**Factor Mobility**

In addition to trade in goods and services, we will also want to consider the consequences to the world economy when factors of production such as labour and capital move among countries. Up until now we have assumed that factors remain in each country and only goods move among countries. Clearly, that is not the case in general since many of us are either temporary or permanent migrants from one country to another, and many of the investments that take place do so in a nation other than the one in which the owner of the capital is resident.

We will begin with a discussion of labour mobility.

Labour Mobility

Labour as a factor of production moves for a variety of reasons. We will not concern ourselves so much about why labour moves but rather explore the consequences of this movement. Obviously labour moves together with non-labour such as children or the elderly, so that labour mobility is not exactly the same as population mobility. To appreciate the scale of labour (population) mobility into a country like Canada, Figure 1 describes the flow of immigrants into Canada since Confederation.

Figure 1: Number of Canadian Immigrants: 1867-2015
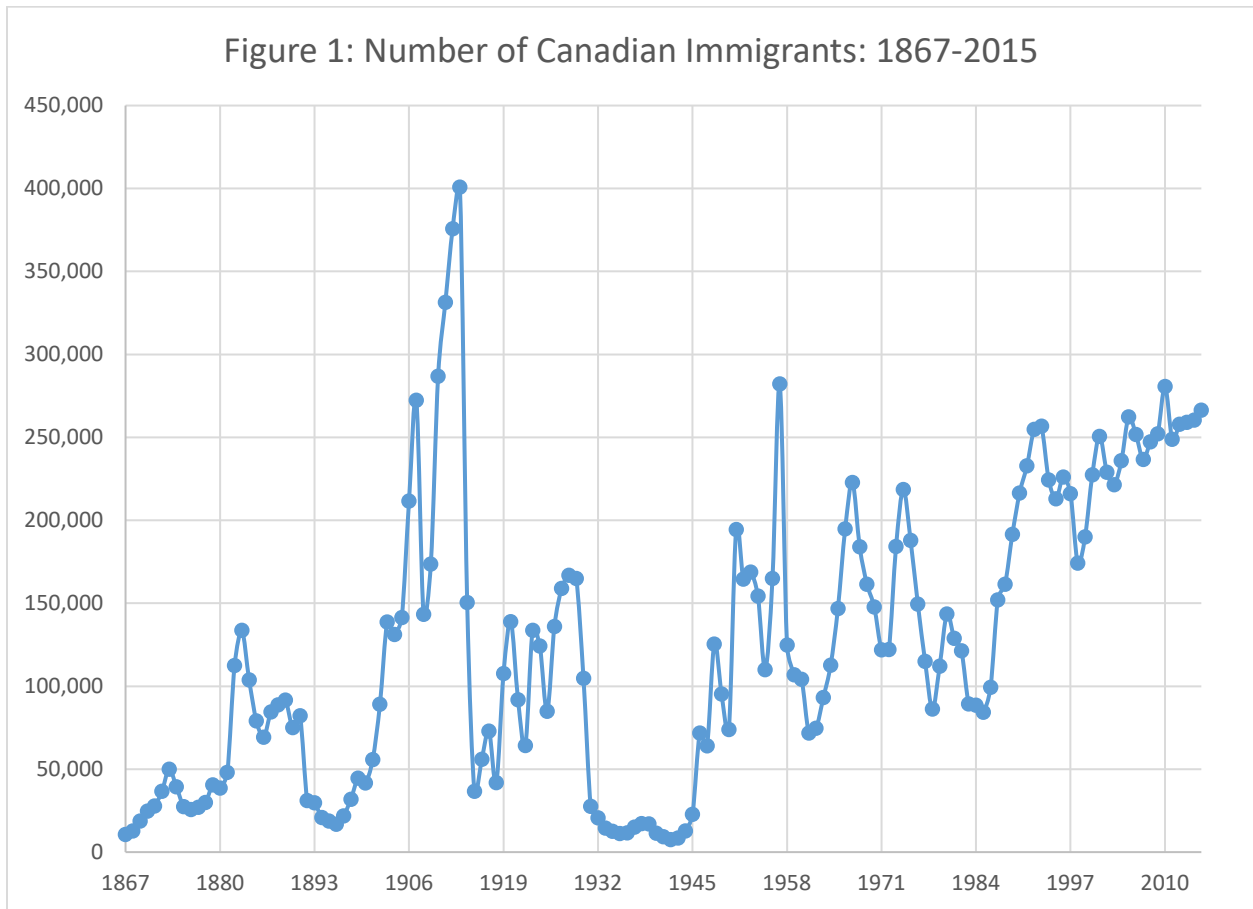
In Figure 2, the ratio of immigrants per 1,000 of current population is provided. As is apparent, the two figures look similar with the notable observation that immigration relative to population has been relative stable during the last half-century.

