the combined effect on 1977 exports of Canadian manufactures and other products of the imposition of export taxes on oil and gas, and of export loan subsidies. The latter stimulate exports directly while the former do so indirectly by inducing a change in the composition of exports. As a first approximation and to put it simply, when exports of oil and gas are throttled, other exports, including manufactured products, must increase to pay the import bill. The combined effects of export taxes and subsidies are larger and more frequently positive than the effects of export subsidies by themselves. The differences are largely due to the greater dollar volume of export taxes, compared with that of export loan subsidies. When that is taken into account, there would seem to be little difference in stimulus to manufactured exports per dollar of the export tax or export subsidy. There is, however, a great difference between their effects on the exports of industries other than manufacturing and mining, which are attributable to their effects on the domestic prices of some intermediate products – namely, oil and gas. Thus export taxes can be credited with a more positive change in some of Canada's exports than loan subsidies.[13]

## Table 2-8

## Effect of Loan Subsidies on Canadian Exports (Case A), 1977

| | Change in equilibrium values resulting from subsidies to: | | | | |
|---|---|---|---|---|---|
| | Agriculture | Manufacturing | Exports | Housing | All four sectors |
| | | | (Per cent) | | |
| Agriculture | 2.52 | -0.65 | -0.91 | -0.08 | 0.88 |
| Fishing, hunting, and trapping | -0.21 | 0.26 | -0.95 | -0.01 | -0.90 |
| Forestry | -0.23 | -0.12 | -0.93 | -0.04 | -1.31 |
| Mining | -0.30 | -1.07 | -0.92 | -0.10 | -2.39 |
| Manufacturing | -0.04 | 0.69 | 0.89 | -0.04 | 1.50 |
| Transport and storage | -0.22 | 0.08 | -0.95 | -0.02 | -1.10 |
| Communications | -0.27 | -0.30 | -0.99 | -0.04 | -1.61 |
| Utilities | -0.32 | -1.25 | -0.91 | -0.11 | -2.59 |
| Wholesale trade | -0.24 | 0.04 | -0.99 | -0.02 | -1.21 |
| Finance, insurance, and real estate | -0.30 | -0.86 | -0.96 | -0.08 | -2.21 |
| Services | -0.24 | -0.32 | -0.95 | -0.05 | -1.56 |

## Table 2-9

### Effect of Export Taxes and Subsidies on Export Volume, 1977

| | Change in export volume | |
|---|---|---|
| | Case A | Case C |
| | (Per cent) | |
| Exports: | | |
| Agriculture | 3.2 | 12.3 |
| Fishing, hunting, and trapping | 2.8 | 6.0 |
| Forestry | 3.0 | 8.6 |
| Mining | -17.1 | -36.0 |
| Manufacturing | 4.1 | 12.0 |
| Transport | 2.9 | 7.4 |
| Communications | 3.3 | 10.0 |
| Utilities | 3.6 | 17.0 |
| Wholesale trade | 3.1 | 7.7 |
| Finance, insurance, and real estate | 3.5 | 14.1 |
| Services | 3.2 | 10.1 |
| Transport margins | 3.9 | 7.2 |

In Chapter 1 it was shown that production subsidies have more definite stimulative effects than loan subsidies. Production subsidies would thus appear to be the more effective policy alternative, if the policy objective is to expand a particular activity or if it is intimately related to such an expansion. If the objective were economic welfare, however, the expanding industry would have to be a low-cost industry using resources reallocated to it from high-cost industries. Comparative costs are affected by taxes, such as the corporate income tax, import duties, and sales taxes. These are some of the barriers to the transfer of resources from where they yield less to where they yield more. Subsidies assist such transfers by breaking down the barriers that stand in their way. Different types of subsidies break down different types of barriers while at the same time, perhaps, erecting new ones. A production subsidy, for instance, is a more direct attack on a sales tax, since it has the opposite effect on the same commodity's price.[14] A loan subsidy diminishes a tax on the employment of capital while, at the same time, increasing the difference between the costs of equity and debt that may be attributed to the corporate tax. Thus a loan subsidy will have a beneficial effect, in economic welfare terms, where capital income taxes are the principal barrier to improvement and where debt/equity ratios can easily be increased.

On the other hand, production subsidies would be indicated in cases where sales taxes are the main

## Table 2-10

### Effect of Substituting Production Subsidies for Loan Subsidies on Output and Economic Welfare (Case A), 1977

| | Agriculture | Manufacturing | Exports[1] | Housing | All four sectors |
|---|---|---|---|---|---|
| | | | (Per cent) | | |
| Output: | | | | | |
| Agriculture | 1.62 | 0.03 | 0.10 | -0.11 | 1.64 |
| Fishing, hunting, and trapping | -- | -0.17 | -0.12 | -0.08 | -0.38 |
| Forestry | -0.15 | -0.16 | 0.09 | -0.08 | -0.30 |
| Mining | -0.23 | 0.23 | 0.19 | -0.13 | 0.05 |
| Manufacturing | -- | -0.16 | -0.14 | -0.08 | -0.38 |
| Construction | -0.04 | -0.09 | 0.03 | 0.02 | -0.08 |
| Transport | -0.14 | -0.16 | 0.12 | -0.08 | -0.26 |
| Communications | -0.07 | -0.04 | 0.01 | -0.10 | -0.19 |
| Utilities | -0.06 | 0.16 | 0.02 | -0.13 | -- |
| Wholesale trade | -0.09 | -0.14 | 0.07 | -0.07 | -0.22 |
| Retail trade | -0.06 | -0.08 | 0.01 | -0.09 | -0.23 |
| Finance | -0.08 | 0.10 | 0.03 | -0.10 | -0.04 |
| Owner-occupied housing | -0.08 | 0.45 | -- | 2.09 | 2.46 |
| Services | -0.07 | -0.02 | 0.02 | -0.09 | -0.16 |
| Real wages | 0.12 | 0.34 | 0.01 | 0.10 | 0.57 |
| Rate of return to capital | -0.03 | -0.97 | 0.02 | 0.14 | -0.84 |
| | | | ($ Millions) | | |
| Economic welfare | -14.5 | 3.8 | 27.8 | 75.2 | 92.2 |

1 Substitution of production subsidies to manufacturing for subsidies to manufactured exports.

barrier to improvement. Given the ubiquity of sales taxes and the fact that an increase in debt/equity ratios is not costless, production subsidies are generally more beneficial than loan subsidies of equal amount (Table 2-4). This shows clearly that loan subsidies are expensive, but it does not mean that any alternative subsidy scheme would be superior from every point of view. Subsidies can have different effects on output and welfare, depending on their interaction with other income and sales taxes. In the case of manufacturing, it makes little difference whether it is stimulated with loan or production subsidies (see Table 2-10). Manufacturing is in the cross-fire between corporate income tax, import duties, and sales taxes. No single subsidy scheme can repair the resulting damage.[15] In the case of agriculture, where corporate income tax has little relevance, where sales taxes are few, and where property taxes are comparatively low while the interest cost of capital is comparatively high, production subsidies have a worse effect on economic welfare than loan subsidies. Both have a negative effect on welfare; so neither of them can be recommended for general efficiency reasons. Other consequences of farm subsidies may also have to be considered before making any policy decisions, such as their possible effect on land prices. It was in that wider context that the Economic Council of Canada made its recommendation on farm loan subsidies in *Intervention and Efficiency*. Production subsidies have their most beneficial effect in housing, where they reduce the effect of property tax.[16]

The conclusion to this chapter, therefore, is that loan subsidies have slight effects on the output of broadly defined economic sectors, and they reduce economic welfare. Superior alternatives can sometimes be found, but general improvement would require simultaneous modifications to a number of tax and subsidy policies.

# 3 Alternative CANDIDE 2.0 Simulations

An econometric model such as CANDIDE 2.0 can provide a second opinion on the effects of government loan subsidies, based on a different set of assumptions. Whereas the model in Chapter 2 claimed to show long-run effects, an econometric model can be used to simulate short- and medium-term effects. The equations in CANDIDE have been fitted to data that span 20 or more years of recent Canadian economic history. Their coefficients thus represent average responses by public and private agents to economic change. The larger number of equations in CANDIDE also provides a richer and more realistic description of the Canadian economy. In particular, its use in this chapter implies the abandonment of the full-employment assumption made in Chapter 2. Not all Chapter 2 simulations can be replicated with CANDIDE to produce comparable results, however. CANDIDE 2.0 can be used to analyse mortgage loan assistance, as it contains a number of equations related to the mortgage loan market and residential construction.

## CANDIDE Simulations of Mortgage Loans and Mortgage Loan Subsidies

Four different and hypothetical federal housing programs were simulated with CANDIDE 2.0:

1 A bond-financed increase in CMHC loans for new, single detached dwellings (Case A);

2 A tax-financed increase in CMHC loans for new, single detached dwellings (Case B);

3 A bond-financed interest subsidy on new NHA loans (Case C);and

4 A tax-financed interest subsidy on new NHA loans (Case D).

In Cases A and B, the increase in CMHC loans was set at $1 billion. In Cases C and D, the subsidy was set at 2 percentage points. In the case of tax-financed assistance, the tax was assumed to fall on personal income.

