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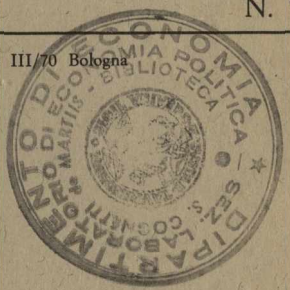

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SOTTO GLI AUSPICI DELLA
UNIVERSITÀ COMMERCIALE LUIGI BOCCONI
E DELLA UNIVERSITÀ DEGLI STUDI DI MILANO

CEDAM - CASA EDITRICE DOTT. A. MILANI - PADOVA

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SUL CONTENUTO NORMATIVO DEI MODELLI ALTERNATIVI ALL'UTILITÀ ATTESA

di
MICHELE BERNASCONI *

1. *Introduzione*

Lo sviluppo piú significativo nello studio dei comportamenti individuali in condizioni di rischio e di incertezza durante gli ultimi quindici anni si è avuto con la produzione di un numero rilevante di modelli che, in un modo o nell'altro, hanno rifiutato l'ipotesi di massimizzazione dell'utilità attesa (EU dall'inglese *Expected Utility*). A cominciare dal contributo pionieristico di Maurice Allais (1953), i teorici delle decisioni hanno raggiunto risultati fondamentali nel corroborare questi modelli con un sostanziale supporto empirico e nel garantirne una flessibilità analitica, pari quasi a quella offerta dall'EU. Un'analisi sistematica di questi due gruppi di risultati, che possono essere considerati, rispettivamente, come l'obiettivo empirico e l'obiettivo teorico, si trova in Machina (1983). Tuttavia, secondo Machina (1989), un terzo obiettivo, definito come l'obiettivo normativo, deve essere soddisfatto prima che i modelli alternativi all'EU possano essere effettivamente utilizzati dall'analisi economica.

Il problema maggiore nel conseguire questo obiettivo deriva da una diffusa convinzione, secondo la quale gli individui che non si adeguano all'EU si comportano in modo inconsistente da un punto di vista dinamico, ovvero, nel corso di processi decisori in cui l'incertezza è risolta in modo sequenziale, questi individui tenderebbero ad esprimere preferenze per scelte da realizzare in istanti successivi, le quali verrebbero rinnegate al momen-

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Desidero ringraziare il direttore di questa rivista, Prof. Aldo Montesano, per i commenti ad una precedente versione del lavoro. Ovviamente, la responsabilità per il contenuto dell'articolo resta esclusivamente mia.

to della loro effettiva implementazione. La difficoltà a conciliare questo tipo di comportamento con l'ipotesi di agenti razionali deriva dal fatto che l'inconsistenza dinamica lascia gli individui vulnerabili ad attività manipolatorie di vario tipo. Tipicamente, una persona che si comporta in modo dinamicamente inconsistente è disposta a pagare una somma di denaro, anche se piccola, per ritornare su una decisione già presa e per scegliere un'alternativa scartata solo pochi istanti prima. In altre parole, tale comportamento genera per l'individuo un costo senza contropartita, secondo uno schema noto in letteratura come *dutch book* (cfr. Yaari, 1985).

In questo articolo ci proponiamo innanzitutto di enfatizzare come, a dispetto del fatto che gli individui che non si adeguano alle implicazioni dell'EU *potrebbero* effettivamente comportarsi in maniera dinamicamente inconsistente, tuttavia, la convinzione secondo cui chi contraddice l'EU *necessariamente* viola la consistenza dinamica, si fonda su un'assunzione sottostante l'EU, che non ci sembra condividere lo stesso *status* normativo – ovvero di principio di razionalità individuale – della consistenza dinamica. Tale è l'assioma di Riduzione. Esso stabilisce che, « al fine di confrontare preferenze e scelte in condizioni di rischio, è sufficiente caratterizzare ciascuna alternativa in termini della probabilità finale che essa induce sull'insieme delle possibili conseguenze » (Fishburn, 1988, p. 27).

Questa assunzione non asserisce semplicemente che gli individui nel scegliere tra azioni alternative determinano la verosimiglianza delle diverse conseguenze possibili, utilizzando le leggi fondamentali del calcolo delle probabilità – un'assunzione nota come Razionalità Bayesiana –; oltre a questo, il principio di Riduzione stabilisce che gli individui scelgono come se le loro preferenze fossero unicamente definite sulla base delle distribuzioni delle conseguenze finali indotte da queste probabilità, ovvero, indipendentemente da considerazioni relative al modo in cui le probabilità stesse sono generate.

In questo senso, il principio di Riduzione ci sembra molto simile al principio di Invarianza Descrittiva mutuato dalla letteratura psicologica, il quale afferma che le preferenze tra scelte alternative sono indipendenti dalla loro particolare descrizione (Tversky e Kahneman, 1986) [1]. Cosí, piuttosto che come condizione di razionalità per gli agenti, il principio di Riduzione ci sembra un'assunzione riguardo al grado di astrazione nella descrizione delle alternative. In effetti, l'argomentazione principale di questo lavoro è proprio quella di mostrare come, operando ad un livello di astrazione piú attento

[1] Una piú dettagliata discussione relativa alle relazioni tra il principio di Riduzione e quello di Invarianza Descrittiva si trova in FISHBURN (1988, p. 27).

alla specifica descrizione delle alternative di quanto imposto dal principio di Riduzione, è possibile identificare almeno due classi di modelli alternativi all'EU, che soddisfano anche i requisiti per la consistenza dinamica. E, in questa prospettiva, tenteremo anche di convincere il lettore come il rifiuto del principio di Riduzione non debba essere semplicemente considerato come un mezzo per ottenere la consistenza dinamica in modelli alternativi all'EU, ma diventi soprattutto un modo per affermare la supremazia dell'obiettivo descrittivo su quello normativo nella teoria delle decisioni.

Il resto del lavoro è organizzato come segue. Nella Sezione 2 indicheremo il tipo di inconsistenza dinamica che può scaturire dal seguire comportamenti che violano l'EU. La Sezione 3 sarà utilizzata per presentare le caratteristiche essenziali di due tipi di soluzioni che sono state elaborate al fine di risolvere questo problema, enfatizzando proprio come entrambi i modelli richiedano un rifiuto, sebbene in direzioni diverse, del principio di Riduzione. La Sezione conclusiva (Sezione 4) riassumerà il lavoro presentando un'aggiornamento di una classificazione, originariamente elaborata da Machina (1989), di tipologie di individui distinti « sulla base delle loro preferenze su lotterie e della maniera in cui si comportano in situazioni di scelte dinamiche» (p. 1651).

2. *Il Paradosso di Allais e l'obiettivo normativo*

In questa sezione mostreremo il tipo di inconsistenza dinamica in cui può incorrere un individuo che viola l'EU. A questo proposito, si consideri la piú famosa violazione contro l'EU, nota come Paradosso di Allais. Essa deriva dalla risposta alle seguenti due domande, dove « *M* » indica milioni.

Domanda 1: si scelga tra

A: \$ 1*M* con prob. 1	o	*B*: \$ 5*M* con prob. .10
		\$ 1*M* con prob. .89
		0 con prob. .01

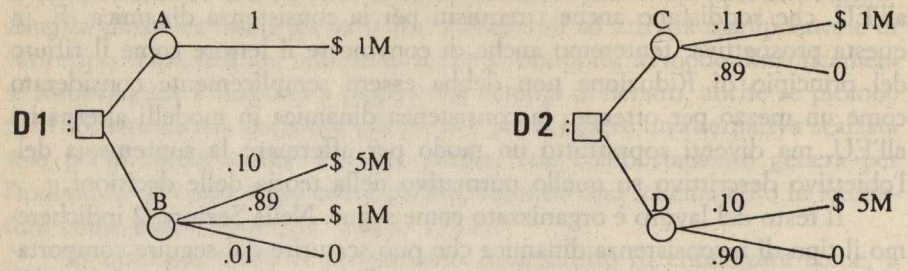
Domanda 2: si scelga tra

C: \$ 1*M* con prob. .11	o	*D*: \$ 5*M* con prob. .10
0 con prob. .89		0 con prob. .90

Nella Figura 1 sono rappresentati gli alberi delle decisioni relativi a queste due domande.

Diversi ricercatori hanno mostrato che la scelta modale nella coppia di Domande {1, 2} è {*A*, *D*} (si veda Allais, 1953; Slovic e Tversky, 1974; e

FIGURA 1: I diagrammi delle decisioni per le Domande 1′ e 2′.



□: nodo delle decisioni; ○: nodo della sorte

Conlisk, 1989; tra gli altri). Questo comportamento viola l'EU contraddicendo l'assioma d'Indipendenza, considerato sinonimo stesso dell'EU [2], che stabilisce che le preferenze tra due prospetti non si devono modificare quando i due prospetti sono combinati nella medesima proporzione con una terza alternativa:

Assioma d'Indipendenza: un prospetto $X = (x_1, p_1; \ldots; x_n, p_n)$ è preferito ad un prospetto $Y = (y_1, q_1; \ldots; y_m, q_m)$ se e solo se per ciascun prospetto $Z = (z_1, r_1; \ldots; z_e, r_e)$ e $\alpha \in (0, 1]$, il prospetto $\alpha X + (1 - \alpha) Z = (x_1, \alpha p_1; \ldots; x_n, \alpha p_n; z_1, (1 - \alpha) r_1; \ldots; z_e, (1 - \alpha) r_e)$ è preferito al prospetto $\alpha Y + (1 - \alpha) Z = (y_1, \alpha q_1; \ldots; y_m, \alpha q_m; z_1, (1 - \alpha) r_1; \ldots; z_e, (1 - \alpha) r_e)$.

Cosí, con $X = (\$\ 1M, 1)$, $Y = (\$\ 5M, 10/11; 0, 1/11)$, $\alpha = .11$ e $Z = (0, 1)$, l'assioma d'Indipendenza sottoscrive la predizione:

$$(C1)\ A\,(= \alpha X + (1 - \alpha)\, Z) \gtreqless (\alpha Y + (1 - \alpha)\, Z =)\, B$$

$$\leftrightarrow X \gtreqless Y \leftrightarrow$$

$$C\,(= \alpha X + (1 - \alpha)\, X) \gtreqless (\alpha Y + (1 - \alpha)\, X =)\, D$$

[2] Piú precisamente, una volta che si assume l'esistenza di una relazione di preferenza che possa venire rappresentata attraverso un funzionale V a valori reali, l'assioma d'Indipendenza è necessario e sufficiente perché il valore di un prospetto $X = (x_1, p_1; \ldots; x_n, p_n)$ sia determinato dall'EU $V(X) = \sum_{i=1}^{n} u(x_i)\, p_i$, dove $u(\cdot)$ è una funzione di utilità definita a meno di una trasformazione lineare del tipo $au(\cdot) + b$, con $a, b > 0$.

(dove $>$ e $-$ denotano, rispettivamente, le relazioni di preferenza stretta e di indifferenza), le quali sono contraddette dal Paradosso di Allais $\{A, D\}$.

In conseguenza del Paradosso di Allais e di simili violazioni contro l'assioma d'Indipendenza, un notevole numero di modelli alternativi all'EU, che possono spiegare tali contraddizioni, è stato proposto negli ultimi quindici anni. Tale letteratura è ampiamente presentata negli articoli di Machina (1983 e 1987), Weber-Camerer (1987), Sugden (1986) e Fishburn (1988).

Tuttavia, questi modelli sono stati spesso criticati su un piano normativo, in quanto darebbero luogo a comportamenti dinamicamente inconsistenti. Tale inconsistenza può essere meglio illustrata facendo riferimento alle seguenti versioni dinamiche delle Domande 1 e 2.

Domanda 1′

Si consideri il seguente gioco a due stadi. Nel primo stadio c'è una probabilità di .89 di vincere \$ 1*M* e una probabilità di .11 di raggiungere un secondo stadio. Se si raggiunge il secondo stadio si presenta la scelta tra:

(\$ 1*M*, 1) o (\$ 5*M*, 10/11; 0, 1/11)

La scelta deve essere fatta prima che il gioco incominci, ovvero prima che l'incertezza relativa al primo stadio sia risolta.

Domanda 2′

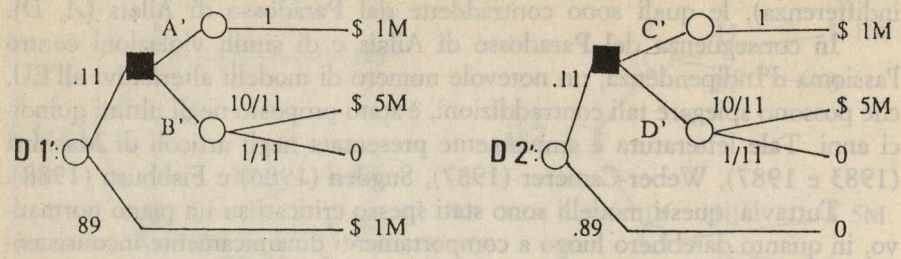
Si consideri il seguente gioco a due stadi. Nel primo stadio c'è una probabilità di .89 di concludere il gioco senza avere vinto nulla e una probabilità di .11 di raggiungere un secondo stadio. Se si raggiunge il secondo stadio si presenta la scelta tra

(\$ 1*M*, 1) o (\$ 5*M*, 10/11; 0, 1/11)

La scelta deve essere fatta prima che il gioco incominci, ovvero prima che l'incertezza relativa al primo stadio sia risolta.

La Figura 2 rappresenta gli alberi delle decisioni per le Domande 1′ e 2′. I due quadri neri al centro degli alberi denotano due nodi degli stati del mondo, o *natural node* secondo la definizione di Hammond (1988). La sorte, attraverso la risoluzione del primo stadio del gioco, ridefinisce l'insieme delle conseguenze possibili cosí da generare i due prospetti (\$ 1*M*, 1) e (\$ 5*M*, 10/11; 0, 1/11). Si noti, infatti, che A' e C' nella Figura 2 denotano gli impegni a scegliere (\$ 1*M*, 1) ai *natural node* delle Domande 1′ e 2′, rispettivamente, presi *prima* che l'incertezza relativa al primo stadio sia risolta; e, in maniera analoga, B' e D' denotano gli impegni a scegliere (\$

FIGURA 2: I diagrammi delle decisioni per le Domande 1′ e 2′.



5*M*, 10/11; 0, 1/11) ai *natural node* nei rispettivi diagrammi, presi *prima* che si conosca il risultato del primo stadio di incertezza.

Consideriamo ora come il principio di Riduzione interagisce con questi due problemi. A questo proposito, si ricordi dall'Introduzione che questo principio assicura che la scelta tra azioni alternative che non generano una conseguenza certa, può essere univocamente definita da una relazione di preferenza rispetto alle probabilità finali indotte dalle azioni stesse.

Due predizioni immediate seguono da questa assunzione:

$$(C2) \quad \begin{cases} (C2') & A \gtrless B \leftrightarrow A' \gtrless B' \\ (C2'') & C \gtrless D \leftrightarrow C' \gtrless D' \end{cases}$$

e

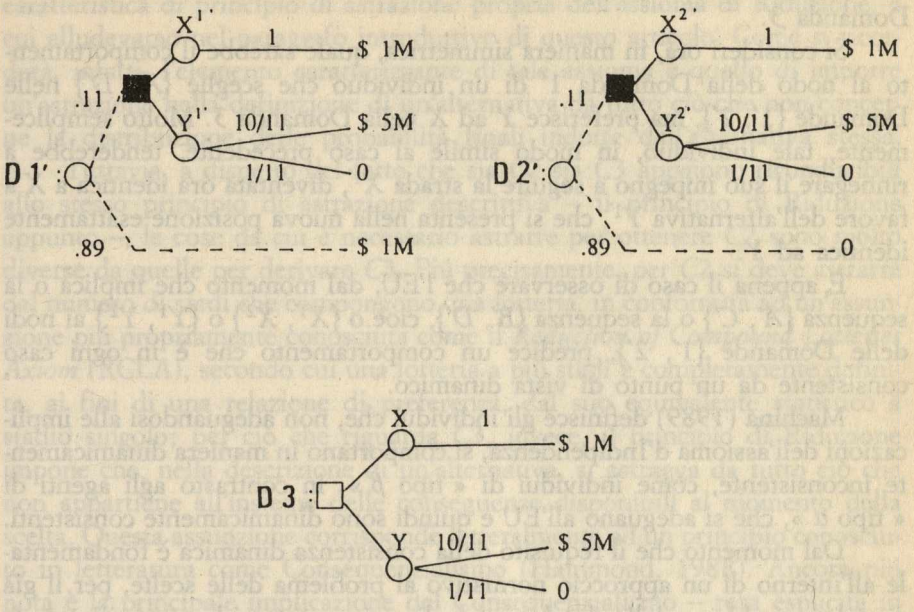
$$(C3) \quad X^{1'} \gtrless Y^{1'} \leftrightarrow X \gtrless Y \leftrightarrow X^{2'} \gtrless Y^{2'}$$

dove $X^{1'}$ e $Y^{1'}$ denotano i secondi stadi delle lotterie a due stadi A' e B', rispettivamente, i.e. (\$ 1*M*;1) e (\$ 5*M*,10/11; 0;1/11); e, in maniera simile, $X^{2'}$ corrisponde al secondo stadio di C', cioè (\$ 1*M*;1), e $Y^{2'}$ al secondo stadio di D', ovvero (\$ 5*M*,10/11; 0;1/11); X e Y infine, denotano pure le lotterie (\$ 1*M*;1) e (\$ 5*M*,10/11; 0;1/11), presentate tuttavia come scelta diretta, come indicato da *D*3 nella Figura 3.

Si considerino ora le implicazioni del principio di Riduzione. *C*2′ segue dal fatto che A e B nella Domanda 1 sono equivalenti, in termini delle probabilità finali offerte dai prospetti, rispettivamente ad A' e B' della Domanda 1′; e, in maniera simile, *C*2″ segue dal fatto che C e D della Domanda 2 sono equivalenti rispettivamente a C' e D' della Domanda 2′.

*C*3, invece, si deriva semplicemente osservando che, dopo che l'incertezza relativa al primo stadio delle Domande 1′ e 2′ è stata risolta e la sorte ha condotto ai *natural node* dei due alberi delle decisioni nelle rispettive doman-

FIGURA 3: I diagrammi delle decisioni per le Domande 1′ e 2′ (dopo che l'incertezza relativa al primo stadio è stata risolta) e il diagramma delle decisioni per la Domanda 3′.



de, allora la parte rimanente dei diagrammi è identica e corrisponde a una scelta diretta tra ($ 1*M*;1) e ($ 5*M*,10/11; 0;1/11), come indicato da *D*3 (Domanda 3) nella Figura 3.

Dunque, in seguito alle implicazioni del principio di Riduzione presentate in *C*2, un individuo che commette il Paradosso di Allais nelle Domande 1 e 2 sceglierà {*A*′, *D*′} nelle Domande {1′, 2′}, ovvero, programmerà di prendere $X^{1'}$ e $Y^{2'}$ ai *natural node* delle Domande 1′ e 2′, rispettivamente.

Tuttavia, un individuo con tali preferenze si comporterebbe, nell'uno o nell'altro degli alberi delle decisioni, in modo dinamicamente inconsistente, ovvero per tale individuo esisterebbe un disaccordo fra le scelte che si farebbero ai *natural node*, a seconda che tali scelte siano considerate relativamente al primo stadio o al secondo stadio del diagramma delle decisioni (essendo i due stadi separati da un atto della natura).

Si supponga, infatti, che un individuo che sceglie {*A*′, *D*′} nelle Domande {1′, 2′}, preferisce *X* ad *Y* nella Domanda 3. Allora, nel caso tale individuo arrivi effettivamente al *natural node* della Domanda 2′, egli si troverebbe nella stessa posizione di un individuo che sta considerando le alternative offerte nella Domanda 3. Perciò, se a questo stadio gli fosse offerta la

possibilità (magari pagando una piccola multa) di cambiare il suo impegno iniziale a scegliere $Y^{2'}$ invece di $X^{2'}$, egli certamente sfrutterebbe tale opportunità in conformità a *C3* e alle sue preferenze cosí come espresse nella Domanda 3.

Si consideri ora, in maniera simmetrica, quale sarebbe il comportamento al nodo della Domanda 1′ di un individuo che sceglie $\{A', D'\}$ nelle Domande $\{1', 2'\}$, ma preferisce *Y* ad *X* nella Domanda 3. Molto semplicemente, tale individuo, in modo simile al caso precedente, tenderebbe a rinnegare il suo impegno a seguire la strada $X^{1'}$, diventata ora identica a *X* a favore dell'alternativa $Y^{1'}$, che si presenta nella nuova posizione esattamente identica ad *Y*.

È appena il caso di osservare che l'EU, dal momento che implica o la sequenza $\{A', C'\}$ o la sequenza $\{B', D'\}$, cioè o $\{X^{1'}, X^{2'}\}$ o $\{Y^{1'}, Y^{2'}\}$ ai nodi delle Domande $\{1', 2'\}$, predice un comportamento che è in ogni caso consistente da un punto di vista dinamico.

