

BANK OF GREECE
Economic Research Department – Special Studies Division
21, E. Venizelos Avenue
GR-102 50 Athens
Tel: +30210-320 3610
Fax: +30210-320 2432

www.bankofgreece.gr

*Printed in Athens, Greece
at the Bank of Greece Printing Works.
All rights reserved. Reproduction for educational and non-commercial purposes is permitted provided that
the source is acknowledged.*

ISSN 1109-669

AN OPTIMUM-CURRENCY-AREA ODYSSEY

Harris Dellas
University of Bern

George S. Tavlas
Bank of Greece

Abstract

The theory of optimum-currency-areas was conceived and developed in three highly influential papers, written by Mundell (1961), McKinnon (1963) and Kenen (1969). Those authors identified characteristics that potential members of a monetary union should ideally possess in order to make it feasible to surrender a nationally- tailored monetary policy and the adjustment of an exchange rate of a national currency. We trace the development of optimum currency- area theory, which, after a flurry of research into the subject in the 1960s, was relegated to intellectual purgatory for about 20 years. We then discuss factors that led to a renewed interest into the subject, beginning in the early 1990s. Milton Friedman plays a pivotal role in our narrative; Friedman's work on monetary integration in the early 1950s presaged subsequent optimum-currency-area contributions; Mundell's classic formulation of an optimal currency area was aimed, in part, at refuting Friedman's "strong" case for floating exchange rates; and Friedman's work on the role of monetary policy had the effect of helping to revive interest in optimum-currency-area analysis. The paper concludes with a discussion of recent analytical work, using New Keynesian models, which has the promise of fulfilling the unfinished agenda set-out by the original contributors to the optimum-currency-area literature, that is, providing a consistent framework in which a country's characteristics can be used to determine its optimal exchange-rate regime.

Keywords: Optimum-currency-areas, Exchange-rate regimes, New Keynesian models

JEL classifications: F33, F41

Acknowledgments: We have benefited from helpful comments on an earlier draft from Russell Boyer, Filippo Cesarano, W. Max Corden, John Devereux, Jerry Dwyer, Heather Gibson, Peter Kenen, James R. Lothian, Ronald McKinnon, Francesco Mongelli, Michael Ulan. We are also grateful to participants in the Federal Reserve Bank of Atlanta/Fordham University Conference, "Money and Monetary Policy", for comments and to Warren Young for providing us with Milton Friedman's personal correspondence during the early 1950s. The views expressed are those of the authors and should not be interpreted as those of their respective institutions.

Correspondence:

George S. Tavlas
Bank of Greece, 21, El. Venizelou Ave.,
10250 Athens, Greece,
Tel. +30210-3202370
Fax +30210-3202432
e-mail: gtavlas@bankofgreece.gr

1. Introduction

The theory of optimum-currency-areas has long been the subject of academic research and the object of controversy. A wide range of views has been expressed about the usefulness of research into the subject. At one end of the spectrum, Krugman (1993, p. 18) has stated that “It is arguable that the optimum-currency-area issue ought to be the centerpiece of international-monetary economics”. At the other end of the spectrum, Buiters (2000, p. 222) has argued that “the theory of Optimal Currency Areas. is, unfortunately, one of the low points of post-World War II monetary economics. ”

The theory of optimum-currency-areas originated in the long-standing debate about the merits of fixed versus floating exchange rates (Ishiyama, 1975, p. 345)¹. Most of the participants in that debate, however, paid little attention to the differences in characteristics among economies in the real world, leaving the general impression that the respective cases made for either floating or fixed-exchange rates were equally applicable to all economies (Kawai, 1992, p. 25). In a triad of influential papers, Mundell (1961), McKinnon (1963), and Kenen (1969) sought to show that an economy’s characteristics should be a determinant of its exchange-rate regime². Those authors identified the characteristics that potential members of a single-currency area should (ideally) possess before relinquishing nationally tailored monetary policies and exchange-rate adjustments, and spelled-out the gains derived from the use of a single currency among economies. Other writers refined the contributions of Mundell, McKinnon and Kenen, adding to the list of characteristics relevant for identifying candidates for participation in a single-currency area and providing more-detailed assessments of the benefits and costs of a common currency, but the original three contributors are usually credited as having laid the foundations for essentially all subsequent work in the field³.

¹ Cesarano (2006) discussed the doctrinal antecedents of the theory of optimum currency areas.

² Mundell was awarded the Nobel Prize in Economics in 1999, in part, for his work on optimum-currency-areas. Surveys of the literature include Kenen (2002), Tavlas (1993), Mongelli (2002) and De Grauwe (2007).

³ In this connection, Bayoumi and Eichengreen (1997, p.762) stated that “the theory [of optimum-currency-areas] has advanced only minimally since the seminal contributions of Mundell (1961), McKinnon (1963) and Kenen (1969).”

In this paper, we examine two issues that have received insufficient attention in the discussion of optimum-currency-areas. First, although Mundell is frequently cited as the originator of the concept of an optimum-currency-area, the basic tenets of optimum-currency-area theory had already been worked-out by Friedman by the early 1950s (Cesarano, 2006). In formulating the notion of an optimum-currency-area, Mundell appears to have been trying to refute Friedman's "strong" case for floating exchange rates⁴; in particular, Mundell's objective was to identify criteria that would make the abandonment of a flexible exchange-rate regime less costly than that implied in Friedman's paper, "The Case for Flexible Exchange Rates" (1953b). We show, however, that, by the early 1950s, Friedman had already recognized the importance of the criteria later set-forth by Mundell. Moreover, unlike other writers who anticipated the basic tenets of optimum-currency-area theory, Friedman thought that the inoperability of the criteria among countries in the real world established the case for separate currencies and flexible exchange rates among those currencies. In this regard, Friedman's view was similar to that of Mundell.

Second, we argue that, although the triad of papers by Mundell, McKinnon and Kenen contained important contributions in that they embedded specific criteria in a framework in which alternative monetary arrangements could be evaluated, the seeds of the long-standing controversy relating to the subject can be traced back to those papers. In particular, we argue that those papers embraced a number of conundrums, including the following: the criteria enumerated by Mundell, McKinnon and Kenen led to conflicting and, at times, contradictory inferences; the underlying assumptions of the analyses used by those authors were tenuous, limiting the real-world applicability of the results derived; and the modeling structure used was a partial-equilibrium, static one that lacked an explicit welfare function by means of which the welfare implications of exchange-rate regimes could be compared.

The remainder of this paper consists of six sections. Section 2 discusses Friedman's anticipations of optimum-currency-area analysis. Section 3 describes the characteristics, identified by Mundell, McKinnon and Kenen, that potential members of a monetary

⁴ This argument was made by Cesarano (2006). See, also, Mundell (1997)

union should possess in order to make it feasible to surrender a national monetary policy and exchange-rate adjustment of a national currency. Section 4 discusses contradictions and inconsistencies inherent in the original optimum-currency-area approach, leading to the virtual abandonment of academic research in the field during most of the 1970s and 1980s. Section 5 presents recent work that has contributed to revival of interest in the subject. A major impetus for renewed interest in the field has been the emergence of the view that the costs of foregoing national monetary policies and exchange-rate adjustments may not be so large as the original contributors to the optimum-currency-area literature had thought. In this connection, we argue that Friedman's contributions in monetary economics helped pave the way for the comeback of optimum-currency-area theory. Section 6 discusses empirical and analytical work on the performance of alternative exchange-rate systems, work that suggests new directions of research in the area of optimum-currency-areas. Section 7 concludes with a discussion of the research tasks in the field that need to be addressed.

2. The origins

As Cesarano (2006) pointed out, during the late-1940s and the 1950s several writers – most notably, Lerner (1947), Friedman (1953b), Meade (1951), and Scitovsky (1958) – anticipated the basic tenets of optimum-currency-area analysis. In analyzing the effectiveness of inter-regional adjustment within countries, those authors drew attention to the crucial role played by single, central monetary and fiscal authorities and the free movement of goods and factors of production among regions in economic adjustment. Cesarano (2006, p. 726) argued that the above-mentioned authors believed that the classical adjustment mechanism would be effective in the absence of exchange-rate variations among separate, national currencies. In other words, the free movement of labor, capital and goods, and a single monetary policy, would negate the need of exchange-rate variations; the logical extension of this line of reasoning is that a single currency would be optimal for the global economy. Cesarano (2006, p. 726) also argued that what set Mundell apart from Lerner, Friedman, Meade, and Scitovsky was that, unlike the latter writers, Mundell (1961) took the view that the conditions (e.g., labor

mobility) needed to make the classical adjustment mechanism work might be inoperative both among countries and among regions of the same country. Under such conditions, it would be optimal to redraw national borders so that the classical adjustment mechanism could work effectively within regional areas. Mundell also thought that a separate currency would be optimal in each such area. In what follows, we deal with Friedman's anticipation of optimum-currency-area analysis. In doing so, we show that Friedman's doubts about the feasibility of a single, global currency was closer to the position of Mundell than suggested by Cesarano.

2.1. Friedman (1952, 1953)

Friedman's (1953a, b) case for floating exchange rates was built on three main arguments. First, in light of the sticky prices and wages that characterize the real world (and made reliance on adjustments in wages and prices a lengthy and costly process), a system of flexible exchange rates would constitute an equilibrium system in which market forces act automatically to bring about external balance while averting the balance-of-payments crises that Friedman believed were an inherent feature of fixed-but adjustable rates (1953b, pp.161–167). Second, floating exchange rates would provide independence for monetary policy, largely protecting “each country from being infected by the monetary mistakes of the others” (1953a, p. 16). Third, a system of flexible exchange rates would be conducive to the removal of controls on the movement of goods and capital among countries, promoting multilateral trade (1953a, p. 16; 1953b, pp. 157–158).