Figure 2: Canadian Immigration Rate per 1000: 1867-2015
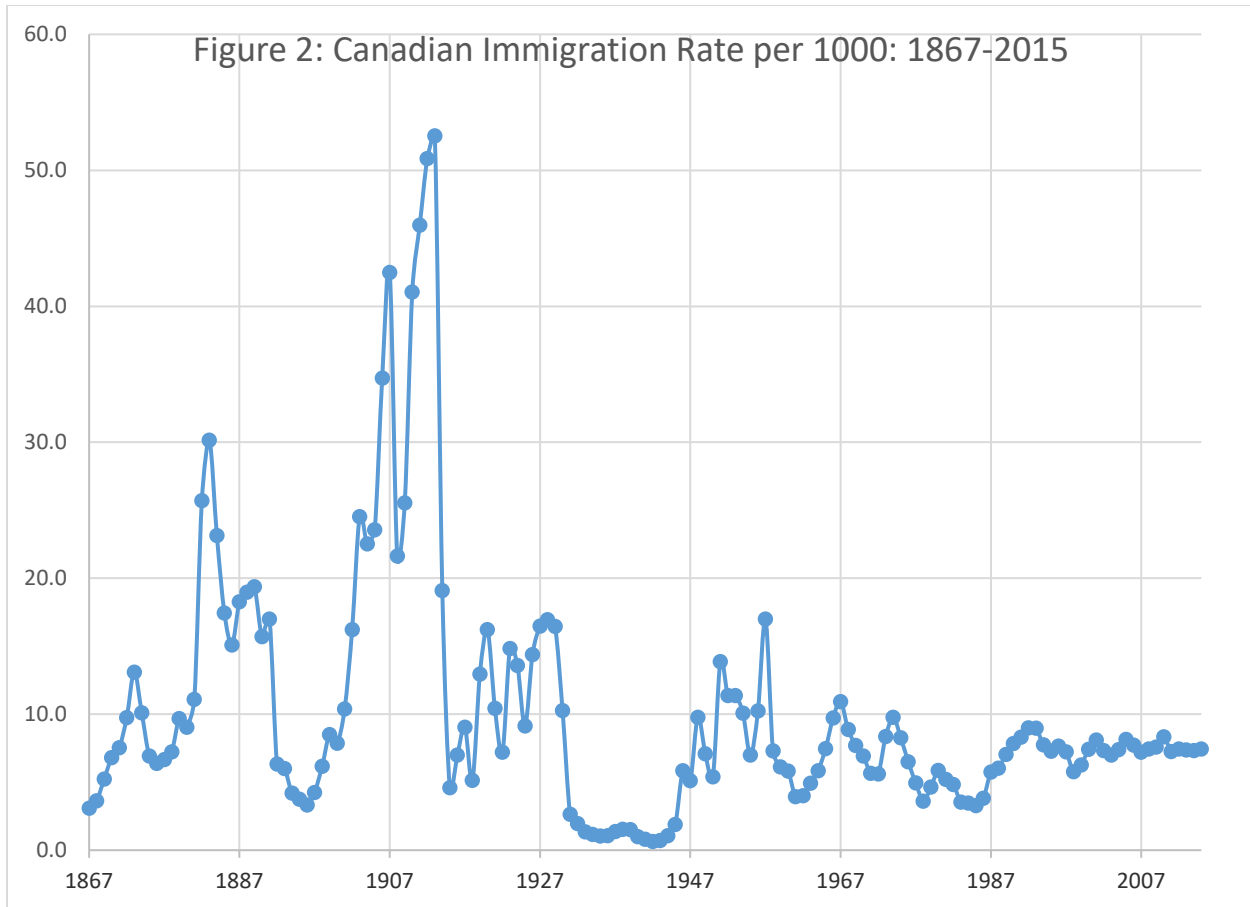
Canadian immigration has been a hot topic since the 1800s. Traditionally the concerns have been twofold: firstly, to keep Canada large enough that it will not be overrun by the United States, and secondly, that "good" Canadians are going to the United States and being replaced by "bad" immigrants. These themes run through to today with worries about the fall in the average education levels of recent immigrants.[1] More recently a burgeoning literature on the "brain drain" has stimulated extensive discussion of the mobility of well-educated Canadians to the US or of well-education Indians or Chinese to Canada.[2]

We turn now to a more theoretical look at the consequences of immigration.

A Conundrum: Do Immigrants raise or lower per capita income in Canada?

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[1] Stephen T. Easton, "Who Goes There? Canadian emigration to the United States in the Twenty-first Century" in Harris, R., Easton, S., and Schmitt,N. Brains on the Move: Essays on Human Capital Mobility in a Globalizing World and Implications for the Canadian Economy. CD Howe, Policy Study Number 42, 2005: 1-12.

[2] The first three essays in Harris, R., Easton, S., and Schmitt,N. Brains on the Move cited above look at the mobility of labour generally from Canada to the US, the mobility of scientists, and the mobility of economists.

1. Per capital output falls with immigration.

Granting the importance of the flows of labour at least potentially, we might ask ourselves how we feel about immigration as current residents of the receiving country. Let me emphasize that this is in a very general context rather than simply in the Canadian milieu.

Suppose, to fix ideas, the home country production function for income **Y** is Cobb-Douglas in labour, **L**, and capital, **K**:

1. $Y = AK^{\propto}L^{1-\propto}$

Now suppose that we look at the output per worker – and no tricks, we are assuming that everyone works in this community. This means we have output per worker:

2. $\left(\frac{Y}{L}\right) = AK^{\propto}L^{-\propto}$

Now when we look at the effect of immigration on the level of output per worker, we can see pretty clearly that it is falling!

3. $\frac{d\left(\frac{Y}{L}\right)}{dL} = -\propto AK^{\propto}L^{-\propto-1} < 0$

So it seems pretty clear that output per worker falls with the influx of labour from abroad. As more labour comes in to work with the same amount of capital, the marginal product of labour declines and overall output per worker falls. *Pure labour immigration reduces per capita income.*

2. Income of Canadians increases with immigration

Consider the marginal product of labour which is downward sloping in Figure 3. Recall that the area under any marginal product schedule is the total value of output. Since labour, L_o, is paid w_o, total labour income is boxes B+A'. Triangle A is consequently the income received by owners of capital – the other factor of production. We will assume that the original inhabitants are also the owners of capital.