Machina (1989) definisce gli individui che, non adeguandosi alle implicazioni dell'assioma d'Indipendenza, si comportano in maniera dinamicamente inconsistente, come individui di « tipo β », in contrasto agli agenti di « tipo α », che si adeguano all'EU e quindi sono dinamicamente consistenti.

Dal momento che il requisito della consistenza dinamica è fondamentale all'interno di un approccio normativo al problema delle scelte, per il già ricordato problema delle *dutch book* [3], diversi ricercatori hanno utilizzato la tipologia β come dimostrazione della inadeguatezza dei modelli che non sottoscrivono l'assioma d'Indipendenza.

È tuttavia evidente che questo tipo di difesa dell'EU non si fonda solamente sul contenuto specifico dell'assioma d'Indipendenza, ma dipende anche dal principio di Riduzione secondo le sue implicazioni in *C2* e in *C3*.

Nella prossima sezione verranno infatti presentate due diverse soluzioni al problema della consistenza dinamica all'interno dei modelli alternativi all'EU, ottenute a seconda che sia rifiutata quella parte del principio di Riduzione che conduce all'implicazione *C2* o quella parte che conduce all'implicazione *C3*.

3. *Il principio di Riduzione e la consistenza dinamica*

Dunque, per affrontare il problema della consistenza dinamica all'inter-

[3] Per un'analisi delle diverse *dutch book* in cui potrebbe incorrere un individuo di tipo β, si veda MACHINA (1989, pp. 1636-39).

no dei modelli alternativi all'EU, conviene partire riconsiderando piú dettagliatamente il principio di Riduzione, cosí come rappresentato nelle implicazioni *C2* e *C3*. Queste ultime sono particolarmente utili per enfatizzare la caratteristica di principio di astrazione propria dell'assioma di Riduzione, a cui alludevamo nel paragrafo introduttivo di questo articolo. Come si ricorderà, infatti, l'elemento caratterizzante di tale assioma è quello di imporre un'astrazione nella definizione di un'alternativa da tutto ciò che non concerne la distribuzione delle probabilità finali indotte dall'alternativa stessa.

Tuttavia, a dispetto del fatto che sia *C2* sia *C3* appaiono riconducibili allo stesso principio di astrazione descrittiva – il principio di Riduzione appunto –, le cose da cui è necessario astrarre per ottenere *C2* sono molto diverse da quelle per derivare *C3*. Piú precisamente, per *C2* si deve astrarre dal numero di stadi che compongono una lotteria, in conformità ad un'assunzione piú propriamente conosciuta come il *Reduction of Compound Lotteries Axiom* (RCLA), secondo cui una lotteria a piú stadi è completamente definita, ai fini di una relazione di preferenza, dal suo equivalente statistico a stadio singolo; per ciò che riguarda *C3*, invece, il principio di Riduzione impone che, nella descrizione di un'alternativa, si astragga da tutto ciò che non appartiene all'insieme delle conseguenze disponibili al momento della scelta. Questa assunzione corrisponde letteralmente ad un principio conosciuto in letteratura come Consequenzialismo (Hammond, 1988). Ancora piú nota è la principale implicazione del Consequenzialismo – resa esplicita in *C3* – che il passato è passato, *bygones are bygones*, per indicare che una diversa storia passata non può alterare le preferenze in decisioni che sono equivalenti in termini delle conseguenze ancora ammissibili.

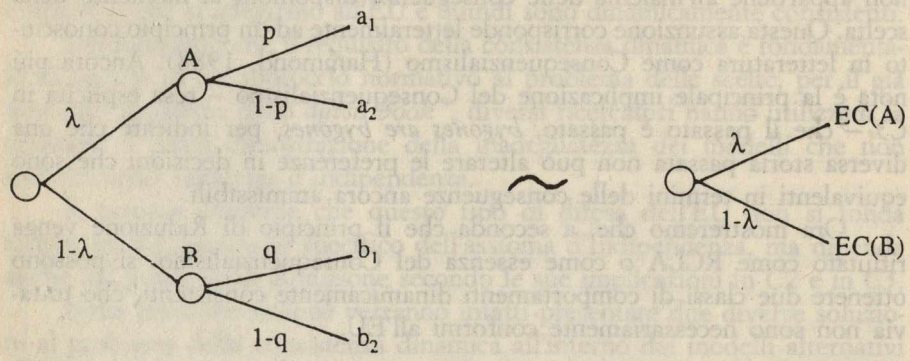
Ora mostreremo che, a seconda che il principio di Riduzione venga rifiutato come RCLA o come essenza del Consequenzialismo, si possono ottenere due classi di comportamenti dinamicamente consistenti, che tuttavia non sono necessariamente conformi all'EU.

3.1. *Il rifiuto del principio di Riduzione per le sue implicazioni come RCLA: la categoria di individui di tipo* η. – Come prima forma di comportamento alternativo all'EU e consistente da un punto di vista dinamico, si supponga che il principio di Riduzione sia valido per le sue implicazioni consequenzialiste, ovvero in *C3*, ma non come RCLA in *C2*. Si consideri quindi un individuo che, nel compiere le sue decisioni nelle Domande $1'$ e $2'$, guardi solamente alle sue preferenze tra le lotterie (\$ $1M$, 1) e (\$ $5M$, $10/11$; 0, $1/11$); in altre parole, tale individuo decide di risolvere il problema dei due stadi delle lotterie rispetto a cui è chiamato a scegliere, « anticipando » lo stato d'animo che preverrà ai *natural node* delle due domande, il che lo

conduce a cancellare dalla mente la probabilità .89 di vincere un milione di dollari, relativa al primo stadio comune alle lotterie A' e B' nella Domanda 1′, e la probabilità .89 di non vincere nulla, comune al primo stadio delle lotterie C' e D' nella Domanda 2′.

Non è probabilmente superfluo notare, a questo punto, come il principio dell'Anticipazione diventi un'ipotesi, alternativa a quella meccanica del RCLA, per ridurre una lotteria a piú stadi ad una lotteria a stadio singolo. Piú specificatamente, nel caso di una lotteria a due stadi del tutto generica come quella nella Figura 4, l'ipotesi che gli individui anticipino lo stato d'animo che prevarrà nei nodi finali della sorte, significa supporre che gli individui valutino innanzitutto ogni *sub*-lotteria assegnandovi una loro valutazione soggettiva, l'equivalente certo (*EC*), sostituendola quindi alla *sub*-lotteria stessa e ottenendo per questa via una lotteria a stadio singolo (si veda la Figura 4).

FIGURA 4: Il principio dell'Anticipazione o dell'Equivalente Certo.



Ancora piú importante, comunque, è osservare come proprio la violazione del principio dell'Anticipazione sia alla base dell'inconsistenza in cui incorre un individuo che sceglie $\{A', D'\}$ nelle Domande $\{1', 2'\}$. Infatti, è immediato osservare che solo due possibili categorie di scelta sono consistenti, per quanto concerne le Domande $\{1', 2'\}$, con il principio dell'Anticipazione: o $\{A', C'\}$ o $\{B', D'\}$ [4]; e, naturalmente, un individuo che adotta questo

[4] Questo dipende solamente dal fatto che, adottando il principio dell'Anticipazione, la scelta tra A' e B' diventa di fatto una scelta tra ($ 1*M*, .89; *EC* (*X*), .11) e ($ 1*M*, .89; *EC* (*Y*), .11); mentre la decisione tra C' e D' corrisponde di fatto a una scelta tra (0, 89; *EC* (*X*), .11) e

principio non avvertirà nessuna esigenza a modificare i propri programmi, proprio come nel caso dell'EU.

Chiaramente, quindi, adottare il principio dell'Anticipazione per preservare la consistenza dinamica nelle Domande 1′ e 2′ è molto diverso che sottoscrivere l'assioma d'Indipendenza, come invece è imposto dall'EU. Ovviamente, il prezzo da pagare per mantenere tale distinzione è l'abbandono del RCLA, ovvero operare ad un livello di astrazione in cui il numero di stadi attraverso cui una lotteria viene risolta diventi variabile esplicitamente rilevante.

Tuttavia, per chi è disposto a sostenere tale maggior onere nella descrizione di un'alternativa, è possibile individuare una classe di modelli che, sottoscrivendo il principio dell'Anticipazione, ma rifiutando il RCLA, sono in grado sia di risolvere il Paradosso di Allais sia di garantire comportamenti dinamicamente consistenti.

Teorie delle decisioni che consentono di esprimere un comportamento di questo tipo, che qui definiamo « tipo η », sono state elaborate da Tversky-Kahneman (1986), Loomes-Sugden (1986) e, soprattutto, Segal (1987, 1990).

3.2. *Il rifiuto del principio di Riduzione per le sue implicazioni consequenzialiste: la categoria di individui di tipo* γ. – Un differente tipo di comportamento dinamicamente consistente può essere ottenuto accettando il principio di Riduzione per le sue predizioni come RCLA in *C*2, ma rifiutandolo per le sue implicazioni consequenzialiste in *C*3.

A questo fine, si consideri un individuo che esibisce il Paradosso di Allais e che, in virtú di *C*2, effettivamente scelga $\{A', D'\}$ nelle Domande $\{1', 2'\}$. Si supponga ora che, nell'eventualità tale individuo raggiunga effettivamente i *natural node* dei diagrammi decisionali relativi alle due domande, egli confermi i suoi impegni originari, ovvero la scelta $X^{1'}$ nella Domanda 1′ e la scelta $Y^{2'}$ nella Domanda 2′, senza riguardo alle preferenze espresse nella Domanda 3.

Machina (1989) definisce questa forma di comportamento dinamicamente consistente come comportamento di tipo γ. La differenza essenziale tra questa tipologia e quelle relative alle categorie α, β ed η presentate precedentemente, è che tutti quegli altri tipi di agenti, nel caso in cui giungano effettivamente ai *natural node* dei diagrammi relativi alle Domande

(0, 89; *EC*(*Y*), .11), dove *EC*(*X*) ed *EC*(*Y*) stanno per l'equivalente certo di $X = (\$\ 1M;1)$ e $Y = (\$\ 5M,10/11;\ 0;1/11)$. Da qui, un semplice argomento di dominanza implica la predizione del testo.

1′ e 2′, dimenticano completamente le ramificazioni non realizzate dei diagrammi – come se tali ramificazioni non fossero mai esistite – e applicano al proseguimento dei diagrammi le preferenze originarie tra X ed Y.

Viceversa, per un agente di tipo γ, l'incertezza relativa alle ramificazioni non realizzate è « passata nel senso che è stata risolta o consumata, piuttosto che passata nel senso che è divenuta irrilevante » (Machina, 1989, p. 1645). Ovviamente, accettare questo punto di vista significa aggiungere una dimensione, quella appunto delle ramificazioni passate, nella descrizione dell'insieme delle alternative di scelta e, di conseguenza, significa anche rigettare il Consequenzialismo. Tuttavia, una volta compiuto questo passo, l'individuo di tipo γ concorre con quello di tipo η a dimostrare che non esiste alcuna difficoltà teorica a conciliare il Paradosso di Allais con il requisito della consistenza dinamica.

4. *Conclusioni*

L'obiettivo principale di questo lavoro era quello di porre in rilievo il ruolo fondamentale occupato dal principio di Riduzione nell'argomentazione che un agente che non si adegua all'assioma d'Indipendenza si comporta in maniera dinamicamente inconsistente.

In verità, rifiutando il principio di Riduzione come principio con validità generale, è possibile ottenere due classi di modelli alternativi all'EU, entrambi consistenti sia con l'evidenza empirica contro l'assioma d'Indipendenza sia con l'esigenza di avere modelli consistenti da un punto di vista dinamico.

La differenza essenziale tra i due approcci, che nella nostra trattazione abbiamo utilizzato per identificare due tipologie di individui – la tipologia η e la tipologia γ –, è che il primo rifiuta il principio di Riduzione per le sue implicazioni come RCLA, ma lo sottoscrive per le sue predizioni consequenzialiste; mentre il secondo rigetta il consequenzialismo, accettando viceversa il RCLA.

Insieme agli agenti di tipo β, che sono dinamicamente inconsistenti poiché, pur rifiutando l'assioma d'Indipendenza, sottoscrivono sia il RCLA sia il Consequenzialismo, gli agenti di tipo η e γ determinano una classificazione di modelli alternativi all'EU, che si discosta leggermente da una classificazione originariamente proposta da Machina (1989) [5]. Naturalmente, il

[5] La differenza principale tra questa classificazione e quella proposta da Machina, è che nella classificazione originale non era considerata la tipologia η che è invece considerata qui,

quesito rilevante che ci si deve porre a questo punto riguarda quale tra queste tipologie è quella che meglio si presta a descrivere l'effettivo comportamento degli agenti che non si conformano all'EU.

I pochi risultati sperimentali disponibili non consentono una risposta definitiva a questo quesito, dal momento che nessuna tipologia risulta sostenuta da un riscontro empirico sufficientemente convincente da escludere altre forme di comportamento [6]. Tuttavia, in conformità all'osservazione piú volte ripresa in questo articolo, di considerare il principio di Riduzione come un assioma di invarianza descrittiva piuttosto che di razionalità individuale, tale evidenza potrebbe non essere sorprendente. In effetti, il rifiuto dell'assunzione che le preferenze tra scelte alternative sono indipendenti dalla descrizione sotto cui ogni alternativa è presentata, potrebbe dare origine a diversità di comportamento, non dipendenti solamente dal modo in cui ogni alternativa è effettivamente presentata, ma anche dal modo in cui ogni alternativa è soggettivamente percepita [7]. In altre parole, l'osservazione di comportamenti diversi a fronte di uno stesso problema potrebbe proprio essere dovuta al fatto che diversi individui percepiscono uno stesso problema secondo forme diverse.

Chiaramente, questa ipotesi è in marcato contrasto con l'approccio assiomatico/normativo tradizionale alla teoria delle decisioni, il quale assume agenti che, eccetto che per differenze nei gusti, sono altrimenti omogenei. Tuttavia, le argomentazioni sviluppate in questo articolo, nonché l'evidenza sperimentale a cui abbiamo fatto allusione, ci sembra siano argomenti sufficienti sia per rifiutare, per lo meno a livello di ipotesi di lavoro, il principio di Riduzione sia, di conseguenza, per rivalutare un'approccio piú descrittivo al problema delle scelte.

mentre nell'originale era considerata una tipologia δ, che viceversa noi abbiamo eliminato dalla nostra classificazione. La ragione di questa eliminazione è che l'individuo di tipo δ, a dispetto del fatto che definisce un comportamento dinamicamente consistente secondo un'ipotesi elaborata da KARNI e SAFRA (1989) e nota come *behavioral consistency*, tuttavia presenta altre caratteristiche particolarmente insoddisfacenti, come è stato ampiamente dimostrato da DARDANONI (1992) e da MACHINA (1989) stesso.

[6] Su questo punto si vedano in particolare i risultati in CONLISK (1989) e BERNASCONI (1992).

[7] Nel contesto di problemi inerenti decisioni a stadi multipli, una discussione relativa agli effetti della percezione soggettiva di un'alternativa si trova in BERNASCONI e LOOMES (1992).

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ON THE NORMATIVE CONTENT OF NON-EXPECTED UTILITY MODELS

Non-expected utility models of individual behaviour, intended as models which dispense with the Independence Axiom, have been often criticized because they could lead to dynamic inconsistency. This paper reconsiders such an argument in the light of another assumption underlying Expected Utility (EU), namely the Reduction Principle. This latter is a restriction on the level of abstraction relevant in the description of the alternatives involved in the decision problems. The main argument of the article is that, by describing the alternatives more accurately than what is imposed by the Reduction Principle, dynamic consistency can be easily guaranteed in non-expected utility models too.

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PRIVATE INVESTMENT, RELATIVE PRICES AND BUSINESS CYCLE IN MALAYSIA

by
GAN WEE BENG *

I. *Introduction*

There is now a consensus that the real interest rate and the real exchange rate are crucial relative prices in determining the relative success of the stabilization and structural adjustment policies in developing countries. Adjustment in the exchange rate affects firms' profitability by changing the cost of imported inputs and by changing the level of real wage faced by the firms. Movements in interest rate affect the user cost of capital to the firms. These joint effects will influence private investment decisions and consequently the future growth of income and output.

In this paper, we attempt to obtain some quantitative evidence on the manner and magnitude in which movements of these relative prices affect the path of private investment in Malaysia. In addition, we seek to understand the broader role played by private investment behaviour in historical Malaysian business cycles, by determining the extent to which autonomous shocks in investment constitute an important impulse to the cyclical fluctuations in economic activity and the extent to which shifts in investment constitute a part of the dynamic propagation mechanism of the economy. In Section II of the paper, we present a brief discussion of the historical macroeconomic developments in Malaysia and relate the behaviour of private investment during the episodes when the economy was subject to various shocks. In Section III, we present the results of an attempt to estimate a general investment function that allows for various channels of

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The views expressed in the paper are those of the author and do not reflect the view of the Monetary Authority of Singapore.

influence for real interest rate, real exchange rate, stock market valuation, and changes in economic activity. In Section IV, we further investigate the effects of autonomous investment shifts, real, and financial shocks on private investment behaviour and evaluate the role of investment in the fluctuation of economic activity within a theoretical vector autoregression (VAR) framework. Section V presents the overall summary of our findings.

II. *Private Investment and Macroeconomic Developments*

This section provides an overview of the response of private investment to the macroeconomic shocks that affected the Malaysian economy during the 1970-89 period. During the period under study, there were two major slowdowns in the economy that caused private investment to deviate from its trend path. Following the first oil shock, a stabilization programme was put into place to reduce inflationary pressure. The resultant slowdown in economic activity in 1975-76 saw private investment fall to 14 percent of the gross domestic product (*GDP*), as indicated in Table 1.

During 1980-81, private investment rose to a high of 19 percent of *GDP*, following a large scale increase in government expenditure that was partly aimed at cushioning the impact of the recession in the industrialized countries on the Malaysian economy. As a result of the increase in public spending, the government budget deficit rose to an average of 18 percent of *GDP* during the 1981-83 period. The current account deficit increased to a peak of 13 percent of *GDP* in 1982. The expansion of the public sector also had an adverse impact on key relative prices in the economy. As indicated in Table 1, the real exchange rate of the economy, as measured by the real effective exchange rate and the relative price of non-tradable to tradable goods, appreciated. The real product wage in the tradable sector, as represented by the manufacturing real product wage, rose steeply.

The following structural adjustment programme undertaken by the government relied heavily on the reduction in public expenditure, with no attempt made at expenditure-switching through exchange rate adjustment. The expenditure reduction policy, undertaken against the backdrop of a continuous decline in the terms of trade, together with tight monetary policy and rigid real wage, resulted in a severe recession in 1985-86. The reduction in monetary growth, together with bouts of speculative attacks on the Ringgit exchange rate caused a steep increase in interest rates. For instance, during 1985-86, the real interest rate on commercial bank loans rose to an average of 17 percent.

TABLE 1.

PRIVATE INVESTMENT AND MACROECONOMIC INDICATORS, 1971-1988

	(a) Real *GDP* Growth (%)	(b) Share of Private Investment in *GDP* (%)	(c) Budget Deficit (% of *GDP*)	(d) Current Account Deficit (% of *GDP*)	(e) Real Exchange Rate (1980=100)	(f) Real Manufacturing Wage (1980=100)	(g) Relative Price of Non-tradable Goods to Tradable Goods (1980=100)	(h) Inflation Rate (%)	(i) Growth of Real Money Supply (%)
1971	10.0	20.3	− 8.8	− 2.5	109.1	n.a.	n.a.	1.6	4.8
1972	9.4	14.0	− 10.9	− 4.9	111.5	n.a.	n.a.	3.3.	27.6
1973	11.7	17.8	− 6.1	1.3	122.1	96.6	122.9	10.6	16.7
1974	8.3	16.4	− 6.3	− 5.0	129.0	89.6	115.1	17.3	− 3.7
1975	0.8	16.2	− 11.0	− 4.7	119.2	92.6	125.1	4.5	10.3
1976	11.6	14.6	− 7.1	5.8	111.4	94.4	116.4	2.6	7.5
1977	7.8	15.0	− 9.3	3.3	109.8	90.7	112.2	4.8	9.1
1978	6.7	15.7	− 7.9	0.7	106.4	97.7	110.6	4.9	7.6
1979	9.5	17.9	− 7.5	4.4	104.7	94.5	102.6	3.6	7.6
1980	7.4	19.6	− 13.6	− 1.1	100.1	100.0	100.0	6.7	7.9
1981	6.9	19.1	− 19.7	− 9.6	104.8	116.1	105.7	9.7	11.7
1982	5.9	17.6	− 18.0	− 13.4	110.4	130.3	114.6	5.9	9.6
1983	6.3	17.5	− 15.9	− 11.5	115.8	141.5	116.3	3.7	2.7
1984	7.8	18.0	− 12.3	− 4.9	122.1	160.6	116.8	3.9	− 5.5
1985	− 1.0	14.7	− 7.2	− 2.1	115.2	184.2	119.4	0.4	3.2
1986	1.2	10.2	− 13.1	− 0.3	93.8	210.8	128.5	0.7	12.2
1987	5.2	13.6	− 7.9	7.6	86.8	205.4	125.3	0.8	2.8
1988	8.9	15.5	− 7.5	5.8	78.3	197.9	118.7	2.5	10.2

NOTES: (c) Consolidated public sector deficit. (e) Real effective exchange rate. (f) Nominal manufacturing wage deflated by producer price of manufacturing output. (g) Consumer price index divided by producer price index. (h) Percentage change in consumer price index. (i) Percentage change in real M1 aggregate.

