Can Political Instability Generate Business Cycles? Evidence from the *Intifada**

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Abstract

This paper presents an econometric model that combines macroeconomic time series data with historical series relating to political instability in Israel during the *Intifada* period, in order to provide a conservative estimate of the extent to which variations in economic performance over time have a political explanation. Political instability is found to have a substantial effect on the cyclical component of aggregate output.

Keywords: Israel, macroeconomics, political instability, VAR

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1. Introduction

In recent year there has been a renewed interest among economists in the possible connections between a country's economic performance and the social and political conditions that prevail there. Much of the interest is a consequence of research in economic growth, and the economic model in which social and political factors are embedded is typically rooted in the theory of long run growth. The focus of the theoretical attention has been on the steady state; and, since time-varying data on political factors is seldom available on a monthly or quarterly basis, empirical work has focussed on cross-country regressions using the panel data sets constructed by the World Bank.

The research based on these cross-country studies indicates that there are strong correlations between countries' long run growth rates and their political characteristics. These characteristics include such factors as the degree of democracy, the degree to which civil and political rights are respected and the incidence of political violence. One explanation for these correlations is that the absence of democracy or civil and political rights, or the presence of political violence, may increase the risks associated with long term investment and so depress capital accumulation and labor productivity. They may also disrupt economic activity or distort factor allocation, again reducing factor productivity. Alesina and Perotti [1994] survey many of the papers outlining these ideas; recent additions to the literature include Easterly and Levine [1997] and Fedderke and Klitgaard [1998]. While different papers find different sociopolitical indicators to be significant in explaining variations in growth rates across countries, there is a consensus that a substantial fraction of the variation is to be explained by the quality of a country's political system.[1]

Whatever the precise nature of the link between political characteristics and long run growth, this work does not directly address the question of whether an individual country can improve its investment performance by improving the quality of its political system. No-one seriously claims that the causal link between political and economic performance is homogenous throughout the World, so slope coefficients on political variables in cross-country regressions are to be interpreted as the mean effect on economic performance of a certain political characteristic, across countries in the sample.[2] Here the potential value of econometric evidence on individual countries using time-series data – were it available – would be very high.

One country for which time-series data on indicators of political stability do exist, and in which these indicators have exhibited a large degree of variability in recent years, is Israel.[3] In this paper we will construct a macro-econometric model of the Israeli economy conditioned on indictors of political stability that correspond to some of those used in cross-sectional analyses.

However, the aim of this paper is not just to provide some time-series evidence to complement existing cross-section work. Econometric modeling of the impact of political instability and violence on economic performance can inform public policy in two ways. First, it can provide an estimate of the size of the "peace dividend", the magnitude of the increase in aggregate income that is likely to ensue from an end to, or at least reduction in, political instability. The size of this expected dividend ought to be one factor in determining the amount of resources devoted to achieving political stability by the state (and also by the international community).[4]

Second, it is possible to distinguish between the economic impact of political activity by anti-state groups (in the case of Israel, those associated with the Palestinian cause) and the economic impact of the state response to such activity (measures taken against Palestinian groups and demonstrators). If the economic costs associated with the former are large and those associated with the latter are small then it is likely to be in the interests of the state to pursue more Draconian security measures. If, on the other hand, the economic costs associated with the state response are also significant then it is likely to be in the interests of the state to pursue a negotiated settlement with its opponents.

We ought to stress at the outset that it is likely that our measures of political instability are likely to pick up only a fraction (though probably a substantial fraction) of the variance in aggregate demand caused by political events. We will not include dummy variables for particular periods, such as political regime changes and high-profile assassinations, because the interpretation of such dummies is always open to question: we wish to restrict our set of explanatory variables to those factors we know to be linked to political instability. (Every month, there is some new political event that could have an economic effect. To the extent that these events are uncorrelated with our measures of instability, some part of the residuals in our equations has a political explanation.) Our estimates of the impact of political instability are therefore conservative estimates. The main point of the paper is that even the conservative estimates are quite large. Moreover, the absence of appropriate instruments precludes the identification of the direct effect of such endogenous political factors as military expenditure. In this sense, the coefficients in our model are to be interpreted as reduced-form coefficients.

2. The Intifada and Indicators of Political Instability in Israel

As a consequence of the 1967 Arab-Israeli war, Israel currently governs territories outside its 1948 borders, including the West Bank, i.e., territory west of the River Jordan but east of the 1948 border, and the area around the city of Gaza. The majority of the population in these areas is made up of Palestinian Arabs, many of whom contest the legitimacy of Israeli rule and Jewish settlement of the territories. In December 1987 there was a sudden uprising (Intifada) amongst Palestinians in these areas (Peretz, 1990). The uprising consisted of strikes and public demonstrations, which often escalated to the point where protestors were shot dead by Israeli security forces; later there was an increase in the number politically motivated assassinations and attacks on Israeli targets by Palestinian paramilitary groups, particularly Hamas. The uprising continued up to September 1993, when the Israeli Government signed an agreement with the Palestine Liberation Organisation (the Oslo Peace Accord). This agreement included PLO recognition of the State of Israel and Israeli recognition of the need for Palestinian self-government in at least part of the West Bank and Gaza areas. The political structures envisaged by the Oslo Peace Accord have not yet been fully implemented, and the political violence and instability have not ceased. Over the 12 years since the start of the Intifada the magnitude of political tensions and violence has varied considerably. The purpose of our paper is to construct a macro-econometric model that uses this variation to estimate the ways in which the political instability has impacted on Israeli economic performance.

Before constructing a macro-econometric model that incorporates political instability effects, it is necessary to define more precisely, and to measure, those time-varying characteristics of the Israeli polity that might be associated with the evolution of the macro-economy. Political violence and instability might impair macroeconomic performance through two channels. First (but less importantly for Israel as a whole), the instability might directly disrupt production, making it more difficult for businesses to open or for workers to get to work. The disruption might be a result of strikes, curfews, more stringent identity checks or just the physical impossibility of economic activity in the presence of political violence. As a consequence there might be lower productivity (because capital is not used to capacity) or higher unemployment (because labor is less mobile). Circumstantial evidence for such effects in the West Bank is presented in Razin and Sadka [1993]. They note that in 1988 the average number of work-days per month in the West Bank and Gaza areas was only 75.6% of the pre-Intifada figure. By 1990 the average number of work-days per month was still only 92.6% of the pre-Intifada figure. However, the economy of the West Bank and Gaza areas contributes only a small fraction to the total GDP of Israeli-controlled territory, and the disruption of this kind caused in Israel proper has been trivially small.

Second, the instability might increase the perceived risk of doing business in Israel. This effect is potentially more important than the first, because it applies to the whole of Israeli-governed territory and not just the West Bank and Gaza areas. Increased risk might be associated with lower aggregate demand (higher precautionary saving and/or lower fixed capital investment), so that increased political instability is associated with business cycle troughs. The risk to consumers and investors might be manifested through a number of channels:

1. The possibility of injury to person or property in paramilitary attacks;

2. The possibility of the uprising spreading to Arab Israelis,[5] who became much more politicized in the 1980s (Mayer, 1988; Rouhana, 1989, 1991);

3. For Arab Israelis, the possibility of losing property rights as a result of Israeli security measures.

In this paper we will draw on time series data capturing some of the elements of political instability in order to investigate the ways in which political instability is correlated with macroeconomic activity. The choice of political time series is motivated by the results of recent empirical evidence gathered by political sociologists in Israel.

Rouhana and Fiske [1995] use factor analysis of individual survey data to explore the characteristics of Israeli society and politics that evoke a sense of threat in survey respondents. The authors are not directly concerned with economic risk, but it is not unreasonable to suppose that perceived economic risk is correlated with "threat" as they define it. There are 22 characteristics in their questionnaire; the ones evoking the greatest sense of threat in Jewish respondents are:

1. "Attacks and acts of sabotage";

2. "Arabs in Israel join the uprising";

The ones evoking the greatest sense of threat in Arab respondents are:

3. "Expropriation of Arab land";

4. "Discussions about expulsion of Arabs";

If the intensity of these characteristics increases (for example, if the number of attacks increases or more Arab land is expropriated) then perceptions of insecurity amongst Jews and Arabs are likely to become more intense. One consequence of this might be a reduction in investment or other economic activity by the Jewish or Arab communities.

There are two readily available time series measures that are closely related to characteristics 1-2. First, there are monthly figures for the number of people (mostly Jews) killed in Israel proper in politically motivated attacks. Violent incidents within the 1948 boundaries might be perceived as signalling an increased risk of the conflict spilling over the border. Second, there are monthly figures for the number of people (mostly Arabs) killed the West Bank and Gaza areas: the number of such deaths is likely to be correlated with the intensity of confrontations between Palestinians and Israeli security forces / Jewish residents of the West Bank and Gaza. B'Tselem [1999] reports all these figures. The degree of perceived insecurity may depend on either the number of deaths in Israel proper, or the total number of deaths, or both figures. Israeli deaths represent a direct threat; but deaths in the West Bank and Gaza may also affect the perceived intensity of the uprising.