In his paper, “The Case for Flexible Exchange Rates” (1953b), Friedman presaged Mundell's identification of the conditions needed for the smooth functioning of a single-currency area. Specifically, in his discussion of the sterling area, he considered the possibility of fixed-exchange rates among the members of that area and freely flexible exchange rates between sterling and other currencies:

In a sense, any flexible exchange system is such a mixed system, since there are rigid rates between the different sections of one nation – between, say, the different states of the United States. The key difference for present purposes between the different states of the United States, on the one hand, and the

different members of the sterling area, on the other, is that the former are, while the latter are not, all effectively subject to a single central fiscal and monetary authority – the federal government – having ultimate fiscal and monetary powers. In addition, the former have, while the latter have not, effectively surrendered the right to impose restrictions on the movement of goods, people, or capital between one another. This is a major factor explaining why a central monetary authority is able to operate without producing serious sectional strains. Of course, these are questions of economic fact, not of political form, and of degree, not of kind. A group of politically independent nations all of which firmly adhered to, say, the gold standard would thereby in effect submit themselves to a central monetary authority, albeit an impersonal one. If, in addition, they firmly adhered to the free movement of goods, people, and capital without restrictions, and economic conditions rendered such movement easy, they would, in effect, be an economic unit for which a single currency – which is the equivalent of rigid exchange rates – would be appropriate (1953b, p. 193n).

As noted, Cesarano (2006) argued that the logical implication of the thinking of those authors who believed in the efficiency of the classical adjustment mechanism is that a single, global currency would be optimal from the standpoint of global welfare.⁵ Whatever the merits of Cesarano’s argument with regard to other authors, we do not believe that this is a valid interpretation in the case of Friedman. In particular, we believe that Friedman’s thinking with respect to the need of separate currencies and flexible exchange rates among geographic areas, delineated on the basis of factor mobility and fiscal and monetary centrality was closer to the view of Mundell than to the views of other authors writing in the classical tradition.

Underlying our view are two pieces of evidence. First, as the above quotation from Friedman, comparing the members of the sterling area with the different states of the United States makes clear, Friedman believed that there was a “key-difference” between

⁵ Cesarano (2006, p. 713) attributed this view to Mundell: “As Mundell (1961, p. 662) remarks, for the classics the optimum-currency-area was the world, because they deemed stabilization policies totally irrelevant so that multiplying the number of currencies entailed only a cost.”

the two areas. Moreover, after describing that key difference between the United States and the sterling area, Friedman continued his appraisal of the potential for fixed-exchange rates in the sterling area as follows:

The problem of maintaining fixed exchange rates within the sterling area without restrictions on trade differs only in degree from the corresponding problem for the world as a whole. In both cases the area includes a number of sovereign political units with independent final monetary and fiscal authority. In consequence, in both cases, the permanent maintenance of a system of fixed rates without trade restrictions requires the harmonization of internal monetary and fiscal policies and a willingness and ability to meet at least substantial changes in external conditions by adjustments in the internal price and wage structure (1953b, pp. 193–94). Many of these differences are, of course, themselves the product of the prior existence of fixed and stable exchange rates. Whatever their cause, there can, I think be little doubt that on balance they mean that a system of fixed exchange rates has more chance of surviving without trade restrictions in the sterling area than in the world as a whole. But, granted that the prospects are better for the sterling area than for the world as a whole, it does not follow that they are very good (1953b, p. 194).

Second, Friedman's belief in the need of separate currencies among geographic areas, delineated on the basis of the existence of the criteria that would ensure smooth adjustment in the absence of exchange-rate variations, came across clearly in correspondence with Robbins in 1952. In a letter dated February 6, 1952, Robbins wrote to Friedman about the efficacy of single, global currency:

In the completely liberal world, I am pretty sure that there would only be one kind of money; people would make their contracts in terms of whatever commodity they thought most likely to be reasonably stable in value and if you started with different currencies in different areas, it seems to me to be almost certain that there would be a tendency for one eventually to come to be chosen in preference to the others. This is surely not a mere fancy of

theoretical imagination. At the present time in Europe there can be no shadow of doubt that we all would make our contracts in gold if we were not forcibly prevented by law from doing so (Robbins, 1952).

Friedman replied as follows⁶:

You may well be right that the end-result in a completely liberal world would be a single currency, though I am less clear that it would be a commodity standard. Whether you are [right] seems to be me to depend on whether there would be sufficient mobility of men and capital in such a world to prevent [the need of] independent monetary policies. Our rejection of flexible exchange rates covering the several states of the United States brings out that flexible exchange rates are not a necessary component of a rigorously liberal position and what seems to me the fundamental consideration - - *the appropriate area for a single currency* (i.e., rigid exchange rates) is that over which a single authority controls monetary policy and within which there is reasonably free movement of men, goods, and capital (Friedman, 1952b, italics supplied).

The above quotation makes clear that, in the early 1950s, Friedman set-forth the basic core of what subsequently emerged as optimum-currency-area analysis. Consequently, Friedman clearly understood that, in an imperfect world, separate currencies and flexible exchange rates among different areas would facilitate adjustment among the areas. The domain of such areas was dependent on the mobility of the factors of production and goods, and the degree of monetary and fiscal integration. It was left to Mundell to embed the criteria identified by Friedman into the standard macroeconomic model of the time and to use that model to assess the macroeconomic costs and microeconomic benefits of single-currency areas. As we discuss in Section 3.2 below, an inherent feature of the standard macroeconomic analysis of the time was the use of macroeconomic policies to fine-tune the economy so that the goals of low unemployment, price stability, and balance-of-payments equilibrium could be

⁶ In his reply to Robbins, Friedman referred to the case for flexible exchange rates made by both himself and by Aaron Director, Friedman's colleague at the University of Chicago. Director was also the brother of Friedman's wife, Rose Director Friedman.

(simultaneously) achieved. It was Friedman's rejection of that paradigm that set him apart from Mundell, as well as such writers as Lerner, Meade, and Scitovsky.

2.2. Why were Friedman's contributions overlooked?

In addition to ground-breaking work on optimum-currency-areas, in his essay, "The Case for Flexible Exchange Rates", Friedman presaged developments in several other sub-fields within international-monetary economics. Among the latter international-monetary subjects Friedman addressed in the article are the following:

- *Exchange-rate overshooting*. Dornbusch (1976) is widely credited as having been the first author to set down the idea that, in a model with sticky prices in the short run, the exchange rate will initially react more to a shock to bring about an equilibrium than it would have if prices were flexible. Over time, goods prices will respond so that the exchange-rate overshooting is dissipated. Similarly, Friedman (1953b, p. 188) wrote:

It is clear that the initial change in exchange rates will be greater than the ultimate change required, for, to begin with, all the adjustment will have to be borne in those directions in which prompt adjustment is possible and relatively easy. As time passes, the slower-moving adjustments will take over part of the burden, permitting exchange rates to rebound toward a final position which is between the position prior to the external change and the position shortly thereafter. This is, of course, a highly oversimplified picture: the actual path of adjustment may involve repeated overshooting and undershooting of the final position, giving rise to a series of cycles around it or to a variety of other patterns. We are here entering into an area of economics about which we know very little, so it is fortunate that a precise discussion of the path is not essential for our purposes⁷.

- *The corner-solution hypothesis*. Eichengreen (1994) is generally regarded as having been the first author to present the notion that, in a world of highly mobile

⁷ In his seminal paper on exchange-rate overshooting, Dornbusch (1976) did not refer to Friedman's 1953 article. Dornbusch did his graduate studies at the University of Chicago and is likely to have read Friedman's paper.

capital, intermediate exchange-rate regimes are susceptible to speculative attacks so that the only viable options are the corner solutions of floating rates and hard pegs. In his 1953 essay, Friedman considered three exchange rate regimes – adjustable pegs (temporarily rigid rates), floating rates, and hard pegs (genuinely rigid rates). He argued that, unlike the latter two regimes, adjustable pegs encourage speculative attacks:

Because the exchange rate is changed infrequently and only to meet substantial difficulties, a change tends to come well after the onset of difficulty, to be postponed as long as possible, and to be made only after substantial pressure on the exchange rate has accumulated. In consequence, there is seldom any doubt about the direction in which an exchange rate will be changed, if it is changed (1953b, p. 164).

Therefore,

The system of occasional changes in temporarily rigid exchange rates seems to me the worst of two worlds: it provides neither the stability of expectations that a genuinely rigid and stable exchange rate could provide in a world of unrestricted trade and willingness and ability to adjust the internal price structure to external conditions nor the continuous sensitivity of a flexible exchange rate (1953b, p. 164).

Why have Friedman's contributions in these areas been overlooked? We believe that the answer to that question probably lies in the nature of the 1953 essay. The essay arose from a 1950 memorandum that Friedman wrote while he was a consultant to the Finance and Trade Division of the Office of Special Representative for Europe, United States Economic Cooperation Administration. The essay was not intended for publication in a professional journal. It did not contain a theoretical framework nor did it provide empirical analysis. In 1952, Friedman submitted the paper for publication in the popular periodical, *Fortune*. In a letter addressed to John McDonald, a member of the Board of Editors of *Fortune*, Friedman wrote:

[The paper] has been lying around primarily because in its present form it falls between two stools, and I have not been able to decide in which direction to

revise it or whether it was worth revising it in either direction - - it is too technical for popular consumption, not scholarly enough for publication in a technical journal (Friedman, 1952a).

McDonald rejected the paper on the grounds that it was too technical for the readers of *Fortune* (McDonald, 1952); Friedman published the paper the following year in his book, *Essays in Positive Economics* (1953c).⁸

The point we wish to stress is that, although Friedman's essay, "The Case for Flexible Exchange Rates", contained seminal contributions, the structure of the paper was such that the specific contributions might be overlooked. The ground-breaking insights were often presented as side remarks or footnotes and were not developed. Thus, although the paper was frequently cited during the 1950s and the 1960s as a key contribution to the subject of the choice of exchange-rate regimes, many of the specific arguments contained were ignored, possibly because Friedman did not expand upon them in the essay.

3. Maturization

3.1. Mundell (1961)

More formally than had earlier authors (including Friedman), Mundell (1961) sought to show that an economy's characteristics should be a determinant of its exchange-rate regime. Effectively, he aimed to identify the conditions which, if satisfied, diminished the case for flexible exchange rates. Conversely, he sought to demonstrate that, under some conditions, separate currencies and exchange rate adjustments would be ineffective.

