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TO JOIN OR NOT TO JOIN A CURRENCY UNION? THE CASE OF ISRAEL

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להצטרף או לא להצטרף לגוש מטבע? המקרה הישראלי

תקציר

עבודה זו אומדת בצורה כמותית את היתרונות והחסרונות הגלומים במהלך אפשרי של ויתור על השקל הישראלי והצטרפות לגוש הדולר או לגוש האירו. מצד החסרונות מוצגת סקירה ספרותית של תיאוריית OCA, שעל פיה המצאות שוקים אסימטריים בין הכלכלות החברות בגוש עשויה להוות בעיה בשל חוסר היכולת להפעיל מדיניות מוניטרית שונה לכל מדינה. תיאוריה זו מיושמת בעבודה באמצעות שימוש בטכניקה האקונומטרית של Blanchard and Quah (1989), ומוצאת מתאם נמוך בין הכלכלה הישראלית לאירופאית, אולם מתאם דומה קיים בתוך גוש האירו עצמו. מתאם גבוה במעט קיים בין כלכלת ישראל לכלכלת ארה"ב. מצד היתרונות מוצגת העבודה One Market, One Money (1992) אשר בדקה את החיסכון הצפוי עקב ביטול עלויות המרת המטבע במדינות גוש האירו. טכניקה דומה מיושמת למקרה הישראלי ומוצאת שהחיסכון כתוצאה מהצטרפות לגוש הדולר נמוך למדי, ובהצטרפות לגוש האירו החיסכון יהיה זניח. ממצאים אלו מצביעים על אפשרות להטייה כלפי מעלה בתוצאות של One Market, One Money.

TO JOIN OR NOT TO JOIN A CURRENCY UNION? THE CASE OF ISRAEL

Yoav Soffer*

The paper quantitatively estimates the advantages and disadvantages for Israel in abandoning the shekel and joining either the dollar or euro block. As to the disadvantages, I present a review of OCA theory, according to which the presence of asymmetric shocks between the members of a currency union could cause difficulties due to the inability to apply differential monetary policies. This theory is implemented in the paper using the econometric technique developed by Blanchard and Quah (1989). I find a low correlation between the Israeli and European economies, although a similar correlation also exists among euro zone countries themselves. A somewhat higher correlation was recorded between Israel and the U.S. As to advantages, we follow the methodology of the "One Market One Money" (1992) study, and assess the potential savings which Israel could reap by abolishing currency exchange costs. Savings due to joining the dollar are fairly small, whereas in the case of joining the euro they are negligible, suggesting a possible upward bias that might exist in the "One Market One Money" estimates.

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1: Introduction

On January 1, 2002, 12 members of the European Union took the final step of their lengthy process of economic and monetary integration, and launched their common currency, the euro. Although not unique (other currency unions exist in the world; for example, the CFA franc zone in Africa and the ECCA dollar in the Caribbean), the European act naturally gained significant attention among the economic community. Surprisingly, it did not arouse a significant discussion in the academic and professional community in Israel, a discussion which would try to assess the feasibility of attempting to join the new monetary entity that was created during the 1990's not far from us. The lack of such a discussion[1] might be from political motives recognizing a low probability of the EMU (Economic and Monetary Union) being ready to accept Israel as a member. However, other alternatives do exist: theoretically, Israel could convert its currency to the euro unilaterally, or more politically realistic, converting its currency into the U.S dollar. This paper will try to shed light empirically on two different aspects of these alternatives, and determine whether Israel might gain from giving up the New Israeli Shekel and joining either one of these major currencies.

This paper intentionally does not go into the political aspects relating to the dilemma of joining a currency union; those might better be dealt with by a political scientist. I am therefore not concerned at this point in determining whether or not the EMU or the United States would support Israel in adopting their currencies or not. Moreover, the EMU (as well as the United States) is more than just a currency union: It is part of a much broader political and economic union. This paper does not consider all aspects of the economic and political union, and deals solely with the question of sharing the same currency.

The question of giving up one's own currency and joining another is a very broad one, and contains implications from almost every field of the science of economics. Section two of this paper lays out a theoretical review of the implications: The macroeconomic implications, most of them covered by the Theory of Optimum

[1] A thorough search in the literature resulted in only two relevant papers: Shiffer (2001) and Melnick (2003).

Currency Areas (OCA), as well as the microeconomic implications, relating mainly to the trade advantages that joining a foreign currency may create. The arguments brought up in this section are more thoroughly dealt with in Soffer (2003). Section three empirically assesses the macroeconomic aspects described in section two, using the Blanchard and Quah (1989) SVAR technique as it was used by Bayoumi and Eichengreen on several occasions.[2] Section four shows a calculation of the potential savings due to abolishing conversion costs. Section five concludes. A technical appendix describes the Blanchard and Quah (1989) technique.

2: Theoretical Review.

The Theory of Optimum Currency Areas[3] was originally laid out in three seminal papers written in the 1960's. Mundell (1961) shows a simple model of two countries, originally in full employment and balance of payments equilibrium, which are struck by an asymmetric shock: The world demand for the products of one country decreases while the demand for the products of the other increases. If wages are sticky in both countries, the first country enters a state of un employment and balance of payments deficit while the other experiences inflation and surplus. Devaluation in the exchange rate of the deficit country's currency against that of the surplus country could bring both countries back to a state of full employment and equilibrium in balance of payments, with an increase in the purchasing power of the surplus country. If prices are sticky, fixing the nominal exchange rate (for example by establishing a currency union) would prevent real exchange rate alignments.

Mundell therefore defines the optimum currency area as an area in which labor is freely mobile, and therefore exchange rate realignments are not necessary. His criterion was later augmented, stating that two countries constitute an optimum currency area if the shocks hitting their economies are highly correlated, or *symmetric*. Mckinnon (1963) discusses the openness of the economy, claiming that if a large share of the economy's consumption is made up of tradable goods, than devaluation of the domestic currency would be followed by domestic prices rising.

[2] For example Bayoumi (1992), Bayoumi and Eichengreen (1993, 1994).
[3] For an excellent review of OCA theory and a critique see DeGrauwe (1994).

Mundell's devaluation would than be more nominal than real (or only nominal in the extreme case) and would therefore not return the economies to the desired equilibrium. Kenen (1969) centered mainly on the structure of the economy, claiming that a diversified industrial structure would prevent the whole economy from being hit by a specific shock and therefore minimize the damage that such shocks may create under a fixed exchange rate regime. Moreover, if factors are mobile among industries in the country, realignment of the exchange rate may not be necessary as realignment in production could take its place.

OCA theory is far from being uncontroversial. The first signs of critique lay in the theory itself, pointing out that nominal devaluation is not necessarily followed by a real one. Later studies have emphasized that point.[4] Another critique concerns "The Endogeneity of the Optimum Currency Area Criteria"[5]. According to this argument, OCA criteria are endogenous to the choice of exchange rate regime: A currency union that will boost bilateral trade would tie the trading economies together, and therefore will increase correlation among their business cycles. Alternatively, if trade is by nature more inter-industry than intra-industry, it would lead to increased specialization of each economy in the specific goods which it produces with comparative advantage, and therefore reduce business cycles correlation over time. Frankel and Rose (1998), however, empirically rule out this option using a sample of 21 industrial countries over 34 years.

In the face of such critiques and others, "The Theory of Optimum Currency Areas remains the workhorse for analyses of … monetary unification" (Bayoumi and Eichengreen, (1997)) and will be used in this paper to help assess the costs of joining a currency union in the Israeli case. However, there are other macroeconomic implications to monetary unification; one of them regards the inflationary bias resulting from discretional monetary policy, a' la Barro and Gordon (1983). De Grauwe (1994) shows a simple version of the Barro-Gordon model for two countries, claiming that if one country's authorities attach more importance to fighting un employment than to fighting inflation, then that country would in the long-run show an inflationary bias with no achievements whatsoever in decreasing un employment.

[4] For example Buiter (2000), DeGrauwe (1994).
[5] Title of the paper by Frankel and Rose (1998).

If there is a potential monetary anchor, i.e., a country whose authorities have a reputation for being concerned more about inflation than about un employment, the long-run equilibrium of that country would result in lower inflation than that of the first country. The un employment-averse country could gain from giving up its monetary independence and adopting the currency of the inflation-averse country, as it would enjoy the lower inflation of the anchor and would suffer no losses regarding un employment in the long-run.

