

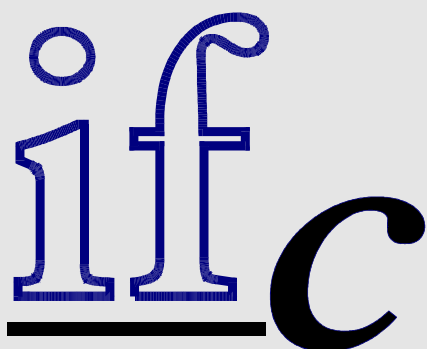
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IRVING FISHER COMMITTEE  
ON CENTRAL-BANK STATISTICS

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*ifc Bulletin*

No. 7 • October 2000



The Irving Fisher Committee is part  
of the International Statistical Institute

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**Do Derivatives Increase the Volatility  
of the Financial Markets?**

**New estimates of the UK term  
structure of interest rates**

**Irving Fisher and the Calendar  
Reform Movement**

**Seoul meeting 2001**

**Fisher's Short Stories on Wealth**



## Irving Fisher Committee on Central-Bank Statistics

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*Chairman:*

Marius van Nieuwkerk

*Executive Body:*

Marius van Nieuwkerk

Bart Meganck

Hans van Wijk

Paul van den Bergh (*Adviser*)

*Office:*

B. Meganck

Eurostat, Directorate B

Bâtiment Jean Monnet

L-2920 Luxembourg

Tel.: +352-4301-33533

Fax: +352-4301-34150

E-mail: bart.meganck@cec.eu.int

## IFC-Bulletin

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*Editor:*

Hans van Wijk

*Editorial Address:*

Burg. s'Jacoblaan 63

1401 BP Bussum

The Netherlands

Tel./Fax: +31-35-6931532

E-mail: wucwo@wxs.nl

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# ifc Bulletin

No 7 – October 2000

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## What is the IFC?

The Irving Fisher Committee (IFC) is a forum for discussion of statistical issues that are of interest to central banks. The Committee, which derives its name from the great American economist and statistician Irving Fisher, is part of the International Statistical Institute (ISI).

## Objectives

By providing a forum for discussion, the IFC aims at:

- participating in the discussion on adapting statistical systems to changing requirements;
- promoting the adoption of international statistical standards and methodologies;
- sharing experience on the development of new statistics and the implementation of new methods of collecting, compiling and disseminating statistical information;
- exchanging views between central bankers and academics on statistical methods and techniques;
- facilitating personal contacts between central-bank statisticians.

## Strategy

To achieve its objectives, the IFC organizes conferences at which papers are presented. These conferences take place both inside and outside the framework of the ISI's biennial sessions. The conferences are supported by the publication of the IFC Bulletin, in which conference papers are reproduced.

## What kind of topics are discussed?

Any kind of theoretical or practical statistical subject that has a relationship with the activities of central banks can be considered for discussion. The subjects will mostly be in the area of monetary, financial and balance of payments statistics.

## Membership and Structure

In principle, the IFC has no personal members. Central banks and other institutions interested in statistical systems and statistical techniques that have a bearing on the collection, compilation and distribution of central-bank statistics can become members by simple application. So far, more than 60 central banks and a number of other institutions have applied for membership. Members are entitled to appoint delegates to participate in the IFC's

activities and to contribute to its conferences by presenting papers.

The prime decision-taking body is the assembly of members' delegates at the "administrative meetings" that are organized within the framework of the ISI biennial sessions. Here the IFC's strategy is determined. At these meetings an Executive Body is elected, which is charged with the committee's day-to-day business and with the preparation of the "administrative meetings". Likewise, at the "administrative meetings" topics are proposed for future conferences, and a Programme Committee is elected to choose from these topics and to organize the conferences.

## A Short History

The Irving Fisher Committee (IFC) was established on the initiative of a number of central banks statisticians who were attending the ISI Corporate Members Meeting at the 1995 ISI Session in Beijing.

In 1997, during the 51st ISI Session in Istanbul, the IFC held its inaugural meeting. Inside the framework of the Istanbul Conference the IFC organized several sessions, on a variety of subjects. At the administrative meeting an Executive Body was established and it was decided to start publishing the IFC Bulletin devoted to the activities of the IFC.

In Helsinki, at the 52nd ISI Session, the IFC presented a programme comprising an invited papers session and a contributed papers session on "Globalisation of Markets and Cross-Border Holdings of Financial Assets", and a contributed papers session on "The Central Banks' Function in the Field of Statistics". Furthermore, the Committee held, in co-operation with the IAOS, a session on "How to measure deregulation". At the administrative meeting, decisions were taken about the IFC's future strategy. A new Executive Body was elected and a Programme Committee was instituted.

## IFC Bulletin

The IFC Bulletin is the official periodical of the Irving Fisher Committee. The Bulletin contains articles and the text of papers presented within the framework of the ISI Conferences. It also sees as its task the recording of interesting events concerning Fisher's life. Institutions and individuals active in the field of central bank statistics can subscribe to the Bulletin free of charge.

## News from the Committee

### IFC Conference Seoul, 2001 (within the framework of the 53rd ISI Session)

Since the publication of the previous issue of the IFC Bulletin (April 2000) work on the preparation of the IFC Conference in Seoul (22-29 August 2001) has continued. The programme of the conference is taking shape. We refer to page 18 for details. The IFC Conference (consisting of an Invited Papers Session, three Contributed Papers Sessions and an Administrative Meeting) is organised within the framework of the 53rd ISI Session.

#### IFC Executive Body and Programme Committee

**Marius van Nieuwkerk** (*Chairman*)

Deputy Director  
De Nederlandsche Bank  
P. O. Box 98  
1000 AB Amsterdam, Netherlands  
Tel.: +31-20-524 3337 Fax: +31-20-524 2526  
E-Mail: [m.van.nieuwkerk@dnb.nl](mailto:m.van.nieuwkerk@dnb.nl)

**Bart Meganck** (*Secretary*)

Directorate B  
Eurostat  
Bâtiment Jean Monnet  
Rue Alcide de Gasperi  
L-2920 Luxembourg  
Tel.: +352-4301-33533  
Fax: +352-4301-34150  
E-Mail: [bart.meganck@cec.eu.int](mailto:bart.meganck@cec.eu.int)

**Hans van Wijk** (*Editor IFC Bulletin*)

Burg. s'Jacoblaan 63  
1401 BP Bussum, Netherlands  
Tel./Fax: +31-35-6931532  
E-mail: [wucwo@wxs.nl](mailto:wucwo@wxs.nl)

*Adviser:* **Paul van den Bergh**

Bank for International Settlements  
Monetary and Economic Department  
4002 Basle, Switzerland  
Tel.: +41-61-2808432 Fax: +41-61-2809100  
E-Mail: [paul.van-den-bergh@bis.org](mailto:paul.van-den-bergh@bis.org)

**Carol Carson**

International Monetary Fund  
Statistics Department  
700 19th Street, NW  
Washington, DC 20431, USA  
Tel.: +1-202-6237900 Fax: +1-202-6236460  
E-Mail: [ccarson@imf.org](mailto:ccarson@imf.org)

**Satoru Hagino**

International Monetary Fund  
Statistics Department  
700 19th Street, NW  
Washington, DC 20431, USA  
[shagino@imf.org](mailto:shagino@imf.org)

**Józef Oleński**

National Bank of Poland  
Department of Statistics  
Ul. Świętokrzyska 11/21  
00919 Warsaw, Poland  
Tel.: +48-22-6531713 Fax: +48-22-6532263  
E-Mail: [nbpds@telbank.pl](mailto:nbpds@telbank.pl)

**Mediyamere Radipotsane**

Bank of Botswana  
P. O. Box 712 Gaborone, Private Bag 154  
Khama Crescent  
Gaborone, Botswana  
Tel.: +267-3606239 Fax: +267-309015  
E-Mail: [radipotsanem@bob.bw](mailto:radipotsanem@bob.bw)

## Independent IFC Conference in 2002

We are currently discussing with the BIS the possibility to organise the independent IFC conference in 2002 in Basle, Switzerland. The still very provisional programme envisaged for this conference is presented below.

### Provisional Programme for the Independent IFC Conference, 2002

#### **Challenges to Central Banks' Statistical Activities**

##### **Liberalisation of Financial Markets and BOP-compiling** (*invited papers session*)

Organiser: Meganck; Chairperson: Meganck; 2 discussants; 4 papers.

##### **Statistical Methods in Safeguarding the Quality of Statistics** (*invited papers session*)

Organiser: Lehtonen; Chairperson: Lehtonen; 2 discussants; 4 papers.

##### **Central Bank Statistics in a Multi-national Set-up** (*invited papers session*)

Organiser: Carson/IMF; Chairperson: (?);  
4 papers, 2 discussants.

##### **Statistics and Transparency** (*contributed papers session*)

Organisers: Schubert/Nesvadba; Chairperson: Schubert or Nesvadba;  
as many papers as possible.

##### **Statistics and Information Technology** (*contributed papers session*)

Organiser: Oleński; Chairperson: (?);  
as many papers as possible.

## Executive Body

Mr Bart Meganck has been appointed director of Directorate B (Economic statistics and economic and monetary convergence) of Eurostat, but will remain Secretary of the Irving Fisher Committee. Consequently, the address of the IFC Secretariat has changed (see Box "Executive Body and Programme Committee"). Mr Meganck left the National Bank of Belgium on 1 October to start his new function in Luxembourg.

The Executive Body has approached Mr Paul van den Bergh of the Bank for International Settlements with the request to act as its adviser. The Executive Body is happy to announce that Mr Van den Bergh has positively reacted to this request. At the next "Administrative Meeting" (in Seoul), Mr Van den Bergh will be nominated for membership of the Executive Body.

## IFC Web site

Presently, arrangements are being made to set up a Web site for the Irving Fisher Committee. A provisional site can be visited on the following address: [www.ifcommittee.org](http://www.ifcommittee.org). It is intended to make the content of the issues of the IFC Bulletin available on this site.

## The IFC Bulletin

The IFC Bulletin offers a means of communication between the members of the IFC. Copies of the IFC Bulletin are distributed to a considerable number of central banks and other institutions that have made known their interest. Additional copies can be requested from the Secretary.

### **This issue**

This issue contains three articles. The first one, by Professor Mattheus van der Nat investigates whether the volatility of financial markets is affected by the use of derivatives. The second one, by John Sleath (Bank of England) sheds light on a new method of estimating the yield curve. Dr Arthur Vogt contributes to this issue with another article highlighting one of Irving Fisher's areas of interest: calendar reform. The publication of Fisher's "Short Stories on Wealth" is continued with a series on income and wealth distribution.