Mundell defined the optimum-currency-area problem as the determination of the geographic domain – as opposed to national territory – in which the goals of internal balance (low inflation and full employment) and external balance (a sustainable balance-

⁸ It is likely that Friedman did not submit the paper to a professional journal. In personal correspondence in 2003 to George Tavlas, Friedman wrote: "With respect to my article on flexible exchange rates, I have absolutely no recollection whatsoever of having submitted it to a journal for publication" (Friedman, 2003).

of-payments position) could most easily be achieved. The author considered two countries, East and West, each with its own central bank, that form a currency union by pegging the exchange rate between their currencies. Mundell's analytic setup included the following assumptions: (i) the East produces only automobiles and the West produces only lumber; (ii) there are no capital movements between the countries, their bilateral trade is initially balanced, and the countries begin at full employment; (iii) both economies are characterized by wage and price stickiness; (iv) the East experiences a rise in productivity, leading to an excess demand for the West's product (lumber) and an excess supply of the East's product (cars). The immediate impact of the productivity shock is to cause unemployment in the East, inflation in the West, a trade deficit in the East, and a trade surplus in the West.⁹

Mundell proposed three criteria to judge optimality. First, he identified labor mobility as the key attribute of an optimum-currency-area since such mobility reduces the need of nominal exchange-rate adjustment as a means of correcting the external imbalances. Second, if wages were flexible (instead of sticky) in both countries, the increase in demand in the West would raise wages in that country, leading to a decline in the aggregate supply of goods and services (i.e., a shift in the aggregate supply function) and a rise in the price level while the decline in demand in the East would decrease wages in that country, leading to an increase in the aggregate supply of goods and services (a shift in the aggregate supply function) and a decline in the price level in that country. Economic agents in both countries would buy fewer Western goods and more Eastern goods, restoring equilibrium. Third, in the absence of labor mobility and/or wage-price flexibility, there exists an efficiency argument for nominal exchange-rate flexibility and separate monetary policies in the two countries. The upshot of Mundell's analysis is that, in the absence of labor mobility and/or wage-price flexibility, the incidence of asymmetric shocks should be a criterion for assessing optimality.

Mundell also enumerated several microeconomic factors supporting relatively-large currency areas. He noted that the efficiency of money as a medium of exchange and unit

⁹ Whether a rise in productivity in the East should result in higher unemployment in that country is debatable, as discussed below.

of account diminishes as the number of currencies increases under flexible exchange rates; the greater the number of currencies the higher the transactions costs (medium of exchange) and information costs (unit of account) of money. Mundell also pointed out that a large number of small currency areas could result in thin foreign exchange markets, making it easier for speculators to affect the market prices (exchange rates) of the currencies, thereby, making the conduct of monetary policy more difficult.

In his paper, Mundell argued that the case for flexible exchange rates depends on the existence of “money illusion”; in other words, an assumption underlying the case for flexible exchange rates is that the participants in the economy in question are willing to accept variations in their real income through variations in the exchange rate, but are *not* willing to accept changes in their real income through adjustments in the nominal-wage rate or price level (Mundell, 1961, p. 663). He also noted, however, that as a currency area grows smaller and more open to trade, the assumption of money illusion becomes increasingly tenuous since the proportion of imports in total consumption grows.¹⁰

3.2. Discussion

Several remarks regarding the views of Friedman, those of other economists, such as Lerner, Meade, and Scitovsky, who anticipated optimum-currency-area theory, and those of Mundell, warrant further comment. First, Cesarano (2006) argued that those economists (e.g., Friedman, Lerner, Meade, and Scitovsky) writing in the classical tradition believed that the existence of national borders (i.e., differentiated governmental jurisdictions) prevents the classical open-economy adjustment mechanism from working properly. In other words, national borders deter the establishment of single, global monetary and fiscal authorities and the free movement of goods, labor, and capital; eliminate the borders, so the argument goes, and world welfare would be maximized with a single currency. Cesarano (2006) also argued that Mundell assumed that national borders are a given characteristic of the real world; unlike those authors who wrote in the (open-economy) classical tradition, Mundell believed that the optimum-currency-area

¹⁰ Friedman (1953b, p. 194) also referred to the importance of a currency area’s openness, as well as its size, without relying on the money-illusion argument: “The smaller extent of the area involved has somewhat divergent effects. On the one hand, it reduces the problem of harmonizing potentially divergent policies; on the other, it means that the area is subjected to larger strains from outside.”

criteria might fail to operate, even among regions of a particular country. Therefore, the elimination of national borders would not be sufficient to establish an optimum-currency-area. As Friedman's correspondence with Robbins makes clear, however, Friedman did not speculate about the implications of the elimination of national borders. Like Mundell, for Friedman national borders are a given characteristic of the real world, a characteristic that points to the need of separate currencies and flexible exchange rates among countries.

Second, we believe the Friedman's views on the use of macroeconomic policies for *domestic stabilization purposes* differed fundamentally from the views of such writers as Lerner, Meade, Mundell and Scitovsky. The latter group of authors, writing in the Keynesian tradition, believed in the efficacy of activist macroeconomic policies to fine-tune the economy so that the goals of low unemployment, price stability, and balance-of-payments equilibrium could be simultaneously achieved.¹¹ Friedman, in contrast, was critical of such views. For Friedman, the *domestic* economy is a self-equilibrating mechanism. For Lerner, Meade, Mundell and Scitovsky, in contrast, stabilization of the domestic economy requires governmental intervention in the form of activist macroeconomic policies. We return to Friedman's views on the role of monetary policy, and the relationship of those views to the optimum-currency-area literature, in Section 5.2.

3.3. McKinnon (1963)

The idea that openness should be a criterion for judging optimality was further developed by McKinnon (1963). Assuming that the output of an economy is divided into tradables and non-tradables, the author examined the effects of a shock that changes the relative price of tradables and nontradables on the economy's overall price level. He argued that if the exchange rate of a currency of a relatively-open economy changes in response to such a shock, the economy's general price index, which (by definition) includes the prices of both tradables and non-tradables, would tend to fluctuate more than the general price index of a relatively-closed economy, reducing the "liquidity" (i.e., unit of account and store-of-value) functions of money. For example, suppose that an

¹¹ It may be recalled that Meade and Mundell helped extend the Keynesian closed-economy model to the open economy.

economy experiences a negative terms-of-trade shock so that its nominal exchange rate depreciates. If the authorities of the economy in question aim to stabilize the general price level, the depreciation of the exchange rate and the resulting rise in the price of tradables require a contraction in domestic demand to push down the price of non-tradables. Other things being equal, the more open an economy – i.e., the larger the share of tradables in output – the larger the required contraction.

McKinnon also argued that nominal exchange-rate changes in a relatively-open economy were not likely to be accompanied by significant effects on competitiveness because such changes would lead to fast and large offsetting changes in domestic wages and prices. That is, exchange-rate variations in a relatively-open economy would likely cause equal or near-equal variations in costs, depriving the flexible exchange rate of its corrective functions. The foregoing considerations led McKinnon to conclude that (a) relatively-open economies should peg their currencies, (b) open economies that trade extensively with one another would find it beneficial to form a currency area because such an area would be more closed than any of its constituent parts, thereby providing a greater buffer against the effects of exchange-rate changes, and (c) large (small) geographic areas are likely to be relatively closed (open) so that the size of the area could be a determinant of its optimal exchange-rate regime.

3.4. Kenen (1969)

Kenen's (1969) paper analyzed the effects of shocks to particular export products (i.e., sector specific or industry-specific shocks)¹². First, Kenen developed the idea, set forth by earlier writers, that fiscal integration should be a criterion to judge optimality for participation in a single-currency-area; the higher the level of fiscal integration between two areas, the greater the ability to smooth asymmetric shocks through fiscal transfers from a low-unemployment region to a high-unemployment region. Second, extending Mundell's argument that countries susceptible to asymmetric shocks should float their currencies, Kenen argued that, in the presence of labor mobility, two countries that possess narrow but similar production structures are suitable candidates for a monetary

¹² Kenen presented his paper on optimum-currency-areas at a conference held in September 1966 at the University of Chicago. The publication outlet (Mundell and Swoboda, 1969) contains the proceedings of the conference, including summaries of the discussions of the papers presented by conference participants.

union comprised of two countries since a terms-of-trade (i.e., sector-specific) shock is likely to affect them symmetrically¹³. Third, the author introduced the idea that product diversification can be used to assess the desirability of permanently-fixed exchange rates. Highly diversified economies, he argued, are better candidates for currency areas than less-diversified economies since diversification provides some insulation from the effects of sector-specific or industry-specific shocks, forestalling the need of frequent changes in the terms-of-trade via the exchange rate. Conversely, sectoral diversification might be needed to provide destinations to which labor has an incentive to move.

4. Optimum-currency-area conundrums

As noted, previous authors had set-forth the basic tenets of the theory of optimum currency areas, but Mundell, McKinnon, and Kenen developed the insights of the earlier writers into a framework with which to investigate the way that alternative international-monetary arrangements can influence the adjustment process. To summarize, the characteristics identified as crucial for judging whether it is optimal for two economies to form a currency union by those three authors are:

- The degree of labor mobility and/or wage and price flexibility (Mundell)
- The incidence of asymmetric shocks (Mundell)
- The degree of openness and/or trade integration (McKinnon)
- The size of an economy (McKinnon)
- The similarity of economic structures between two economies (Kenen)
- The degree of product diversification (Kenen)
- The level of fiscal integration (Kenen)

However, the framework developed by Mundell, McKinnon, and Kenen was not internally consistent and was fragile, as we discuss in what follows.

¹³ Kenen focused on two single-product areas that had highly mobile labor between them.