Anti-inflationary reputation is not the main reason for a country to give up its currency and adopt another. Frankel and Rose (2000), in fact, claim to show empirically that the only effect of joining a currency union on an economy is created through the channel of boosting international trade. Mundell (1961) quotes John Stuart Mill (1848) as probably the first economist to claim that the need to use several currencies depresses international trade. Mill describes the choice of countries to use their own currency as "barbaric" and inconvenient for the countries themselves, as well as for their neighbors.

Monetary union affects international trade and investments in numerous ways. First, it cancels the need for exchanging currencies, a requirement which entails costs. Second, it abolishes the risk concerned with nominal exchange rate volatility, and therefore makes international trade and investments less dangerous and more attractive. Third, the use of a single unit of account increases economic efficiency and prevents price discriminations between countries. Some empirical works shed light on these effects: Emerson *et al*. (1992) estimated the potential savings that the European Community would reap from not having to convert currencies among community members to be somewhere between 0.3-0.4 percent of the community's GDP.[6] Several studies by Frankel, Rose and others[7] estimated the effect of a common currency on trade, reaching an extraordinary finding that trade among two countries sharing the

[6] This paper will argue that Emerson's estimation is less valid today as technological improvements and increased competition in the foreign exchange markets have made costs lower than those estimated by Emerson *et al*.
[7] For example Rose (2000), Rose and van Wincoop (2001), Frankel and Rose (2000).

same currency is three times larger than among countries that do not share currencies.[8]

In combination, joining another country's currency has many effects on the economy, though estimating and comparing the advantages and disadvantages of such a move is very difficult, perhaps even impossible. Krugman (1990) describes the difficulties bluntly but accurately, by saying that "the best defense I can offer is that monetary union is inherently a messy subject, and that becoming aware of that inherent messiness is the first part of wisdom in this field". However, many empirical studies[9] have tried to estimate at least some aspects of those pros and cons for different countries and regions. In the following parts of this paper such an estimation for the Israeli case is carried out.

3: Optimum Currency Area Analysis

3.1 introduction

The empirical literature on optimum currency areas has used different statistical approaches trying to estimate the extent of asymmetric shocks among the economies of candidate countries. The Structural Vector Auto Regression (SVAR) approach was first introduced to this literature by Bayoumi (1992), and later implemented in several studies by Bayoumi and Eichengreen[10] as well as others. It is now very widespread in the literature. The approach is based on the econometric procedure introduced by Blanchard and Quah (1989), and stands out for its ability to separately identify shocks hitting the economy as demand and supply shocks.

When one examines the co-movement of macroeconomic aggregates such as GDP, inflation, un employment etc., one is actually examining variables which are sensitive to shocks hitting the economy, but not necessarily measuring the shocks themselves. Let us assume, for example, that Michigan and Germany are hit by the same worldwide shock: a global decrease in the demand for automobiles. Michigan could enjoy federal fiscal transfers from the U.S government which could prevent output from decreasing, where as Germany, standing on its own, would not enjoy such aid

[8] Later findings were more moderate. Micco *et al*. review those findings, and estimate that the effect of EMU on trade is about **4-26%**, using pre-EMU compared to post-EMU data.
[9] A survey of empirical literature is given in Soffer (2003).
[10] See Footnote 1.

and would suffer greater depression than Michigan. Measuring macroeconomic aggregates rather than shocks, we would conclude that Michigan and Germany have experienced an asymmetric shock, although this is not the case. Furthermore: a measured change in output of one country, for example, could be the result of a demand shock induced by local monetary policy. When assessing the sustainability of a common currency, we would prefer to isolate such endogenous shocks from exogenous shocks, which are bound to exist also after monetary unification. The framework offered by Bayoumi and Eichengreen does exactly that.

3.2 Methodology

The theoretical framework is described by the standard macroeconomic AD-AS model,[11] which assumes that prices and wages are flexible in the long-run, and so the long-run equilibrium is always achieved with output at its potential level. A demand shock, resulting, for example, from monetary or fiscal expansion, raises the AD curve and increases output (above the potential level) and prices in the short-run. In the long-run, however, prices and wages are adjusted upwards to divert the AS curve so that the new equilibrium is achieved at a higher price level, but output is back to its potential level. A supply shock, resulting, for example, from a technological improvement, termination of a war situation, etc, shifts the AS curve and the potential level of output to the right, increasing output but decreasing prices in the short-run. In the long-run, prices and wages are adjusted downwards, further diverting the AS curve to the right. The long-run equilibrium is at a higher level of (potential) output and a lower level of prices. From this description, we can state the following results:

Result 1: *A demand shock has no effect on output in the long-run. A positive (negative) demand shock will increase (decrease) the price level in the long-run.*

Result 2: *A positive (negative) supply shock increases (decreases) output and decreases (increases) the price level in the long-run.*

The econometric model estimates the simultaneous and the lagged effect of the change in (the logarithm of) output (y) and the change in (the logarithm of) the price level (p) on each other, using a bivariate VAR that can be presented as follows[12]:

[11] For a full graphic description of the model see Soffer (2003).

[12] The mathematical representation follows Enders (1995). For simplicity, the VAR presented here is of first order, but the conclusions are valid for any order selected.

$$y_t = b_{10} - b_{12}p_t + \gamma_{11}y_{t-1} + \gamma_{12}p_{t-1} + \varepsilon_{yt} \quad (1)$$

$$p_t = b_{20} - b_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}p_{t-1} + \varepsilon_{pt} \quad (2)$$

where ε_{yt} and ε_{pt} are uncorrelated white noise disturbances. This system cannot be estimated in its *structural form*, as it is presented here, due to contemporaneous correlation between independent variables and disturbances. For example, note that p_t contemporaneously affects y_t through the coefficient $-b_{12}$, and is contemporaneously affected by the disturbance ε_{pt}. If so, $\varepsilon_{pt,}$ the disturbance in equation 2, has a contemporaneous effect on y_t, which is an independent variable in the same equation. However, the system can be presented in matrix form:

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix}\begin{bmatrix} y_t \\ p_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix}\begin{bmatrix} y_{t-1} \\ p_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{pt} \end{bmatrix} \quad (3)$$

Or:

$$Bx_t = \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t \quad (4)$$

Where:

$$B = \begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \quad x_t = \begin{bmatrix} y_t \\ p_t \end{bmatrix} \quad \Gamma_0 = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} \quad \Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \quad \varepsilon_t = \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{pt} \end{bmatrix}$$

Multiplying equation 4 by the matrix B^{-1} results in:

$$x_t = A_0 + A_1 x_{t-1} + e_t \quad (5)$$

Where:

$$A_0 = B^{-1}\Gamma_0 \quad A_1 = B^{-1}\Gamma_1 \quad e_t = B^{-1}\varepsilon_t$$

This is the *reduced form*, which can also be presented as follows:

$$y_t = a_{10} + a_{11}y_{t-1} + a_{12}p_{t-1} + e_{1t} \quad (6)$$

$$p_t = a_{20} + a_{21}y_{t-1} + a_{22}p_{t-1} + e_{2t} \quad (7)$$

It can easily be observed that the contemporaneous correlations that were bothering us in the structural form do not exist in the reduced form, and therefore it can be estimated simply as two separate OLS equations. The disturbance vector e_t can also be calculated from the estimation. However, additional restrictions are needed in order to recover the structural parameters, and specifically the disturbance vector ε_t,

from the estimated variables of the reduced form.[13] A very common identification method is *The Choleski Decomposition*, which restricts all elements under the main diagonal of the B matrix to be zero.[14] However, this decomposition is usually arbitrary, and does not result from economic theory. Blanchard and Quah's (1989) procedure imposes restrictions that result from economic theory.

According to Blanchard and Quah, the structural VAR (SVAR) model can be obtained if there is a theoretical reason to assume that one of the disturbances in the system has no long-run cumulative effect on one of the dependent variables. The approach does not relate the disturbances directly to the dependent variables as they appear in equations 1 and 2, rather they are considered to be "exogenous shocks" to the economy: A supply (or long-run) shock and a demand (or short-run) shock. Bayoumi and Eichengreen's approach which is presented here, classifies the shocks according to the AD-AS model, thus restricting the system so that a demand shock has no long-run effect on output, according to above proposition 1. Blanchard and Quah show that this restriction is sufficient for full identification of the model (see Appendix).