The simulation of new loans and subsidies required adjustments to CANDIDE equations. These adjustments are shown in Table 3-1.

The simplest adjustments are those for Cases A and B. The CMHC mortgage approvals were increased by $1 billion, and federal government financing requirements were increased by a corresponding amount. This amount is net of CMHC receipts on account of the principal and interest due on loans made in previous years under the simulated policy. As this policy entails growth in the CMHC portfolio and portfolio income, the new net loans to CMHC decrease over time. The principal and interest payments mentioned above were calculated at the NHA rate simulated for the year in which the corresponding loans are supposed to be made or renewed, supposing 25-year amortization and 5-year terms to maturity. This involved successive approximations until the NHA rates used to calculate mortgage payments to CMHC coincided with the NHA rates resulting from implementation of the new lending policy.

The subsidy was treated as an interest rate buy-down of NHA loans made by institutional lenders, including the CMHC.[1] The cost to CMHC of the buy-down is the discount from par value of a mortgage that yields 200 basis points less than the current NHA rate, using this same rate to calculate present values. In this exercise, the subsidy is assumed to be renewed upon refinancing after five years.

The simulation of the buy-down also required successive approximations until initial and final NHA rates coincided. In addition, other adjustments were required to take account of the fact that the yield of NHA loans to lenders includes the subsidy. These adjustments were made in the mortgage-approval and interest-rate-setting equations, where the NHA lending rate is an argument.

Some of the principal results of the simulations are shown in Tables 3-2 and 3-3. Apparently it makes a great difference whether the housing assistance is financed by new borrowing or by taxation.

## Table 3-1

### Adjustments to CANDIDE 2.0 Equations to Simulate CMHC Mortgage Assistance[1]

| Equation | Variable label | Simulation | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ($ Millions) | | | |
| Net change in loans to CMHC | *.FLOANS.CMHC* | A | 828.0 | 659.3 | 506.4 | 366.3 | 232.8 | 140.8 | 54.6 |
| | | B | 828.4 | 660.3 | 508.5 | 369.8 | 238.4 | 150.4 | 69.0 |
| | | C | 724.4 | 810.0 | 1,002.8 | 1,198.4 | 1,359.7 | 1,506.9 | 1,661.3 |
| | | D | 725.4 | 811.8 | 1,004.8 | 1,202.1 | 1,367.7 | 1,521.0 | 1,682.5 |
| Mortgage approvals: | | | | | | | | | |
| CMHC, Single detached | *FMAP.CMHC.SD* | A&B | 1,000.0 | 1,000.0 | 1,000.0 | 1,000.0 | 1,000.0 | 1,000.0 | 1,000.0 |
| Private, new residential | *FMAP.PNWRT* | C&D | 236.9 | 236.9 | 236.9 | 236.9 | 236.9 | 236.9 | 236.9 |
| Chartered banks | *FMAP.CD* | C | 40.6 | 40.7 | 42.5 | 43.5 | 44.2 | 44.5 | 44.3 |
| | | D | 40.6 | 40.8 | 42.8 | 43.9 | 44.9 | 45.4 | 45.5 |
| Life insurance company | *FMAP.LI* | C | 4.5 | 4.6 | 4.8 | 4.9 | 5.0 | 5.0 | 5.0 |
| | | D | 4.6 | 4.6 | 4.8 | 4.9 | 5.0 | 5.1 | 5.1 |
| Trust and mortgage company | *FMAP.TM* | C | 84.1 | 84.4 | 88.1 | 90.2 | 91.8 | 92.3 | 92.6 |
| | | D | 84.2 | 84.7 | 88.7 | 91.1 | 93.2 | 94.1 | 94.4 |
| Other financial institutions | *FMAP.OFI* | C | 1.87 | 1.88 | 1.96 | 2.01 | 2.04 | 2.05 | 2.05 |
| | | D | 1.88 | 1.89 | 1.98 | 2.03 | 2.08 | 2.10 | 2.10 |
| Federal personal income tax | *GRF.DT.PINC$* | B | 828.4 | 660.3 | 508.5 | 369.8 | 238.4 | 150.4 | 69.0 |
| | | D | 725.4 | 811.8 | 1,004.8 | 1,202.1 | 1,367.7 | 1,521.0 | 1,682.5 |
| | | | | | | (Percentage points) | | | |
| NHA mortgage lending rate | *FRATE.NHA.MORT* | C&D | -1.54 | -1.54 | -1.54 | -1.54 | -1.54 | -1.54 | -1.54 |
| Trust company 5-year GIC rate | *FRATE.TM* | C&D | .51101 | .51101 | .51101 | .51101 | .51101 | .51101 | .51101 |

1 The figures in this table represent adjustments in addition to those already made for the base case scenario.

## Table 3-2

### Effect of CMHC Mortgage Assistance on the Housing Industry, as Simulated with CANDIDE 2.0

| Variable | | Policy | Change from base case 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|
| | | | ($ Millions) | | | | | |
| Variable label: | | | | | | | | |
| *FMAP.TOT* | Mortgage approvals: Total | A | 1,002 | 1,001 | 1,006 | 998 | 994 | 995 |
| | | B | 997 | 975 | 958 | 943 | 931 | 910 |
| | | C | 73 | 112 | 134 | 142 | 163 | 201 |
| | | D | 64 | 55 | 41 | 24 | 21 | 18 |
| *FMAP.PNWRS* | Mortgage approvals: Private, new singles | A | -1,114 | -1,189 | -1,263 | -1,369 | -1,329 | -1,267 |
| | | B | -1,118 | -1,210 | -1,291 | -1,401 | -1,364 | -1,314 |
| | | C | 128 | 118 | 128 | 124 | 131 | 146 |
| | | D | 123 | 90 | 84 | 68 | 63 | 60 |
| | | | (Basis points) | | | | | |
| *FRATE.NHAMORT* | NHA mortgage lending rate | A | -1 | -2 | -4 | -5 | -6 | -7 |
| | | B | -6 | -11 | -16 | -20 | -25 | -29 |
| | | C | -104 | -124 | -117 | -115 | -111 | -106 |
| | | D | -110 | -134 | -133 | -137 | -140 | -143 |
| *FRATE.CONMORT* | Conventional mortgage rate | A | 1 | 2 | 2 | 1 | 1 | 2 |
| | | B | -4 | -8 | -11 | -15 | -18 | -22 |
| | | C | 5 | 7 | 10 | 15 | 20 | 26 |
| | | D | -1 | -3 | -6 | -8 | -11 | -13 |
| | | | (Thousands) | | | | | |
| *RTS* | Total housing starts | A | 8.3 | 7.7 | 7.1 | 6.5 | 6.0 | 5.5 |
| | | B | 8.4 | 7.8 | 7.3 | 6.9 | 6.5 | 6.1 |
| | | C | 3.6 | 4.4 | 5.0 | 4.2 | 4.0 | 3.6 |
| | | D | 3.7 | 4.5 | 5.1 | 4.5 | 4.6 | 4.4 |
| *NCNST* | Employment in construction | A | 3.5 | 3.5 | 3.0 | 2.7 | 2.3 | 2.0 |
| | | B | 2.6 | 2.6 | 2.1 | 2.1 | 2.3 | 2.4 |
| | | C | 1.6 | 2.4 | 3.0 | 3.0 | 2.6 | 2.2 |
| | | D | 0.7 | 1.2 | 1.5 | 1.5 | 1.5 | 1.6 |

## Table 3-3

### Effect of CMHC Mortgage Assistance on General Economic Indicators, as Simulated with CANDIDE 2.0

| Variable | | Policy | Change from base case 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|
| | | | ($ Millions) | | | | | |
| Variable label: | | | | | | | | |
| *GNE* | Gross national product (at 1971 prices) | A | 287.6 | 314.9 | 321.5 | 319.7 | 314.2 | 295.4 |
| | | B | 55.1 | -65.4 | -23.8 | 21.6 | 69.3 | 137.6 |
| | | C | 222.3 | 383.7 | 549.7 | 642.5 | 731.6 | 764.0 |
| | | D | -61.2 | -145.6 | -61.3 | -32.7 | 32.0 | 91.9 |
| *NBTOT* | Compensation of employees | A | 313.4 | 482.6 | 665.4 | 853.6 | 1,045.6 | 1,212.2 |
| | | B | -25.6 | -169.9 | -256.4 | -336.4 | -399.3 | -419.6 |
| | | C | -41.7 | 50.8 | 177.8 | 399.5 | 907.2 | 1,451.1 |
| | | D | -403.6 | -742.2 | -1,118.5 | -1,517.9 | -1,732.1 | -1,945.2 |

