Working Papers

The Vienna Institute
for Comparative Economic Studies (WIIW)

Wiener Institut
für Internationale Wirtschaftsvergleiche (WIIW)

No. 4
July 1994

wiiw

Amit Bhaduri,
Kazimierz Laski and
Martin Riese

Fallacies in Aggregate Demand/Supply Analysis

Amit Bhaduri,

Kazimierz Laski and

Martin Riese

Amit Bhaduri (professor at Jawaharlal Nehru University, Delhi) is consultant of WIIW; Kazimierz Laski is WIIW Research Director; Martin Riese is associate professor at Johannes Kepler University, Linz, Austria.

Fallacies in Aggregate Demand/Supply Analysis

Contents

Abstract

The aggregate demand (AD)/aggregate supply (AS) framework as presented in almost all textbooks is logically inconsistent, because it separates the demand side from the supply side. Due to the circular flow nature of the macroeconomic process, however, production/supply and income/demand cannot be dichotomised. Specifically it is shown that the AD/AS apparatus implies incompatible levels of employment for all positions out of equilibrium. A reformulated aggregate demand schedule, which avoids these inconsistencies, typically has a positive slope; together with the positively sloped AS curve equilibrium thus becomes unstable.

Fallacies in Aggregate Demand/Supply Analysis^{*)}

Almost all textbooks on macroeconomics (e.g. Baumol–Blinder, 1991, pp. 181-182, Felderer–Homburg, 1992, pp. 97-101, 109-112, Sachs–Larrain, 1993, pp. 66-68, Dornbusch–Fischer, 1994, pp. 202-208) present a framework of analysis of aggregate demand (AD) and aggregate supply (AS) in terms of which real output and the price level are simultaneously determined. With a falling demand and a rising supply curve intersecting in the usual price–quantity space, it seems plausible to argue that the equilibrium levels of output and price are achieved simultaneously via the price mechanism. The reader – especially an unsuspecting student – is likely to come away with a comfortable message that the price mechanism works as effectively at the aggregate level, as at the micro-level of an industry or particular product. The purpose of this paper is to demonstrate that this message is unwarranted. The aggregate AD-AS framework is logically faulty in so far as the AD curve cannot be separated logically from the AS curve in out-of-equilibrium situations[1] (section I). Moreover, when the AD & AS curves are constructed in a logically valid way, the slope of the aggregate demand curve may turn out to be non-negative. In turn, this raises doubts about the stability of the process of adjustment based upon the price mechanism (section II).

I.   Inseparability of AD from AS

The construction of the AD curve relates price P to that level of output Y which would produce demand-side equilibrium, i.e. generate just enough demand to clear the commodity market at that price. In a closed economy without a government sector aggregate demand consists only of private consumption and investment. Assuming uniform propensities to consume for wage-earners and profit-earners, (induced) consumption may be postulated as proportional to Y, namely, cY, the other part of consumption $\tilde{C}$ is assumed to be negatively responsive to price via the real-balance effect, with $(d\tilde{C}(P)/dP) \leq 0$, while investment is assumed to be autonomously given at $\bar{I}$.

---

[1]   Hall and Treadgold (1982) hint at the difficulty resulting from various feedbacks between AD and AS, but fail to pinpoint the logical inconsistency.

Consequently the demand-side equilibrium is,

$$Y_d = \bar{I} + \tilde{C}(P) + cY_d \qquad [1]$$

implying

$$\frac{dY_d}{dP} = \frac{1}{s} \frac{d\tilde{C}(P)}{dP} \leq 0, \text{ where } s = (1-c) \qquad [2]$$

which establishes that the conventional AD curve is negatively sloped owing to the real-balance effect.[2]

The supply side is constructed on the postulate of profit maximization under diminishing returns to labour as the only variable factor of production in the short run. Thus, price equals rising marginal cost under competitive conditions to yield

$$P = \frac{w}{f'} \qquad [3]$$

with

$$Y_s = f(L), \quad f' > 0, \quad f'' < 0 \qquad [4]$$

where w denotes the nominal wage and f(L) represents utilization of labour through the short period production function with labour as the only argument in that function. At any given money wage $w = \bar{w}$, [3] and [4] imply,

$$\left. \frac{dY_s}{dP} \right|_{w=\bar{w}} = (f') \cdot \frac{dL}{dP} > 0 \qquad [5]$$

since,

$$\left. \frac{dL}{dP} \right|_{w=\bar{w}} = -\left((f')^2 / wf''\right) > 0$$

Thus AS increases with price at a given nominal wage $\bar{w}$, because real wage falls to induce more employment and output at profit-maximizing equilibrium[3].

