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Low-inflation-targeting monetary policy and differential unemployment rate: Is monetary policy to be blamed for the financial crisis? — Evidence from major OECD countries

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ABSTRACT

Since the mid-1990s, monetary policy discussion has been centered around whether targeting inflation rate too low was responsible for the differential unemployment rate observed between major OECD countries and the US. In late 2000s with the financial crisis, critiques have argued that these economies had fallen into liquidity trap sooner because of the policy mistake of adhering to the 2% inflation target when the policy rate was already too close to zero. As the argument goes, since there was not enough room left to maneuver, central bankers were powerless in their attempt to revive the economy when aggregate demand collapsed. Using SVAR methodology, this paper formally investigates whether unanticipated deviation of OECD short-term rates from the fund rate can indeed explain differential unemployment rate with the US. It also discusses whether low-inflation targeting monetary policy is to be blamed for the financial crisis. The results show that interest rate differential shocks have no effects on unemployment in the very short-run. However, in the long-run, the cost for deviating drastically from US monetary policy is indeed higher and persistent unemployment at home, on average 30, 102, and 186 basis-points after 10, 15, and 20 quarters, respectively for the period 1989q1–2009q4. This cost is on average higher for inflation- than non-inflation targeting countries. These findings suggest that the fear of unemployment was partly the reason central bankers kept interest rate low since commodity prices were falling as a result of globalization while the economies were returning to normal partly due to positive supply shocks. Since Canada had its interest rate well aligned with the fund rate prior to the crisis while the inflation target was 2%, but did not suffer as much because sound mortgage rules and financial regulation were in place, the view that higher inflation target might have produced a different outcome does not seem to rest on firm grounds. Therefore, this paper lends support to the view that lax mortgage rules and financial deregulations in the US were the main factors responsible for the crisis.

1. Introduction

The objective of this paper is to determine whether unanticipated deviations of OECD countries' short-term interest rates from the United States (US) rate can explain differences in their unemployment rates with the US, and whether low-inflation targeting monetary policy could be blamed for the recent financial crisis. The countries selected for comparison are France, Germany, Italy, Japan (which are known as non-inflation targeters — non-IT), Canada, United Kingdom (UK), Australia, and New Zealand (which are known as inflation targeters — IT).[2] Cognizant that central bankers in the latter group of countries influence short-term interest rates through a policy rate to keep inflation at a certain level or within a certain range while the US and others did not have such a target (Collins and Siklos, 2004), at least explicitly, we therefore ask whether the stance on inflation matters when it comes to the repercussions of large differential interest rate with the US.

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[2] See Hu (2006) for a comprehensive list of inflation and non-inflation targeters, and Collins and Siklos (2004) for a comparison between Australia, Canada, and New Zealand that explicitly targets inflation, and the U.S. that does not explicitly target inflation. Their results show that there are broad similarities in monetary policies despite the apparent differences. It is worth noting that our distinction between IT and non-IT is only valid for the period prior to EMU for European countries.

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It has been a little over a decade since Akerlof, Dickens, and Perry (hereafter ADP) (1996), based on the original work of Tobin (1972), have challenged the wisdom of monetary neutrality embodied in the long-run vertical Phillips curve and its empirical counterpart; the non-accelerating inflation rate of unemployment, NAIRU, by showing that low rates of inflation may cause high and persistent rates of unemployment when nominal wages are downward rigid. Their findings therefore suggest that low inflation-targeting monetary policy can be destabilizing for countries if central bankers take as *article of faith* that there is no trade-off between inflation and unemployment in the long-run. This contribution is particularly of importance for OECD countries where labor unions are strong and inflation is targeted at low levels.

Several authors have built on the work of Akerlof et al. (1996) to either explain unemployment rate in a single country or differential unemployment rate across countries and their link with aggressive zero-inflation-targeting monetary policy. For example, Akerlof et al. (1996) have applied their own model to US and Canadian data to show there is a long-run tradeoff between unemployment rate and inflation rate. Djoudad and Sargent (1997) reached a similar conclusion based on Canadian Data. Exploring the same line of research, ADP (2000) and Fortin and Dumont (2000) have respectively present empirical results based on US and Canadian data for an efficiency wage model where agents are assumed to be near-rational, and therefore may deviate from profit- and utility-maximization under certain conditions. Lundborg and Sacklén (2006) apply the ADP model to Swedish data to investigate the relationship between low-inflation targeting and long-run unemployment. Their research shows that the data do not support the NAIRU model for the Swedish economy and suggests that an increase in inflation target from 2% to 4% would bring long-run unemployment down by several percentage points. In their view, this finding carries serious implications for the euro countries since adherence to a single inflation target by the European Central Bank (ECB) is likely to generate excess unemployment in individual member countries. On a cross-country basis, Fortin (1996, 2001) offers the relative tightness of monetary policy in Canada in comparison to that of the US as the main culprit for the high and persistent differential unemployment rate between the two countries that worsens in the 1990s with the recession, the so-called The Great Canadian Slump. Ball's (1997) work on the linkages between changes in unemployment and disinflation reveals that the cost of disinflation is high and persistent unemployment rates for OECD countries. He noted that OECD countries with larger reductions in inflation or which take longer to achieve a given reduction in inflation have also endured increases in unemployment for longer periods of time. Dickens (2001) provides further evidence of a nonlinear Phillips curve for a number of European countries based on the near-rationality hypothesis.

Disagreements, however, persist in the literature as to whether monetary policy can be destabilizing for economies that targets zero-inflation or price stability, a proposition that goes against the well-accepted consensus among economists on NAIRU (see Friedman and Macklem, 1998; Crawford and Hogan, (1998–99); Crawford, 2001; Crawford and Wright, 2001; Faruqui, 2000; Farès and Hogan, 2000; Mishkin, 2001; Parkin, 2001, to cite just a few). The key puzzling question however remains: can differences in monetary policy targets explain the differential unemployment rate between major developed countries and the US? Subsequent contributions to the literature have mostly amplified on the advantages or pitfalls of inflation targeting. The focus has been generally on inflation and output outcomes over several years (e.g. Ball and Sheridan, 2005; Batini and Laxton, 2007; Batini et al., 2005; Brito and Bystedt, 2010; Gonçalves and Salles, 2008), but not on the ensuing differential unemployment rate that may arise or the vulnerability to economic shocks, be they local, regional, or global. Beck et al. (2009) examine the size and persistence of differential inflation rates for six euro area countries and find that national factors such labor market institutions play an important role in inflation rates variation. Malikane and Semmler (2008) investigate the implications of adopting inflation targeting policy when unemployment rate is high in a small open economy. Their finding show that the optimal Taylor rule is robust to real exchange rate, aggregate demand and productivity shocks. However, they also show that in the context where the unemployment rate is high, the robustness to demand shocks is equivalent to trapping the economy at high unemployment rate equilibrium. Altavilla and Ciccarelli (2010) study the link between inflation forecasts, monetary policy, and unemployment dynamics in the euro area and the US. Their results show that the estimated effects of shocks to interest rates on unemployment might depend on both the method used to forecast inflation and on the rule that the policymaker adheres to. Altavilla and Ciccarelli argue that the result of their paper is independent of whether they consider the euro area or the US. In the latter, interest rate shocks can have larger and more significant effects on unemployment than in the former, the reason being the higher degree of persistence in European unemployment. de Carvalho Filho (2010) has recently investigated how countries with inflation targeting fared in comparison with their non-inflation peers during the recent financial crisis. Of importance to this paper, she finds some weak evidence that inflation targeting countries did better on unemployment rates, though advanced IT countries have had relatively stronger industrial production performance and higher GDP growth rates than their non-inflation targeting peers. However, she could not find such difference for emerging countries or her full sample. Brito and Bystedt (2010) show that there is no evidence that IT in emerging economies improves economic performance as measured by the behavior of inflation and output growth. Output growth is actually lower during IT adoption.

It is worth noting that none of the above cited papers explored the direct linkages between the monetary instruments and unemployment rates. What we care about in this paper along with Akerlof et al. and Fortin is not the usual deviation from the fund rate that takes place due to financial market adjustments in prevention of capital outflows from OECD countries but rather the large unexpected deviations with excess unemployment as a consequential effect. The critical issue that is also raised in this paper is that of foreign central bank dependence on the US. These issues do not appear to have been formally investigated in the literature.

This paper tests for cointegration to uncover the interest rate linkages between each major OECD country and the US and estimates quarterly structural vector autoregression (SVAR) models with two and three endogenous variables. The bivariate models contain the differential between each country's real short-term interest rate and the US rate and the differential between each country's unemployment rate and the US unemployment rate whereas the trivariate models include the differential inflation rate between each country and the US as a third variable. The empirical results indicate that major differences with the US in terms of monetary policy did give rise to higher and persistent unemployment rate for the countries considered, save for Japan in the 1990s. These finding tend to suggest that keeping interest rate in line with the fund rate by targeting inflation rate at a higher level could have alleviated unemployment in OECD countries prior to the recent crisis. However, since monetary policy in the US has been blamed for the debacle in the housing market that triggered the financial crisis, and given that OECD countries had higher interest rates than the US, this should have served as a shield for their housing market, but it did not. Therefore, the consensus that lower interest rate was the major culprit for the financial crisis does not seem to sit on firm grounds. It makes more sense to blame the crisis on lax mortgage rules and financial regulations in general than on monetary policy. The reason is that Canada had almost the same interest rate as the US prior to the recent crisis but did not suffer as much as its counterparts of the G8. Canada's ability to weather the storm, as many economists agree, stems from the sound financial structure and regulations in place.

The rest of the paper is organized as follows. Section 2 discusses the conceptual framework and methodology. Section 3 presents the empirical results and analysis. Section 4 concludes the paper.

2. Conceptual framework and methodology

The conceptual framework is that central banks manage reserves through different means (government switching deposits, discount rate, and open market operations) to set a policy rate based on some targeted rate of expected inflation that influences the short-term interest rate. Economic agents receive that information and, if they understand it, decide whether to use it fully, or partially, or not to use it all, the near-rationality proposition of Akerlof et al. (2000) and Fortin and Dumont (2000). The outcome in terms of actual inflation and unemployment from that point on is uncertain; inflation higher or lower than the expected rate may co-exist with or without lower or higher unemployment rate, depending on whether the long-run Phillips curve is vertical or not, hence the argument on nominal wage rigidity by Akerlof et al. (1996), Fortin (1996, 2001), Simpson et al. (1998), and Fortin and Dumont (2000). This paper makes a valuable contribution to the existing literature in taking a direct approach to ask if one were to hold other factors constant, how monetary-policy shocks would influence the differential unemployment rate between those countries with an explicit inflation target and the US which officially did not have such a target. The US and other major OECD countries fit well this profile. It is wise to surmise at this point that the approach we take in this paper to settle the debate is novel in that neither Fortin (1996, 2001), Akerlof et al. (1996, 2000), nor others have used the SVAR approach to uncover the linkages between the two economic variables.