## Table 3-3 (Concl'd.)

| | | | Change from base case | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Variable | Policy | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
| *Y.PROFBT.CORP$* | Corporate profits (private) | A | 721.7 | 870.7 | 954.6 | 1,001.5 | 1,016.0 | 1,075.8 |
| | | B | 187.8 | -145.5 | -143.4 | -230.2 | -279.7 | -378.8 |
| | | C | 149.2 | 230.9 | 472.2 | 596.8 | 673.6 | 1,049.7 |
| | | D | -459.2 | -1,076.7 | -1,276.4 | -1,725.1 | -2,165.2 | -2,464.2 |
| | | | | | (Dollars) | | | |
| *W/CPI* | Real average hourly wage rate | A | -- | -- | -- | -- | 0.01 | 0.01 |
| | | B | | -- | -- | -- | -- | -- |
| | | C | -- | 0.01 | 0.01 | -- | 0.01 | 0.01 |
| | | D | -- | 0.01 | 0.01 | -- | -- | -- |
| | | | | | (Per cent) | | | |
| *DURATE* | Unemployment rate | A | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -- |
| | | B | -- | -- | -- | -- | -- | -- |
| | | C | -- | -0.1 | -0.1 | -0.2 | -0.2 | -0.2 |
| | | D | 0.1 | 0.1 | 0.1 | -- | -- | -- |
| | | | | | ($ Millions) | | | |
| *GDF$* | Federal government surplus | A | -16.9 | -89.1 | -173.0 | -293.8 | -431.2 | -580.4 |
| | | B | 723.5 | 920.3 | 926.4 | 957.5 | 1,013.5 | 1,153.3 |
| | | C | -174.2 | -315.2 | -441.4 | -685.0 | -1,057.5 | -1,526.4 |
| | | D | 680.6 | 1,138.6 | 1,463.9 | 1,735.7 | 1,943.5 | 2,251.2 |
| *TBC.BAL.CAW$* | Current account of balance of payments | A | -231.6 | -250.7 | -261.9 | -278.3 | -306.3 | -327.4 |
| | | B | 69.0 | 251.8 | 238.1 | 237.6 | 222.0 | 178.0 |
| | | C | -138.4 | -259.1 | -396.3 | -489.5 | -610.6 | -725.8 |
| | | D | 218.8 | 432.6 | 462.5 | 578.2 | 646.5 | 690.2 |
| | | | | | (Basis points) | | | |
| *FRATE.GDBOND.10Y* | Government of Canada bond yield - 10 years | A | 5 | 6 | 7 | 8 | 9 | 10 |
| | | B | -- | -1 | -3 | -5 | -7 | -9 |
| | | C | 5 | 8 | 12 | 16 | 21 | 27 |
| | | D | -- | -1 | -2 | -3 | -4 | -5 |
| | | | | | (Percentage change in rate of increase) | | | |
| *CPI* | Consumer price index | A | -- | -- | -- | -- | -- | -- |
| | | B | -- | -- | -- | -- | -- | -- |
| | | C | -- | -0.1 | -0.1 | 0.1 | 0.1 | 0.1 |
| | | D | -0.1 | -0.2 | -0.1 | -- | -- | -- |
| | | | | | (Cents) | | | |
| *REXCAN** | Exchange rate (U.S.$ per Cdn.$) | A | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.1 |
| | | B | -- | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | | C | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 |
| | | D | -0.1 | -0.2 | -0.2 | -0.2 | -0.2 | -0.1 |

The effect of subsidies on housing is made a little larger by CANDIDE than in the model of Chapter 2. The two simulations can be compared if it is considered that, in the long run, the stock of housing and the flow of services derived from it are the result of cumulated housing starts. Thus in CANDIDE, a 15 per cent NHA-rate subsidy increases 1987 starts by 3.6 to 4.4 per cent (Table 3-2), whereas in Chapter 2 a 4.7 per cent loan subsidy (Table 2-3) increased housing services by 1.05 per cent (Table 2-7). This latter figure is somewhat smaller in alternative Case C of Chapter 2 – namely, 1.03 per cent. Thus the elasticity of housing supply with respect to loan subsidies may be said to be up to 0.3 in CANDIDE and only 0.2 in the model of Chapter 2. This is a small number, regardless of the model employed.

Regarding unsubsidized loans, it was argued in Chapter 1 that their effects on real resource allocation could not be predicted. This is confirmed by CANDIDE in a rather curious way. New CMHC loans would seem to have no significant effect on aggregate private-sector mortgage approvals, especially if CMHC is debt-financed; however, the simulated private mortgage approvals for new, single detached homes decrease by more than the amount by which CMHC loans for the same type of housing were increased. Thus CANDIDE simulations do not show that government lending can be used to stimulate the construction of a specific type of dwelling.

## CANDIDE Simulations of Export Loan Subsidies

The Export Development Corporation, which is wholly owned by the Crown, advances to foreign buyers up to 85 per cent of the value of some Canadian exports in fixed interest loans, with up to ten years to maturity. The purpose of the simulations reported here was to explore the effects of new and selective export assistance.[2] It was assumed that the EDC would add its support to $1 billion worth of new exports, at 1971 prices, and that the additional exports would be concentrated in machinery (61.3 per cent), electrical products (11 per cent) and transport equipment (27.7 per cent). This approach differs from the one followed in Chapter 2. In that chapter, a model was used to infer the change in export volumes that can result from exogenous export subsidies. In this section, the subsidies are inferred from exogenous export changes, and a model is used to simulate the effects of exogenous exports and subsidies.

The real and financial parts of the transaction have been simulated in two different ways. The difference between them is in the treatment of the transfer of foreign payments. In every case it is assumed that the transfer abroad of Canadian funds is effected by a corresponding shipment of goods. Indeed, if that were not the case, the simulation exercise would be unnecessary. In Simulation Case 1, however, no such assumption was made concerning the transfer of money to Canada for down payments on exports purchased by nonresidents and for the repayment with interest of export loans. Instead, we let CANDIDE work out the changes in imports caused by the multiplier effect of exports, by changes in interest and exchange rates, and by the debt service.

Case 2 is based on the symmetric assumption that inflows of money associated with new export credits are effected in commodities and not in cash. This assumption of real transfers to complete all sides of the credit transactions is made to adapt the CANDIDE 2.0 model of the national economy to a case of intervention in the international economy.

In every case, the simulations take account of the Bank of Canada's nonaccommodating monetary policy.

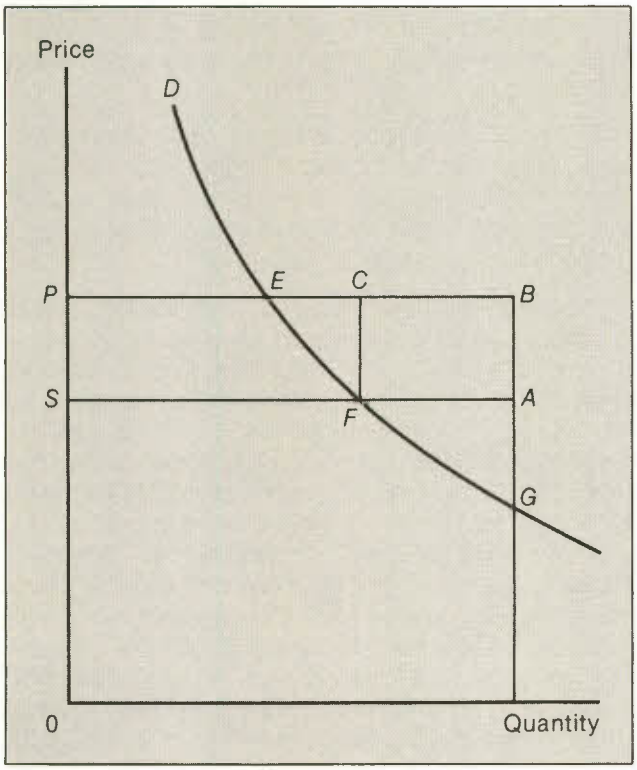
The increase in exports is supposed to be achieved by an offer of additional credit facilities on soft terms. The softness of the new terms represents a subsidy. It is this subsidy that stimulates new foreign demand for Canadian products.

The dollars of subsidy required to cause a $1 billion increase in exports depend normally on the elasticity of foreign demand for Canadian goods, on the elasticity of supply by Canadian manufacturers of these products, and on the initial volume of exports. Since the initial exports are already subsidized by the EDC, the new subsidy expenses consist of two parts: a triangle and a rectangle. A triangle above the export-demand curve represents the subsidies necessary to induce the new exports, assuming that the EDC sets subsidy rates discriminately so as to minimize the subsidy cost per dollar of new exports. The rectangle represents the cost of extending pre-existing subsidies to new exports [see EDC (1982), Chap. IV, pp. 60-61]. In the diagram on Figure 1, *DD* is a demand curve for subsidized exports. The current export volume is *SF* at a unit cost *OP*. The foreign buyer pays *OS* per unit after an EDC subsidy of *SP* per unit. Foreign buyers would buy more, if the subsidy was increased. The assumed goal of the EDC is to increase exports by *FA*. To sell the *A*-th unit requires an additional subsidy of *GA* for that unit, making a total subsidy on the marginal unit of *GB*. The *F*-th unit was exported with a subsidy of *FC*. The minimum subsidy that will sell other units between the *F*-th and *A*-th is equal to the vertical distance between the segment *CB* and the demand curve *FG*, supposing that the additional units are in perfectly elastic supply. Thus the minimum additional subsidy expense required to increase exports by *FA* is the area *FGBC*. Of this amount, *FGA* can be charged to the increased export effort, and *FABC* is incurred as a consequence of pre-existing subsidies. The actual cost can exceed this minimum if supply slopes upwards from point *C* or if the subsidy on units between *F* and *A* cannot be finely differentiated. The minimum average subsidy on these units is approximately one-half of *FC* plus *GB*, but the actual subsidy may be closer to the value of *GB*.