With respect to characteristics 3-4, the Israeli Central Bureau of Statistics publishes data detailing the number of private residential buildings for which construction started each quarter in Jewish settlements in the West Bank and Gaza areas.[6] Not all building in the West Bank and Gaza areas is on expropriated land, but it might well be the case that Arabs perceive the expansion of the West Bank and Gaza settlements to be at the expense of Arab property rights. In this case an increase in the rate of expansion will be linked to an intensification of the perceptions of economic insecurity associated with characteristics 3-4.

Figure 1 illustrates the three political instability-related time series, plotted as quarterly data from the beginning of the Intifada in 1987q4. Fatalities in the West bank and Gaza are measured as $\ln(1+tk)$ where tk is the number of deaths per quarter; similarly, Israeli fatalities are measured as $\ln(1+ik)$ where ik is the number of Israeli deaths per quarter. (Logarithms are used to create series that are approximately normally distributed. The series $\ln(ik)$ cannot be used because there are a few quarters in which no fatalities occurred.) The West Bank and Gaza fatality series peaks in 1994q1 at 104 deaths; the Israeli fatality series peaks in 1996q1 at 45 deaths. The figure also plots private Jewish residential construction statistics for West Bank and Gaza settlements. The figure plots the logarithm of the reported number of buildings started, $\ln(c)$; no data on the size of dwellings is available. Construction peaks in 1991q2 at 7,310 houses.

[Figure 1 here]

In Section 4 of the paper we will present a model that investigates the structure of the relationship between the political and social times series discussed in this section and variables that quantify macroeconomic performance. The next section provides a context for this analysis by giving a brief overview of the characteristics of the Israeli macro-economy over the last 15 years, and of the properties of Israeli macroeconomic time series.

3. The Israeli Macro-economy

3.1 Historical Overview[7]

The period leading up to the start of the Intifada was an economically dramatic one. Although not historically susceptible to hyperinflation, the Israeli economy began to suffer annual inflation rates at the triple-digit level in the late 1970s, a possible consequence of large inflows of military aid combined with financial liberalization allowing domestic residents to hold foreign currency and assets in large quantities (Fischer, 1987). The inflation rate continued to increase in the early 1980s (see Figure 2). However in 1985, just before the start of the Intifada, there was a stabilization program that immediately brought inflation to low and stable levels. The Economic Stabilization Program (ESP) comprised a reduction in the Fiscal deficit from 12% of GDP in mid-1985 to zero by the end of 1986, a 19% devaluation of the Sheqel combined with the introduction of a fixed exchange rate peg, a suspension of official wage indexation and the (temporary) introduction of credit and foreign exchange controls (Cuckierman, 1988; Liviatan, 1988; Razin and Sadka, 1993; Ruge-Murcia, 1999). The ESP is now cited as a textbook example of a successful stabilization program (see for example Agénor and Montiel, 1996). Average annualized inflation over the period 1986-1999 was 12% with a quarter-on-quarter standard deviation of 7%. The monetary authorities have succeeded in maintaining financial stability over the 1990s, and have been able gradually to liberalize Israeli financial markets (Bank of Israel, 1999).

[Figures 2-3 here]

There has also been some loosening in the exchange rate regime (Figure 3). Through the mid-1980s Israel maintained an adjustable peg regime that required frequent realignments: although already down in the low teens, Israel's inflation was still high relative to that of its industrial trading partners. Expectations of frequent realignment coupled with a high degree of capital mobility made interest rates extremely volatile (Werner, 1995). Moreover the frequency of realignments meant that the peg was of little use as a nominal anchor. Budget deficits, and hence expansion of the money base, were successfully reduced during this period (Razin and Sadka, 1996), but this was despite rather than because of the exchange rate regime. At the end of the decade Israel moved to a target-zone regime with an adjustable (and later crawling) target band for the value of the Sheqel against a trade-weighted basket of currencies. The band is wide enough to accommodate shocks to the capital account, and the secular trend in its limits accommodates a level of Israeli inflation that is still several percentage points higher than the OECD average. The credibility of the regime is reflected in the fact that the spot exchange rate has never been close to the upper limit (i.e., the minimum possible value of the Sheqel). There is a nominal anchor in the limited sense that there is a notional commitment to prevent extraordinarily large shocks to the capital account impacting on the exchange rate and domestic prices. The exchange rate band has become ever wider, and there is now a great deal of flexibility in the exchange rate regime.

The increase in financial stability has also corresponded to some increase in the stability of real economic variables. Figure 4 shows how real GDP has evolved over the last two decades. Output has grown steadily over the period, with the growth rate in the late 1980s and early 1990s a little higher than in the early 1980s or late 1990s. Deviations around trend are highest in the pre-stabilization period: over 1980-84 the standard deviation of the log of quarterly GDP around trend was in excess of 3%; this is true both when the trend is assumed to be linear and when some kind of filter (such as the Hodrick-Prescott Filter) is used. Over subsequent years the standard deviation has typically been below 3%, as shown in Table 1 and illustrated in the corresponding Figure 5. Nevertheless, there is still a substantial amount of variation in real output to be explained. The dramatic reduction in the mean and variance of inflation shown in Figure 2 has not corresponded to a similarly dramatic reduction in output instability.

[Table 1 and Figures 4-5 here]

Moreover, there has been a substantial amount of variation in other real variables in the post-stabilization era. Table 1 also shows post-stabilization values of the standard deviations of two other macroeconomic time series. These are the log of the unemployment level (the difference between the economically active population and the number of people employed) and of the log of the real exchange rate p/[s/p*], where s is the nominal exchange rate, p the Israeli consumer price index and p* a trade-weighted average of the price indices of industrial countries).[8] Both series, and particularly unemployment, have exhibited a substantial degree of variability. One possible explanation for this is that some of the potentially beneficial effects of stabilization have been offset by an increase in political instability as manifested in the Intifada.

3.2 Statistical Properties of Israeli Macroeconomic and Political Variables

The model that will be developed in the next section to test this hypothesis needs to be informed both by the preceding historical perspective and by the time-series properties of the dependent variables on which the model will focus. These are: log real GDP, ln(y), log unemployment, ln(u), and the log real exchange rate, ln(e).

Visual inspection of Figure 4 shows that the output series is dominated by a trend, but it is not immediately obvious whether the trend is deterministic or stochastic, i.e., whether the series is trend-stationary or difference-stationary. Previous papers on growth in Israel, such as Scacciavillani and Swagel [1999], are not able to reject the null of difference stationarity; but these papers base their tests on a smaller sample than is now available. Table 2 shows the results of our test for the null that ln(y) is difference stationary against the alternative that is trend stationary, using the method of Dickey and Fuller [1979]. The table also reports the results of similar tests for ln(u) and ln(e). The figures given for each time series x_t are p-values for the test of the null that the series is a random walk with drift against the alternative that it is stationary around a linear trend. The statistic indicates the level of significance of m_2 in the regression:

(1) $$\Delta x_t = m_0 + m_1 \cdot t + m_2 \cdot x_{t-1} + S_i a_i \cdot \Delta x_{t-i} + u_t$$

where u_t is white noise and the lag order for Δx_t is chosen according to the Schwartz Bayesian Information Criterion. We are using a relatively small sample, and simulated critical values for the test can be sensitive to the form of the data generating process assumed under the null. So in all cases the p-values are based on our own simulated distributions for the t-ratio on m_2, rather than on the distributions reported in the Dickey and Fuller paper. These distributions are constructed on 10,000 replications under the null that $m_1 = m_2 = 0$, and the data generating process uses estimates from the regression:

(2) $$\Delta x_t = m_0' + S_i a_i' \Delta x_{t-i} + u_t'$$

The sample periods for ln(y) and ln(u) are the longest available without a change in the definition of the variable; the sample period for ln(e) begins in 1987, so as to be sure that the real exchange rate is free from the effects of the hyperinflation.

The null can be rejected at the 1% level for ln(y) and at the 5% level for ln(e). For ln(u) the statistic lies very close to the 5% interval. We will proceed on the assumption that all three variables are stationary around a deterministic trend, subject to the caveat that it is only in the case of ln(y) that the null of non-stationarity can be rejected at the 1% level.[9] The deterministic trends are not necessarily linear; the Table 2 results are consistent with a more complex trend term than is allowed for in equation (1), and as Figure 4 shows standard filtering techniques do not produce a linear trend for ln(y).

[Tables 2-3 here]

Our model will treat output, employment and unemployment as trend stationary variables. Implicit in this model is the assumption that the evolution of productivity in the Israeli economy can be described by a deterministic trend plus stationary shocks. If the measures of political instability discussed in the previous section are to be used to explain changes in productivity then they also must be stationary. Table 3 presents stationarity test statistics for the three variables from Section 2: Fatalities in the West Bank and Gaza, ln(1+tk), Israeli fatalities, ln(1+ik), and private Jewish residential construction in the West Bank and Gaza, ln(c). The method used in constructing the p-values for the null of non-stationarity is the same as in Table 2.