2.1. Interest rate linkages

The real interest rate parity (RIP) condition[3] is one of the most used tests of interest rates linkages between countries. However, as Frankel and MacArthur (1988) and Frankel (1992) demonstrate, the use of this test suffers from a flaw. It is difficult to decompose the currency premium that arises into foreign exchange risk premium and expected real depreciation for the latter is not observable. To get around this problem, Mylonidis and Bowe (1999) suggest incorporating the international Fisher effect into the conventional RIP condition and to impose rational expectations, assuming that the disturbances are normally distributed with zero mean and constant variance. Their version could be written as:

$$R_t - R_t^* = \left([i_t - i_t^* - (f-s)] + [(f-s) - d_t] - [(p_t - p_t^*) - d_t]\right) \quad (1)$$

where R_t, i_t, p_t, f_t, s_t, and d_t are the real interest rate, nominal interest rate, expected rate of inflation, forward rate, spot rate, and the expected nominal currency depreciation of the domestic country, respectively. The asterisk is used for foreign countries' variables.

Eq. (1) dictates that differential real interest rates across countries are the sum of two terms: the country premium and the currency premium, which is the difference between the foreign exchange risk premium and the expected real depreciation. To deal with the problem of unobservability of exchange rate expectations, Mylonidis et al.(1999) further argue that when financial instruments are denominated in the same currency, the currency premium is equal to zero by definition, leaving $(R_t - R_t^*) = (i_t - i_t^*)$ from Eq. (1). This leads them to conclude that testing for capital market integration using nominal international bond yield is equivalent to testing for capital market integration using real interest rates.

Katsimbris and Miller (1993) and Karfakis and Moschos (1990) have followed Mylonidis et al.'s strategy. They use an interest arbitrage relation, which stipulates that the interest rate differentials on two traded one-period bonds in *different* currencies equals the difference between the forward and the spot exchange rates. By taking into consideration expectation and risk premium, they have considered a model of the form:

$$i_t - i_t^* = f_t - s_t = Ds_{t+1} + (Es_{t+1} - s_{t+1}) + \pi_t \quad (2)$$

where D and E are first difference and expectation operators, π_t is the risk premium, and the error term is assumed to be normally distributed. Their assessment, which is based on previous works of Meese and Rogoff (1983), leads them to conclude that the right hand side variables are stationary, which automatically implies that the left-hand side is stationary. They then argue that national interest rates should be pairwise cointegrated. They test cointegration with the following equation:

$$i_t = \alpha + \beta i_t^* + \varepsilon_t \quad (3)$$

A common approach to uncover the interest rate linkages among countries is sensitivity analysis (Karfakis and Moschos, 1990 and Meese and Rogoff, 1983). This paper uses a similar approach that follows the dynamic ordinary least squares (DOLS) of Stock and Watson (1993), which is an improvement upon the two-step approach proposed by Engle and Granger (1987) and the Johansen's (1988) multivariate approach.[4] The first step resumes to estimating a co-integration equation with OLS where both leads and lags of the change in the independent variables and the second step consists in testing for unit root on the residuals obtained from the first step. An error-correction model is then estimated to capture short-run effects and gradual adjustments. The cointegration equations contain each country's short-term interest rate as left-hand side variable and the US's short-term rate as right-hand side variable.

$$i_t = \delta_0 + \delta_1 i_t^{US} + \sum_{j=-p}^{p} \lambda_j \Delta i_{t-j}^{US} + e_t \quad (4)$$

2.2. Differential interest rate and differential unemployment rate linkages

SVAR tests with 4 lags as per Akaike Information Criteria are employed to determine how a once-and-for-all interest rate shock affects the unemployment rate differential between each country and the US. If it is true that a higher interest rate in one of the countries (say, country j) widens the unemployment rate gap with the US, one will observe an increase in unemployment rate differential following a shock in the interest rate differential. An identified vector autoregression model will tell us about the size and permanence of any response. For the matter at hand, the SVAR test is unequivocally a robust test. Nominal interest rate differential can only influence differential unemployment rate through differential real interest rate, which alters the interest-sensitive components of aggregate demand. Assuming currency risk premium and country-risk premium are zero for the major OECD countries, we follow Mylodinis et al. (1999) as per Eq. (1) to link differential interest rate with differential unemployment rate:

$$\left(R_t^d - R_t^f\right) = \left(i_t^d - i_t^f\right) = \alpha(t)\left(u_t^d - u_t^f\right) \quad (5)$$

[3] $(R_t - R_t^*) = (i_t - i_t^*) - p_t - p_t^*)$ where R_t, i_t, p_t are respectively real interest rate, nominal interest rate, expected rate of inflation and * denotes similar foreign variables.

[4] The main issue with the Engle-Granger approach is that the estimated standard errors from the cointegration equation cannot be used for statistical inference because they do not follow a normal distribution. Although the coefficients of the OLS estimator are consistent, they are not normally distributed even in large samples. This is so even when heteroschedasticity autocorrelation consistent standard errors are used in the error correction model estimation. By contrast, Stock and Watson (1993) procedure has been found to produce estimates that are much more reliable, even if the dynamic structure is over specified. Inder (1993) and Montalvo (1995) have shown that the leads and lags eliminate asymptotically any possible bias due to endogeneity or serial correlation.

Where d and f are respectively domestic and foreign variables; $\alpha(t)$ is the response over time of differential interest rate to differential unemployment rate shock. Eq. (5) is easily manipulated to answer the research question at hand:

$$\beta(t)\left(R_t^{\mathrm{d}}-R_t^{\mathrm{f}}\right)=\beta(t)\left(i_t^{\mathrm{d}}-i_t^{\mathrm{f}}\right)=\left(u_t^{\mathrm{d}}-u_t^{\mathrm{f}}\right) \tag{6}$$

Where $\beta(t)={}^{1}/_{a}(t)$ measures the responses of differential unemployment rate to either the differential real or the nominal interest rate. $\beta(t)$ is expected to be either positive or negative depending on whether it is true that excessive contractionary monetary policy gives rise to higher differential unemployment rate or not. This is the underlying justification for exploring the linkages between the two variables.

The bivariate SVAR models orderly include the unemployment rate differential ($U_t^{*}=U_t^{\text{Country }j}-U_t^{\mathrm{US}}$) and the real interest rate differential ($r_t^{*}=r_t^{\text{Country }j}-r_t^{\mathrm{US}}$). Each of these variables is driven by both an unemployment shock (e_t^{u}) and an interest rate shock (e_t^{i}). For the trivariate SVARs, the differential inflation rate ($\pi_t^{*}=\pi_t^{\text{Country j}}-\pi_t^{US}$) is added to the bivariate models. Using the lag operator L, the infinite moving average representation of the structural model can be represented as:

$$\begin{bmatrix} U* \\ \pi* \\ r* \end{bmatrix}=\sum_{i=0}^{\infty}L^{i}\begin{bmatrix} \alpha_{11,i} & \alpha_{12,i} & \alpha_{13,i} \\ \alpha_{21,i} & \alpha_{22,i} & \alpha_{23,i} \\ \alpha_{31,i} & \alpha_{32,i} & \alpha_{33,i} \end{bmatrix}\begin{bmatrix} e_{t-i}^{u^{*}} \\ e_{t-i}^{\pi^{*}} \\ e_{t-i}^{r^{*}} \end{bmatrix} \tag{7}$$

The model is identified by using short-run restrictions as in Sims (1986). The short run restrictions are that neither the real interest rate shocks nor the shocks to inflation have contemporaneous effects on the unemployment rate differential and the shocks to real interest rate differential have no contemporaneous effects on differential inflation, which amount to setting $\alpha_{12,0}=\alpha_{13,0}=\alpha_{23,0}=0$. This assumption is plausible because it takes some time before monetary policy decisions can have real effects on the economy, and the unemployment rate is one of the most sluggish real variables. Note that the unemployment rate differential is allowed to respond as early as the next quarter, so this restriction still allows for a lot of flexibility in response. The third moving average expression of Eq. (7) can be seen as each country's central bank monetary policy reaction function in differential terms where differential real interest rate react to disturbances arising from all variables in the system. [5]

3. Empirical results and analysis

3.1. Data analysis, cointegration analysis, and SVAR results

The quarterly data on unemployment, inflation, and short-term interest rates for all the countries come from OECD Economic Outlook Database and span the period 1970:1–2009:4. Fig. 1 shows a plot of the nominal interest rate pairing with the US while Fig. 2 shows a similar picture for unemployment rate. The gap between the two rates in each figure represent it*($=i_t^{\text{Country }j}-i_t^{\mathrm{US}}$) and U_t^{*}, respectively. Coincidentally, all the countries (except Japan) have their interest rates above that of the US while their unemployment rate gap with the US expands dramatically after the debt crisis and more so in the 1990s. Fig. 3 captures the link between real and nominal interest rates for each country and the gap represents the actual inflation rate. There is clear indication of a tight alignment of the two rates starting 1986 until the end the sample period for most of the countries, reflecting the low-inflation targeting period of the 1990s onward. The scatter plot in Fig. 4 of $r_t^{*}$and U_t^{*} does not show a priori any correlation between the two series.

Table 1 reports two sets of results for the cointegration tests along with the error-correction model estimation: one for 1970q1–2009q4 and the other for 1989q1–2009q4, which captures the inflation-targeting monetary policy period.[6] Each box contains the results pertinent to each country and there is evidence of a long-run relationship with the US in terms of interest rate, regardless of the sample considered. On aggregate, by taking the average of intercepts and coefficients, the long-run relationship between the countries as a block and the US can be summarized as follows: (1) for the overall sample, a 1-percentage point increase in US short-term rate leads to 85 basis-points with gradual adjustment of 12 percent per quarter for any deviation from the long-term relationship; (2) for the reduced sample, these figures drop to 77 basis-points and 8 percent, respectively. When we differentiate between inflation and non-inflation targeters, we find a 1-percentage point increase in US rate is associated with 84 and 86 basis-points with adjustment coefficients of 13% and 10% per quarter on average for the two groups respectively over the full sample. For the 1990s onwards, however, a huge gap in interest rate linkages with the US emerges between the two groups. Inflation targeting countries display an average cointegration coefficient of 93 basis points whereas the non-inflation targeting countries lies between 61 and 71 depending on whether or not Germany is included in the calculation. These findings indeed suggest that, in their pursuit of zero inflation, major OECD countries have deliberately conducted monetary policy in a fashion that deviates from the US's in the 1990s, as shown in Fig. 1. For the Euro zone, a 1-percentage point increase in the fund rate gives rise to 48 basis points increase in the Euro rate with gradual adjustment of 12 percent per quarter.

Figs. 5 and 6 summarize the results of the SVAR tests for the full and the reduced samples, respectively. The first column of Fig. 5 shows the non-cumulative response of differential unemployment rate to differential real interest rate assuming inflation had been targeted at a low level over a 10-period horizon. The third column presents the same information over a period of 40 quarters to shed further light on the impulse response patterns of the second column that shows an ever increasing tendency. The results demonstrate that differential real interest rate shocks have little or no effect on differential unemployment rate in the first 5 quarters. Thereafter, for the full sample of the real data, in response to an interest rate shock, the differential unemployment rate with the US increases for each country and remains above the baseline for extended periods of time. The only exceptions are for Canada and Italy where differential unemployment rate first declines for 5 quarters before it starts rising. This might be due to the sluggishness of unemployment to respond to interest rate shocks, or, simply that in the very short-run interest rate differentials have no effects on unemployment.

