Global Savings, Investment, and World Real Interest Rates

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- *Over the past 25 years, world long-term real interest rates have declined to levels not seen since the 1960s.*
- *This decline in the world real interest rate has been accompanied by falling world investment and savings rates. Looking at the behaviour of desired world savings and investment provides insights into the factors likely to have contributed to the decline in the world real interest rate.*
- *The behaviour of the world real interest rate has been affected by a number of key variables that change relatively slowly over time. These variables include labour force growth, which affects investment demand, and the age structure of the world economy, which influences savings. Other variables, such as the level of financial development, also affect savings.*
- *Since most of the key variables tend to change slowly, it is unlikely that they will be a source of significant changes in world interest rates in the near future.*

Over the past 25 years, long-term interest rates in the G–7 countries[1] have declined to levels not seen since the 1960s.[2] This decline reflects both a fall in inflation expectations and a decline in the real cost of borrowing. Although interest rates have increased in recent years with the cyclical expansion of the global economy and a moderate rise in inflation expectations, real long-term interest rates remain at their lowest level in more than 35 years.

As might be expected, the current low level of the world real interest rate is being closely linked to the other major international macroeconomic topic of concern; namely, large imbalances in current account positions among major countries, chiefly China and the United States. Although the two occurrences are undoubtedly related, it is interesting to note that while the emergence of global imbalances is a relatively recent phenomenon, the fall in real interest rates has developed gradually since the 1980s. Consequently, any investigation into the causes of the current low real interest rate must take into account not only the recent phenomenon, but also the long-term trends of the past 20 or more years (Knight 2006).

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1. The G–7 countries are Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

2. Increased integration of capital markets around the world has led to significant co-movement in national interest rates. The world interest rate shown in Chart 1 is based on the common component of ex ante five-year real long-term interest rates across the G–7 countries (see Box 1 for more details). For the other variables, the "world" is defined as 35 industrialized and emerging economies accounting for 94 per cent of the 2004 global real gross domestic product (GDP). See the Appendix for a description of the variables included in this study.

Box 1: Identifying the World Real Interest Rate

Ex Ante 5-Year Real Interest Rates for the G-7 Countries
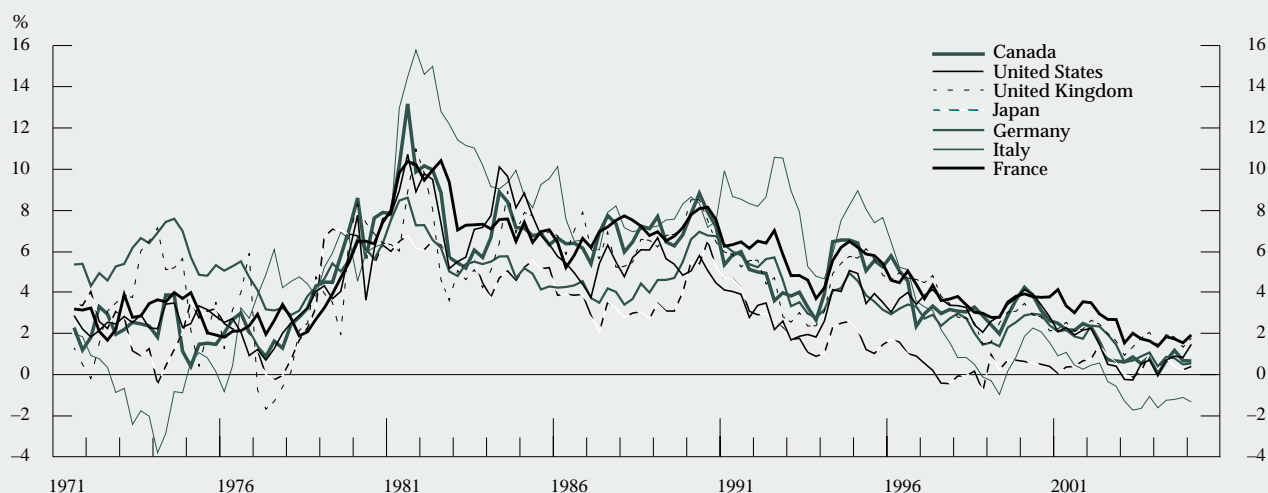
Source: BIS, IMF, Bank of Canada calculations

Over the years, global capital markets have become highly integrated, and it is readily apparent in Chart B1—which shows the ex ante 5-year real rates for G–7 countries over the period from 1971 to 2005—that real interest rates across countries tend to move together. Indeed, the correlation between real interest rates suggests that there is a common global component to G–7 real interest rates that could be referred to as a world real interest rate.[1]

As Chart B1 also illustrates, however, real interest rates on sovereign debt are generally not equalized across countries, especially for some less-developed economies.[2] There are several possible reasons for this divergence. Interest rates may differ across countries because of the existence of country-specific risk premiums, perhaps owing to the possibility of sovereign default in countries with potentially unsustainable government debt burdens,

or country-specific events such as the reunification of East and West Germany.[3]

The divergence can also be explained by the fact that capital markets are not fully integrated. For G–7 countries this is noticeable when the early period of relatively low real interest rates (1971–78) is compared with the recent period of low interest rates (from 1998 until today). The most obvious reason for this narrowing in real interest rate spreads is the removal of capital controls and financial regulations in the post-Bretton Woods era. Nevertheless, capital controls and regulations that limit arbitrage possibilities remain in a number of emerging markets and less-developed countries. China and India, for example, both employ capital controls that limit international capital flows, as well as an assortment of domestic controls aimed at directly influencing domestic interest rates.

Another possible reason for cross-country differences in observed real rates stems from an inability to define country-specific inflation expectations.[4] Any systemic measurement problem across economies (such as

1. Gagnon and Unferth (1995), for example, find strong evidence for, and were able to estimate, a common component to the real interest rate among a group of nine advanced economies, while Breedon, Henry, and Williams (1999) find evidence of a cointegrating relationship between the real interest rates on 10-year bond issues of the G–7 countries.

2. The hypothesis that real interest rates are not equal across countries has been confirmed by a number of studies. Mishkin (1982) found, for example, that short-term ex post real euro rates are not equal. Moreover, he found that real interest rates have dissimilar movements through time, although he could not rule out the tendency for real rates to converge over time. More recently, Gagnon and Unferth (1995) have also found that 12-month real rates differ significantly across economies.