Now consider immigration that increases the labour force to L_1. Recall at this point that we are only considering an increase in pure labour immigration – that is, no capital comes with the immigrants. The increase in the labour force is (L_1-L_o). The wage rate falls to w_1. Income earned by labour is now w_1L_1 (B'+B" in the figure), and that received by capital is A+A'+A". What is the effect on the income of the original inhabitants – the non-immigrants? Presumably this is an important question since they are ones that decide whether to admit immigrants (at least in our model).

Notice that the income accruing to the original L_o workers is w_1L_o (or B). Clearly this is less than their labour income before immigration took place. However, as owners of capital, their income is A+A'+A". Clearly the original inhabitants (L_o) have higher total income and are unambiguously better off. There is a transfer of income from labour to capital owners, A', and there is additional capital income A". B" goes to the immigrant workers who are assumed not to own any capital.

Figure 3: Immigration
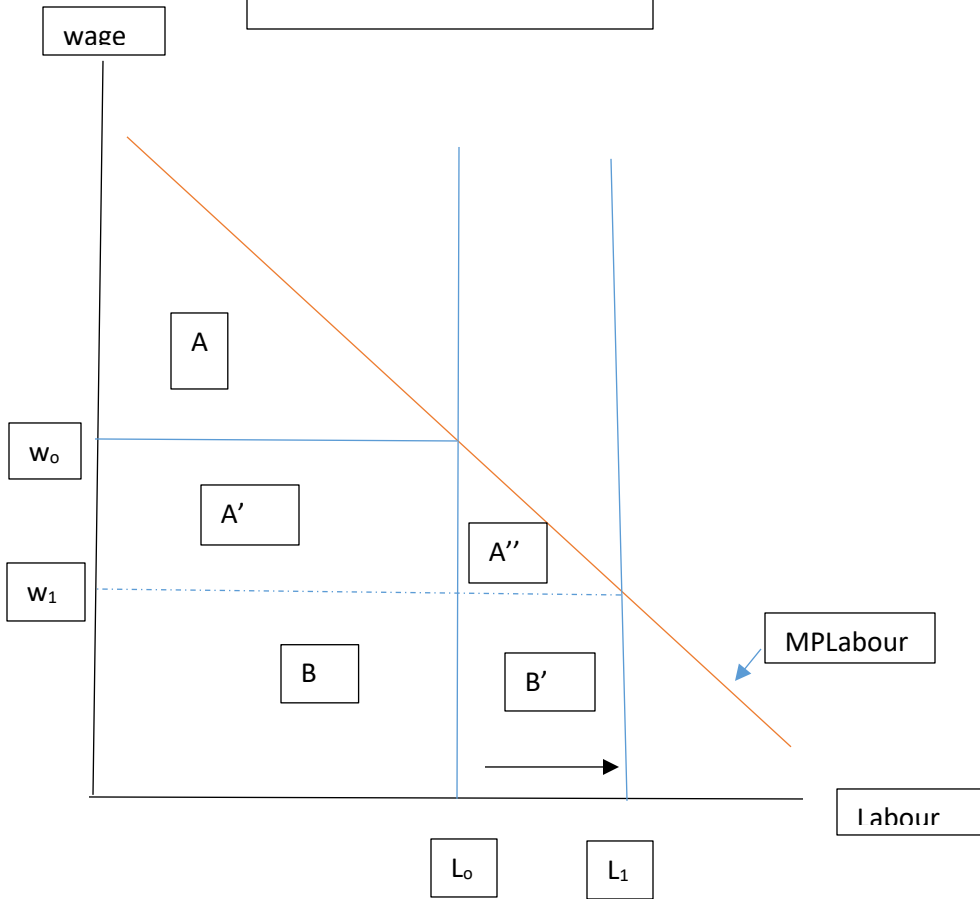
Clearly *the income of the original inhabitants is higher after immigration* than before immigration.

How do you reconcile the two italicized passages at the end of section 1 and section 2?

More extensive questions

There are any number of important questions that we have not discussed with respect to immigration. Many of them have economic content, many of them do not. In the context of our discussion, we have assumed that the original inhabitants own all the capital as well as their labour and consequently unambiguously benefit from immigration. Clearly that need not be the case if the original inhabitants own only a fraction of the original capital stock.

We have not looked at congestion costs associated with immigration. If immigrants use finite common resources and are not able to augments those resources – think roads or parks – in a timely fashion, then the costs to the original inhabitants will be greater than our simple model suggests.[3]

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[3] This leads to an interesting puzzle of its own. The capital stock of a nation – think roads, bridges, the physical plant of educational institutions, medical institutions, etc., is relatively fixed in the short-run. Adding more people leads to less for all. In the long run, immigrants contribute like everyone else although the initial 'balance' of costs and benefits to the general population likely depends on age, education, etc., of the immigrants. In the extreme, imagine a healthy infant who arrives and consequently is no different in resource use from the general population.