Estimating just bivariate SVAR models to document the link between monetary policy shocks and persistent unemployment rate differential may be construed as improper because there is no clear indication that the pursuit of low inflation is the culprit. To avoid possible misspecifications of the SVAR models, Inflation differential was incorporated, Eq. (7) was estimated, and the results are reported in Fig. 6. The non-cumulative responses are analyzed here but the cumulative responses are inserted in Appendix B for the same reason mentioned earlier.[7] Irrespective of the country considered, differential real interest rate rises in response to a one-standard deviation differential inflation innovation, which is theoretically sound and compatible with the common understanding of the purpose of monetary policy.

[5] It is worth noting that monetary policy shock is any change in monetary and non-monetary demand variables that forces the central bank to change its key rate. Since we use mostly differential variables, what is to be construed as shock is the difference of the changes in these monetary and non-monetary variables between the US and each other OECD countries in the sample.

[6] Coefficient estimates of the leads and lags of the right hand-side variables in Eq. (4) are not reported for the sake of brevity.

[7] Appendices A and B are not for publication, they are provided so that the referee can better assess the paper. These results will be made available to readers upon request.

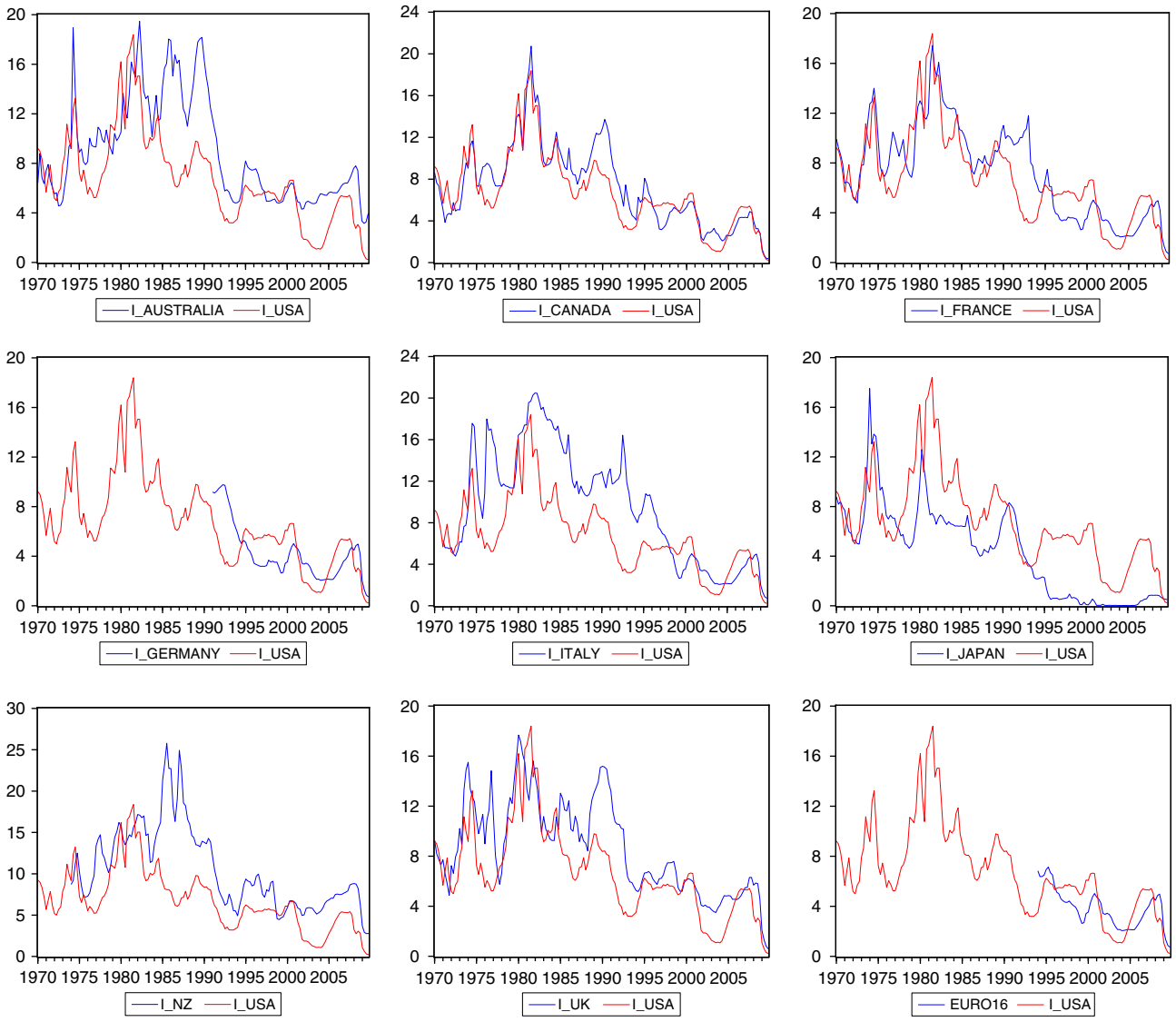


Fig. 1. Short-term interest rates comparison with the US.

The first column confirms that central bankers implement contractionary monetary policy to combat inflation. The second column displays the relationship between inflation and unemployment in differential terms for each country. All countries but Australia and Canada confirm the existence of a short-run Phillips curve. The long-run vertical Phillips curve could not be confirmed for most countries. Differential unemployment rate responses never cross the baseline back up after falling in the case of Germany for the 1990s onward and Japan over the 40-quarter period. The third column presents the responses of differential unemployment rate to differential real interest rate shock. The same pattern observed in the bivariate case is present here. Only Canada and Italy show a clear decline of differential unemployment rate within the first 3 or 4 quarters. The remaining countries show a slight sluggishness to rise and remain above the baseline for quite some time and never cross the baseline down. Therefore, whether we consider a bivariate or a trivariate model, the results are pretty much the same: Excessive low-inflation targeting monetary policy does give rise to persistent differential unemployment rate. These results do not change at all for the differential real interest and unemployment rates responses when the change in actual inflation is used in lieu of differential inflation between the two countries. However, the unemployment rate differential remains below the baseline for most countries. These results are reported as Figures B-2 and B-3 in Appendix B.

For the reduced sample characterizing the period of low-inflation-targeting monetary policy (see Fig. 7), all but two countries have shown a pattern similar to Canada and Italy when the focus is on the response (cumulative or not) of unemployment rate differential to real interest rate differential shock. Japan's unemployment rate differential with the US actually declines in response to an interest rate shock and never reaches the baseline, confirming Japan's economy not moving along the same wavelength as other major OECD countries. Table 2 provides further details by displaying the data behind the impulse responses. On average, the cost in terms of unemployment that is borne by the countries for deviating significantly from US monetary policy is −4, 30, 106, and 186 basis-points after 5, 10, 15, and 20 quarters respectively. After removing Japan as an outlier, the cost increases to −2, 42, 129, and 228 basis-points over the same horizon.[8] Fig. 8 originated from Table 2 partially lends support to the claim that Canada had had a weak macroeconomic performance in the early 1990s but overall has done better than France

[8] These results contrast von Hagen and Hofmann (2004) that aggregate demand in euro-area countries is significantly affected by the euro-area real interest rate, but not by national real-interest-rate differentials.

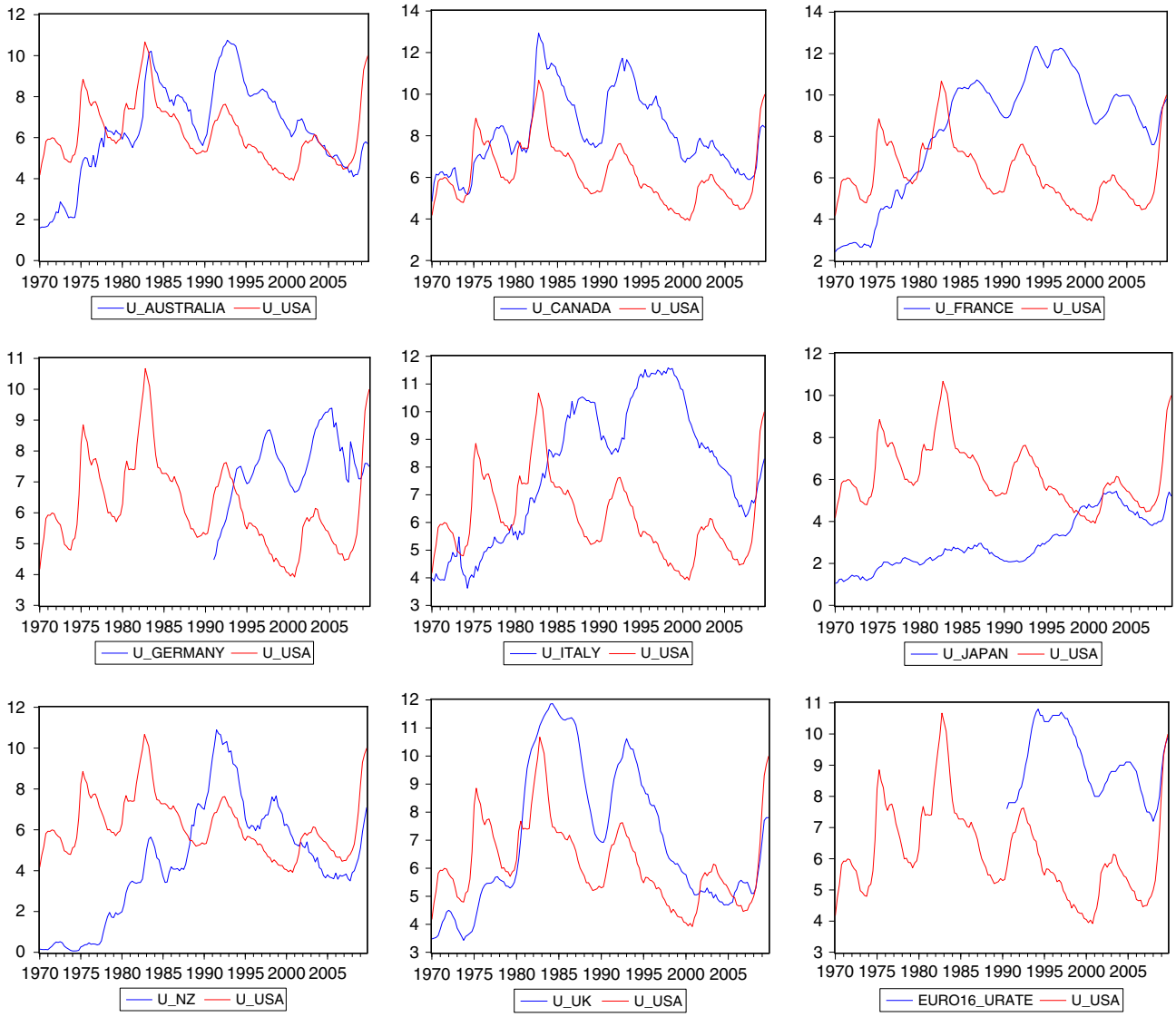


Fig. 2. Unemployment rates comparison with the US.

and New Zealand. The responses of differential real interest rate to differential inflation shock across countries are similar to the full sample results. Differential interest rate rises, reaches a peak, and then dies out over time and the error bands are not as large as those of the differential unemployment rate at longer horizons. Table 2 also shows that the unemployment cost of deviating from US monetary policy is much higher for IT than for Non-IT countries.