3. A difference in real interest rates can also occur because of an expected movement in real exchange rates.

4. We estimate the inflation expectations using a regression for quarterly data on an index of consumer prices for each country. The functional form for the inflation regressions is an $AR\ (p)$; expected inflation is thus based solely on the history of inflation. The estimated $AR\ (p)$ processes have an order between 1 and 6, depending on the country, and the sum of the coefficients is between 0.98 and 1.02. The inflation expectations are calculated using 5-year ahead dynamic forecasts. Other measures of inflation expectations will be studied in future research.

The purpose of this article is to explore the global forces that have led to the decline in the world real interest rate over recent decades, including the key factors that have shaped the behaviour of desired world savings and investment. The article begins with a description of the general trends in the world real interest rate, as well as global savings-investment outcomes from both international and national perspectives. The key factors driving investment demand and desired savings are then summarized. Finally, the contributions of various factors are quantified, and some insight is provided into the factors of particular importance for policy-makers.

Trends in the World Real Interest Rate, Savings, and Investment

The world real interest rate has exhibited a downward trend since its peak in the early 1980s. Indeed, it returned to levels experienced in the 1970s only relatively recently (Chart 1). Chart 2 shows that this decline in the world real interest rate has been accompanied by falling world investment and savings rates.

Although global investment demand and the supply of savings are equalized through movements in the real interest rate, access to international capital markets means that the actual level of domestic savings and investment realized in any particular country need not be equalized. In recent years, developments in net national savings have been dominated by large short-falls in the United States and significant surpluses in the countries of emerging Asia and those belonging to the Organization of Oil-Exporting Countries.

In addition, the trends in gross savings and investment are not uniform worldwide (Charts 3 and 4). For example, Japan and the United States are the main sources of the decline in global savings, whereas the long-run decline in investment seems to stem from Japan and the other industrialized countries (Europe, Australia, and Canada). In contrast, emerging Asia has experienced growth in both investment and savings rates.[3]

This decline in the world real interest rate has been accompanied by falling world investment and savings rates.

In order to go beyond a simple description of the data, we need to adopt a framework for thinking about how global savings and investment decisions are made and how they affect world real interest rates and the level of savings and investment undertaken.

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3.   Although world savings and investment must be identical by definition, world savings and investment may not be exactly equal in practice. In our analysis, we focus on a subset of countries in the world economy that account for 94 per cent of world GDP; hence, savings and investment rates are not likely to be equal. Furthermore, measurement problems raise additional complications in that the two statistics rarely equal one another even when a universal data set is used.

Chart 1

World Interest Rates and Inflation Expectations

%
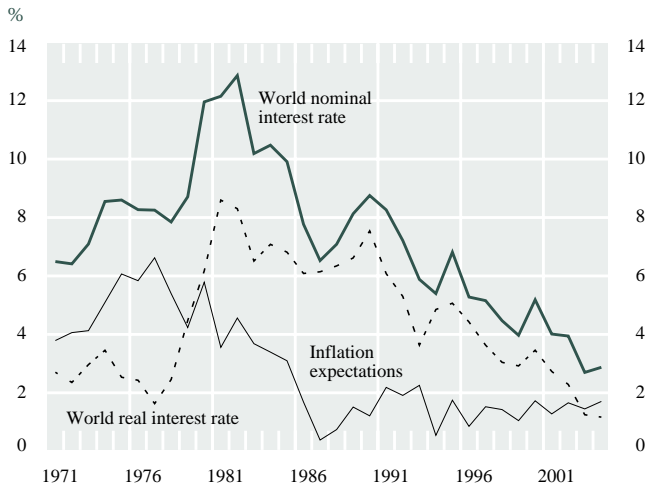
Source: World Bank, BIS, IMF, Bank of Canada calculations

Chart 2

Global Savings, Investment, and the Real Rate of Interest
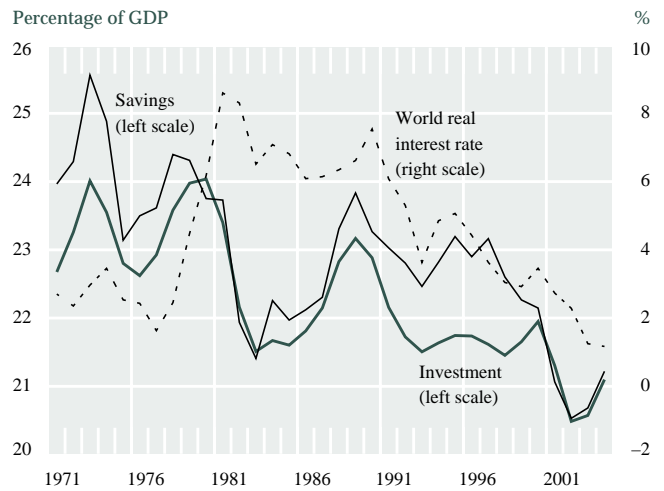
Percentage of GDP

Source: World Bank, BIS, IMF, Eurostat, national official sources, Bank of Canada calculations

Chart 3

Savings and Investment Rates among Industrialized Countries
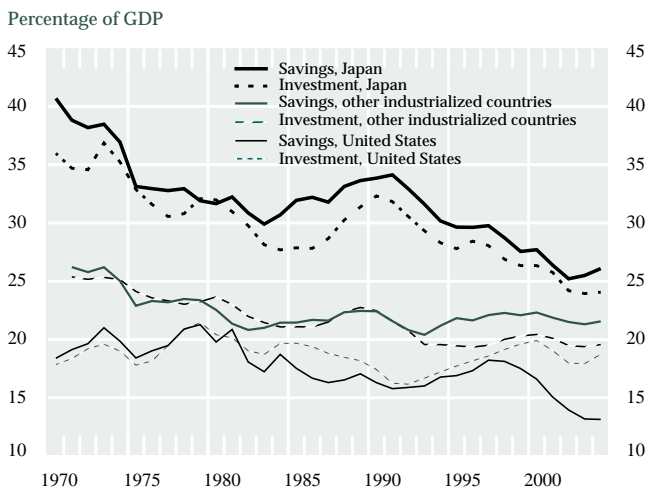
Percentage of GDP