This null can be rejected against the alternative of trend stationarity at the 1% level for ln(1+pk) and ln(1+tk). It cannot be rejected for ln(c). However, the null that Dln(c) is a random walk can be rejected against the alternative that it is stationary around a constant at the 1% level. We will proceed on the assumption that ln(1+tk) and ln(1+ik) are trend stationary and that ln(c) is difference stationary. Note also that no lags are significant in the ADF tests for variables that turn out to be stationary. Current growth in the political instability series is not correlated with past growth.

4. Modeling the Macro-economy in the Presence of Political Instability

4.1 An Interpretative Theoretical Model

The evidence presented in the previous sections suggests that the Israeli economy over the last decade and a half has exhibited the following characteristics:

1. There is a low and stable rate of money supply growth corresponding to a low and stable rate of inflation. The money supply is not used to accommodate increases in the budget deficit.
2. The levels of output and unemployment are stationary around a deterministic trend. Once one has controlled for the deterministic changes in productive capacity, shocks to output do not persist indefinitely.
3. Although stabilization in the mid-1980s involved an exchange rate peg, Israel appears not to have used the exchange rate as a rigid nominal anchor. Exchange rate bands have widened over the 1990s, and there is a great deal of flexibility in the nominal exchange rate. Given the tight control of money and price growth, this flexibility is necessary for achieving an external balance in the presence of shocks to the capital account. Consequently, there has been a great deal of variance in the real exchange rate; this variance is nevertheless stable over time.
4. There has been a great deal of variability in political time series that might influence economic performance. Indicators of political instability and violence can change rapidly from one year to the next, and seem to be entirely unpredictable.

We will estimate a conditional VAR model of the Israeli macro-economy, in which the dependent variables will be aggregate output, unemployment and the real exchange rate and the conditioning variables will be measures of political instability. The economic variables will be measured as deviations from their estimated long-run trends, so any significant coefficient on a political variable could be interpreted as capturing the effect of political instability on cyclical movements in the economy. The simple theoretical macro-model below illustrates how one might interpret the VAR coefficients in a way that is consistent with observations (i-iv) above. In the absence of any obvious way to identify the structural equations in the model, we will estimate only a reduced form VAR, so the theoretical model is purely interpretative. The purpose of the theory is to show that the econometric model we will estimate is consistent with a simple theoretical model. Richer theoretical models (for example, ones with wage inertia) are also consistent with the econometrics. For the sake of clarity the theory is constructed so as to keep macroeconomic dynamics to a minimum. The empirical VAR model will allow for a more complex lag structure than is implicit in the theoretical model that follows now.

The model consists of ten equations, which will be solved down to a reduced form system of three equations. It is similar in style to the theoretical models discussed in Fischer [1977] and Blanchard and Quah [1989], but deals explicitly with the real exchange rate and incorporates trend-stationary rather than difference-stationary productivity shocks.[10] The equations are:

(3) $\ln(y)_t = \alpha \cdot [\ln(m)_t - \ln(p)_t] - \gamma \cdot \ln(e)_t + \mu_t$

(4) $\ln(y)_t = \eta \cdot \ln(n)_t + \theta_t$

(5) $\ln(e)_t = \lambda \cdot \ln(e)_{t-1} - \zeta \cdot \ln(y)_t + \varepsilon_t^e$

(6) $\ln(p)_t = \ln(w)_t - \theta_t$

(7) $\theta_t = f(t) - \kappa \cdot \Pi_t + \varepsilon_t^s$

(8) $\mu_t = \varepsilon_t^d - \nu \cdot \Pi_t$

(9) $\ln(m)_t = \ln(m)_{t-1}$

(10) $\ln(w)_t = \ln(w)_t \,\big|\, \{E[\ln(n)_t] = \ln(n)_t^*\}$

(11) $\ln(n)_t^* = \varphi \cdot \ln(y)_{t-1} - \chi \cdot \ln(u)_{t-1} - \psi \cdot \ln(e)_{t-1}$

(12) $\ln(u)_t = l(t) - \ln(n)_t$

The interpretation of the variables is as follows:

y_t aggregate output

m_t the aggregate money stock

p_t the aggregate consumer price level

e_t the real exchange rate (i.e., the ratio of p_t to an average of the consumer price level in Israel's trading partners, expressed in Sheqels)

q_t productivity in aggregate production

n_t aggregate employment

P_t a vector of variables capturing the magnitude of political instability

u_t unemployment

w_t the money wage rate

n_t^* the natural rate of employment

m_t unanticipated shifts in aggregate demand

f(t) a deterministic trend in productivity

l(t) a deterministic trend representing the size of the working population

e_t^s stationary random economic shocks to productivity

e_t^e stationary random economic shocks to the real exchange rate

e_t^d stationary random economic shocks to private sector aggregate demand

Equation (3) is an aggregate demand curve. In logarithms, aggregate demand is a linear function of real money balances and the real exchange rate, but also has a stochastic component, m. Correspondingly, equation (4) is a production function: total output depends on employment and productivity.

Equation (5) explains the evolution of the real exchange rate. In the steady state the nominal exchange rate will adjust within its band so that the real exchange rate is consistent with a Balance of Payments equilibrium, given the existing levels of domestic and foreign prices. If the Balance of Payments is a negative function of the real exchange rate (because a higher e means lower competitiveness) and of domestic aggregate demand (because a higher y means more demand for imports) then in the steady state e will be a negative function of y. However for $l > 0$ adjustment to the steady state is not instantaneous. Shocks to the real exchange rate (for example, because of changes in the foreign price level) will have an effect on e that lasts for several periods.

Equation (6) is a price-setting equation for firms. Equation (7) describes the evolution of productivity. In the light of the evidence discussed above, we describe productivity as the combination of a deterministic trend and stationary random component. We also allow productivity is also affected by a vector of political instability variables, p. This is made up of the three variables described in detail in Section 2. However, it is unlikely that the major impact of political instability on Israel as a whole is through a productivity effect. The main effect is likely to be through aggregate demand, as indicated by equation (8). Equation (8) indicates a decomposition of aggregate demand shocks into the economic component, e_t^d, and the shocks to aggregate demand caused by changes in the political instability variables, p. An increase in instability will depress aggregate demand.

Equation (9) describes the evolution of the nominal money stock. The long run rate of growth of the money supply is constant (and without loss of generality set equal to zero). It would be possible to incorporate random deviations around this rate without loss of generality, but they would not be distinguishable from the e_t^d.

Equations (10-11) describe characteristics of the labor market. Equation (10) states that the money wage, set one period in advance, adjusts so as to ensure that expected labor demand equals the natural rate of employment. Equation (10) indicates that this rate depends on prevailing macroeconomic conditions. Reductions in output and increases in the real exchange rate can cause structural unemployment, lowering the natural rate; and recent increases in actual unemployment can reduce the natural rate through a hysteresis effect. Equation (11) defines an unemployment rate. The size of the economically active population, l, is assumed to follow a deterministic trend.

Assuming that the economic shocks e_t^i and political shocks p_t have a mean of zero:

$$(13) \qquad E[e_t^s] = E[e_t^d] = E[e_t^e] = E[p_t] = 0$$

equations (3–12) can be solved down to a VAR for output, unemployment and the real exchange rate, conditional on a set of deterministic trends and the political factors p:

$$(14) \qquad \begin{bmatrix} \ln(y)_t \\ \ln(u)_t \\ \ln(e)_t \end{bmatrix} = \begin{bmatrix} f(t) \\ l(t) \\ -z \cdot f(t) \end{bmatrix} + \begin{bmatrix} h \cdot j & -h \cdot c & -h \cdot y \\ -j & c & y \\ -z \cdot h \cdot j & z \cdot h \cdot c & 1-[z \cdot h \cdot y] \end{bmatrix} \begin{bmatrix} \ln(y)_{t-1} \\ \ln(u)_{t-1} \\ \ln(e)_{t-1} \end{bmatrix} + \frac{\Pi_t}{1-g \cdot z} \begin{bmatrix} -k \cdot [a-(g \cdot z)]-n \\ [-(1-a) \cdot k+n]/h \\ [k \cdot (a-[g \cdot z])+n] \cdot z \end{bmatrix}$$

$$+ \frac{1}{1-g \cdot z} \begin{bmatrix} a-[g \cdot z] & 1 & -g \\ [1-a]/h & -1/h & g/h \\ -z \cdot [a-(g \cdot z)] & -z & 1 \end{bmatrix} \begin{bmatrix} e_t^s \\ e_t^d \\ e_t^e \end{bmatrix}$$

The assumption that changes in p can be treated as "unanticipated" at the aggregate level is not strictly necessary for deriving a relationship between the macroeconomic variables and political instability, though it does influence the interpretation of estimated reduced-form parameters. We conjecture that innovations in the number of attacks on Israelis, in the number of demonstrations leading to Palestinian deaths, and in the expansion of real estate on privately owned land in Jewish West Bank settlements are activities planned by a few individuals that come as a shock to the majority of the population. (They certainly seem to come as a shock to most politicians.)

Output ought to be negatively related to unemployment and the real exchange rate, and these two variables ought to be positively related. Except in a "perverse" case where $g/z > a$ or $g/z > 1$ (exceptionally large feedback between output and the real exchange rate), political instability ought to reduce output and raise the real exchange rate. The real exchange rate effect depends on a strictly positive value of z, which measures the sensitivity of the real exchange rate to output. The impact of political instability on unemployment is ambiguous.