More grandly, it pays to spend some thought on what it means to be an "immigrant" beyond simply physical location of birth. When we calculate the ratio of immigrants to population as 7.4 per thousand that is clearly only part of the question. Why do we want to know? For immigration services? What about immigrants in previous years? How long do they need or want specialized services to help them acculturate? How many immigrants enrich the 'original' culture? How many immigrants does it take to ask whether the original culture is being changed in intended or unintended ways? For example, if Canada were to join with the US, clearly US 'culture' would dominate. We usually assume that immigrants entering Canada will join Canadian culture and contribute to it. Yet we observe residents who may well have been immigrants themselves (or at one remove) protesting that the new immigrants are changing Canadian culture in undesirable ways or importing ways from "the old country".

What is the optimal level of immigration for a country and what are the criteria by which we judge? This is a questions that politicians solve every year and to which economists have yet to give an answer.

We turn now to the other great mobility, the mobility of capital.

Capital Mobility

When we think of capital mobility in the context of our trade models, want to distinguish between financial capital and physical capital. Both are important but may address different issues and be motivated by different impulses.

Financial Capital

This is usually broken down into two components: portfolio capital and direct foreign investment.

Portfolio investment includes purchases of stocks, bonds and money market instruments as well as dividends received on their holdings. It is, as the name suggests, investment thought to be designed to help investors diversify their holdings without taking an active part in ownership and direction of the firms.

Direct investment: Direct investment include enterprises are foreign subsidiaries, equity acquired of more than 10% in companies and unincorporated branches of enterprises in which the investor may take a more active role in the company's operation.

Clearly these administrative definitions are only broadly useful as it is easy to imagine fuzziness in the actual motivation of the investors.

Canada has lots of foreign investments abroad and lots of foreigners investing in Canada.[4] We will be most interested in direct foreign investment. The figure below tracks direct foreign investment into Canada (DFII), Canadians direct foreign investment in other countries (DFIO) and the NET each year.

Alternatively, for example imagine, an older person who is too old to work and uses a disproportionate share of medical resources for which they do not now contribute. Each of these cases raises issues.
[4] The figures in the appendix give some of the longer period flows.

Canadian Direct Foreign Investment Relative to GDP: 1970-2016
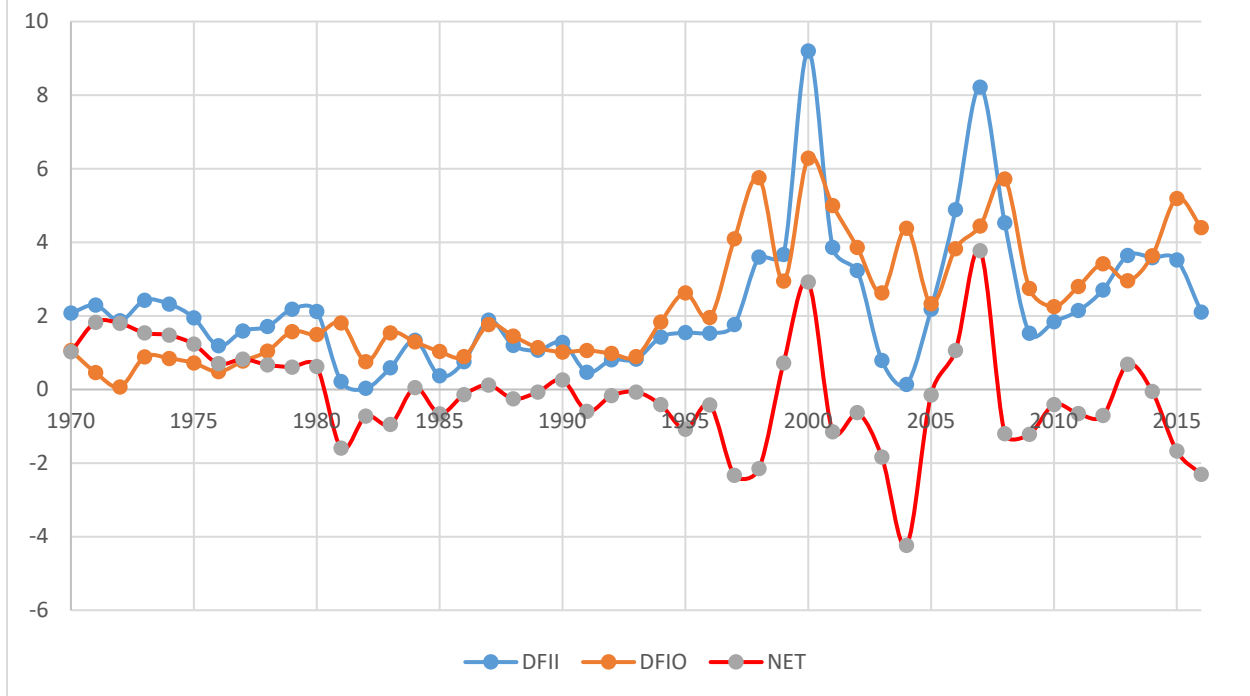
Although capital is often thought of as financial - although some physical capital goods are clearly moving across boundaries, we are interested in financial capital only insofar as it gives rise to increased levels of physical capital that affects production. Foreign investment of this sort augments domestic investment.

An interesting question economists ask in this context is whether capital is free to flow across countries. If it were perfectly free – perfect capital mobility, then there would be no correlation between domestic saving and domestic investment. If, however, investment is not free to flow across international boundaries, then domestic saving is trapped at home and consequently domestic saving and investment are positively correlated. This was the finding by Feldstein and Horioka (1980).[5] If we explore this relationship more recently, Figures 4 and 5 suggest that there is still a relationship between domestic savings and domestic investment (expressed as a share of GDP) in 2000 and 2016.