3.3 Some Empirical Examples.

Bayoumi and Eichengreen (1993) were the first to use this technique in order to determine weather the European Union members are an optimum currency area. They separately calculated the correlation between supply shocks among the different countries and between demand shocks among the countries, and they attach more importance to the supply shocks' correlation, because these shocks are bound to exist after monetary unification as well, whereas demand shocks might be endogenous to monetary policy. In other words, the higher the correlation between the supply shocks of two countries, the more chance there is for these countries to be an optimum currency area. They also applied a useful method to assure that the econometric model does indeed identify the theoretical model adequately. They plotted the accumulative

[13] There are more structural parameters to recover than equations tying the structural parameters and the reduced form parameters. Specifically, in this bivariate first order example there are ten variables to recover with only nine equations to use.

[14] In this bivariate example, it specifically means that y_t has no contemporaneous effect on p_t, or $b_{21}=0$.

impulse response functions (IRF) of each shock to each variable. The IRF's always show no long-run effect of demand shocks on output, as this is restricted in the estimation. However, the long-run effects of supply shocks on output and of supply and demand shocks on prices are free to vary. If the long-run effects estimated in the system show that supply shocks increase output and decrease the price level while demand shocks increase the price level, this is an indication of a suitable econometric identification of the theoretical framework.

The authors used annual data of 11 European countries, 11 other OECD members, and 8 statistical regions of the United States. Out of the thirty regressions, only three did not follow the patterns of the long-run IRF's expected according to theory, a fact which the authors consider as testifying to the appropriateness of the technique. The results show a core of European countries[15] (supply shocks correlation of over 0.5) centered on Germany, which was considered the heart of the future European currency. Other periphery countries scored a correlation of 0.3 or lower, and some even negative. The core regions of the United States (around the mid-east) had correlations ranging between 0.5-0.82, with periphery correlations as low as in Europe.

Bayoumi and Eichengreen repeated this analysis several times. In 1994 they examined the validity of a North American currency union consisting of the United States, Canada and Mexico. Compared to the European results, the United States and Canada are an optimum currency area, but Mexico has very low correlations with both countries. In the Israeli context it is important to mention Arnon and Spivak (1996), who applied the technique for Israel, Jordan, and the Palestinian Territories (West Bank and Gaza Strip, separately). Long-run shocks show a very high correlation (0.89 and over) between Israel and the Territories, while correlation with Jordan is very low.

There are also many recent examples in the empirical literature. One of them, Ng (2002), examines the feasibility of a currency union among ASEAN countries.[16] Ng estimated a model which is a little more sophisticated, as it includes a third variable-

[15] France, Holland, Denmark and Belgium.
[16] Indonesia, Malaysia, Philippines, Singapore and Thailand.

the world output- and assumes, besides the regular AD-AS restriction, two other restrictions: that local demand and local supply shocks have no long-run effect on world output. The model was also estimated for 15 EU countries and the three members of NAFTA. NAFTA countries score the highest average supply correlation (0.36) while ASEAN countries are not far behind (0.31). However the EU seems highly inadequate as an optimum currency area, with an average correlation of only 0.07 for supply shocks. Another example for newer and more sophisticated models is that of Fielding and Shields (2001), who estimated a four variable system[17] for the CFA franc zone in Africa.

3.4 Data

As mentioned earlier, most examples in the literature use annual data. The Israeli case is problematic in this sense, due to the severe fluctuations the Israeli economy experienced during the 1970's and the 1980's, which took the form of very high and unstable inflation rates. The hypothesis of unit root in the inflation series is therefore not rejected by the statistical tests. I therefore use a sample beginning after the successful stabilization program of 1985. Data is quarterly (1986:1-2002:2) in order to maximize the degrees of freedom of the model. Real GDP and GDP deflator series for Israel, the United States and the euro block were obtained from the IFS. However, quarterly data were not available for Ireland, Greece and Luxemburg, and these were dropped from the analysis. I calculated the difference of the logarithms of the data, to obtain real GDP growth rate and the inflation rate of the GDP deflator.

Data must be in stationary form in order to be used in the VAR analysis. I therefore conducted an ADF test for each series, with the optimal number of lags to be tested determined by the Schwartz Information Criterion (SIC) criterion. If the test rejected the hypothesis of no (second order) serial correlation in the residuals of the regression using Breusch-Godfrey Lagrange Multiplier (LM) test, additional lags were added to the ADF test, until the hypothesis was not rejected at a significance level of at least 10%. In the case of inflation in Holland, adding lags did not prevent serial correlation, and therefore a Phillips Perron (PP) test was used. In all cases the test was conducted with an intercept, and in the cases marked with a "t" a time trend was added. Results

[17] Output, money stock, price level and price level in France.

are given in Table 1. It can be observed that except for the inflation rate in Austria, all series reject the hypothesis of a unit root at significance levels of at least 7.5%. Austria was removed from the sample.

Table 1: Results of unit root tests

	GDP GROWTH		INFLATION	
	ADF Significance Level	Lag length	ADF Significance Level	Lag length
Austria	0.0476	3	0.2562	3
Belgium	0.0000	2	0.0011	1
Finland	0.0000	2	0.0653 t	5
France	0.0700	3	0.0000	0
Germany*	0.0000	0	0.0000	0
Holland**	0.0002	0	0.0000	---
Italy	0.0000	0	0.0043	0
Israel	0.0000	1	0.0202 t	5
Portugal	0.0472	3	0.0111	2
Spain	0.0750	1	0.0000	0
USA	0.0000	0	0.0028 t	1

* In the first quarter of 1991 an unusual increase in German inflation was recorded, apparently as a result of East and West German unification. The test was conducted ignoring this observation, and the VAR for Germany was estimated with a dummy for this observation

** PP test for inflation; see text.

Since data is quarterly, each VAR was estimated with a dummy for the first three quarters. Systems in which one of the variables was trend stationary were estimated with a time trend. The optimal number of lags for each VAR was determined using the Akaike Information Criterion (AIC); however, if a VAR did not reject the hypothesis of serially correlated residuals, lags were added until the hypothesis could be rejected. Each VAR therefore has a different lag length and different number of observations. This approach was taken in order to best specify the model for each country.[18] Table 2 summarizes the number of lags and observations in each VAR:

[18] Estimating all systems with the same number of lags did not vary the results significantly.

Table 2: Number of lags and observations in each estimated VAR.

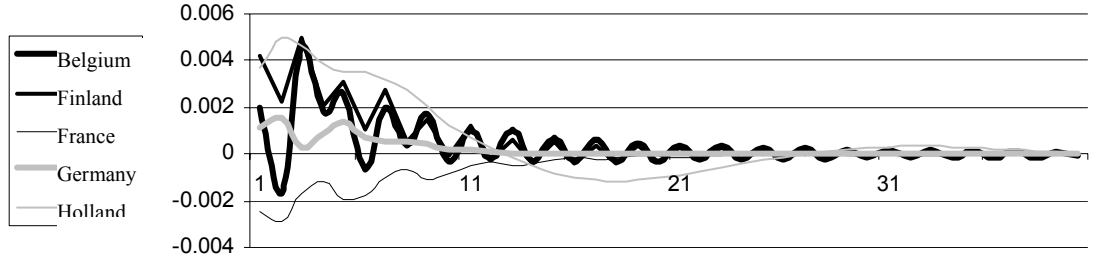
Country	Lags	Observations	Country	Lags	Observations
Belgium	4	61	Israel	2	63
Finland	4	61	Italy	2	63
France	4	61	Portugal	5	60
Germany	6	59	Spain	4	61
Holland	6	59	USA	4	61

3.5 Results

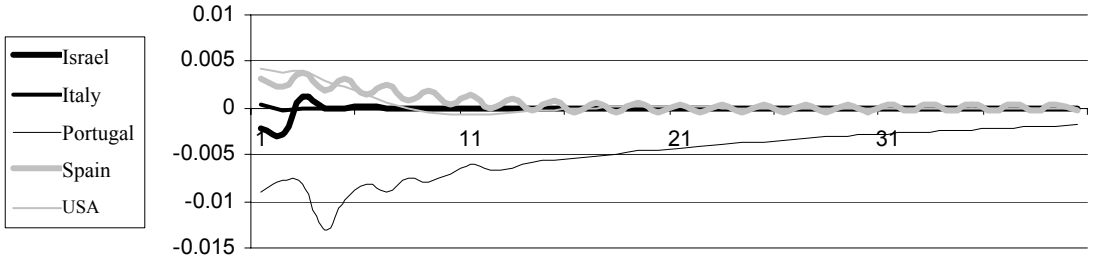
After estimating the VARs, I applied the long-run restriction, according to which demand shocks have no long-run accumulative effect on output. Figures 1-4 present the accumulative impulse response functions of a one standard deviation supply and demand shock on output and prices. As mentioned earlier, the assumptions derived from the AD-AS model are that a demand shock has a positive accumulative effect on prices in the long-run, while a supply shock has a positive long-run effect on output and a negative long-run effect on prices. [19] It can be observed that in 25 out of 30 cases, the results are compatible with these assumptions.