The left-hand side of Figure 1 reformulates geometrically the AD/AS framework familiar from many textbooks. For a specified nominal wage $\bar{w}$ and a certain price,

---

[2] The model could be complicated by making investment a function of the interest rate, price level etc., e.g. in the IS-LM framework. However, these complications are unnecessary for our present purpose, since none of these complications – in contrast to the real-balance effect – provides unambiguous argument in favour of a negatively sloped AD curve.

[3] Dornbusch-Fischer (1994, pp. 218-227) do not assume profit-maximizing firms, but posit mark-up pricing. They obtain an upward sloping AS curve by postulating money wages rising with employment, a construction not without its own problems which will not be dealt with here.

say P_1, the real wage $\bar{w}/P_1$ (represented by the slope of the tangent to f(L) at point A) determines via profit maximization a certain amount of employment L_{s1} on the right-hand side, corresponding to aggregate supply P_1A' on the left-hand side of the diagram. Parametric variation of P traces out the AS(P) curve in accordance with [5].

Figure 1

The components of aggregate demand in [1] are exhibited on the right-hand side of Figure 1. Aggregate consumption cY becomes just a scaled-down version of the utilization function. By adding the constant term $\bar{I}$ + $\tilde{C}$ (P_1) at price P_1 we derive total demand at price P_1. Thus, on the right-hand side of Figure 1 for price level P_1, Y_{d1} = = $f(L_{d1})$ brings total demand and output into equilibrium[4]. Again, by varying P parametrically the negatively sloped AD(P) curve may be traced out, in accordance with equations [1] and [2], without making any explicit reference to nominal wage. However, for consistency of comparisons assume that the nominal wage in the construction of AD remains the same as for AS, viz $\bar{w}$. In that case, profit maximization at real wage $\bar{w}/P_1$ implies point A on the right-hand side of Figure 1; however, the demand-equilibrium point on the right-hand side is B with the same real wage $\bar{w}/P_1$. This out-of-equilibrium position is shown explicitly on the left-hand side of Figure 1. At the specific money wage $\bar{w}$, for price P_1 aggregate demand (AD) at B' is

---

[4] This corresponds to the familiar "Keynesian cross" or 45°-diagram with production (employment) explicitly shown. Also note, if demand depends on distribution, e.g. in the form of a classical savings function making consumption equal to the wage bill, multiple equilibria may emerge, so that the conventional AD curve is no longer unique. On the right-hand side of Figure 1 this would result in a straight line with intercept equal to investment plus the price-sensitive component of consumption, having a slope equal to the given real wage, e.g. at ($\bar{w}/P_1$). For prices above equilibrium this straight line may intersect the utilization function twice.

less than aggregate supply (AS) at A'. Nevertheless, these two positions A' and B' cannot be meaningfully compared due to a fundamental logical flaw in the construction.

It should be noted that there are two different employment levels L_{d1} and L_{s1} corresponding to B' and A' respectively. This results in logical inconsistency in AD-AS analysis in all out-of-equilibrium positions. Some authors formulate the out-of-equilibrium AD-AS analysis in terms of discrepancy between *desired expenditure* measured along AD and *actual supply* measured along AS. This interpretation is untenable in so far as the relevant employment level corresponding to actual supply Y_s is L_{s1}; consequently the ordinate of point C – and *not* that of point B – on the right-hand side of Figure 1 is the relevant level at which the desired expenditure needs to be calculated. More simply put, the level of desired expenditure cannot be arbitrarily fixed irrespective of the level of employment obtained in the economy. It must be consistent with the level of employment actually offered by the firms at their profit-maximizing output level, i.e. L_{s1}.

This inconsistency becomes all the more glaring when one notes that at the constant money wage $\bar{w}$ any increase (decrease) in the price level from P_1 requires profit-maximizing firms to increase (decrease) employment along the supply curve AS. But it also requires the same firms to decrease (increase) employment along the demand curve AD. In other words, firms are being subjected to logically contradictory rules of behaviour – along the AS curve they maximize profit, but along the AD curve they are driven to satisfy the level of aggregate demand[5].