The initial volume is that projected in the CANDIDE 2.0 base case. In this reference case, some export growth had already been projected. Thus the $1-

## Figure 1

### Cost to EDC of Additional, Discriminatory Export Subsidies




billion increase now contemplated represents a progressively diminishing shock, when compared with the export growth already simulated in the base case. Therefore, the constant-dollar subsidy required to induce a given amount of new exports can be expected to diminish over time.

The elasticities of foreign demand are derived from the CANDIDE model equations. The elasticity of domestic supply is assumed to be extremely large (virtually infinite). This assumption biases our results in favour of export promotion. It implies that Canadian producers have no difficulty responding to EDC incentives; that increased exports do not directly and in themselves put any pressure on export prices; and that resources are easily transferable to export industries. It is arguable whether or not this really is the case, and it would be of concern if the EDC actively sought out borrowers. The EDC, however, operates principally in response to credit applications initiated by exporters, and it may be assumed that those exporters have the capacity to deliver the goods they seek to finance.

Subsidization takes the form of seven-year export credits at less than market rates. The EDC effectively takes foreign securities at par, although their market value is less than that. On the supposition that the federal government pays for subsidy expenses out of current income and borrows to acquire assets, it was assumed also that the subsidy is financed by an equal increase in the federal tax on personal income and that the federal government borrows, each year, an amount equal to the market value of foreign securities acquired. To complete the $1-billion transaction, foreign purchasers make their 15 per cent down payments in cash.

Since the subsidy expense can be expected to fall (in real terms) each subsequent year, the real increase in federal tax collections connected to the subsidy may also be expected to fall year by year. The amount of government of Canada bonds outstanding rises throughout the simulation period, however, because in the first seven years of the program new loans are granted more rapidly than old export loans are paid off.

Taxation and government borrowing are the financial costs of export promotion. The real cost is the transfer abroad of valuable products and any other effects of the transaction on the real economy. The corresponding financial benefit is the return with interest of monies loaned out and the down payments of 15 per cent received each year. Their effects are also simulated. They may be expected to increase over time, since initially the subsidized importers remit money only to service the first loan made to inaugurate the new program. The following year, they service two years' loans; the next year, three years'; and so on, until in the eighth year the balance of payments includes inflows on account of loans disbursed over the entire simulation period.

Up to this point we have considered the factors relevant for Case 1, omitting some of the wider implications of export promotion. The simulations must also take into account the complete reaction by nonresidents, beyond their immediate response to our offer of softer credit terms.

The importing countries may have a policy of buying from us only if we buy from them; competing exporters may retaliate by expanding their own official export credit programs; and the world as a whole has a financial problem not resolved by the solution of CANDIDE equations.

Initially, the EDC lends dollars; but the borrowers never get to see them. They are assumed to return immediately in payment for exports. In fact, they may never leave the country, and may not even leave the banks that handle the export and credit transactions. Over the next seven years, however, our foreign customers must acquire Canadian dollars to service their debt. There are only two ways to acquire them:

either by further borrowing in Canada or by exporting to Canada. Unless Canada should want to acquire and hold foreign securities without limit – effectively depriving herself of real resources without getting anything tangible in return – the service of the new loans would lead to an increase in imports into Canada. These imports need not come from the same countries that are receiving our new exports. Payments can be settled in multilateral trade. Bilateralism and retaliation can be interpreted in part as symptoms of the urgency of such a settlement and as (clumsy) efforts to speed it up by short-circuiting multilateral flows.

The synchronization of commodity flows with money payments may, of course, take some time. Therefore, Case 1, in which foreigners pay cash, can serve as a model of the short-term effects of export promotion. Case 2, in which nonresidents pay back in kind, is more representative of long-run conditions. The imports made to transfer the down payments of 15 per cent and the annual service of new export loans are computed on the assumption that there is an equal percentage increase in 27 of the principal import categories. This percentage increase is set at a level sufficient to exhaust the money flows.

One can also envisage a third case in which the payments are settled by the transfer of some Canadian assets from foreign to Canadian ownership. This would involve Case 1, plus the simulation of new policies on foreign investment in Canada. Thus Cases 1 and 2 correspond to different extreme assumptions about the effects of financial intervention in merchandise trade. Actual events may unfold between these extremes, depending on what other new policies are pursued at the same time and depending also on the accuracy with which each simulation describes the corresponding scenario.

The precise effects of new, subsidized export loans can depend also on the source of funds for the associated new borrowing by the Government of Canada on behalf of the EDC, or by the EDC itself. In recent years the EDC has borrowed abroad. Accordingly, we have simulated four scenarios:

1-D Domestic borrowing and long-term adjustment in cash;
1-F Foreign borrowing and long-term adjustment in cash;
2-D Domestic borrowing and long-term adjustment via imports; and
2-F Foreign borrowing and long-term adjustment via imports.

In the case of foreign borrowing there is no net foreign demand for Canadian dollars to repay export loans. The inflow of funds to repay these loans is offset by an equal outflow to reduce the foreign debt incurred by Canada to finance export loans. Assuming that these loans are very small relative to the volume transacted on international capital markets, one can neglect the possible effects of Canada's intervention in these markets on the international commodity flows that balance the financial flows. Consequently, in Case 2-F it is assumed that imports increase only by the amount necessary to settle in kind the down payments of 15 per cent that foreigners make on their new purchases in Canada.

Table 3-4 shows the adjustments made to CANDIDE 2.0 equations to simulate the four scenarios. In the case of domestic financing, the nominal value of new loans in any year is 85 per cent of the real value of the new exports times the index of export prices for that year. This amount was run through the import side of the balance of payments by adding it to exogenous transfers to foreign residents, and it includes the subsidy. In the case of foreign financing, only the subsidy is transferred to foreigners.

The subsidies in Case 1 were estimated by the EDC, using their estimate of the percentage rate of pre-existing subsidies and the Economic Council's estimates of elasticities of foreign demand for exports. In their computations, the EDC aggregated the three categories of exports under one demand curve of average elasticity. For Case 2 the subsidies were estimated by Council staff, treating the three categories of new exports separately.

Upon deducting the subsidy from the nominal amount of new loans, one obtains the market value of new loans at a subsidized rate. The payments by foreigners over the seven simulation years for principal and interest on these loans can be simulated either as payments at the subsidized rate of interest on the nominal value of EDC loans or as payments at the market rate of interest on the market value of EDC loans. The present value of either stream of payments is the same, but there is a slight difference in the time-shape of these streams. This difference has been ignored, and the adjustments were simplified by calculating the payments returning to Canada to service EDC Canadian-dollar loans as annuity payments of present value equal to the market value of loans when discounted at a market rate of interest. This is equivalent to assuming that the subsidy is used by the EDC to buy down the market rate. This market rate was taken to be the yield of Government of Canada 10-year bonds in the year in which the EDC loan is made. The corresponding streams of annuity payments were then run through Canada's balance of payments by deducting them from the disbursements of new EDC loans. Thus the transfers