Figure 1: Demand shock effect on output

(a)



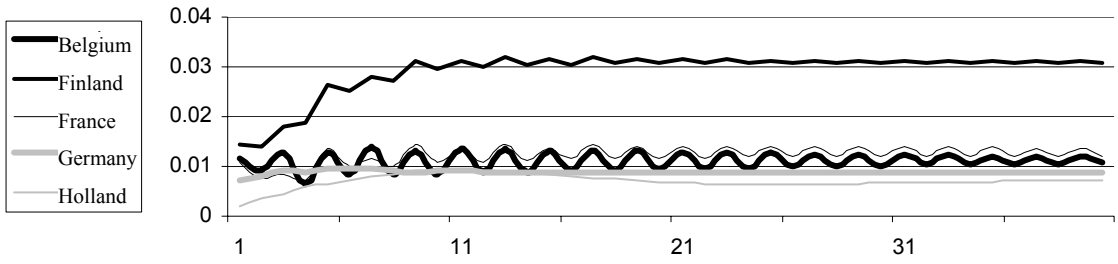
(b)



[19] The assumption that a demand shock has a positive long-run effect on output is restricted into the model and therefore necessarily results from the estimation.

Figure 2: Supply shock effect on output.

(a)



(b)

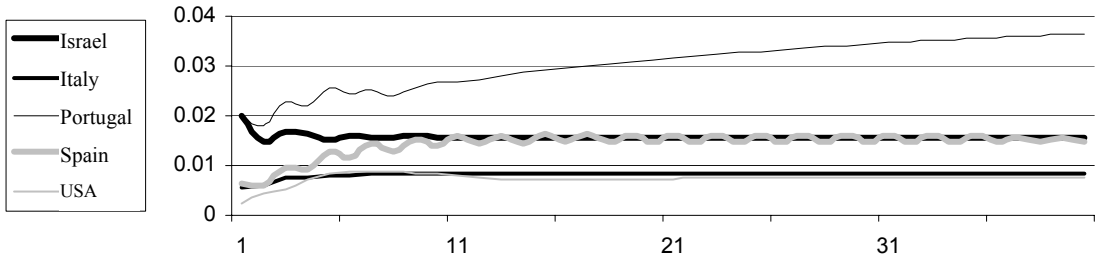
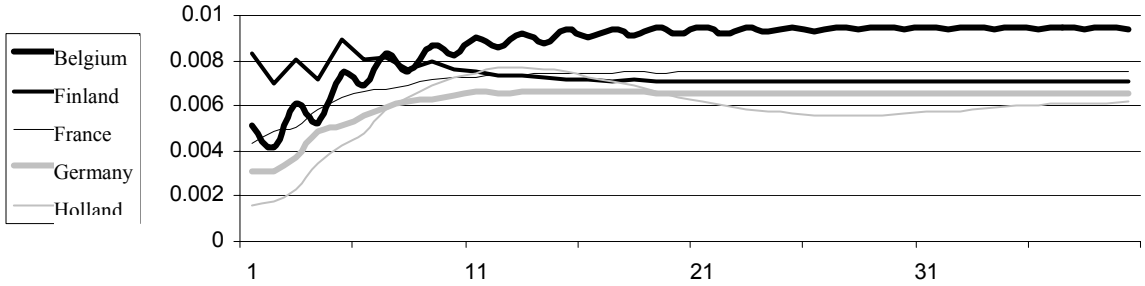


Figure 3: Demand shock effect on prices

(a)



(b)

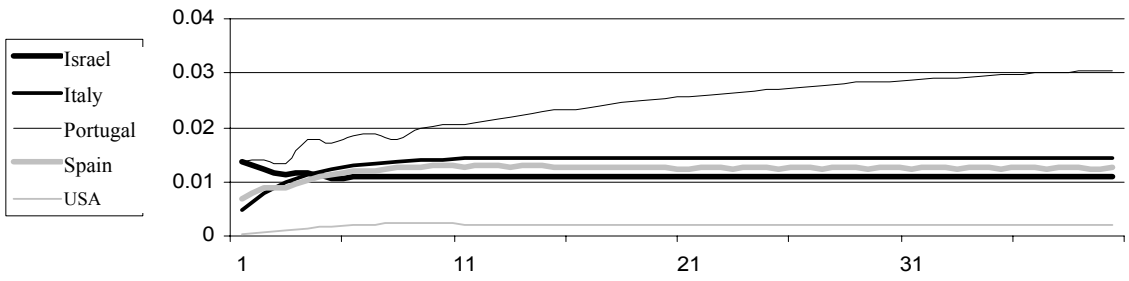
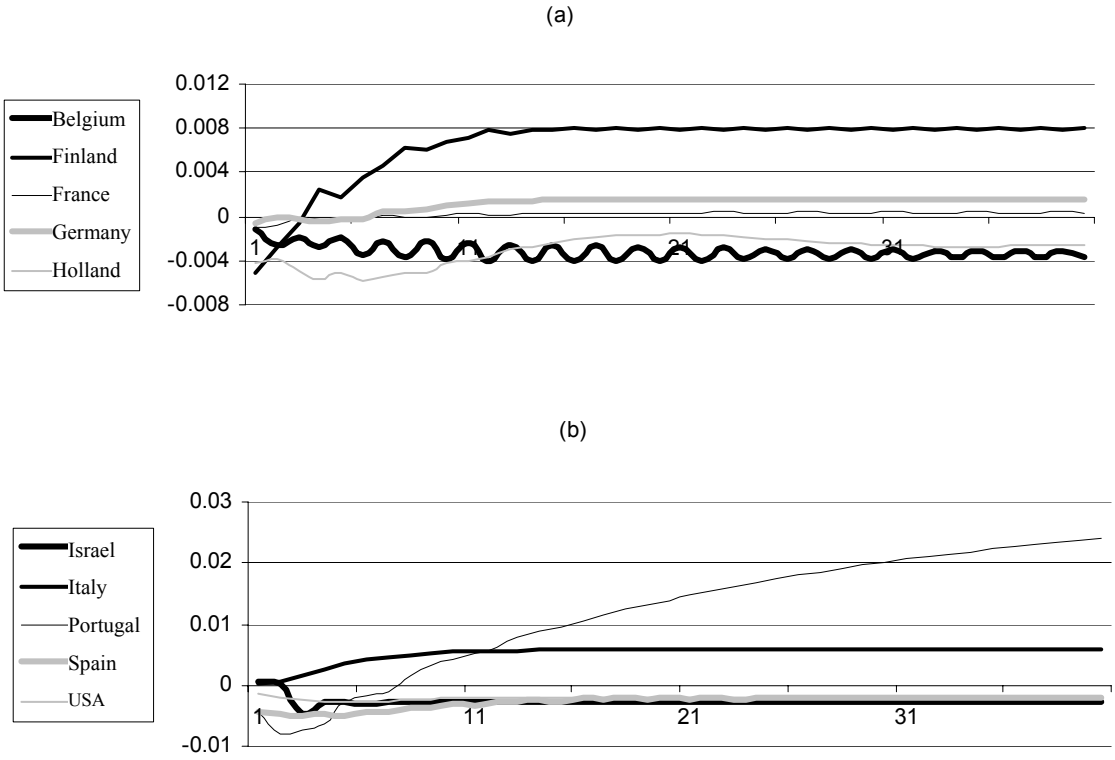


Figure 4: Supply shock effect on prices



It is also interesting to see how well the analysis actually identifies demand and supply shocks in the economy. Naturally, I chose to address this question using the shocks estimated in the VAR of the Israeli economy, reported in figures 5-6.