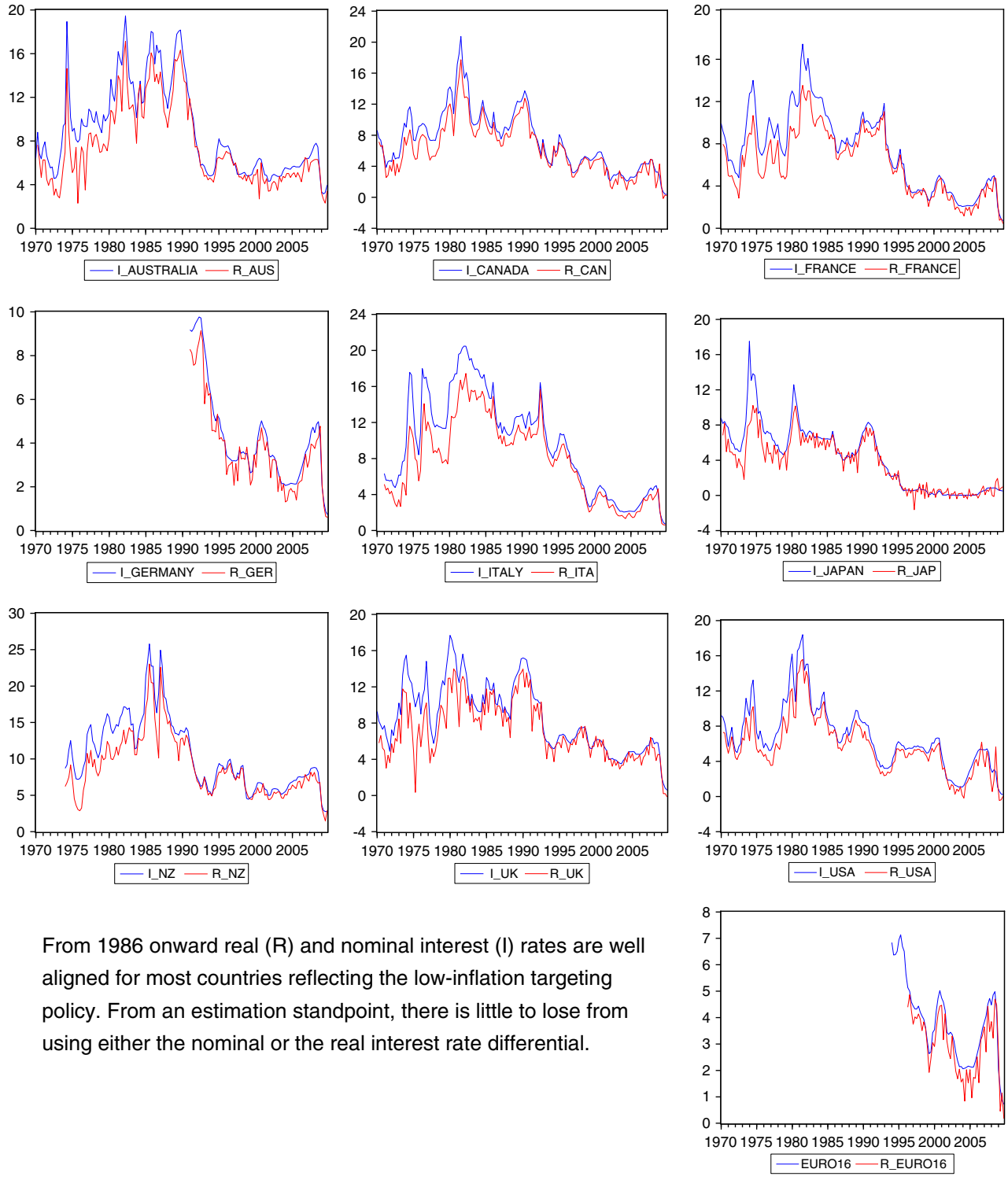
3.2. Empirical results critique and rebuttal

The empirical results thus far have shown that regardless of whether one uses bivariate or trivariate VAR with or without inflation, with nominal interest rate (not reported here) or real interest rate differential, low-inflation targeting monetary policy indeed is associated with persistent unemployment rate differential for the selected countries considered. These findings however have left a number of questions unanswered. Basically, why is not differential nominal interest rate incorporated in the VAR? And most importantly, could it be that: (a) Fiscal distortions generate higher real interest rates and unemployment in European countries? (b) International portfolio shocks affect interest rate differentials and generate persistent real interest rate differentials? And (c) the unemployment persistence observed is due to the nominal exchange rate targeting policy pursued by some countries during the sample period? These may have nothing to do with low-inflation targeting.[9]

There are a number of relationships that we can use as guides in our attempt to address the potential concerns above:

1) Nominal interest rate (i) = interest payment/price of bonds
2) Real interest rate (r) = nominal interest rate (i) − expected rate of inflation (π^e)
3) Bonds market dynamic is a reflection of money market dynamic: money market equilibrium<=>bond market equilibrium

[9] We are grateful to an anonymous participant at the Weekly Seminar of the College of Business Administration of the University of Dubai for raising these questions and for suggesting the inclusion of inflation, which we interpret as differential inflation, in the VAR. The results are not sensitive to the inclusion of either variable.



From 1986 onward real (R) and nominal interest (I) rates are well aligned for most countries reflecting the low-inflation targeting policy. From an estimation standpoint, there is little to lose from using either the nominal or the real interest rate differential.

Fig. 3. Comparison between nominal and real interest rates.

4) Interest-sensitive expenditure components of aggregate demand $(AD) = f[C = C(Y_d,\ r,\ldots),\ I_g = I_g(r,\ldots),\ XN = XN(e = e(i - i^*) = (r - r^*) + (\pi - \pi^*),\ldots)]$ where C, I_g, and XN are respectively consumption, gross investment, and net exports. The determinants are disposable income (Y_d), real interest rate (r), exchange rate (e), and π^e

Suppose the Central Bank wants to combat observed and/or expected inflation by way of altering the short-term interest rate. It can impose higher reserve requirements, or increase the discount rate, or switch government deposits or sell bonds through open-market operations, or use a combination of these tools to achieve the level of interest rate suitable for the targeted inflation rate. Let us assume that the central bank opts for the open market operations. By selling government bonds in the bonds market, the supply of bonds will shift rightward increasing the quantity of bonds available and decreasing the price of bonds while purging the excess liquidity that exists in the market. Since nominal interest rate is the ratio of

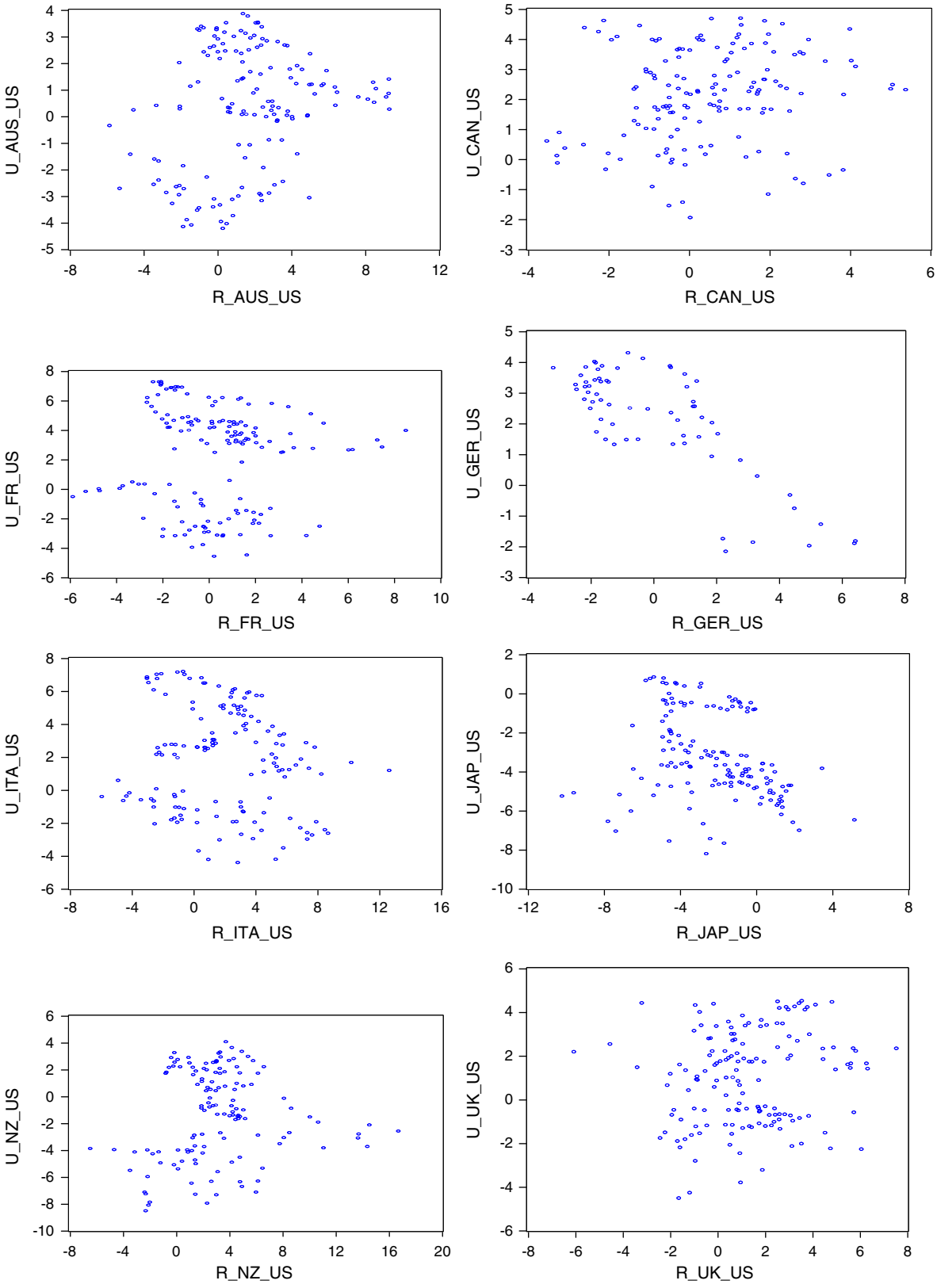


Fig. 4. Differential real interest rate and differential unemployment rate compared.

interest payment over the price of bonds, interest rate therefore increases as a result. The effect of the rise of nominal interest rate on the real interest rate is not a clear cut. Real interest rate will increase if inflation remains constant or if the expected change in inflation is outweighed by the change in nominal interest rate. Real interest rate will remain constant if change in nominal interest rate equals expected change in inflation. Real interest rate will decline or even become negative if the change in nominal interest rate is not

Table 1
Interest rates linkage between OECD and Australasian countries and US.