As we have already noted, the dynamics of the VAR might be richer than in our simple illustrative model, so we would not want to use the relationships between the parameters in equation (14) as the basis for identification of structural equations, given an estimated reduced form VAR. Nevertheless, the simple model provides a basis for interpreting such reduced form results. The results are presented in the next sub-section.

4.2 The Econometric Model

The estimated VAR is presented in Table 4. This quarterly VAR is estimated using the macroeconomic data discussed in Section 3 and published by the Israeli Central Bureau of Statistics (CBS), and the political data discussed in Section 2 and published by the CBS and B'Tselem. The VAR includes lags of the macroeconomic variables (ln(y), ln(u), ln(e)) up to order 4; this lag order is indicated by both the Akaike and Schwartz Bayesian information criteria. With four lags, the sample runs from 1988 to 1999. The VAR is conditioned on the three political variables in the p-vector: ln(1+tk) (fatalities in the West Bank and Gaza), ln(1+ik) (Israeli fatalities) and Δln(c) (the growth rate of private residential construction in Jewish settlements in the West Bank and Gaza areas). The VAR includes a single lag of each of these variables. Since the main effect of the two fatality series is likely to be through its effect on aggregate demand, and since accurate information about the magnitude of violent clashes becomes available only two or three months after they occur, the series appear with a one-quarter lag. (When the contemporaneous values of the two series are added to the regression, their coefficients are insignificant.) The residential construction statistics report the number of notifications that construction of a building is about to start. The buildings in Jewish West Bank settlements actually go up in the subsequent quarter(s), but are probably at or near completion – and visible to Arab residents – by the time the statistics are released. Choice of an appropriate lag for the Dln(c) variable is therefore somewhat arbitrary. In the reported equations a four-quarter lag is used; results from using three- or five-quarter lags are similar to the ones shown. All three political variables are detrended using a linear trend.

The VAR model summarized by equation (13) assumes that the p-variables are strongly exogenous to the macro-economy. The Appendix to this paper provides some support for this assumption by showing that there is no evidence whatsoever that the macroeconomic variables Granger-Cause the p-variables. This result is consistent with those of Khawaja [1993, 1995], who uses panel data on the incidence of uprisings in different parts of the West Bank in order to explore the determinants of the intensity of the Intifada. He does not include any explicitly economic variables, but is able to explain a large part of the sample variance by using geographical characteristics, the intensity of past activity by the local Israeli security forces, and schooling. The Khawaja results suggest that the intensity of the Intifada has depended largely on social and political factors rather than on economic ones.

As noted in Section 3, it is not obvious that the deterministic trends in the macroeconomic variables appearing in equation (13) are linear. We have a choice between using a linear trend and some nonlinear filter. A wide range of filters produce very similar results. We tried out a Hodrick-Prescott filter, a cubic spline filter and a kernel density filter (the last two using bandwidths selected on the basis of generalized cross-validation). The correlation coefficients for the detrended series using these three alternatives are all in excess of 0.95, and it makes very little difference which is used. The choice between a linear trend and some nonlinear filter makes more of a difference, as illustrated in Figure 5 above. So two sets of results are reported in the paper. Appendix Table A2 reports results using a linear trend; Table 4 below reports results using a Hodrick-Prescott filter; both sets of regressions include seasonal dummies. The two sets of results are quite similar, but standard errors in the Table 4 results tend to be a bit lower. The following discussion relates to the estimates presented in Table 4.

The unrestricted VAR estimate includes many insignificant coefficients and appears to be over-parameterized. In order to check the robustness of those coefficients in the VAR that are significantly different from zero, we also estimated a version in which lags of individual variables have been omitted in order to minimize the Schwartz Bayesian Criterion. This restricted VAR appears alongside the unrestricted version. The omission of the lags does not make a substantial difference to the size of the significant coefficients in the unrestricted VAR.[11] We also estimate the model over sub-samples omitting the final ten or twenty observations. Table 4 reports joint F-test statistics for structural changes in the model parameters, which are insignificant.[12] The table also reports the coefficients on the political instability variables in the output equation in the two sub-samples, which are all negative and insignificantly different from the coefficients in the whole sample.

The statistically significant reduced form interactions between the three macroeconomic variables are consistent with the theory encapsulated in equation (14). The real exchange rate is positively related to lagged unemployment, though the effect is insignificantly different from zero in the steady state, the ln(e) regression suggesting an effect via $D\ln(u)_{t-1}$. This is consistent with a model in which higher past unemployment leads via a hysteresis effect to higher current unemployment, lower current output and a higher equilibrium real exchange rate, an effect of magnitude $z \cdot h \cdot c$ in equation (14). Conversely, unemployment is positively related to the lagged real exchange rate, which is consistent with a model in which rapid real exchange rate appreciation can generate structural unemployment, an effect of magnitude y. Unemployment is also negatively related to lagged income, though this effect too is insignificant in the steady state. This is consistent with a model in which reductions in output can generate structural unemployment, an effect of magnitude j. Finally, output is negatively related to the lagged real exchange rate, which is consistent with the effect of real exchange rate appreciation on unemployment that has already been noted. In equation (13) this effect has a magnitude $h \cdot y$.

The VAR also indicates the significance of the p-variables in the output equation. Each of the three variables has a negative impact on output. They do not appear significantly in either of the two other equations, with the exception that in the restricted VAR the t-ratio on $D\ln(c)$ indicates significance at around the 5% level in the unemployment equation (the coefficient is positive, which is consistent with the negative coefficient in the output equation). As indicated in equation (14) the effect of political instability on unemployment is ambiguous a priori, and real exchange effects are likely to be insignificant when z (the income elasticity of the exchange rate) is small.

The coefficients themselves do not give an indication of the relative importance of each political instability variable in the output equation, so Table 5 reports the asymptotic cumulative impulse responses of output and employment to a unit shock to each of the three p-variables. The table also notes the sample standard deviation of each variable, and thus indicates the magnitude of impulse responses to a one standard deviation shock to each of the p-variables. In addition to the asymptotic effects indicated in Table 5, Figure 6 illustrates the dynamics of a shock to any of the p-variables by plotting the cumulative impulse response of output to a standard deviation shock to each variable. The figure indicates that output converges quickly on its asymptote.

The asymptotic unemployment effects jointly are insignificantly different from zero, but this is not true of the asymptotic output effects. A unit shock to the West Bank and Gaza fatality variable ln(1+tk) will reduce output by 1.16%, ceteris paribus. A similar shock to the Israeli fatality variable ln(1+ik) will reduce output by 0.30%. The corresponding figures for standard deviation shocks are 1.28% and 0.30%. A unit shock to the rate of growth of private residential construction in Jewish settlements in the West Bank/Gaza areas will reduce output by 0.57%; the corresponding figure for a standard deviation shock is 0.35%.

Alternatively, we can consider the estimated effect on the Israeli economy of individual political episodes. For example, the trend in West Bank and Gaza fatalities up to 1999q4 (the last quarter in our fatality data set) implies an expectation of 16 fatalities in 2000q4 (the time of writing). Current rough estimates put the actual number of fatalities in this quarter at around 120. This deviation from the trend implies a recession equivalent to 5.39% of Israeli GDP in our estimated model. We should note that this figure might be an overestimate, because there could be non-linearities in the political instability effects at very high levels of p that our relatively small sample cannot pick up. Nevertheless, the model suggests that we can expect substantial reductions in GDP whenever violence flares up.

[Table 5 and Figure 6 here]

The regression results presented here suggest two stylized facts. First, the potential "peace dividend" from bringing an end to the political violence and instability in Israel is substantial, so there is an economic motive for devoting resources to political stabilization. Second, a large fraction of this dividend arises from the costs of insecurity faced by Palestinians, so a more Draconian state security policy is unlikely to bring economic benefits. Such benefits will only accrue as a result of a negotiated settlement.

5. Summary and Conclusion

In this paper we have constructed an econometric model combining Israeli macroeconomic time series data with historical series reflecting the degree of political instability in the country. Several of these series have a quantitatively significant impact on the macro-economy. In particular, economic performance is related to the number of Palestinians and Israelis killed in politically related violence and time series relating to Arab perceptions of insecurity (such as the rate of growth of Jewish settlements in the West Bank). Greater degrees of violence and insecurity lead to poorer performance. The impact of the political instability variables appears to be largely through output effects rather than employment or real exchange rate effects. For example, we estimate that a standard deviation increase in fatalities in the West Bank and Gaza, relative to the secular trend in fatalities, leads to a recession equivalent to over 1% of GDP. A reduction in political instability in the long term is therefore is likely to improve Israeli economic performance substantially.

The benefits of greater stability will depend on the way in which it is achieved. The econometric model indicates that the deleterious consequences of the Intifada arise partly from the anti-Israeli violence of Palestinian groups and partly from the activity of the state and state security measures during the Intifada period. A more Draconian security apparatus might mitigate the former, but at the expense of aggravating the latter. This means that any substantial improvement in economic performance from greater political stability requires the success of the Israeli-Palestinian peace process.