As a consequence of these shocks, *GDP* fell by 1 percent in 1985 and recovered weakly by 1 percent in 1986. Private investment declined to 14 percent of *GDP* in 1985 and fell further to 10 percent of *GDP* in 1986. Private investment, however, picked up quickly following the economic recovery, and by 1989, it constituted around 18 percent of *GDP*.

In Table 2, we provide a summary decomposition of the relative contributions of the variability of private investment and non-investment *GDP* to overall fluctuations in the real income. The decomposition is based on the formula:

$$\text{var}\,(\Delta GDP_t) = \text{var}\,(\Delta INV_t) + \text{var}\,(\Delta NIGDP_t) + 2\,\text{Cov}\,(\Delta INV_t, \Delta NIGDP_t)$$

where ΔINV is the change in real private investment and $\Delta NIGDP$ is the change in the non-investment component of real *GDP*.

TABLE 2

DECOMPOSITION OF VARIANCE OF CHANGES IN *GDP*

	Var (ΔGDP)	Var (ΔINV)	Var ($\Delta NIGDP$)	2 Cov (ΔINV, $\Delta NIGDP$)	$\frac{\text{Var}\,(\Delta INV)}{\text{Var}\,(\Delta GDP)}$	$\frac{\text{Var}\,(\Delta NIGDP)}{\text{Var}\,(\Delta GDP)}$
1971-1989	2403.6	1421.6	1256.8	− 274.8	0.59	0.52
1971-1979	1082.2	834.7	1613.5	− 1366.0	0.77	1.49
1980-1989	3532.5	2095.2	848.3	589.0	0.59	0.24

As indicated in Table 2, over the entire sample period of 1970-89, the magnitude of variability in private investment is almost similar to the variability in the non-investment component of *GDP*. The relatively small negative covariance term indicates that fluctuations in investment and in non-investment tend to offset each other. During the 1970's, variability in non-investment expenditure contributed considerably more to the cyclical movement in *GDP* than the variability of private investment. The negative offsetting movements between private investment and non-investment are large. The situation was reversed in the 1980's. The variance of cyclical behaviour of private investment was then twice the variability of non-investment spending. Fluctuations in private investment accounted for 60 percent of the variability of real income. In addition, the co-movement of private investment spending and non-investment expenditure was positive.

Given that public expenditure rose considerably during the 1980's, the positive co-variation between private investment and non-investment expenditures tend to suggest some form of 'crowding-in' of private investment by large scale increases in public spending. Public spending on construction and infrastructure helped to fuel private investment in the housing and construction sectors during the early 1980's.

III. *An Empirical Model of Private Investment Determination*

The model of private investment behaviour used in the empirical analysis in this section consists of two equations, in which the real private investment and the stock market valuation of the investment project, i.e. Tobin's q, are endogenously determined. The key consideration in the specification of the model is to capture the impact of the real exchange rate and the real interest rate on private investment decisions through the cost of capital accumulation and indirectly through the stock market valuation of the planned investment project.

The real interest rate affects investment decisions directly through the user costs of capital [1]. Exchange rate adjustment influenced investment by changing the costs of imported equipment and components. Besides these two variables that affect the investment costs, the planned level of investment is also determined by the expected change in the level of output [2]. The level of investment is also determined by the stock market valuation of the potential profitability of the investment project. More precisely, investment is influenced by the ratio of the stock market valuation of the existing capital asset to the replacement costs of these assets, i.e. the ratio [3].

The underlying insight of the q approach is that if the market value of a firm exceeds the replacement costs of its assets, it can increase its market value by investing in more capital assets. In an efficient capital market where stock prices impound all relevant information, the q can be expected to summarize information relevant for investment decisions and hence provide a basis for forward looking investment behaviour.

An additional consideration in the specification of the investment

[1] In the neoclassical model of HALL and JORGENSON (1971), the desired capital stock is a function only of the relative user cost of capital.

[2] Most of the accelerator type of models assume that there is a fixed relationship between the desired capital stock and output level of each point in time.

[3] The original idea of q theory was put forward by TOBIN (1969).

function is the existence of a time lapse, due to the time taken to design, build and install capital equipment, between the time when the investment decision is made and the time when the investment actually materializes (Kydland and Prescott, 1982; Ueda and Yoshikama, 1986). This inevitably gives rise to lags in the response of private investment to shocks in the economy, even if investment decisions are forward looking.

The above considerations lead to the following autoregressive distributed lag specification for the investment equation. A variety of dynamic adjustment models, including the partial adjustment model and the error correction model, can be shown to be restricted versions of the autoregressive distributed model (Hendry et al., 1986):

$$\log INV_t = + \sum_{i=1}^{p} \beta i \log INV_{t-i} + \sum_{i=0}^{p} \alpha_i \Delta \log NIGDP_{t-i} + \sum_{i=1}^{p} \delta_i RR_{t-i} + \sum_{i=0}^{p} \phi_i \log REX_{t-i} + \sum_{i=0}^{p} \tau_i \log q_{t-i} + u_t \quad (1)$$

where RR = expected real lending rate of commercial banks, REX = real effective exchange rate, q = the ratio of *KLSE* industrial price index to the index of private investment deflator [4]. The RR is computed as the nominal lending rate less the within-sample forecast of the percentage change in the *GDP* deflator. The percentage change in the *GDP* deflator is forecasted from an $AR1$ model. The dependent variable, *INV*, is expressed as the ratio of real private investment to the trend value of real *GDP*.

Table 3 presents the estimates of the investment function. The lag structure was chosen after considerable experimentation, largely to ensure that the dynamics of the model are adequately captured. Several observations can be made from estimates obtained in equation 3(a). Firstly, the ex ante real interest rate variable is highly significant. While the expected real interest rate variable is statistically significant, its economic significance in influencing private investment is minimal. The short run interest rate elasticity, evaluated at the mean ex ante real rate, is only -0.056. Secondly, the real exchange rate does not appear to have any direct impact on private investment. The F test fails to reject the null hypothesis that the coefficients

[4] The above empirical proxy for q refers to the average q, whereas for the purpose of determining an additional unit of capital expenditure, it is the marginal q that is of relevance. However, since the marginal q is not observable, we follow other empirical literature by using the average q. HAYASHI (1982) has shown the exact equivalence of the marginal and average q under perfect competition and constant returns to scale in production and installation technology.

TABLE 3

ESTIMATES OF THE INVESTMENT FUNCTION

	(a)	(b)	(c)
Constant	0.096 (0.115)	− 0.607 (− 3.293)	− 0.645 (− 3.22)
log INV_{t-1}	0.704 (4.607)	0.711 (8.561)	0.670 (6.711)
Δlog $NIGDP_{t-1}$	0.652 (2.173)	0.562 (2.366)	0.518 (2.014)
Δlog $NIGDP_{t-2}$	0.524) (1.877)	0.512 (1.781)	0.393 (1.801)
Sum exclude	1.176 0.052	1.074 0.048	0.911 0.059
RR_t	-0.309×10^{-2} (− 1.301)	-0.355×10^{-2} (− 2.249)	-0.302×10^{-2} (− 1.679)
RR_{t-1}	-0.674×10^{-2} (− 3.652)	-0.741×10^{-2} (− 4.767)	-0.777×10^{-2} (− 4.542)
Sum exclude	-0.983×10^{-2} 0.011	-0.011×10^{-2} 0.258×10^{-2}	-0.011×10^{-2} 0.708×10^{-2}
log REX_d	0.108 (0.410)		
log REX_{T-1}	− 0.243 (− 1.301)		
Sum exclude	− 0.134 0.414		
log q_t	0.447 (7.261)	0.502 (10.776)	0.470 (7.347)
log q_{t-1}	− 0.251 (− 4.733)	− 0.244 (− 4.636)	− 0.232 (− 4.071)
Sum exclude	0.196) 0.483×10^{-3}	0.258 0.765×10^{-4}	·0.237 0.501×10^{-3}
$VAR\ q_t$			− 0.029 (− 0.419)
$VAR\ GDP_t$			-0.729×10^{-2} (− 0.775)
$\bar{R}$	0.98	0.97	0.97
SEE	0.029	0.029	0.031
Q (8)	7.31	8.86	8.71

NOTES: Figures in parentheses are t-values. Sum refers to the sum of the estimated coefficients. Exclude refers to the marginal significant level of the test of the null hypothesis that the coefficients are jointly zero.

of the real exchange rate are jointly zero. Thirdly, the q variable is highly significant in determining private investment. However, the estimated short-run elasticity suggests that, on an average, a 1 percent increase in the stock market valuation of existing capital stock results only in a 0.2 percent increase in private investment. This suggests that, while firms look towards the stock market in making investment decision, the excessive volatility in the stock market valuation in the short run relative to the time horizon needed to plan and construct investment projects, tend to make management ignore substantial signals coming from the market. Fourthly, past changes in non-investment output exert a fairly strong effect on current investment, indicating the presence of a substantial accelerator effect. The short run output growth elasticity is 1.2. On the whole, the estimates suggest that private investment is more responsive to the changes in the real sector of the economy than to the developments in the financial market. Finally, the assumption of significant lags in the adjustment of actual investment to the planned level is confirmed by the statistical significance of the coefficient of INV_{t-1}. The significance of lagged investment is an important part of the propagation mechanism that transmits the effects of past shocks into the future, generating serially correlated movements in private investment and economic activity.

In equation (b) in Table 3, the real exchange rate variables are dropped, without affecting significantly the coefficients of the remaining variables. In equation (c), two proxies for investment risks are included for estimation. Two justifications can be made for the effects of risk on investment. One is the usual assumption of risk aversion, where investors care about both the mean and variance of the probability distribution of returns associated with an investment project. Secondly, risk arises from the fact that investment is irreversible. Investment is, in general, sector specific so that once investment is made, shifting capital to another sector or disinvestment can be made only with considerable capital loss (Bernanke, 1988; Pindyck, 1988). Under these circumstances, uncertainty concerning the returns to an irreversible investment made it optimal to postpone the decision to invest.

Here, we are concerned with both the financial market uncertainty and uncertainty of aggregate demand. The financial market uncertainty is proxied by the moving standard deviation of q, while aggregate demand uncertainty is proxied by the moving standard deviation of *GDP* growth. As indicated in equation (c) in Table 3, the coefficients of the two risk variables are negative, as predicted by the risk factor consideration. However, the coefficients are not significantly different from zero. This seems to

suggest that private investment is not significantly affected by financial market volatility and the variability of demand so long as the level of market valuation and the level of capacity utilization remains high.

Next, we specify and estimate the equation for q. Here, q is postulated as being determined by *GDP* growth, expected real interest rate and the real exchange rate. *GDP* growth is used as a proxy of the profitability component of the share valuation, while the real interest rate is used as a proxy for the discount rate/cost of capital component of the share valuation [5]. Greater expected profitability from investment would raise the q, while a rise in the discount rate would depress it. The real exchange rate affects both the numerator and the denominator of the q [6]. Permanent real depreciation by raising the price of tradable goods relative to the non-tradable goods, increases the market value of the firms producing tradable goods. Real depreciation also lowers the profitability of firms producing non-tradable goods by raising the cost of imported inputs relative to non-tradable goods prices (Van Wijnbergen, 1986). On the other hand, real depreciation raises the replacement costs of imported capital goods, thereby increasing the denominator of q. Given the conflicting effects of the real exchange rate movement on the numerator as well as the denominator of the q, it is an empirical question to evaluate which effect dominates. We estimate the following equation for the q:

$$\log q_t = \underset{(0.202)}{-\ 0.049} + \underset{(1.741)}{3.688}\ \Delta \log GDP_{t+1} - \underset{(2.868)}{1.969}\ \Delta \log GDP_t$$

$$- \underset{(3.019)}{0.185}\ RR_t + \underset{(1.286)}{1.975}\ \log REX_t$$

$$\bar{R}^2 = 0.42 \qquad SEE = 0.186 \qquad Q(8) = 2.98$$

From the estimates, we see that future growth in *GDP* increases current stock market valuation, as in the case of a forward looking rational expectation stock market (Fama, 1981). The elasticity of the q with respect to changes in output growth is 1.7. An increase in the expected real interest rate lowers the q, although its elasticity is quite small. The interest rate elasticity, evaluated at the mean real rate, is − 0.8. It appears from the estimates that the q in Malaysia is more responsive to variations in expected profitability than to changes in the discount rate. The positive coefficient of

[5] See ABEL and BLANCHARD (1988) and UEDA and YOSHIKAMA (1986) for attempts to decompose the variance of q into the variability of expected profitability and variability of expected document rate.

[6] See BRANSON (1986) for discussion on the effects of currency devaluation on the q.

the real exchange rate indicates that real depreciation has a net effect of raising the q, although the small t value for the coefficient precludes one from making any firmer conclusion.

In summary, from our estimates of the two equation model of investment behviour, it is evident that real investment in Malaysia is very sensitive to fluctuations in real economic activity. Changes in real output affect private investment directly through the accelerator-capacity pressure effect and indirectly by raising the stock market valuation of capital assets. The total effects of real interest on investment, while statistically significant, is economically not significant. The direct elasticity of real interest rate on investment via the user costs of capital is -0.06, while the indirect elasticity via the impact on the q is -0.26. So the total sum of the real interest rate elasticity is only -0.32. Finally, the estimates suggest that real exchange rate has no significant effect on private investment.

IV. *Private Investment in Malaysian Business Cycles*

The role of private investment in the Malaysian business cycles is analyzed by examining the extent to which autonomous shifts in private investment constitute an important impulse that initiates cyclical fluctuation in economic activity and how far movements in private investment constitute part of the propagation mechanism that transmits and amplifies the effects of policy and exogenous shocks throughout the economy [7].

For this purpose, we employ the method of vector autoregressions (*VAR*) that was pioneered by Sims (1980). In a *VAR* model, all variables are considered as potentially endogenous, in which no attempts have been made to obtain any identifying restrictions. From the estimated *VAR*, one can derive its moving average representation, which in turn, allows us to construct the variance decomposition of each variable in the model.

The variance decomposition shows the proportion of the variance of the K-step ahead forecast error of a variable of interest that is attributed to its own innovations and innovations in other variables. The innovations or shocks in the *VAR* are the one-step ahead forecast errors that cannot be explained by the lagged values of the variables in the model [8]. By choosing

[7] For discussion of the impulse and propagation mechanism in the modern business cycles analysis, see BLANCHARD and WATSON 1(986) and KING and PLOSSER (1987).

[8] In a conventional dynamic simultaneous equation system, impulses originate from the exogenous variables and the residuals of the equations. In a *VAR* model, where all variables are endogenous, the system is driven by the serially uncorrelated shocks.

different values for K, one can evaluate the extent to which each of the shocks tends to persist over the short, medium and long run.

The first *VAR* model that we estimated consists of the five variables that we employed in the investment model of Section III. In view of the small sample size, we only allow one lag for each variable. Since the variance decomposition is derived from the orthogonalized moving average representation, the results of the innovation accounting is potentially sensitive to the way in which the variables are ordered in the orthogonalization process (Runkle, 1987). Here we employ two systems of orderings: (Δ log *NIGDP, RR,* log *REX*, log q, log *INV*) and (log *INV*, Δ log *NIGDP, RR*, log *REX*, log q). The first ordering is deliberately made to handicap the role of autonomous shifts in investment as an independent source of impulse by allowing the contemporaneous innovations of all other variables to affect it within the same year while at the same time, restricting the effect of its contemporaneous innovations on other variables. In the second ordering the financial variables appear last. This incorporates the view that in an efficient financial market, prices instantaneously impound news of other variables (Gordon and Veitch, 1986). In addition, placing private investment at the beginning of the ordering, assumes that because of time-to-build and other lags, other variables do not influence investment contemporaneously.

The results of the variance decomposition for private investment, growth of non-investment *GDP* and the q are presented in Table 4. By examining the percentage contribution of each innovation to the one, two and seven-years ahead forecast error of these selected variables, one can have a good idea of the role of private investment in the Malaysian business cycles.

Based on the first ordering, it is apparent that autonomous shifts in investment spending contribute to a substantial proportion of the cyclical fluctuation in private investment, especially during the short and intermediate terms. This can be seen from the fact that own innovations account for around 30 percent of the variance of private investment for the first two years. Here the partial adjustment mechanism, as represented by the lagged investment variable, propagate the impact of these autonomous impulses, leading to serially correlated movements in investment over time. However in the long run, the effects of these autonomous shocks, tend to dampen considerably. Shifts in business optimism and other animal spirits tend to be quickly translated into overbuilding of capacity, leading to a subsequent correction in the longer run.

Shocks in non-investment *GDP* account for 43 percent of the variance of private investment in the long run. This is indicative of the role of private

TABLE 4
VARIANCE DECOMPOSITION OF PRIVATE INVESTMENT, NON INVESTMENT *GDP* AND *q* - FIVE VARIABLE *VAR*

	Variables Explained	Forecast horizons (Years Ahead)	By Innovations in				
			log *NIGDP*	log *INV*	*RR*	log *REX*	log *q*
Δlog *NIGDP*, *RR*, log *REX*, log *q*, log *INV*	log *INV*	1	0.1	32.7	41.2	1.5	24.6
		2	17.5	24.6	33.6	1.6	22.7
		7	42.9	14.7	27.1	6.0	9.3
	Δlog *NIGDP*	1	100.0	0.0	0.0	0.0	0.0
		2	97.2	0.9	0.1	0.0	1.7
		7	95.2	1.1	1.5	0.3	1.8
	log *q*	1	3.8	0.0	5.8	0.2	0.0
		2	10.8	5.3	8.1	5.0	5.5
		7	54.6	6.4	19.2	6.9	6.4
log *INV*, Δlog *NIGDP*, *RR*, log *REX*, log *q*	log *INV*	1	0.1	99.9	0.0	0.0	0.0
		2	17.5	79.8	0.0	2.4	0.4
		7	42.9	49.6	1.6	5.3	0.6
	Δlog *NIGDP*	1	100.0	0.0	0.0	0.0	0.0
		2	97.2	0.0	0.1	0.0	2.6
		7	95.5	0.5	1.0	0.3	2.6
	log *q*	1	3.7	38.6	4.2	2.0	51.4
		2	10.8	27.5	17.3	9.3	35.1
		7	54.6	26.3	5.9	6.7	6.5

NOTES: *NIGDP* refers to real non-investment *GDP*, *INV* refers to real private investment, *RR* refers to the ratio of share price index to index of private investment deflator, *REX* refers to the real effective exchange rate.

investment in propagating the effects of shocks in other expenditure components, through the accelerator mechanism. Compared to the response to its own innovations, the movements in private investment in response to shocks in non-investment expenditure tend to be relatively slow. This can be explained by the existence of excess capacity in plant and equipment, which causes firms to delay further investment expenditure until existing capacity is fully utilized.

Shocks in the real interest rate appear to have a considerable impact on the variance of private investment, accounting for 40 percent of its variance

in the first year. However, this inference is tampered by two considerations. First, the impact of the real interest rate shocks could be a proxy for the effects of credit tightening. Credit rationing by banks is potentially an important restraining factor on investment in Malaysia where there is no alternative debt instrument to substitute for bank borrowing [9]. To evaluate whether credit rationing or high real lending rate is the primary constraint on financing decision by firms, we add a one-year lagged real net commercial bank lending to private sector variable into the *VAR* model.

The results of the variance decomposition indicates that in the presence of the lending variable, the contribution of the real lending rate innovations drops to zero. On the other hand, credit shocks now explain around 30 to 20 percent of the variance of private investment, leading to the view that it is the rationing of credit rather than high real interest rate, per se, that impacts on private investment. The impact of credit availability seems to be fairly robust to the ordering of the variables. The results indicate one of the channels whereby credit shocks are propagated throughout the economy is through the variation in private investment.

The variance decomposition also indicates that the impact of credit availability on economic activity is transmitted through its impact on non-investment expenditure. The effect of bank credit shocks on non-investment expenditure appears to be smaller than its effect on investment spending.

The q and the real exchange rate account for a very small fraction of the variance of private investment. There is some feedback private investment to the variability of the q. High and profitable investment tend to raise the stock market valuation of existing capital assets.