4.1. Conflicts and contradictions

The various criteria can lead to inconsistent and/or contradictory results. Consider the following. (1) An economy that is small and open, suggesting the preferability of pegged exchange rates, might also possess a low degree of labor mobility with adjoining areas, implying the desirability of flexible exchange rates. (2) The openness characteristic suggests that small economies should adopt pegged rates since small economies are likely to be relatively open. Such economies, however, are also apt to be relatively undiversified, making them better candidates for flexible rates according to the diversification criterion.¹⁴ (3) The relationship between economic size and the type of exchange-rate regime is not clear-cut for another reason. Consider two countries, East and West. Suppose the East is like Luxembourg and the West is like Germany. Economic developments in the East will have much less impact than economic developments in the West on union-wide economic aggregates such as real GDP. A regional central bank will, therefore, need to pay much more attention to economic developments in the West (Germany), so that the West gives up less than the East (Luxembourg) in terms of a nationally-tailored monetary policy.¹⁵ Based on this line of reasoning, large economies are better suited for pegged exchange rates than are small economies, contrary to the inference of the openness characteristic which suggests that open economies are apt to be small and likely to be best served by fixed-exchange rates. (4) The diversification principle leads to a paradox. It suggests that two relatively undiversified economies should float their currencies. Yet, if the economies in question peg their currencies against each other, the new, combined currency union would be more diversified than its individual members, contrary to the inference drawn from the diversification principle, which suggest that such countries float their exchange rates.¹⁶ (5) The diversification thesis can be turned around; it can be argued that those economies that are highly diversified can best afford to have flexible exchange rates, whereas undiversified economies are less able to deal with exchange-rate fluctuations. Therefore, it is by no means evident that diversification can be used to choose between floating exchange rates

¹⁴ See McKinnon (1969, p.112)

¹⁵ This argument was made by Kenen and Meade (2008).

¹⁶ This argument was made by Mundell (1969, p.111)

and pegged rates. ¹⁷(6) As an economy becomes open to trade, it could become more specialized. That is, the removal of barriers to trade makes it possible to concentrate production so as to reap economies of scale (Krugman, 1991). Consequently, sector-specific shocks might well become country specific shocks, suggesting the desirability of flexible exchange rates, contrary to the inference drawn from the openness criterion, which suggests that increased openness is conducive to pegged exchange rates.

4.2. OCA analytics

The theory of optimum-currency-areas was originally analyzed in a world characterized by the Bretton Woods System of fixed-but-adjustable exchange rates and limited international capital mobility. The analytical set-up used by the earlier researchers in the field assumed wage and price stickiness, the existence of a long-run and exploitable Phillips curve trade-off between inflation and unemployment, and the ability of the monetary and fiscal authorities to fine-tune the economy along the Phillips curve. Mundell (1961), McKinnon (1963), and Kenen (1969) examined the effects of an asymmetric shock involving a switch in demand in a world comprised of two countries. Among the factors overlooked by those authors in their discussions of the choice of exchange-rate regime were differences in the level of economic development between two countries. In what follows, we consider issues that complicate considerably the choice of an exchange-rate regime. These issues are: (i) the nature of the asymmetric shock; (ii) freer capital flows; (iii) limits of fiscal policy; (iv) differences in the level of economic development between countries; and (v) the role of the underlying model structure used by the earlier writers in terms of its having limited the applicability of optimum-currency-area analytics in real-world situations.

4.2.1. The nature of the asymmetric shock

As noted above, in his two-economy (i.e., East and West) set-up Mundell assumed that the East, which produced cars, underwent a positive productivity shock, which, according to the author, led to an increase in demand by the East for the product (lumber)

¹⁷ See Mundell (1969, p.111-112)

produced by the West.¹⁸ As a result, the East experienced a current-account deficit and an excess supply of labor. The West experienced a current account surplus and an excess demand for labor.

An issue that arises – but which was not addressed in the earlier optimum-currency-area literature – is the reason a positive productivity shock in the East would cause a switch in demand from Eastern products to Western products.¹⁹ Contrary to the inferences drawn by Mundell, an increase in productivity should have the following effects on the Eastern economy: (i) an increase in the marginal productivity of labor, causing a (positive) shift in the demand for labor, (ii) an upward shift in the aggregate production function, and (iii) given (i) and (ii), a rightward shift in the aggregate supply function (in real output-real interest rate space). To the extent that the productivity shock is permanent, the marginal product of capital will rise in the East, leading to a rise in aggregate demand in the East. The net effect of the shock on output, employment, and trade in the East will depend on the underlying behavioral parameters.

Be that as it may, a basic conclusion that emerged from the post-1960s literature is that the shock absorbing capacity of exchange-rate regimes is considerably more complicated than had been assumed in the early optimum-currency-area literature. One important result of the subsequent writings is that the costs of adopting pegged exchange rates and abandoning policy autonomy depend importantly on the nature of the shocks to which an economy is subjected and whether the shocks are permanent or temporary; the greater the number and impact of real shocks, the greater the benefit from floating rates.²⁰ This result carries over to the degree of diversification; if a country experiences a shock to aggregate demand, a floating exchange-rate regime will provide insurance against the shock regardless of the degree of diversification. Correspondingly, if the underlying shock is temporary, the benefits derived from exchange-rate adjustment are smaller than they would be if the shock is permanent.

¹⁸ Mundell (1961, p. 659) wrote: “assume. that an increase in productivity (say) in the automobile industry causes an excess demand for lumber products and an excess supply of cars.” Kenen (1969, p. 43) repeated this example.

¹⁹ To our knowledge, this issue has not been previously addressed.

²⁰ This argument traces back to Poole (1970).

4.2.2. Capital flows

The introduction of capital flows into optimum-currency-area analysis alters the results of the original Mundellian framework in at least two important respects. First, following Mundell (1961), assume that a particular country experiences a positive productivity shock. Also, assume that the economy undergoes a relatively-fast growth rate and that, as a result, it runs a current-account deficit with the rest of the world. The rise in productivity is likely to induce capital inflows that make it possible to finance the current-account deficit without the need of devaluing the currency²¹. Whether the current-account deficit is sustainable will depend, in part, on whether (i) the increased investment associated with the external imbalance can be expected to provide a rate of return that exceeds the cost of borrowing, (ii) any increase in consumption associated with the imbalance is temporary and desirable for purposes of inter temporal consumption smoothing, and (iii) the fiscal position is appropriate in terms of both the level and composition of government spending, as well as the structure and mix of taxes and borrowing used to finance the budget. The key result, and contrary to the premise underlying the original optimum-currency-area analyses, is that a current-account deficit need not make a depreciation of the real exchange rate necessary. Second, to the extent that the exchange rates produced under a system of floating rates may reflect non-fundamental noise, a floating system creates variability, uncertainty, and over- or under-valuation of currencies. Capital mobility can, therefore, be a *source* of asymmetric shocks (through its effect on the exchange rate).²² In the presence of genuine scientific uncertainty concerning exchange-rate determination, it is often difficult to interpret whether movements in real exchange rates reflect changes in underlying economic fundamentals or non-fundamental noise (Stockman, 1999).

4.2.3. Fiscal policy

The notion the fiscal adjustment can be used in a flexible way to smooth the effects of shocks has proved to be overly simplistic for several reasons. First, the systematic use

²¹ In fact, the capital inflows may lead to a balance-of-payments surplus and appreciation of the real exchange rate.

²² A parallel argument applies to capital mobility under pegged rates. Under such a system, speculative capital movements show up as changes in reserves and money and credit growth rates rather than in changes in nominal exchange rates.

of fiscal policy can lead to problems relating to debt sustainability. Consequently, the use of the fiscal instrument in the present may constrain its use in the future (De Grauwe, 2007). Second, fiscal transfers in the face of permanent shocks can have the perverse effect of locking resources in place, preventing necessary adjustment. Third, a country with large fiscal deficits and a high debt-to-GDP ratio that is in a monetary union can create negative spillover effects for the rest of the union, driving the union interest rate upwards and increasing the burden of financing government debts in the other members of the union. This situation can give rise to the formulation of control mechanisms, such as fiscal rules, to restrict the size of budget deficits and government debt in the union (De Grauwe, 2007).²³

4.2.4. Real convergence

The literature on optimum-currency-areas has not considered the appropriateness of a single monetary policy for countries at different stages of economic development. To explain the implications, consider two countries, A and B; country A is a mature economy with high *per-capita* income, while country B is at an early stage of development with relatively-low *per capita* income.²⁴ In a monetary union between the two countries, under which a regional central bank has been assigned the objective of price stability, country B could face the following situation: (i) relatively-high expected rates-of return on investment; (ii) low real (and nominal) interest rates (because of the low area-wide inflation rate maintained by the regional central bank)²⁵; (iii) with free movement of capital, factors (i) and (ii) can lead to overly-optimistic income expectations, a “wrong” incentive structure of investment (i.e., investment in high-risk projects that would not have been undertaken in the absence of low interest rates) and excessive domestic demand; and (iv) in light of the above, the economy concerned may eventually be faced with the need to undergo a prolonged deflation in order to regain competitiveness. The upshot of this line of reasoning is that the degree of real

²³ This argument underpins the use of fiscal rules in the euro area.

²⁴ The following example is based on Kröger and Redonnet.

²⁵ Because of productivity differentials, country B would likely have a higher inflation rate than country A, so that a given area-wide nominal interest rate leads to a lower real interest rate in country B compared with country A.

convergence should be an important characteristic underpinning the choice of exchange-rate regime.²⁶

4.2.5. Model set-up

The core optimum-currency-area paradigm was partial-equilibrium and static, involving the following elements: (1) a world comprised of only two countries; and (2) the absence of an explicit welfare function through which the various criteria can be evaluated. The two-country framework leads to the drawback that a “national” optimum-currency-area determined under this set-up need not coincide with the “global” optimum-currency-area (Kawai, 1992). Given the degree of spillover effects and economic interdependence among highly-integrated economies, the implications of national policies on world welfare should have been – but were not – considered by earlier researchers. The absence of an explicit welfare function led to a situation in which several, perhaps competing, welfare objectives were assessed. McKinnon (1963, p. 717), for example, described the objectives as follows: “(1) the maintenance of full employment; (2) the maintenance of balanced international payments; (3) the maintenance of a stable internal average price level.” These objectives are imprecise and raise the following questions.²⁷ How and over what time period is external balance defined? Why is price stability an objective and over what period of time should it be achieved? How is full employment defined? Such questions were not addressed by the early contributors to the optimum currency- area literature. The absence of an explicit welfare function and the static, partial equilibrium set-up, under which the optimum-currency-area criteria were assessed one at a time, led to a situation in which it was not possible to learn about the relative importance of the criteria or to assess whether participation in a monetary union could itself alter an economy’s structure. If there are inconsistencies among the criteria, the criteria need to be considered as a group and weighted. The earlier optimum currency- area paradigm, however, did not provide a mechanism for resolving conflicts among the criteria.