The economic aspect of the fallacy of AD-AS analysis in out-of-equilibrium positions should now be apparent. In ordinary demand–supply analysis in a partial equilibrium set up, it is often plausible, at least as a first approximation, to posit two separate economic agents – households as "consumers" whose demand is inversely related to price, and firms as "producers" whose supply is positively related to price. But in the macroeconomic context this two-agent dichotomy breaks down, precisely because firms are not only profit-maximizing producers, but they are also providers of employment to the households, thus determining indirectly the level of income and therefore, expenditure of the households. The economic fallacy of AD-AS analysis stems from the failure to appreciate this dual role of the firms underlying the circular

---

[5] Kalecki (1971) unlike Keynes (see succeeding footnote 6) gave up the assumption of *precise* profit maximization to emphasize the centrality of aggregate demand in his analysis. By postulating more or less constant average variable (= marginal) cost until full capacity utilization, he argued that the level of output is entirely demand driven, so long as price exceeds average variable cost by some fixed mark-up.

nature of income flow which, in turn, results in the untenability of separating households as "consumers" from firms as "producers" at the macroeconomic level.

II. A Reformulation: Derived Aggregate Demand

Although AD and AS cannot be meaningfully compared in out-of-equilibrium positions because they relate to incompatible levels of employment, this inconsistency may be eliminated by reformulating the AD schedule so as to correspond to the profit-maximizing supply positions of the firms at each price level (given nominal wage). It implies that the firms always succeed in carrying out their plan of profit maximization by suitably adjusting output and employment levels (see conditions [3] to [5]). Therefore, the level of employment corresponding to that profit-maximizing output level also enters in determining aggregate demand. In this sense aggregate demand is *derived* from the profit-maximizing supply decisions of the firms[6]. In terms of the right-hand side of preceding Figure 1 this means that at given nominal wage $\bar{w}$ and price P_1, firms maximize profit by producing output at A and the corresponding employment level L_{s1} determines the level of aggregate demand by the ordinate of point C. Since this derived aggregate demand (DAD) schedule depends on the profit-maximizing supply Y_s by the firms at each price level (given nominal wage, see condition 5) the DAD schedule must satisfy,

$$Y_{dd} = \bar{I} + \tilde{C}(P) + cY_s \qquad [6]$$

in place of former AD equation [1].

So long as the real-balance effect is relatively weak, Y_{dd} can be seen to be less responsive than Y_s to variations in the price level. Because, from [6],

$$\frac{dY_{dd}}{dP} = \frac{d\tilde{C}(P)}{dP} + c\frac{dY_s}{dP} \qquad [7]$$

with $d\tilde{C}/dP$ a relatively small (negative) term, the (positive) term $c(dY_s/dP)$ dominates to make the left-hand side of [7] positive, while $1>c>0$ ensures

$$\frac{dY_s}{dP} > \frac{dY_{dd}}{dP} > 0 \qquad [8]$$

---

[6] By accepting the so-called "first postulate" of Classical Economics (i.e. real wage rate equals the marginal product of labour) Keynes in the *General Theory* (1936, pp. 17, 31) elaborated on a framework of analysis where the level of effective demand needed to be consistent with the profit-maximizing output and employment levels of the firms. This seems to suggest something similar to the DAD curve presented here. However, unlike in the present analysis conforming closely to the mainstream neoclassical argument, the real wage rate is an *endogenous* variable in the *General Theory*, where effective demand determines the level of output and where the marginal product of labour which equals the real wage rate is being adjusted to that demand-determined level of output. In contrast, in the mainstream neoclassical analysis (and similar to the argument presented here) an *exogenous* real wage determines the level of output and employment by profit-maximizing firms.

or equivalently (for inverse functions),

$$\frac{dP}{dY_{dd}} > \frac{dP}{dY_s} > 0 \qquad [9]$$

where customarily price is measured on the vertical axis, as in Figure 2. It is worth emphasizing that condition [8] or (equivalently) [9] is economically the most plausible outcome, since cY_s is usually considerably larger in magnitude than $\tilde{C}(P)$.[7]

The stability implication of condition [8] or [9] concerning the efficacy of the price mechanism deserves emphasis.