## Table 3-4

### Adjustments to CANDIDE 2.0 Equations to Simulate the Effects of New Export Loan Subsidies[1]

| | Variable label | Simulation | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|
| | | | ($ Millions at 1971 prices) | | | | | | |
| Exports | | | | | | | | | |
| Non electrical machinery | *TENELECMEW* | All | 613 | 613 | 613 | 613 | 613 | 613 | 613 |
| Electrical machinery | *TEELECMEW* | All | 110 | 110 | 110 | 110 | 110 | 110 | 110 |
| "Other" transport equipment | *TERETRW* | All | 277 | 277 | 277 | 277 | 277 | 277 | 277 |
| | | | ($ Millions at current prices) | | | | | | |
| EDC cash requirement | *.FLOANS.OTHER* | 1-D | 2,303.4 | 2,083.6 | 1,788.1 | 1,458.2 | 1,163.5 | 836.1 | 496.7 |
| | | 1-F | 490.9 | 593.6 | 617.6 | 638.9 | 670.0 | 710.0 | 757.2 |
| | | 2-D | 1,981.4 | 1,780.4 | 1,574.4 | 1,341.5 | 1,142.0 | 909.3 | 664.6 |
| | | 2-F | 628.3 | 643.9 | 684.3 | 706.4 | 746.3 | 786.9 | 826.0 |
| Funds transferred abroad (net) | *TMSIMFDW$* | 1-D | 2,303.4 | 2,083.6 | 1,788.1 | 1,458.2 | 1,163.5 | 836.1 | 496.7 |
| | | 2-D | 1,981.4 | 1,780.4 | 1,574.4 | 1,341.5 | 1,142.0 | 909.3 | 664.6 |
| Increase in personal income tax | *GRF.DT.PINC$* | 1-D; 1-F | 490.9 | 593.6 | 617.6 | 638.9 | 670.0 | 710.0 | 757.2 |
| | | 2-D; 2-F | 628.3 | 643.9 | 684.3 | 706.4 | 746.3 | 786.9 | 826.0 |
| | | | ($ Millions at 1971 prices) | | | | | | |
| Imports | | | | | | | | | |
| Alcoholic beverages | *TMALBVW* | 2-D | 0.8 | 1.5 | 2.2 | 2.7 | 3.3 | 3.8 | 4.2 |
| Fruits and vegetables | *TMFUVEW* | | 3.1 | 5.7 | 8.2 | 10.3 | 12.3 | 14.1 | 15.7 |
| Dairy, meat, and fish products | *TMDAMEW* | | 1.7 | 3.2 | 4.5 | 5.6 | 6.6 | 7.5 | 8.3 |
| Residual agricultural products | *TMAGRESW* | | 3.5 | 6.5 | 9.2 | 11.6 | 13.8 | 15.8 | 17.5 |
| Noncompetitive products | *TMNONCW* | | 1.4 | 2.5 | 3.5 | 4.5 | 5.3 | 6.0 | 6.7 |
| Other crude materials | *TMOCRDMTW* | | 3.6 | 6.7 | 9.6 | 12.3 | 14.7 | 16.9 | 19.0 |
| Processed wood products | *TMWOPRW* | | 1.8 | 3.4 | 4.8 | 6.1 | 7.3 | 8.3 | 9.3 |
| Iron and steel alloys | *TMTRASW* | | 3.9 | 7.3 | 10.4 | 13.2 | 15.8 | 18.2 | 20.4 |
| Nonferrous metals and alloys | *TMNOFRW* | | 1.5 | 2.8 | 4.0 | 5.0 | 6.0 | 6.9 | 7.7 |
| Textiles and materials | *TMTEXMW* | | 3.7 | 7.0 | 10.2 | 13.1 | 15.8 | 18.4 | 20.8 |
| Chemicals and products | *TMCHEMW* | | 6.9 | 12.6 | 17.7 | 22.0 | 25.7 | 28.9 | 31.6 |
| Misc. processed goods | *TMMCPROCW* | | 3.6 | 6.8 | 9.8 | 12.6 | 15.1 | 17.5 | 19.7 |
| Agricultural machinery | *TMMAFAW* | | 6.3 | 12.0 | 17.3 | 22.2 | 26.9 | 31.2 | 35.3 |
| Industrial machinery - U.S. | *TMINMAU* | | 9.4 | 17.5 | 24.9 | 31.6 | 37.6 | 43.1 | 48.1 |
| Industrial machinery - Rest of world | *TMINMAR* | | 1.8 | 3.4 | 4.9 | 6.2 | 7.4 | 8.5 | 9.5 |
| Business machinery | *TMBZMAW* | | 3.8 | 7.2 | 10.3 | 13.0 | 15.5 | 17.7 | 19.8 |
| Motor vehicles - U.S. | *TMMTRVEHU* | | 16.6 | 30.6 | 43.5 | 55.4 | 66.3 | 76.3 | 85.4 |
| Motor vehicles - Rest of world | *TMMTRVEHR* | | 2.4 | 4.4 | 6.3 | 8.0 | 9.6 | 11.0 | 12.3 |
| Motor vehicle parts - U.S. | *TMMTRVPARTSU* | | 18.4 | 34.1 | 48.4 | 61.4 | 73.1 | 83.8 | 93.4 |
| Motor vehicle parts - Rest of world | *TMMTRVPARTSR* | | 0.7 | 1.2 | 1.7 | 2.2 | 2.6 | 3.0 | 3.3 |
| Aircraft and parts | *TMAIRCW* | | 3.3 | 6.2 | 8.9 | 11.3 | 13.5 | 15.6 | 17.4 |
| Residual transport equipment | *TMRETRW* | | 1.3 | 2.5 | 3.5 | 4.5 | 5.4 | 6.2 | 7.0 |
| Communications equipment | *TMTALKW* | | 7.1 | 13.6 | 19.8 | 25.8 | 31.4 | 36.9 | 42.0 |
| Misc. equipment and tools | *TMMEQTW* | | 6.6 | 12.5 | 18.0 | 23.0 | 27.6 | 32.0 | 35.9 |
| Apparel and household goods | *TMAPHTW* | | 4.1 | 7.6 | 11.0 | 14.1 | 17.0 | 19.6 | 22.1 |
| Misc. personal and household equipment | *TMMPERW* | | 6.4 | 12.0 | 17.3 | 22.2 | 26.7 | 30.9 | 34.7 |
| Misc. manufactured goods | *TMMCMFRW* | | 8.8 | 16.4 | 23.6 | 30.0 | 35.9 | 41.4 | 46.3 |

1 The figures indicated here are in addition to other adjustments made for the base case.

abroad diminish over time in Cases 1-D and 2-D as the expanded EDC loan program matures. By 1988 those transfers turn negative, as the repayment of old seven-year loans with interest more than extinguishes the disbursements for new seven-year loans.

As the repayments with interest increase over time and approach a steady-state level, so too do the imports that are required in Case 2-D to enable foreigners to obtain Canadian dollars. The corresponding adjustments to import equations are shown in Table 3-4. Adjustments to imports for Case 2-F, however, are not shown. As they relate only to the transfer of the down payments of 15 per cent, they are much smaller and of similar magnitude each year to the figures shown in the 1981 column.

As for the federal government, it has a cash requirement equal to the market value of new Canadian-dollar loans, plus subsidies and less the interest and principal received on account of loans made under the simulated program. The part not dealt with by increased taxes is automatically simulated by CANDIDE 2.0 as being borrowed on domestic capital markets after bumping up total government cash requirements by the amount of the EDC requirements.

Table 3-5 shows the simulation results concerning Canada's foreign exchange position. Since both the capital and the income transactions related to new EDC loans were dealt with by adjusting an exogenous current account, we have deducted the capital portion of these transactions from the current account balance simulated by CANDIDE and added them to the simulated capital account balance. The figures in Table 3-5 are inclusive of these side calculations. As the table shows, export subsidies have, in every case, a negligible effect on the overall balance of payments and do not serve to accumulate significantly foreign exchange reserves. This result is similar to that obtained in Chapter 2.

The long-run multiplier effect of the new exports ranges between virtually zero and unity, since by 1987 real GNP is not increased by much more than the real value of new exports and can actually decline if Canadian-dollar loans are repaid in kind with interest (see Table 3-6). This occurs when the return flow begins to exceed the market value of new loan disbursements.

## Table 3-5

### Effect of New, Subsidized EDC Loans on Canada's Foreign Exchange Position, as Simulated with CANDIDE 2.0

| | | | Change from base case | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Variable | Case | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
| | | | ($ Millions) | | | | | |
| Variable label: | | | | | | | | |
| *TBC.BAL.MERW$* | Merchandise trade balance | 1-D | 862.4 | 1,172.1 | 1,301.1 | 1,506.9 | 1,544.7 | 1,678.9 |
| | | 1-F | 738.9 | 1,195.9 | 1,348.6 | 1,599.1 | 1,688.7 | 1,846.9 |
| | | 2-D | 657.6 | 871.2 | 866.6 | 909.4 | 767.7 | 685.1 |
| | | 2-F | 669.3 | 1,105.3 | 1,243.1 | 1,462.4 | 1,527.7 | 1,656.1 |
| *TBC.BAL.CAW$* | Current account balance | 1-D | 744.0 | 1,195.9 | 1,461.5 | 1,785.1 | 1,897.0 | 2,081.2 |
| | | 1-F | 237.2 | 762.0 | 934.3 | 1,221.0 | 1,321.6 | 1,505.5 |
| | | 2-D | 511.0 | 864.8 | 995.6 | 1,149.0 | 1,081.6 | 1,046.8 |
| | | 2-F | 156.0 | 624.4 | 777.6 | 1,015.1 | 1,085.9 | 1,236.1 |
| *TBK.BALK$* | Net capital balance | 1-D | -734.8 | -1,185.7 | -1,457.8 | -1,781.8 | -1,894.3 | -2,076.4 |
| | | 1-F | -237.6 | -749.4 | -932.8 | -1,220.3 | -1,321.8 | -1,505.2 |
| | | 2-D | -503.9 | -856.4 | -994.5 | -1,148.0 | -1,081.2 | -1,044.8 |
| | | 2-F | -154.2 | -613.4 | -776.1 | -1,014.3 | -1,086.1 | -1,235.6 |
| *TBK.URES$/U* | Cdn. foreign exch. reserves in U.S.$ | 1-D | -7.5 | 1.2 | 4.8 | 8.1 | 11.2 | 16.2 |
| | | 1-F | 6.1 | 17.6 | 19.9 | 21.4 | 22.3 | 23.5 |
| | | 2-D | -10.4 | -3.4 | -2.4 | -1.3 | -0.7 | 1.3 |
| | | 2-F | 5.0 | 15.0 | 17.2 | 18.7 | 19.3 | 20.6 |
| | | | | | (Cents) | | | |
| *REXCAN* | Exchange rate — Cdn.$/U.S.$ spot | 1-D | 0.3 | -- | -0.2 | -0.3 | -0.4 | -0.6 |
| | | 1-F | -- | -- | -0.4 | -0.5 | -0.5 | -0.6 |
| | | 2-D | 0.4 | -- | -0.1 | -0.1 | -0.2 | -0.3 |
| | | 2-F | -- | -0.3 | -0.4 | -0.5 | -0.5 | -0.5 |