Turning to the accounting of the variance of non-investment *GDP* it is apparent that its variance is largely accounted by its own innovations, with little feedback from other variables in the system. Of interest is the small influence of private investment innovation on the variance of non-investment expenditure. This is suggestive of the weak multiplier mechanism, which is taken to be the effect of autonomous investment shocks on non-investment spending. The missing multiplier is to some extent explainable by the fact that non-investment spending consists of a large component of government expenditure. In addition, the multiplier effect is weakened by the large import content of private investment.

In order to isolate more precisely the dynamic propagation mechanism generated through the interaction between the multiplier and the accelerator

[9] For analysis of the modern approach to credit rationing based on asymmetric information between borrowers and lenders, see STIGLIZ and WEISS (1981). For analysis of the credit transmission mechanism, see BERNANKE and BLINDER (1988).

mechanisms, the dynamics of which lie at the heart of business cycle analysis (Samuelson, 1939; Blanchard, 1981), we estimated a two-variable *VAR* consisting of real private consumption and real private investment, along the line suggested by Sims (1986) and implemented by Gordon and Veitch (1986). From the moving average representation of the *VAR*, we compute the impulse response functions, which traces out the timing and direction of a change in a variable of interest, over a time horizon, to a given shock.

The multiplier mechanism is at work, if following either an innovation in consumption or investment, consumption rises in a sustained manner. On the other hand, the accelerator is at work, if following a consumption shock which generates expectations of higher output and larger production capacity, investment rises in a sustained manner.

Table 5 presents the impulse response functions computed over seven years. The response of private consumption to a one standard deviation shock in either consumption or investment is relatively small compared to the response of investment to either a shock to investment itself or to a shock in consumption. This shows again that the multiplier effect is considerably smaller than the accelerator effect. Further it should be noted that the typical response pattern of investment or consumption to shocks take the form of a hump shape, with investment or consumption rising steadily, up to three to four years, after which their effects taper off. Such a hump shape response conforms with the time path obtained from analytical models of dynamic interaction between the accelerator and the multiplier (Blanchard, 1981).

TABLE 5

IMPULSE RESPONSE FUNCTIONS FOR PRIVATE INVESTMENT AND CONSUMPTION

Years	Shock in Investment		Shock in Consumption	
	Investment response	Consumption response	Investment response	Consumption response
1	0.84	0.37	0.00	0.19
2	0.71	0.42	0.59	0.31
3	0.37	0.22	0.39	0.31
4	− 0.01	0.00	0.30	0.19
5	− 0.25	− 0.11	0.00	0.01
6	− 0.23	− 0.11	− 0.01	− 0.01
7	− 0.01	− 0.01	− 0.01	− 0.003

V. *Summary and Conclusions*

This study set out to estimate a model of private investment behaviour for Malaysia in order to quantify the effects of real interest rate and real exchange rate on investment spending. The empirical estimates indicate that while both the direct and indirect (through the stock market valuation) effects are statistically significant, their combined influence are economically small and insignificant. The influence of the real exchange rate is even weaker. However, the evidence indicates the influence of the strong accelerator effect associated with changing output level. Overall, the evidence points to the fact that private investment in Malaysia is more influenced by the changes in the real sector of the economy than to developments in the financial market.

We next evaluate the role of private investment in the business cycles. We find that autonomous shifts in private investment constitute an important impulse to the cyclical fluctuations in economic activity. Through the accelerator effect, private investment also constitutes an important part of the propagation mechanism, transmitting the impact of shocks in non-investment spending. The multiplier effect of autonomous investment shocks on aggregate demand appears to be weak. Credit shocks, rather than real interest rate, constitutes an impulse to the fluctuation of economic activity. The impact of this credit impulse is transmitted through fluctuations in private investment and to a lesser extent through movements in non-investment expenditure. However, this does not deny that high interest rates in a specific episode might play an important role in the movement of economic activities.

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INVESTIMENTO PRIVATO, PREZZI RELATIVI E CICLO ECONOMICO IN MALAYSIA

Questo articolo cerca di esaminare le determinanti dell'investimento privato in Malaysia e il ruolo degli investimenti nella trasmissione dei cicli economici. I risultati empirici indicano che i movimenti del tasso d'interesse reale e del cambio reale hanno un impatto minimo sulla variazione dell'investimento privato. Le fluttuazioni nella produzione, attraverso l'effetto dell'acceleratore, sono responsabili di gran parte dei movimenti ciclici degli investimenti. Spostamenti autonomi nell'investimento privato costituiscono una importante fonte di impulso ai cicli economici.

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INFRASTRUCTURE AND PRIVATE SECTOR INVESTMENT: THE CASE OF PAKISTAN'S TRANSPORTATION AND COMMUNICATIONS SECTOR, 1972-90

by
ROBERT E. LOONEY *

Introduction

Infrastructure development has long been looked upon as an essential part of development as it affects the growth and efficiency of all sectors of the economy. An increase in the supply of electricity, an expansion of transport and communications facilities, a better trained and healthier labor force all lower the unit costs of production and raise the productive capacity of the economy as a whole. Shortages in the availability of any of the key facilities and services can have a multiplier effect on the aggregate output of the economy, causing inflationary pressures and a slow-down in the growth of the economy. This crucial and strategic role of infrastructure facilities underlines their economic significance. It is generally recognized that the poor quality and limited supply of infrastructure facilities constitute a major source of high costs for all producers and consumers [1].

Pakistan has a network of basic infrastructure facilities, some of which like the railways were established during the colonial period. However the high rates of population growth and rapid urbanization are causing attrition and decay of the existing infrastructure. Many of these facilities are proving extremely inadequate for meeting the rapidly growing needs of population expansion and urban concentration [2].

Interestingly enough, despite the obvious importance of infrastructure in the country's development no empirical assessment has been undertaken

* Naval Postgraduate School, Monterey, CA (U.S.A.).

[1] UNITED NATIONS (1991, p. 121).

[2] Cf. HESTON et al. (1985).

to date to determine its effectiveness in stimulating investment and/or growth. Because the Pakistani government is going through a process of structural adjustment with emphasis on encouraging private sector investment, it is of considerable importance to determine the potential effect of infrastructural investment in contributing to this goal.

The purpose of the analysis below, therefore, is to assess the impact the country's infrastructure program has had on the Pakistani private sector. More specifically, has the private sector been willing to expand its investment in the transport and communications sector, following increased public sector investment in infrastructure? If so what types of infrastructure have been most productive in this regard? Were there any offsetting effects associated with the government's funding of these programs – i.e. did the government compete with the private sector for scarce financial resources?

Patterns of Investment

Increasing efficiency and international competitiveness is an important aspect of the government's program of adjustment with growth. To achieve these objectives, sectoral policies that enable market signals to guide efficient shifts in investment are essential. The Government has been implementing trade, industrial and financial policy changes in the past few years, but progress has been slow and often inadequate to achieve the objectives. Industrial development has also been hampered by low public investment in infrastructure [3].

The trends in public and private sector investment (Tables 1-3) reveal several interesting patterns. For purposes of this study the most important trend is the gradual acceleration in the rate of private sector capital formation in the transportation/communication sector:

1. For the period (1972-1990) real capital formation by the private sector averaged (Table 1) 3.8 percent per annum (compared with 6.0 percent per annum for total private sector investment).

2. However for the period 1985-1990, private sector investment in transportation/communication averaged 8.6 percent per annum (an increase from the 4.5 percent increase for the 1980s as a whole and the rate of 2.9 percent per annum for the 1972-1990 period).

Public sector investment has shown much more erratic movements with capital formation in the railroads increasing by 7.5 percent per annum

[3] World Bank (1991, p. 25).

TABLE 1

PAKISTAN: GROWTH IN INVESTMENT, 1972-1990

Private Investment						
Years	Agriculture	Manufacturing		Transportation Communication	Services	Total
		Large	Small			
Average Annual Growth						
1972/1990	6.1	8.7	6.9	3.8	5.0	6.0
1972/1980	6.7	− 3.0	4.0	2.9	5.1	3.1
1980/1990	5.7	19.0	9.3	4.5	5.0	8.3
1985/1990	5.9	18.2	11.8	8.6	9.5	10.4

Public Investment						
Years	Rural Works	Industrial Basin	Energy	Railway	Large Scale Manufacturing	Total
Average Annual Growth						
1972/1990	12.5	− 18.5	14.3	− 2.7	10.7	8.4
1972/1980	6.1	− 15.1	9.5	7.5	49.3	14.4
1980/1990	17.9	− 21.1	18.3	− 10.1	− 12.9	3.7
1985/1990	− 2.7	− 16.0	18.2	− 19.8	− 8.7	5.8

Source: Compiled from data in: WORLD BANK (1983, 1991).

in the 1980s and declining by 10.1 percent per annum in the 1980s (Table 1). Because investment in transportation and communication has grown slower than that of total private sector capital formation transportation communication declined (Table 2) from 11.8 percent of total private sector investment in 1972 (and 17.9 percent in 1973) to 8.1 percent by 1990. Similarly public sector allocation to the railways has declined from 6.6 percent of total government capital formation in 1970 to 0.8 percent in 1990 (Table 3).

TABLE 2

PAKISTAN: COMPOSITION OF PRIVATE INVESTMENT, 1972-1990
(Percent of Total Private Investment)

Years	Agriculture	Manufacturing		Transportation Communication	Services	Other
		Large	Small			
1972	18.1	20.7	4.3	11.8	8.5	36.5
1973	19.4	14.9	4.7	17.9	8.8	34.2
1974	22.8	13.3	5.9	18.0	10.0	30.0
1975	19.3	13.7	5.9	13.4	9.5	38.1
1976	24.7	14.6	5.4	11.4	9.2	34.6
1977	24.6	14.3	5.2	10.4	11.4	34.2
1978	26.5	12.7	5.0	9.7	10.2	35.9
1979	25.7	11.9	5.2	10.0	10.4	36.7
1980	23.7	12.8	4.5	11.7	10.0	37.3
1981	21.6	16.1	4.9	8.6	9.4	39.4
1982	21.0	18.4	5.7	7.6	9.4	38.6
1983	22.3	20.5	5.0	7.2	8.5	36.5
1984	23.4	22.5	4.8	7.6	8.0	33.7
1985	22.8	23.3	4.6	8.8	7.6	32.9
1986	20.4	25.8	4.9	9.2	7.8	32.0
1987	20.4	25.8	4.8	9.9	7.8	31.4
1988	19.5	26.9	5.0	10.0	8.0	30.5
1989	18.3	31.2	5.0	9.9	7.6	27.9
1990	18.5	32.7	5.0	8.1	7.3	28.4
Average Annual Growth of Share						
1972/1990	0.1	2.6	0.8	− 2.1	− 0.8	− 1.4
1972/1980	3.4	− 5.8	0.6	− 0.1	2.1	0.3
1980/1990	− 2.4	9.8	1.1	− 3.6	− 3.1	− 2.7
1985/1990	− 4.1	7.0	1.7	− 1.6	− 0.8	− 2.9

Source: Compiled from data in: WORLD BANK (1983, 1991).

Until the last several years, Pakistan's investment in transport and communications (as a share of the central government budget) is somewhat below that of its neighbors (Table 4):

1. For the period 1970-74 the government allocated 4.8 percent of its budget to transportation and communications, compared with 10.2 for Asian countries as a whole.

TABLE 3

PAKISTAN: COMPOSITION OF PUBLIC INVESTMENT, 1974-1990
(Percent of Total Public Investment)

Year	Rural Works	Industrial Basin	Energy	Railway	Large Scale Manufacturing
1970	3.1	31.0	4.7	6.6	5.4
1971	1.1	28.0	16.4	6.6	1.9
1972	1.2	30.0	12.6	3.5	3.0
1973	2.1	18.3	9.8	2.7	2.8
1974	1.3	10.8	10.4	1.7	5.5
197	1.3	9.5	21.8	5.4	9.6
1976	1.0	9.1	19.6	3.9	19.4
1977	0.5	3.1	13.5	4.2	24.1
1978	0.3	4.2	13.7	3.7	30.3
1979	0.6	1.9	13.8	3.5	30.4
1980	0.6	2.7	8.8	3.4	24.9
1981	2.0	3.4	13.0	4.2	18.5
1982	2.6	2.8	12.5	4.5	15.0
1983	3.8	2.8	17.7	3.9	14.6
1984	3.6	1.5	16.2	2.6	15.0
1985	3.4	0.6	18.9	3.2	9.1
1986	3.7	0.6	17.6	3.7	9.6
1987	3.3	0.6	21.9	3.1	5.7
1988	3.7	0.4	22.2	2.3	5.1
1989	2.6	0.2	32.5	0.3	3.7
1990	2.2	0.2	32.8	0.8	4.3
Average Annual Growth of Share					
1972/1990	3.4	− 24.3	5.4	− 7.9	2.0
1972/1980	− 8.3	− 26.0	− 4.4	− 0.4	30.3
1980/1990	13.9	− 22.9	14.1	− 13.5	− 16.1
1985/1990	− 8.3	− 19.7	11.7	− 24.2	− 13.9

Source: Compiled from data in: WORLD BANK (1983, 1991).

2. During 1980-84 the transportation/communications share of the government budget was 7.9 (compared to 11.4% for Asian countries).

3. By 1985-88 however, transportation/communications averaged 9.4 percent of the government budget compared with 8.9 percent average for its neighbors.

TABLE 4

SHARE OF GOVERNMENT EXPENDITURE
ON TRANSPORT AND COMMUNICATIONS IN TOTAL EXPENDITURE:
PAKISTAN AND OTHER ASIAN COUNTRIES
(Percentage)

Country	Average 1970-74	Average 1975-79	Average 1980-84	Average 1985-88
South Asia				
Pakistan	4.8	7.4	7.9	9.4
India	9.4	7.7	8.4	7.3
Nepal	27.0	21.1	17.4	12.5
Sri Lanka	7.9	9.6	8.7	12.1
Bangladesh	16.3	13.2	13.4	8.4
Burma	4.9	4.9	6.6	10.0
East Asia				
Thailand	11.0	9.7	8.6	7.4
South Korea	7.6	6.2	6.4	4.1
Philippines	11.7	17.7	23.4	14.1
Hong Kong	19.3	17.1	18.4	13.1
Singapore	2.0	6.5	5.4	2.2
Malaysia	6.4	8.2	9.5	7.7
Indonesia	4.6	15.1	14.3	7.8
Average	10.2	11.1	11.4	8.9

Source: UNITED NATIONS (1991, p. 138).

Impact of Infrastructure

While the patterns noted above are suggestive they do not tell us much about the relative effectiveness of different types of infrastructure in stimulating private sector investment in the transport/communications sector. More importantly they provide no insights as to the direction of causation – has infrastructural development through lowering costs of production stimulated private investment? Or, instead, has infrastructure simply expanded to accommodate the needs created by previous investments by the private sector? That is, has the government responded with increased provision of infrastructure only after infrastructure deficiencies have severely constrained the flow of private capital into the sector?

This distinction is important for policy purposes. In a resource scarce

country such as Pakistan, Government spending for infrastructure can be increased only by diverting resources from other uses – either from investment by the private sector or from consumption by the public and private sectors. To the extent that the benefits from Government investment can be quantified, the rule for allocation is simple: greater government investment will increase aggregate output as long as the extra Rupee invested yields benefits that are greater than those derived from alternative uses of the funds. The added capital spending, in other words must yield not only a positive return, but a return greater than that which could be achieved by using the funds for other purposes.

Among economists there is a broad spectrum of viewpoints, some of them diametrically opposed to one another, concerning the dynamics of infrastructure in the development process [4]. There is consensus however, as to the need for a certain level of basic infrastructure facilities, since ultimately infrastructure must be a limiting factor without which no development process could take place even if other development processes could take place even if other development-inducing factors were present. However, opinions as to infrastructure's precise role in the growth process beyond this point differ greatly.

Some economists such as Glover and Simon [5] and Frederiksen [6] take the view that the role of infrastructure is simply to relieve "tensions" generated by supply and demand patterns as well as bottleneck pressures. Another (smaller) group of economists led by Voigh [7] maintain that alternations in infrastructure exert a follow-on influence on investment and growth.

The majority of economists [8] seem to take a middle position between these two more or less diametrically opposed views. Some of them consider infrastructure to be a function of the level of development; in other words the more economically and socially backward a potential development area, the stronger the impulses emanating from improvements in the stock of infrastructure. Others feel that the reciprocal relationship between changes in infrastructure and socio-economic developments is such that the problem of cause and effect is not open to solution.

However, most economists agree that if infrastructure investments, labor market planning and educational planning are uncoordinated they are

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[4] The following draws on LOONEY and FREDERIKSEN (1981).

[5] GLOVER and SIMON (1975).

[6] FREDERIKSEN (1981).

[7] VOIGH (1974).

[8] See for example HANSEN (1965) and the essays contained in FROMM (1965).

likely to yield conflicting results or, at any rate, outcomes that could eventually lead to undesirable solutions. Much of the confusion as to the role of infrastructure in industrial development occurs because infrastructure itself is not homogeneous. In addition it is quite likely that the contribution to output from infrastructure investment will be dependent on the stock of supporting factors, the composition and level of which are likely to vary somewhat over time.

Complicating the issue is the fact that for many years economists were reluctant to discuss the issue of causality from a statistical perspective. However in recent years several statistical tests are gaining wider acceptance in addressing issues of this type. The original and most widely used causality test was developed by Granger [9]. Applied to the situation at hand, infrastructure causes (in the Granger sense) private sector investment in transportation and communications, if that investment can be predicted more accurately by past values of infrastructure investment than by past values of private investment in the sector. To be certain that causality runs from infrastructure to private investment, past values of infrastructure must also be more accurate than past values of private investment in transportation-/communications at predicting infrastructure expenditures.

More formally, four cases are possible: (*a*) *Infrastructure Causes Investment* when the prediction error for growth decreases when infrastructure investment is included in the private sector investment equation. In addition, when private sector investment is added to the infrastructure equation, the final prediction error should increase; (*b*) *Investment Causes Infrastructure* when the prediction error for investment increases when infrastructure is added to the regression equation for private investment in transportation and communications, and is reduced when investment is added to the regression equation for infrastructure; (*c*) *Feedback* occurs when the final prediction error decreases when infrastructure is added to the private investment equation, and the final prediction error also decreases when private investment is added to the infrastructure equation; and (*d*) *No Relationship* exists when the final prediction error increases both when infrastructure is added to the private investment equation and when private investment is added to the infrastructure equation.

These patterns also imply something about the extent to which inadequate stocks of infrastructure may constrain or inhibit private sector investment. Extending the original ideas of Hirschman [10] infrastructure devel-

[9] Granger (1969).

[10] Hirschman (1958, especially Chapters 3-5).

opment can initiate growth through subsidizing industry through cheapening certain inputs used in production. This is the process referred to by Hirschman as "development via excess capacity" (of social overhead capital). Conversely lagging infrastructure may increase costs of producing and result in slowing investment. In this situation the authorities are under pressure to expand infrastructure to "catch up" with the stock of directly productive capital. This route is often referred to as "development via shortage" (of social overhead capital) [11]. As Higgins [12] notes: "Either method of unbalanced growth yields an extra dividend" of "induced, easy-to-take or compelled decisions resulting in additional investment and output". Balanced growth (of social overhead capital and directly productive activity) is not only unattainable in most underdeveloped countries, it may not even be desirable. The rate of growth is likely to be faster with chronic imbalance, precisely because of the "incentives and pressures" it sets up.

From the above it follows that at least four possible situations characterize the relationship between infrastructure investment and manufacturing output in Pakistan:

1. *Infrastructure Causes Investment.* This pattern is likely to reflect a situation where infrastructure is in excess (or non-constraining); the lower costs stemming from its provision result in investment and output. In this situation, infrastructure could be expected to have a high degree of linkage with productive factors and thus produce a strong private investment response.

2. *Investment Causes Infrastructure.* Here infrastructure is lagging and responds to the needs created by previous private sector capital formation. In this situation, infrastructure is likely to be a constraint on that investment in the sense of reducing its profitability. This may have occurred in Pakistan, particularly during periods (such as the 1980s) when private investment in transport/communications increased rapidly. Although infrastructure expanded during this period it may still (given the needs) have been insufficient to produce a substantial stimulus to output.

3. *Feedback.* Private investment and infrastructure become interdependent, perhaps reflecting a situation where infrastructure is likely a binding constraint on investment. Once increased infrastructure is adequate (relative to needs) to provide a positive stimulus to investment and/or further output.

4. *No Relationship.* As it implies, infrastructure is not a constraint

[11] Higgins (1959, p. 405).

[12] Op. cit., p. 405.

on private investment, nor does it possess or create the type of linkages needed to induce increases in investment.

Points two and three above imply that some threshold level of infrastructure may be necessary before positive economic results can be obtained from expanding this type of capital.

Operational Procedures

The Pakistani Government does not publish data on the stock of and increments to the country's infrastructure. However, following the procedure of Blejer and Khan [13] it is possible to approximate increments to the nation's infrastructural base. The basic assumption underlying these proxies is that infrastructure investment is an ongoing process that moves slowly over time and cannot be changed very rapidly.