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[5] *Feldstein, Martin; Horioka, Charles (1980), "Domestic Saving and International Capital Flows",* Economic Journal, ***90** (358): 314–329.*

Figure 4

GS2Y2000

GS2Y2016
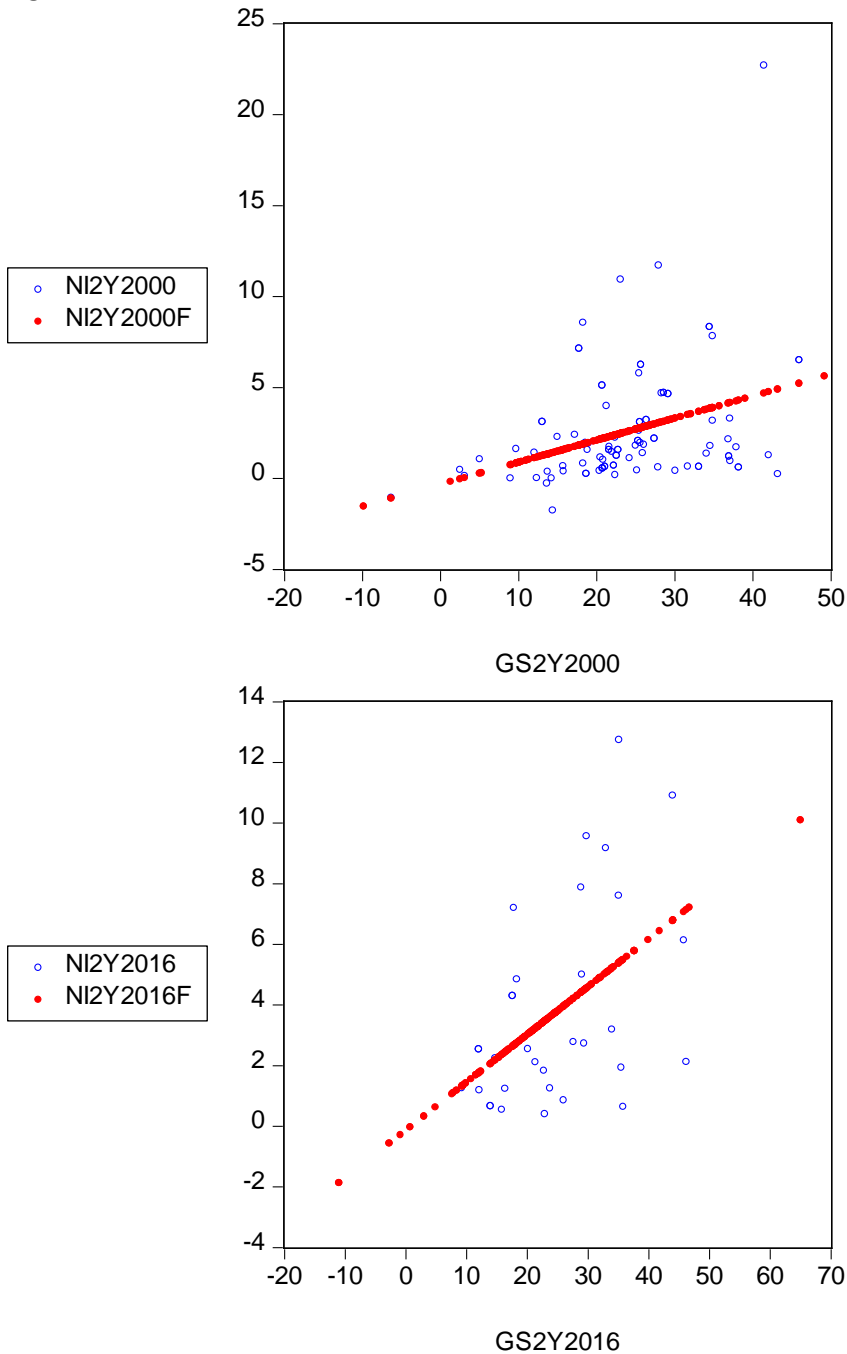
The actual coefficients of the relationships depicted above can be seen from a regression of gross saving (relative to income) and (investment relative to income.)

The table below spells out the relationship more clearly. I have included two years to give a flavour of the results from the World Development data Indicators data base from which the data were drawn as there are surprisingly few countries with both saving and investment. (GS2Y2016 is gross saving relative to income in 2016 and net investment relative to income is the dependent variable.)

Figure 5

Dep Variable: Net Investment relative to income
2000
Included observations: 77 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.369568	0.974724	-0.379151	0.7056
GS2Y2000	0.121141	0.038124	3.177557	0.0022

R-squared	0.118652

Dep Variable: Net Investment relative to income
2016
Method: Least Squares
Included observations: 30 after adjustments

| Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.163892	1.547685	-0.105895	0.9164
GS2Y2016	0.157459	0.055822	2.820721	0.0087

R-squared	0.221281

While the coefficient on savings is not large – recall that a perfectly domestic savings market would have a coefficient of "1", the coefficient is distinctly not "0" which would suggest perfect capital mobility.