Figure 2
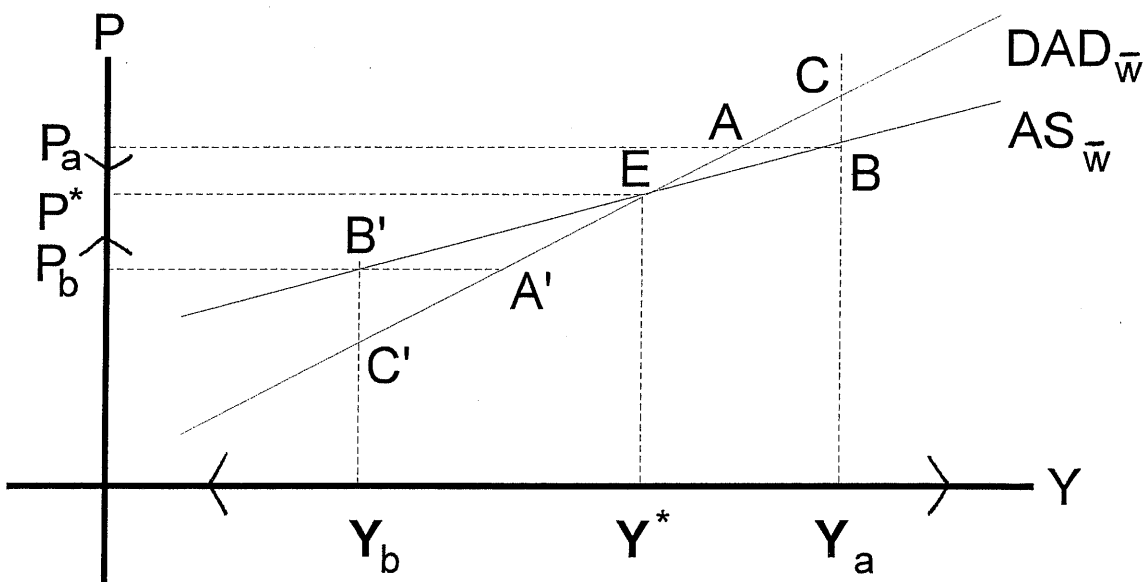
In Figure 2, for price above equilibrium $P_a > P^*$, there is excess supply AB and, for price below equilibrium, $P_b < P^*$ there is excess demand B'A'. Consequently, the process of price adjustment to P^* would tend to be stable in the Walrasian sense.

However, as is well known (Allen, 1965, pp. 19-23; Henderson and Quandt, 1980, p. 160), the stability of price adjustment in the Walrasian sense would imply in this case of a positively sloped demand curve instability of quantity adjustment in the Marshallian sense. With initial supply above equilibrium, $Y_a > Y^*$, the demand (market clearing) price received by the firms is CY_a which exceeds their supply price BY_a, inducing firms to expand output further away from equilibrium Y^* in Figure 2.

---

7) More precisely, the price elasticity of $\tilde{C}(P)$ would have to be considerably larger than the price elasticity of $Y_s(P)$ to produce a negatively sloped DAD curve.

6

Obversely, for $Y_b < Y^*$ demand price $C'Y_b$ is less than their supply price $B'Y_b$ leading to further output contraction away from equilibrium. In short, while price adjustment is stable in a Walrasian sense, the quantity adjustment is unstable in a Marshallian sense under condition [8] or [9].

This dual instability proposition about price and quantity adjustment is of general validity in the present macroeconomic context of a single market. More formally, the Walrasian price adjustment represented by

$$\frac{dP}{dt} = a[D(P) - S(P)], \quad a > 0$$

can be linearly approximated around the equilibrium price P^* and the resulting differential equation solved to yield the particular solution,

$$P(t) = P^* + (P_o - P^*) e^{akt}$$

with the Walrasian stability condition

$$k = \left(\frac{dD(P^*)}{dP} - \frac{dS(P^*)}{dP} \right) < 0 \qquad [10]$$

With the relevant derivatives evaluated at equilibrium price P^*, condition [10] is satisfied by condition [8] to yield Walrasian stability.

Marshallian quantity adjustment may be represented by the use of the corresponding inverse functions of demand and supply, i.e.

$$\frac{dY}{dt} = b\left(D^{-1}(Y) - S^{-1}(Y) \right), \quad b > 0$$

which by the same analytical route yields the stability condition,

$$\left(\frac{dD^{-1}(Y^*)}{dY} - \frac{dS^{-1}(Y^*)}{dY} \right) < 0 \qquad [11]$$

In the notations of the text with derivatives evaluated at Y^* it implies,

$$\frac{dP}{dY_{dd}} - \frac{dP}{dY_s} < 0$$

which violates condition [9] to generate Marshallian instability, confirming formally the proposition on dual instability between Walrasian price and Marshallian quantity adjustment under condition [8] or [9].