# Do Derivatives Increase the Volatility of the Financial Markets?

*Mattheus van der Nat*

## 1. Introduction

This paper discusses the risk that financial markets become more volatile and destabilised by the increasing use of financial derivatives. Several studies examine such effects as one of the possible triggers for a crisis in the financial system as a whole, however they fail to reach definitive conclusions (BIS [1992], Directorate General for Research [1995], Global Derivatives Study Group [1993]). This issue is extremely important, because the fear of such systemic crises is one of the motives for [regulators and other] authorities to consider regulation of the derivative markets (GAO[1994], Van der Nat [1996]).

A great many studies have investigated whether a general relationship could be found between the impact of increasing derivative activities and the level of volatility on financial markets. One testable hypothesis (Global Derivatives Study Group [1993], p. 137) could be that derivative trading would reduce the barriers between markets. This would mean shocks in one part of the financial system could be transmitted faster and farther than was previously possible, consequently resulting in increasing market volatility.

Until now there is no well-founded argument for or against such a hypothesis. Several authors believe that theoretical analyses will not provide a definite answer and emphasise the importance of empirical research (Akgiray [1989]). In practice most studies on the relationship between derivative activities and market volatility are indeed empirical. They focus on special markets, varying from treasury securities and shares to commodities, and try to draw conclusions by analysing volatility levels before and after the introduction of derivatives. Most of these research studies (including, amongst many others: Damodaran and Lim [1991] and Antoniou and Foster [1992]) do not indicate increasing volatilities as a result of derivative use. On the contrary, they suggest decreasing volatility. Only a few reports on stock index futures point to increasing volatility (Harris [1989], Antoniou and Holmes [1995], Gulen and Mayhew [2000], and this last study only found this to be true for two of the 25 markets examined). Several authors that have summarised empirical studies carefully conclude, with reservation, that the majority of these empirical studies indicate decreasing volatility (Damodaran and Subrahmanyam [1992], Smithson [1998], chapter 3). Other authors have in fact asserted that the use of derivatives may reduce systemic risks by diffusing market shocks (Edwards [1995]). However, there is every reason to question whether absolute conclusions may be drawn. It is important to realise that the scope of most studies was necessarily restricted, as analyses of the volatility of over-the-counter markets have scarcely been reported, for obvious reasons.

## 2. The Model

In this paper a simple theoretical model is presented that may explain why most empirical research studies do not indicate increasing volatilities of underlying markets as a result of using derivatives. However, the model also indicates that volatility may also increase depending on the specific mar-

ket circumstances. The most important insight offered by the model is that it is impossible to draw a general conclusion concerning the impact of derivatives on underlying markets. It suggests that in all financial markets the impact depends on the specific situation and may even change from time to time. If this hypothesis, which essentially runs counter to that discussed in the introduction, would prove correct in practice, then further research is thoroughly justified to determine whether or not regulation of the derivative market is necessary.

In this model it is assumed that the price movement of cash (spot) instruments is determined by three elements, defined as a function of time  $t$ .

$X(t)$  : The market trend as indicated by the forward rates.

$Y(t)$  : The effect of market sentiment.

$Z(t)$  : The random behaviour related to the trend.

$X(t)$ ,  $Y(t)$  and  $Z(t)$  are assumed to be mutually independent, whereas for the spot price  $P(t)$  the relation  $P(t) = X(t) + Y(t) + Z(t)$  holds. Naturally, the analyses of  $X(t)$  and  $Z(t)$  are in line with traditional market analyses while  $Y(t)$  deserves special attention. The market sentiment element reflects situations wherein financial markets are driven more by psychological or other non-rational mechanisms than would be expected in efficient markets with rational market players. For many dealers at financial institutions this is a well-known phenomenon. Some authors who generally assume rational behaviour from market players acknowledge such aberrant market sentiment in that sense that they believe managers of financial institutions must be aware of the possibility that their employees could be carried away by non-rational mechanisms (Davis [1995] pp. 356-347).

The basic assumption of the model is that the effect of market sentiment is influenced by the extent to which financial derivatives are used. The advantage of this approach is that this  $Y(t)$  effect can be analysed completely separately from other elements. This last analysis will resemble that of the forced vibrations in classical mechanics. The factor  $Y(t)$  vanishes of course in situations wherein market sentiment does not play any role. However, the following sections will illustrate that under particular circumstances even a very small degree of market sentiment may induce large consequences.

A sharp distinction is made in this paper between the factors  $X(t)$  and  $Z(t)$  that together reflect the normal market changes on the one hand, and the factor  $Y(t)$  reflecting market sentiment on the other hand. This distinction somewhat resembles the distinction between fundamental volatility dependent on market circumstances, and the transitory noise caused by trading by irrational traders (Hwang and Satchel [2000]). However, there are differences. In the model developed in this paper the effects of increasing use of financial derivatives are only expressed in the behaviour of the  $Y(t)$  factor. In the statistical approach using fundamental volatility and transitory noises the derivative markets can influence both factors.

### 3. Forced Deviations from the Market Trend

In other words  $Y(t)$  has been defined as a deviation from the normal market trend, triggered by market sentiment that can be considered as an external factor. If market sentiment were to vanish completely, this deviation would also vanish within a short time. This suggests a further refinement of the model in the sense that market sentiment moving in one direction, always evokes an opposite force that aims to bring prices back to their normal market level. The combined effect of these forces determines whether the deviation will increase faster or not, as formulated in the behaviour of the second differential derivative of  $Y(t)$ :

$$\frac{d^2 Y(t)}{dt^2} = Y_1(t) + Y_2(t),$$

wherein  $Y_1(t)$  could be interpreted as the effect of the market players who rely on their subjective market feelings and  $Y_2(t)$  could be interpreted as the effect of other market players who analyse the market trend and who increasingly believe in a reversal of the price movement as the deviation becomes more substantial.

### 4. Counteractive Forces

The larger the deviations of the market trend, the larger the assumed degree of market sentiment leading to these deviations. There is an obviously similar association based on the speed with which these deviations arose. It is reasonable to assume that cases where market sentiment is more



prevalent and faster acting will evoke corresponding counteractive forces. To express such associations the following formula for the counteractive effect of  $Y_2(t)$  is assumed:

$$Y_2(t) = -A * Y(t) - B * \frac{dY(t)}{dt},$$

with  $A$  and  $B$  as constants. It is enlightening to see what would happen if at  $t = 0$  a deviation from the market trend would have been evoked by market sentiment and market sentiment vanished completely from that moment on. Substituting  $Y_1(t) = 0$  these assumptions would result in the differential equation:

$$\frac{d^2Y(t)}{dt} = -A * Y(t) - B * \frac{dY(t)}{dt}.$$

This linear differential equation and its solution are well known in mathematical analysis and in classical mechanics. Assuming that the first counteractive power is the most important one by starting from the additional assumption  $A > B^2/4$ , this differential equation results in the following general solution  $YA(t)$  :

$$YA(t) = c_1 * \exp(-c_2 * t) * \cos(c_3 * t - c_4), \text{ with}$$

$$c_2 = B/2, \quad c_3 = (A - B^2/4)^{0.5},$$

and  $c_1$  and  $c_4$  non-negative constants determined by the initial conditions for  $t = 0$ . The function  $YA(t)$  represents a dampened cosine function. In the beginning the oscillating character is prominent, but gradually the maximum and minimum become smaller and smaller. The interpretation of  $YA(t)$  is straightforward. After the market sentiment has disappeared the rational market players try to restore the stable situation as determined by the market trend. For instance suppose that USD forwards against the DEM are overpriced due to past market sentiment. This would mean the supply of USD forwards could increase as the demand decreases, resulting in a decreasing USD forward price. However, once the equilibrium price is reached, these movements do not stop directly but continue in order to reverse later back towards the equilibrium position from the other side. In this model the real market prices oscillate around the equilibrium position, although these oscillations will become weaker and weaker.

## 5. Market Sentiment

The large unknown factor in the development of financial markets is the influence of market sentiment. Merely based on the very subjective nature of market sentiment, perhaps one should accept that a general applicable theory on this subject does not exist. In this paper the assumption is made that the direction of market sentiment periodically changes and demonstrates a somewhat similar behaviour to  $Y(t)$  in situations without remaining market sentiment as described above. In a certain sense the effect of the market sentiment may then be interpreted as following the trend. Based on these assumptions the influence of market sentiment  $Y_1(t)$  could also be described as a cosine function:

$$Y_1(t) = C * \cos(D * t),$$

with  $C$  and  $D$  as constants. Including this market sentiment element, the following differential equation describes the behaviour of  $Y(t)$ .

$$\frac{d^2Y(t)}{dt^2} = C * \cos(D * t) - A * Y(t) - B * \frac{dY(t)}{dt}.$$

In physics this differential equation describes the motion of a body under periodic force and the following general solution is well known for  $A > B^2/4$ . In fact the model described in this paper is analogous to this physics theory.

$$Y(t) = YA(t) + YB(t),$$

with  $YA(t)$  as described above and

$YB(t) = c_5 * \cos(c_6 * t - c_7)$ , with

$$c_5 = C / ((D^2 - A)^2 + B^2 * D^2)^{0.5}$$

$c_6 = D$  and

$$c_7 = \arctan(B * D / (D^2 - A)).$$

Remembering that the function  $YA(t)$  describes gradually vanishing fluctuations centred around an equilibrium position, the conclusion is justified that after some time the behaviour of  $Y(t)$  is fully described by  $YB(t)$ . Further conclusions may then be drawn by comparing  $YB(t)$  and  $Y_1(t)$ . The first observation can be that the frequency of the fluctuations of the price function  $Y(t)$  around the equilibrium position  $Y(t) = 0$  is equal to the frequency of the market sentiment effect  $Y_1(t)$ . However, there is a time lag because of the constant  $c_7$ . The conclusion is that the influence of market sentiment in the model is substantial, yet it should not be exaggerated: generally speaking the influence relates only to the deviations  $Y(t)$  from the market trend  $X(t)$  and not to  $X(t)$  itself. The following sections assert that the model allows for both increasing and decreasing volatility in the use of derivatives. What will happen in reality depends on the specific situation.

## 6. Increasing Financial Instability in Special Situations

As previously explained, after some time the frequency of market sentiment as expressed in the constant  $D$  determines the periodicity in the market fluctuations of  $Y(t)$ . But the frequency of market sentiment also determines the amplitude  $c_5$ , that indicates the magnitude of the deviations from  $Y(t) = 0$ . The maximum value of  $c_5$  is:

$$c_5 \text{ max} = \frac{C}{B * (A - B^2/4)^{0.5}}.$$

This maximum is reached when the frequency  $D$  of market sentiment equals the frequency  $D_{max}$ , which in classical mechanics is called the resonance frequency, with

$$D_{max} = (A - B^2/4)^{0.5}.$$

Let us suppose that the constant  $B$  is very small. This means that the powers counteracting the market sentiment are dependent only on the deviations of the equilibrium position, so that the speed with which these deviations originated does not determine these forces. In these situations two important properties apply:

- The resonance frequency  $D_{max}$  equals approximately the constant  $c_3$  that expresses, again following the usage in physics, the natural frequency of the gradually vanishing fluctuations that would occur without market sentiment.
- When the frequency of the market sentiment  $D$  equals the resonance frequency  $D_{max}$ , the amplitude  $c_5$  will be very substantial.