Source: World Bank, BIS, IMF, Eurostat, national official sources, Bank of Canada calculations

Chart 4

Savings and Investment Rates among Non-Industrialized Countries

Percentage of GDP

Source: World Bank, BIS, IMF, Eurostat, national official sources, Bank of Canada calculations

The World Real Interest Rate and the Market for Savings and Investment

Economists agree that the real interest rate is determined in the market for investment and savings and thus by the forces of productivity and thrift. Hence, the real interest rate adjusts to equilibrate desired savings (providing the net supply of funds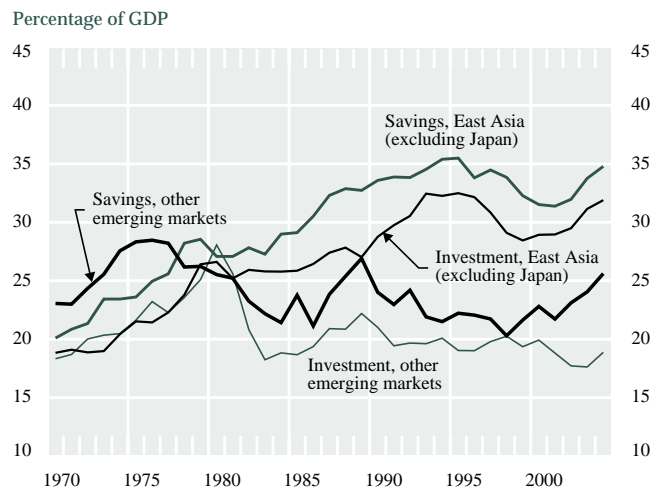) with desired investment (generating the net demand for funds).[4] In an increasingly integrated world economy with internationally mobile capital, the real rate of interest is determined largely by global forces in the world market. Thus, for relatively small open economies, the world real rate of interest is somewhat independent of domestic circumstances, especially over the medium-to-long term.

In an increasingly integrated world economy with internationally mobile capital, the real rate of interest is determined largely by global forces in the world market.

Chart 5 is a graphical depiction of the global market for savings and investment. The world real interest rate is plotted on the vertical axis, and the quantity of savings/investment is on the horizontal axis. The desired investment schedule (I) traces out the net demand for funds for various levels of the real interest rate, holding constant the other factors that influence investment decisions. Similarly, the desired savings schedule (S^1) is the net supply of funds at various interest rates, holding constant the other factors that influence savings decisions. The world real interest rate, otherwise known as the real cost of funds, is the key price that adjusts in order to equalize desired savings and investment. For example, if desired demand exceeds desired supply, then the cost of funds will be bid up until supply and demand for funds are equalized.

In order to take this framework to the point where we can track the historical evolution of real interest rates, we need to allow for shifts in both the desired savings

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4. The presence of an output gap would likely imply that the interest rate is not at its equilibrium level. In the empirical section, however, we assume that the long-run interest rate is in equilibrium.

and desired investment schedules. For example, Chart 5 shows the implications of a downward shift in desired savings, from S^1 to S^2. This shift would result in a shortfall of savings, leading to upward pressure on interest rates, which would result in a fall in investment until the shortfall in savings was eliminated.

Chart 6 presents a scatter plot of the world real interest rate against the realized world rate of investment/savings. One possible interpretation of Chart 6 is that the net supply of savings had two distinct periods: the first, which one might consider to be before 1979 (highlighted by the savings-supply curve $S_A S_A$), and a subsequent period after 1983 (illustrated by the curve $S_B S_B$). During each of these two periods, it appears that the savings-supply equation was *relatively* stable, suggesting that variations in investment demand could be the dominant factor driving changes in the world interest rate. For example, in the late 1970s, there appears to have been an increase in the level of desired investment (a shift in the investment demand curve, not shown), which caused excess demand in the market, pushing real interest rates up along the savings-supply locus $S_A S_A$. Between 1979 and 1983, however, interest rates seem to have been pushed higher, primarily owing to a reduction in global savings plans, as illustrated by the shift of the savings-supply curve from $S_A S_A$ to $S_B S_B$. In the period between 1983 and 1989, interest rates stayed high as investment demand remained strong. A final observation to be drawn from Chart 6 is that the low level of real interest rates that had appeared by 2004 seems more likely to be explained by a decade or more of weak investment demand than by an excess supply of savings. Indeed, relative to the early 1970s, when real interest rates were also low, the supply of global savings during and before 2004 appears to have fallen. Chart 6 naturally raises questions as to what caused these three significant shifts in desired savings and investment. With this in mind, the next section provides a conceptual overview of the key determinants of desired savings and investment.

What Drives Investment and Desired Savings?

Investment

Savings and investment decisions are made by each of the three sectors of the world economy: households, firms, and government. In the case of investment, however, firms are by far the most important source of investment demand.

Chart 5

The Market for Savings and Investment
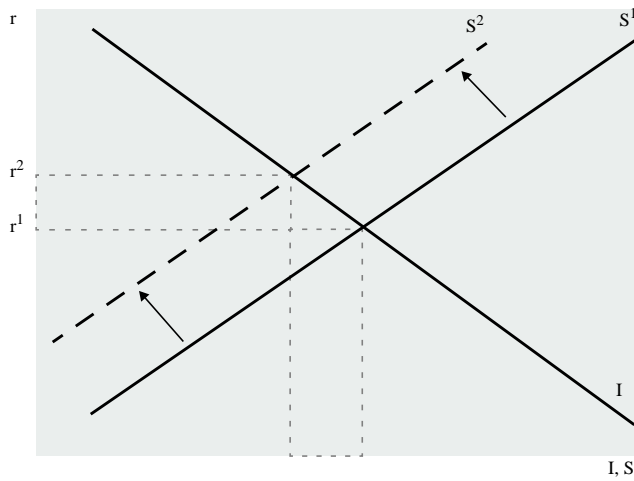
Chart 6

The Market for Savings and Investment

Real interest rate (%)