The first of the two approaches takes the trend level of real public sector investment as representing the long-term or infrastructural component. In the discussion that follows this measure is referred to as "estimated infrastructure". In computing this measure of infrastructure we have used a linear trend. Deviations of real public sector investment from the trend are assumed to correspond to non-infrastructural investment.

A second approach is to make the distinction between types of public investment on the basis of whether the investment is expected or not. Again, it is assumed that expected, or anticipated, public investment is closer to the long-term or infrastructural component. If deterioration is occurring in the country's stock of infrastructure, this measure may be a more accurate proxy than that obtained using the trend method. It was the one used in the computations that follow.

The data for investment upon which the infrastructure expenditures were calculated were derived from figures in: World Bank (1983, 1991). Gross Domestic Product and the GDP price deflator is from various issues of the International Monetary Fund, *International Financial Statistics Yearbook*. All variables were deflated by the GDP deflator and are in constant 1985 prices. For best statistical results [14], the variables were transformed into their logarithmic values.

A major conceptual problem in a study of this sort is that public

[13] Blejer and Khan (1985).

[14] The reasons underlying involve the assumption of stationary conditions. See: Hsiao (1981); Joerding (1986).

infrastructure is usually not specifically directed towards one particular sector. Energy for example might be used by a number of sectors, some of which perhaps were not even considered in the original feasibility studies. Because of this a number of different measures of infrastructure (and investment) were used:

1. total public investment (and infrastructure);
2. semi public organizations (including energy);
3. public enterprises (including railroads, and the post office, telegraph and telephone);
4. general government (including federal, provincial and local governments).

Relationships between infrastructure expenditures and the economy were considered valid if they were statistically significant at the ninety-five percent level of confidence. That is, if ninety-five percent of the time we could conclude that they had not occurred by pure chance, we considered them statistically significant.

There is no theoretical reason to believe that infrastructure and private investment have a set lag relationship, that is they impact on one another over a fixed time period. The period could be rather short run involving largely the spin-off from construction or longer term as either term expands from the stimulus provided by the other. To find the optimal adjustment period of impact, lag structures of up to six years were estimated. The lag structure with the highest level of statistical significance was the one chosen to best depict the relationship under consideration (the optimal lag reported in Table 5).

Results

The causation analysis produced several interesting patterns (Table 5):

1. There were a number of statistically significant relationships between infrastructure and private investment in transportation and communications. Although a number of feedback relationships were found, the general direction of causation was for public investment and infrastructure to stimulate follow-on private investment in transportation and communications.
2. Although a number of feedback relationships were found, there were no cases where private investment initiated a one-way expansion of public investment.
3. In the case of feedback relationships between public capital for-

TABLE 5

PAKISTAN: INTERACTION OF PUBLIC INVESTMENT, INFRASTRUCTURE AND PRIVATE INVESTMENT IN TRANSPORT AND COMMUNICATIONS, 1972-1990

Optimal Lag (Years) Final Prediction Error ( )	Causation Patterns				Dominant Pattern
	A	B	C	D	
Private Investment in Transport and Communications					
Total Public Investment	2 (0.32E-1)	1 (0.24E-1)	2 (0.82E-2)	2 (0.64E-2)	Feedback (+ *w*, + *w*)
Total Public Infrastructure	2 (0.32E-1)	1 (0.23E-1)	2 (0.67E-2)	3 (0.21E-2)	Feedback (+ *w*, + *m*)
Public Enterprises Investment	2 (0.32E-1)	2 (0.18E-1)	4 (0.39E-1)	1 (0.46E-1)	Public → Private (+ *w*)
Public Enterprises Infrastructure	2 (0.32E-1)	1 (0.15E-1)	1 (0.25E-1)	4 (0.26E-1)	Public → Private (+ *s*)
Public Investment Electricity	2 (0.32E-1)	4 (0.19E-1)	4 (0.89E-1)	1 (0.87E-1)	Feedback (+ *m*, + *w*)
Public Infrastructure Electricity	2 (0.32E-1)	4 (0.20E-1)	4 (0.81E-1)	2 (0.84E-1)	Public → Private (+ *m*)
Railroad Investment	2 (0.32E-1)	1 (0.28E-1)	4 (0.39E-0)	1 (0.40E-1)	Public → Private (+ *w*)
Railroad Infrastructure	2 (0.32E-1)	1 (0.25E-1)	4 (0.58E-1)	1 (0.56E-1)	Feedback
Public Investment, Post Office, Telegraph, Telephone	2 (0.32E-1)	3 (0.14E-1)	1 (0.84E-0)	1 (0.93E-1)	Public → Private (+ *w*)
Public Infrastructure, Post Office, Telegraph, Telephone	2 (0.32E-1)	2 (0.12E-1)	1 (0.67E-0)	1 (0.73E-1)	Public → Private (+ *m*)
General Public Investment	2 (0.32E-1)	1 (0.19E-1)	1 (0.10E-1)	1 (0.69E-2)	Feedback (+ *m*, + *m*)
General Public Infrastructure	2 (0.32E-1)	1 (0.21E-1)	1 (0.77E-2)	2 (0.62E-2)	Feedback (+ *m* + *w*)
General Federal Investment	2 (0.32E-1)	1 (0.23E-1)	1 (0.19E-1)	4 (0.10E-2)	Feedback (+ *w*, + *w*)
General Federal Infrastructure	4 (0.32E-1)	1 (0.22E-1)	1 (0.13E-1)	2 (0.12E-1)	Feedback (+ *w*, + *w*)
General Provincial Investment	2 (0.32E-1)	2 (0.17E-1)	2 (0.13E-1)	1 (0.13E-1)	Public → Private (+ *s*)
General Provincial Infrastructure	2 (0.32E-1)	4 (0.17E-1)	2 (0.96E-2)	2 (0.99E-2)	Public → Private (+ *m*)
General Local Investment	2 (0.32E-1)	4 (0.15E-1)	1 (0.34E-1)	3 (0.29E-1)	Feedback (+ *w*, + *w*)
General Local Infrastructure	2 (0.32E-1)	3 (0.16E-1)	1 (0.37E-1)	1 (0.38E-1)	Public → Private (+ *w*)

Notes: Summary of results obtained from Granger Causality Tests. A Hsaio Procedure was incorporated to determine the optimal lag. All variables estimated in logarithmic form. *Regression Patterns*: *A* = private on private; *B* = public on private; *C* = public on public; *D* = private on public. The dominant pattern is that with the lowest final prediction error. The signs (+, −) represent the direction of impact. In the case of feedback the two signs represent the lowest final prediction error of relationships *B* and *D*. Each of the variables was regressed with 1, 2, 3 and 4 year lags. Strength assessment (*s* = strong; *m* = moderate; *w* = weak) based on the size of the standardized regression coefficient and *t* test of statistical significance.

mation and that of the private sector, the public sector had a greater impact on the private.

In general it appears that public investment and infrastructural development has played an important role in stimulating private sector investment in transport and communications. Of course a number of other factors may have also encouraged private capital formation in this area. Since there is always the chance that the public sector's investment in infrastructure is correlated with these factors (thus producing a spurious correlation between public and private investment), additional analysis must be undertaken before any definitive conclusions can be drawn concerning the precise role of infrastructure.

Impact of Infrastructure Investment on Private Investment

The findings presented above indicated that both public investment and infrastructure had stimulated private investment in transportation and communications. However, much of the current literature [15] on private sector investment in developing countries tends to argue that public investment involves both the development of infrastructure, which likely would be complementary with private investment, and other types of consumption and non-infrastructural investment which may compete with private investment. The latter could occur either through absorbing limited physical resources or through the production of marketable output. In the aggregate, the effects of the infrastructural and non-infrastructural components can offset each other, thereby yielding the impression that the impact of total government investment on the level of private investment is weak or insignificant.

It can be shown [16], however, that once the two aspects of public sector investment are recognized the picture becomes much clearer. Here, the key is to distinguish public sector expenditures along functional lines involving infrastructural and non-infrastructural investment and consumption. Once this delineation is made, considerably stronger statements can be made of the role of government in private capital formation.

Following this approach, the model developed below is a neoclassical variant of the standard accelerator model, adapted to incorporate some of the institutional and structural characteristics of the Pakistani economy.

[15] LEFF and SATO (1980).

[16] BLEJER and KHAN (1985).

As a starting point, it is reasonable to assume that private investors in Pakistan undertake investment to bridge the gap between their actual capital stocks and perceived optimal levels. Following Blejer and Khan we assume the process takes place as follows:

$$DIP_t = b\,[IP_t^* - IP_{t-1}] \tag{1}$$

Where IP^* is the desired level of gross private investment; IP is the actual level of gross private investment, b is the coefficient of adjustment with b greater than or equal to 0 (and less than or equal to 1), and D is a difference operator in the steady state. The desired rate of gross private investment can be related to the desired stock of private capital KP^* in the following manner:

$$IP_t^* = [1 - (1 - z)\ L)\ KP_t^*) \tag{2}$$

where z is the rate of depreciation and L is a lag operator $LKP_t = KP_{t-1}$.

In the long run representation of the simple accelerator model, the desired stock of capital can be assumed to be proportional to lagged output, YR_{t-1}:

$$KP_t^* = aYR_{t-1} \tag{3}$$

Combining equations 1-3 and solving for IP_t yields the basic dynamic accelerator function:

$$IP_t = [1 - (1 - z)\,\mathrm{L}]\ baY_{t-1} + (1 - b)\ IP_{t-1} \tag{4}$$

As for the role of public investment and other factors in the rate of private capital formation, we hypothesize that the response of gross private investment to the gap between desired and actual investment, as measured by b in equation (1) is not a fixed parameter, but rather varies systematically with economic factors that influence the ability of private investors to achieve the desired level of investment.

We assume the ability to respond on the part of the private sector depends on the general ease or tightness of financial markets. The rudimentary nature of capital markets in Pakistan, however, limits the financing of private investment to the use of retained profits, bank credit and, in particular, government subsidies. An increase in real credit to the private sector will, other things being equal, directly encourage real private sector investment, and by rolling over bank loans the maturity of debt can be lengthened sufficiently to correspond to the length of the investment project.

Obviously many of these factors are related to government actions. In addition many of the government's policies work at cross purposes. Government subsidies for example may facilitate private sector investment, but government borrowing to finance these programs may compete with the private sector for scarce domestic savings. Operationally, we assume these effects are captured by the lagged public budget deficit [17]:

$$(5) \qquad b_t = b_0 + \frac{1}{[IP_t^* - IP_{t-1}]}[b_1\, GDEF_{t-1} + b_2\, GI_t]$$

Where $GDEF_{t-1}$ is the value of the real public sector deficit in period $t-1$, and GI represents real government investment. Equation (5) states that the response of private investment depends on the magnitude of the two factors measured in relative terms with respect to the size of the discrepancy between desired and actual investment $[IP_t^* - IP_{t-1}]$. The signs of the parameters in this equation are expected to be: $b1$ greater than 0; $b2$ less than or greater than zero.

Substituting equation (5) into equation (1) yields:

$$(6) \qquad IP_t = b_0\,[IP_t^* - IP_{t-1}] + b_1\, GDEF_{t-1} + b_2\, GI_t$$

Since from equations (2) and (3) we show that

$$IP_t^* = b_0 a\,[YR_{t-1} - YR_{t-2}] + b_1\, GDEF_{t-1} + b_2\, GI_t + (1 - BO)\, IP_{t-1}$$

we can now derive s dynamic reduced form equation for gross private investment

$$(7) \qquad IP_t = b_0 a\,[YR_{t-1}) - (1 - c)\; YR_{t-2}] + \\ + b_1\, GDEF_{t-1} + b_2\, GI_t + (1 - b_0)\, IP_{t-1}$$

The effects of government policy on private investment can be directly obtained from the estimates of b_1 and b_2.

Given recent findings [18] that public sector investment plays an important role in effecting private capital formation in Pakistan we should expect a large proportion of the variance in private investment to be accounted for by this factor. On the other hand, since it is always possible that the infrastructural and non-infrastructural components of public investment

[17] Both current and lagged public sector deficits were used in the estimated equations, with the lagged version performing slightly better.

[18] In particular see KHAN (1988).

offset each other (financial competition crowding out some private investment), it makes sense to separate and estimate the independent effects of the different categories of public investment. Unfortunately, it is not possible, given the existing data on government expenditures in Pakistan, to make such functional distinctions.

One way of getting around this problem is to develop alternative proxies for infrastructural and non-infrastructural components. The basic assumption underlying these proxies is that infrastructure investment is an ongoing process that moves slowly over time and cannot be changed very rapidly. The first of the two approaches takes the trend level of real public sector investment (*GILT*) as representing the long-term or infrastructural component and argues that this should have a positive effect on gross real private investment. Deviations from the trend (*GIDLT*) are assumed to represent non-infrastructural investment.

Operationally a negative sign on the non-infrastructural term $[GI_t - GILT_t]$ can be assumed to reflect crowding out of private sector investment due to excessive allocations to non-infrastructural uses, i.e.:

$$(8) \quad IP(t) = b_0 a\,[YR_{t-1}(1-c)\,YR_{t-2}] + b_1\,GDEF_{t-1} + b_2\,GILT_t + \\ + b_3\,[GI_t - GILT_t] + (1 - b_0)\,IP_{t-1}$$

The coefficient on the infrastructure term (b_2) is expected to be positive, with a negative sign for b_3 if real crowding out has occurred.

A variant on this approach is to make a distinction between types of public investment on the basis of whether or not investment is expected. Again, it is assumed that expected public investment, *GIE*, reflects the allocations of public investment for infrastructure. However, the effect of unanticipated levels of investment may result in crowding out. Incorporating these considerations into the basic model yields:

$$(9) \quad IP_t = b_0 a\,[YR_{t-1} - YR_{t-2}] + b_1\,GDEF_{t-1} + b_2\,GIE_t + \\ + b_3\,[GI_t - GIE_t] + (1 - b_0)\,IP_{t-1}$$

Where: unexpected expenditures ($GIU_t = GI_t - GIE_t$) are assumed to be the difference between actual expenditures and expected expenditures. A negative sign for b_3 would be indicative of real crowding out.

The data for investment upon which the infrastructure expenditures were calculated were derived from figures in: World Bank (1983, 1991). Gross Domestic Product and the *GDP* price deflator is from various issues of the International Monetary Fund, *International Financial Statistics Year-*

book. All variables were deflated by the *GDP* deflator and are in constant 1985 prices.

Empirical Results

For convenience the following symbols are used to report (Table 4) the regression results: $DY_{t-1} = YR\,(t-1) - YR\,(t-2)$. IPM_t = private sector investment in manufacturing; IG_t = infrastructure investment (by type of government investment); NIG_t = the non-infrastructural component of government investment [19]; and $GDEFU_{t-1}$ = the unanticipated [20] public sector budgetary deficit lagged one year.

Several different types of government investment (both infrastructural and non-infrastructural components) were examined:

1. total public investment (*IGT*, *NIGT*);
2. semi-public (*IPO*, *NIPO*);
3. public enterprises (*IPE*, *NIPE*);
4. railroads (*IPR*, *NIPR*);
5. post office, telegraph (*IPT*, *NIPT*);
6. general government-federal, provincial and local (*IGG*, *NIGG*);
7. federal government (*IFG*, *NIFG*);
8. provincial government (*IPG*, *NIPG*);
9. local government (*ILG*, *NILG*);
10. rural works (*IRW*, *NIRW*);
11. Indus Basin (*IIB*, *NIIB*);
12. energy (*IEN*, *NIEN*).

The analysis (Table 6) confirmed the importance of public infrastructure in stimulating private sector investment in the transport and communications sector:

1. The statistical significance of the lagged private investment term indicates that the private sector's capital formation in transportation and communications follows the distributed lag relationship assumed above. That is investment by the private sector in transportation and communica-

[19] Regressions were estimated using both proxy measures of infrastructure noted in the previous section. The results using expected and unexpected measures of infrastructure yielded slightly better results and these are the ones reported in Tables 4-6.

[20] Calculated the same way as unexpected expenditures. The unanticipated deficit was slightly more significant than the actual deficit in the estimated equations, and hence it is presented in the results of Table 6.

TABLE 6

PAKISTAN: FACTORS AFFECTING PRIVATE SECTOR INVESTMENT IN TRANSPORTATION AND COMMUNICATIONS 1972-1990

(Standardized coefficients)

Non-Public Investment Component

$$IPTC_t = \underset{(3.63)^{***}}{0.45}\, IPTC_{t-1} + \underset{(1.80)^{*}}{0.15}\, DY_{t-1} - \underset{(-4.11)^{***}}{0.43}\, GDEFU_{t-1}$$

$r^2\,(adj) = 0.895$; Durbin's $h = -1.17$; $F = 38.11$

Total Public Investment (*IGT, NIGT*)

$$IPTC_t = \underset{(5.00)^{***}}{0.59}\, IPTC_{t-1} - \underset{(-1.62)}{0.21}\, DY_{t-1} - \underset{(-0.77)}{0.07}\, GDEFU_{t-1} + \underset{(4.52)^{***}}{0.45}\, IGT_t + \underset{(5.49)^{***}}{0.28}\, NIGT_t$$

$r^2\,(adj) = 0.966$; Durbin's $h = -0.84$; $F = 80.46$

Semi-Public Organizations Investment (*IPO, NIPO*)

$$IPTC_t = \underset{(2.62)^{**}}{0.38}\, IPTC_{t-1} + \underset{(0.61)}{0.09}\, DY_{t-1} - \underset{(-2.49)^{**}}{0.24}\, GDEFU_{t-1} + \underset{(2.81)^{**}}{0.30}\, IPO_t + \underset{(4.64)^{***}}{0.36}\, NIPO_t$$

$r^2\,(adj) = 0.972$; Durbin's $h = -0.11$; $F = 62.09$

Public Enterprises Investment (*IPE, NIPE*)

$$IPTC_t = \underset{(2.42)^{**}}{0.41}\, IPTC_{t-1} + \underset{(1.87)^{*}}{0.30}\, DY_{t-1} - \underset{(-3.04)^{**}}{0.44}\, GDEFU_{t-1} - \underset{(-0.09)}{0.01}\, IPE_t - \underset{(-0.92)}{0.01}\, NIPE_t$$

$r^2\,(adj) = 0.891$; Durbin's $h = -1.34$; $F = 24.00$

Rail Transport (*IPR, NIPR*)

$$IPTC_t = \underset{(2.18)^{*}}{0.31}\, IPTC_{t-1} + \underset{(2.44)^{**}}{0.24}\, DY_{t-1} - \underset{(-5.55)^{***}}{0.50}\, GDEFU_{t-1} - \underset{(-1.36)}{0.13}\, IPR_t - \underset{(-1.13)}{0.08}\, NIPR_t$$

$r^2\,(adj) = 0.911$; Durbin's $h = -1.20$; $F = 29.77$

Post Office Telegraph (*IPT, NIPT*)

$$IPTC_t = \underset{(4.08)^{***}}{0.54}\, IPTC_{t-1} - \underset{(-0.42)^{**}}{0.06}\, DY_{t-1} - \underset{(-3.08)^{**}}{0.37}\, GDEFU_{t-1} + \underset{(0.88)}{0.14}\, IPt_t + \underset{(2.27)^{**}}{0.14}\, NIPT_t$$

$r^2\,(adj) = 0.911$; Durbin's $h = -0.58$; $F = 29.53$

General Government (*IGG, NIGG*)

$$IPTC_t = \underset{(4.06)^{***}}{0.65}\, IPTC_{t-1} - \underset{(-2.18)^{*}}{0.40}\, DY_{t-1} - \underset{(-1.38)}{0.19}\, GDEFU_{t-1} + \underset{(2.98)^{**}}{0.47}\, IGG_t + \underset{(0.68)}{0.06}\, NIGG_t$$

$r^2\,(adj) = 0.944$; Durbin's $h = -0.73$; $F = 30.42$

Federal Government (*IFG, NIFG*)

$$IPTC_t = \underset{(4.89)^{***}}{0.75}\, IPTC_{t-1} - \underset{(-2.93)^{**}}{0.46}\, DY_{t-1} - \underset{(-1.67)}{0.01}\, GDEFU_{t-1} + \underset{(3.72)^{***}}{0.23}\, IFG_t + \underset{(2.31)^{**}}{0.12}\, NIFG_t$$

$r^2\,(adj) = 0.925$; Durbin's $h = -1.14$; $F = 35.38$

Provincial Government (*IPG, NIPG*)

$$IPTC_t = \underset{(3.85)^{***}}{0.64}\, IPTC_{t-1} - \underset{(-1.25)}{0.21}\, DY_{t-1} - \underset{(-0.57)}{0.08}\, GDEFU_{t-1} + \underset{(3.16)^{**}}{0.49}\, IPG_t - \underset{(-1.47)}{0.10}\, NIPG_t$$

$r^2\,(adj) = 0.937$; Durbin's $h = -0.59$; $F = 42.46$

Local Government (*ILG, NILG*)

$$IPTC_t = \underset{(3.53)^{***}}{0.46}\, IPTC_{t-1} - \underset{(-3.51)^{***}}{0.55}\, DY_{t-1} - \underset{(-4.47)^{***}}{0.43}\, GDEFU_{t-1} + \underset{(3.82)^{***}}{0.51}\, ILG_t + \underset{(3.55)^{**}}{0.31}\, NILG_t$$

$r^2\,(adj) = 0.957$; Durbin's $h = -0.75$; $F = 40.50$

(*continued Table 6*)

Rural Works (*IRW, NIRW*)

$$IPTC_t = 0.46\,IPTC_{t-1} + 0.17\,DY_{t-1} - 0.37\,GDEFU_{t-1} + 0.09\,IRW_t - 0.06\,NIRW_t$$
$$(3.08)^{**} \quad (1.12) \quad (-3.45)^{***} \quad (0.89) \quad (-0.81)$$
$$r^2\,(adj) = 0.936;\ \text{Durbin's } h = -0.89;\ F = 26.25$$

Indus Basin (*IIB, NIIB*)

$$IPTC_t = 0.97\,IPTC_{t-1} - 0.46\,DY_{t-1} - 0.15\,GDEFU_{t-1} - 0.33\,IIB_t - 0.17\,NIIB_t$$
$$(5.61)^{***} \quad (2.56)^{**} \quad (-1.28) \quad (-3.42)^{***} \quad (-2.13)^{**}$$
$$r^2\,(adj) = 0.940;\ \text{Durbin's } h = -0.07;\ F = 45.15$$

Energy (*IEN, NIEN*)

$$IPTC_t = 0.29\,IPTC_{t-1} + 0.13\,DY_{t-1} - 0.47\,GDEFU_{t-1} + 0.08\,IEN_t + 0.22\,NIEN_t$$
$$(1.79)^{*} \quad (1.05)^{**} \quad (-5.60)^{***} \quad (0.47) \quad (2.89)^{**}$$
$$r^2\,(adj) = 0.958;\ \text{Durbin's } h = -0.56;\ F = 41.11$$

Notes: Equations estimated with *Soritec Statistical Analysis System Version 6.5* (Springfield, Virginia: Soritec group, 1990). Estimation method = ordinary least squares with a Cochrane-Orcutt iterative autocorrelation procedure to correct for first and second degree autocorrelation in the disturbances. r^2 = coefficient of determination from the differenced model; Durbins h = Durbin's h statistic for equations with lagged variables; F = F statistic; ( ) = t statistic of significance; *** significant at the 99th level of confidence; ** significant at the 95th level of confidence; * significant at the 90th level of confidence; $_t$ = current time period; $_{t-1}$ = previous time period; D = difference from $_{t-1}$ to $_t$. All variables were deflated with the *GDP* deflator and are in 1985 prices.

tions adjusts over time to bridge the gap between the actual level of capital stock and that deemed optimal by investors.