In such situations even a relatively small degree of market sentiment could precipitate very large deviations around the equilibrium position. It is reasonable to assume that as the deviations become larger, the chance increases of a breakdown in the financial system and very substantial instability. It can therefore be concluded that market sentiment that immediately follows the real market trend may present a very serious threat to stability. However, the situation changes radically when market sentiment does not immediately follow the trend, as described in the following sections.

## 7. Decreasing Volatility through the Use of Derivatives

It is important to realise that derivatives are not only used by speculators, but by rational market players. These market players in particular try to hedge their financial positions when they arise without waiting for changing markets. Inasmuch as they refrain from hedging financial contracts, they do so because they expect that deviations from the market trends as deduced from the forward rates are only temporary. However, unexpectedly unfavourable market changes stimulate them to

hedge their positions as soon as possible to stop further losses. The effect of increased use of derivatives by this category of market players is an increasing counteractive force against non-rational market sentiment. Of course, speculators who use derivatives want to lock in their profits or stop their losses and they too work against a changing market. These effects may result in a larger value for the constant  $A$  and therefore in a decreasing amplitude  $c_5$ . As a final consequence, volatility of course decreases.

The key in this explanation of decreasing volatility is the increase in counteractive forces. At this point one could consider the derivative markets and the underlying markets as a whole. On the other hand, a distinct approach to these two markets is thinkable too. For instance, one could explain the increasing counteractive values in the underlying markets as the result of a shift of less well-informed and speculative traders to the derivative markets (for recent research concerning the hypothetical existence of such a shift see Bechetti and Caggese [2000]).

## 8. Increasing Volatility through the Use of Derivatives

On the other hand there are also market players that follow market sentiment and use derivatives to gain additional profit from their own market estimates. Of course in this category one can also find players that manage only real financial positions. But there are also market players that enter into speculative positions without underlying value in the expectation that the indications provided by market sentiment will be realised. In this case, the effect of an increasing use of derivatives is a stronger influence on market sentiment as expressed by a larger value of  $C$ . This effect results in larger deviations of the market trend and therefore in a higher volatility. However, this is not where the story ends. The use of derivatives could also give these market players opportunities to act faster and more effectively in the financial markets. An increasing use of derivatives for this purpose could change the constant  $D$  that expresses the frequency of market sentiment. In theory  $D$  could move towards the resonance frequency  $D_{max}$  and deliver a very substantial degree of volatility as described above.

## 9. Conclusions

As discussed above, several authors have empirically investigated the influence of the use of derivatives on the volatility of underlying markets. Surveys of these investigations suggest decreasing volatility. Several authors argue that the use of derivatives may absorb the effects of shocks in the financial markets more effectively. That would reduce the influence of such shocks on volatility. However, the empirical and theoretical results are limited and a number of deviant empirical results have been reported. Therefore, future exceptions that demonstrate an increasing level of volatility, whether or not temporarily, cannot be excluded.

The model described in this paper provides insight into two opposite movements. On the one hand there is reason to assume that an increasing use of derivatives could result in a counteractive force against market sentiment that would reduce volatility. On the other hand there is clear evidence that an increasing use of the derivatives could also lead to a certain enlargement of market sentiment that would increase volatility. In reality of course, both effects may appear together. Determining for the net effect is whether the more rational market players predominate that base their actions on the normal market trends and are often risk averse or whether the more speculative market players dominate that are motivated by market sentiment. In the first case volatility decreases while in the second volatility increases. The model fits with conclusions from empirical research indicating that changing volatilities cannot be explained by rational traders only (amongst others: Schwert [1989], Hwang and Satchell [2000]). As an example of a possible theoretical approach it may provide some insight into the relationship between rational behaviour and market sentiment, as well as the influence of the increasing use of derivatives on this relationship, using some relatively simple assumptions.

Of course in practice the distinction between the two categories of market players is not so clear. In general terms the model described in this paper is a simplification of the reality based on a special situation and other approaches are plausible. However, this theory suggests that the impact of the use of derivatives depends on the volume as well as the purpose of derivatives use. If there is substantial volume and use is for the most part speculative, then a strong increase in volatility could theoretically present a danger. In the special case of resonance, even a substantial financial crisis could hypothetically arise. However, in other situations decreasing volatility could be expected. The model strongly indicates that a general conclusion concerning the impact of derivatives on the underlying markets cannot be drawn. It is a theoretical justification for taking a

sceptical stance towards drawing general conclusions based on empirical research.

Perhaps it is wise to remain agnostic on the point of volatility as Davis recommends, because in certain situations strong a priori reasons may be adduced for volatility transfer (Davis [1995], p. 313). The theoretical model developed in this paper provides an additional indication that it is too early to draw definitive conclusions.

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## Summary

*This paper discusses the risk that the interest rate and currency markets will become more volatile and destabilised by the increasing use of financial derivatives. The basic hypothesis is that volatilities partially originate from irrational and psychological factors, or so-called market sentiment. A simple theoretical model is presented that provides insight into two opposite movements. On the one hand the availability of derivatives could reinforce the influence of market sentiment on volatility. On the other hand, there is reason to assume that the increasing use of derivatives could*

*have a counteractive impact against market sentiment that would reduce volatility. What determines the net effect is which of the following predominates: the more rational market players that base their actions on normal market trends and are often risk averse predominate, or the more speculative market players that are led by market sentiment.*

*Keywords:* Financial markets, volatility, derivatives, and market sentiment.

*Key results:* The theory developed suggests that no general rule can be applied regarding the impact of derivatives on the underlying markets. The impact depends on the volume as well as the purpose of their use.

*Abbreviated heading:* Derivatives and volatility.

*The Author:* Mattheus van der Nat studied mathematics and physics at the University of Leiden. After several years of research at the University of Leiden, he joined (then) Bank Mees & Hope in Rotterdam as a management trainee (1980). Thereafter, he held several positions in the bank's credit department. In 1987 he joined (then) AMRO Bank in Amsterdam, as head of product management of AMRO Treasury Manager (electronic banking). After a period as an alderman for economic affairs for the City of Leiden Dr van der Nat rejoined (then) Amro Bank as a senior consultant with Treasury Management Consultants. In 1992 he was appointed as a vice president for ABN AMRO Treasury Management Consultants and since 1998 he has served as head of this department. In 1993 he was also appointed as a professor of treasury management at the Vrije Universiteit of Amsterdam. He is a member of the Association of Corporate Treasurers in London and the Dutch Association of Corporate Treasurers in Eindhoven. In addition, he is a deputy member of the Social and Economic Council in the Netherlands (SER).

11 September 2000.

*Mattheus van der Nat*

*Head ABN AMRO Treasury Management Consultants, Amsterdam. Professor of treasury management at the Vrije Universiteit, Amsterdam.*

*Correspondence:*

*Prof. Dr M. van der Nat.*

*Tromplaan 17, 3742 AA Baarn, The Netherlands.*

*Telephone/fax/E-mail:*

*+31-20-444 6103 (tel Vrije Universiteit).*

*+31-20-628 7776 (tel ABN AMRO).*

*+31-35-542 9850 (tel home).*

*+31-35-542 9851 (fax home).*

[Theo.van.der.Nat@ICU.NL](mailto:Theo.van.der.Nat@ICU.NL)

# New estimates of the UK term structure of interest rates

*John Sleath*

In November 1999, the Bank of England switched to a new approach for estimating the term structure of interest rates from the prices of gilts. The new method is known as the Variable Roughness Penalty (VRP) model, and replaces the previously used Svensson and ITS (based on Svensson) models. This article briefly describes the new model and outlines the reason for its adoption in preference to the earlier models. More detailed information can be found in “New estimates of the UK real and nominal yield curves”, Bank of England Quarterly Bulletin, *November 1999*, and also in a forthcoming working paper, entitled “New estimates of the UK real and nominal yield curves” by Nicola Anderson and John Sleath.

## The VRP model

The VRP model is a spline-based approach, that is the forward interest rate curve is fitted by a cubic spline. Splines are mathematical curves which are composed of many segments (each of which in this instance is a cubic polynomial), with constraints imposed to ensure that the overall curve is continuous and smooth. This contrasts with the parametric approach of the earlier Svensson model which specifies a single functional form to describe the entire curve. The ability of the individual segments of the spline curve to move to some degree independently of one another (subject to the continuity and smoothness constraints) gives rise to the superior performance of the VRP method.

The key requirements and properties of the VRP model are summarised in Table 1.

## Comparison with former models

Full details of the tests used to compare the VRP and Svensson (and other models) are provided in the references listed above. In summary:

- The VRP estimates do not show the spurious volatility evident in the Svensson data.
- The Svensson functional form forces the forward rate curve to asymptote at long maturities, and as a result it is unable to capture the (generally) downward slope evident from market data, and expected by theory. No such constraint is imposed on the VRP fitted curve, and it is able to capture the shape of the interest rate more reliably.
- We are now able to incorporate additional data (GC repo rates) to substantially improve estimates of the short end of the curve. This was not possible with the Svensson method without distorting the fitted long end.
- Because gilt prices are quoted as multiples of £0.01, the observed price may differ slightly from the ‘fundamental’ price, i.e. that which would be observed if prices were quoted continuously. Changes to bond prices of this order have, therefore no economic significance, and we require the derived interest rate curves to be largely unaffected by such movements. This criterion is satisfied by the VRP method, but not by the Svensson model.
- The VRP model, furthermore, fits the data better, as measured by the out-of-sample goodness-of-fit. This is calculated on any given day by taking each gilt in turn, omitting it from the estimation process, determining the pricing error of the fit for that gilt and then averaging over all gilts used in the complete estimation. A good out-of-sample goodness-of-fit implies that the method is able to fit the data well, without introducing spurious structure.