Full sample (1970q1–2009q4)	Reduced sample (1990q1–2009q4)
Cointegrating Equation:	**Cointegrating Equation**:
I_AUSTRALIA = 3.60 + 0.79 I_USA	*I_AUSTRALIA = 2.58 + 0.85 I_USA*
t = (6.41) (11.14) R^2 = 0.4564	*t = (4.35) (7.09) R^2 = 0.4252*
d = 0.2251	*d = 0.0563*
Error Correction Equation:	**Error Correction Equation**:
ΔI_AUSTRALIA = 0.01 + 0.33ΔI_USA – 0.12Ehat$_{t-1}$	*Δ I_AUSTRALIA = 0.12 + 0.61ΔI_USA – 0.13Ehat$_{t-1}$*
t = (0.09) (3.43) (−3.49)	*t = (−2.72) (6.58) (−5.63)*
R^2 = 0.1436 d = 1.9168	*R^2 = 0.5764 d = 0.9706*
Cointegrating Equation:	**Cointegrating Equation**:
I_CANADA = 0.96 + 0.95 I_USA	*I_CANADA = 0.52 + 1.031 I_USA*
t = (3.05) (23.71) R^2 = 0.7916	*t = (0.92) (8.92) R^2 = 0.5394 d = 0.099*
d = 0.2474	**Error Correction Equation**:
Error Correction Equation:	*ΔI_CANADA = −0.08 + 0.88 ΔI_USA - 0.09*Ehat$_{t-1}$*
*ΔI_CANADA = −0.01+ 0.62*ΔI_USA - 0.15*Ehat$_{t-1}$*	*t = (−1.25) (5.96) (−2.26)*
t = (−0.18) (11.21) (−4.15)	*R^2 = 0.4453 d = 1.85*
R^2 = 0.5182 d = 1.77	
Cointegrating Equation:	**Cointegrating Equation**:
I_FRANCE = 1.82 + 0.82 I_USA	*I_FRANCE = 2.27 + 0.61 I_USA*
t = (4.41) (15.64) R^2 = 0.6231	*t = (2.74) (3.66) R^2 = 0.16 d = 0.06*
d = 0.2075	**Error Correction Equation**:
Error Correction Equation:	*ΔI_FRANCE = −0.10 + 0.09ΔI_USA - 0.072*Ehat$_{t-1}$*
ΔI_FRANCE = −0.031 + 0.29 ΔI_USA - 0.12 Ehat$_{(t-1)}$	*t = (−1.28) (0.54) (−2.39)*
t = (−0.46) (4.85) (−4.03)	*R^2 = 0.1018 d = 2.02*
R^2 = 0.23 d = 1.44	
Cointegrating Equation:	**Cointegrating Equation**:
I_ITALY = 2.50 + 1.07I_USA	*I_ITALY = 2.22 + 0.95 I_USA*
t = (3.64) (12.27) R^2 = 0.51 d = 0.15	*t = (1.97) (4.16) R^2 = 0.20 d = 0.06*
Error Correction Equation:	**Error Correction Equation**:
ΔI_ITALY = −0.013 + 0.28Δ I_USA - 0.10Ehat$_{(t-1)}$	*ΔI_ITALY = −0.12 + 0.06ΔI_USA - 0.05Ehat$_{t-1}$*
t = (−0.13) (3.25) (−3.79)	*t = (−1.29) (0.27) (−1.95)*
R^2 = 0.16 d = 1.35	*R^2 = 0.06 d = 1.50*
Cointegrating Equation:	**Cointegrating Equation**:
I_JAPAN = −0.35 + 0.70 I_USA	*I_JAPAN = −1.04 + 0.59 I_USA*
t = (−0.68) (10.87) R^2 = 0.44	*t = (−1.5) (4.22) R^2 = 0.21 d = 0.20*
d = 0.20	**Error Correction Equation**:
Error Correction Equation:	*ΔI_JAPAN = −0.09 + 0.17ΔI_USA - 0.05Ehat$_{t-1}$*
ΔI_JAPAN = −0.06 - 0.05Δ I_USA - 0.09Ehat$_{(t-1)}$	*t = (−2.76) (2.54) (−3.10)*
t = (−0.76) (−0.71) (−3.47)	*R^2 = 0.24 d = 0.79*
R^2 = 0.08 d = 1.51	
Cointegrating Equation:	**Cointegrating Equation**:
I_NZ = 5.11 + 0.82I_USA	I_NZ = 3.64 + 0.83 I_USA
t = (7.05) (8.93) R^2 = 0.38 d = 0.16	*t = (7.19) (8.09) R^2 = 0.49 d = 0.17*
Error Correction Equation:	**Error Correction Equation**:
ΔI_NZ) = 3.3 × $^{10-4}$ + 0.18 ΔI_USA - 0.08Ehat$_{(t-1)}$	*ΔI_NZ = −0.05 + 0.80ΔI_USA - 0.11Ehat$_{t-1}$*
t = (−0.003) (1.72) (−2.58)	*t = (−0.64) (4.83) (−2.36)*
R^2 = 0.07 d = 1.37	*R^2 = 0.33 d = 1.29*
Cointegrating Equation:	**Cointegrating Equation**:
I_UK = 3.38 + 0.8 I_USA	*I_UK = 2.03 + 1.00 I_USA*
t = (8.12) (14.93) R^2 = 0.60 d = 0.33	*t = (3.03) (7.34) R^2 = 0.44 d = 0.07*
Error Correction Equation:	**Error Correction Equation**:
ΔI_UK = −0.02 + 0.21ΔI_USA - 0.15Ehat$_{(t-1)}$	*Δ I_UK = −0.12 + 0.30*ΔI_USA - 0.11Ehat$_{(t-1)}$*
t = (−0.20) (2.66) (−3.74)	*t = (−2.32) (2.51) (−4.21)*
R^2 = 0.12 d = 1.62	*R^2 = 0.33 d = 1.40*
Cointegrating Equation:	**Cointegrating Equation**:
I_EURO16 = 1.95 + 0.48 I_USA	*I_GERMANY = 3.10 + 0.30 I_USA*
t = (3.48) (3.68) R^2 = 0.36 d = 0.06	*t = (4.10) (1.84) R^2 = 0.05 d = 0.02*
Error Correction Equation:	**Error Correction Equation**:
ΔI_EURO16 = − 0.06 + 0.45ΔI_USA - 0.12 Ehat$_{(t-1)}$	Δ I_GERMANY = −0.08 + 0.14 ΔI_USA - 0.05Ehat$_{(t-1)}$
t = (−1.42) (5.60) (−3.17)	*t = (−1.94) (1.58) (−2.51)*
R^2 = 0.42 d = 0.63	*R^2 = 0.18 d = 0.76*

Note: Data for Germany and for the Euro Area are only available starting 1990 and 1996 from OECD Online Statistics, respectively.

enough to match the expected change in inflation. Since the central bank does not have any magic stick, one cannot predict that it will hit the targeted inflation rate every time it sets its policy. There is room for mistakes of course because there is no such thing as a perfect forecast. Assuming that the real interest rate does increase following the contractionary monetary policy pursued by the central bank, the natural outcome is that interest-sensitive components of aggregate demand may decline depending on whether economic agents factor this information in their decision-making process or not. If they do modify their consumption and/or investment decisions intertemporally, we will observe an increase in unemployment. Therefore, the nominal interest rate does not influence unemployment directly but it does so rather through its effects on the real interest rate, and these effects compete with the underlying determinants of inflation, whether they are supply- or demand-driven or both. The link between real interest rate and unemployment rate is well understood in the literature and there is little or no controversy on the channels by which the former alters the latter. This paper emerges from the lively debate that took place in the mid 1990s starting with the works of Akerlof et al. (1996) in the US and Fortin (1996) in Canada who question the existence or verity of the vertical long-run Phillips curve and blame central bankers for stepping too hard on the brakes to stop inflation. The instrument of monetary policy is the policy rate, which influences all other interest rates, trade flows and capital flows across countries. Assuming real interest rate does increase not because of decline in inflation alone but rather because of the competing forces that tilde towards the nominal interest rate and agents do take that information seriously, the linkage between the short-term interest rate and the unemployment rate follows through the line of reasoning above. That is, there is a direct relationship at least expected between the nominal interest rate and the unemployment rate. If the US does not adhere to an explicit target rate of inflation, sets its fund rate, which is supposed to influence all other interest rates in the rest of the world, and ends up with a lower unemployment rate. For sure, differential short-term interest rates will be positively correlated with differential unemployment rate. This is pretty much the research question at hand. We therefore ask whether the logic is true empirically. As could be understood from the argument above, we investigate the relationship between real interest rate differential and unemployment rate differential despite there could be other factors such as premia for political unrest and risk default that could inflate the real interest rate of some countries. These factors could give rise to higher real interest rate if reduced or eliminated, holding constant nominal interest rate and expected inflation rate. As could be gleaned from Fig. 3, there is no major difference between the real and the nominal interest rates after 1985 for most countries and from 1990s onward there is a very close relationship between the two, which is evidence of a low inflation rate leaning towards a zero gap.

The concerns on the role played by fiscal distortions and international portfolio shocks in unemployment persistence are also valid. There are however two plausible explanations. The first one has to do with the methodology used. The fundamental assumption of the SVAR technique is that it enables us to trace the responses of, say, differential unemployment rate to a differential interest rate shock, holding constant all other factors. The second follows from our line of reasoning above, real interest rate is the gap between nominal interest rate and the expected rate of inflation. Fiscal expansion in an AS-AD model, for example, will produce a shift of the AD curve giving rise to higher price and output levels. Assuming nominal interest rate remains constant even for a short while, if economic agents form expectation that inflation will rise, the real interest rate will decrease and thereby foment gross investment, consumption, and net exports, which eventually lead to a reduction in the level of unemployment, unless we are in a situation of liquidity trap. As could be seen, this is not how we anticipate central bankers who are committed to achieve a targeted inflation rate to behave upon the news of fiscal expansion, nominal interest rate will rise too and the two competing effects may give rise to higher real interest rate along with its repercussions. The insight gathered here would be the same if we instead

started out with an IS-LM model where the downward sloping IS curve shifts to the right increasing both output and nominal interest rate (= real interest rate + expected rate of inflation). Since the IS-LM is a fixed price model, the expected rate of inflation is zero, hence real and nominal interest rates are the same, which is not too realistic. Romer (2000) contains a discussion about the advantages and shortcomings of the IS-LM model and we shall also remember that the AD curve is a locus of IS-LM equilibria under different