Figure 5: Demand shocks in Israel, 1986:3-2002:2

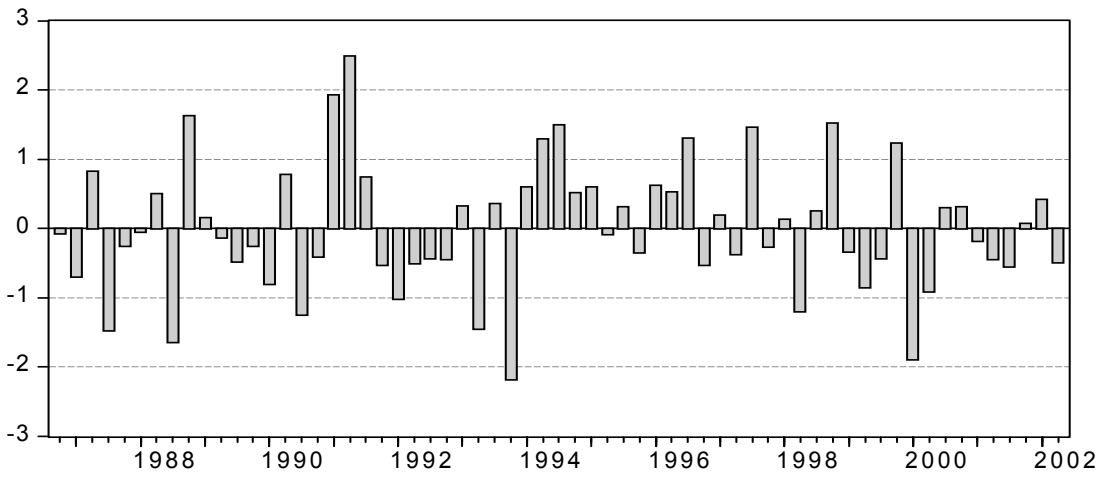
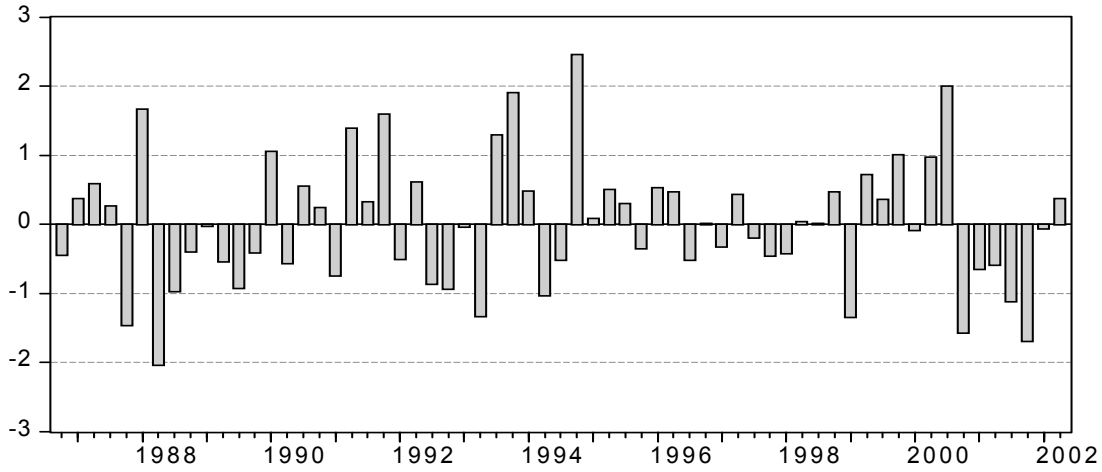


Figure 6: Supply shocks in Israel, 1986:3-2002:2



The demand shocks (Figure 5) identify the start of the major immigration wave from the former Soviet Union to Israel at the end of 1990 and beginning of 1991, which created substantial demand for investments, mainly in the housing sector. In 1993 negative shocks are observed, which could be attributed to the spillover created in the market due to excess supply of housing, and the rise of the Rabin administration which cut back on investments in the occupied territories. In 1994 expansionary wage contracts were signed in the public sector, and those appear as positive shocks in that year, together with the increase in demand for productive investments following the Oslo agreements. The "Oslo effect" continues to be observed during 1996-1998, while on the other hand the contractionary monetary policy of the Bank of Israel is showing signs of negative demand shocks during 1998-2000.

Supply shocks (Figure 6) also identify the start of the immigration wave during 1990-1991, which, on the supply side, brought about a substantial increase in the labor force. The Oslo agreements also seem to be reflected as positive supply shocks, probably due to the opening of new markets to the Israeli economy and the optimistic expectations of the markets. The monetary crisis of 1998, which took the form of a severe devaluation of the shekel and increased uncertainty in the context of financial crises in several emerging markets, appears as a negative shock in the first quarter of 1999. The hi-tech boom takes the form of several positive shocks during 1999 and 2000, whereas the bursting of the hi-tech bubble, together, of course, with the

deteriorating security situation, is well reflected in the results of the end of 2000 and all of 2001.

We now come to the main result of this chapter: the correlation coefficients between the shocks of the Israeli, European, and U.S economies. Tables 3 and 4 present the correlations of supply and demand shocks, respectively. The reader may note that correlations are very low and suffer low significance[20]. Bayoumi and Eichengreen's analyses usually show higher correlations among EU countries. It is therefore possible that integration among EU countries has decreased correlations among the economies, as predicted by Kenen (1969). Another possible explanation for the low correlations in this paper is the use of quarterly data, whereas most other studies that used the Blanchard and Quah SVAR used annual data.[21]

Table 3: Correlations among supply shocks.

	Belgium	Finland	France	Germany	Holland	**Israel**	Italy	Portugal	Spain	USA
Belgium	1									
Finland	0.052	1								
France	0.462*	0.273*	1							
Germany	0.411*	0.179	0.124	1				Europe	average	0.169
Holland	0.199	0.137	0.146	0.294*	1					
Israel	0.037	-0.024	0.065	0.060	-0.105	1				
Italy	0.282*	0.265*	0.425*	0.012	-0.002	0.052	1			
Portugal	-0.006	0.074	0.203	0.040	0.050	0.115	0.075	1		
Spain	0.411*	-0.116	0.385*	-0.010	0.050	0.051	0.153	0.176	1	
USA	0.041	0.175	0.052	0.014	-0.064	**0.175**	-0.056	0.166	0.275*	1
Average with Europe	0.259	0.109	0.288	0.150	0.125	**0.032**	0.173	0.087	0.150	0.075

* Significant at 5% level ** Significant at 10% level

Analyzing the results concerning the supply shocks confirms the findings of other studies, of the existence of a core of European countries, including Germany, France, Belgium, and according to my results also Italy. Results concerning the demand shocks are not as strong, however they also point to a core including Germany and France.

[20] The statistic for the significance of the correlation coefficient is 0.5ln[(1+r)/(1-r)], and it is normally distributed with variance 1/(T-3), where T is sample size and r is the calculated correlation. See Kendal and Stuart (1973), 292-293

[21] Bayoumi (1992) used quarterly data, and his correlations are also somewhat lower than in other similar studies.

Table 4: Correlations among demand shocks

	Belgium	Finland	France	Germany	Holland	Israel	Italy	Portugal	Spain	USA
Belgium	1									
Finland	0.051	1								
France	0.252*	0.081	1							
Germany	0.087	0.112	0.076	1				Europe	average	0.082
Holland	-0.132	0.030	0.047	0.009	1					
Israel	0.043	0.044	0.118	0.026	0.130	1				
Italy	-0.192	0.307*	0.085	0.285*	0.136	-0.037	1			
Portugal	0.211**	-0.236	0.190	0.243**	-0.035	-0.108	-0.105	1		
Spain	0.156	0.252*	0.138	0.173	-0.202	0.099	0.017	0.262*	1	
USA	0.046	0.020	0.049	-0.013	-0.043	**0.047**	-0.092	0.110	0.028	1
Average with Europe	0.062	0.092	0.124	0.141	-0.021	**0.039**	0.076	0.076	0.114	0.0.013

* Significant at 5% level ** Significant at 10% level

The entries in the tables which are of most interest are shown in bold. These entries compare the correlations of shocks between Israel and Europe, and Israel and the US, with the average correlation among European countries. There is no significant conclusion stemming from the demand shock correlations: The average correlation for Israel with Europe is rather low (0.039), as well as with the US (0.047). However, the average correlation among European countries is also rather low (0.082). Supply shocks show a slightly clearer result: The average correlation for Israel with Europe is low (0.032), also when compared to the average correlation in Europe (0.169). However, correlation with the US is somewhat higher (0.175).