Finally, a comment on the economic significance of this dual instability result in the present context may be in order. Walrasian price adjustment requires the familiar coordinating role of an auctioneer. Marshallian adjustment is based upon the assumption of instantaneous market-clearing (demand) prices which are received by numerous firms whose supplies are not coordinated. In the present macroeconomic context highlighting the working of the overall price mechanism, it may be especially worthwhile considering both Walrasian and Marshallian stability in so far as they touch partially on the complex issue of possible "coordination failures" in the market mechanism.

III. Concluding Observations

Our aim in this paper has been to demonstrate the logical inconsistencies rather than to examine the practical relevance of the AD-AS framework. As already noted, the fundamental difficulty with the AD-AS framework arises from its insufficient appreciation of the circular flow of income which leads to a false dichotomy between households as consumers on the demand side who are strictly separated from firms as producers on the supply side. This dichotomy is untenable in a macroeconomic context because the income of the households as consumers (i.e. demanders) depends critically on the level of employment provided to them by the firms as producers (i.e. suppliers)[8]. Therefore, positing any AD curve independent of the firms' employment decisions on the AS curve leads to logical inconsistency in terms of two incompatible levels of employment on the two curves in out-of-equilibrium positions (section I). However, if this interdependence is adequately recognized, the reformulated aggregate demand curve (DAD) derived from the profit-maximizing employment levels of the firms turns out to be positively sloped under the most plausible assumptions about the relative strength of the real-balance effect.[9] Consequently, the stability of the adjustment process becomes problematic either in the Marshallian or in the Walrasian[10] sense (section II).

---

[8] Note, the Kahn-Keynes multiplier process works precisely on the assumption that each round of demand expansion is matched by corresponding expansion of output and employment by the firms on the supply side. This must entail that firms are also adjusting output along the DAD curve according to their supply response along the AS curve, as ensured by equation [6].

[9] One practical implication of the reformulated DAD curve is the economic interpretation of the shift in either curve. For instance one needs to be more careful than is usually the case about distinguishing between a demand- and a supply-shock in the macroeconomic context.

[10] It can be shown that – with different propensities to consume out of wages and profits – a positively sloped DAD curve might cut the AS curve from above.

It deserves emphasis that apart from these logical difficulties, the AD-AS framework is based on a host of oversimplifying assumptions which can be thoroughly misleading. Perhaps the most awkward assumption underlying this construction is that, in a modern industrial economy, it is meaningless to think of variations in the price level without significant repercussions on nominal wages (see especially conditions [3] to [5]). Nor is the empirical significance of the real-balance effect unquestionable, although it remains critical for arguments in favour of a downward-sloping AD curve. But even then the logically consistent aggregate demand curve, i.e. the DAD curve, fails to be negatively sloped for plausible magnitudes of the real-balance effect (section II; conditions [6] to [9]). Finally, logical difficulties tend to be compounded when the assumption of a uniform savings propensity is replaced by the classical assumption of different saving propensities out of profits and wages. Undoubtedly this list of implausible assumptions could be longer. However, with or without these assumptions the usual AD-AS construction remains logically faulty in the first place.

References

Allen, R.G.D. (1965), *Mathematical Economics,* 2nd edition, Macmillan, London.

Baumol, W.J. and Blinder, A.S. (1991), *Economics,* 5th edition, Harcourt, Brace, Jovanovich, San Diego.

Dornbusch, R. and Fischer, S. (1994), *Macroeconomics,* 6th edition, MacGraw-Hill, New York.

Felderer, B. and Homburg, S. (1992), *Macroeconomics and New Macroeconomics,* 2nd edition, Springer-Verlag, Berlin.

Hall, P.H. and Treadgold, M.L. (1982), "Aggregate demand curve: a guide to use and abuse", *Australian Economic Papers 21,* June, pp. 37-48.

Henderson, J. and Quandt, R. (1980), *Microeconomic Theory: A Mathematical Approach,* 3rd edition, McGraw-Hill, New York.

Kalecki, M. (1971), *Selected Essays on the Dynamics of the Capitalist Economy,* Cambridge University Press, Cambridge.

Keynes, J.M. (1936), *The General Theory of Employment, Interest and Money,* Macmillan, London. (Page reference to Harbinger Edition, New York 1964.)

Sachs, J.D.–Larrain, F. (1993), *Macroeconomics in the Global Economy,* Harvester/Wheatsheaf, New York.

WIIW WORKING PAPERS (since 1993)

(Published, under its own imprint, by WIIW)

Under the heading "Working Papers" WIIW publishes studies dealing with theoretical problems of transformation from command to market economy, which are intended to serve the academic exchange of ideas. Forwarded on request only.