**Table 1: Requirements of a yield curve model, and properties of the VRP method**

<b>Criteria</b>	<b>Properties of the VRP model</b>
<p><b>Smoothness</b></p> <p>The technique should give smooth forward curves, rather than attempt to fit every data point, since the aim is to supply a measure of market expectations for monetary policy purposes rather than a precise pricing of all bonds in the market.</p>	<p>Forward rates are estimated to maximise the fit of the model to observed bond prices, but penalising curvature in the forward curve.</p>
<p><b>Flexibility</b></p> <p>The technique should be sufficiently flexible to capture movements in the underlying term structure. It should also be relatively less flexible at the long end than at shorter maturities, where expectations are likely to be better defined.</p>	<p>The extent to which curvature in the forward rate is penalised depends on maturity; the shorter the maturity, the more structure is allowed in the curve. The penalty function is chosen to maximise the out-of-sample goodness-of-fit of the model estimates.</p>
<p><b>Stability</b></p> <p>Estimates of the yield curve at any particular maturity should be stable, in the sense that small changes in data at one maturity (such as at the very long end) do not have a disproportionate effect on forward rates at other maturities.</p>	<p>Forward rates are described by a number of segments joined together. This, in effect localises the influence of idiosyncratic price movements to a specific portion of the curve.</p>

Estimation of the real and inflation term structures

The estimation of the real term structure from the prices of index-linked gilts (IGs) is considerably more complex than deriving the nominal yield from conventional bond prices. This is mainly because IG coupon payments are indexed to the level of the retail price index (RPI) prevailing eight months prior to when the cash flows occur; for the last eight months of its life, an IG therefore offers no inflation protection at all, and it trades as a purely nominal bond. As a result, IG prices in general reflect a mixture of both the real and nominal term structures.

Evans (1998)<sup>1</sup> introduced a new framework for dealing with this problem. He derives a relationship between the nominal and real yields and the term structure of (incompletely) indexed bonds,<sup>2</sup> allowing an interest rate curve to be fitted directly to IG prices. We have extended his work to account explicitly for the variation of the effective indexation lag for each IG's constituent cash flows, and also to deal with the delay in publication of the RPI.

The new model for the real term structure offers similar advantages to those discussed above in relation to the nominal rate estimates. In particular, the new method is better able to capture the shape of the long end of the real curve, which was previously forced to quickly asymptote because of the functional form used.

Nevertheless, a number of caveats must be placed on the interpretation of the new estimates of the real term structure. First, the sparsity of IG issues means that we are unable to estimate the very short end of the curve. Second, the relatively large spacing between IG redemption dates means the local slope of the yield curve is not as well determined as that of the nominal curve, and hence care must be taken when examining real forward-rate curves. These are fundamental restrictions arising from the structure of the index-linked market, and therefore affect all estimates of the real term structure, irrespective of the method used.

1 Evans M. D. D., (1998), 'Real rates, expected inflation, and inflation risk premia', *Journal of Finance*, Vol 53, page 187

2 The index-linked term structure is a mathematical construct that simply allows us to price IGs using the standard discounted present value formula. It is not in itself an interesting term structure, since it is a mixture of the real and nominal curves.

### **Conclusion**

As part of the Bank's continual process of review and improvement, we have switched to a new method for estimating the term structure of interest rates from the prices of coupon bonds. It uses a cubic smoothing spline to fit to the forward rate curve, and is better able to capture the shape of the term structure as observed by other methods (for example from Strips prices), as well as being more stable.

*John Sleath*  
*Bank of England*  
*Tel: +44-20-7601 3658;*  
*Email: john.sleath@bankofengland.co.uk*



# Irving Fisher and the Calendar Reform Movement

*Arthur Vogt*

In all mathematical sciences  
the first essential is a unit of measurement.

Irving Fisher

The above quotation was the motto to the second batch of Irving Fisher's Short Stories on Wealth, reproduced in IFC Bulletin No 3. The context was price indices, let us say *money*. Now it is *time*. According to Fisher, standardization of one of our units of time, the month, is of less importance than standardization of the unit of money. A year of 13 equal months of 4 weeks or 28 days each would stabilize our time measurement. "Probably, time is money. It is strange that the business world should have struggled so many centuries under the handicap of unstable units of money and time, and that they are yet to be standardized."

Fisher devoted a great part of his working time to price measurement. Time measurement was only one of his side-interests. But as Fisher had many fields of interest it is not astonishing that the IFC Bulletin publishes a contribution on an issue that fits the occasion of the (real) start of the new millennium at the end of the current year: the calendar reform.

Fisher (Fisher, 1930) began his address to the accountants attending an international congress by observing:

There is a movement in the United States and abroad now definitively under way to simplify the calendar. The calendar has remained virtually unchanged for two thousand years.

Previously, the League of Nations Committee had examined 200 suggestions for calendar reform: two of them were considered practical. After 3 years' study of the defects (sic!) of the Gregorian calendar, the League Committee suggested the formation of national committees to study and report on the question.

The calendar standardizing reform had a long tradition. Already in 1834, the Italian Marco Mastrofini proposed to exclude the last day of the year – as well as the extra day in each leap year – from the pattern of weekdays (extrahebdomadal days), to the effect that the remaining 364 days would add up to exactly 52 weeks. A particular date would fall every year on the same day of the week. In 1849, the French philosopher Auguste Comte suggested to introduce a calendar of 13 months of 28 days each. The additional month should be inserted between June and July, and a 29th day in December as well as the extra day in leap years should be treated as proposed by Mastrofini. Both ideas came back in a solution proposed by Cotsworth. This was one of the two suggestions considered useful by the League of Nations. The present author proposes to call such calendars "synthetic calendars", as opposed to the natural, culture based calendars.

More modest attempts to achieve a degree of standardization were the "Banker's Calendar" (already introduced in the 19th century), which numbered days from 1 to 365 or 366 throughout the year, and the Calendar of the International Organization for Standardization, which specified Monday as the first day of the week and attached an ordinal number to each week of the year, starting with the first week that contained at least four days of the new year (Dershowitz and Reingold, 1997:42).

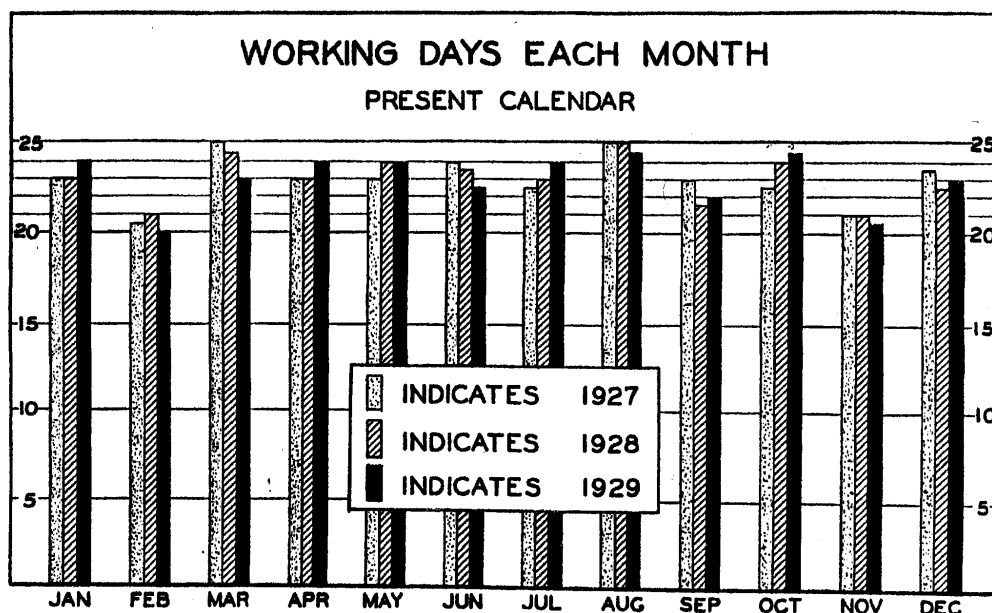


CHART I

Fisher (Fisher, 1920:1) lists four stages in solving any social problem. We are now demonstrating how these stages can be applied to the calendar problem. The stages are:

- What is it?
- Why is it?
- What of it?
- What are you going to do about it?

In the last, 86th, Story Fisher puts these questions in another light (Fisher, ca. 2005).

#### ***What is it (the facts) with the calendar reform?***

Let us start with Fisher's first question: "What is it?" Fisher demonstrated the "defects of the Gregorian calendar" with Charts I and II. They show the uncoordinated weeks and months. Figures which should be comparable are not so. The percentage increase in the number of working days between February and March is especially acute, and explains how monthly business comparisons are invalidated.

Thus a business organization is confronted with a dilemma: should it fix its monthly meetings on, say the third Thursday of a month, or on a specific date, such as the 10th of each month? The third Thursday falls anywhere from the 15th to the 21th, so that accounts as of the preceding month, available after two weeks, may not be examined, occasionally, until 20 days have elapsed. – Weekly wages must be paid, sometimes 4 times a month, sometimes 5 times.

#### ***Why is it (the causes)?***

It was the vanity of the Roman emperor Augustus making his special month of August a month of 31 days, which was previously of 30 days. Augustus robbed February for his purpose, and disturbed the alternating sequence of 30-day and 31-day months established in the Julian calendar. One day each was subtracted by Augustus from September and November, and allotted to October and December, which had been 30-day months.

Some proposals for calendar reform would go no further than to restore the Julian calendar, with its alternate months of 30 and 31 days.

#### ***What of it (the evils)?***

The fundamental defect of the Gregorian calendar is that the months are not exact multiples of the weeks. They begin on different days of the week. The months are not standardized. They have different numbers of days. Months with equal numbers of days may have different numbers of working days depending on the number of Sundays in the month and on the flexible Easter and the holidays moving with Easter.

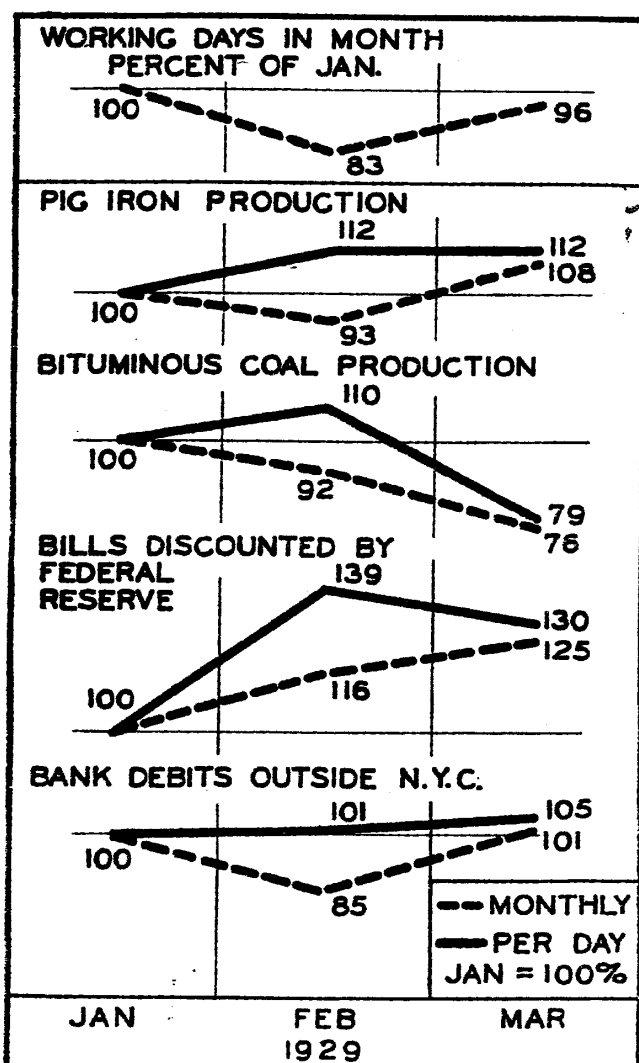


CHART II

*What are you going to do about it (the remedy)?*

Fisher does not think that the restoration of the Julian calendar mentioned above is enough because it would not permit a scientific standardization of time. He presents the solution proposed by Cotsworth.