So according to demand shocks, Israel and the euro block are not an OCA, but then neither is the euro block itself. Supply shocks, as mentioned earlier, are more relevant for assessing the macroeconomic cost which might result from joining a currency union, as they represent events which are more exogenous and less a result of policy. According to these shocks, Israel is not a member of the European OCA, not even in its periphery, l*et al*one its core. However, the correlation between Israel and the US is higher than between the European periphery and the whole euro block. The European experience following monetary unification could serve here as a test case for the Israeli decision: If in the long-run the European periphery countries do not suffer significant costs from being part of the euro, then Israel should not be expected to suffer costs from adopting the dollar.

4: Savings due to abolishing currency conversion.

4.1 Introduction

Most studies in the literature that deals with assessing the worthiness of joining a currency union analyze OCA aspects only, thus taking the advantages embedded in currency unions for granted. In this study I chose to add another aspect to the OCA question which was analyzed in the previous chapter, that is, to calculate the potential savings the Israeli economy could reap by joining a currency union. Those savings would result from the fact that a major part of the currency conversions that currently take place would no longer be necessary if Israel shares its currency with one of the major blocks.

4.2 An Empirical Example: One Market, One Money

The highly quoted study by Emerson *et al*. (1992) is a comprehensive and thorough report, which attempted to analyze the costs and benefits of the establishment of the EMU from almost every possible aspect. Its relevance here is its calculation that the abolishment of currency conversion costs among members of the EMU would save the members about 0.3-0.4% of GDP annually. This paper follows, as far as possible, the methodology of Emerson *et al*[22], and therefore their calculations are described briefly in the following paragraphs.

The calculation is based on the assumptions that residents of the member countries are the only ones who convert currencies in their countries, and that they convert their currencies in their countries only. Another assumption is that currency conversions among banks are not relevant for calculating the savings. The reason for this is that to the extent that banks exchange currencies for speculative reasons, they will continue those speculations after the local currency is abolished, though they will shift this activity to other currencies or assets. Moreover, the costs of the interbank conversions that banks perform on behalf of their customers are eventually passed on to the customers. Therefore, it is sufficient to examine the activity between banks and their non-bank customers.

[22] Melnick (2003) calculated potential savings in joining the euro in a different manner, making different assumptions. His calculation showed savings three times larger than that shown here.

Based on a comprehensive survey conducted among European banks, Emerson *et al*. evaluated the total currency trade between banks and non-bank customers at ECU 12,075 billion annually.[23] Of this, around 34-43% is estimated to be conversions of European currencies, where the rest is trade involving other international currencies. It is assumed the latter will continue to exist after monetary unification. The relevant activity among banks and customers is therefore estimated at ECU 4100-5200 in 1989. In order to assess the potential saving, we need to multiply this volume by the average spread that banks charge their customers. This spread varies widely, of course, according to the type and size of transactions, among other parameters. On average, the spread is estimated at 0.15-0.2%. By multiplying this spread by the relevant trade volume, we obtain savings of ECU 6.2-10.4 billion annually.

This result does not include those conversion costs resulting from usage of smaller means of payment, i.e, cash, credit cards, travelers' cheques, etc. The usage of these instruments is of a much smaller scale than those of the bank transfers discussed above, although conversion costs are much higher. All in all, the evaluated costs of currency conversion involving small means of payment totals ECU 1.8-2.5 billion. Another component of the costs calculated in Europe has to do with cross border payments. Apparently, a bank transfer within a European country is much cheaper than a transfer carried out among two members of the European community. In total, the costs differential is evaluated at ECU 1.3 billion. This differential is expected to disappear when each European bank holds an account with the ECB. The last component associated with the existence of different currencies in different countries is the "in-house" costs. These costs evolve from the fact that firms need to allocate resources, human as well as physical, to manage their foreign exchange matters. A survey encompassing six major European firms led to the conclusion that in-house costs amount to around 0.36% of intra-European exports, or 0.07-0.08% of GDP, which is ECU 3.6-4.8 billions. Table 5, reproduced from Emerson *et al*, summarizes the total savings expected from the establishment of a single European currency.

[23] It should be noted that ECU 5909 billions out of the total of ECU 12,075 billion were from trade within the UK, expressing the international importance of the financial markets in London. This could result in an upward bias of the results.

Table 5: Summary of Expected Savings due to abolishing conversion costs in Europe.
Source: Emerson *et al*. (1992).

	Lower Limit (ECU billion)	Upper Limit (ECU billion)
Bank transfers	6.4	10.6
Banknotes, credit cards, etc.	1.8	2.5
Cross border payments	1.3	1.3
In house costs	3.6	4.8
Total	13.1	19.2

4.3 Calculating the potential savings in Israel

In this section the savings reaped by the Israeli economy in a scenario of giving up the shekel and adopting either the euro or the U.S dollar as legal tender is calculated, trying to stick as much as possible to the methodology of Emerson *et al*. as described above. It should be noted that this calculation is based on many assumptions and estimates, just like the calculation presented by Emerson *et al*., and should therefore be treated as no more than an approximation.

4.3.1 Savings due to bank transfers

The Bank of Israel publishes data on the volume of foreign exchange/shekel trade on a monthly basis. The summary of this data for the year 2002 is given in Table 6:

Table 6: Volume of foreign exchange/shekel trade, 2002. NIS billions.

Other Customers	Foreign Financial Institutions	Domestic Interbank	Total
121.938	33.420	49.098	204.456

The first fact we can learn from the data is that foreign currency trade between banks and their non-bank customers amounts to 124 percent of GDP in Israel in 2002, whereas in Europe it amounted to 250 percent of GDP (in 1989). This is partly a result of the fact that London houses one of the world's main financial markets, and therefore the projected savings for Israel will be lower than those for Europe.

Following Emerson *et al*., I will only refer to the data on trade with non-bank customers, and will try to assess the costs which result from this trade. This is not a simple task: the financial spread varies according to transaction size and currency. Moreover, the data in Table 6 regards trade in all currencies, while a breakdown of activity by currency is not available. I therefore turned to a reliable, professional source in the industry, who estimated that on average 85% of the trade is shekel/dollar, 8% is shekel/euro, and 7% of the trade is between the shekel and other currencies. One can therefore conclude that a significant share of the trade in goods and services between Israel and the EU is actually conducted in US dollars.

We now have an estimate of the volume of shekel/dollar and shekel/euro trade, and we need to multiply this volume by the transaction cost. The same professional source provided an estimate of the distribution of transactions according to four transaction size groups, and attached a financial spread to each group. The cost for the client is actually a half of the financial spread. These estimates enabled me to construct Table 7.

The expected savings from abolishing shekel/foreign exchange bank transfers, then, are estimated at $46.4 million if Israel adopts the dollar, or 0.05% of GDP (in 2002). The expected savings in the scenario of adopting the euro are $5.4 million, which is negligible in terms of GDP. These estimates should be considered as a lower bound, especially in the scenario of joining the euro, because they ignore the potential shift of activity from other currencies to the major currency that Israel chooses to adopt; for example, trade with China that is currently conducted in U.S dollars, is likely to be conducted in euros if the euro were to become Israel's legal tender. Nevertheless, one cannot overlook the fact that the estimated savings are very low, especially if we compare them to the European results. That difference results from two factors: first, as mentioned above, foreign exchange trade volume in Israel as of 2002 is much

lower than in Europe as of 1989. Second, the average transaction cost estimated here (0.04% in the shekel/dollar or 0.05% in the shekel/euro trade) is much lower than that estimated in Europe (0.15-0.2%). This could be the result of progress in trading technology, as well as deepening and improved competition processes that the markets have through during these years.