Why might we care? Investments in capital may be "locked in" until it is worn away.
The latter may give rise to opportunistic behaviour in terms of confiscatory taxation or confiscation.
This in turn leads to reduced levels of investment as international investors are hardly desiring to see

FIGURE 4: The capital stock and taxation in a small country
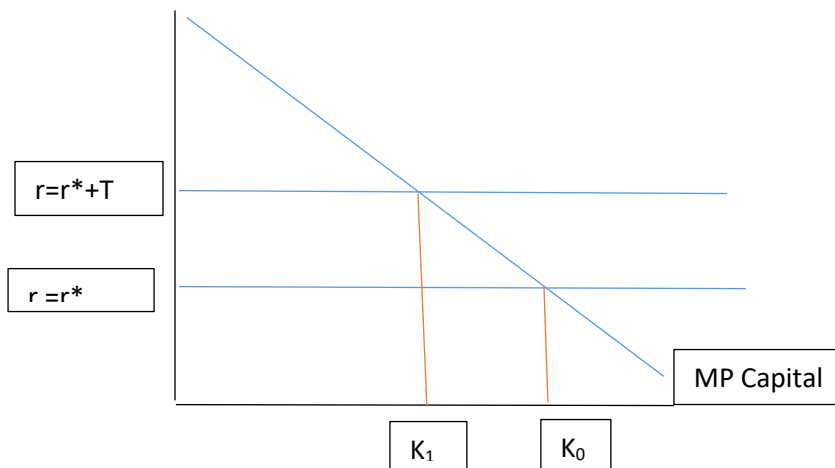
their investments disappear. (Imagine an investor who is interested in making a positive return putting money into Venezuela at the present time!) To see this Figure 4 plots the marginal product of capital

(MPC) in the home country and the supply of capital (investments) when capital is perfectly mobile internationally.

Initially if there is no taxation on capital, the domestic return to capital, **r**, will be the world rate of return, **r*** and the stock of domestic capital, **K_0**.

Any effort by the home country to tax capital at rate **T** will lead to a diminished capital stock, **K_1**, and a higher domestic return on capital employed at home of **r=r*+T**. Since the world rate of return is **r*** this can be obtained by investors only if the domestic stock of capital is reduced to **K_1**. A lower capital stock of course reduces domestic income by the area under the marginal product schedule. Ironically, once the tax is imposed, the higher domestic return on capital is sometime touted as a good thing![6] The important point here is that the tax does not punish investors in the long run. Only domestic residents who depend on domestic income are damaged with the reduced stock of capital as their wages will be lower.

Why do we as economists care about capital mobility? Equating the returns to the same factors of production across countries is really a statement about economic efficiency or what is equivalent, maximizing world income.

The Allocation of Capital When It Becomes *Internationally Mobile*

For example, imagine a world in which there are different returns to homogenous capital (Figure 5) in which one country is capital rich with a low domestic rate of return on a large capital stock, and one country is poor with a high rate of return on a small capital stock.

The initial allocation of capital between the home country and the foreign country (*) assumes no capital mobility. This means that capital stocks in the two countries are at K(0),K*(0) and rental rates in the two countries differ as the home country is relatively capital rich so that r(0)<r*(0). People in each country own all their capital.

In the initial allocation, home capital earns E+F and home labour earns A+B+C+D.
Foreign capital earns I+J. Foreign labour earns G.

Now let capital flow to find the highest rate of return. This results in an allocation of capital in which rates of return on the mobile factor (capital in this case) is equalized at rate r=r(1)=r*(1) Capital used in the home country is reduced from K_0 to K_1. Capital in the foreign country is increased to K*(1).

Location and ownership are not the same. Even though K(1)K(0) home capital has been reallocated to the foreign country, the home residents still own it and receive the international rate of return r.

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[6] Someone will say, "See how productive we are, we get a high return on domestic capital." Of course it gets even more complicated as taxation may also lead to complaints that there is "not enough R&D generating capital" at home because we want to boost labour productivity (Y/L). Simple algebra tell you that labour productivity depends on the capital stock.
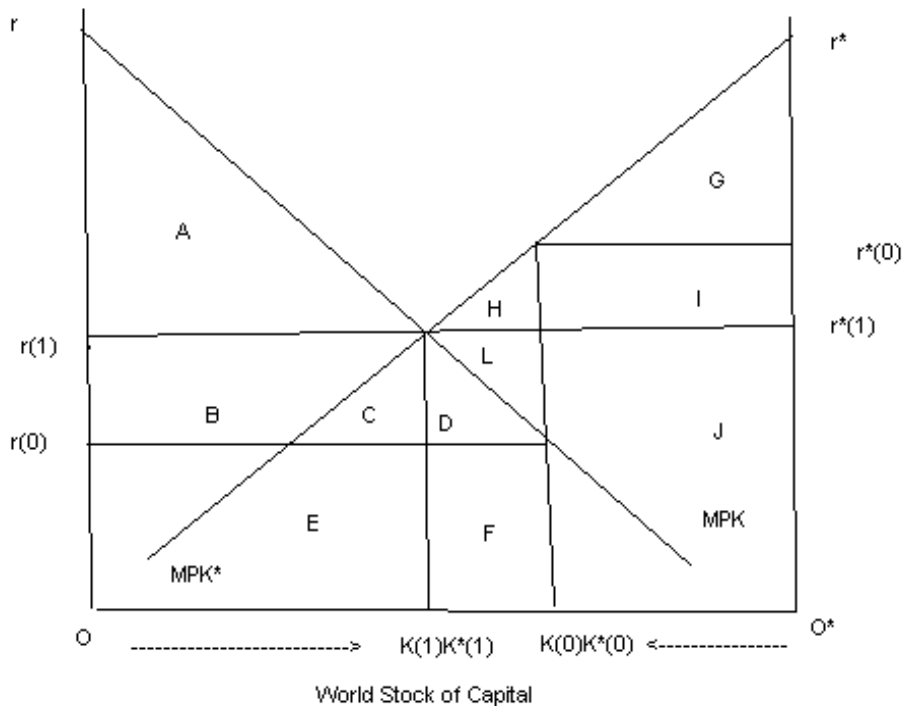
In the new equilibrium in which capital is mobile, capital owned by home residents is located both at home and abroad earns B+C+E+F+D+L. Home labour earns A.