No. 1   K. Laski et al., Vienna: Transition from the Command to the Market System: what went wrong and what to do now? March 1993

No. 2   A. Bhaduri, Vienna: Patterns of Economic Transition and Structural Adjustments. February 1994

No. 3   Ewa Dzwonik-Wrobel, Warsaw/Jolanta Zieba, Vienna: Money Supply and Money Demand in Poland, 1990-1992. July 1994

No. 4   A. Bhaduri, New Delhi–Vienna/K. Laski, Vienna/M. Riese, Linz: Fallacies in Aggregate Demand/Supply Analysis. July 1994

Mitgliederservice des WIIW

Das WIIW hat für Firmen und Institutionen, die an den Wirtschaftsbeziehungen mit Osteuropa besonders interessiert sind, ein Mitgliederservice aufgebaut.

Mitgliedsfirmen erhalten alle Publikationen des Institutes im Rahmen ihrer Mitgliedschaft kostenlos.

Weiters werden ausschließlich für Mitglieder monatlich **Mitgliederinformationen** erstellt. Sie enthalten Kurzanalysen über aktuelle Wirtschaftsfragen in den zentral- und osteuropäischen Ländern, in den Nachfolgestaaten der Sowjetunion und Jugoslawiens sowie über den Ost-West-Handel.

Jeweils im März/April jedes Jahres wird ein ganztägiges **Mitgliederseminar** über die Wirtschaftslage im osteuropäischen Raum abgehalten.

Den Mitgliedsfirmen werden auch Auftragsarbeiten des Instituts, die nicht oder erst zu einem späteren Zeitpunkt veröffentlicht werden, zum internen Gebrauch zur Verfügung gestellt.

Der Mitgliedsbeitrag beträgt dzt. öS 23.000,- pro Jahr.

WIIW Membership Service

- WIIW offers a membership service to firms and institutions interested in East-West economic relations.

- Members receive free copies of all WIIW publications.

- The monthly information bulletin **Mitgliederinformationen** is published exclusively for members. It contains short analyses on topical economic issues concerning the countries of central, eastern and south-eastern Europe, the successor states of the former Soviet Union and Yugoslavia, as well as studies on East-West trade. Starting in January 1994, the bulletin will appear under the title "The Vienna Institute Monthly Report".

- **Members are invited to attend a closed seminar** held in March every year dealing with topical developments within the Central and East European region to establish or intensify personal contact with WIIW's team of country economists and data experts.

- Special WIIW project studies not available to the general public are made available to WIIW members for their internal use.

- Consulting: The Vienna Institute will counsel members on questions concerning the east European economies or east-west economic relations.

- Members have access to WIIW's documentation service, library and database.

- The membership fee is AS 23,000.- per year.

As from 10 August 1994:

Tel.: 00+43 1 – 533 66 10 - 0 Fax: 00+43 1 – 533 66 10 50

Postal address: WIIW, Oppolzergasse 6/6, A-1010 Vienna

An das
Wiener Institut für
Internationale Wirtschaftsvergleiche

Postfach 87
A-1103 Wien

○   Bitte um Zusendung detaillierter Informationen über das Mitgliederservice des Wiener Instituts

○   Bitte um Zusendung einer kompletten Publikationsliste des Wiener Instituts an folgende Adresse

Hiemit bestelle ich

○   1 Jahresabonnement "Forschungsberichte" und "Reprint-Serie" zum Preis von öS 2.400,- (im Inland) bzw. öS 2.600,- (im Ausland)

○   folgende Nr. des Forschungsberichtes . . . . à öS 250,- (plus Porto)

○   folgende Nr. der Reprint-Serie . . . . à öS 150,- (plus Porto)

Name

Adresse

. . . .
Datum   Unterschrift

To
The Vienna Institute for
Comparative Economic Studies

P.O. Box 87
A-1103 Vienna

○   Please forward more detailed information about the Vienna Institute's membership service

○   Please forward a complete list of the Vienna Institute's publications to the following address

Please enter me for

○   1 yearly subscription of "Forschungsberichte" and "Reprint-Serie" at a price of AS 2,400.- (within Austria) and AS 2,600.- (abroad)

Please forward

○   the following no. of "Forschungsberichte" . . . . à AS 250.- (postage extra)

○   the following no. of "Reprint-Serie" . . . . à AS 150.- (postage extra)

Name

Address

. . . .
Date   Signature