Savings, Investment (% of GDP)
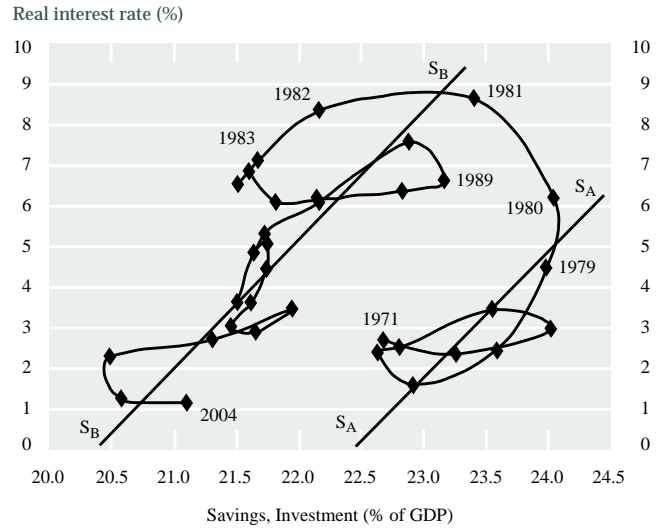
Source: World Bank, Eurostat, national data sources for individual
countries, BIS, Bank of Canada calculations

Chart 7

**Absence of Capital Market Regulations and
Trade Liberalization Index**
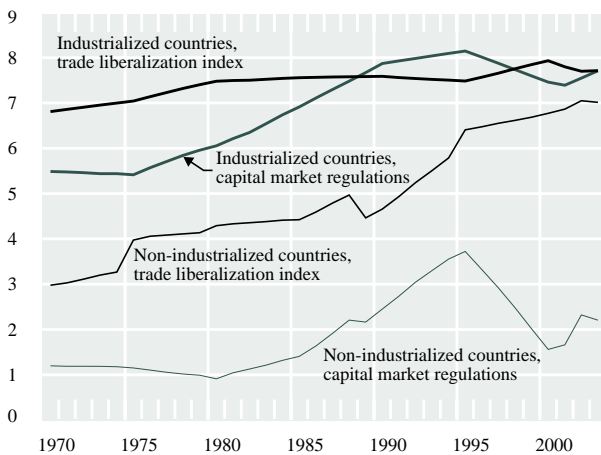
Note: An increase in the indexes represents a reduction in capital mar-
ket regulations or an increase in trade.

Source: Fraser Institute, Bank of Canada calculations

Chart 8

**Investment Rate and Growth of the Working-Age
Population**

Percentage of GDP   %

Source: World Bank, Eurostat, national date sources for individual
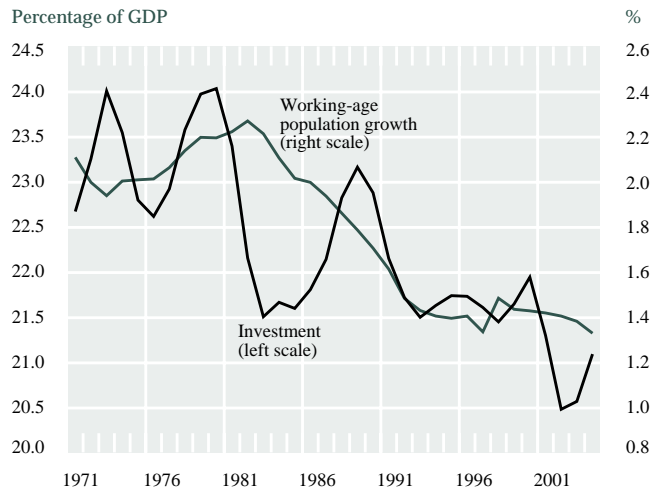countries, BIS, Bank of Canada calculations

Economic and financial liberalization

One of the most significant events affecting the global economy over the past 25 years has been the substantial reduction in capital controls, tariffs, and other impediments to economic integration (Chart 7). By allowing resources to move more freely to regions and sectors where the return is highest, the removal of such impediments is likely to have raised overall firm profitability and expected returns on investment, thereby stimulating global investment demand.[5]

Labour force growth

One important determinant of investment demand is labour force growth. Low rates of labour force growth combined with high ratios of capital to labour help to explain why many industrialized countries face an apparent dearth of investment opportunities,[6] since a fall in labour force growth means that less investment is required to equip the labour force with capital. The effect on investment is more significant when the production process is capital intensive.[7] Thus, an increase in labour force growth in countries that use labour-intensive production techniques will generate a smaller increase in investment demand than it would in countries that employ capital-intensive techniques.

> *One important determinant of investment demand is labour force growth.*

Chart 8 illustrates the GDP-weighted growth rate of the working-age population for the 35 countries in our data set, along with the world investment rate.[8] It can be seen that, although the growth rate of the working-age population increased between 1971 and 1982, it has generally fallen since then.[9] The data suggest that the behaviour of labour force growth could provide an explanation for two of the key trends mentioned earlier in our discussion of Chart 6—strong investment demand in the latter part of 1970s and the ongoing weakening of investment demand since the late 1980s.

Stock market returns

Another source of investment demand in addition to labour force growth is total factor productivity (TFP) growth. This factor, as well as other determinants of investment demand, are difficult to identify. Empirically, this problem can be partially addressed by examining the behaviour of stock prices.[10] Since the stock market is forward looking, stock market returns reflect expectations about a variety of factors and can contain information regarding shifts in the investment curve. A change in the marginal product of capital, for example, could be captured by movements in stock market returns.
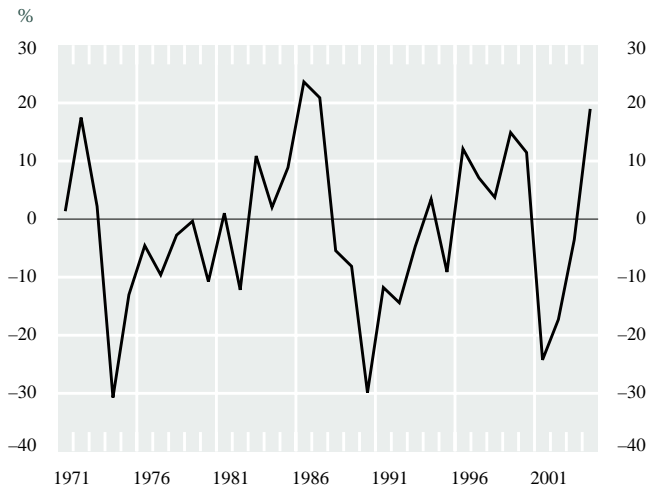
Although most firms are not listed on stock exchanges, particularly in small emerging economies, stock prices are generally known to reflect expected future profitability, and hence, the value that can be gained by the firm through investment. Favourable stock market returns are therefore associated with stronger investment demand. Chart 9 shows that high world real rates of interest in the period from 1981 to 1986 could have been partly driven by favourable stock returns (which stimulated investment and raised real interest rates).