Foreign capital (owned by foreigners) earns J. Foreign labour earns H+I+G.

Who gains and who loses from international mobility of capital?

Home labour finds that it earns A, whereas before it earned A+B+C+D.

Figure 5

Home (owned) capital now earns B+C+E+F+D+L whereas before it earned E+F.
There has been a transfer of income from labour to capital of B+C+D. Capital earned E+F before. There has been a net increase of income of L to the home country. This is paid to owners of capital.

Foreign labour now earns H+I+G whereas before it earned G.

Foreign (owned) capital now earns J whereas before it earned I+J.

There has been a transfer of income from foreign capital to foreign labour in the amount of I. There has been a net increase in income, H, to the foreign country. This increase is received by labour.

World income is higher by H+L. Both countries have gained.

<u>Labour and Capital Mobility</u>

Now consider a general proposition about factor mobility: if home labour owns its own capital, then either an inflow of labour or an inflow of capital will raise income to the pre-immigration inhabitants: those who we will refer to as the original inhabitants.

Let income be produced by labour and capital such that a doubling of inputs doubles output (for example, the Cobb-Douglas).

$$Y = F(K, L)$$

Writing output on a per capita basis means that we can express the production function in intensive form where it is described only in terms of the capital-labour ratio, $\left(\frac{K}{L}\right) \equiv k$:

$$y \equiv \frac{Y}{L} = F(\frac{K}{L}, 1) \equiv f(k)$$

The marginal product of capital is:

$$\frac{dy}{dk} = f'(k) = r$$

The marginal product of labour can be defined from the fundamental definition of income in terms of payments to the factors of production – in this case labour and capital:

$$Y = wL + rK$$

$$\left(\frac{Y}{L}\right) = w + r\left(\frac{K}{L}\right)$$

$$y - rk = w$$

Or written so as to expose the dependence on the capital-labour ratio:

$$f(k) - f'(k)k = w$$

Thus per capital income as a function of capital to labour ratio looks like:

$$y = [f(k) - kf'(k)] + f'(k)k$$

The Original Inhabitant's Income

Suppose we look at the income of who we are calling the original inhabitants, **L$_o$**, who are also those who own the original capital stock, **K$_o$**. This means we write original inhabitants income which we term **Y$_o$** as:

$$Y_o = wL_o + rK_o$$

Writing it in per capita form – per *original inhabitant*:

$$y_o = \left(\frac{Y_o}{L_o}\right) = w + r\left(\frac{K_o}{L_o}\right)$$

Or writing the original inhabitant's income as an explicit function of the capital-labour ratio, **k**, <u>and</u> the capital-labour ratio of the original inhabitants, **k$_o$**:

$$y_0 = [f(k) - kf'(k)] + f'(k)k_o$$

Now we ask the important question: how does the original inhabitant's income, **y$_o$**, change with a change in the economy-wide capital-labour ratio, **k**, since that is what immigration or capital flows will affect. To that end we differentiate the original inhabitant's income, **y$_o$**, with respect to **k** which is our economy-wide capital to labour ratio:

$$\frac{dy_o}{dk} = [f'(k) - kf'(k) - f'(k)] + k_o f''(k)$$

$$= (k_o - k)f''(k)$$

Notice that the change in income is a function of the capital-labor ratio and the original inhabitant's capital-labour ratio, k$_o$. Further, since f''(k) is the slope of the marginal product of capital schedule, f''(k)<0.

First look at the lower diagram in Figure 6. The upward sloping line represents the change in income of the original inhabitants when capital-labour, **k**, changes. Notice that the plot of $\frac{dy_o}{dk}$ crosses the k-axis at **k$_o$**. Notice, too, that the slope is negative since when k<k$_o$, the term $(k_o - k) > 0$ and $f''(k)$<0. At k_o, the slope is zero – where it crosses the horizontal axis. When **k>k$_o$**, then the $(k_o - k) < 0$ as is **f''**, so the expression is positive.

But, if this is the slope of **dy$_o$** when **k**, the economy-wide capital-labour ratio changes, then we can plot the <u>*level*</u> of the original inhabitant's income, **y$_o$**, as a function of **k**, as well. This is done in in the upper part of the figure.

Start at k_o. As we increase the capital-labour ratio to say **k'**, the level of income rises as the slope is positive. Thus the income of the original inhabitants increases with an inflow of capital.

Start at k_o. As we decrease the capital-labour ratio to say **k''**, the level of income rises as the slope is negative and we are reducing **k**, by say, increasing, for example, the stock of labour – increasing the denominator.