Appendix: Granger-Causality Tests for the Independence of Political Instability Variables with Respect to Macroeconomic Time Series

The Granger-causality tests are carried out as follows. For each time series $x_t = \{\ln(1+pk)_t, \ln(1+ik)_t, D\ln(ct)_t\}$ we estimate a regression of the form:

$$\text{(A1)} \quad x_t = n_0 + S_i [n_{1i} x_{t-i} + m_{1i} \cdot \ln(y)_{t-i} + m_{2i} \cdot \ln(u)_{t-i} + m_{3i} \cdot \ln(e)_{t-i}] + u_t$$

where i = 1,… N. As long as there is no evidence of serial correlation in the residual u_t F-tests are constructed for (i) the joint significance of all the m_{ji} together, and (ii) the joint significance of the m_{1i}, the m_{2i} and the m_{3i} individually. There is no N for which any of these F-test statistics is significant. Table A1 reports the p-values of the F-tests for N = 1 and N = 4.

[Tables A1-A2 here]

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Table 1: Standard Deviations of the De-trended Quarterly Time Series

period	using Hodrick-Prescott Filter	using linear trend
ln(y) log real GDP		
1980-84	0.032	0.040
1985-89	0.018	0.018
1990-94	0.023	0.029
1995-99	0.018	0.026
ln(u) log unemployment		
1986-89	0.148	0.173
1990-94	0.098	0.141
1995-99	0.125	0.115
ln(e) log real exchange rate		
1987-89	0.034	0.046
1990-94	0.026	0.028
1995-99	0.035	0.045

Table 2: Unit Root Test Statistics for Quarterly Macroeconomic Variables

variable	sample period	p-value	lag order
ln(y)	1980-99	0.009	8
ln(u)	1986-99	0.056	4
ln(e)	1987-99	0.047	3

Table 3: Unit Root Test Statistics for Quarterly Political Instability Variables*

variable	sample period	p-value	lag order
ln(1+ik)	1987-99	0.000	0
ln(1+tk)	1987-99	0.000	0
ln(c)	1987-99	0.282	1
Dln(c)	1987-99	0.000	0

* Except for Dln(ct) the null is that the series is a random walk with drift and the alternative is that it is stationary around a linear trend. For Dln(ct) the null is that the series is a random walk and the alternative is that it is stationary around a constant.

Table 4: The Estimated VAR Model (Quarterly Sample, 1988-99)

ln(e) equation (σ = 0.01822, RSS = 0.00863)

	unrestricted VAR				restricted VAR			
variable	coeff.	std. err.	t ratio	h.c.s.e.	coeff.	std. err.	t ratio	h.c.s.e.
ln(e)$_{t-1}$	0.46895	0.18902	2.481	0.16057	0.56947	0.09427	6.041	0.08647
ln(e)$_{t-2}$	0.19120	0.20623	0.927	0.16197				
ln(e)$_{t-3}$	-0.05295	0.20342	-0.260	0.17281				
ln(e)$_{t-4}$	-0.18645	0.17610	-1.059	0.18151				
ln(y)$_{t-1}$	0.18931	0.17560	1.078	0.14115				
ln(y)$_{t-2}$	-0.23996	0.22004	-1.091	0.15784				
ln(y)$_{t-3}$	-0.23790	0.20832	-1.142	0.17186				
ln(y)$_{t-4}$	0.10106	0.19596	0.516	0.20163				
ln(u)$_{t-1}$	0.12949	0.05652	2.291	0.06280	0.12273	0.03960	3.099	0.05165
ln(u)$_{t-2}$	-0.19669	0.06280	-3.132	0.08243	-0.19743	0.03961	-4.984	0.05365
ln(u)$_{t-3}$	0.04262	0.07173	0.594	0.05990				
ln(u)$_{t-4}$	-0.05420	0.06096	-0.889	0.06402				
?ln(c)/100	0.26650	0.60673	0.439	0.70373				
ln(1+ik)/100	0.06546	0.30866	0.212	0.33106				
ln(1+tk)/100	-0.52924	0.48869	-1.083	0.44974				

ln(y) equation (σ = 0.01273, RSS = 0.00421)

	unrestricted VAR				restricted VAR			
variable	coeff.	std. err.	t ratio	h.c.s.e.	coeff.	std. err.	t ratio	h.c.s.e.
ln(e)$_{t-1}$	0.18247	0.13204	1.382	0.12089	0.23063	0.06496	3.550	0.04944
ln(e)$_{t-2}$	-0.11059	0.14407	-0.768	0.14861				
ln(e)$_{t-3}$	0.16704	0.14211	1.175	0.12697				
ln(e)$_{t-4}$	-0.53869	0.12302	-4.379	0.11339	-0.39582	0.07252	-5.458	0.07277
ln(y)$_{t-1}$	0.24850	0.12267	2.026	0.12694	0.21482	0.09857	2.179	0.10154
ln(y)$_{t-2}$	0.11252	0.15372	0.732	0.12096				
ln(y)$_{t-3}$	-0.05729	0.14553	-0.394	0.13859				
ln(y)$_{t-4}$	-0.29243	0.13689	-2.136	0.13668	-0.21944	0.09139	-2.401	0.09293
ln(u)$_{t-1}$	0.05573	0.03948	1.411	0.03750				

$\ln(u)_{t-2}$	0.00129	0.04387	0.029	0.04087				
$\ln(u)_{t-3}$	-0.01845	0.05011	-0.368	0.04720				
$\ln(u)_{t-4}$	-0.02389	0.04259	-0.561	0.03727				
?ln(c)/100	-1.20210	0.42384	-2.836	0.44060	-0.94279	0.35683	-2.642	0.37022
ln(1+ik)/100	-0.47766	0.21563	-2.215	0.21488	-0.30852	0.18643	-1.655	0.19171
ln(1+tk)/100	-1.31210	0.34139	-3.843	0.31304	-1.20960	0.27953	-4.327	0.26765

Table 4 (Continued)

ln(u) equation (σ = 0.06261, RSS = 0.10191)

	unrestricted VAR				restricted VAR			
variable	coeff.	std. err.	t ratio	h.c.s.e.	coeff.	std. err.	t ratio	h.c.s.e.
$\ln(e)_{t-1}$	1.01760	0.64935	1.567	0.77656	1.10220	0.37872	2.910	0.35600
$\ln(e)_{t-2}$	0.54733	0.70850	0.773	0.61367				
$\ln(e)_{t-3}$	-0.09520	0.69884	-0.136	0.65053				
$\ln(e)_{t-4}$	-0.00930	0.60498	-0.015	0.33584				
$\ln(y)_{t-1}$	-1.87760	0.60327	-3.112	0.62075	-2.01690	0.50315	-4.009	0.56216
$\ln(y)_{t-2}$	0.33187	0.75595	0.439	0.66223				
$\ln(y)_{t-3}$	0.85415	0.71568	1.193	0.72905	1.62860	0.51232	3.179	0.47421
$\ln(y)_{t-4}$	0.24214	0.67320	0.360	0.55682				
$\ln(u)_{t-1}$	0.69470	0.19417	3.578	0.21674	0.56423	0.10385	5.433	0.13766
$\ln(u)_{t-2}$	-0.23539	0.21573	-1.091	0.18155				
$\ln(u)_{t-3}$	0.27122	0.24643	1.101	0.27448	0.34396	0.12097	2.843	0.13669
$\ln(u)_{t-4}$	0.23018	0.20942	1.099	0.17880				
?ln(c)/100	2.92600	2.08440	1.404	1.73480	3.46640	1.75040	1.980	1.82590
ln(1+ik)/100	-1.79170	1.06040	-1.690	1.01720				
ln(1+tk)/100	0.04864	1.67890	0.029	1.57040				

ARCH Tests	e	y	e
order 4: F(4,18)	0.50415 [0.7332]	1.50870 [0.2416]	0.15063 [0.9603]
order 1: F(1,24)	1.53710 [0.2270]	3.41310 [0.0770]	0.32421 [0.5744]

Residual Autocorrelation Tests (System): order 4: F(36,36) = 0.66796 [0.8846], order 1: F(9,51) = 0.70880 [0.6981]

Residual Correlations: (e,y) = -0.11783, (e,u) = 0.13201, (y,u) = 0.20222

Log-likelihood = 540.15, R^2(LM) = 0.75901

Parameter Constancy Forecast Tests
Last 20 periods: F(60,6) = 1.78170 [0.2407]
Last 10 periods: F(30,16) = 1.38370 [0.2497]

Selected coefficients in the ln(y) equation in sub-samples

	Sample less last 10 periods				Sample less last 20 periods			
variable	coeff.	std. err.	t ratio	h.c.s.e.	coeff.	std. err.	t ratio	h.c.s.e
?ln(c)/100	-0.79312	0.59022	-1.344	0.64353	-1.36340	0.63200	-2.157	0.63181
ln(1+ik)/100	-0.50814	0.30981	-1.640	0.28088	-1.15410	0.54826	-2.105	0.49497
ln(1+tk)/100	-1.35040	0.46697	-2.892	0.43620	-1.45440	0.79711	-1.825	0.89827

Table 5: Asymptotic Cumulative Impulse Responses to Unit Shocks
Responses are measured in %; figures in parenthesis are standard errors.

	ln(1+ik)	ln(1+tk)	Δln(c)
ln(u)	0.405	1.590	13.026
	(0.663)	(2.449)	(8.101)
ln(y)	-0.296	-1.159	-0.567
	(0.181)	(0.302)	(0.504)
s.d.* indpendent variable	1.023	1.103	0.61

* These standard deviations are for the detrended independent variables.