Cotsworth had suggested his calendar to be introduced in the year 2000 (Richards, 1998). Fisher argues, however, that January 1, 1933 is the most convenient day for putting the new calendar into effect because it falls on a Sunday.

Under the proposed calendar, annual dates would be regularized. Authorities of schools and colleges could standardize their school year and the periodic vacations. The same days of the month, in different years, would fall on the same days of the week. Once a date is fixed by the day of the month, such as the fourth of July, the day of the week on which it falls would not vary any more. Conversely, when a date is fixed by the day of the week, such as Thanksgiving Day, it will come on the same day of the month. In every month everybody would understand in advance that the four Mondays, for example, fall on the second, ninth, sixteenth and twenty-third, respectively.

From the religious point of view the most objected reform would be the "regularization or stabilization" of Easter. Easter wanders over 35 days from year to year. This subtle Easter date calculation would be "ironed out".

The last day of the year, the 29th December, would not count as one of the seven weekdays. The day before, the 28th of December, would always be a Saturday and the 1st of January a Sunday. December 29, by international agreement, might become a World Peace Holiday, or "Year Day". This shows that the new calendar would put an end to the traditional, long lasting order of the weekdays. In fact, this order was introduced more than 5000 years ago by the Babylonians. It was

interrupted by the French Revolution calendar, but on 1 January 1806 the Gregorian calendar was reinstated, preserving the old order of the weekdays.

When Fisher gave his talk in 1930 he probably thought that the Gregorian calendar would not last as long as the League of Nations. History has shown the contrary: Today we have other means to improve statistics by making them better comparable. Fisher, in his role as a bookkeeper, wrote that months are not exact multiples of the week. As a mathematician he knew better that the day (astronomically speaking: the mean solar day) and the year (astronomically speaking: the tropical year) are incommensurable and, accordingly, cannot be made commensurable...

Instead of correcting the calendar, it is generally accepted today that statistical numbers are corrected by seasonal adjustment. This allows us to have comparable statistics and to go on with the traditional, beautiful and subtle Gregorian calendar!

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*Arthur Vogt*  
*Federal Office of Social Insurance*  
*Effingerstr. 20*  
*CH-3003 Bern, Switzerland*  
*Tel. +41-31-322 90 02*  
*Arthur.Vogt@bsv.admin.ch*



## SEOUL MEETING 2001

# Programme of the IFC Conference

At the moment that this Bulletin went to press, the time-schedule of the 53rd ISI Session in Seoul, 22-29 August 2001, was not yet available. We advise you to regularly visit the Web site of the conference ([www.nso.go.kr/isi2001](http://www.nso.go.kr/isi2001)) to acquire the necessary information.

As announced in the previous issue of the IFC Bulletin, the Provisional Programme for the IFC Conference within the framework of the 53rd ISI Session comprises four sessions (see next page). A number of persons has already expressed the wish to present a paper.

### Call for papers

Any persons who want to contribute to the conference by presenting a paper should inform the Secretary of the IFC as soon as possible (*Please use the enclosed form*).

In accordance with the rules of the ISI, papers should not exceed 4 pages (invited papers) or 2 pages (contributed papers). All papers will be published as part of the ISI's Proceedings.

### Deadlines

Consult the website of the 53rd ISI Session ([www.ngo.go.kr/isi2001](http://www.ngo.go.kr/isi2001)) for a complete overview of deadlines and procedures laid down by the *ISI* for authors of invited and contributed papers.

Besides, for a proper organisation of the *IFC* sessions, authors are requested to observe the following deadlines:

- **Draft** versions of invited and contributed papers must be submitted to the organiser of the session, as well as to the Secretary of the IFC before **22 February 2001**.
- **Final** versions of invited and contributed papers must be submitted to the organiser of the session, as well as to the Secretary of the IFC before **22 April 2001**.

### Publication in IFC Bulletin

Papers also qualify for publication in the IFC Bulletin. However, the IFC encourages authors to submit a more comprehensive version of their papers, which will be published in the IFC Bulletin instead of the restricted version.

Likewise, the IFC would be pleased to receive abstracts of the papers – comprising 150-300 words – giving an outline of the papers at an early stage. These abstracts will be published in the IFC Bulletin at the end of 2000 or in the first half of 2001.

For **publication in the IFC Bulletin**, final versions of papers and abstracts should be sent, preferably by E-mail, to the Editor of the IFC Bulletin:

- **Abstracts** of papers must be made available not later than **15 November 2000**.
- Final versions of **papers** must be put at the Editor's disposal immediately after the conference, at the latest.

## Sessions

*Invited Papers Session No 30*  
**“Financial Stability Statistics”**

Organiser: Philip Turnbull (Bank of England)

Chair: Philip Turnbull (Bank of England)

Session 1: *The perspective of international organisations*

Paper: Paul van den Bergh (BIS) and Charles Enoch (IMF)

Session 2: *The perspective of a central bank of a developed country*

Paper: Sarah Wharmby (Bank of England)

Session 3: *The perspective of a central bank in a developing country*

Paper: Sunny Yung (Hong Kong Monetary Authority)

Discussants: Peter Bull (ECB)

Federico Signorini (Banca d'Italia)

*Contributed Papers Session No 153***“The Measurement of External Debt and External Reserves”**

Organiser: Carol Carson (IMF)

Chair: Carol Carson (IMF)

Papers: Daniel O. Boamah (Central Bank of Barbados)

Jean-Marc Israël (ECB)

Nicolai Ivanov (Bank of Russia)

Petr Vojtisek (Czech National Bank)

*Contributed Papers Session No 152***“Collection of Financial Data from Companies: Statistics and International Accountancy Standards”**

Organiser: Józef Olejski (National Bank of Poland)

Chair: Józef Olejski (National Bank of Poland)

Papers: Józef Olejski (National Bank of Poland)

L.V. Voronova (National Bank of Ukraine)

*Contributed Papers Session No 154***“The Relationship between Central Banks and Statistical Institutes”**

Organiser: Bart Meganck

Chair: Mediyamere Radipotsane (Bank of Botswana)

Papers: Gregor Bajtay (National Bank of Slovakia)

Assad Monajemi (Bank Markazi Iran)

Eva-Maria Nesvadba and Aurel Schubert (Oesterreichische Nationalbank)

Mediyamere Radipotsane (Bank of Botswana)

# FISHER'S SHORT STORIES

## Fisher's Short Stories on Wealth 40-48

Arthur Vogt

### The Stock Market Crash

In October 1929 the world was shocked by the stock market crash. Possibly, It happened at the very moment that Fisher wrote Story 45. It is astonishing that Fisher did not mention it in his Stories. His monograph on it, "The Stock Market Crash – and after", is dated February 1930, its preface even December 15, 1929. Two charts, taken from it, are shown below.

Up to 1929 Fisher made a fortune of \$ 10,000,000, mainly with one of his inventions, the index card system (and subsequent stock market gains). His firm producing it, later became Remington Rand Corp. After the stock market crash, his fortune melted away to about minus half a million, going down further to nearly minus one million until the death of his main creditor, his sister-in-law. Fisher's personal financial failure was a double burden for him as a great economist. However, he remained an optimist throughout his life. After the crash, he kept on seeing the economic recovery "round the corner".

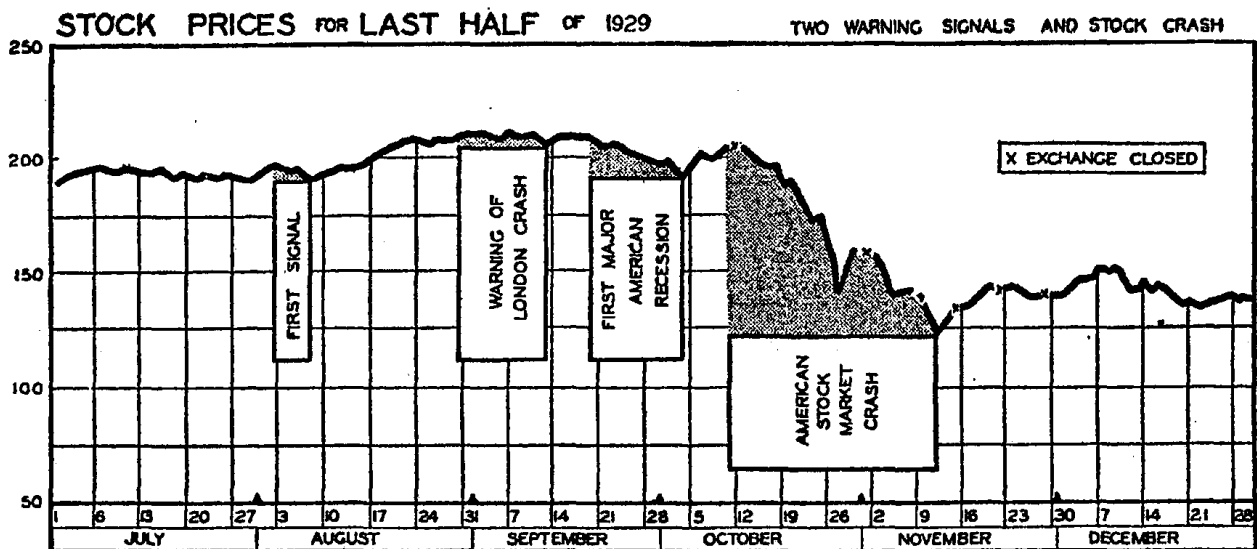


CHART 2.—The first sharp drop was after the raising of the New York Federal Reserve rediscount rate from 5 to 6 per cent on August 8. The Hatry failure in London started the British crash on August 30. During September there was heavy liquidation on the New York Stock Exchange. The American crash began October 12, lasting until November 13, when stock prices touched bottom.