2. While private sector investment is not stimulated by the change in Gross Domestic Product, it is retarded by unanticipated increases in the government's deficit. That is increased government borrowing in the domestic market to fund budgetary deficits crowds out a certain amount of private sector capital formation in the transportation and communications sector.

3. While generally stimulated by government investment, private sector investment in transportation and communications was not affected by certain types of public sector capital formation. In particular infrastructure and investment provided by public enterprises did not stimulate the private sector. The same was also true of rural works investment, Indus Basin Projects and to a certain extent energy (which only stimulated private investment through the non-infrastructural component).

4. The strongest (as indicated by the size of the regression coefficients) stimulus to private investment came from: total public, federal, and local government infrastructure (and non-infrastructural capital formation).

Conclusions

Public investment in Pakistan has generally played a critical role in

stimulating private sector involvement in the transport/communications sector. Unfortunately this relationship has not characterized that provided by the public enterprises – railroads and post office, telegraph and telephone – where the potential effect should be the greatest. Clearly in Pakistan's case the creation of infrastructure facilities does not insure their efficient utilization and management.

While not directly examined here there is a good chance that the softness [21] of the budget constraint faced by the railroads, telegraph/telephone etc. arising from the knowledge that any losses will be picked up by the government may introduce inertia and lack of efficiency in the public enterprise area. This effect on private investment is compounded by the crowding out of private investment to finance the enterprise deficits. Hopefully, the economic reforms introduced in early 1991 requiring fiscal accountability on the part of the government enterprises will correct this situation.

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[21] For a general discussion of this problem see KORNAI (1986).

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INFRASTRUTTURE E INVESTIMENTI NEL SETTORE PRIVATO: IL CASO DEL SETTORE DEI TRASPORTI E COMUNICAZIONI DEL PAKISTAN, 1972-1990

L'investimento pubblico nel Pakistan ha generalmente avuto un ruolo essenziale nello stimolare il coinvolgimento del settore privato nel settore dei trasporti e comunicazioni. Purtroppo questa relazione non ha caratterizzato le imprese pubbliche – ferrovie e poste, telegrafi e telefoni – per le quali l'effetto potenziale avrebbe dovuto essere massimo. Evidentemente nel caso del Pakistan la creazione di infrastrutture non assicura la loro efficiente utilizzazione e gestione.

Benché il problema non sia qui direttamente oggetto di studio, vi è molta probabilità che la debolezza del vincolo di bilancio con cui deve misurarsi il settore ferroviario, telegrafico, i telefoni ecc. derivanti dalla consapevolezza che qualsiasi perdita sarà affrontata dal governo, può generare inerzia e mancanza di efficienza nel settore dell'impresa pubblica. Questo effetto sull'investimento privato è accentuato dallo spiazzamento dello stesso per finanziare le imprese dell'area

pubblica. Si spera che le riforme economiche introdotte all'inizio del 1991 che impongono responsabilità di bilancio da parte delle imprese pubbliche correggano questa situazione.

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MOBILISATION OF FOREIGN SAVINGS FOR DEVELOPMENT

A Study of the Impact of External Public Debt on Economic and Human Development in Bangladesh and India

by
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Introduction

Although contemporary models of economic growth owe their origin mostly to John Maynard Keynes, Roy Harrod and Evsey Domar, the essential difference between the Keynesian and Harrod-Domar model lies in their relative emphasis on the forces of economic growth. Keynes primarily concerned with employment and writing during the depression placed greater reliance on raising aggregate demand and expenditure, whereas Harrod and Domar emphasised the need for raising savings to achieve the desired rate of growth (Roy, 1991). The implicit assumption of both models that resources would remain fairly elastic until the full-employment is reached is not tenable. Moreover, the Harrod-Domar model also implicitly assumed that savings could be easily transformed via investment into physical goods and services without any difficulty. However, it is now recognised that even if a sufficient amount of domestic saving is available, the required amount of investment may not be undertaken because of lack of human skills, organisational ability, technological knowledge and of capital goods etc. Also, the rate of domestic savings in many LDCs tends to remain at very low levels. Hence the need for foreign savings assumes paramount importance in the economic development of developing countries.

The role of foreign savings in economic development can be illustrated in the following algebraic model:

$$Y = C + I + (X - M) \qquad (1)$$

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where Y = income, C = consumption (including government), I = investment (including government), X = exports of goods and services and M = imports of goods and services.

Therefore total expenditure = total income. But the total income derived in any one year is partly spent on consumption (C) and partly saved (S).

Therefore $Y = C + S$.

Hence equation 1 can be rewritten as:

$$C + I + (X - M) = C + S \tag{2}$$

By cancelling C on both sides and moving $(X - M)$ to the right hand side and reversing its sign we derive:

$$I = S + (M - X) \tag{3}$$

Therefore, a country's investment opportunities are determined by its potential for domestic savings (S) and any net capital inflows from abroad (Hogendorn, 1987). The only way to obtain foreign savings is by increasing imports. Therefore an excess of imports over exports is equivalent to a net capital inflow.

A number of studies in the 1960s on the constraints of development (Balassa, 1964; Rosenstein-Rodan, 1961; Chenery and Strout, 1966) provided the added impetus to LDCs for seeking, and to DCs for channelling, foreign savings for development. However, borrowing from overseas on a large scale to finance development programmes also raises the external debt burden.

As the public sector accounts for a substantial proportion of economic activities in LDCs, its share in the total external debt of these countries also remains very large. The adverse economic consequences of external debt are well documented (World Bank, 1983, 1985, 1988; Roy and Sen, 1989; Cline and Griffin, 1988; Bock, 1988; Dooley and Watson, 1989; Husain, 1989; Borensztein, 1989). However, the beneficial effects of foreign savings can also be felt on the economic and human aspects of development. Therefore, despite its manifest disadvantages, if external public debt does appear to have a significant impact on several economic and social indicators of development, it can be argued that external public debt is not ipso-facto harmful to the economy.

This paper analyses the external debt scenario for Bangladesh and India and examines the impact of external public debt on selected economic and human indicators of development in Bangladesh and India. This impact

assessment study also provides important lessons for policy directions of governments of recipients and suppliers of foreign savings.

External Public Debt Scenario for Bangladesh and India

In the case of both Bangladesh and India, public debt accounts for more than 90 percent of total external debt. It is generally recognised that external capital plays a smaller role in the development of such large economies as India but plays a larger role in the development of such smaller economies as Bangladesh. Therefore, large amounts of foreign savings tend to flow into smaller economies. This trend is illustrated in Table 1.

TABLE 1

PER CAPITA EXTERNAL PUBLIC DEBT FOR BANGLADESH AND INDIA (U.S. DOLLARS)

Year	India	Bangladesh	Year	India	Bangladesh
1974	13.67	16.22	1982	20.15	54.60
1975	14.41	22.86	1983	19.64	57.85
1976	15.70	26.62	1984	18.39	58.02
1977	16.77	29.51	1985	19.74	66.24
1978	17.67	35.04	1986	20.71	78.09
1979	18.68	36.11	1987	22.17	92.69
1980	21.21	40.57	1988	23.04	97.75
1981	20.00	49.33			

SOURCE: For Bangladesh: WORLD BANK, *World Tables 1989-90*, Baltimore: Johns Hopkins University Press, 1990.
For India; IMF, *International Financial Statistics Year Book*, Washington D.C.: IMF, 1990.

The per capita external public debt has been consistently higher for Bangladesh than for India as Table 1 illustrates. In 1974, the per capita external debt of Bangladesh was only 18.7 percent higher than that of India but in 1988 this percentage increased to 324.3. However, along with the growth in the size of the debt, the burden of repayment also is expected to grow.

A comparative scenario of external debt burden for Bangladesh and India is presented in Table 2.

To obtain a clearer picture of the magnitude of the debt burden it is

TABLE 2

EXTERNAL DEBT BURDEN OF BANGLADESH AND INDIA

	1980	1981	1982	1983	1984	1985	1986	1987	1988
1. % Change in Total Debt:									
Bangladesh	–	10.6	13.3	8.3	2.4	16.6	20.4	23.6	5.2
India	–	9.8	21.3	16.5	6.2	20.8	18.3	14.4	3.4
2. Debt Ratios:									
(a) *EDT/XGS*									
Bangladesh	343.7	331.4	407.0	366.9	346.9	412.6	498.9	497.6	492.7
India	136.9	154.2	192.0	208.4	209.5	264.4	298.9	291.3	262.6
(b) *EDT/GNP*									
Bangladesh	31.5	31.3	38.5	45.5	40.2	41.0	51.3	55.6	53.2
India	11.9	12.6	14.9	16.0	17.5	19.2	21.2	21.6	22.3
(c) *TEDD/GNP*									
Bangladesh	6.9	4.7	6.2	5.0	3.8	4.3	7.1	7.5	5.4
India	1.9	1.7	2.6	2.2	2.0	1.9	2.4	2.4	2.5
(d) *TDS/XGS*									
Bangladesh	16.8	14.2	17.3	13.9	17.2	21.3	28.5	28.9	23.3
India	9.2	10.4	13.9	16.7	18.2	22.2	30.0	30.3	29.2
(e) *INT/XGS*									
Bangladesh	6.4	7.0	9.2	8.0	7.7	8.6	9.8	9.4	8.6
India	4.1	5.0	7.3	9.2	10.6	12.3	14.0	13.9	14.0

NOTES: *EDT* = Total external debt; *XGS* = Exports of goods and services; *TDS* = Total debt service; *INT* = Interest; *TEDD* = Total external debt disbursed.

SOURCE: WORLD BANK, *World Debt Tables 1989-90*, Washington D.C.: World Bank, 1989.

necessary to look at various debt ratios. It can be seen from the table that the ratios of external debt to exports of goods and services and to *GNP* have increased for both Bangladesh and India. In 1988, total external debt accounted for nearly 500 percent of exports of goods and services and more than 50 percent of *GNP* for Bangladesh and for more than 260 percent and 22 percent for India. Total external debt disbursed as a proportion of *GNP* also was higher for Bangladesh than for India. It may appear from these ratios that Bangladesh faces a more serious debt problem than India. But the two other ratios (*TDS/XGS* and *INT/XGS*) which are more important for the developing economies, at least in the short run, would indicate the opposite. While the ratios of total debt service and interest payment

to exports of goods and services have been rising for both countries, since 1983 such ratios for Bangladesh have consistently remained well below those for India. This is due mainly to the fact that since its birth, Bangladesh has received loans on far more generous terms than India. Table 3 illustrates the average terms of new commitments to India and Bangladesh.

TABLE 3

AVERAGE TERMS OF NEW CREDIT COMMITMENTS (IN PERCENT)

	1970	1980	1981	1982	1983	1984	1985	1986	1987	1988
Interest (%)										
Bangladesh	n.a.	1.7	2.1	1.7	1.5	1.4	1.3	1.1	1.1	1.5
India	2.5	5.4	4.7	7.0	6.4	6.7	5.8	6.0	5.3	6.3
Grant element (%)	n.a.	68.2	61.8	71.0	70.3	74.3	71.8	76.5	77.3	70.6
India	60.8	45.3	46.6	24.8	28.6	27.3	32.7	26.4	34.6	26.3

SOURCE: WORLD BANK, *World Debt Tables 1989-90*, Washington D.C.: World Bank, 1989.

The correct measure of the softness of a credit is given by the grant element. With lower interest rate, longer maturity and grace periods, the share of grant element in loans will rise. This is clearly demonstrated in the case of Bangladesh. However, despite softer repayment conditions being attached to loans to Bangladesh, total service payment still poses a serious problem for the country. Total debt service to current account balance ratio moved upward very sharply after 1982 and reached 368 percent in 1986. With a lower debt service payment, the country would have recorded a favourable current account balance in a number of years. Lower debt service payment would also have reduced India's payments deficit. This is illustrated in Table 4.

The Impact Assessment of Foreign Savings

The hypothesis to be tested is that external public debt, while producing an adverse impact on several economic indicators, would also produce a beneficial impact on other economic and human development indicators. But the nature and magnitude of impact on the same indicator in these two countries may be quite different. Hence the results of the test would

TABLE 4
SHARES OF TOTAL DEBT SERVICE AND INTEREST PAYMENT IN CURRENT ACCOUNT BALANCE OF BANGLADESH AND INDIA (IN PERCENT)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
TDS/Current Account Balance									
Bangladesh	23.3	22.6	24.0	53.7	116.3	55.0	368.0	182.8	134.8
India	47.1	56.4	63.3	104.9	85.7	58.8	85.2	91.7	91.4
Interest/Current Account Balance									
Bangladesh	8.9	11.3	12.8	30.7	51.9	22.1	127.0	59.9	49.6
India	21.0	27.2	33.5	57.7	50.0	32.1	39.8	42.0	43.9

SOURCE: WORLD BANK, *World Debt Tables 1989-90*, Washington D.C.: World Bank, 1989.

indicate which of the two countries has been better able to utilise foreign savings for its development and whether the impacts are consistent with the amounts received and with the terms and conditions under which these were received. In this impact assessment, GDP, exports, imports, current account balance, contributions of agriculture and industry to GDP and gross domestic investment have been used as proxies for economic development indicators whereas total fertility rate, crude birth rate, infant mortality rate, life expectancy at birth, primary and secondary school enrolment ratios and government expenditure have been used as proxies for human development indicators.

The Statistical Analysis

The statistical analysis is intended to test (1) whether foreign public debt has any significant influence on each of the economic and social indicators considered for Bangladesh and India separately and (2) whether there is any significant difference between the effects of foreign debt on each of the indicators of the two countries. If the latter test is significant with respect to any indicator, one would be able to conclude which country is being benefited more from its foreign debt. To carry out this analysis, two dummy variables D_1 and D_2 are introduced to estimate the combined equation for both countries. D_1 takes a value of 1 for Bangladesh and 0 for India. And

D_2 takes a value of 0 for Bangladesh and 1 for India. Consequently the combined equation for both countries will be

$$Y_t = \beta_1 D_{1t} + \beta_2 D_{2t} + \beta_3 (D_{1t} X_t) + \beta_4 (D_{2t} X_t) + u_t$$

$t = 1, 2, \ldots 30$ (15 years of data for each country)

where Y represents data on any indicator
X represents data on foreign debt and
u represents stochastic disturbances with usual assumptions.

Since the application of ordinary least squares on the above model will lead to a dummy variable trap (Johnston, 1984), the model is estimated using the restricted least squares (forcing the equation through the origin) method. The above model can be used to estimate the models for each country separately and the difference in the regression coefficients can easily be obtained.

The data used for the analysis represent the period from 1974 to 1988 (both inclusive) for Bangladesh and India. The currency figures for both countries are in U.S. dollars. This uniformity will be necessary for appropriate comparisons. Each of the economic and social indicators are regressed on the foreign debt figures of both countries with the dummy variables scheme as explained. Preliminary analysis using the ordinary least squares method provided the appropriate estimates and high R^2 values but with low *D-W* statistic values. This indicated the presence of autocorrelation in the disturbance terms. The application of ordinary least squares on models where disturbances are autocorrelated does not provide efficient estimators. Also the standard errors of the coefficients will be underestimated (Johnston, 1984). Hence all the equations are re-estimated assuming that the equations have autocorrelated disturbances of the first order autoregressive scheme (i.e. $u_t = \rho u_{t-1} + \varepsilon_t$ for $|\rho| < 1$).

To account for the autocorrelated disturbances of the above type the method used here is a modified Cochrane-Orcutt procedure as developed by Beach and MacKinnon (1978). The estimates obtained by the ordinary least squares method are not provided in the paper as they are not efficient. Only the estimates obtained by the Beach and MacKinnon method, which takes autocorrelation into consideration, are provided in Table 5 and Table 6. However these two tables contain only the estimates of regression coefficients and thus the difference for each indicator. The estimates of the intercept (constant) term are not included in these tables as they contribute no additional information to the discussion of the main theme of the paper.

Looking at the figures of Table 5, it is evident that external public debt

TABLE 5
REGRESSION COEFFICIENTS OF ECONOMIC INDICATORS ON FOREIGN DEBT FOR BANGLADESH AND INDIA AND THEIR DIFFERENCES

Economic Indicators	Regression Coefficients		Difference in Regression Coefficients	R^2-value	*D-W* Statistic
	Bangladesh	India			
1. Gross Domestic Product	1.351 (.07)	16.709 (11.6)	15.358 (6.0)	0.9960	1.378
2. Exports	0.124 (3.2)	0.809 (23.1)	0.685 (13.0)	0.9922	1.695
3. Imports	0.237 (1.8)	1.423 (12.4)	1.186 (6.1)	0.9834	1.518
4. Current Account Balance	0.00389 (0.04)	− 0.762 (7.7)	− 0.766 (4.6)	0.8838	1.654
5. Contribution of Agriculture to *GDP*	0.273 (0.5)	3.328 (6.3)	3.055 (3.3)	0.9859	1.742
6. Contribution of Industry to *GDP*	0.262 (0.5)	4.042 (10.4)	3.780 (5.6)	0.9961	1.063
7. Gross Domestic Investment	0.013 (0.04)	4.942 (15.1)	4.929 (9.1)	0.9903	1.996

Figures in parentheses are *t* values.

has a statistically significant influence on all the economic indicators for India. Foreign debt in the Indian situation has a significant and positive influence on gross domestic product, exports, imports, contribution of agriculture to *GDP*, contribution of industry to *GDP* and on gross domestic investment. In India, as the foreign debt increases, the above economic indicators will improve. However, foreign debt has a negative and significant influence on the current account balance in India. With increases in foreign debt in India, the deficit in current account balances widens as one would expect. However, with regard to Bangladesh, foreign debt has a positive and significant influence on exports though foreign debt also increases imports but not significantly at the 0.05 level of significance. Except for the exports and imports which are positively influenced by foreign debt in Bangladesh, other economic indicators are not affected by foreign debt as evident from the *t* values present. It is worth noting that in Bangladesh the

impact of foreign debt is little or negligible on gross domestic product, current account balance, contributions of agriculture and industry to *GDP* and gross domestic investment.