The long-run effect on corporate profits is negative, especially if the EDC finances its lending activity abroad. This is reminiscent of the result obtained in Chapter 2, where export subsidies reduced the rate of return to capital (see Table 2-6). Results of this nature raise doubts about the usefulness of export subsidies to stimulate and strengthen Canadian industry. They may, however, strengthen Canadian ownership, as falling rates of return or corporate profits could cause a withdrawal of foreign capital. Such an outflow is produced by the model in Chapter 2. CANDIDE simulates both negative and positive

## Table 3-6

### Effect of New, Subsidized EDC Loans on Some General Economic Indicators, as Simulated with CANDIDE 2.0

| | | | Change from base case | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Variable | Policy | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
| | | | ($ Millions) | | | | | |
| Variable label | | | | | | | | |
| *GNE* | Gross national product (at 1971 prices) | 1-D | 1,575.9 | 1,411.1 | 1,357.2 | 1,229.3 | 1,150.4 | 1,042.8 |
| | | 1-F | 1,538.8 | 1,313.2 | 1,274.7 | 1,169.2 | 1,154.9 | 1,097.2 |
| | | 2-D | 1,159.5 | 795.7 | 592.1 | 336.2 | 135.0 | -72.1 |
| | | 2-F | 1,296.9 | 1,060.9 | 1,033.6 | 948.7 | 935.6 | 894.4 |
| *WBTOT* | Compensation of employees | 1-D | 2,159.4 | 2,886.1 | 3,754.4 | 4,510.9 | 5,223.2 | 5,791.5 |
| | | 1-F | 1,829.9 | 2,397.9 | 3,059.3 | 3,622.2 | 4,188.6 | 4,650.6 |
| | | 2-D | 1,778.1 | 2,162.2 | 2,579.2 | 2,804.1 | 2,916.4 | 2,891.6 |
| | | 2-F | 1,602.1 | 2,033.2 | 2,571.6 | 3,018.1 | 3,477.2 | 3,866.7 |
| *Y.PROFBT.CORP$* | Corporate profits (private) | 1-D | 1,529.4 | 1,141.2 | 706.8 | 110.3 | -431.5 | -816.2 |
| | | 1-F | 935.4 | 35.5 | -541.2 | -1,314.9 | -1,923.3 | -2,358.4 |
| | | 2-D | 1,133.1 | 585.4 | 168.7 | -338.7 | -688.2 | -833.5 |
| | | 2-F | 710.6 | -105.2 | -596.4 | -1,241.2 | -1,752.7 | -2,137.6 |
| | | | (Dollars) | | | | | |
| *W/CPI* | Real average hourly wage rate | 1-D | .01 | .01 | .02 | .03 | .04 | .04 |
| | | 1-F | .01 | .02 | .02 | .03 | .04 | .04 |
| | | 2-D | .01 | .01 | .01 | .02 | .02 | .02 |
| | | 2-F | .01 | .01 | .02 | .03 | .03 | .03 |
| | | | (Per cent) | | | | | |
| *DURATE* | Unemployment rate | 1-D | -0.6 | -0.6 | -0.5 | -0.4 | -0.2 | -0.1 |
| | | 1-F | -0.5 | -0.5 | -0.4 | -0.3 | -0.2 | -0.1 |
| | | 2-D | -0.5 | -0.4 | -0.3 | -0.1 | - | 0.1 |
| | | 2-F | -0.5 | -0.4 | -0.4 | -0.3 | -0.2 | -0.1 |
| | | | ($ Millions) | | | | | |
| *GDF$* | Federal government surplus | 1-D | 1,291.3 | 1,613.4 | 1,563.3 | 1,241.4 | 1,038.5 | 866.8 |
| | | 1-F | 1,707.1 | 2,210.5 | 2,416.7 | 2,362.8 | 2,402.3 | 2,546.2 |
| | | 2-D | 1,139.2 | 1,296.2 | 1,074.2 | 629.4 | 312.1 | 28.6 |
| | | 2-F | 1,591.8 | 2,076.4 | 2,260.4 | 2,250.8 | 2,318.1 | 2,468.8 |
| | | | (Basis points) | | | | | |
| *FRATE.GBOND.10Y* | Government of Canada bond yield — 10 years | 1-D | 4 | 3 | 3 | 3 | 3 | 2 |
| | | 1-F | -7 | -11 | -15 | -18 | -21 | -24 |
| | | 2-D | 4 | 5 | 6 | 8 | 9 | 10 |
| | | 2-F | -6 | -10 | -13 | -16 | -18 | -21 |
| *FRATE.NHAMORT* | NHA mortgage rate | 1-D | 7 | 11 | 13 | 16 | 18 | 20 |
| | | 1-F | -3 | -4 | -5 | -6 | -6 | -7 |
| | | 2-D | 7 | 10 | 13 | 15 | 18 | 19 |
| | | 2-F | -3 | -4 | -5 | -6 | -6 | -7 |
| | | | ($ Millions at 1971 prices) | | | | | |
| *XMF* | Real domestic product — manufacturing | 1-D | 810.6 | 818.0 | 818.8 | 776.7 | 746.5 | 704.8 |
| | | 1-F | 822.2 | 794.1 | 805.6 | 758.8 | 739.4 | 708.7 |
| | | 2-D | 622.8 | 540.9 | 469.9 | 368.7 | 287.4 | 203.9 |
| | | 2-F | 716.0 | 689.8 | 702.9 | 667.6 | 652.9 | 628.6 |

## Table 3-6 (Concl'd.)

| | Variable | Policy | Change from base case | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
| | | | (Thousands) | | | | | |
| *RTS* | Housing starts | 1-D | – | -0.2 | -0.6 | -0.9 | -1.1 | -1.4 |
| | | 1-F | 0.3 | – | -0.4 | -0.6 | -0.7 | -0.8 |
| | | 2-D | -0.1 | -0.2 | -0.5 | -0.7 | -0.8 | -0.8 |
| | | 2-F | 0.3 | – | -0.3 | -0.4 | -0.5 | -0.6 |
| *NMF* | Employment in manufacturing | 1-D | 39.4 | 38.2 | 35.2 | 31.0 | 27.5 | 24.4 |
| | | 1-F | 39.9 | 37.5 | 34.7 | 30.2 | 27.1 | 24.5 |
| | | 2-D | 31.9 | 26.8 | 21.2 | 15.1 | 10.4 | 6.6 |
| | | 2-F | 35.2 | 32.7 | 30.4 | 26.7 | 24.2 | 22.1 |

flows of long-term capital with, however, no net outflow over the seven simulation years. Thus CANDIDE simulations cannot demonstrate that export subsidies benefit Canadian industry or increase the degree of Canadian ownership. The real beneficiaries of export subsidies appear to be labour and government, as indicated by the compensation of employees, real wages, and the change in the federal surplus or deficit. Provincial finances generally improve also but to a lesser extent, especially in the case of foreign financing. In Case 2-F, provincial deficits increase during the later simulation periods.

# 4 Conclusion

Governments extend subsidized loans to assist home-owners and farmers, to stimulate exports, and to aid investment and employment in manufacturing. The initial impact of these loans is on the liability side of the private sector's balance sheet, but the more substantive effects are sought on the asset side and on the statement of income and expenses. Thus the place where government loans have their first impact is somewhat removed from, although connected to, the places where government seeks to produce a beneficial effect. In this study we have explored the relationship between liabilities, assets, income, and expenses in an effort to gauge the effectiveness of official financial assistance. The results are mixed.

In Chapter 1 it was found that unsubsidized and subsidized government loans can cause a lot of financial churning on the liability side of the balance sheet and in the corresponding interest expenses, instead of stimulating investment and production as was perhaps originally intended. The reason for this is that the private sector has a multitude of financial choices, and the government's financial activity has ambiguous effects on most of them. This ambiguity was shown to increase when attention was shifted from any single program of financial assistance to several programs at once. This raises at least two questions. First, is there a way to improve the aim of government loan programs? Second, is there a better alternative?

The answer to the first question is that the effectiveness of loans can be increased at the cost of artificially reducing the financial choices of those who seek assistance. Even so, the design of loan *subsidy* programs is more difficult than that of unsubsidized loan programs, because the former requires a larger amount of information of a type that does not as yet seem to exist in Canada. This recommends the search for alternatives. One such alternative that was explored in Chapter 1 is production subsidies (and shelter allowances). Neglecting other existing tax and subsidy measures, production subsidies were shown to be more powerful than loan subsidies.