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5. Financial liberalization was particularly important for many industrialized economies that substantially deregulated their domestic financial markets in the latter half of the 1970s. In emerging markets, the process of liberalization has been more gradual and still lags behind that of the industrialized economies. Indeed, the process of deregulation was partially reversed in the early 1990s, partly reflecting the experiences of many emerging markets with banking crises during the 1980s and 1990s.

6. This is discussed in Bernanke (2005).

7. This argument would be consistent with Leontief-style production functions in which each worker would have to be equipped with a certain amount of capital. Alternatively, the size of the labour force could affect investment demand by influencing demand for the final good.

8. The working-age population is used as a proxy for the labour force because of limitations on the availability of data. A more detailed measure of the labour force would also take into account participation rates and hours worked. Technically, for the reasons outlined in the text, the aggregate for the working-age population should be capital weighted. However estimates of capital stocks are often unreliable for the purposes of making international comparisons over time and are unavailable for many of the countries in our data set. We therefore use real GDP weights as a proxy. This is a reasonable approximation because larger economies typically have larger capital stocks.

9. The fall in labour force growth in the 1980s became especially important in industrialized countries as the impact of baby boomers entering the labour force diminished.
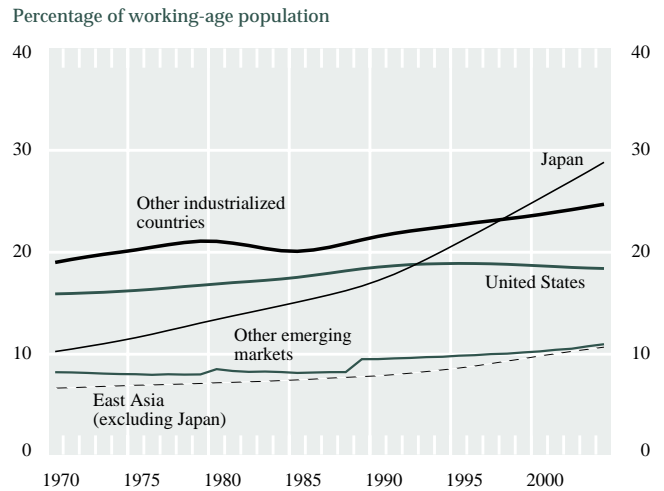
10. Investment demand can be explained by a variable resembling Tobin's q, which is a measure that summarizes all information about the future that is relevant to a firm's investment decisions. Measures of stock market returns are taken to be a proxy for future expected profitability. See the Appendix for a description of the variables.

Chart 9

Real Stock Market Returns

%

30 20 10 0 −10 −20 −30 −40

1971 1976 1981 1986 1991 1996 2001

Source: IMF

Chart 10

Elderly Dependency Ratio

Percentage of working-age population

40 30 20 10 0

Japan

Other industrialized countries

United States

Other emerging markets

East Asia (excluding Japan)

1970 1975 1980 1985 1990 1995 2000

Source: World Bank, Bank of Canada calculations

Chart 11

Youth Dependency Ratio

Percentage of working-age population

80 70 60 50 40 30 20 10 0

East Asia (excluding Japan)

Other emerging markets

United States

Other industrialized countries

Japan

1970 1975 1980 1985 1990 1995 2000
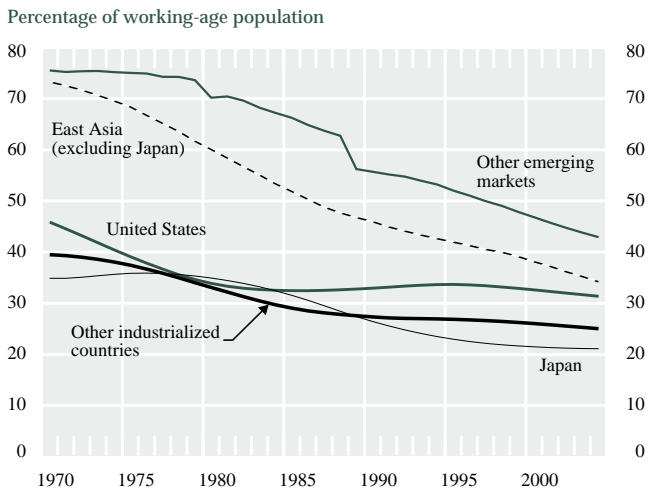
Source: World Bank, Bank of Canada calculations

Chart 12

Real Price of Oil

2000 = 100

US$

180 160 140 120 100 80 60 40 20 0

1972 1977 1982 1987 1992 1997 2002
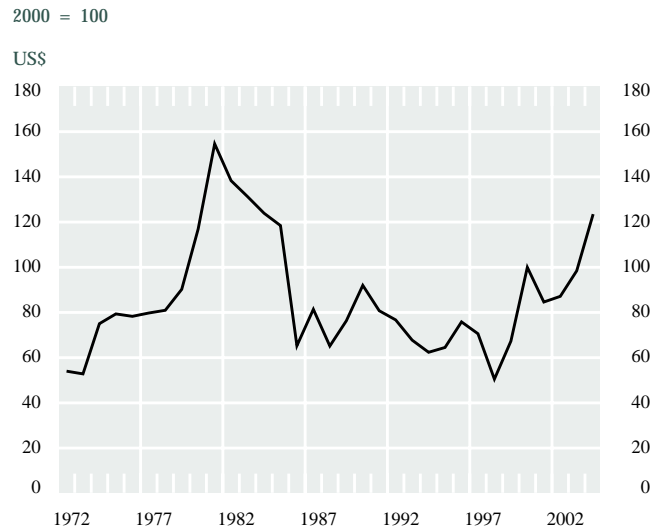
Source: IMF

Savings

While firms are the primary source of investment, savings plans by all three sectors of the world economy (households, firms, and government) have a significant effect on aggregate savings. This section describes the various factors that could provide an explanation for the decline in savings rates over the past 25 years.