Chart 2 shows the development of USA stock prices in the second half of 1929. Two warning signals have been indicated.

Chart 4 shows the price development at the New York Stock Exchange since 1870. To do so, three indices have been chained: the Dow-Jones, Barron's and, from 1926, Irving Fisher's index in a separate "window". The optimist Fisher stated that the crash left more than half of the rise since 1926 intact. Irving Fisher's index stems from his own firm. In 1923 he established his Index Num-

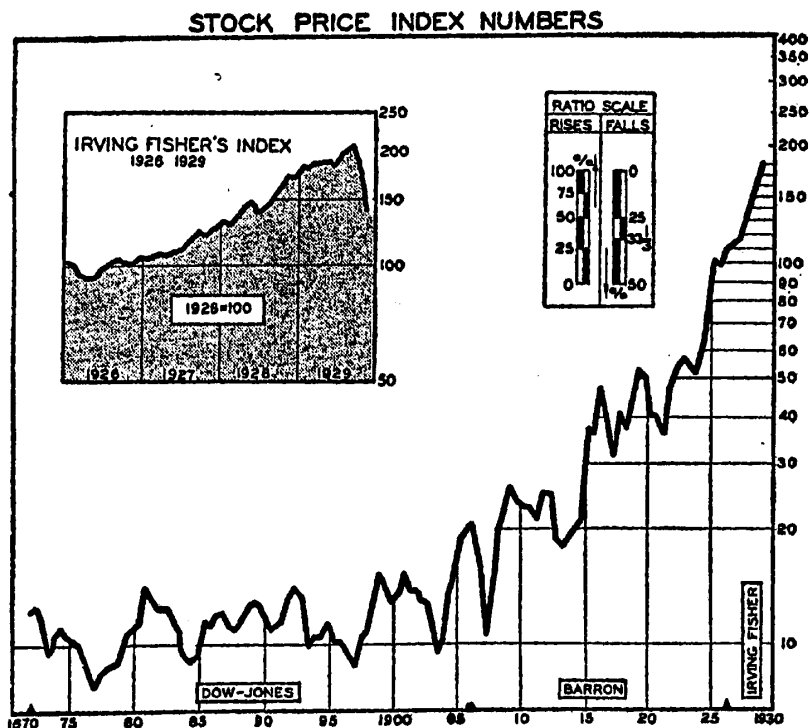


CHART 4.—Three Plateaus: 1870-1905, 1905-1913, 1915-1923; thence sharp upward climb to September, 1929. Inset chart shows October-November crash, 1929, not halfway down from rise since 1926.

ber Institute, a business to compile and sell index numbers and other economic data for publication. The Index Number Institute became the first organization to provide systematic economic data in index number form to the public, long before governments even began to think about it. By 1929 Fisher's wholesale price index reached 5 million newspaper readers. In Chart 4 index numbers are indicated in a logarithmic scale. The absolute distances in the small window correspond to relative rises and falls.

### *Fisher's Short Stories on Wealth, 1926-1933*

*Dr. Arthur Vogt has drawn our attention to a series of simple explanations of elementary principles of economics which Fisher wrote in an agreement with the Worker's Education Bureau. Fisher called them "Short Stories of Wealth". The bureau issued them monthly for publication in any union newspaper that desired to print them. They appeared in the "Brotherhood of Locomotive Firemen and Enginemen's Magazine", "Trade Union News", "Labor Herald" etc.*

*The stories had never been reprinted and had not been included in "The Works of Irving Fisher" (General Editor W.J. Bates, Consulting Editor J. Tobin), which was published in 1997. However, the Stories are worth to be read up to the present day. Besides the scientific and historical interest they are of didactical use as they are models of explaining economic phenomena to the public. The IFC Bulletin decided to publish all these "Short Stories of Wealth"*



# Short Stories on Wealth

*Irving Fisher*

## 40. Wages and Employers' Profits<sup>1</sup>

THE peculiarity of profits lies in the element of chance. Stipulated wages are supposedly certain, while profits are, by the nature of the case, uncertain. Many a worker has the option of hiring out to some one else or of being his own employer. If he hires out for a fixed wage, he gives up the chance of any gain beyond that fixed wage. If, instead, he "works for himself", he has the chance of getting much more but he gets this at the risk of getting much less.

As a consequence, workers are classified into two chief groups – wage earners, or employees, and profit earners, or employers – like the two chief groups into which capitalists are classified; namely, bondholders and stockholders.

And just as the bondholders consist of those who wish to avoid chance and the stockholders of those who are willing to assume risks, so also the employees are those who wish to avoid chance and the employers those who are willing to assume risks.

And just as the stockholders are responsible to the bondholders for their stipulated income from capital, so the employers are responsible to the employees for their stipulated income from labor. This is a consequence of the fact that those become enterprisers who are believed to be especially adapted to the responsibilities which their position involves.

Chance, or uncertainty, is a matter of the degree of the knowledge we have. By foreknowledge, or foresight, we reduce the risks we take as to what will happen in the future. The wage earner does not usually need to exercise foresight in his work in any great degree, while one of the chief jobs of the profit taker or enterpriser is to make forecasts. Again, a man, in order to be an employee, does not require any accumulation of capital, while an employer is far better equipped for his position if he is the fortunate possessor of a considerable fund of capital. He can then afford to lose much better than if he has little or no capital. It therefore happens that while theoretically an employer may have little or no capital, practically he is usually a capitalist as well as an employer.

Profits stand in a double relation to wages; for the work of the employers and the work of the wage earners are, to some extent, substitutes, that is, compete with each other, and, to some extent, mutually complementary, that is, in need of each other.

So far as they compete, the price of the one tends to correspond to the price of the other. If, for instance, wages of plumbers go down, it will often happen that a few enterprising plumbers – rather than take these low wages – will set up for themselves as independent plumbers. This transfer of men from the ranks of employees to the ranks of the employers tends, by diminishing the supply of plumber employees, to raise their wages. On the other hand, by increasing the supply of plumber employers, it tends to diminish their profits. In this way it tends to diminish the difference between them.

If, on the contrary, the wages of plumbers rise, it will often happen that some of the plumbers who were working for themselves will be attracted from the ranks of employers to the ranks of employees. Finding that they can make only a small and precarious living as employers, either because there is too much competition among the independent plumbers or because of their own personal shortcomings or misfortunes, they may prefer to accept the high wages which plumbers are getting rather than to keep up the struggle.

There is a similar competition between the carpenter employer and the carpenter employee; in fact, between the "boss" and the "man" in every trade or walk of life. So there is a tendency toward equalizing wages and profits. Why they are not equal will be considered in the next short story.

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1) *The Lather, Cleveland, Vol. XXIX, No. 10, June 1929, pp. 18-19.*

## 41. Profits and Wages<sup>2</sup>

WE have seen that, there is a tendency for the profits of the employer to equalize with the wages of the employees. Why are they not equal? One reason is risk. Men in general regard uncertainty as a great evil and require higher compensation for assuming it. Few workmen would be willing, or even able, to assume the risks of the employer. Just as, in general and normally, a stockholder gets a higher average return than the bondholder, so the profit taker will, in general and on the average, get a higher average return than the wages guaranteed to the employee.

But the difference in superiority of profits is still further increased by the fact that the employers form a special class. While almost every employer is capable of being a wage earner, not every wage earner is capable of being an employer. Therefore the supply of employers is always somewhat restricted, and this fact tends to raise their profits. Moreover, employers are also a special class in that they are usually capitalists. While the possession of capital does not prevent man from being a wage earner, the lack of it tends to prevent his becoming an employer. This still further limits the supply of employers and tends to elevate still further their profits.

In short, the employers' profits tend to be high for three reasons: (1) Because these persons assume risks and responsibilities which few are able or willing to take; (2) because, for that very reason, qualities of foresight, courage and exceptional ability, which few possess, are required for success; and (3) because the work of the employer usually requires, for its success on a large scale, the possession of capital.

Partly as a consequence of these peculiarities of employers and partly because of the general conditions of modern industrial organization, the relation between employers and employees is not altogether, or even generally, competitive, but is, to a large extent, complementary. The work of each is necessary for the efficient work of the other. This complementary relationship is more obvious and important than the competitive relationship just described. The employer could not accomplish very much if he worked merely by himself; he requires for the best use of his abilities a large number of employees. Conversely, the employees cannot receive a guaranteed wage unless they find some employer who is willing to make the guarantee. The two stand in a relation similar to that existing between any two complementary commodities, as, for instance, the relation of the engine to the train it draws.

To the extent that enterprisers and wage earners are complementary the earnings of the one tend to move, not in unison with, but in opposition to, the earnings of the other. The lower the wages of the employee in any establishment, the more in general will be the profits of the employer, and vice versa. We see, therefore, that the relation between the employer and the employee is a complicated one, being partly competitive and partly complementary, and that therefore their interests, though partly allied, are largely opposed. The net result is usually that profits are far greater per capita than wages.

But, while this is true of the average rate of profits, we must remember that, as the very nature of profits requires an element of chance, they vary enormously, far more than wages vary, and that in many instances the individual employer may make less money than the wage earner, or even less than nothing at all, while in the extreme cases, he may make a great fortune. One secret of great fortunes is this element of good luck. Only the lucky few make the large fortunes while a very large number are barely earning enough profits to keep them at their tasks.

## 42. The Capitalist-Employer<sup>3</sup>

HITHERTO we have spoken separately of the capitalist who is a profit-taker and of the employer who is a profit-taker, but, as has been indicated, often one and the same person is both capitalist and employer. In fact, those who receive profits as employers of labor usually receive profits also from capital which they own, although the converse is not so universally true. Those who wish to receive income through their capital without any work become bondholders rather than stockholders; while those who wish to get income from their work without investing (or perhaps even possess-

2) *The Lather, Cleveland, Vol. XXIX, No 11, July 1929, p. 28.*

3) *The Lather, Cleveland, Vol. XXIX, No.12, August 1929, p. 41*

ing) capital prefer to work for wages or salaries. If a man wishes to become a stockholder, he usually is actively interested enough to do a certain amount of work, if it is no more than investigating the relative prospects of different companies offering chances for investors. And it is still truer that those who wish to take the responsibility of conducting an enterprise wish not only to put their effort into it, but their capital also.