In Chapter 2 we went further into the asset, income, and expenses side of the question, constructing a stylized model of the Canadian economy, as of 1977, to simulate the effects of loan subsidies on a number of economic variables. Following the discussion in Chapter 1, this exercise could only be performed by supposing that loan programs are designed to avoid the difficulties encountered in Chapter 1. This and other features of the model mentioned in the text give the analysis of Chapter 2 an interventionist bias. The simulations in Chapter 2 involve three different scenarios and a number of policy alternatives. The scenarios were created by different sets of inevitably arbitrary assumptions. The different policy alternatives serve to put loan subsidies in perspective and include the production subsidies discussed in Chapter 1. The general impression created by the results is that, on the whole, the Canadian economy seems well adjusted to a number of tax and subsidy interventions so that the static welfare losses attributable to them are relatively small. The aggregate annual economic loss caused by loan subsidies is $15 million to $25 million (at 1977 prices). Such a loss, however, is not enough to condemn the subsidies. Instead, it may indicate that loan subsidies are poorly designed. Indeed, their replacement by production subsidies, with no change in government expenditures or in the level of support given to agriculture, housing, manufacturing, and exports, would bring a gain of between $72 million and $92 million.

This last result is in line with the conclusion of Chapter 1 but masks differences in detail that can be attributed to factors neglected in Chapter 1, such as the myriad of taxes on corporate income, property, sales, imports, and exports of oil and gas. While these were not considered in Chapter 1, they were brought into Chapter 2, as they obviously affect the intersectoral transfers of resources that are sought with loan subsidies. The tax structure seems to discriminate against primary and manufacturing industries, and also against exports. Loan subsidies offset some of the negative impacts of the tax system as a whole. The magnitude of the offset depends on

the methodology employed to measure it. For instance, if a partial equilibrium method were used, an estimated elasticity of demand for manufactured exports of 3.6 would lead to the conclusion that a reduction of 1 per cent in the export price of Canadian goods, brought about by a certain amount of export loan subsidy, would increase exports of manufactures by 3.6 per cent. This method, however, does not capture the effects that export promotion can have on many other facets of the economy. Many of these are considered with the general equilibrium approach followed in Chapter 2. This allows for the effects of export loan assistance on the rate of return to capital, capital imports, the balance of trade, the exchange rate, commodity imports, and so on, with the result that an initial reduction of 1 per cent in the cost to foreigners of Canadian manufactures increases exports of these, not by 3.6 per cent but by 1.95 per cent.

Turning now from export loans to loans to residents in Canada, it was shown in Chapter 2 that loan subsidies and the alternative production subsidies have different effects on housing, agriculture, and manufacturing. The differences depend in part on the ease with which each sector can substitute debt for equity finance and on the importance of taxes on capital income or on capital that can be offset by interest subsidies. Thus loan subsidies for housing have a beneficial effect on economic welfare. This may be due to loan subsidies offsetting a rather heavy burden of property tax. With the substitution of debt for home-owner equity not being particularly easy, however, shelter allowances (production subsidies) would have a more beneficial effect than mortgage loan subsidies. In agriculture the burden of taxes is lower, and financial risk is so high that the substitution of debt for equity is very costly. Consequently, loan subsidies are potentially more effective than production subsidies in moving resources to agriculture, but the simulation shows that they both reduce economic welfare, with production subsidies having the worst effect. Unlike housing and agriculture, manufacturing is affected also by the corporate income tax and by sales taxes. This greatly complicates the design of assistance to manufacturing. Few of the simulations made here could simultaneously increase manufacturing output, exports, employment, and general welfare. Policies that have such an all-round beneficial effect in one case do not have it in another, after changing the assumed magnitude of some key parameters. This shows that alternatives superior to loan subsidies for manufacturing can be found, but a realistic improvement would require simultaneous changes in a number of tax and subsidy policies after careful measurement of the key parameters. These parameters are not alone in hampering policy choice. The entire model can be called into question. Changes in model design can change one's opinion of policies. Different models can be used to sieve out the policies that do not perform equally well in all models. As a step in that direction we have made some simulations with the Economic Council's econometric model of Canada, CANDIDE 2.0.

CANDIDE is far richer than the model in Chapter 2. With its greater number of equations, it describes the Canadian economy in greater detail. The parameters of its equations have been estimated statistically and represent average economic responses that fit the data over a period of 20 or more years. The data are continually updated, and the model can be used to simulate the short- and medium-term effects of policies. The model is not as static as the one used in Chapters 1 and 2, and several restrictive assumptions can be relaxed; however, not all the Chapter 2 simulations can be replicated. For example, somewhat heroic assumptions would be necessary to work out the effect of production subsidies. Thus CANDIDE was used only to simulate new CMHC mortgage loans, mortgage subsidies, and export loan subsidies.

The results of the CANDIDE simulations are in line with the qualitative conclusions of the analysis in Chapter 1 and are similar in direction, if not in amount, to the results obtained in Chapter 2 for housing and exports.

Regarding unsubsidized mortgage loans, it was argued in Chapter 1 that their effects on housing investment would be unpredictable, that they would not necessarily stimulate housing. CANDIDE confirmed that in a somewhat curious way. New CMHC loans have no effect on aggregate private-sector mortgage approvals, especially if CMHC is debt-financed instead of supported through increased personal income taxes. Furthermore, CMHC cannot stimulate a particular type of construction, as private mortgage approvals for new, single detached houses would decrease by the amount that CMHC increased its loans for the same type of housing.

As for subsidized CMHC loans, CANDIDE shows that a subsidy that reduces the NHA mortgage rate by 10 per cent would increase new starts by about 3 per cent, whereas the model in Chapter 2 would make the stock of housing increase by 2 per cent. Were it not for demolitions and aborted starts, a sustained increase in new housing starts, as simulated in CANDIDE, would be equivalent to the change in stock concept of Chapter 2. Estimates of demolitions and aborted starts (which were not made) would bring the two simulation results closer together. The response of housing to loan subsidies is, in any event, small, regardless of the model employed.

With regards to exports, we made several CANDIDE simulations based on different assumptions as to the type of export loan financing, the method of settling the foreigners' debt to Canada, and the computation of subsidies incorporated in loans by the Export Development Corporation.

The effect of export loan subsidies on exports of manufactured products is, unfortunately, not comparable between CANDIDE and Chapter 2. The incomparability arises from an inevitable difference in methodology. To make the simulations with CANDIDE, the increase in export volume was given *ex-hypothesi*, and the model gave the subsidies required to induce them, plus the other economic ramifications. In Chapter 2 we could follow a more appealing approach – that is, derive the change in export volume from a given amount of subsidies. Comparisons could thus only be made on items other than exports.

Both CANDIDE and the Chapter 2 model show that export loans do not cause any significant improvement in the foreign-currency position of Canada, as measured by the overall balance of payments. The value of the Canadian dollar is increased by between zero and .05 per cent in CANDIDE, with the figure increasing from 1982 to 1987, whereas in Chapter 2 it was shown to increase by the approximate average of those figures – namely, 0.03 per cent. Thus the impact on the exchange rate is much stronger in Chapter 2 than in CANDIDE, considering that the latter simulation involved a larger volume of subsidies and of subsidized exports.

Both models show a decline in the rate of return to capital in response to export subsidies. The CANDIDE result, however, is not as straightforward as the one in Chapter 2. In CANDIDE it appears as a reduction in corporate profits, coupled with either reductions or increases in bond yields and mortgage loan rates, depending on the locus of EDC finance (foreign or domestic). In no case, however, could it be said that export loan subsidies increase the income from capital invested in business.

Having completed this study, definite conclusions are nevertheless hard to reach. First of all, it is hazardous to make statements about the effect of a loan subsidy. Such a subsidy interacts with other features of the Canadian tax and subsidy system, as well as with finance, so that conclusions that may be valid for one sector of economic activity may not apply to another sector. Second, much of the impact of a subsidy gets lost in the reshuffling of liabilities, and little of it is left over to induce the accumulation of assets or to stimulate production. In this respect, the reader's attention is directed to Table 2-3 which shows that relatively large subsidy rates may result in comparatively small reductions in the gross cost of capital; indeed, some are so small that they vanish after rounding off the figures.

Should further research into this subject be desired, we would like to make the following suggestions. The model of Chapter 2 could be refined and expanded in two ways. One would be to dynamize it, incorporating saving vs. consumption and work vs. leisure or retirement choices in a general equilibrium framework. This avenue does not seem fruitful, given the relatively small volume of loan subsidies. Investment and employment questions are better answered with partial equilibrium analysis of local problems. The direction in which to go with general equilibrium analysis would be to disaggregate the model, after obtaining additional data on loan subsidies, to more narrowly defined economic sectors, further analysing the financial response of these sectors to subsidies.

## Notes

CHAPTER 1

1 Externalities found elsewhere in the economy and not in financial markets would not by themselves support a case for financial intervention. See Economic Council, *Intervention and Efficiency*, p. 12.