Demographics

For households, savings decisions generally reflect a preference by individuals to smooth consumption over time. As a result of this consumption-smoothing preference, savings rates are thought to vary according to the individual's life cycle (Modigliani 1986). In particular, people are generally believed to have a relatively low ratio of savings to income when they are young and during the early stage of their careers, a high savings rate as they approach the end of their working life, and a low savings rate in retirement.[11]

Globally, the elderly dependency ratio (that is, those aged 65 and over relative to the population aged 15 to 64) has grown over time (Chart 10). This is true for most regions of the world, but particularly so in Japan, where the elderly dependency ratio rose from just over 10 per cent of the population in 1970 to close to 30 per cent in 2004. This trend would predict that savings rates should have declined over time.[12] On the other hand, the ratio of the young to the working-age population has fallen worldwide (Chart 11). These two effects tend to offset one another, making it unclear how they have affected the global savings rate over the past 25 years.

Fluctuations in income

Assuming that households prefer a smooth rather than a volatile consumption pattern over time, fluctuations in income are also likely to be an important determinant of movements of the savings rate (Friedman 1957). From the point of view of households, a temporary increase in real income (a windfall) can be expected to lead to a temporary increase in the savings rate as households try to save a larger portion of their income in order to finance a permanent rise in consumption. On the other hand, a permanent increase in income would imply a permanent increase in consumption and would therefore not require any changes in the savings rate in order for the household to enjoy a permanent increase in consumption.

We can think of the relative price of oil as an indicator of temporary world income.[13] From the point of view of households, a reduction in real incomes due to an increase in oil prices is likely to have relatively modest effects on aggregate consumption. However, since real incomes fall when oil prices rise, a temporary shock should cause savings rates to fall.[14] Chart 12 shows the real price of oil over time. Interestingly, the increase in oil prices in the early 1980s that is associated with the second oil shock is consistent with the sudden shift in the supply of savings that was hypothesized in Chart 6 (from S_AS_A to S_BS_B), but it doesn't explain why the savings rate remained persistently low thereafter.

Financial development

Although it is often overlooked, the state of development in the financial sector—reflected in its ability to mobilize savings, allocate capital, and facilitate risk management—should, in theory, also be an important explanation for household savings rates, but the theoretical arguments go in both directions, and the empirical evidence is mixed. On one hand, a well-developed financial sector could stimulate household savings rates by offering a greater variety of savings vehicles that offer a higher rate of return than might otherwise be the case (Edwards 1995). On the other hand, there is evidence that improved financial sector development can reduce household savings rates by relaxing household borrowing constraints or by providing better insurance instruments that reduce the demand for precautionary savings (Jappelli and Pagano 1994).

As was noted in the discussion on investment, the 1980s was a decade of financial liberalization, particularly for industrialized countries. The asymmetric process of financial liberalization is one reason why household savings in industrialized countries may have fallen relative to that in less-industrialized economies.

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11. Demographic trends also contribute to a shift in investors' portfolio preferences, affecting long-term interest rates. As a consequence of population aging, pension funds may shift their asset composition towards long-term bonds, contributing to lower yields. Although this portfolio reallocation might have magnified the recent decline in real interest rates, it cannot explain the long-run decline.

12. The empirical support for the life-cycle model of savings is mixed. Some studies find that households tend to save more than is predicted by the life-cycle model. A bequest motive is one possible explanation. Savings behaviour is also a function of life expectancy.

13. In their study of world real interest rates, Barro and Sala-i-Martin (1990) find that oil prices can be an important determinant of savings rates. In this regard, oil prices can also be thought of as a proxy variable, capturing factors such as disruptions of international markets, whose effects go beyond the immediate impact on the supply and demand of oil prices.

14. For oil exporters, however, a rise in oil prices would increase savings. The net effect of oil prices will be determined in the empirical results (p. 13).

More importantly for our study, the process of financial deregulation—given its timing, particularly in industrialized countries—could also explain why the supply of savings apparently remained weak in the 1980s after the effects of the oil crisis had diminished.

Fluctuations in corporate profits and the business regulatory environment

Firms, through their use of retained earnings, can also be an important source of savings. This has been particularly true over recent years, during which the corporate sector in the G–7 countries has gone from being a net borrower of funds to a net lender. One reason for this behaviour might be that firms see recent high profitability as temporary, and like households, are responding cautiously by using the windfall to finance future, rather than current, investment plans.[15] This postponement of investment implies that firms pay off debt rather than acquire new capital. Other determinants of savings may include regulatory and supervisory changes, which may have induced firms to try to improve their credit ratings.[16] This may be particularly true for financial sector firms, where improvements in supervisory standards and the removal of government guarantees have induced such firms to increase their capital base.

Fiscal and monetary policy

Governments also have a significant direct impact on aggregate savings. Governments are typically a source of dissaving because they have tended to run budget deficits by spending more than they raise in taxes. At times, the level of government dissaving around the globe has been substantial (Chart 13).[17] For this reason, fiscal deficits were a popular explanation for high world interest rates in the early to mid-1980s, when, as the analysis in Chart 6 indicates, savings appeared to fall significantly. Since then, fiscal deficits have declined dramatically, which, everything else remaining the same, should have led to higher savings and lower real interest rates.
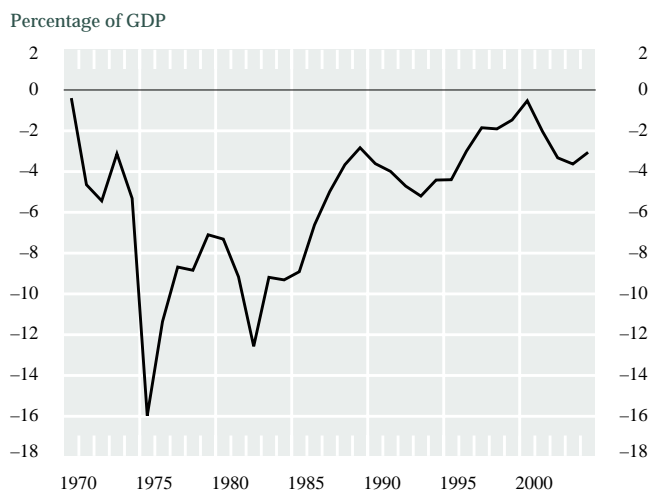
That said, households may have viewed the decrease in fiscal deficits as meaning that their future tax liabili-

Chart 13

Real Government Surplus

Percentage of GDP

Note: Excluding Mexico, Turkey, and Russia
Source: IMF, EIU, Eurostat, World Bank

ties were also being reduced.[18] If so, households can be expected to have responded to smaller deficits by lowering their savings and increasing their consumption. Thus, it is likely that the effect on aggregate savings of declining fiscal deficits may have been offset by lower household savings, albeit only partially. Empirical studies suggest that approximately one-third to one-half of any increase in government savings are offset by a decline in household savings (International Monetary Fund, IMF, 2005).