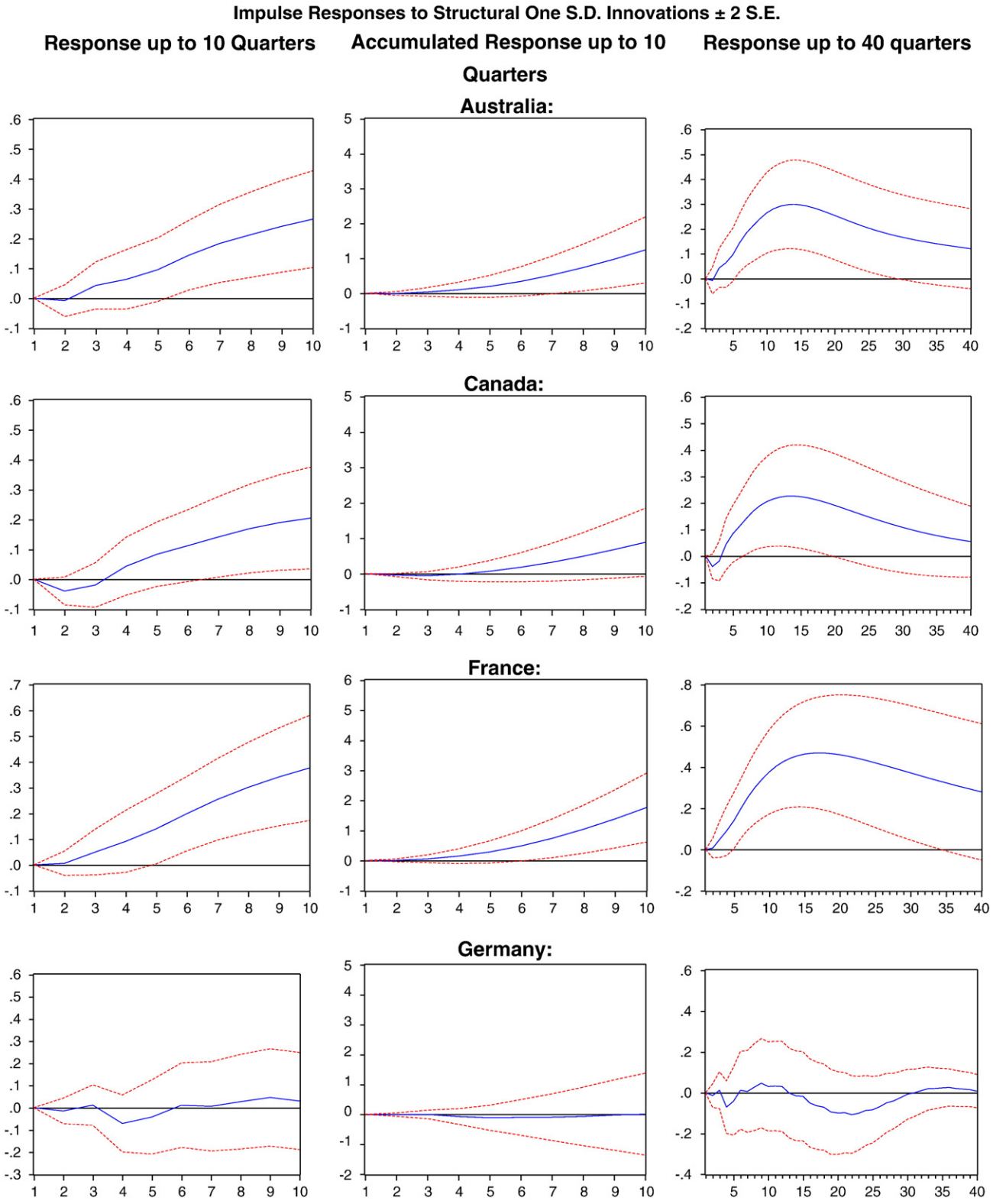


Fig. 5. Impulse responses of differential unemployment rate to differential real interest rate shocks.

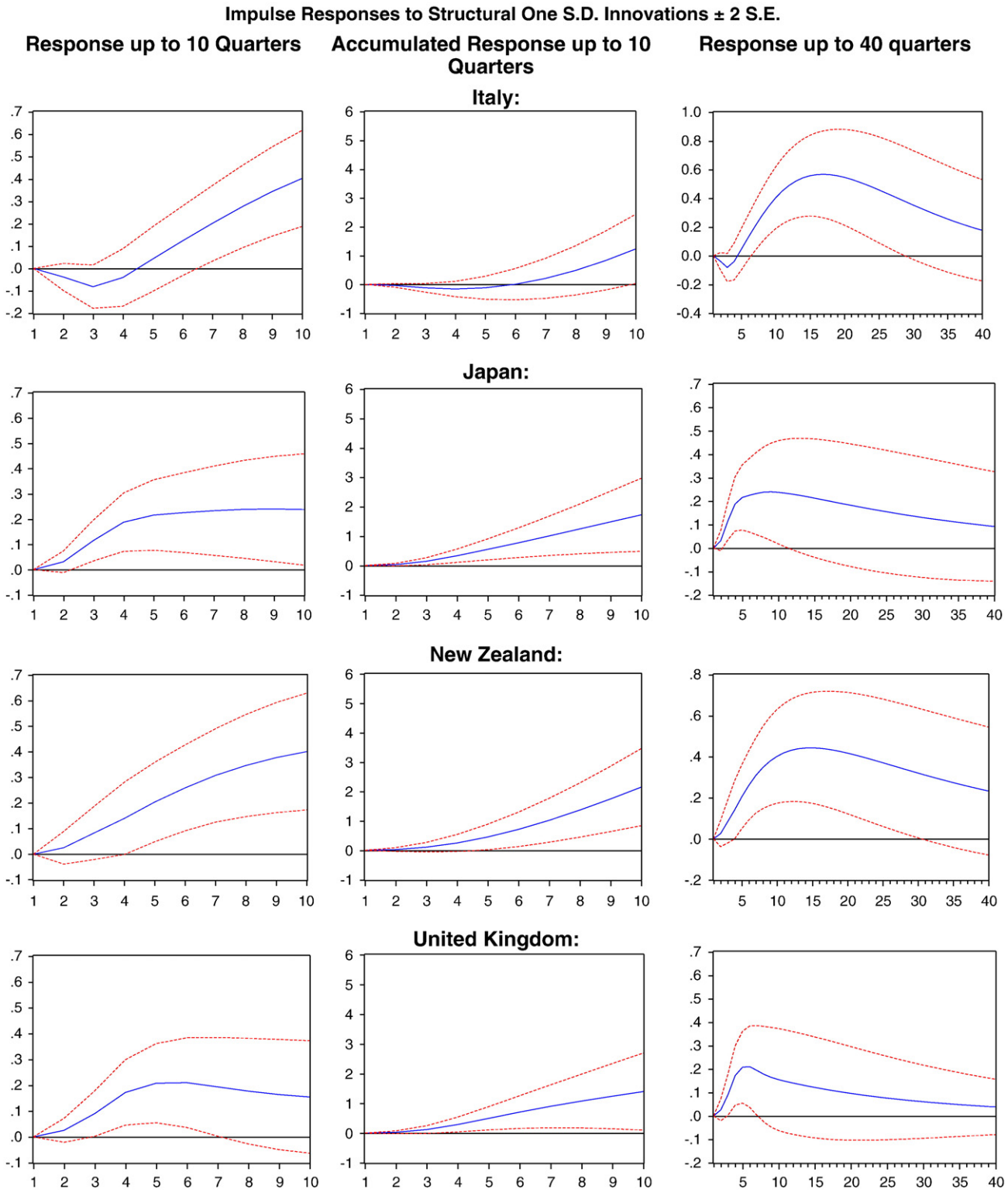


Fig. 5 (*continued*).

assumptions of prices, monetary and fiscal policies. In few words, what we are arguing is that these possibilities of fiscal and international portfolio shocks have already been accounted for once the central bank makes the decision to set the interest rate at a certain level because they do form expectations about inflation, which would reflect the effect of these shocks. These explain why there is a possibility that central bankers may make mistakes and also why it makes sense to use the real interest rate.

On the effect of nominal exchange rate target on unemployment rate, it is worth emphasizing that the monetary policy reaction

function of a central bank can have at least two objectives: an inflation rate target and an exchange rate target. This simply means that the central bank is trying to kill two birds with one stroke. The natural question that emerges is how does the central bank accomplish that objective? What we have learnt from open-macroeconomics is that the central bank will stand to exchange international reserves into domestic currency at any time whenever they feel the need. Well, any time the central bank buys its domestic currency, the money