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Appendix Table A1: Granger-Causality Test Statistics

lag order	dep. variable	all 3	ln(e)	ln(y)	ln(u)
N = 4	ln(1+ik)	0.993	0.885	0.960	0.994
N = 1	ln(1+ik)	0.999	0.891	0.971	0.996
N = 4	ln(1+tk)	0.680	0.629	0.715	0.255
N = 1	ln(1+tk)	0.846	0.513	0.707	0.545
N = 4	Δln(c)	0.893	0.757	0.484	0.882
N = 1	Δln(c)	0.458	0.236	0.348	0.381

Appendix Table A2:
The VAR Model Using Linearly Detrended Macroeconomic Time Series

ln(e) equation (σ = 0.01972, RSS = 0.01011)

variable	coeff.	std. err.	t ratio	prob.	h.c.s.e.
$ln(e)_{t-1}$	0.65671	0.18293	3.590	0.0013	0.14577
$ln(e)_{t-2}$	0.22385	0.22302	1.004	0.3248	0.17787
$ln(e)_{t-3}$	-0.09740	0.21723	-0.448	0.6576	0.19260
$ln(e)_{t-4}$	-0.26407	0.17464	-1.512	0.1426	0.17002
$ln(y)_{t-1}$	0.24270	0.16742	1.450	0.1591	0.12048
$ln(y)_{t-2}$	-0.30768	0.23303	-1.320	0.1982	0.18700
$ln(y)_{t-3}$	-0.17717	0.21665	-0.818	0.4209	0.18613
$ln(y)_{t-4}$	0.12672	0.19820	0.639	0.5282	0.23731
$ln(u)_{t-1}$	0.12483	0.05678	2.199	0.0370	0.05986
$ln(u)_{t-2}$	-0.18922	0.06728	-2.812	0.0092	0.09187
$ln(u)_{t-3}$	0.06139	0.07658	0.802	0.4301	0.05948
$ln(u)_{t-4}$	-0.01937	0.06024	-0.322	0.7504	0.05755
ln(1+ik)/100	0.38220	0.33151	1.152	0.2597	0.34299
ln(1+pk)/100	-0.84323	0.58684	-1.437	0.1627	0.58662
Δln(c)/100	-0.09036	0.66197	-0.137	0.8925	0.82469

ln(y) equation (σ = 0.01828, RSS = 0.00868)

variable	coeff.	std. err.	t ratio	prob.	h.c.s.e.
$ln(e)_{t-1}$	0.26559	0.16957	1.566	0.1294	0.15334
$ln(e)_{t-2}$	-0.09727	0.20673	-0.471	0.6419	0.21275
$ln(e)_{t-3}$	0.14204	0.20136	0.705	0.4868	0.13407
$ln(e)_{t-4}$	-0.32967	0.16188	-2.036	0.0520	0.16451
$ln(y)_{t-1}$	0.55578	0.15519	3.581	0.0014	0.16143
$ln(y)_{t-2}$	0.06257	0.21601	0.290	0.7744	0.21244
$ln(y)_{t-3}$	0.12540	0.20083	0.624	0.5378	0.21714
$ln(y)_{t-4}$	-0.01405	0.18372	-0.076	0.9396	0.16440
$ln(u)_{t-1}$	-0.01608	0.05263	-0.306	0.7624	0.05235
$ln(u)_{t-2}$	0.03858	0.06237	0.619	0.5415	0.05778
$ln(u)_{t-3}$	-0.03345	0.07099	-0.471	0.6414	0.07459
$ln(u)_{t-4}$	0.05177	0.05584	0.927	0.3625	0.06186
ln(1+ik)/100	-0.16988	0.30730	-0.553	0.5851	0.29034
ln(1+pk)/100	-1.48590	0.54397	-2.732	0.0112	0.52437
Δln(c)/100	-1.56470	0.61361	-2.550	0.0170	0.58966

ln(u) equation (σ = 0.06272, RSS = 0.10226)

variable	coeff.	std. err.	t ratio	prob.	h.c.s.e.
$ln(e)_{t-1}$	1.11630	0.58187	1.919	0.0661	0.80681
$ln(e)_{t-2}$	0.57113	0.70940	0.805	0.4281	0.55794
$ln(e)_{t-3}$	-0.01655	0.69096	-0.024	0.9811	0.65214
$ln(e)_{t-4}$	-0.16312	0.55551	-0.294	0.7714	0.35208
$ln(y)_{t-1}$	-2.24060	0.53253	-4.208	0.0003	0.60872
$ln(y)_{t-2}$	0.35799	0.74125	0.483	0.6332	0.68010
$ln(y)_{t-3}$	0.66083	0.68914	0.959	0.3464	0.69576
$ln(y)_{t-4}$	0.05890	0.63045	0.093	0.9263	0.53060
$ln(u)_{t-1}$	0.77365	0.18059	4.284	0.0002	0.19042
$ln(u)_{t-2}$	-0.32836	0.21401	-1.534	0.1370	0.19934
$ln(u)_{t-3}$	0.34395	0.24360	1.412	0.1698	0.29416
$ln(u)_{t-4}$	0.17798	0.19160	0.929	0.3615	0.14245
ln(1+ik)/100	-2.52990	1.05450	-2.399	0.0239	0.93103
ln(1+pk)/100	-0.14218	1.86660	-0.076	0.9399	1.83720
Δln(c)/100	3.75910	2.10560	1.785	0.0859	1.88030

Residual Correlations: (e,y) = -0.02670, (e,u) = 0.15612, (y,u)= -0.05695

Log-likelihood = 519.06, R^2(LM) = 0.825175

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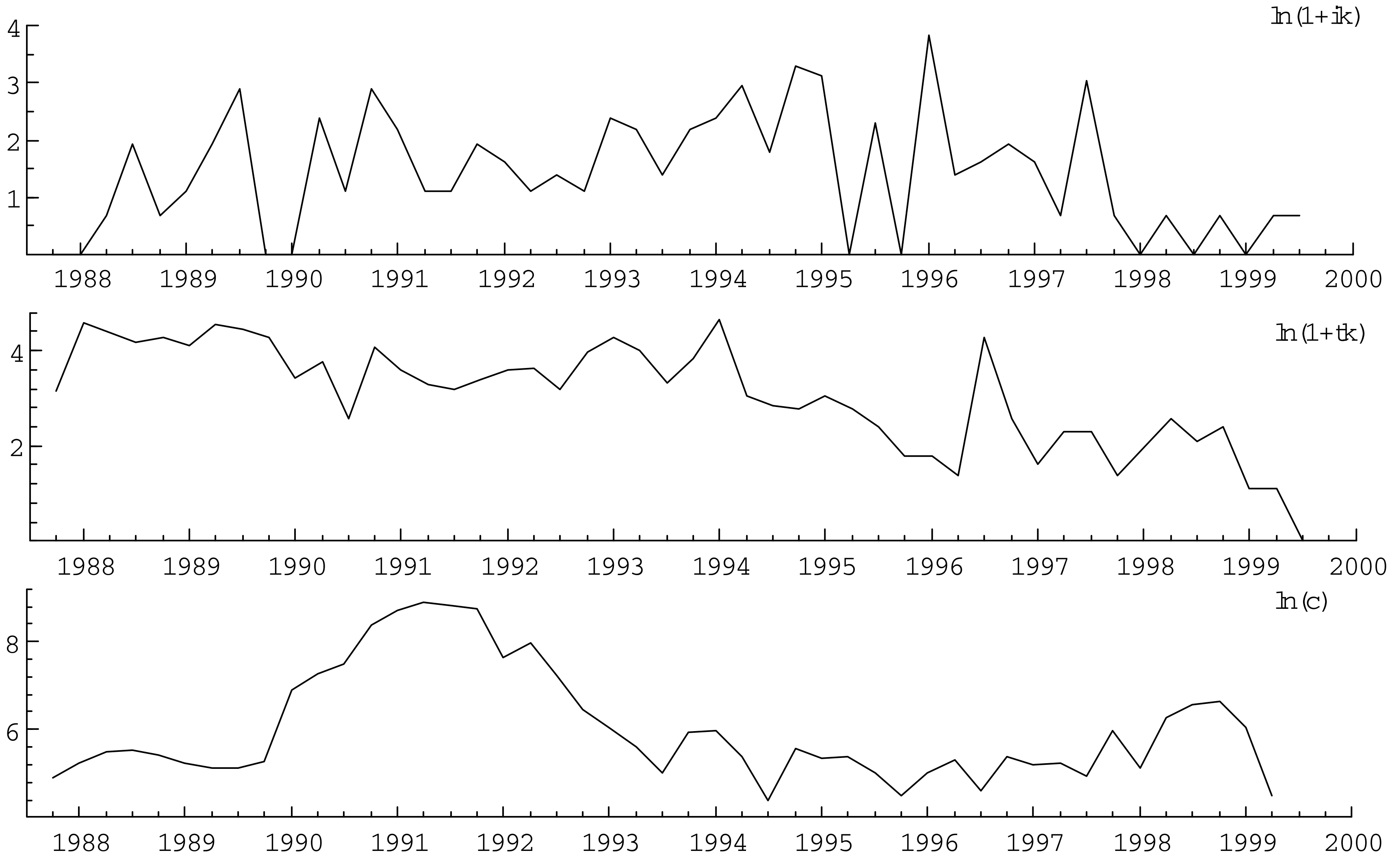