Monetary policy may also contribute to explaining the recent decline in real interest rates. Monetary policy credibility established over a long period may have caused part of the decline in long-term rates through a reduction in the inflation-risk premium.

World distribution of income

Lastly, some observers have argued that global savings and investment rates have been affected by a shift in the world distribution of income.[19] Since income has been growing faster in emerging markets with high savings rates and less-developed financial sectors (where borrowing constraints are more important)

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15. Lower desired investment could also reflect the absence of investment opportunities with sufficiently high expected returns.

16. For example, the U.S. Sarbanes-Oxley Act of 2002, which was enacted in response to financial scandals, introduced major changes in financial practices and corporate governance. Accounting changes also increased the demand for long-term bonds, contributing to the recent decline in bond yields.

17. The two troughs in 1975 and 1982 were periods of global recession.

18. The view that households will adjust their savings behaviour in response to changes in government spending because they take into account future tax liabilities is known as the Ricardian equivalence hypothesis. If true, aggregate savings should not respond to changes in government savings.

19. For example, if world income is redistributed from countries with low savings rates to countries with high savings rates, the world savings rate should rise, putting downward pressure on the world interest rate.

than in advanced economies with relatively low savings rates, the changing distribution of world income might be a possible explanation for the decline in world interest rates over recent years. We find, however, that the change in world income has not contributed significantly to changes in the world savings rate over time, because the fast-growing high savers do not yet represent a sufficiently large share of world savings for this effect to be dominant. This shift may become a more important factor in the future, however, as the importance of the high-saving economies grows.

In summary, many factors could account for the observed trends in the world real interest rate. The anecdotal evidence suggests that declining labour force growth may have been one important factor in the fall in investment demand since the mid-1980s, while the consequent decline in world interest rates would seem to account for the fall in savings during the same time. More difficult to explain is the fall in desired savings after 1979. There appears to have been a change in the relationship between the interest rate and the quantity of funds supplied. Graphically, Chart 6 shows, that, after 1979 the fall in desired savings appears to be the result of a leftward *shift* of the savings schedule rather than a movement *along* the curve (which would have been the case if savings had fallen in response to interest rate changes). The review of the evidence, however, points to several factors, including the effect from temporary rises in oil prices, financial deregulation, and the increasing ratio of elderly to young. The next section examines the results of a more formal empirical assessment of the issue.

Empirical Results

Within our empirical framework (see Box 2 for more details), we evaluate the contribution of several variables discussed in the previous section in driving investment demand and desired savings and in explaining the relatively low level of long-term real interest rates. Although we do not provide a framework to forecast long-term world interest rates, we provide policy-makers with some insight into those factors likely to be of particular importance.

The variation in the real rate of interest over time has been the subject of several studies. The relatively high level of the real rate of interest in the 1980s has been examined by Barro and Sala-i-Martin (1990). They offer partial answers regarding the determinants of world real interest rates in industrialized countries by measuring the shocks to investment demand against

changes in stock market returns, and shocks to desired savings against movements in oil prices. While stock market shocks were used to isolate shifts to expected profitability of investment, the relative price of oil is an indicator of temporary shifts in world income. Their results show that the key elements leading to high world real rates of interest in the period from 1981 to 1986 were favourable stock returns and relatively high oil prices.[20]

Within a broader empirical framework, the recent low level of real long-term interest rates has been studied by the International Monetary Fund (IMF) (2005). They show that the decline in public savings, financial sector reform, and demographic changes are the key factors in explaining movements in savings and investment rates between 1997 and 2004.

In considering how real interest rates are determined, we focus on the interaction between global savings and investment as described earlier (see Box 2 for more details on the empirical estimation and results). Our results are consistent with the literature on the determinants of savings and investment. In particular, increases in oil prices (reflecting temporary factors) represent a temporary negative income shock and appear to cause savings rates to fall. We also find that financial development is an important element in explaining the decline in savings rates, since improved financial sector development can relax borrowing constraints.[21] Demographic changes (for example, an increase in the ratio of elderly to young) are also significant in explaining the global fall in savings rates. Within our empirical framework, the decline in global investment rates is mainly explained by slower growth in the labour force, since a smaller increase in investment is required to equip the more slowly growing labour force with capital, and by lower stock market returns.

Our empirical framework allows us to decompose movements in the long-term world real interest rate. Chart B2 in Box 2 shows, for example, how the various explanatory variables contributed to the change in the world real interest rate over time, measured on the vertical axis. The contribution of each variable in explaining movements in the real interest rate is presented for the periods of interest in Chart 6:

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20. Within their empirical framework, the oil-price increase (proxy for temporary reduction in world income) represents a negative shock to desired savings that generates higher real interest rates.

21. This is captured by measures of private credit and domestic credit.

Box 2: Empirical Estimation and Results

To investigate the relative importance of the various determinants of the long-term world interest rate, a data set was compiled for 35 industrialized and emerging economies over the period from 1971 to 2004. The countries included in the data set accounted for 94 per cent of 2004 global real GDP, and the sample covers the full period since the breakdown of the Bretton Woods system and the substantial liberalization of global capital flows. The data set can thus be viewed as a reasonable representation of the global capital market.[1] The definitions of the series are found in the Appendix.

The empirical approach to estimating a real interest rate equation follows Barro and Sala-i-Martin (1990). Savings and investment rates (that is, divided by GDP) for each country are aggregated into world measures. The world savings[2] rate is, by definition, a GDP-weighted sum of country savings rates,

$$s_t = \sum_j s_{tj} \frac{y_{tj}}{y_t},$$

where time is denoted by t and each country is denoted by j.