²⁶ For this reason, the European Commission and the European Central Bank have pressed prospective entrants into the euro area to achieve a degree of real convergence prior to entry into the European monetary Union. See Buiter (2008).

²⁷ McKinnon was aware of these limitations. After presenting the above objectives, he wrote: “The idea of optimality, then, is complex and difficult to quantify precisely, so what follows does not presume to be a logically complete model” (McKinnon, 1963, p. 212).

5. The comeback

Against the backdrop of the various conflicts, contradictions and other problems inherent in the optimum-currency-area framework, by the late 1960s and early 1970s the theory of optimum currency- areas began a decent into intellectual purgatory. At the above-mentioned 1966 conference at the University of Chicago that included most of the main contributors to the theory in the 1960s,²⁸ Johnson (1969b, p. 396) concluded the proceedings with the observation that the various criteria used to assess optimality had rendered the subject “too complex for its statement to be very illuminating”; “the optimum-currency-area problem”, he judged, “has proved to be something of a dead-end problem.”²⁹ In a similar vein, Ishiyama (1975, p. 378), in a survey of the optimum-currency-area literature as of the mid-1970s, concluded that, “the theory of optimum-currency-areas is primarily a scholastic discussion which contributes little to practical problems of exchange rate policy and monetary reform.” For a period of about twenty years, from the late-1960s/early 1970s until the late- 1980s/early 1990s, academic interest in the theory of optimum-currency-areas was of second-order importance. Beginning in the late-1980s and early-1990s, however, the theory of optimum-currency-areas resurfaced as an active area of academic interest, an interest that continues until the present day. What accounts for the resuscitation of the theory? Clearly, events at the ground level had a major impact. The experience of the European monetary union, which is perceived to have been beneficial for its members, has been a catalyst for interest in monetary unions in regions outside Europe and in the conditions necessary for the adoption of a common currency among countries.³⁰ In addition, developments in academic thinking have played a role in reviving interest in optimum-currency-area theory. These latter developments are discussed below.

²⁸ Mundell, McKinnon, and Kenen were among the participants.

²⁹ A similar judgment was made by De Cecco (1974).

³⁰ See Kenen and Meade (2008) for a discussion of recent initiatives aimed at regional monetary integration and the use of optimum-currency-area theory in that connection.

5.1. Monetary policy and credibility

The focus of discussions on exchange-rate regime choice has shifted in recent years. Whereas the earlier optimum-currency-area literature dealt mainly with the country characteristics of the potential members of a monetary union, recent discussions focus on the credibility of monetary policy and alternative commitment mechanisms for policy makers. The earlier literature attached considerable weight to the ability of monetary authorities to attain a desired point along what was thought to be a stable long-run Phillips curve, with the implication that the loss of monetary policy independence imposes a high cost on an economy. The recent literature, in contrast, views inflation prevention as the main macroeconomic objective of a central bank, with a secondary objective of dampening business cycle fluctuations.

Contributing to the shift in emphasis in discussions of exchange-rate regime choice have been theoretical developments over the past thirty years or so, which have cast doubt about the possibility of using macroeconomic policies to attain an optimum point along a long-run and exploitable Phillips curve. Several such developments are important to mention. (1) An implication of the natural-rate hypothesis is that the best that macroeconomic policy can hope to achieve is price stability in the medium term, especially in light of the long and variable lags associated with monetary policy actions (Friedman, 1968). A logical extension of the natural-rate hypothesis is that, in case of an external shock, the nominal exchange rate should be allowed to adjust to the new equilibrium level after the shock has rendered the old constellation of relative prices obsolete (Larrain and Velasco, 2001, pp. 22–23). (2) A major benefit attributed to monetary unions or hard pegs (such as currency boards and dollarization) in the recent literature is the elimination of the inflation-bias problem of discretionary monetary policy (Barro and Gordon, 1983). This bias stems from (i) attempt to over-stimulate the economies on average and (ii) the incentives to monetize budget deficits and debt (Alesina and Barro, 2001). Monetary unions and hard pegs are said to provide commitment to low inflation, changing agents' inflation expectations so that the output and employment costs of attaining a low-inflation equilibrium are reduced. An implication of this literature is that the economies operating in an environment of highly

mobile capital should adopt either floating rates or monetary unification, but not intermediate regime solutions (e.g., Eichengreen, 2002).³¹

The upshot of these developments is that what had been identified as a major cost of monetary unification, namely, the loss of the ability to use a nationally-tailored monetary policy, may not be a cost after all. In fact, a key inference of the recent literature is that, for countries with histories of high inflation, joining a monetary union with a regional central bank can provide credibility, reducing interest rates and the unemployment costs of moving to low-inflation equilibrium. These developments have helped underpin the desire of some formerly high-inflation countries to join the European monetary union. It needs to be stressed, however, that, although the foregoing developments have contributed to a renewed interest in the theory of optimum-currency-areas, they represent a distinct shift in emphasis of that theory, that is, a shift away from examination of a country's characteristics and toward the credibility aspects of alternative exchange-rate regimes. In addition, it needs to be noted that these developments were put forth in a literature that was, by-and-large, not directly related to the optimum-currency-area question. That is, revival of interest in the theory of optimum-currency-area reflected developments in a literature that had little to do with the subject of optimum-currency-areas itself.

5.2. The role of Friedman

Mundell wrote his original article on optimum-currency-areas with the intention of making the debate about exchange-rate regimes, initiated mainly by Friedman, more relevant.³² Yet, it was Friedman who, without intending to do so, contributed to a resurrection of Mundell's conception of an optimum-currency-area, helping to elevate it to a position of policy centrality.

As noted above, by the early 1950s Friedman had set down the basic elements of what would subsequently emerge as the theory of optimum-currency-areas. There was, however, a fundamental difference between the approaches of Friedman, on the one hand,

³¹ As noted, above, the argument that the only viable exchange-rate options are flexible rates or hard pegs was initially set-forth by Friedman (1953b).

³² Thus, Mundell (1961, p. 663) stated that his objective was to carry "the argument for flexible exchange rates to its logical conclusion."

and those of Mundell, McKinnon, Kenen, and other early contributors to the optimum-currency-area literature, on the other. As we have pointed out, Friedman believed that, under a fixed-exchange-rate system, wage and price stickiness in the real world made the classical adjustment mechanism both lengthy and costly. In this circumstance, flexible exchange rates would provide smoother adjustment of balance-of-payments imbalances than a system of fixed-exchange rates.

Two themes that run throughout Friedman's work are that (1) monetary policy actions are subject to long and variable lags, and (2) as a first approximation, money is neutral in the long-run.³³ Consequently, and in contrast to the short-term policy activism of the Keynesian models of the 1950s and 1960s, Friedman believed that monetary policy should aim only at achieving price stability in the medium term.³⁴ Although flexible exchange rates provide independence for national monetary policy, such independence was, in Friedman's view, to be used to shield the domestic economy from inflationary policies elsewhere (Friedman, 1953a, p. 16), not to pursue domestic targets for the unemployment rate.³⁵

Friedman's 1968 address before the American Economic Association formalised the idea that monetary policy should aim at achieving price stability in the medium term, helping to pave the way for the subsequent revival of interest in the subject of optimum-currency-areas. Specifically, Friedman's contributions to the resurrection of optimum-currency-area theory included the following: (1) the concept of a natural rate of unemployment, to which the unemployment rate returns following a disturbance (Friedman, 1968); and, (2) the ideas that the Phillips Curve should be augmented with a variable representing price expectations, and that its steady-state value is unity, so that the

³³ As Friedman (1958, p. 199) stated, "The direction of influence between the money stock and income and prices is less clear-cut and more complex for the business cycle than for longer movements."

³⁴ See, for example, Friedman (1951, p.263)

³⁵ The prevailing view in the profession at the time about the existence of a long-run trade-off between inflation and the unemployment rate was reflected in the following remarks by Johnson (1969a, p. 18): "Flexible rates would allow each country to pursue the mixture of unemployment and price trend objectives it prefers, consistent with international equilibrium, equilibrium being secured by appreciation of the currencies of "price stability" countries relative to the currencies of "full employment" countries". The view that the main cost of joining a monetary union is the loss of the ability to choose a desired point along a long-run Phillips curve was set-forth by Corden (1972) and Giersch (1973).

long-run Phillips curve is vertical (Friedman, 1968), ideas that are now part of mainstream economics.

Friedman's view that there is no long-run Philips-curve trade-off predated his 1968 address. In a 1966 comment,³⁶ Friedman (1966, pp. 58–60) wrote:

The basic fallacy is to suppose that there is a trade-off between inflation and employment; that is, to suppose that by inflating more over any long period of time, you can have on the average a lower level of unemployment. By speeding up the rate of monetary expansion and aggregate demand, you can unquestionably increase output and employment temporarily. Only until people adjust their anticipations from a logical point of view, the true trade-off is between unemployment today and unemployment at a later date. It is not between unemployment and inflation. There is no long-run, stable trade-off between inflation and unemployment.

In light of the above discussion of Friedman's role in helping to revive interest in the case for hard pegs, what was Friedman's view about the optimum exchange-rate regime? As noted in Section 2.2, in his 1953 essay, "The Case for Flexible Exchange Rates", Friedman presented the idea that the only viable exchange-rate regimes are flexible exchange rates and hard pegs. Throughout his career, Friedman was an advocate of both types of regimes (e.g., Friedman, 1969, 1973, 1974, 2000).³⁷ Friedman considered the particular choice between the two options to be dependent on such factors as the size of the economy and the degree of trade openness (Friedman, 1969, p. 365). He thought that larger, relatively closed economies should float their currencies. With regard to smaller, more-open economies, he argued: "My position has always been that a small economy should do one of two things: eliminate its central bank and really hard peg [as under a currency board]. or it ought to float completely" (2000, p. 418).