It thus usually happens that the profits which a man receives cannot be easily classified into profits from his capital and profits from his own exertions. Generally his profits are the joint product of both his labor and his capital. The profit-takers – who are, of course, also loss-takers – are, then, the risk-takers of society. Some men risk only their capital (and receive dividends per cent or profits per unit of physical capital according to the form of their investment), others risk their own labor (and receive earnings of management), while most risk both their capital and their labor and receive the joint earnings of their capital and labor. These enterpriser-capitalists are well called the “captains of industry.” They take the initiative in enterprises of all sorts, and on their judgment will depend whether not only their own capital and labor, but the capital and labor of others (to whom they undertake to pay stipulated interest or rent, on the one hand, and wages, on the other), shall be economically or wastefully employed. When their leadership proves wise they make large profits for themselves, but these may be said to be a well-deserved reward for the general good their sagacity brings the public. When their leadership proves unwise, they suffer a loss, and this may be said to be a deserved penalty for wasting the capital and labor of society. The men, like Commodore Vanderbilt and J.J. Hill, who have built railways which were needed, have made fortunes. So also men like Ford, who have given us the best automobile, have made fortunes. Those who made less serviceable models have lost fortunes. Those who have built railways which had to be abandoned have lost fortunes. There is, then, to some extent, a justification of our system by which we put a premium on enterprises which turn out well for society and a penalty on those which turn out ill.

It is, however, also true that just as there are types of successful speculators which should be condemned, so there are types of successful enterprisers which should be condemned. Those clever promoters who gain at the expense of the public through the frauds of “high finance” are among the worst forms of public enemies.

The enterprise-capitalist then is the leading figure in modern industry. He gathers round him other capitalists and laborers and jointly they produce the income of society. After paying them the parts of this income agreed upon, he takes for himself whatever may be left, large or small as the case may be. Their parts are the earnings of capital (in the two forms of rent and interest) and the earnings of labor (in the form of wages). His own part is the earnings of his own capital and labor (in the form of profits jointly on his capital – whether measured per cent or per unit of physical capital – and on his own labor).

## 43. The Capitalist-Employer – Continued<sup>4</sup>

WE can not too much emphasize the fact that though each of the various laborers (both employers and employees) and instruments of capital (land and other instruments) which jointly produce income, is credited with a certain part of that income, no one person or thing could produce this part alone. Joint production is the rule. The earnings of a railway company are due, for instance, to the joint services of the stockholders, bondholders, officers, employees, locomotives, cars, roadbed and terminals. These agents of production are not independent, but mutually complementary, instruments and laborers, and their services are complementary services.

We impute to each a certain part, determined according to the principles which regulate the prices of complementary goods.

The sum of all these items – that is, the interest, rent, wages and profits, in any community in any given period of time is, of course, the total income of that community. Complete catalogue of these would show what quota was contributed to this total by or imputed to human beings, land, and other instruments. As a matter of fact, by far the larger part is contributed by human beings. Professor Nicholson of Edinburgh estimated that the income from what he called “the living capital” of Great Britain was five times as great as that from the “dead capital.” Lately, Dr. Dublin of the Metropolitan Life Insurance Company has obtained the same result for the United States. In less wealthy countries the preponderance of man-produced income is probably still larger. Of the

4) *The Lather, Cleveland, Vol. XXX, No. 1, September 1929, p. 19.*

part produced by "dead capital" the larger portion is from land.

In a new country the rent of land tends to be low but rent of other things and wages high. For in such a country land is relatively abundant and other instruments, including laborers, relatively scarce. As a country grows older and more populous, land becomes scarce relatively to population, or in other words, the demand increases without any increase in supply. Therefore land rent tends to rise, and other rents and wages to fall.

Progress in scientific knowledge causing an increase in productivity of land is like the rejuvenation of a country. Any increase in general productivity, whether of land or of other agents of production, has a tendency to make the rate of wages increase. For (1) by increasing the wealth of employers and thereby diminishing their marginal desirability of money, there is a tendency to increase their demand for everything, including the services of workmen; and (2) so far as workmen themselves are owners of houses, implements, and other instruments of any kind, and thus share in the increased affluence, the supply of work they offer is decreased.

Such a result is probably the chief general effect of so-called labor-saving machinery. It increases the income of other classes than laborers, and with it their power to buy the work of laborers. The first effect, however, is for the labor-saving machine to displace laborers, with which, in fact, it is a competing article, and we have seen that the increase in one of two competing articles or substitutes tends to lower the price of the other. The individual laborers thus displaced are likely to be injured by the improvement, being unable to learn another trade without undue loss of time. It is even conceivable that labor-saving machinery might become so automatic and so fully a substitute for human work that there would be no need and no demand for such work. But such an effect seems very improbable. The human machine is so much more versatile than other machines that its relation as a substitute for labor-saving machines is not so important as its complementary relation to them. As a matter of history, so-called labor-saving machinery, while it "saves" or displaces laborers from one sort of work, often, if not usually, produces new needs for them in another sort of work. If automobiles were introduced in China, they would largely dispense with the need of coolies, who now carry passengers in sedan chairs, but they would call for chauffeurs and mechanics. When stagecoaches gave place to railways, the trade of drivers of stagecoaches became obsolete, but the new trades of locomotive engineers, firemen, conductors and brakemen were created. In fact, the very names of these occupations, as of hundreds of others, show that the demand for these kinds of work arises from the existence of machinery.

We have considered income as distributed among the agents which produce it – labor and capital, including land. We are now ready to turn to the other sort of distribution – the distribution among the owners. A decrease in the amount of capital which laborers own will, as we have already seen, make them willing to take lower wages than otherwise. In fact, the chief reason that there exists a wage class is that those constituting it have little or no capital apart from their own persons. Wage earners are chiefly "propertyless" persons – persons who have either never had any property, or have lost what they did have, as, for instance through too high a degree of impatience. We see, therefore, that the question of wages depends, among other things, on the distribution of the ownership of wealth.

## 44. Personal Distribution<sup>5</sup>

I HAVE already dealt with the distribution of income relatively to the agents or instruments which produce that income. In the present Short Story I shall take up the second half of the study – i. e., the distribution of this same income relatively to those who own and enjoy it. The two sorts of distribution are quite different, although there has been a tendency to confuse them. This was natural, for in the early days of economics people were classified roughly according to the sort of instruments they owned. There was the landlord class, whose chief income was ground rent; the non-landed capitalist, whose chief income was from other capital than land; and the laborer, whose chief income was wages. It was then natural to imagine that the incomes produced by laborers, by land, and by other capital, were also the incomes enjoyed by laborers, by landlords, and by other capitalists. But even were such a classification possible and duly made, it would still fail to tell us anything whatever as to how large was the per capita share within each class, or whether the amounts enjoyed by different individuals were or were not very unequal. The best we could say would be

5) *The Lather, Cleveland, Vol. XXX, No. 2, October 1929, pp. 20-21*

that certain land yields a rent of \$10 an acre, and other lands more or less than this; that certain houses rent for \$1000 a year, and others for more or less; that money lenders make five per cent on their loans; and that ordinary wage earners get \$5 a day. But these data, however detailed, would not tell us the relative income enjoyed by different persons, except in the case of the common laborer, and then only on the assumption that he derived no income from any other source than from his work. Furthermore, today there are only small traces left of the old social stratification, and correspondingly little excuse for confusing the two sorts of distribution, the distribution of income with reference to the capital which yields it and its distribution with reference to the persons who own it.

But, though the two sorts of distribution are distinct, each is needed to understand the other. The problems now before us – of distribution relatively to owners – may be described as the three problems of the total income of a nation, of the average income of its inhabitants, and of the relative numbers of people owning incomes of various sizes.

The last-named problem is the problem of grading the population according to income – the problem of discriminating the relatively rich and the relatively poor. No other problem in economics has so great a human interest as this, and yet scarcely any other problem has received so little scientific study. Since income necessarily comes from capital or from labor, the problem of “distribution” of income is largely that of the “distribution” of capital. Our problem may therefore be stated in two ways: Either as the problem of the personal distribution of income or as the problem of the personal distribution of capital and labor power. It is what is popularly known as the problem of “the distribution of wealth.”

In order to compare the incomes or capitals of widely distant times or places, a correction may need to be made for differences in the purchasing power of money, and other circumstances.

Practically, however, if we confine our attention to modern times and conditions in western Europe and America, it is true, in a general way, that of two nations or individuals the one which is richer in capital-goods is richer also in income-goods, in income-value, and in capital-value. For simplicity we shall hereafter assume that these four comparisons are thus similar. We may say that a man is “rich” if he has a large amount of capital-goods of various kinds – lands, houses, stocks, bond, etc.; or a large money-value of such goods; or a large amount of benefits of various kinds – nourishment, clothing, shelter, amusements, etc.; or a large money-value of such benefits. A man is “poor” if he has small amounts of all these things.

Of course, the two terms “rich” and “poor” are purely relative, and represent no deeper scientific meaning. A man who is rich according to one standard may be poor according to another. But the two terms are very convenient to designate relative conditions. Corresponding to the adjectives “rich” and “poor” are the nouns “wealth” and “poverty”; for, the term “wealth” is especially used to indicate a large amount of wealth, just as the term “poverty” is used to indicate a small amount. Our present subject, then, is comparative wealth and poverty, both of nations and of individuals.

## 45. National Wealth or Poverty<sup>6</sup>

WE may divide the subject of personal distribution – of the rich and poor – into two heads: How rich or poor are nations and how rich or poor are individuals in a nation. In either case the result depends upon two things: labor and capital, including lands and produced capital.

The income earned by the people of a nation always far exceeds the income earned by all its physical capital. Yet people do not earn income without at least that basic form of capital called land. Given laborers and land, we have the two original requisites of producing income. Other capital springs from these two. It is sometimes said that labor is the father, land the mother, while all other kinds of capital are the children of these two parents.

A nation, then, is the richer, as a whole, the larger the number of its inhabitants, the greater the extent of its territory, and the greater the amount of its accumulated products.

These three factors depend each on somewhat different conditions. The amount of land and its power to produce are largely a question of natural resources. The extent of land may be taken as a given quantity presented to man by nature. It is now becoming recognized, however, that land is not definitely constant in its power to produce as was once imagined. One of the most important results of the recent “conservation movement” in this country and of the new agricultural experi-

6) *The Lather, Cleveland, Vol. XXX, No. 3, November 1929, pp. 25-26.*

ments with their “creative agriculture” has been to show conclusively that land is by no means a source of constant income, but that it is possible by the impoverishing and washing away of top soil greatly to impair or destroy absolutely the productivity of land; while, on the contrary, by irrigation, proper fertilization, keeping land fallow, rotation of crops, scientific seeding, etc., it is possible to increase the efficiency of land just as it is possible to increase the efficiency of other instruments.

The dominion over land by any group of men may depend on wresting it by military force from another group. In fact, one of the chief objects of war has been to increase national wealth by adding to territory. This was a chief object of the Roman Empire and of the early colonial system of Great Britain. These and other nations have had what is called “earth hunger.” The wealth of the British Empire today lies for the most part outside of the British Isles; for it includes, besides England, a number of important colonies – Canada, India, Australia, New Zealand, and parts of Africa. Except for the war of the Revolution, the British Empire would now include also the territory occupied by the United States. The World War represented in part Germany’s desire to retain and improve her “place in the sun” – her colonies.