Looking at the differences in regression coefficients and their *t* values, it is clearly evident that foreign debt has a significantly greater impact on all economic indicators in India than Bangladesh. Looking at these economic indicators and the relative influence of foreign debt on these indicators, one could conclude that India has benefited significantly more than Bangladesh from utilising foreign debt.

Table 6 provides the regression coefficients of social indicators on foreign debt for both countries. Foreign debt has a statistically significant effect in reducing total fertility rate, crude birth rate and infant mortality rate for both countries. The differences in these rates between the two countries are not statistically significant, indicating that the impact of for-

TABLE 6

REGRESSION COEFFICIENTS OF SOCIAL INDICATORS ON FOREIGN DEBT FOR BANGLADESH AND INDIA AND THEIR DIFFERENCES

Economic Indicators	Regression Coefficients		Difference in Regression Coefficients	R^2-value	*D-W* Statistic
	Bangladesh	India			
1. Total Fertility Rate	− 0.000130 (6.4)	− 0.0000839 (4.9)	0.0000461 (1.5)	0.9874	1.348
2. Crude Birth Rate	− 0.000842 (4.8)	− 0.000468 (3.1)	0.000374 (1.4)	0.9806	1.414
3. Infant Mortality Rate	− 0.003045 (2.4)	− 0.002161 (2.1)	0.000884 (0.5)	0.9454	1.366
4. Life Expectancy at Birth	0.000610 (6.9)	0.000662 (8.6)	0.000052 (0.4)	0.9886	1.653
5. Primary Enrolment Ratio	− 0.00173 (2.9)	0.00182 (3.5)	0.00355 (3.9)	0.9538	1.856
6. Secondary Enrolment Ratio	− 0.000572 (1.8)	0.001628 (5.8)	0.0022 (4.8)	0.9241	1.973
7. Government Expenditure	0.401 (0.7)	3.553 (8.7)	3.152 (4.5)	0.9941	0.707

Figures in parentheses are *t* values.

eign debt on these rates do not differ between Bangladesh and India. Again, foreign debt has a significant influence in increasing the life expectancy at birth in both countries. Also, the difference in regression coefficients of life expectancy at birth is statistically insignificant indicating that foreign debt has more or less the same effect on life expectancy at birth in both countries. It is interesting to note that foreign debt in Bangladesh has a significantly negative effect on primary school enrolment ratio. The effect on secondary school enrolment ratio is also negative if not significant at the 0.05 level. These ratios started declining over the period as the foreign debt was increasing rapidly in Bangladesh. In India, the situation is completely reverse. Foreign debt in India has a positive and significant impact on both primary and secondary enrolment ratios. With increases in foreign debt in India, both primary and secondary enrolment ratios significantly rose over the years. Looking at the differences between these ratios, one can conclude that the foreign debt has significant and favourable influence on both primary and secondary ratios in India compared to Bangladesh where foreign debt has an unfavourable effect. With respect to the impact of foreign debt on total government expenditure, it can be said that it is significant in India while it is negligible in Bangladesh. Hence foreign debt has significantly more impact on total government expenditure in India compared with Bangladesh. Increases in foreign debt in India increases the total government expenditure. For this equation, the *D-W* statistic is very small, indicating that there is some sort of autocorrelation other than first order autoregressive scheme considered still present in the model. Hence foreign debt has a similar impact on total fertility rate, crude birth rate, infant mortality and life expectancy at birth for both Bangladesh and India. However foreign debt has a favourable impact on primary and secondary enrolment ratios in India compared to Bangladesh where the reverse is true. With respect to government expenditure, the influence of foreign debt is significantly higher in India than in Bangladesh.

Reasons for Divergent Impacts

It is generally recognised that foreign savings play a minor role in the development of such large countries as India and China and a major role in such smaller countries as Bangladesh, Pakistan, Senegal, Mali etc. (Gillies, Perkins, Roemer and Snodgrass, 1987). In fact, total foreign debt accounted for a large proportion of Bangladesh's *GNP* and the amount of debt disbursed also constituted a reasonable share of *GNP* (Table 2, Rows 3 and 4).

Moreover, foreign savings were channelled to Bangladesh on very soft terms and conditions. In 1988 the interest rate on a new credit commitment to Bangladesh was only 1.5 percent and grant element accounted for 71 percent of the credit (Table 3). Despite such a large inflow of foreign savings on extremely generous terms, it would appear that the beneficial impact of external public debt on the economic aspects of development have not been as pronounced in Bangladesh as they have been in India. One important reason, which is also applicable to Bangladesh, is, of course, the lack of important complementary inputs to development such as human skills, administrative capacity, infrastructure, economic institutions and political stability which prevents foreign savings from producing desirable effects on development. In Bangladesh, administrative machinery is highly inefficient and corrupt, infrastructural facilities are not adequate and political stability has been almost non-existent since the birth of the country.

The development and supply of infrastructural facilities, human capital etc. are financed by government expenditure. But one analysis has demonstrated that external public debt had very little impact on government expenditure. Even if these barriers to growth were overcome, it is suggested that foreign savings may substitute for – not add to – domestic savings, permitting increases on consumption rather than increases in investment (Gillies et al., 1987). Thus it is quite likely that a significant part of the foreign savings which flowed into Bangladesh may have been used for consumption rather than for investment. Gross domestic savings, in fact, declined from 8 percent of *GDP* in 1965 to only 3 percent in 1988 (World Bank, 1990). Furthermore, when large amounts of foreign savings are offered to a country on very generous terms and conditions, the scarcity value of foreign savings diminishes and the country may become more interested in cultivating the techniques of 'foreign savings dependence' than in directing those savings to productive investments so as to eventually become independent of foreign savings. On the other hand, in India, foreign public debt accounted for a smaller proportion of *GNP* and the amount of loans disbursed also constituted a very small share of *GNP*. Moreover, terms of new credit commitment were considerably harder and the share of grant element in total credit was smaller for India (Table 3). Domestic savings as a proportion of *GDP* also increased from 15 percent in 1965 to 21 percent in 1988 (World Bank, 1990). While administrative machinery is also inefficient and corrupt, India does possess an enormous supply of skilled labour, better infrastructural facilities and enjoy greater political stability than Bangladesh. Moreover, as foreign savings did not

flow into India on soft terms, scarcity value of foreign capital would not have diminished to the same extent as in Bangladesh.

These factors can provide some explanations for the divergent impacts of foreign savings on development in Bangladesh and India.

Implications for Policy Directions

The foreign debt impact analysis presented above has important implications for policy directions of both the Bangladeshi and Indian governments. For Bangladesh, since the foreign debt has a positive impact on exports, the government should utilise external savings for the development of exports. However, since the development of the export sector also requires import of capital goods, technology etc. one would have expected the impact of foreign debt on imports to be equally strong. Unfortunately the impact of foreign debt on imports appears to be mildly positive. This would suggest that foreign savings should be directed to labour-intensive light manufacturing and primary goods processing industries in the export sector.

However, foreign debt has a significant positive impact on all health related indicators. Therefore, foreign savings should be utilised for improving health care which will improve the quality of human capital which in turn would produce beneficial effects on the overall economic growth.

In India all economic indicators are very strongly influenced by foreign debt. All social indicators are also strongly influenced by foreign debt. Since the returns from foreign savings in terms of the improvement in the performance of the economy and in the quality of human lives are very high in India, the government should channel foreign savings in both directions.

Concluding Remarks

The analysis presented above thus demonstrates that while foreign savings raise foreign debt burden and may enlarge the balance of payments deficit of the recipient country at least in the short run, it has significant beneficial effects on the economy. If channelled properly and used efficiently it can enhance the performance of the export, agricultural and industrial sectors, improve the quality of human capital and produce favourable effects on *GDP*. However it appears that the beneficial impacts on economic and important social indicators are significantly less pronounced in Bangladesh than in India despite the fact that on per capita terms, Bangladesh received

significantly more savings than India. Hence the inescapable conclusion that emerges from the study is that pouring large amounts of foreign savings into a poor country does not automatically ensure rapid economic growth and greater human development. Widespread corruption among public officials, political and economic elites, lack of adequate infrastructural facilities and lack of motivation to direct foreign savings into productive investment combine together to seriously undermine the effectiveness of foreign savings in development. The analysis also has significant implications for policy directions of the suppliers of foreign savings. The issue to be settled is, should larger amounts of foreign savings be directed on softer terms to a poor country which has greater infrastructural facilities and is capable of utilising it more efficiently than another or, should a country continue to receive large amounts of foreign savings even if it fails to utilise it productively and effectively? This question needs to be addressed if foreign saving is to make any effective contribution to development in a world in which increasing demand is being made on a limited supply of foreign savings by an ever growing number of newly emerging countries [1].

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MOBILITAZIONE DEL RISPARMIO ESTERO PER LO SVILUPPO

Studio dell'impatto del debito pubblico estero sugli aspetti economici e umani dello sviluppo in Bangladesh e India

Questo articolo analizza la situazione del debito estero del Bangladesh e dell'India ed esamina l'impatto relativo del debito pubblico estero sullo sviluppo economico e umano in Bangladesh e India. Lo studio rivela che il risparmio estero ha avuto una maggior influenza positiva sullo sviluppo economico e umano in India che in Bangladesh nonostante l'ammontare di risparmio estero ricevuto procapite sia stato considerevolmente inferiore per l'India che per il Bangladesh. Si deduce che destinare grandi ammontari di risparmio estero ad un paese povero non assicura automaticamente una rapida crescita economica e un maggior sviluppo umano.

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GROWTH AND INSTABILITY OF LATIN AMERICAN PRIMARY COMMODITY EXPORTS TO THE EC

by
STEFANO MAINARDI *

1. *Introduction*

Primary commodities still account for a substantial share of Latin American countries' exports to the EC. This commodity trade pattern reflects to an even greater extent the lack of diversification towards higher value-added goods which characterizes national production in most countries of the region. In some cases, especially smaller and open economies such as in Central America or Chile, the high concentration of exports in one or two major agricultural or mining products is coupled with high dependency of the economy on exports and foreign exchange availability.

Given the frequent fluctuations and poor performance of the relative prices and demand for primary commodities, these economies have suffered serious losses through their foreign trade exposure, and on the whole many countries of the region have been induced to restrain their imports, thus reducing their growth potential. Besides this, higher export price instability implies also greater difficulties for policy planning and inflation stabilization. Inflationary pressures can not only be brought about by sudden revenue booms due to a buoyant performance in export commodity prices or quantities, but also in the opposite case of an unpredicted shortfall in export earnings: in the latter case, in fact, the increased level of government spend-

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ing for social services is often maintained by relying more on direct public deficit financing.

With few exceptions, the only major trade policy instrument applied by the EC to try to redress this negative trend in the case of Latin American countries has been the Generalised System of Preferences (GSP), which has theoretically granted duty-free access to most manufactured products, subject to quotas and similar restrictions. In this way, the GSP has indirectly stimulated an export diversification strategy. However, this instrument has been scarcely useful in practice, because of administrative difficulties and insufficient competitiveness of Latin American manufacturing. Furthermore, no guarantee funds for the stabilization of primary export earnings have been established, such as Stabex and Sysmin within the Lomé Convention for the associated countries in the African, Caribbean and Pacific region.

Therefore it appears useful to focus on some primary commodities of particular relevance for Latin American exports to the EC, by examining their recent growth pattern and instability, comparing results with the corresponding performance of EC imports from the rest of the world, and possibly exploring the causes of their fluctuations, i.e. whether more price or quantity-related or more supply or demand-determined. These topics are considered in Section 3, with reference to statistical and econometric analyses on 8 commodities from 17 Latin American countries. In view of the controversial methodological and empirical aspects involved in the study of instability, Section 3 also provides a brief description of some of these problems. The analysis is preceded by some remarks and figures of a broader nature, presented in Section 2, and ends up with a short overview of results and a possible outlook in Section 4.

2. *International Trade of Primary Commodities and EC-Latin American Relations*

Primary commodities have experienced high price fluctuations in world markets particularly since the early 1970s. In general terms, during the 1970s these high short-term fluctuations were coupled with a slightly positive trend. The opposite occurred in the 1980s, with a marked decline of world primary commodity prices in real terms, and an even higher market volatility, although a moderate recovery has been registered since 1987 (Cepal, 1991, p. 54). As a consequence of this stagnation in price levels and the relatively lower demand for these products, primary commodities de-

creased their share in world trade from almost half of the total in the early 1960s, to nearly one fourth in the late 1980s.

Developing countries have decreased in turn their participation in world primary commodity trade, if oil is excluded: while in 1966 they made up 34% of this trade, in 1988 their share had shrunk to 28%. Within this amount, the share of Latin American exports of these products diminished slightly, from ca. 14% in 1966 to 12% in 1988 (if oil and fuels are included, the corresponding figures are 6.4% and 4%, respectively) (García, 1990). However, the share of Latin America in world primary commodity trade is particularly high in products such as bananas, coffee and sugar, representing more than half of the world total. For some minerals, such as copper, iron ore and bauxite, this share reaches nearly one third and, with the exception of bauxite, has tended to increase in the last two decades. Among other products, cocoa and soya beans appear to follow a particularly dynamic trend.

The negative trend in world prices of primary products and the high participation of these products in total Latin American exports help explain the divergent evolution between *quantum* and unit value indexes of total exports of the region. Having 100 in 1980 as a base year, Latin American non-oil exporters increased their exports in quantity terms up to 159 in 1988 and oil exporters to 152, but their export unit value indexes decreased to 87 and 58, respectively (Cepal, 1989, pp. 20-21). Several factors account for the slowdown and instability of primary commodity prices: distinctions can be made between different time horizons and between aspects related to demand or supply.

In the short and medium term, the demand for these products can be influenced by changes in inflationary expectations, exchange rates, and international interest rates. In this regard, increased interest rates since the early 1980s have brought about higher storage costs and, at the same time, due to the worsening foreign debt position of many developing producer countries, further stimulated the need to export and hence indirectly put downward pressures on commodity prices.

In the case of many developing countries, in view of the urgent need of foreign exchange, sudden price or demand falls may paradoxically induce in turn increases in export volumes of these commodities, thus fostering cyclical swings. This is also caused by the relatively more difficult adaptation of supply to rapid changes in demand, because of the slower adjustment capacity of agricultural and mining production activities, which are respectively hampered by long maturation periods and high fixed costs of production (Wagner et al., 1989).

In the long term, primary commodities have experienced a less dynamic growth in world demand relative to manufactured products, as a consequence of their lower income elasticity. Moreover, changes in tastes and dietary habits and technical progress have negatively affected world markets of many tropical foodstuffs, and technological changes have also contributed to reduce the use of other primary commodities for industrial processing. Some products, particularly certain minerals and metals, like copper and tin, have been substituted over the past few years by other products for several industrial processes, such as optical fibres for telecommunications, with a view to increasing productivity, saving energy, and matching new demand requirements (Cepal, 1991).

Another negative factor for the evolution of international prices is constituted by the predominant market structure. Its oligopolistic character coupled with the weakness of the labour market in developing producer countries implies that, unlike in the industrial sector, productivity increases tend to entail more moderate price increases, rather than allowing higher export earnings. The presence of this market structure leads also to significant differences between export prices in developing countries and sale prices in industrial countries, even if no substantial product processing is needed in the importing country, such as for bananas and coffee.

On the supply side, market disruptions eventually affecting world prices can be caused by natural phenomena, such as floods, droughts, and frosts, or social and political events, like strikes and sudden government changes. With regard to a number of agricultural products, in the last few years increasing protectionism in industrial countries, including in particular non-tariff barriers, and public support to local production have also reduced the outlet prospects for developing countries' exports. However, as for the Asian experience in agricultural commodity trade, the relevance of supply-side features is shown by empirical results that point out how policy regimes which avoided excessive direct state intervention and were not biased against exports led to higher and steadier export growth for these products (Athukorala, 1991).

As for the relevance of the EC market for Latin American commodity exports, if oil and fuels are excluded and the intra-regional trade is taken into account, nearly one third of these exports enter the EC. This trade linkage is particularly high for Bolivia, Brazil, Colombia, Paraguay and most Central American and Caribbean countries. Latin American exports to the EC appear more concentrated in primary products than total export flows of the region (nearly three fourth vis-à-vis two third, respectively).

Similarly to other developing regions, Latin America has decreased its

already rather low share in total EC imports over the last twenty five years, passing from 9% in 1965 to ca. 6% in 1989. This performance can partly be attributed to the insufficient achievements in Latin American countries' efforts to diversify and render more competitive their production and exports. In view of the mostly very high concentration of exports to the EC of Latin American countries in one or two primary products, it is worth examining the above mentioned problems and trends in greater detail.

3. *Empirical Results on Some Major Commodities*

3.1. *Preliminary methodological remarks.* – In order to evaluate growth and instability of main Latin American commodity exports to the EC, a statistical analysis has been applied on Eurostat import flow data relative to the period 1977-1989 [1]. For each Latin American country, the most relevant commodity exported to the EC was considered; in a few cases two major commodities were included in the analysis, due to the predominant weight of one of the two in different years of the reference period. Argentina and Uruguay were excluded because of the limited relative importance of their main export commodities and their specialization towards temperate-zone agricultural commodities.

Instability is here defined as short and medium term movements of trade variables, expressed in value, quantity and price terms, from their growth trends. In the relevant empirical literature, export instability has been treated and measured with numerous different approaches and methods. Most studies on the subject focus on high frequency components, i.e., as in this case, they evaluate fluctuations lasting from 1 to 2 years during a time span of 10-15 years. While the assessment of very high-frequency is generally hindered by the lesser availability of monthly or quarterly data, the use of longer estimation periods would allow the assessment of medium and low-frequency components, i.e. fluctuations with minimum duration of 2 and 5 years, respectively.

According to Gelb (1979), the costs imposed on developing countries by medium frequency changes are less easy to dismiss than high-frequency export revenue fluctuations, since production structures are subject to relatively more serious problems of adjustment whenever export revenues experience declining trends not over one or two, but a number of years. Other

[1] The level of disaggregation was chosen at 4, 6 or 8-digits, depending on the degree of homogeneity of the items according to Nimexe classification. Tin includes metallic ore and concentrates and unwrought tin, not alloyed; soya refers to soya beans and oil cake.

authors have similarly stressed that the relevance of short-term export instability for developing countries has been overstated, and some distinguish between consumer and producer interests involved.

Also in terms of long-term growth, empirical evidence seems to suggest that, "if there are negative feedbacks from instability to growth, they are sufficiently small in magnitude relative to other factors", so as to impinge upon the significance of statistical tests geared to detect them (Krueger 1988, p. 564). On the one hand, time series studies appear more suitable to measure short run macroeconomic implications, rather than the impact on long term growth. On the other hand, cross-country studies usually support the hypothesis of a negative relationship between instability and growth, but results are sensitive to country samples, time series, and measurement methods chosen. Furthermore, the causal link is not proved in this way, since higher export instability and lower growth can be influenced by a set of exogenous variables (MacBean-Nguyen, 1988).

Aside from the limitations of the empirical findings, the effects of sharp fluctuations in export earnings will be less severe when imports and domestic investment are relatively less dependent on commodity export earnings and these fluctuations do not contribute to lower expected returns on investment. An evaluation of these aspects is beyond the scope of the present analysis. However, both the specific market structure and the sectoral composition of production, and the development strategies so far implemented in most Latin American countries let one suppose that economic losses did arise in the period analysed here. These losses can be attributed not only to the downward trend in relative commodity prices and the sluggish world demand for these products, but also to short term fluctuations in corresponding export earnings. Medium term fluctuations, not captured by the present analysis because of data constraints, might have mattered even more.

3.2. *Market shares, trends and instability.* – The three agricultural commodities and five mineral products selected (as described above) generally represent remarkable shares of total EC imports from individual Latin American countries (Table 1). In 1989, for 9 out of 21 cases, this share lay at approximately 50% or more. However, except Bolivian zinc, Dominican ferronickel, and soya from Paraguay, there appears a reduction of dependency on the first export primary commodity or at least the maintenance at similar levels over the period [2].

[2] This is mostly verified by analyzing the evolution in the time series. In the case of Ecuadorian bananas two opposite trends seem to prevail, the reduction of dependency on this commodity being accomplished only from the mid-1980s.