Table 7: Expected savings from bank transfer conversions.

	Total Turnover:			$121,398 Million		
NIS/ $	Transaction size ($ thousand)	0-10	10-100	100-500	Above 500	Total
	Share of total activity	0.1%	3.2%	11.1%	85.6%	*100%*
	Turnover($ million)	96.1	3333.2	11529.5	88688.5	103,647
	Financial Spread	0.5%	0.4%	0.3%	0.05%	
	($ million) Saving	0.2	6.7	17.3	22.2	**46.4**
NIS/EURO	Transaction size ($ thousand)	0-10	10-100	100-500	Above 500	Total
	Share of total activity	0.0009	0.0322	0.1112	0.8557	*100%*
	Turnover ($ Million)	9	313.7	1085.1	8347.2	9755
	Spread Financial	0.53%	0.43%	0.32%	0.07%	
	($ million) Saving	0.02	0.7	1.7	2.9	**5.4**

4.3.2 Savings due to currency conversions in cash and credit cards

The Bank of Israel reports the total sales and purchases of foreign exchange by Israelis from banks, authorized moneychangers, and international credit card firms. The data reported enabled us to construct Table 8.

Table 8: Foreign exchange conversion and purchasing through cash and credit cards in Israel, 2002 (NIS million)

Foreign Exchange Conversion by Moneychangers	**Total Foreign Exchange Purchases**	Cash Purchases from Domestic Moneychangers	Cash Retrieval In Domestic Banks	Cash Retrieval Using Credit Cards Abroad	Credit Card Purchases Abroad
721	**3,487**	**1,775**	**666**	**210**	**836**

As a proxy for estimating the currency composition of these foreign currency sales and purchases, we used data from the Central Bureau of Statistics, regarding the geographical destinations of Israelis leaving Israel through Ben-Gurion Airport. This data indicates that at 2001 19% of the passengers went to the U.S, 40% to the Euro zone, and 39% to the rest of the world.

When Israelis use their credit cards to shop abroad, they bear a cost which is represented by the differential between the sell transfers exchange rate and the representative rate. This differential is about 0.4% for shekel/dollar and about 0.7% in shekel/euro. Cash withdrawals from ATM's are charged a commission of $2.75 and an additional 0.33% over the differential between the two rates. Assuming that the average withdrawal is around $450,[24] the average cost is 1.35% for dollar withdrawals and 1.65% for euro withdrawals.

Cash withdrawals from local banks are charged by $6-6.5 or 0.175% of the withdrawal, whichever is higher. Estimating the average withdrawal at $400 results in an average cost of 1.5%. Additionally, the client bears the differential between the banknotes' sell rate and the representative rate, or 1.8% for shekel/dollar and 2% for shekel/euro. In total, the average cost of withdrawal is 3.4% for dollars and 3.6% for euros. Moneychangers do not charge a commission, and only earn the differential between their sell or buy rate and the representative rate. This differential is about 1.8% for both dollars and euros. Using all the above information we can present the figures as shown in Table 9. One can see that due to the greater importance of the

[24] Given the high fixed cost of withdrawals, it is reasonable to assume that tourist would prefer a few large withdrawals over many smaller ones. The maximum daily limit for withdrawal is between NIS 2000-3000.

euro compared to the dollar in outgoing tourism, the calculated savings due to small means of payment are larger in the scenario of joining the euro than in case of adopting the dollar.

Table 9: Summary of savings due to cash and credit cards conversions

		Moneychangers		Banks	Credit Cards		Total
		Forex Conversions	Forex Purchases		Cash Retrieval	Purchases	
dollar	Total Turnover ($ Million)	137.0	337.3	126.5	39.9	158.8	799.5
	Cost (%)	1.8%	1.8%	3.4%	1.4%	0.4%	
	Total saving ($ Million)	2.5	6.1	4.3	0.5	0.6	**14.0**
euro	Total Turnover ($ Million)	288.4	710.0	266.4	84.0	334.4	1683.2
	Cost (%)	1.8%	1.8%	3.6%	1.7%	0.7%	
	Total saving ($ Million)	5.2	12.8	9.6	1.4	2.3	**31.3**

4.3.3 Savings on in-house costs

The savings on to in-house costs are calculated here in exactly the same way as they were calculated by Emerson *et al*, except that we will assume that due to technological improvements costs have decreased from 0.2% of turnover, as they were evaluated in the European research, to 0.1% of turnover. Similar to the European research, we will assume that the added value of firms are a portion of 55% of total turnover, and therefore the costs sum up to 0.18% (0.1%/55%) of the added value which results from international trade. Another necessary assumption is that in the event of Israel joining the euro, all trade with the euro zone will be conducted in euros, but all other international trade will be in dollars.

In 2002 Israeli imports reached $51.5 billion, whereas exports amounted to $43.2 billion. Applying data on trade in goods by country[25] to these figures, we can construct Table 10:

[25] According to which 36.7% of imports and 27.2% of exports are from/to the euro zone

Table 10: Savings Due to In-House Costs (NIS Millions)

	Exports	0.18% Saving	Imports	0.18% Saving	Total Saving
Euro	11750	21.2	18900.5	34	**55.2**
Dollar	31450	56.6	32599.5	58.7	**115.3**

4.4 Summary of savings

The total savings from abolishing currency conversion costs therefore sum up as follows:

Table 11: Summary of savings due to abolishment of currency conversion costs, 2002 (NIS million)

	Euro	Dollar
Bank Transfers	**5.4**	**46.4**
Cash and Credit cards	**31.3**	**14**
In House Costs	**55.2**	**115.3**
Total	**91.9**	**175.7**
% of GDP (2002)	**0.09%**	**0.18%**

Once again it should be noted that these estimates are a lower bound, particularly in the scenario of adopting the euro, because they ignore the potential divergence of activity from other currencies to the one major currency that Israel eventually chooses to adopt. Nevertheless, compared to the European study, the estimated savings are very low, although we can assume that had the European study been conducted nowadays its results would also have been affected by the technological advancement and improved market conditions which have apparently reduced conversion costs. In any case, the estimated savings in the event of Israel joining the dollar are very low, and practically negligible if Israel adopts the euro.

5: Summary and Conclusions

There are many implications to giving up monetary independence and joining a currency union. Trade profitability increases, while uncertainty regarding the real exchange rate decreases. Anti-inflationary credibility could also be gained as a result of surrendering monetary policy to a credible authority. On the other hand, monetary unification subordinates monetary policy in each country to that of the whole union,

and thus limits the ability of policymakers to react to business cycle fluctuations. The miscellaneous implications make it hard to quantitatively assess the advantages and disadvantages of such a move, and to strictly determine whether monetary unification would be profitable for the country or not.

This paper tried to determine the advantages and disadvantages for Israel in adopting either one of the world's major currencies, the euro or the dollar, as legal tender. In assessing the disadvantages, the extent to which Israel is part of an optimum currency area with the Euro zone or with the dollar block was examined. Although results are not as unequivocal as in other studies conducted on Europe and the U.S, it can be concluded that correlation of shocks in the Israeli economy is somewhat higher with those in the U.S economy than with those of the euro zone. This is especially true for supply shocks, which, as explained above, are more relevant for the question of OCA criteria.

In assessing the advantages, the paper evaluates the savings that the Israeli economy could reap as a result of abolishing currency conversion costs with the currency that Israel decides to adopt as a legal tender. The calculated savings are 0.09 percents of GDP if the euro is chosen as a legal tender, compared to 0.18 percent of GDP in the scenario of adopting the U.S dollar. This result is somewhat low, especially if it is compared to the results of Emerson *et al*, which concluded that the savings reaped by EU members will stand at 0.3-0.4 percent of GDP following establishment of EMU and replacement of all local currencies by the euro. The lower savings expected in Israel are a result of lower volumes of foreign exchange in Israel (in 2002) as compared to Europe (in 1989), as well as lower conversion costs, probably as a consequence of improvements in trading technologies, as well as markets becoming deeper and more competitive over the time. This finding on lower conversion costs is important not only for the Israeli case, as it apparently points to an over estimation of the European study, which is often used as a basis for evaluating potential savings of monetary unification in other countries. It should be highlighted that the estimated savings, here as well as in the European study, are actually a lower bound for the potential savings. Once a major currency is adopted, activity from other currencies will, to some extent, be shifted towards that currency – thus increasing the savings to a higher level then reported here.