The world investment rate is calculated in a similar manner. The world savings and investment rates are:

$$S = f(X^s, r)$$

$$I = f(X^i, r),$$

where X^s and X^i are vectors of exogenous global variables that explain shifts in global savings and investment, respectively, and r is the world real interest rate.

Savings and investment levels are jointly determined along with interest rates. In order to understand the impact of shifts in desired savings or investment, we must use the exogenous variables to identify separately the savings and investment functions specified above.[3]
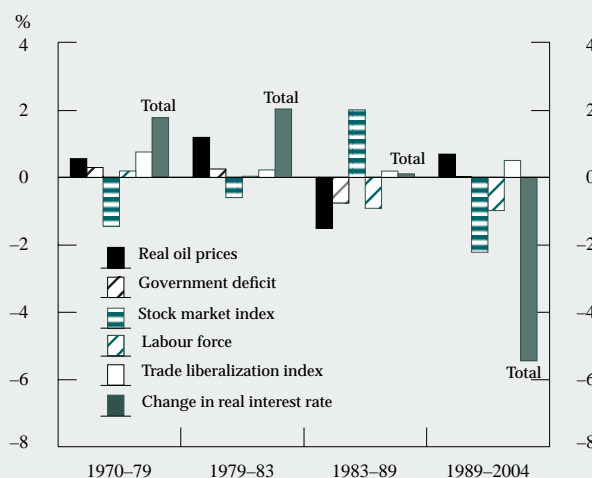
The results suggest that the key factors explaining the decline in savings and investment in the past 25 years

Chart B2

Decomposition of Movements in the World Real Interest Rate

Note: The constant, lags of savings and investment, dependency ratio, foreign exchange reserves, and industrial production are omitted from this chart for the sake of simplicity.

are variables that change relatively slowly over time. The variables affecting investment demand are found to include labour force growth, stock market returns, stock market volatility, and economic and financial liberalization. Desired savings is mainly explained by the age structure of the world economy, movements in real temporary income, and government deficits.[4] Other variables, such as the level of financial development (reflected in the ability to mobilize savings, to allocate capital, and to facilitate risk management) also affect savings (Chart B2). For more details on the empirical results, see Desroches and Francis (forthcoming).

1970–79, 1979–83, 1983–89, and 1989–2004. A negative contribution of a variable would indicate that this determinant contributes to the decline in the world real interest rate

In considering how real interest rates are determined, we focus on the interaction between global savings and investment.

There are several key findings. First, labour force growth has a particularly important effect on investment. While it explains only a modest portion of the increase in investment demand (and therefore the world interest rate) through 1982, from then on it accounts for a gradual decline in the world real interest rate of about 1.5 percentage points. The oil-price shock had a significant negative effect on savings and contributed to a rise in the real interest rate in 1979 that persisted through 1983. Chart B2 also shows that favourable stock market returns is a key variable accounting for high world real interest rates in the mid-1980s.

Conclusion

The foregoing discussion suggests that the behaviour of the world real interest rate has been affected by a number of key variables that change relatively slowly over time. These variables include labour force growth, which affects investment demand, and the age structure of the world economy, which affects savings. Other variables, such as the level of financial development (reflected in the ability to mobilize savings, to allocate capital, and to facilitate risk management) also influence savings. Since these variables adjust gradually, it is unlikely that they will be a source of significant changes in world interest rates in the near future.

Over the longer term, the analysis suggests that labour force growth is an important determinant of investment demand. Since labour force growth is likely to continue to fall for some time, it might be concluded that this source of downward pressure on interest rates will remain. This effect may be offset, however, by the fact that emerging markets are becoming more capital intensive. Thus, since labour force growth in these economies remains higher than in most industrialized countries, emerging markets are likely to become a more important source of investment demand than in the past.

The behaviour of the world real interest rate has been affected by a number of key variables that change relatively slowly over time.

These conclusions suggest that, over the long term, the interest rate is likely to continue to adjust slowly, reflecting long-term trends. In the short term, however, the empirical analysis implies that unexpected temporary shocks to income, due perhaps to fluctuations in oil prices, could lead to short-term fluctuations in savings behaviour and real interest rates.

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Appendix

Definitions and Sources of Variables

Note: Data are annual unless indicated otherwise. The global variables are real GDP-weighted sums of the 35 countries in our sample. Real GDP (at market exchange rates) was used to calculate the time-varying weights.

Nominal interest rate:	5-year government bonds, quarterly (BIS and IMF)
Inflation:	Consumer price (2000=100) inflation, quarterly (IMF)
Inflation expectations:	Constructed measure of expected inflation, quarterly (see Box 1) (authors' calculations)
Real interest rate:	Nominal interest rate minus expected inflation (authors' calculations)
Real GDP:	Real GDP at market exchange rates (deflator = 100 in 2000) (World Bank)
Savings rate:	Gross domestic savings (private and public) as a percentage of nominal GDP (World Bank and IMF)
Investment rate:	Gross domestic capital formation as a percentage of nominal GDP (World Bank and IMF)
Labour force:	Working-age population (aged 15–64) (World Bank)
Stock market returns:	Nominal returns are computed for December on industrial share prices. Consumer price inflation (December–December) was subtracted from the nominal returns to calculate the real returns (IMF).
Oil prices:	Ratio of oil prices (West Texas Intermediate) to U.S. producer price index (2000=100) (IMF)
Trade liberalization and capital market regulations:	Indexes indicating the extent of capital market regulations and trade liberalization. An increase in the indexes represents a reduction in capital market regulations or an increase in trade liberalization (Fraser Institute)
Dependency ratios:	*Elderly dependency ratio:* population aged 65 and over relative to the population aged 15–64 (World Bank) *Youth dependency ratio:* population aged 0–14 relative to the population aged 15–64 (World Bank) *Total dependency ratio:* population aged 0–14 and 65 and over relative to the population aged 15–64 (World Bank)
Budget deficit:	Ratio of real budget deficit to real GDP. The real budget deficit is the ratio of the nominal deficit to the December consumer price index (IMF, Economist Intelligence Unit, Eurostat, World Bank)[1]

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1. Other inflation-adjusted measures of the real deficit are discussed in Desroches and Francis (forthcoming).