³⁶ The comment was on a paper written by Robert Solow. The comment was made at a conference held at the University of Chicago in April 1966. In his comment, Friedman also presented the concept of the natural rate of unemployment. See Shultz and Aliber (1966).

³⁷ Friedman (1969, 1973) thought that small and open economies would likely have more effective monetary policies if they adopted a hard peg against the currency of a larger economy that had a track record of monetary discipline than if they followed a nationally-tailored monetary policy. For a discussion of Friedman's views on exchange-rate regimes, see Hanke (2008).

5.3. Endogeneity of the criteria

Whereas the early framework used to study optimum-currency-areas was static, seeking to identify the characteristics that an economy should satisfy prior to joining a monetary union (i.e., *ex ante*), much recent work, initiated by Frankel and Rose (1998, 2002), has focused on changes in economic structure and performance that may result from participation in a monetary union (i.e., *ex post*). Endogenous optimum-currency-area theory is grounded in the following propositions.³⁸ First, “borders” (broadly defined to include separate monies) constitute an impediment to trade. Monetary unification represents the removal of borders in that it is tantamount to a narrowing of distances and raises the incentives of agents within the monetary union to trade amongst themselves (McCallum, 1995; Engel and Rogers, 2004). The intuition underlying this view is that the introduction of a single currency eliminates exchange-rate risk (and, therefore, the cost of hedging), lowers information costs, and raises price transparency, reducing market segmentation and encouraging competition (Skudenly, 2003). Therefore, a common currency promotes, over-and-above what may be attained by pegged rates among separate currencies, reciprocal trade, economic and financial integration, and the accumulation of knowledge (De Grauwe and Mongelli, 2005). Second, there is a positive linkage between trade integration and income correlation (Frankel and Rose, 1998). Specifically, trade integration leads to more-highly-correlated business cycles because of common demand shocks and greater intra-industry trade, lessening the need of country-specific monetary policies and reducing the cost of giving up a nationally-tailored monetary policy.³⁹ In contrast to the earlier literature, which focused on the number and/or severity of asymmetric shocks among economies as a criterion for choosing potential participants in a monetary union (i.e., *ex ante*), the endogenous optimum-currency-area literature leads to the conclusion that participation in a monetary union itself reduces the incidence of asymmetric shocks among participants.

The following comments on the above line of research are warranted. First, the view that the introduction of a single currency promotes trade over-and-above what

³⁸ De Grauwe and Mongelli (2005) and Mongelli (2005) reviewed the endogenous optimum-currency-area literature.

³⁹ De Haan et al. (2008) reviewed the literature on the convergence of business cycles among members of the euro area.

would have taken place under a rigid exchange-rate regime has led to a large body of empirical work that examines the issue. The first such study was that of Rose (2000), who found that membership in a currency union tripled the size of trade flows among the participants in the union. Subsequent work, which addressed both specification and estimation problems contained in Rose's study, have found that any trade-creating effects of a currency union are much smaller than Rose's findings. For example, recent estimates of the trade creating- effect of the euro area are typically estimated to be in the range of 8 per cent to 23 per cent (Rose, 2008). Although these results suggest that participation in a monetary union may provide endogenous trade-creating effects, it is important to point out that, while the theoretical literature can provide support for these results, it cannot justify effects of the size of the effects that have been reported in the literature.

Second, an increase in trade integration between countries, say A and B, may lead to the export or import of business cycles induced by demand fluctuations through trade linkages because changes in income in country A, for example, will typically lead to a change in that country's demand for country B's goods. Yet, as noted earlier, standard trade theory predicts that as an economy becomes more open to trade, it could become more specialized in production, leading to higher inter-industry patterns of trade. Consequently, if business cycles are dominated by industry-specific shocks, trade-induced specialization can lead to lower business-cycle correlations. Alternatively, if intra-industry trade dominates trades, industry-specific shocks may lead to higher business-cycle correlations. Analytically, therefore, the relationship between trade intensity and the co-movement of output is ambiguous.

6. The performance of alternative exchange rate regimes

An underlying implication of the theory of optimum-currency-areas is that, because different country characteristics are associated with different optimal exchange-rate regimes, the exchange-rate regime that a country chooses should matter for key welfare criteria, such as growth performance, output volatility, and inflation. What are the implications of empirical and theoretical work on the performance of alternative exchange-rate regimes for optimum-currency-areas? In what follows, we first discuss the

empirical and analytical literature on regime performance, and then draw inferences from this work for future research in the field of optimum-currency-areas.

6.1. Empirical literature

The recent empirical literature has compared exchange-rate-regime performance using the more than thirty years' experience with managed floating and other currency arrangements following the demise of the Bretton Woods system of pegged-but-adjustable exchange rates.⁴⁰ This literature uses both *de jure* classification reported by the IMF, which classified regimes according to what the authorities said they did, and *de facto* regime classifications devised by researchers, which attempt more accurately to capture the authorities' practices based on movements in variables such as nominal exchange rates and reserves. The main findings of this literature can be summarized as follows. (1) Unconditionally and conditionally, it is difficult to discern a clear-cut relationship between per-capita growth and the exchange-rate regime. Conditionally, there is some evidence that, for advanced economies, the exchange-rate system either made little difference for growth or that floats registered higher growth rates than other regimes. For developing economies there is some positive association between pegs and growth. Those authors who examined the effects of a strong monetary policy framework found that such a framework, rather than the presence of a particular exchange-rate system *per se*, appeared to be a positive determinant of growth. (2) Both unconditionally and conditionally, pegged exchange-rate systems tend to be associated with lower inflation than other types of regimes, but the results are sensitive to the grouping of economies and the fact that many high-inflation economies have had floating rates because of the need of frequent adjustments of exchange rates. For upper-income or advanced economies, floating regimes tend to produce the lowest inflation. For lower-income or developing economies, pegged regimes are associated with lowest inflation. (3) Unconditionally, all studies using *de facto* codings found that pegged regimes were associated with higher output volatility than were regimes with any flexibility.

⁴⁰ Tavlas et al. (2008) surveyed the literature on the classification and performance of alternative exchange-rate regimes

In sum, the literature on the performance of alternative exchange-rate regimes indicates that the level of economic development plays a role with regard to the effects of the regime on economic growth and inflation. For lower-income (i.e., developing) countries, there is a positive association between pegged exchange rates and growth, although there appears to be no association between the exchange-rate regime and growth for higher-income (i.e., advanced) economies. For upper-income economies, floating rates appear to produce lower inflation, while, for lower-income economies, pegged rates are associated with lower inflation. Finally, pegged rates are associated with higher output volatility for all groups of countries, irrespective of the level of economic development.

6.2. Analytical considerations

In models without nominal rigidities, the exchange-rate system does not affect real variables (except real money balances). This result is the direct consequence of the neutrality or super-neutrality of money, even in the short run (Stockman, 1999, p.1485). The situation is very different in the presence of nominal frictions (price and/or wage rigidities). The standard vehicle for studying the effects of monetary policy in the presence of frictions is the New Keynesian model. There exists a large body of literature, deriving from the Kollmann (1992) and Obstfeld and Rogoff (1995) open-economy extensions of the New Keynesian model, that deals with issues pertaining to the properties and optimal choice of the exchange-rate regime. An important difference between this work and the earlier literature is that the former uses explicit, micro founded, stochastic general equilibrium models and welfare criteria that are consistent with the objectives of the agents operating in the model while the latter does not.

The New Keynesian model uses diverse ‘‘formats’’ and has produced rather diverse findings. Nevertheless, the main conclusion drawn from analysis using this model often echoes that of the traditional Mundell–Fleming model and for the same reasons – namely, that abstracting from non-fundamental fluctuations and speculative attacks, flexible exchange rate systems tend to produce better results in terms of welfare than regimes that severely restrict exchange rate fluctuations (Stockman and Ohanian, 1997; Benigno and Benigno, 2003; Obstfeld and Rogoff, 2000; Kollmann, 2002; Pappa, 2004; Canzoneri,

Cumby, and Diba, 2005). Moreover, independent national monetary policy performs quite well – that is, the gains from international policy coordination are negligible.

There are several reasons to believe that the alleged superiority of monetary policies that feature activism and a flexible exchange rate, absent international coordination, may not be so general as it appears. First, it is typically assumed that the monetary authorities have complete information about the structure of the economy and the shocks to which it is subjected. Combining this assumption with the assumption that monetary policy is conducted optimally, that is, it maximizes the utility of the representative agent, often allows these models to generate activist policy equilibria that replicate the efficient, flexible price (or wage) equilibrium. Consequently, when monetary policy is omniscient and omnipotent, it is not sensible to constrain it by making it target the nominal exchange rate. This conclusion holds especially when beggar-thy-neighbor effects associated with independent policies are not strong – for instance, when domestic and foreign goods are poor substitutes (see Pappa, 2004). Second, most of the existing literature assumes nominal-price rigidities. When prices are rigid, fixing the exchange rate incapacitates a mechanism that could bring about desired relative price changes, as in Friedman’s (1953a, b) case for flexible rates. While this adjustment mechanism could remain in place in the presence of nominal-wage rigidities, its role in existing models with nominal-wage rigidity tends to be limited, due to the combination of the assumptions of imperfect competition and a single input (labor), which transfers nominal-wage rigidity into nominal-price rigidity (Obstfeld and Rogoff, 2000). Third, most of the literature assumes that prices are fixed in terms of the currency of the producers.

With regard to the first two issues, Dellas (2006) showed that nominal-wage rigidity and imperfect information tend to favour a passive, fixed-exchange rate regime. With regard to the third issue, Devereux and Engel (2003), Duarte (2003), and Corsetti and Pesenti (2005) showed that fixing prices in terms of the currency of the buyer reduces the magnitude of the expenditure-switching effect relative to the volume of expenditure switching that occurs when the prices of tradables are fixed in terms of the seller’s currency, making the exchange rate an ineffective instrument for managing demand. When prices are set in the currency of the buyer, unanticipated movements in the nominal exchange rate do not affect the price of imported goods on impact, generating very low

pass-through of exchange-rate changes to consumer prices in the short run. In this case, optimal monetary policy implies that the nominal exchange rate does not respond to country-specific shocks.