Except by allowing labour and capital into our country in *exactly the same proportions* as the owned capital to labour ratio of the original endowment, the original inhabitants will gain.
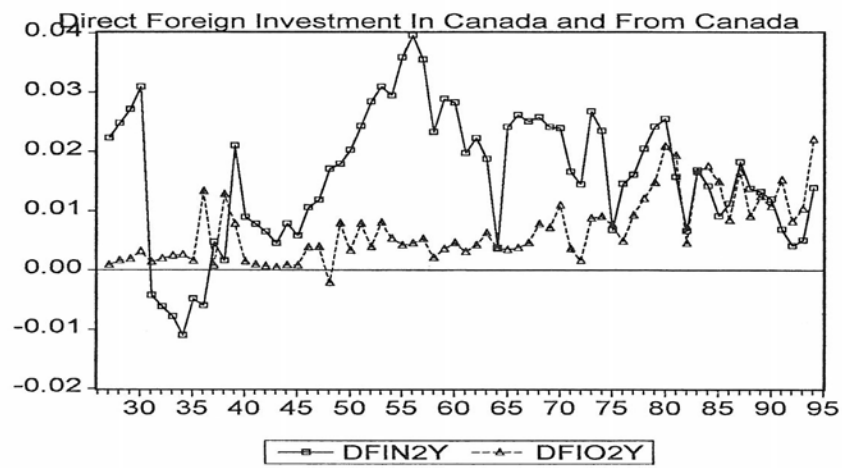
Figure 6: The Level and Rate of Change of Original Inhabitant's Income

y_o

y_o'

y_o''

k'' k_o k' k

dy_o/dk

$+$

0 k

k_o

$-$
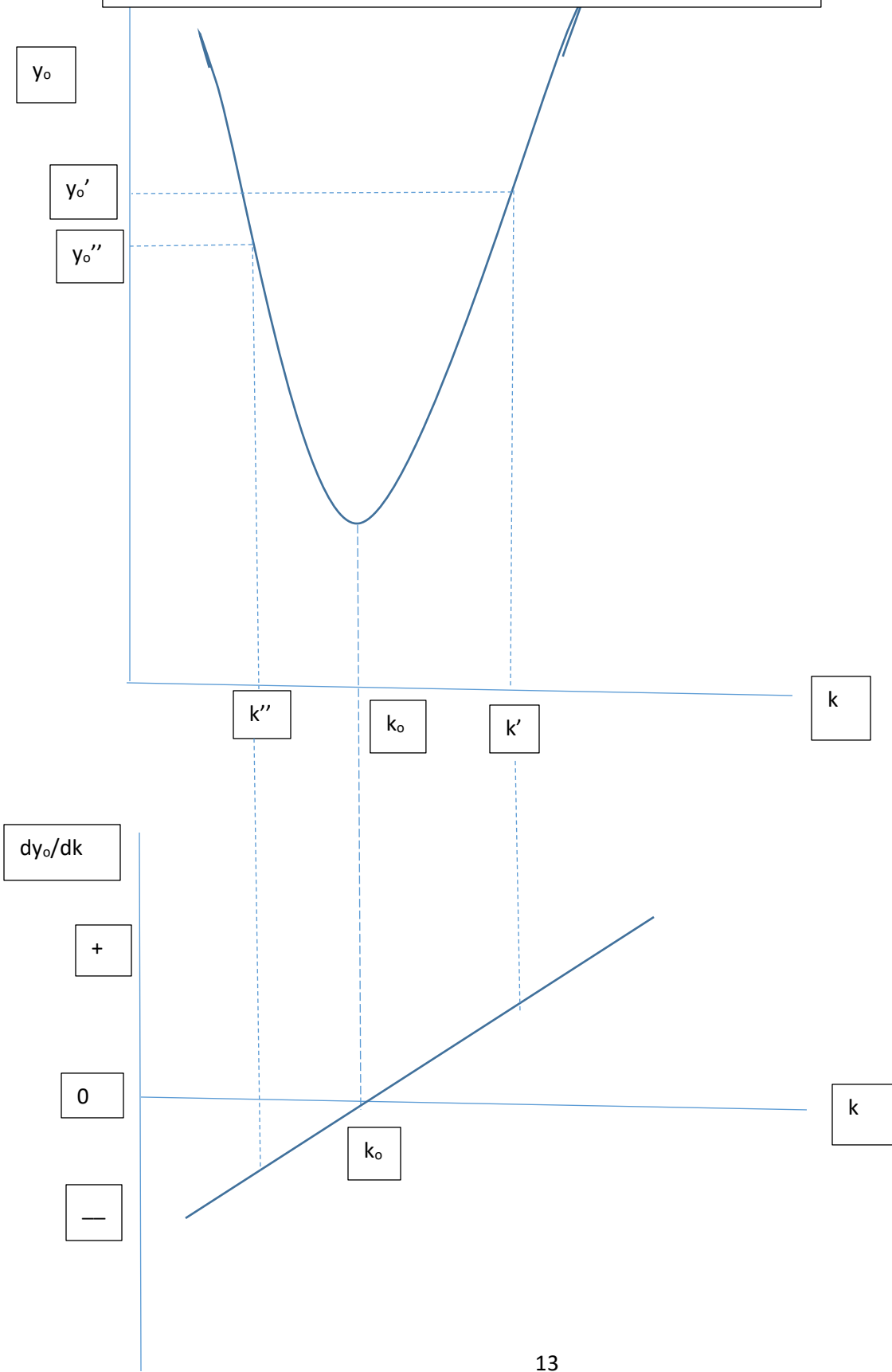
Appendix

Capital Flows in Canadian History

For those who are curious about the flow of capital into and out of Canada over a longer period.

Direct Foreign Investment In Canada and From Canada

Capital Flows: 1870-1926

Dollars per Capita

□ long/pop   + short/pop