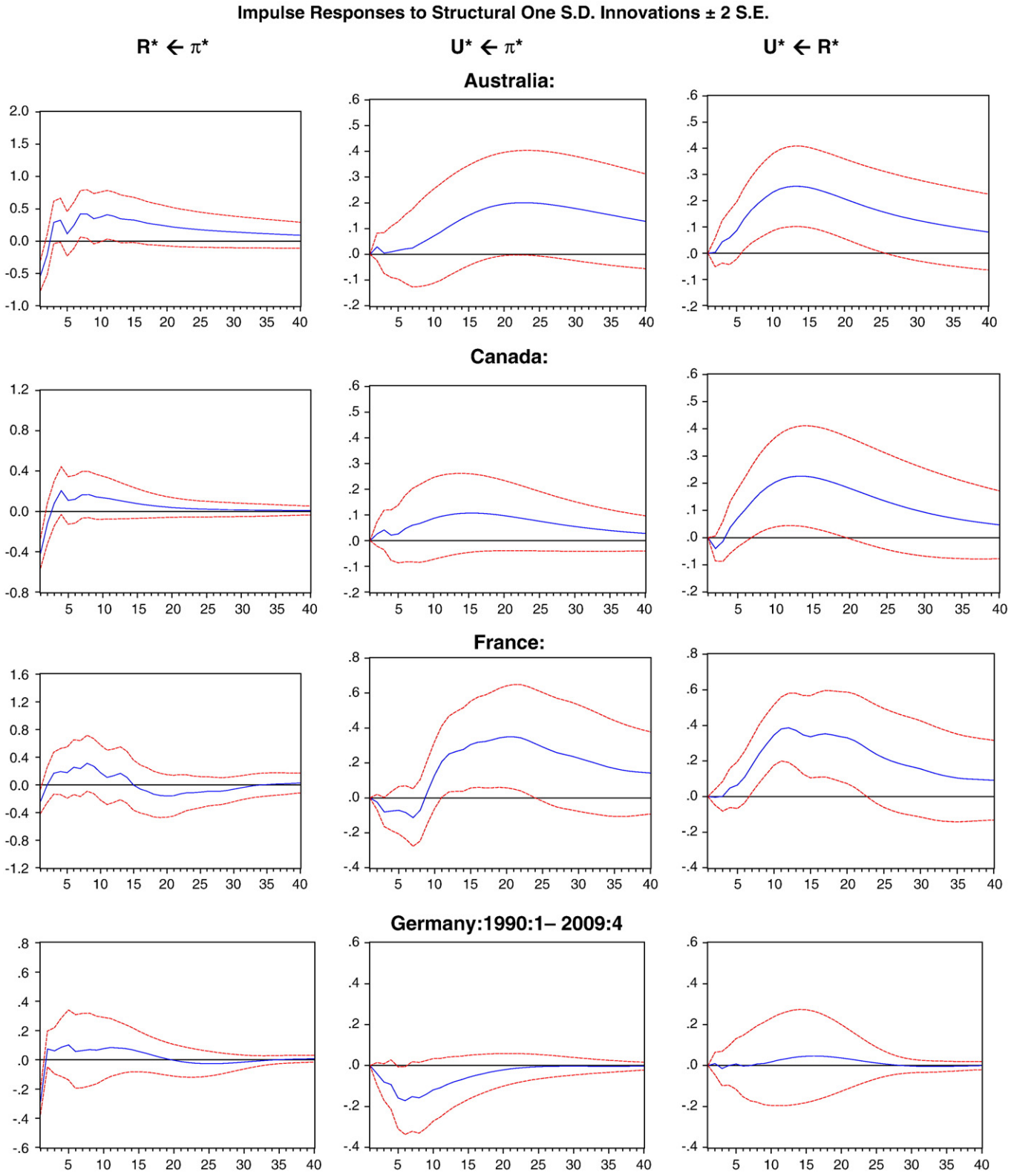
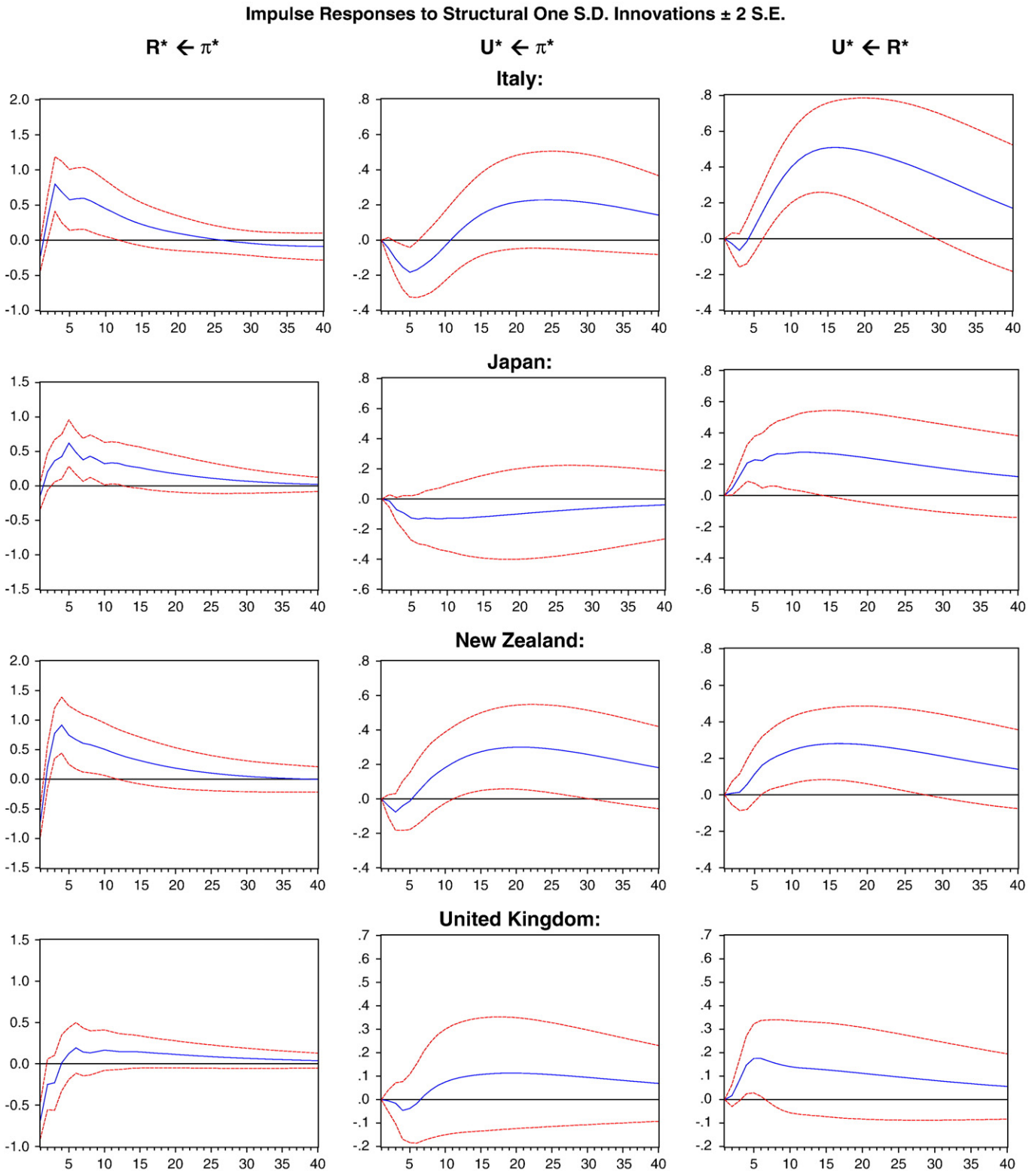


Fig. 6. Impulse responses of differential real interest rate and differential unemployment rate.



R*, U*, and π* are real interest rate, unemployment rate, and inflation rate differentials. For example, R*← π* is the response of real interest rate differential to inflation rate differential.

Fig. 6 (*continued*).

supply decreases giving rise to higher nominal interest rate, hence contractionary monetary policy, and as a result real interest rate will increase giving rise to lower investment, consumption, trade balance, etc. As transpired from this line of argument, whether we consider the real or the nominal side of the economy, as long as we stick to the basic Fisher Equation of the determination of real interest

rate, we can establish that the nominal interest rate is a relevant factor in its determination and as the effect of the real interest rate run through the real side of the economy, we can still make a connection between the nominal interest rate, which in the first place drives the real interest rate, and a real economic variable, though it is the real interest rate that ends up doing the trick.

One of the known shortcomings of monetary transmission mechanism is that it mainly models the demand side effects of monetary

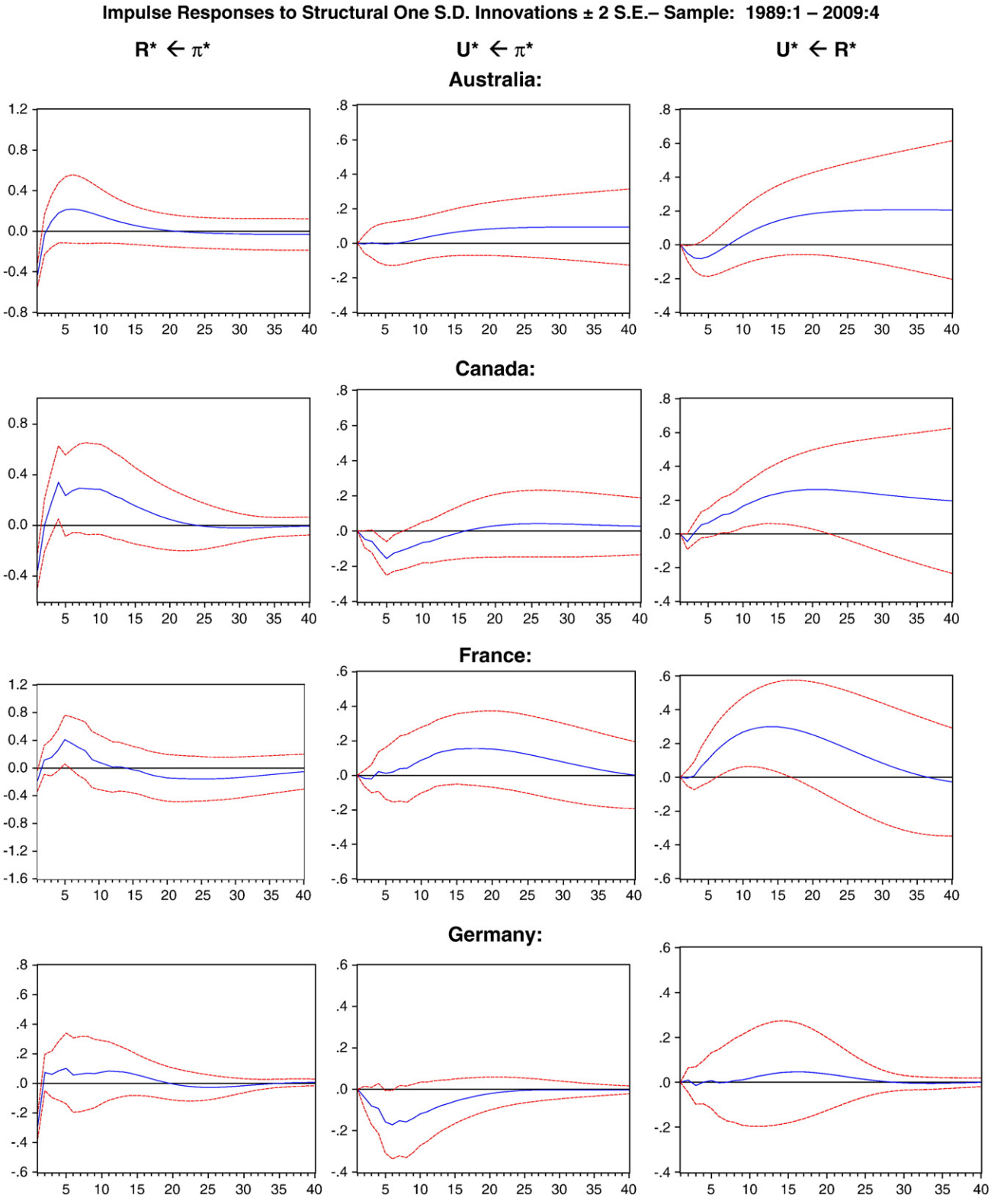


Fig. 7. Responses of differential real interest rate and differential unemployment rate — reduced sample.