Despite the low calculation of projected savings, joining a currency union might still be beneficiary for Israel. Abolishing exchange rate volatility against a significant portion of Israel's trade and investment partners could decrease risk levels and induce higher volumes of trade and investment, as well as directly reducing costs for those agents that currently hedge their exchange rate exposures in the financial markets.

References

Arnon, A. and Spivak, A. (1996). "Monetary Integration Between the Israeli, Jordanian and Palestinian Economies". Weltwirtschaftliches-Archiv. 132(2): 259-77.

Barro, R. and Gordon, D. (1983). "Rules, Discretion and Reputation in a Model of Monetary Policy". Journal of Monetary Economics, 12: 101-21.

Bayoumi, T.A. (1992). "The Effect of the ERM on Participating Economies". IMF Staff Papers 39(2): 330-356.

Bayoumi, T.A and Eichengreen, B. (1993). "Shocking Aspects of European Monetary Unification". In Giavazzi, F and Torres, F. (eds.) The Transition to Economic and Monetary Union in Europe. Cambridge University Press.

Bayoumi, T.A and Eichengreen, B. (1994). "Monetary and Exchange Rate Arrangements for NAFTA". Journal-of-Development-Economics, 43(1): 125-65

Bayoumi, T.A and Eichengreen, B. (1997). "Ever Closer to Heaven? An Optimum Currency Area Index for European Countries". European Economic Review, 41: 761-770.

Blanchard, O.J and Quah, D. (1989). "The Dynamic Effects of Aggregate Demand and Supply Disturbances". American Economic Review, 79(4): 655-73.

De, Grauwe, P. and Vanhaverbeke, W. (1993). "Is Europe an Optimum Currency Area? Evidence From Regional data". In Masson, P.R and Taylor, M.P (eds.) Policy Issues on the Operation of Currency Unions. Cambridge University Press: 111-29.

Emerson, M, D Gros, A. Italianer, J. Pisani-Ferry and H. Reichenbach (1992). One Market, One Money: An Evaluation of the Potential Benefits and Costs of Forming an Economic and Monetary Union. Oxford University Press.

Enders, W. (1995). Applied Econometric Time Series. John Willey, NY.

Fielding, D. and Shields, K. (2001). " Modelling Macroeconomic Shocks in the CFA Franc Zone". Journal of Development Economics, 66(1): 199-223

Frankel, J.A and Rose, A.K (1998). "The Endogeneity of the Optimum Currency Area Criteria". Economic-Journal. 108(449): 1009-25

Frankel, J.A and Rose, A.K (2000). "Estimating the Effect of Currency Unions on Trade and Output". NBER Working Paper no. 7857.

Kendall, M. and Stuart, A. (1973). The Advanced theory of Statistics. Charles Griffin, London.

Kenen, P.B. (1969) “The Theory of Optimum Currency Areas: An Eclectic View,” in Monetary Problems of the International Economy, R.A. Mundell and A.K. Swoboda, eds. Chicago: Univ. of Chicago Press.

Krugman, P. (1990). “Policy Problems of a Monetay Union”. In De Grauwe, P. and Papademos L. (eds): The European Monetary System in the 1990’s. London: Longham.

McKinnon, R.I. (1963) “Optimum Currency Areas,” American Economic Review 53: 717-725.

Melnick, R. (2003). “Should Israel Join the EMU?” IEPN Discussion Paper, December.

Micco, A. Stein, E. and Ordonez, G. (2004) "The Currency Union Effect on Trade: Early Evidence from EMU". In Baldwin, R. Giuseppe, B. and Seabright, P. (Eds.): EMU: Assessing the Impact of the Euro. Blackwell Publishing.

Mill, J.S. (1894). Principles of Political Economy. Vol. 2, NY.

Mundell, R. (1961). “A Theory of Optimum Currency Areas”. American Economic Review 51(4): 657-665.

Ng, T.N (2002). “Should the Southeast Asian Countries Form a Currency Union?” Developing Economies 40(2): 113-34.

Rose, A.K. (2000). “One Money, One Market? The Effect of Common Currencies on International Trade”. Economic Policy.

Rose, A.K. and van Wincoop, E. (2001). “National Money as a Barrier to International Trade: The Real Case for Currency Union”. American Economic Review, 91(2): 386-390.

Shiffer, Z. (2001). "Israel between Monetary Independence, the Euro and the Dollar". Unpublished Manuscript, Bank of Israel Research department.

Soffer, Y. (2003). "Theoretical Review and Empirical Assessment of the Advantages and Disadvantages for Israel in Joining a Currency Union". MA Dissertation, Ben Gurion University (In Hebrew). http://www.econ.bgu.ac.il/doctorants/yoyo/Thesis.pdf

Appendix: The Blanchard and Quah Technique

The VAR model of equation 5 can also be presented in the following manner (ignoring the constants A_0, without loss of relevance):

$$y_t = \sum_{k=0}^{\infty} c_{11}(k)\varepsilon_{d(t-k)} + \sum_{k=0}^{\infty} c_{12}(k)\varepsilon_{s(t-k)} \quad (8)$$

$$p_t = \sum_{k=0}^{\infty} c_{21}(k)\varepsilon_{d(t-k)} + \sum_{k=0}^{\infty} c_{22}(k)\varepsilon_{s(t-k)} \quad (9)$$

This representation, known as "The Bivariate Moving Average" (BMA), presents each variable as a sum of the effects of the two shocks in the model on the variable. The restriction that states that a demand shock has no long-run effect on output is expressed by:

$$\sum_{k=0}^{\infty} c_{11}(k)\varepsilon_{d(t-k)} = 0 \quad (10)$$

From the definition of the VAR, we know that e_{yt} is the period t random error term of output from equation 1, and therefore $e_{yt}=\Delta y_t - E_{t-1}\Delta y_t$. In equation 8, however, this error term is given by $c_{11}(0)\varepsilon_{dt} + c_{12}(0)\varepsilon_{st}$ (recall that by assumption the structural errors are white noise), therefore:

$$e_{yt} = c_{11}(0)\varepsilon_{dt} + c_{12}(0)\varepsilon_{st} \quad (11)$$

And similarly:

$$e_{pt} = c_{21}(0)\varepsilon_{dt} + c_{22}(0)\varepsilon_{st} \quad (12)$$

In order to identify the structural shocks from the estimated reduced form shocks, we need to identify the elements of matrix $C = \begin{bmatrix} c_{11}(0) & c_{12}(0) \\ c_{21}(0) & c_{22}(0) \end{bmatrix}$. It can be shown that equation 10 can also be written as follows:

$$\left[1 - \sum_{k=0}^{p} a_{22}(k)\right] c_{11}(0) + \sum_{k=0}^{p} a_{12}(k) c_{21}(0) = 0 \quad (13)$$

where p is the lag order used in the estimation of the VAR.[26] In order to identify the system we employ the assumption stating that structural shocks are independent, and normalize the variance of these shocks to 1, thus determining that the variance-covariance matrix is given by:

[26] By this we assume that there were no shocks in previous lags. Blanchard and Quah address this problem, and determine that it does not significantly bias the results.

$$\sum \varepsilon = \begin{bmatrix} \text{var}(\varepsilon_1) & \text{cov}(\varepsilon_1, \varepsilon_2) \\ \text{cov}(\varepsilon_1, \varepsilon_2) & \text{var}(\varepsilon_2) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad (14)$$

From equation 14 and equations 11,12, we can write:

$$\text{var}(e_1) = c_{11}(0)^2 + c_{12}(0)^2 \quad (15)$$

$$\text{var}(e_2) = c_{21}(0)^2 + c_{22}(0)^2 \quad (16)$$

$$\text{cov}(e_1, e_2) = c_{11}(0)c_{21}(0) + c_{12}(0)c_{22}(0) \quad (17)$$

Since the variance-covariance matrix $\sum e = \begin{bmatrix} \text{var}(e_1) & \text{cov}(e_1, e_2) \\ \text{cov}(e_1, e_2) & \text{var}(e2) \end{bmatrix}$ is obtainable from the VAR estimation, we can use equations 13,15,16,17 in order to calculate all four elements of matrix C, and thus identify the structural shocks from the reduced form errors.