2 A "credit gap" is a situation where, among identical borrowers, some get credit and others do not. The credit market is said to reach an equilibrium with rationing. Neither increased interest rates nor stiffer collateral requirements would clear such a market. For conditions under which credit gaps could exist see Stiglitz and Weiss (1981). A credit gap does not mean simply that someone was refused a loan.

3 The focus is on financial resource allocation. The linkage of finance to real resource allocation will be considered in the fifth section of this chapter. The assumption of costless and instantaneous adjustment to one-period rates of return can be removed and replaced by lagged adjustment to expected holding-period returns. In that case, the analysis in this chapter is to be interpreted as that of the long-run effects of government financial intermediation.

4 This assumption is made subject to three qualifications. The first is implied in the previous footnote: if there is a link between the financial and the real worlds, government financial programs may affect the level of real wealth – that is, they may assist or impede the creation of wealth. Second, if the government is closing a credit gap or internalizing into private decision making some externalities, its actions may lead to an increase in real wealth. For analytical purposes, this wealth creation has not been considered in the analysis of the effects of government credit and credit guarantee programs; instead, it enters separately into a cost-benefit analysis of government financial intermediation. Finally, intermediaries have the opportunity to create wealth by efficiently carrying out tasks that would be more expensive if performed without them – a possibility that has not been considered in this study. On this last point, see the Council's *Intervention and Efficiency*, Ch. 7.

5 This is true, assuming a closed economy – as we do to simplify the exposition. For the Canadian economy, wealth is reduced below the level of real capital by its foreign indebtedness.

6 An empirical analysis may have to allow for complementarity among assets. Gross substitutability is assumed at this point, so that theoretical discussion may lead to statements as definite as possible about the probable effect of government intermediation.

7 For example, the small business deduction from corporate income tax indiscriminately to all who qualify is market-specific. Small business loans by the Federal Business Development Bank are firm-specific, as they are conditional on specific characteristics of the recipient.

8 This result does not depend on the prior presence of government in financial markets. The exercise in 1.7 gives the effect of a $dG$ in two markets, where $dG$ can be thought of as added to any prior level of $G$.

9 Subsequent impacts and the total effect are similar in direction but not in magnitude. The total effect is obtained by equation 1.7.

10 Not everyone has to regard the securities as perfect substitutes to obtain this result. All that is needed is that either $D_{ij}$ or $S_{ij}$ be extremely large in absolute value, since $X_{ij} = D_{ij} - S_{ij}$.

11 Paul David and John Scadding (1974) cautioned against taking their analysis of "ultra-rationality" to the conclusion that financial intermediation is ineffective. See their second last paragraph on p. 247.

12 The guarantee can be viewed as a gift to the lender of an interest-free government bond, redeemable on demand at any time, subject to default of the guaranteed loan at that time. This gift is a lump sum, but it can be transferred in the form of an equivalent annuity or regular payment, additional to the interest income from the guaranteed loan. This renders the guarantee equivalent to a loan subsidy.

13 This applies especially to private financial intermediaries. Should the subsidized persons or firms issue Security 1, one would have to subtract an $S_1'$ function from the left-hand side of the first line in 1.9 and also enter $y_1$ as an argument in all three $S_i'$ equations. The consequence of this is a subtraction of a column of $S_1'$ from the first column in the Jacobian, which makes it more difficult to determine the sign of $dy_j$.

14 The difficulty in finding significant interest-rate coefficients of asset demand functions was demonstrated in a recent paper by Stephen Poloz (1983).

## CHAPTER 2

1 This is a departure from the Modigliani-Miller view that financial structure is irrelevant with respect to the value of the firm or the cost of finance. Financial structure does matter when bankruptcy is possible [Stiglitz (1969)] and when there are significant agency and tax arbitrage costs [Barnea, Haugen, and Senbet (1981)].

2 That is after corporate income tax. Personal income tax is regarded as a lump-sum tax devoid of significant allocative effects. While this is an assumption made to simplify the analysis and not a statement of facts, it has some support in that the evidence on the work disincentive and incentive effects of personal income tax is conflicting.

3 It may be argued, as it was by Ballentine and Thirsk (1978), that various provisions of foreign income tax laws and of tax treaties would make the level of capital employed in Canada by incorporated subsidiaries of U.S. companies a function of the gross rate of return, provided that the U.S. parent can get, and use, credit for Canadian taxes paid and that the marginal rate of corporate tax is higher in the United States than in Canada. Although the decision to locate in Canada may not depend on the rate of Canadian corporate income tax, the opportunity to defer U.S. income tax, however, makes the reinvestment in Canada of profits earned in Canada sensitive to Canadian tax rates. Furthermore, portfolio capital was found to be highly sensitive to Canadian taxes, and long-term bond interest earned in Canada by foreign residents was correspondingly exempted from the Canadian withholding tax.

4 Various capital grants, such as DREE subsidies, were not the subject of *Intervention and Efficiency*, and they were excluded from this study.

5 One of the side products of this study is a solution to the model for zero financial subsidies and zero corporate income taxes on all sectors. The result was that economic welfare would fall by 0.08 per cent in Case A, defined in the third section of this chapter, and by 0.09 per cent if some elasticities of substitution are reduced to make them all equal to unity, but it would increase by 0.16 per cent if the elasticity of supply of foreign capital were 10 and the elasticities of demand for exports were −10 while the elasticities of substitution are held at unity.

6 In addition to export subsidies, there are also export taxes on some mineral products. These and import duties were set at zero to simulate the welfare effect of unilateral free trade. The result was a 0.02 per cent increase in welfare under the "base case" assumptions about some parameter values and if all elasticities of substitution are unitary, and a 0.45 per cent increase if the elasticities of foreign supply of capital and export demand are 10.

7 Table 4 of Leipziger's article shows elasticities of long-run capital with respect to Canadian bond yields between 7.87 and 10. A figure under the lower end of the range – like the 7 used in this study – may be reasonable in view of the FIRA and NEP, which appeared after Leipziger's work and are likely to reduce the responsiveness of capital inflows to rates of return.

8 In the case of eight policy alternatives there are 128 sign changes in 944 solutions. The index of economic welfare changes its sign in 10 out of 32 cases.

9 A production subsidy for the $i$-th sector is simulated as a cut in $v_i$ (other value added).

10 The welfare loss from elimination of housing loan subsidies simulated for Cases A, B, and C is $37.7 million, $37.3 million, and $31.3 million, respectively.

11 An indication of this is given by the $v_i$. The one for owner-occupied housing is 27 cents per dollar of output; for other sectors it is generally less than 4 cents, and sometimes negative. The residential property tax is not deductible from taxable personal income in Canada, but see the final note to this chapter.

12 The assets acquired by the Export Development Corporation in the course of its lending activities are, to a large extent, Canadian-dollar assets. In the case of EDC foreign-currency loans, these tend to be offset by the EDC foreign-currency liabilities incurred to finance those loans.

13 None of this should be taken as indicating unqualified benefits from export taxes or subsidies, as the Case A welfare cost of export subsidies is $36.2 million, and the cost of taxes and subsidies is $300.3 million. The corresponding figures in Case C are $33.0 million and $756.6 million.

14 The most direct attack, of course, would be a reduction in the sales tax. There are no sales taxes, however, on agricultural products or on services of owner-occupied housing. Thus the alternative to loan subsidies is not a sales tax reduction but a subsidy to production. Production subsidies appear in Statistics Canada's input-output tables as a reduction in "other value added" that reduces producer prices, as per equation 2.24.

15 Neither would the elimination of all "distortions" bring about a demonstrable improvement. The simulated effects on some model variables from elimination of all loan subsidies, corporate income tax, import duties, export taxes, and taxes on final and intermediate sales are as follows:

| | Change in equilibrium values | | |
|---|---|---|---|
| | Case A | Case B | Case C |
| | (Per cent) | | |
| Output: | | | |
| Agriculture | -2.4 | -2.3 | -16.7 |
| Mining | 18.9 | 19.5 | 35.8 |
| Manufacturing | 6.5 | 6.2 | 4.5 |
| Owner-occupied housing | -20.1 | -18.9 | -18.8 |
| Real wages | 6.7 | 7.0 | 7.5 |
| Rate of return to capital | 17.1 | 14.3 | 14.7 |
| Exchange rate | .7 | -.6 | -3.1 |
| | ($ Millions) | | |
| Economic welfare | -92.9 | -104.6 | +1,646.7 |

See also notes 5 and 6 to this chapter.

16 Many provinces have property-tax-reduction schemes that may have similar beneficial effects. They are, however, different from the "production subsidy" or shelter allowance discussed in this chapter, as they generally involve graduated personal income tax reductions.

## CHAPTER 3

1 A "buy-down" is a payment (usually by a vendor) to a lender in consideration for a loan extended to the borrower (the purchaser) at a rate of interest that is below the market rate. A fair amount for the buy-down is the discount from par of a debt instrument that yields less than the market rate for similar loans.

2 For a further description of some of these simulations, see Export Development Corporation, *Canadian Capital Goods Exports and EDC Financing: An Economic Assessment* (Ottawa: EDC, November 1982), Chapter IV, section 2.

## List of Tables

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