Figure 1: The political time series

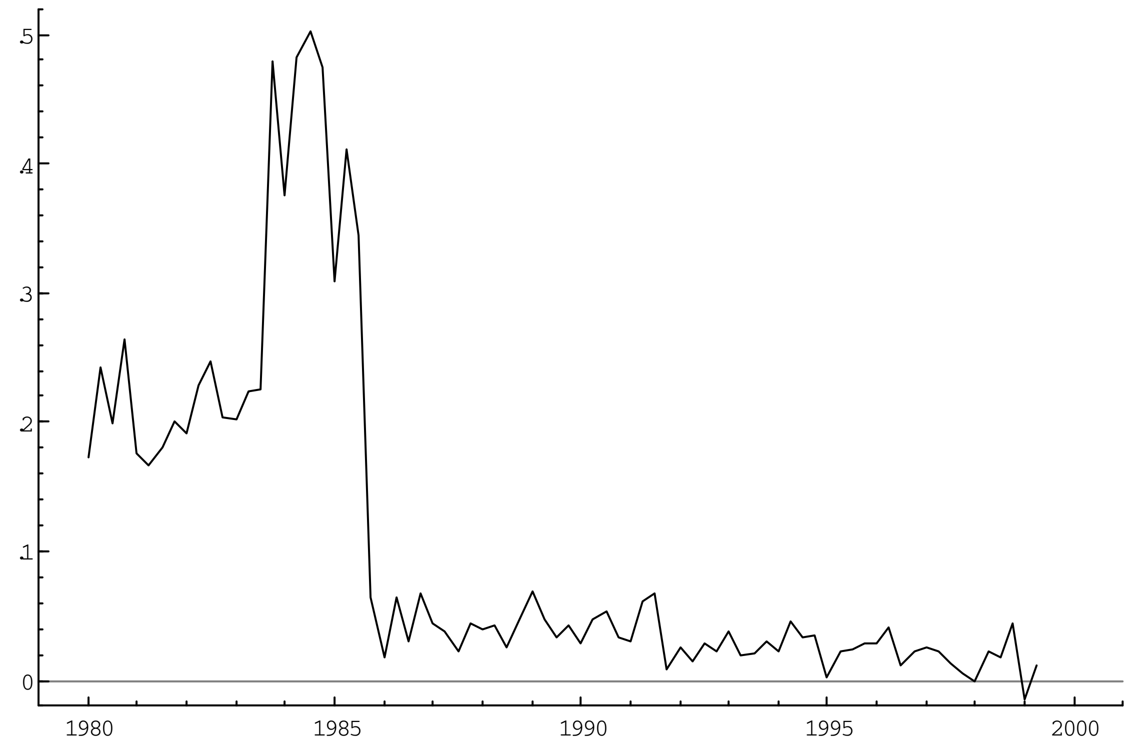

Figure 2: Quarterly Rate of Growth of the Israeli Consumer Price Index

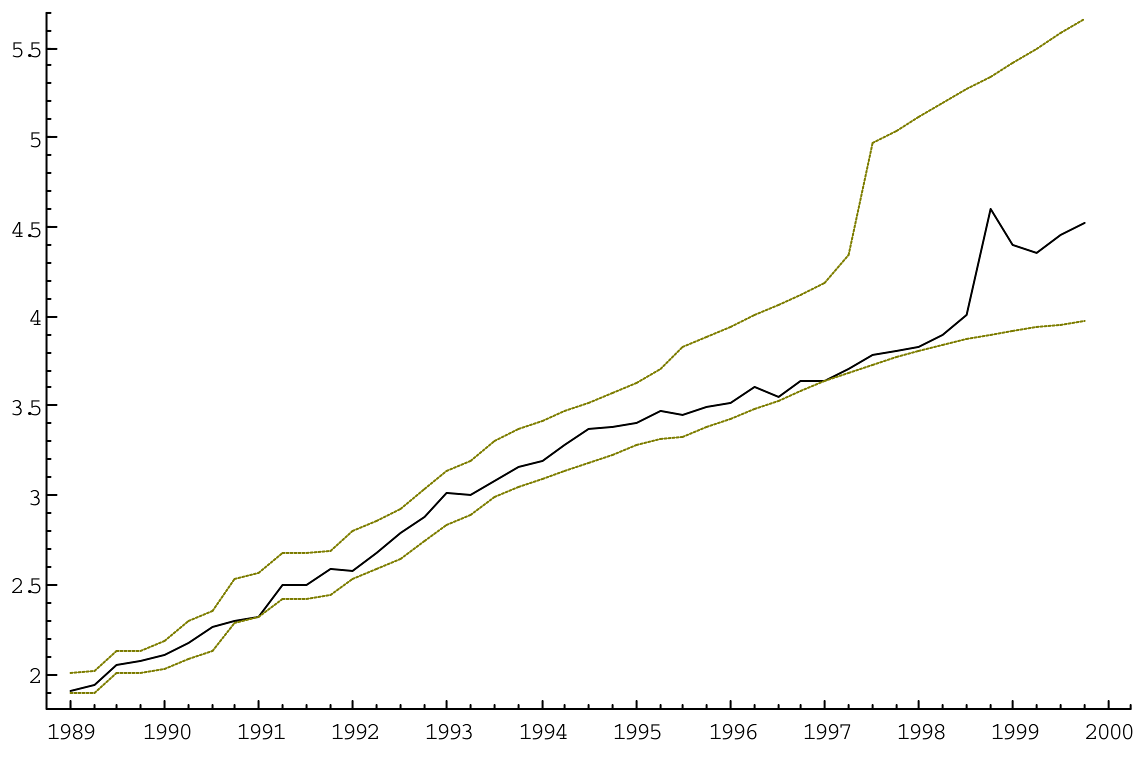

Figure 3: Logarithm of the Israeli Nominal Trade-Weighted Exchange Rate, With Target Bands