The comparison of alternative exchange-rate arrangements is typically carried-out in the context of single or two country models with a great deal of cross-country symmetry. Yet, as mentioned above, a “national” optimum-currency-area determined under a two-country set-up need not coincide with the “global” optimum-currency-area. To address this issue, Dellas and Tavlas (2005a, b) used a three country model, allowing for substantial asymmetries across countries, in particular, with regard to labor markets. That is, those authors assessed the implications of an optimum-currency-area characteristic, i.e., the degree of wage flexibility, and generalised the model setting to a three-country world so that externalities could be incorporated in the model. They found that, in terms of the benefits of monetary union, asymmetries among economies matter. Economies with relatively flexible wages lose (in terms of macroeconomic volatility and welfare) when they join a monetary union with economies with relatively rigid wages (Dellas and Tavlas, 2005b). Moreover, the authors found that symmetries among economic structures are also crucial in determining the extent to which the elimination of exchange-rate uncertainty between two currencies (attributable to monetary unification) resurfaces elsewhere in the global financial system (Dellas and Tavlas, 2005a).

Research on optimum-currency-area theory using dynamic general equilibrium analysis is a recent development. This research, however, may shed light on the issue of asymmetries among economies using clearly-specified welfare criteria. Euro-area economies, for example, are at similar levels of economic development. This circumstance has made it easier to establish a monetary union without generating pressures for migration of labor and fiscal transfers on a scale that might prove unsustainable. As noted above, traditional optimum-currency-area theory has little to say about such issues as the level of economic development. Such issues, however, are likely to play a key role in future research into the feasibility of monetary unions.

7. Conclusions

We have argued that the papers by Mundell (1961), McKinnon (1963) and Kenen (1969) on the subject of optimum-currency-areas evinced a paradox. On the one hand, those papers contained key insights. They drew attention to (1) the different nature of adjustment for regions within an economy compared with adjustment among separate economies, and (2) the important role played by factor mobility in the adjustment process.⁴¹ Moreover, they demonstrated that the choice of exchange-rate regime should depend on a country's structural characteristics, such as size, openness, and product diversification. In other words, the respective cases for either floating or fixed-exchange rates (or an intermediate regime) are not equally applicable to all economies, so that the exchange-rate regime that a particular country chooses may matter a great deal for macroeconomic performance. On the other hand, the particular characteristics enumerated by those three authors were mired in inconsistencies, contradictions, and a tenuous model set-up, leading to the virtual abandonment of interest in the subject of optimum-currency-areas in the 1970s and 1980s. Like the sirens in Homer's *Odyssey*, the optimum-currency-area characteristics provided seductive appeal, but led to a "dead-end". As we have also argued, the rehabilitation of interest in the subject reflects the experience of European monetary union and developments in academic thinking regarding the effectiveness of nationally-tailored monetary policies and the endogeneity of the optimum-currency-area criteria. Friedman's contributions played a pivotal role in our narrative; Friedman's work on monetary integration in the early 1950s presaged subsequent optimum-currency-area contributions; Mundell's classic formulation of an optimal currency area was aimed, in part, at refuting Friedman's "strong" case for floating exchange rates; and Friedman's work on the role of monetary policy had the effect of helping to revive interest in optimum-currency-area analysis.

Some of the problems with the first-round optimum-currency-area models may have reflected the limited tools available to macroeconomists in the 1960s. Subsequent developments in analytical methods and empirical techniques have, along with the experience of European monetary union, contributed to a renewed interest in the subject of optimum-currency-areas. Recent empirical and theoretical work on the performance of

alternative exchange-rate regimes suggests that the particular regime that a country adopts may matter for real growth, output volatility and inflation performance. The empirical work on the performance of an alternative exchange-rate regimes suggests that the level of economic development plays a role with regards to the effects of the regime on economic growth and inflation. Yet, traditional optimum-currency-area analysis has overlooked the role of economic development as a determinant of the exchange-rate regime. The *analytic* work on exchange-rate regimes provides a framework for weighing and comparing asymmetries among (more-than-two) countries in terms of the optimum-currency-area criteria, and for specifying a welfare function containing explicit macroeconomic objectives. In our view, the use of modern analytical tools has the promise of fulfilling the unfinished agenda set-out by the original contributors to the optimum-currency-area literature, that is, providing a consistent framework in which a country's characteristics, including the level of economic development, can be used to determine its optimal exchange-rate regime.

References

- Alesina, A., Barro, R., 2001. Dollarisation. *American Economic Review* 91, 381–385.
- Barro, R., Gordon, D., 1983. Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics* 12, 101–121
- Bayoumi, T., Eichengreen, B., 1997. Ever closer to heaven? An optimum-currency-area index for European countries. *European Economic Review* 41, 761–770.
- Benigno, G., Benigno, P., 2003. Price stability in open economies. *Review of Economic Studies* 70 (4), 743–764.
- Buiter, W., 2008. Economic, political, and institutional Prerequisites for monetary union among the members of the GuldCooperation Council. *Open Economies Review* 19, 579–612.
- Buiter, W.H., 2000. Optimal currency areas: why does the exchange rate regime matter? With an application to UK membership in EMU. *Scottish Journal of Political Economy* 47 (3), 213–250.
- Canzoneri, M., Cumby, R., Diba, B., 2005. The need for international policy coordination: what's old, what's new, what is yet to come? *Journal of International Economics* 66 (2), 363–384.
- Cesarano, F., 2006. The origins of the theory of optimum currency areas. *History of Political Economy* 38 (4), 711–731.
- Corden, W.M., 1972. Monetary Integration. In: *Princeton Essays in International Finance*, vol. 93. Princeton University, International Finance Section.
- Corsetti, G., Pesenti, P., 2005. International dimensions of optimal monetary policy. *Journal of Monetary Economics* 52 (2), 281–305.
- De Cecco, M., 1974. Optimum currency areas and European monetary integration. *Journal of World Trade and Law* 8, 463–474.
- De Grauwe, P., 2007. *The Economics of Monetary Union*, seventh ed. Oxford University Press, Oxford, UK.
- De Grauwe, P., Mongelli, F.P., 2005. Endogeneities of Optimum Currency Areas: What Brings Countries Sharing a Single Currency Closer Together? *European Central Bank Working Paper Series* no. 468.
- De Haan, J., Inklaar, R., Jong-A-Pin, R., 2008. Will business cycles in the euro area converge? A critical survey of empirical research. *Journal of Economic Surveys* 22 (2), 234–273.
- Dellas, H., 2006. Monetary policy in open economies. *European Economic Review* 50 (6), 1471–1486.
- Dellas, H., Tavlas, G.S., 2005a. Mixed exchange rate systems. *Journal of International Money and Finance* 24 (2), 243–245.
- Dellas, H., Tavlas, G.S., 2005b. Wage rigidity and monetary union. *Economic Journal* 115 (506), 907–927.

- Devereux, M., Engel, C., 2003. Monetary policy in the open economy revisited: price setting and exchange-rate flexibility. *Review of Economic Studies* 70 (4), 765–783.
- Dornbusch, R., 1976. Expectations and exchange rate dynamics. *Journal of Political Economy* 84 (6), 1161–1176.
- Duarte, M., 2003. Why don't macroeconomic quantities respond to exchange rate variability? *Journal of Monetary Economics* 50 (4), 889–913.
- Eichengreen, B., 2002. International monetary options for the 21st century. *The Annals of the American Academy of Political and Social Science* 579, 11–25.
- Eichengreen, B., 1994. *International Monetary Arrangements for the 21st Century*. Brookings, Washington, D.C.
- Engel, C., Rogers, J., 2004. European product market integration after the euro. *Economic Policy*, 347–384.
- Frankel, J., Rose, A., 2002. An Estimate of the effect of currency unions on trade and income. *Quarterly Journal of Economics* 117, 437–466.
- Frankel, J., Rose, A., 1998. The endogeneity of the optimum currency area criteria. *Economic Journal* 108, 1009–1025.
- Friedman, M., April 8, 2003. Personal correspondence with George Tavlas.
- Friedman, M., 2000. Canada and flexible exchange rates. Available from: In: Bank of Canada, *Revisiting the Case for Flexible Exchange Rates* www.bankofcanada.ca/en/res/wp/2000/keynote.pdf.
- Friedman, M., 1974. Monetary policy in developing countries. In: David, P., Reder, M. (Eds.), *Nations and Households in Economic Growth*. Academic Press, New York, pp. 265–278.
- Friedman, M., 1973. *Money and Economic Development*. Praeger, New York.
- Friedman, M., 1969. Round table on exchange rate policy. *American Economic Review* 59 (2), 364–366.
- Friedman, M., 1968. The role of monetary policy. *American Economic Review* 58, 1–17.
- Friedman, M., 1966. Comments. In: Shultz, P.G., Robert, Z.A. (Eds.), *Guidelines, Informal Controls, and the Market Place: Policy Choices in a Full Employment Economy*. University of Chicago Press, Chicago, pp. 55–61.
- Friedman, M., 1958. *The Supply of Money and Changes in Prices and Output*. US. Joint Economic Committee, 85th Congress, 2nd session, *The Relations of Prices to Economic Stability and Growth, 1958*. Reprinted in Milton Friedman, (Ed.), 1969. *The Optimum Quantity of Money and Other Essays*, MacMillan, London.
- Friedman, M., 1953a. Living with the Dollar. *The Economist* 166, 16.
- Friedman, M., 1953b. The case for flexible exchange rates. In: Friedman, Milton (Ed.), *Essays in Positive Economics*. University of Chicago Press, Chicago, pp. 157–203.
- Friedman, M., 1953c. *Essays in Positive Economics*. University of Chicago Press, Chicago.