TABLE 1

MAIN PRIMARY COMMODITY EXPORTS TO THE EC FROM LATIN AMERICA: SHARES BY COUNTRY AND PRODUCT (1977-1989)

	(M/Mt)	*M/MT*		*M/Mext*		*Mext/Mtext*	
	(average)	(1977)	(1989)	(1977)	(1989)	(1977)	(1989)
Bananas						0.33	0.33
Panama	50.1	53.6	44.2	12.2	12.1		
Costa Rica	44.1	37.5	44.0	11.7	11.9		
Ecuador	44.8	37.9	34.3	12.4	7.6		
Honduras	42.3	38.6	36.5	7.6	4.4		
Coffee						2.6	0.9
Brazil	14.0	22.3	7.6	17.1	20.1		
Colombia	66.5	72.3	50.1	11.4	19.4		
Costa Rica	45.8	57.2	36.7	2.2	3.7		
El Salvador	89.1	91.6	89.2	6.9	3.0		
Guatemala	57.1	70.8	57.1	4.0	2.9		
Nicaragua	70.5	79.9	66.8	2.9	1.6		
Haiti	69.9	83.9	70.1	0.9	0.8		
Soya						1.8	1.1
Brazil	19.5	20.1	22.2	22.5	47.3		
Paraguay	40.3	37.8	65.6	1.6	5.7		
Copper						1.5	1.3
Chile	52.1	62.6	49.1	16.0	23.8		
Peru	29.2	32.3	30.3	3.9	5.6		
Zinc						0.19	0.21
Peru	15.1	16.3	13.0	15.2	14.5		
Bolivia	16.1	4.2	25.6	1.7	3.9		
Tin						0.3	0.08
Bolivia	44.6	58.9	14.0	14.9	5.9		
Petroleum						26.3	11.5
Mexico (1)	65.0	41.0	44.9	0.6	2.4		
Venezuela	80.9	71.3	62.4	0.8	1.9		
Ferronickel						0.10	0.12
Domin. Rep.	40.1	49.8	61.1	17.7	19.9		

M/Mt = share of main primary commodity import from the Latin American country to the EC (*M*) in total EC imports from the country concerned (*Mt*).

M/Mext = share of main primary commodity import from the Latin American country to the EC (*M*) in total EC imports of the commodity concerned (*Mext*).

Mext/Mtext = share of EC imports of the primary commodity (*Mext*) in total EC imports of goods (*Mtext*).

(1) period 1980-1989 (instead of 1977-1989).

In Table 1, countries are ordered according to their participation in EC imports of the commodities concerned in 1989 (fifth column in the table). In the majority of cases, Latin American countries tend to increase their share in the EC market or to keep it nearly constant. Exceptions are constituted by Ecuador and Honduras for bananas, three Central American countries for coffee, and Bolivia for tin: whereas for bananas this can possibly be due to the preferential treatment granted by some EC member states to exporters of other regions, for coffee these losses in market shares appear more than offset by gains of major Latin American producers and exporters. The low income elasticity of demand and other problems mentioned in Section 2 underlie the negative trend of the shares of these commodities in total EC imports: the only products not declining in their import shares are bananas, zinc and ferronickel (Table 1).

For the analysis of instability, an exponential growth regression model has been applied to each time series, for values, quantities and import unit prices separately. Instability has then been estimated by normalizing the standard error of the regressions obtained, i.e. by calculating the ratio of the standard error of estimate to the mean of the dependent variable. An exponential trend is more appropriate than a linear trend, not only because it turns out to be in most cases the best fit in this kind of analyses, but also because the latter trend would entail an upward bias to the estimation of instability whenever the use of the former appears to be more strictly needed (MacBean-Nguyen, 1988, p. 108). Statistically significant results are reported in Table 2 [3].

While bananas – except from Honduras – and coffee appear less unstable on the whole than other primary products, the highest instability is observed in soya from Paraguay, zinc, especially from Bolivia, and Bolivian tin. In the two cases for which it has been possible to estimate instability for all three aspects, instability appears much higher in unit prices than quantity and value terms.

Prices of products such as coffee and tin have been negatively affected in the last few years by the dismantling of international commodity agreements. As for the EC market, the unit price of coffee imports almost halved between 1986 and 1989, and the same happened for tin in the period

[3] Results of the instability index and the trend coefficient are presented multiplied by 100. For further details on this estimation procedure, see LORD (1980). The fact that only in two cases significant results have been obtained for estimated trends of unit prices witnesses the slack performance of this variable over the period considered. Heteroscedasticity tests, not presented in the table, discard the hypothesis that instability has tended to follow an ascending or descending pattern over the period analysed.

TABLE 2

INSTABILITY AND GROWTH
IN MAIN LATIN AMERICAN COMMODITY EXPORTS TO THE EC:
ESTIMATES FOR VALUES, QUANTITIES AND PRICES

	$I(M)$	$t(M)$	(1)	$I(MQ)$	$t(MQ)$	$I(p)$	$t(p)$
Bananas							
Panama	3.011	6.53	0.46				
Costa Rica	2.679	6.05	0.44				
Ecuador	3.541	7.19	0.49				
Honduras	6.188	7.61	0.81				
Coffee							
Brazil				4.234	5.42		
Costa Rica	3.060	6.28	0.49	3.213	5.99		
El Salvador				6.015	– 4.60		
Guatemala	2.977	– 1.98	–				
Soya							
Brazil	3.649	11.28	0.32	1.894	9.91		
Paraguay	16.885	23.31	0.72	12.795	17.65		
Copper							
Chile	2.881	7.18	0.40	1.240	2.26	37.732	5.15
Peru	4.998	9.43	0.53	4.304	4.72	38.456	4.85
Zinc							
Peru	7.051	7.49	0.94	2.607	1.28		
Bolivia	14.115	9.24	1.53	3.741	8.56		
Tin							
Bolivia	9.087	– 22.66	–	7.636	– 11.36		

M, MQ, p = value, quantity and unit price of the primary commodity imports to the EC from individual Latin American countries.
I = instability index (s.e. of regression/mean of dependent variable) (multiplied by 100).
t = estimated trend coefficient (multiplied by 100).
(1) $I(M)/t(M)$ = (weighted instability index).

1985-1989. Major exceptions are constituted by copper and ferronickel, for which slightly positive trends have been registered in the late 1980s and are still present at the beginning of the 1990s.

As a positive sign it should be noted that in a few cases higher instability is "smoothed down" by higher than average rates of growth, such as for Hondurian bananas, soya from Paraguay – as compared to the performance of Brazil –, Peruvian copper – as opposed to the Chilean case –, and Bolivian zinc – opposite to Peruvian zinc –. However, according to a

weighted instability index, constructed in order to take into account the different growth rates (column (1) in Table 2), these higher growth trends are unable to offset completely the drawbacks of stronger fluctuations. Moreover, there is the contrasting case of Bolivian tin, where high fluctuations have been coupled by a highly negative trend in both value and quantity terms. If the relative importance of the primary commodities in individual countries' exports is considered again, Honduras, Paraguay and Bolivia stand out as the countries with relatively greater problems of major fluctuations in export earnings in their trade relations with the EC.

An alternative way to estimate instability is provided by the coefficients of variation, as defined in Table 3. These measures overlook the trend pattern of the variables, but can be applied for general comparative purposes. Except for few cases, the coefficients are higher for unit prices than quantities, similarly to results for total EC imports of the same commodities. However, in very few cases quantity and price variations are lower than corresponding total values of EC imports: particularly for import quantities, the coefficients of variation for many countries are more than double the corresponding figure of overall EC imports of the commodity concerned.

As for price competitiveness of Latin American countries over the period considered, the average level of prices is higher than the respective figure for total EC imports in the case of coffee, zinc and ferronickel, while lying at similar levels for soya, and generally lower for the other commodities. These differences can be due to transport costs, quality levels, and, with regard to minerals, possibly varying degrees of initial processing.

As a rough indication of whether fluctuations of commodity exports can be explained more by EC demand-induced or producer country's supply induced-disturbances, correlation coefficients of import unit prices with import quantities have been used: a significant positive coefficient would appear when prices and quantities move in similar directions and hence imply that demand shifts are the predominant cause of instability, and conversely for a significant negative coefficient [4].

The former case seems to apply to Chilean copper and Venezuelan petroleum, with correlation coefficients equal to 0.63 and 0.84, respectively. On the other hand, significantly negative coefficients and hence apparently supply-induced fluctuations result for Guatemalan coffee (– 0.69) and, as could be expected, overall petroleum imports (– 0.73). All other cases

[4] In the presence of longer time series, BROOK, GRILLI and WAELBROECK (1977) use an alternative more sophisticated method: after estimating the respective growth trends, quantity deviations from trends are regressed against price deviations, and the same reasoning is then applied.

TABLE 3

AVERAGE UNIT PRICES VERSUS QUANTITY AND PRICE INSTABILITY OF EC PRIMARY COMMODITY IMPORTS FROM LATIN AMERICA

	Average	Coefficients of variation	
	(*p*)	(*MQ*)	(*p*)
Bananas	0.46	0.19	0.25
Panama	0.46	0.17	0.25
Costa Rica	0.41	0.25	0.26
Ecuador	0.40	0.19	0.29
Honduras	0.43	0.21	0.25
Coffee	2.98	0.14	0.23
Brazil	2.98	0.29	0.23
Colombia	3.24	0.23	0.24
Costa Rica	3.24	0.27	0.21
El Salvador	3.17	0.32	0.23
Guatemala	3.28	0.20	0.20
Nicaragua	3.25	0.15	0.23
Haiti	3.13	0.16	0.23
Soya	0.24	0.16	0.18
Brazil	0.22	0.42	0.17
Paraguay	0.25	0.79	0.21
Copper	1.75	0.06	0.24
Chile	1.63	0.11	0.26
Peru	1.59	0.24	0.25
Zinc	0.25	0.09	0.34
Peru	0.27	0.15	0.38
Bolivia	0.46	0.36	0.42
Tin	6.81	0.20	0.32
Bolivia	2.69	0.42	0.45
Petroleum	0.17	0.14	0.46
Mexico (1)	0.16	0.44	0.41
Venezuela	0.14	0.27	0.47
Ferronickel	1.67	0.28	0.45
Domin. Rep.	2.09	0.40	0.37

(Symbols at Table 2).
(Coefficient of variation: std. deviation/mean).
(1) 1980-1989.

TABLE 4

MAIN PRIMARY COMMODITY EXPORTS TO THE EC FROM LATIN AMERICA: IMPORT ELASTICITIES AND STRUCTURAL CHANGES (1977-1989)

	b	*T*	*T* (*m*)	*T* (*u*)	*b* (*lin*)	*D*1	*D*2	*DMext*
Bananas								
Panama	0.77	2.34		− 0.68	0.08	45.9	− 23.1 *	
Costa Rica	0.61	5.16	− 1.95	− 3.26	0.07			
Ecuador	0.80	7.16		− 1.83	0.08			
Honduras	0.84	4.35	1.19	− 0.80	0.06			
Coffee								
Brazil	1.04	1.37 *		0.05	0.20	370.5	− 335.6	
Colombia	1.03	7.61		0.22	0.19			0.03 (*D*2)
Costa Rica	0.54	2.19	− 2.55	− 1.86	0.01	22.9	25.2	
Nicaragua	1.17	5.19	2.80	0.75	0.02			0.004 * (*D*1)
Haiti	0.86	3.61		− 0.59	0.01			
Soya								
Brazil	1.49	2.81		0.93	0.40			0.12 (*D*2)
Paraguay					0.06	− 97.6 *	151.3	
Copper								
Chile	1.33	12.38	− 3.48	3.07	0.24			
Peru	1.70	8.48	1.85	3.50	0.07			0.03 (*D*2)
Zinc								
Peru	0.96	5.66	− 0.80	− 0.23	0.14	34.1	− 25.3	
Bolivia	1.09	2.50	0.31	0.20	0.02	11.9		
Tin								
Bolivia	1.71	7.73		3.21	0.18			
Petroleum								
Venezuela	1.40	7.23	− 0.26	2.05	0.04	584.0		
Mexico (1)	1.45	4.30	0.15	1.34	0.06			
Ferronickel								
Domin. Rep.	1.21	3.22		0.56	0.11			0.07 (*D*2)

b = import elasticity of EC demand for primary commodity.

T = *t* statistics (* less than 90% significance level); (*m*: test that minimum and maximum estimates are significantly different; *u*: test that *b* is significantly different from 1).

b (*lin*) = estimated coefficient of linear regression (*M* on *Mext*).

*D*1, *D*2, *DMext* = dummy variables accounting for structural variations (1981 and 1986).

appear to be subject to a more balanced mix of demand and supply induced fluctuations.

Finally, the import elasticity of EC demand for primary commodities from Latin American countries has been estimated by applying OLS [5] to double-log functions, regressing commodity imports from individual countries on total EC imports of the commodity concerned. Only 7 out of 18 possible estimations reveal elasticities significantly different from 1, under a minimum 90% confidence interval (Table 4): Costa Rican bananas and coffee and Ecuadorian bananas come out with significantly lower elasticities; on the contrary, copper, tin, and, for Venezuela, petroleum appear most sensitive to corresponding changes in EC demand. *T*-tests have also been used to check whether extreme values of the estimates within separate groups of commodity exporters differed significantly (Table 4, third column). In this regard, significant differences in import elasticities are registered only for coffee and copper: Nicaragua and Peru appear to have been more sensitive to demand changes in the EC relative to other Latin American exporters.

In order to test for the presence of structural changes in the time series, as a consequence of the entry of new member states in the EC (Greece in 1981 and especially Spain and Portugal in 1986) and other coinciding events, such as the international debt crisis in the early 1980s, two dummy variables have been added to simple linear equation estimations relating the above mentioned variables. In Table 4, *D*1 and *D*2 refer to the 1981 and the 1986 break, respectively, with regard to the constant term, whereas *DMext* corresponds to the slope parameters.

While the changes occurring since the early 1980s seem to have had a positive influence on Latin American countries' exports in a few cases, those possibly connected with the latest EC market enlargement appear to have had mixed effects, being positive for soya, copper and ferronickel, negative for bananas (Panama) and zinc (Peru), and with some redistribution for coffee (negative for Brazil, positive for Colombia and Costa Rica). The latter results seem to smooth down the assumption of a negative influence of the entry of Spain and Portugal in the EC on export possibilities of Latin American countries, as far as major export commodities are concerned (Lerman Alperstein, 1991).

[5] Similarly to the estimation of growth trends, in few cases the Cochrane-Orcutt iterative method has been applied to remove problems of serial correlation. Except for few cases of inconclusive results, the Durbin-Watson test is satisfied at the 5% significance level.

4. *Conclusions*

A great deal of the problems affecting the economies of Latin American countries derives from their condition as primary commodity exporters and still insufficient diversification of their production and exports. Contrary to the case of other developing regions, particularly South East Asia, Latin American countries have neither received the amount of financial resources necessary for a radical transformation of their production structure, nor even applied adequate and selective industrial policies, apart perhaps from some of the latest initiatives of structural reform. On the other hand, only two countries of the region. Haiti and Dominican Republic, can presently count on EC financial mechanisms of stabilization of primary commodity export earnings, as established by the Lomé Convention.

In view of the financial and institutional constraints hindering an enlargement of this stabilization system to non-associated developing countries, prospects for Latin American commodity exports could improve if world consumption levels were to resume growth and suppliers' cartels were established again. The latter possibility is rather unlikely to occur. As for the former, although one should take into account that official forecasts of economic growth have recently been downgraded, expectations of stronger economic growth in major industrial countries do not rule out a medium-term reversal of the declining trend in non-fuel primary commodity prices, towards the mid-1990s, provided that no major supply disruptions occur (IMF, 1990).

Within this scope, positive implications for certain Latin American products are envisaged to be brought about by the new Single European Market. However, as far as some mineral commodities are concerned, downward pressures on world prices are at the moment being exercised by the political changes in the former Soviet Union, a major world producer of non-ferrous minerals and precious metals.

This analysis has pointed out that: (*i*) while mostly reducing the excessive bias towards their first export commodity, Latin American countries have been able to maintain or even increase their participation in the EC market in several primary commodities; (*ii*) rather than focusing on the problem of import discrimination by the EC, which can be partly overcome in some cases by higher price competitiveness of Latin American commodities [6], attention should be paid to the stagnating EC demand for primary

[6] It should be added that as from November 1990 duty-free access or preferential treatment has been granted by the EC to a group of Latin American countries (Bolivia,

commodities of major concern to Latin American producers; and (*iii*) export instability and/or sensitiveness to changes in EC demand are particularly acute for some mineral products, with the consequences of commodity export instability being more burdensome for some smaller and relatively less diversified economies. Moreover, for the commodities analyzed instability in both *quantum* and price terms appear generally higher in EC imports from Latin American countries than in corresponding total EC imports.

In this regard, it would be interesting to test whether these results hold also for a longer observation period. This would allow a more thorough analysis, including medium-term fluctuations. Furthermore, it would be worth extending the analysis to developing countries outside the region and other commodities.

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CRESCITA E INSTABILITÀ DELLE ESPORTAZIONI LATINOAMERICANE DI PRODOTTI PRIMARI ALLA CE

Le esportazioni dei paesi latinoamericani alla Comunità Europea sono molto concentrate in prodotti primari. Il primo prodotto di esportazione occupa anzi spesso una quota molto elevata del totale dei prodotti esportati alla CE: questo dato è particolarmente preoccupante per paesi latinoamericani ad economia piccola e aperta, maggiormente vulnerabili alle tendenze negative e alle fluttuazioni nel mercato interno ed internazionale del prodotto in questione.

Vari fattori di breve e lungo periodo, relativi all'offerta e alla domanda, contribuiscono a spiegare l'evoluzione sfavorevole della maggior parte dei prodotti primari in termini di crescita in volume e prezzi relativi nei mercati mondiali, soprattutto negli anni ottanta. Inoltre, anche se il rapporto tra instabilità dei proventi di esportazione e crescita economica non trova univocità di interpretazioni negli studi sul tema, le forti fluttuazioni annuali e biennali nei prezzi e nelle quantità dei prodotti primari esportati hanno costituito un ulteriore freno per uno sviluppo sostenuto ed equilibrato dei paesi della regione. I paesi latinoamericani appaiono per lo più mantenere o perfino ampliare negli ultimi anni la loro partecipazione nel mercato comunitario, nelle loro principali esportazioni di materie prime. Questo sembra tuttavia realizzarsi con fluttuazioni più alte di quanto registrato per le importazioni complessive della CE per i prodotti esaminati, e, nel caso di prodotti minerari, con una forte sensibilità a variazioni nella domanda europea. Alcuni paesi con una struttura produttiva scarsamente diversificata presentano i problemi più seri, con la coesistenza a volte di una tuttora eccessiva dipendenza dal principale prodotto di esportazione, una tendenza sfavorevole rispetto ad altri paesi esportatori, e maggiore instabilità nei proventi di questa esportazione.

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CAPITALE SOCIALE L. 108.000.000.000 INTERAMENTE VERSATO
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TRIBUNALE DI ROMA - REGISTRO DELLE SOCIETÀ N. 219-220/1908

Si è tenuta a Roma, venerdì 29 maggio 1992, l'Assemblea ordinaria degli Azionisti dell'Istituto Italiano di Credito Fondiario che ha approvato il bilancio al 31 dicembre 1991, la cui regolarità è stata certificata dalla KPMG Peat Marwick Fides S.n.c. di Giuseppe Angiolini e C..

Sulla base dei risultati conseguiti, l'Assemblea ha deliberato accantonamenti netti a riserve per 17 miliardi e la distribuzione ai Soci di 8,1 miliardi (6,5 nel 1990), con un **dividendo di 600 lire** per azione (480 nel 1990).

Dopo tali assegnazioni ed a seguito della duplice rivalutazione degli immobili, operata ai sensi delle leggi n. 413/91 e n. 408/90 con la costituzione di riserve per complessivi 164,6 miliardi, il patrimonio dell'Istituto si attesta a 627 miliardi (445,4 nel 1990) con un aumento del 40,8%.

Si evidenziano di seguito i dati più significativi del bilancio 1991:

	1991	1990	Var. %
Raccolta da clientela ordinaria e da Istituzioni creditizie	5.571,3	5.228,8	+ 6,6
Fondi e altre passività	854,7	616,2	+ 38,7
Mezzi propri	627,0	445,4	+ 40,8
Impieghi a favore di clientela ordinaria	6.409,7	5.797,3	+ 10,6
Altre attività	651,4	501,6	+ 29,9
Utile operativo	151,3	141,6	+ 6,9
Accantonamenti e ammortamenti	87,3	82,0	+ 6,5
Risultato economico lordo	49,4	45,9	+ 7,6
Utile netto	25,1	24,9	+ 0,8

Nell'anno sono pervenute n. 5.478 domande di finanziamento per 3.653,6 miliardi (n. 4.862 per 2.453,3 miliardi nel 1990).

Sono stati erogati n. 4.733 finanziamenti per 1.161 miliardi (n. 4.708 per 929,7 miliardi nel 1990).

Alla fine dell'anno i finanziamenti in istruttoria erano 2.389 per 3.064,3 miliardi (n. 2.414 per 2.273,8 miliardi nel 1990).

* * *

Il **dividendo è esigibile dal 17 giugno 1992** presso la sede sociale, ovvero presso la Cassa di Sovvenzioni e Risparmio fra il Personale della Banca d'Italia nelle sedi della Banca stessa in Ancona, Bari, Bologna, Cagliari, Firenze, Genova, Livorno, Milano, Napoli, Palermo, Roma, Torino, Trieste e Venezia, nonché in Milano presso gli uffici delle Direzioni Generali dell'Istituto Centrale delle Banche Popolari Italiane e dell'Istituto Centrale di Banche e Banchieri e, per le azioni amministrate da Montetitoli S.p.A., presso le banche depositarie.