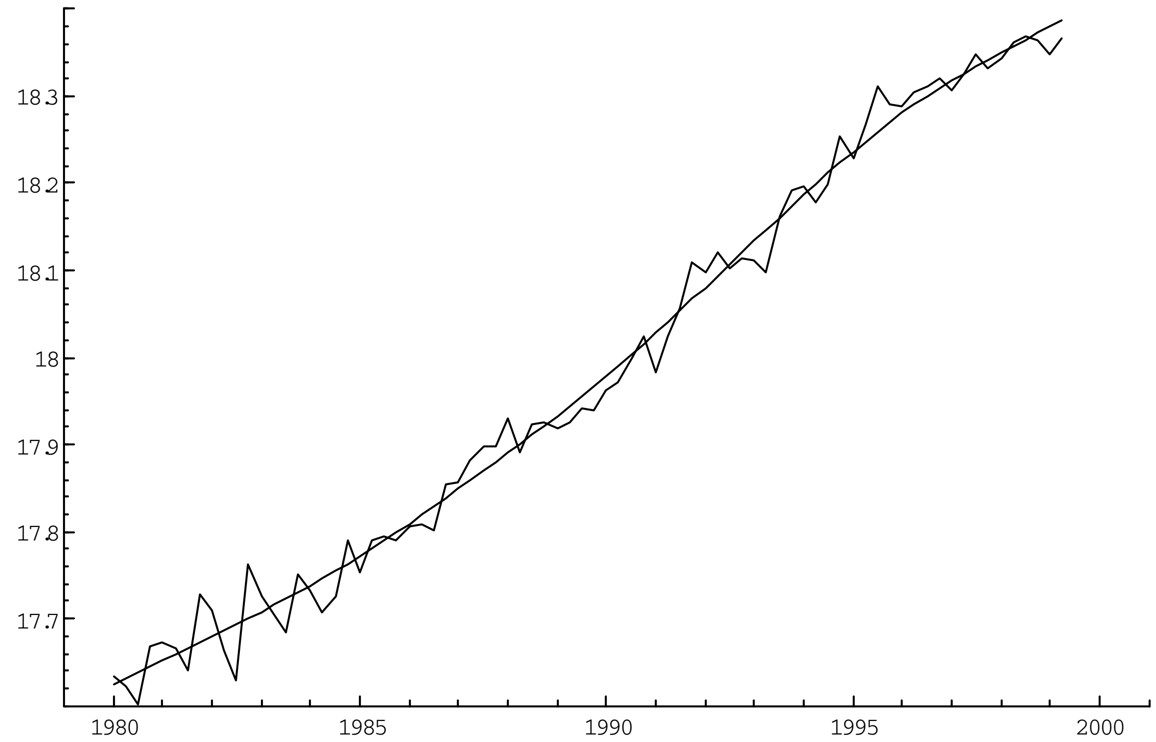

Figure 4: ln(y) (logarithm of real GDP) and its Hodrick-Prescott trend

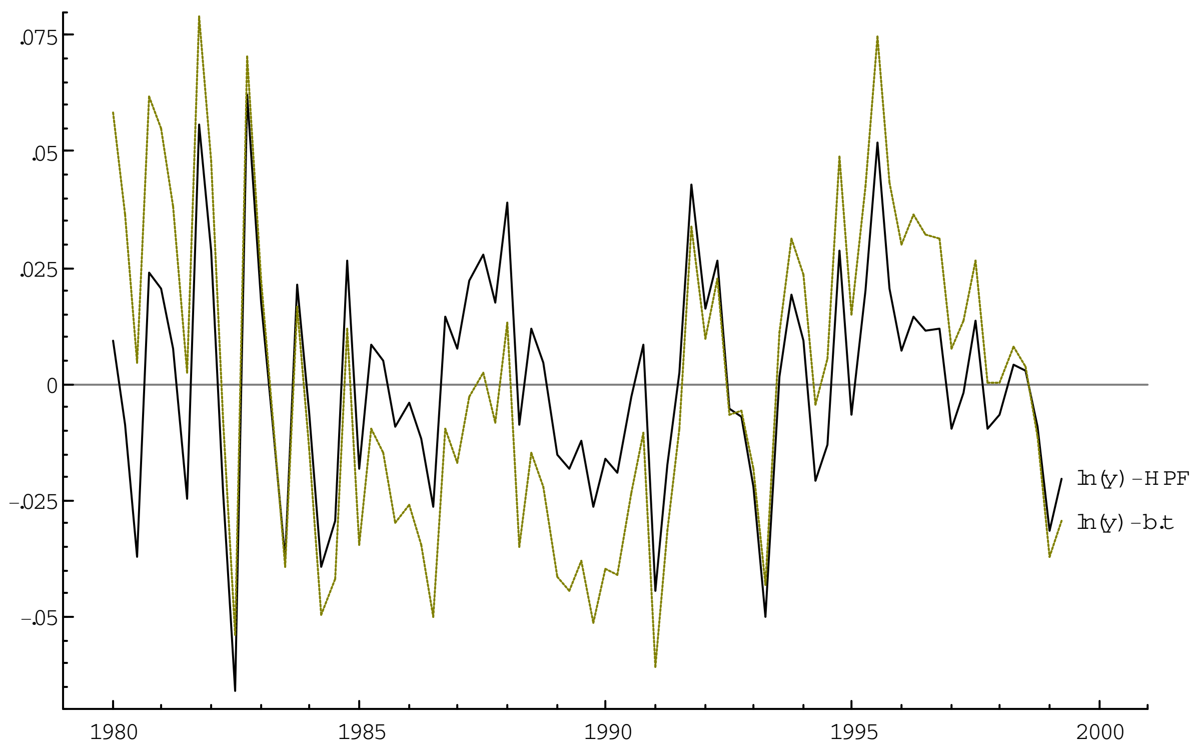

Figure 5: Cyclical component of ln(y) using (i) Hodrick-Prescott Filter (HPF) and (ii) linear trend

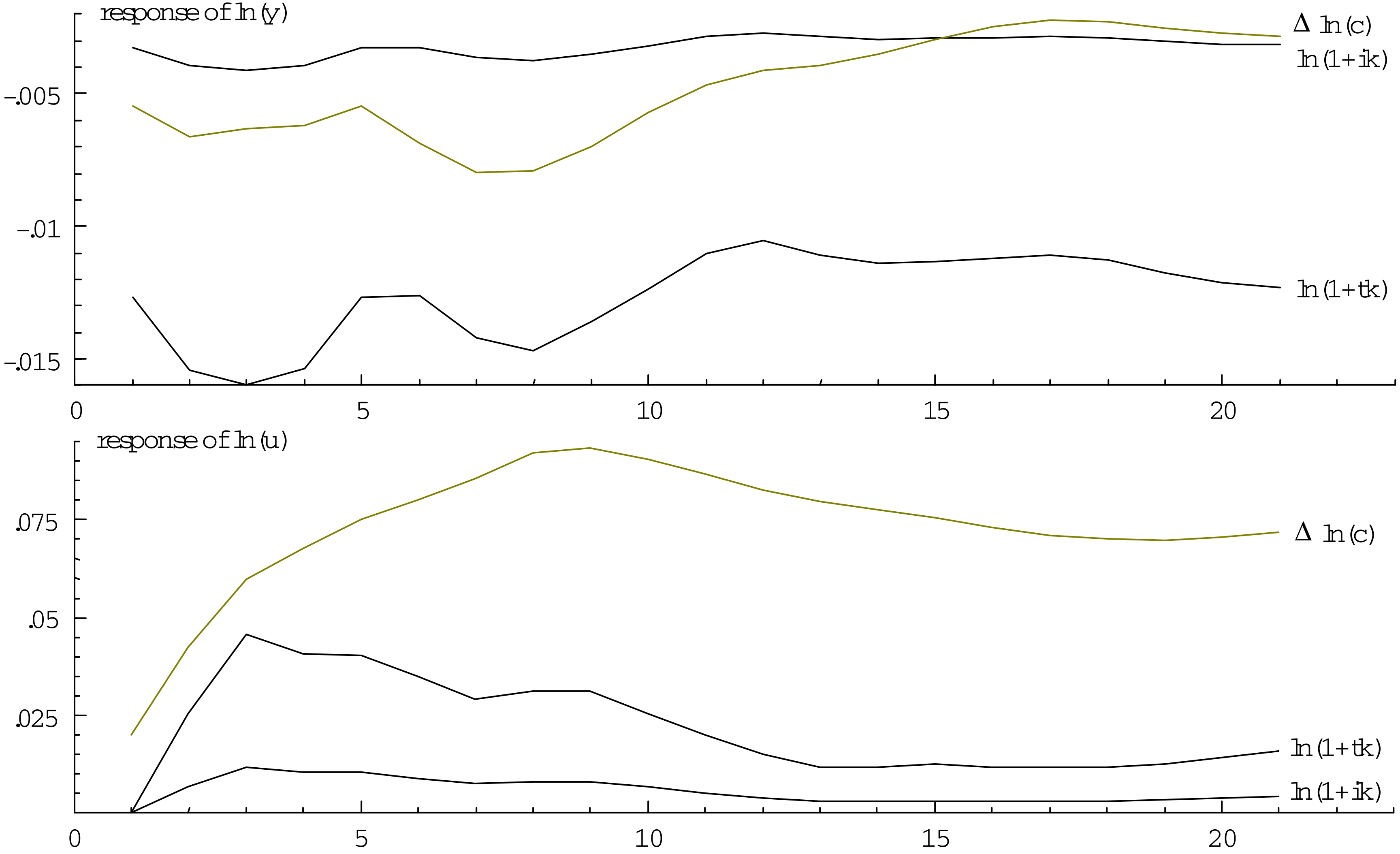

Figure 6: Cumulative impulse responses of ln(y) and ln(u) to a one s.d. increase in each conditioning variable (using restricted VAR coefficients)

Notes

1. There is a closely related literature examining cross-country variations in investment performance. A paper by Alesina and Perotti [1993] explains such variations by using a "sociopolitical instability index" constructed using principal components analysis. The important factors in the index are indicators of the absence of democracy and the incidence of political violence. Kormendi and Meguire [1985] and de Haan and Siermann [1996] discover a negative cross-country correlation between the investment-GDP ratio and indices of political freedom.

2. One serious problem with the panel data regressions is the difficulty in producing an unbiased estimate of this mean value. See Pesaran and Smith [1995].

3. All place names are purely geographical and have no geopolitical implications.

4. Of course the consequences of the Intifada should be measured in terms of the ensuing human costs. The point of this paper is to show that these costs are not confined just to those suffering personal injury or loss of property as a result of violent action by Israeli and Palestinian forces. Israel as a whole suffers from greater poverty.

5. The term "Arab Israelis" refers to those Arabs with Israeli nationality and right of abode in Israel proper.

6. Figures before 1990 are reported only annually; the quarterly figures for 1988-9 are interpolations using the method of Lisman and Sandee [1964].

7. The data used in this section are drawn from the Israeli Central Bureau of Statistics Monthly Bulletin. Further details are available on request.

8. The weights are the same as in the official Israeli exchange rate basket.

9. We did try out an alternative version of the model in the next section that used ln(y), Δln(u) and Δln(e). This model exhibited signs of over-differencing: in particular, coefficients on the lagged dependent variables in equations for the differenced series tended to sum to less than -1.

10. This second characteristic prevents identification of the structural model along the lines of Blanchard and Quah [1989].

11. The unrestricted VAR is estimated by OLS. Each equation includes identical RHS variables, so this is equivalent to the Maximum Likelihood estimator. The restricted VAR is estimated by numerical optimization of the log-likelihood function.

12. The test statistic is equivalent to h_2 in Doornik and Hendry [1997, p.199].