- Friedman, M., January 22, 1952a. Personal correspondence with John McDonald.
- Friedman, M., February 22, 1952b. Personal correspondence with Lionel Robbins.
- Friedman, M., 1951. Comments on monetary policy, Reprinted from: Friedman, M., (Ed.) 1953, *Essays in Positive Economics*. University of Chicago Press, Chicago, pp. 263–273. *Review of Economics and Statistics* 53, 179–200.
- Giersch, H., 1973. On the desirable degree of flexibility in exchange rates. *Weltwirtschaftliches Archiv* 109, 191–213.
- Hanke, S., 2008. Friedman: float or fix? *The Cato Journal* 28 (2), 275–285.
- Ishiyama, Y., 1975. The theory of optimum currency areas: a survey. *IMF Staff Papers* no. 22, 344–383.
- Johnson, H.G., 1969a. The case for flexible exchange rates, 1969. Federal Reserve Bank of St. Louis. *Review* 51, 12–24.
- Johnson, H.G., 1969b. Closing comment: the ‘problems’ approach to international monetary reform. In: Mundell, R.A., Swoboda, A.K. (Eds.), *Monetary Problems of the International Economy*. University of Chicago Press, Chicago, pp. 393–399.
- Kawai, M., 1992. Optimum currency areas. In: Newman, P., Milgate, M., Eatwell, J. (Eds.), *The New Palgrave Dictionary of Money and Finance*, vol. 3. MacMillan, London, pp. 78–81.
- Kenen, P.B., 1969. The theory of optimum currency areas: an eclectic view. In: Mundell, R.A., Swoboda, A.K. (Eds.), *Monetary Problems of the International Economy*. University of Chicago Press, Chicago, pp. 41–60.
- Kenen, P.B., 2002. Currency Unions and Policy Domains. In: Andrews, D.M., Henning, C.R., Pauly, L.W. (Eds.), *Governing the World’s Money*. Cornell University Press, Ithaca.
- Kenen, P., Meade, E., 2008. *Regional Monetary Integration*. Cambridge University Press, Cambridge, UK.
- Kollmann, R., 1992. *Essays on International Business Cycles*. Unpublished doctoral dissertation, University of Chicago.
- Kollmann, R., 2002. Monetary policy rules in the open economy. *Journal of Monetary Economics* 49 (5), 989–1015.
- Kroger, J., Redonnet, D., 2001. Exchange rate regimes and economic integration: the case of the accession countries. *CESiFo Forum* 2, 6–13.
- Krugman, P., 1993. Six skeptical propositions about EMU. *Greek Economic Review* 15, 93–104.
- Krugman, P., 1991. *Geography and Trade*. MIT Press, Cambridge, Mass.
- Larrain, F., Velasco, A., 2001. Exchange-Rate Policy in Emerging-Market Economies: The Case for Floating. In: *Princeton Essays in International Finance*, vol. 224. Princeton University, International Finance Section.

- Lerner, A., 1947. Discussion of international monetary policy and the search for economic stability by Ragwar Nurkse. *American Economic Review* 37, 590–594.
- McCallum, J., 1995. National borders matter: Canada-US Regional trade patterns. *American Economic Review* 52, 712–725.
- McDonald, J., February 21, 1952. Personal correspondence with Milton Friedman.
- McKinnon, R.I., 1963. Optimum currency areas. *American Economic Review* 53, 717–725.
- McKinnon, R.I., 1969. Discussion: the currency area problem. In: Mundell, R.A., Swoboda, A.K. (Eds.), *Monetary Problems of the International Economy*. University of Chicago Press, Chicago, p. 112.
- Meade, J.E., 1951. *The Balance of Payments*. Oxford University Press, London.
- Mongelli, F.P., 2002. ‘New’ Views on the Optimum Currency Area Theory: What is EMU Telling Us? European Central Bank. Working Paper no. 138.
- Mongelli, F.P., 2005. What is the European economic and monetary union telling us about optimum currency area perspectives? *Journal of Common Market Studies* 43 (3), 607–635.
- Mundell, R.A., 1961. A theory of optimum currency areas. *American Economic Review* 53, 657–665.
- Mundell, R.A., 1969. Discussion: the currency area problem. In: Mundell, R.A., Swoboda, A.K. (Eds.), *Monetary Problems of the International Economy*. University of Chicago Press, Chicago, p. 111.
- Mundell, R.A., 1997. Updating the agenda for monetary union. In: Bleijer, M., Frenkel, J., Laidermann, L., Razin, A. (Eds.), *Optimum Currency Areas: New Analytical and Policy Developments*. International Monetary Fund, Washington, D.C., pp. 29–48.
- Mundell, R.A., Swoboda, A.K. (Eds.), 1969. *Monetary Problems of the International Economy*. University of Chicago Press, Chicago.
- Obstfeld, M., Rogoff, K., 1995. Exchange rate dynamics redux. *Journal of Political Economy* 103 (3), 624–660.
- Obstfeld, M., Rogoff, K., 2000. New directions for stochastic open economy models. *Journal of International Economics* 50 (1), 117–153.
- Pappa, E., 2004. Do the ECB and the Fed really need to cooperate? Optimal monetary policy in a two-country world. *Journal of Monetary Economics* 51 (4), 753–779.
- Poole, W., 1970. Optimal choice of monetary policy instruments in a simple stochastic macro model. *Quarterly Journal of Economics* 85.
- Robbins, L., February 5, 1952. Personal correspondence with Milton Friedman.
- Rose, A., 2008. EMU, trade and business cycle synchronization: what do we know? Unpublished memo, University of California at Berkeley.
- Rose, A., 2002. One Money, One Market: Estimating the Effects of Common Currencies on Trade. *Economic Policy* 30, 9–45.

Scitovsky, T., 1958. *Economic Theory and Western European Integration*. Allen & Unwin, London.

Shultz, G.P., Aliber, R.Z., 1966. *Guidelines, Informal Controls, and the Market Place: Policy Choices in a Full Employment Economy*. University of Chicago Press, Chicago.

Skudenly, F., 2003. *Exchange-rate uncertainty and trade: a survey*. Katholieke Universiteit Leuven, Unpublished work.

Stockman, A.C., 1999. Choosing an exchange-rate system. *Journal of Banking and Finance* 23, 1483–1498.

Stockman, A., Ohanian, L., 1997. Short run independence of monetary policy under pegged exchange rates and the effects of money on exchange rates and interest rates. *Journal of Money, Credit and Banking* 29 (4), 780–806.

Tavlas, G.S., 1993. The ‘new’ theory of optimum currency areas. *The World Economy* 16, 537–554.

Tavlas, G.S., Dellas, H., Stockman, A., 2008. The classification and performance of alternative exchange-rate systems. *European Economic Review* 52, 941–963.

BANK OF GREECE WORKING PAPERS

76. Kossev, K. D., “The Banking Sector and the Great Depression in Bulgaria, 1924-1938: Interlocking and Financial Sector Profitability”, June 2008.
77. Buyst, E. and I. Maes, “The Regulation and Supervision of the Belgian Financial System (1830-2005)”, June 2008.
78. Barisitz, S., “Banking Transformation (1989-2006) in Central and Eastern Europe – with Special Reference to Balkans”, June 2008.
79. Lazarević, Ž., “Banking Performance in South-Eastern Europe during the Interwar Period”, July 2008.
80. Apostolides, A., “How Similar to South-Eastern Europe were the Islands of Cyprus and Malta in terms of Agricultural Output and Credit? Evidence during the Interwar Period”, July 2008.
81. Avramov, R. and D. Gnjatović, “Stabilization Policies in Bulgaria and Yugoslavia during Communism’s Terminal Years: 1980s Economic Visions in Retrospect”, July 2008.
82. Nenovsky, N., M. Ivanov and G. Mihaylova, “The Evolution of Bulgarian Banks’ Efficiency during the Twenties: A DEA Approach”, July 2008.
83. Görmez, Y., “Banking in Turkey: History and Evolution ”, July 2008.
84. Ceca, K., K. Rexha and E. Orhan, “Banking and Finance in South-Eastern Europe: The Albanian Case”, July 2008.
85. Bordo, M., “Growing up to Financial Stability”, July 2008.
86. Lazaretou, S., “Banking and Central Banking in Pre-WWII Greece: Money and Currency Developments”, July 2008.
87. Sojic, M. and L. Djurdjevic, “Monetary Policy Objectives and Instruments Used by the Privileged National Bank of the Kingdom of Serbia (1884-1914)”, July 2008.
88. Stoenescu, G.V., E. Blejan, B. Costache and A. I. Aloman, “The National Bank of Romania and its Issue of Banknotes between Necessity and Possibility, 1880-1914”, July 2008.
89. Masciandaro, D. and M. Quintyn, “Institutions Matter: Financial Supervision Architecture, Central Bank and Path Dependence. General Trends and the South Eastern European Countries”, September 2008.

90. Tavlas, G., H. Dellas and A. Stockman, "The Classification and Performance of Alternative Exchange-Rate Systems", September 2008.
91. Milionis, A. E. and E. Papanagiotou, "A Note on the Use of Moving Average Trading Rules to Test for Weak Form Efficiency in Capital Markets", October 2008.
92. Athanasoglou, P.P. E. A. Georgiou and C. C. Staikouras, "Assessing Output and Productivity Growth in the Banking Industry", November 2008.
93. Brissimis, S. N. and M. D. Delis, "Bank-Level Estimates of Market Power", January 2009.
94. Members of the SEEMHN Data Collection Task Force with a Foreword by Michael Bordo and an introduction by Matthias Morys, "Monetary Time Series of Southeastern Europe from 1870s to 1914", February 2009.
95. Chronis, P., "Modeling Distortionary Taxation", March 2009.
96. Hondroyiannis, G., "Fertility Determinants and Economic Uncertainty: An Assessment using European Panel Data", April 2009
97. Papageorgiou, D., "Macroeconomic Implications of Alternative Tax Regimes: The Case of Greece", May 2009.
98. Zombanakis, G. A., C. Stylianou and A. S. Andreou, "The Greek Current Account Deficit: Is It Sustainable After All?", June 2009.
99. Sideris, D., "Optimum Currency Areas, Structural Changes and the Endogeneity of the OCA Criteria: Evidence from Six New EU Member States", July 2009.
100. Asimakopoulos, I. and P. Athanasoglou, "Revisiting the Merger and Acquisition Performance of European Banks", August 2009.
101. Brissimis, N. S. and D. M. Delis, 'Bank Heterogeneity and Monetary Policy Transmission', August 2009.