Turning from the quantity of land, or the “natural resources” of a nation, to the number of inhabitants, we note that this itself depends in turn upon the extent of the territory of that nation as also on its past history as well as on other conditions. Many nations have sought to increase their wealth and power by increasing their population. In fact, a chief reason for extending a nation’s territory has been to fill it with colonists. A country is usually alarmed at the prospect of a stationary or decreasing population. France is now trying to conserve its population, recognizing that national strength for future political position among the nations of the earth depends largely on numbers.

We come last to the amount of accumulated products. This depends on two chief qualities: First, thrift, which leads to savings; and secondly, inventiveness, which leads to the creation of income-producing instruments.

We have considered the conditions determining the aggregate income of a nation. We may pass now to the more important subject of the riches or poverty of individuals. This subject may be divided into two parts: the average, or per capita, riches, and its distribution among different individuals. The per capita capital or income of any nation is found by dividing the total for the nation by the number of inhabitants. It is evident that two nations may compare very differently as to the aggregate and the per capita figures. For instance, the small countries, Holland and Switzerland, when compared with the large countries, India and China, are far poorer in the aggregate, but far richer per capita.

## 46. Population and Poverty<sup>7</sup>

WITH the advent of democracy in politics has come a greater emphasis on per capita as compared with aggregate wealth. Under autocracies the aim was to increase the wealth of the nation as a whole, partly for the mere aggrandizement of the autocrat or potentate, who often regarded himself as a sort of owner of the nation, and partly because the popular sentiment of national greatness was satisfied in this way. Under these conditions an increase in population was almost invariably welcomed and encouraged. But since the individuals of the nation have become its rulers and, so to speak, shareholders, they have regarded increase of numbers with mixed feelings; for while on the one hand they welcome an increase in the total wealth which a greater population brings, on the other hand they do not relish any resulting decrease in per capita wealth. In the democratic ideal, therefore, an increase of population is usually welcomed only in a new country where there is plenty of land, or in a country acquiring colonies to provide room for a surplus population.

The effect of an increase of total national wealth upon per capita wealth will evidently depend upon the ratio between land and population. In a sparsely settled country an increase of population will not only increase the total wealth, but also the per capita wealth; for each new worker adds, by his cooperation, to the efficiency of workers already on the ground. A very few men can not work together to as great advantage as a moderate number. The co-operation and division of labor incident to a moderate increase in population more than outweigh the fact that the greater population will require more nourishment, clothing, and other items of income. In short, though there be more

7) *The Lather, Cleveland, Vol. XXX, No. 4, December 1929, pp. 29-30.*

mouths to feed, each additional mouth means an additional pair of hands; and in a new country added capacity of the new hands to produce exceeds the added capacity of the new mouths to consume. So the history of new countries shows that an increase is a blessing individually and collectively.

But after the country is populated up to a certain point, the opposite becomes true. Any further increase of population, while continuing to increase aggregate wealth will decrease per capita wealth. It then happens that each new pair of hands adds less to production than each new mouth subtracts in consumption. This fact sets a sort of elastic limit to an increase of population. That there must be such a limit is evident, since an indefinite number of people can not be supported on one acre of land. We know, as a generalization from ordinary observation, that the billion and a half people now living on this planet could not be supported if all were packed into the State of Rhode Island and entirely dependent on Rhode Island soil for sustenance. Per capita poverty would then be so intense that people would die of actual starvation. Famine, with the plagues which follow, would decimate the population. Overpopulation in India and China often results in famine and plague. In western civilization only milder instances of insufficiency of food are found. Long before a starvation point is reached, every increase of population beyond a certain point results in an increased death rate. In fact, statistics show that the death rate increases as per capita wealth decreases. This fact is due to the unsanitary conditions which poverty necessarily brings – conditions which pertain not so much to the quantity of food as to its quality and to the quantity and quality of housing and other comforts and conveniences of life, and perhaps above all to conditions of employment, especially hours of labor. These unsanitary conditions incident to poverty result in fatigue, malnutrition, infection, diseases such as tuberculosis, and deaths. In short, when the ratio of population to land becomes excessive, the death rate is increased, and consequently the further increase of population is checked.

The law of per capita wealth is chiefly based on the anterior fact that land is an essential agent in production, and that each successive increase in the productivity of land is acquired at increasingly great cost – or, expressed otherwise, that, with each successive increase in cost, the return diminishes. This is the familiar law of diminishing returns in agriculture. There is, then, based on facts, a general law of per capita wealth in relation to population. It may be stated as follows: Given a particular stage of knowledge and of all other conditions that determine productivity, an increase of population up to a certain point increases the per capita wealth, after which a further increase of population decreases the per capita wealth.

## 47. Population and Poverty – Continued<sup>8</sup>

THE population of any country may be increased either by births or immigration and decreased either by deaths or emigration. The population of the world, as a whole, can be increased only by births and decreased only by deaths. As we are more interested in general than in local increases or decreases in population, we may overlook emigration and immigration, assuming for the area under consideration that they are either absent or balance each other.

With this proviso, we may say that population will decrease if the death rate exceeds the birth rate, and will increase if the birth rate exceeds the death rate. As we have already stated, the facts show that the death rate increases with a decrease in per capita wealth. The birth rate, on the other hand, tends to decrease with a decrease in per capita wealth. There are exceptions to this last statement, but these exceptions will be ignored for the present.

If we assume what history has almost invariably shown to be the fact, that in a sparsely settled country the birth rate exceeds the death rate, so that population tends at first to increase, we are now in a position to state what will happen to the population of that country in future generations, quite apart from any increase in immigration. By hypothesis the population will increase at first and, as at first each increase in population brings an increase in per capita wealth, it will continue to increase as long as this condition continues. But it will ultimately happen that per capita wealth will cease to increase and will begin to diminish. It will then happen that the death rate will increase and the birth rate decrease, so that the increase of population will be slackened and ultimately cease altogether. Under these conditions, then, population in a new country will increase up to a certain point at which it will cease to increase. The population is then in a sort of equilibrium, the birth rate

8) *The Lather, Cleveland, Vol. XXX, No. 5, January 1930, pp. 20-21.*

equaling the death rate because the per capita wealth has been reduced to such a point as to bring this equilibrium about.

The laws of population, therefore, may be stated as follows:

1. An increase in population will tend to increase aggregate wealth but less rapidly than population. That is, the increase in population tends to decrease per capita wealth.

2. A decrease in per capita wealth will tend to increase the death rate and decrease the birth rate. That is, the decrease in per capita wealth checks the increase of population.

In accordance with these laws the sequence of events is usually as follows: In a new and sparsely settled country, population at first increases. As the country fills up this increase is slackened and finally comes to a standstill when the death rate equals the birth rate. This stationary state is reached when the people are either unable or unwilling to lower the standard of subsistence. Such a stationary state has been nearly reached in India, where people are unable to lower the standard of subsistence, and in France, where they are unwilling. In most countries, population is still increasing and will probably continue to do so until the vast areas opened by the exploration and colonization in the last four centuries shall have been filled up. These areas include North and South America, Australia, and parts of Africa. The rendering available of these continents to occupation by Europeans constitutes the greatest economic event of modern times and has relieved for a season the pressure of population on subsistence. Similar relief has been afforded by great labor-saving inventions which enable a given population to secure increased subsistence. Future inventions may be expected to increase this process. But ultimately there must be a limit to the capacity of the world to support population.

This limit on human population is the same sort of limit which nature sets on animal and plant population. Blades of grass multiply until they cover the ground on which they grow. When grass is sown on a grass plot, it multiplies with great rapidity, but after the whole plot is covered and there is no room for more, the number of blades remains nearly stationary. There is a struggle for life constantly going on, and the death rate thus produced is great enough to balance the birth rate which the capacity of the soil allows. Out of this struggle for existence among animals and plants comes what Darwin called natural "selection," and it is interesting to know that Darwin's first idea of such a struggle came from reading the economist Malthus, who first wrote an important treatise on Population. Population may then be said to be limited by the means of subsistence.

Since Malthus' day there has come into more definite operation what he called the "preventive check" on population. While it is still true that among the poor it usually happens that an increase in per capita wealth tends to increase the birth rate by encouraging marriage or making them earlier or increasing the number of children per marriage, it has become unfortunately true that among the wealthier classes an increase in wealth tends sometimes in the opposite direction.

## 48. Population and Wealth<sup>9</sup>

HAVING studied Population and Poverty, we may next study Population and Wealth. We have already seen that the rich tend to have fewer and fewer children as they grow richer. Instead of wealth being then thought of as a means for gaining or maintaining "social position," and the more wealth gained the more ambitious are its possessors that its enjoyment may not be interfered with by child-bearing, or that it shall not be decreased by subdivision in the next generation. The result is that the wealthier classes often have, on the average, smaller families than the poorer classes. We must, therefore, modify the law of population so as to read that an increase in per capita wealth, instead of tending always to increase the birth rate, tends first to increase it and then, after the increase of wealth passes a certain point, to decrease it. This wealth check to population is peculiar. It is quite different from the poverty check. The poverty check works automatically so as to check population when it is too large and not to check it when it is too small. But the wealth check acts in the opposite way – or rather it would do so if it were sufficiently strong and general, which is not yet the case. Then it would come about that the greater the per capita wealth the more would population be checked, and as the check to population usually tends to increase per capita wealth, this would still further decrease population. The logical result is depopulation or what President Roosevelt called "race suicide."

At present, however, this wealth check is confined to certain parts of the population, and only

9) *The Lather, Cleveland, Vol. XXX, No. 6, February 1930, p. 14.*



results in “race suicide” for these particular parts. These parts include particularly the so-called “better classes” of the population. Statistics show that the children of college graduates are less numerous than the graduates themselves. Thus, besides depopulation, there is another danger, degeneration. If the vitality of vital capital is impaired by a breeding of the worst and a cessation of the breeding of the best, no greater calamity could be imagined. But while the risk of such a result undoubtedly exists, this is not immediate, and, in increasing realization of its possibility, we may hope, will lead to some way of counteracting it. A method of attaining the contrary result – namely, reproducing from the best and suppressing reproduction from the worst – has been suggested by the late Sir Francis Galton of England, under the name of “eugenics.” This movement, which promises to become a strong one, aims to prevent (by isolation in public institutions and in some cases by surgical operations) the possibility of the propagation of feeble-minded and certain other classes of defectives and degenerates, and also to develop a public sentiment which shall, condemn marriages in which either husband or wife has a transmissible disease, or any inheritable taint, or is otherwise unfit to become a parent.