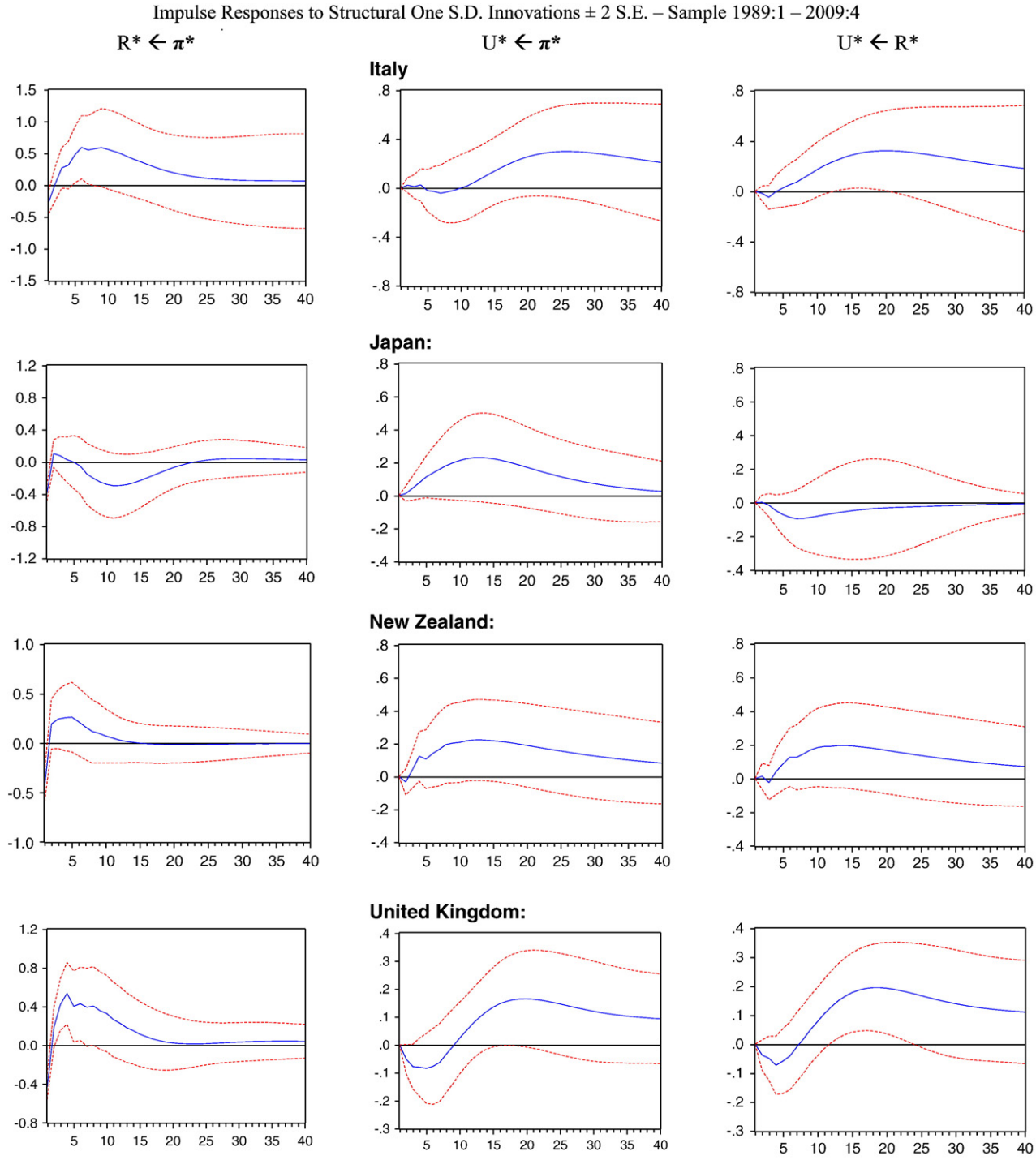


Fig. 7 (*continued*).

policy. Other shocks to the economy, such as productivity shocks, which can affect both supply and demand sides, are neglected, thereby leaving our VAR model impotent in explaining differential unemployment rate that may be tributary to such shocks.[10] We address this problem by estimating a trivariate VAR with output growth, unemployment rate, and real interest rate differentials to determine whether our findings on the linkage between differential unemployment rate and differential real interest rate are robust. The results presented in Fig. 9 are consistent with the theory in that in response to differential output shocks differential unemployment rate declines, and shocks to differential interest rate lead to a decrease in differential growth rate and an increase in differential unemployment rate, thereby confirming our earlier findings. It is worth noting that we can no longer have the argument that Japan is subjected to a business cycle different from those of the

[10] We thank an anonymous referee from Economic Modelling for valuable comments that have substantially improved the paper, particularly for making the suggestion that we incorporate differential growth rates in the VAR.

Table 2
Unemployment cost due to monetary policy shocks and correlation and granger causality of the key responses.

Country	Quarter 5	10	15	20	Correlation	Two-way Granger Causality (*p*-value)
Australia	−0.28	−0.27	0.29	1.14	0.42	0.00
Canada	0.08	0.70	1.77	3.05	0.76	0.00
France	0.18	1.25	2.72	4.10	-0.53	0.00
Germany	0.01	0.02	0.05	0.04	0.22	0.00
Italy	−0.04	0.50	1.74	3.32	0.89	0.00
Japan	−0.13	−0.57	−0.87	−1.05	0.94	0.00
New Zealand	0.12	0.87	1.84	2.73	0.50	0.00
UK	−0.22	−0.12	0.61	1.57	0.74	0.00
Average	−0.04	0.30	1.02	1.86		
Average — Japan	−0.02	0.42	1.29	2.28		
IT Average	0.08	0.30	1.13	2.12		
Non-Average TI	0.005	0.30	0.91	1.60		

The Correlation of the Responses relates to the link between unemployment rate differential cumulative response to real interest rate differential shock and the real interest rate differential cumulative response to differential inflation shock. There is clear evidence that for all countries but France the policy towards inflation adopted can partially explain the unemployment outcome observed. Two-way Granger causality of the two variables shows that the cumulative responses of differential unemployment rate to differential real interest rate shock can be explained by the cumulative responses of differential real interest rate to differential inflation shock. The same results hold for the non-cumulative responses. Inflation targeting (IT) countries are Canada, UK, Australia and New Zealand whereas non-inflation targeting (Non-IT) countries are France, Germany, Italy, and Japan in our study.

major OECD countries in the sample when differential output growth is part of the VAR. However, we continue to observe a decrease in differential unemployment rate for Canada and Italy for the first 3 quarters. By and large, the result that differential real interest rate has a long-term effect on differential unemployment is robust.

The key question that summarizes all the concerns above to which answers may bring further robustness to the finding is: how can one isolate the contribution of low-inflation targeting contribution to unemployment from other factors? To this end, we extract the response of real interest rate differential to differential inflation shock, the response of unemployment rate differential to differential interest rate shock over time, and compute the correlation for each country. We take the analysis one step further by asking whether these two created variables can explain each other by using a two-way Granger causality test. The results are presented in the last 2 columns of Table 2 and are reassuring. There is clear evidence that for all countries except France the policy towards inflation adapted can explain the unemployment outcome observed. Two-way Granger causality of the two variables shows that the cumulative responses of differential unemployment rate to differential real interest rate shock can be explained by the cumulative responses of differential real interest rate to differential inflation shock. The same results hold for the non-cumulative responses (not reported here). For France, there is reason to believe that other factors such as labor unrest, unions, immigration policies, and fiscal distortions among others might explain the unemployment persistence observed. The statistically significant high positive correlation found for Japan is in line with the notion that Japan's economy is subjected to business cycles different to other OECD countries. For the sample 1990 onward, in response to an inflation shock, differential interest rate declines and in response to an interest rate shock differential unemployment rate declines and neither crosses the baseline ever after.

In general, cognizant that country-specific factors such as labor market institutions may play an important part in the linkage between monetary policy and unemployment, mostly it amounts to comparing the US to European Economies, we conducted dynamic panel data analysis to control for country and time specific factors.

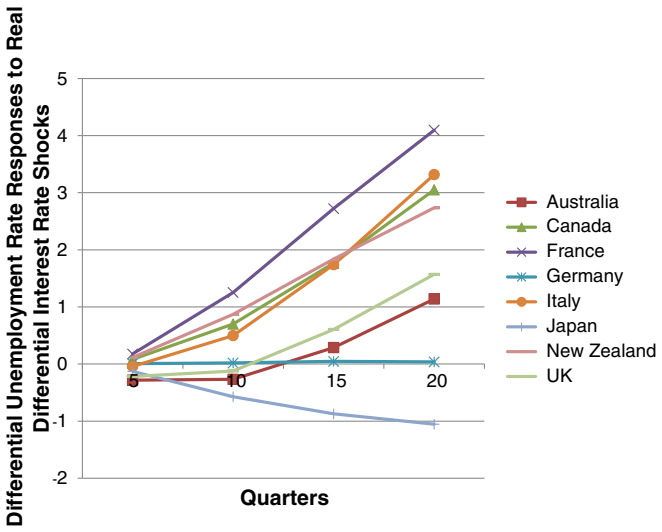


Fig. 8. Cross-country comparison of unemployment cost associated to low-inflation-targeting monetary policy.

The results shown in Table 3 confirm that differential real interest rate at impact negatively influences differential unemployment rate, but right after that the effect is positive and rising when only these two variables are included in the estimation. Using differentials output growth and real interest rate, we find differential real interest rate has no significant (though positive) instantaneous impact on differential output growth. The effect is negative and statistically significant after two quarters. When we regress differential unemployment rate on both differential output growth and differential nominal (or real) interest rate, we find a negative effect of differential output growth, a negative effect of differential interest rate at impact, and a positive effect after one lag. Overall, the results are not sensitive to country and time fixed effects.[11]

3.3. Is monetary policy to be blamed for the financial crisis?

What can we learn from the insight of this paper when it comes to assessing the origin of the recent financial crisis? The findings of this paper suggest that OECD countries (with the exception of Japan) had suffered from unemployment more than normal because their monetary policy had deviated from the US since the early 1980s, partly due to the debt and oil crises. Interest rate in these countries was on average far above the fund rate. A number of factors starting the 1990s have contributed to lower unemployment and these include productivity growth, technological progress, the birth of the Information Age, improvements in inventory management and quality control, economic integration and globalization, smaller shocks, and structural changes. The resulting effects of lower prices and lower output gap due to the positive supply shocks nurture the idea that monetary policy was indeed effective in achieving economic stability as inflation was still being monitored closely around the 2% target, and therefore fiscal policy should remain in the back burner. This view was further strengthened when monetary policy was able to successfully respond to shocks such as the 1987 stock market crash, the Long-Term Capital Management collapse in 1998, and the burst of the dot-com bubble in early 2000s (see Blanchard et al., 2010 for a thorough discussion).

With the recent financial crisis, it has now been argued vehemently that the pursuit of low-inflation-targeting monetary policy was a

[11] We thank the referee again for this valuable comment. Panel Granger non-causality tests with output growth, inflation, real interest rate, and unemployment rate. We reject the null hypothesis at the 1% level in all pairwise combinations. Detailed results are not included to conserve space.

contributing factor to the recent financial crisis. In fact, many have blamed the Fed and other central bankers for targeting inflation too low. There is the view that the Fed had been blindsided by rising stock market prices and failed to distinguish between cheap product imports from China that kept commodity prices low and the demand for capital from China that kept stock markets booming. The combination of low interest rate and low inflation rate gave rise to toxic assets. It has also been advocated that a higher interest rate consistent with a higher targeted rate of inflation, say 4%, would have left enough room for the Fed to weather the financial crisis. Had this been the case, monetary authorities would have been able to lower interest rate without having to hit the rock bottom of zero or negative real interest rate, a situation of clear liquidity trap (Blanchard et al., 2010; Williams, 2009).

Although there might be little debate on the stance that higher inflation rate target consistent with higher interest rate technically may have created more room for monetary authorities to manage the crisis, there is however no guarantee that the outcome we observed would have been different. Effectiveness of monetary policy is heavily dependent on economic agents' expectations about the future. Irrespective of how low interest rate can go, once individuals have lost confidence in the market and refrain from spending, businesses do not take advantage of lower interest rate to carry out investment projects, hence job cuts and a sluggish economy. Although monetary policy is a quicker fix than fiscal policy in periods of relatively good times, the recent crisis has proven that it is not in periods of major distresses, because its effectiveness depends mostly on economic agents' moods. Interest rate could have been as low as it was in the midst of the crisis, yet the housing market might not have suffered, at least not in the magnitude it did, had mortgage rules and financial regulations in place been capable of preventing the catastrophe. Canada's example makes the point even clearer; the bank rate prior to the crisis was as low as the

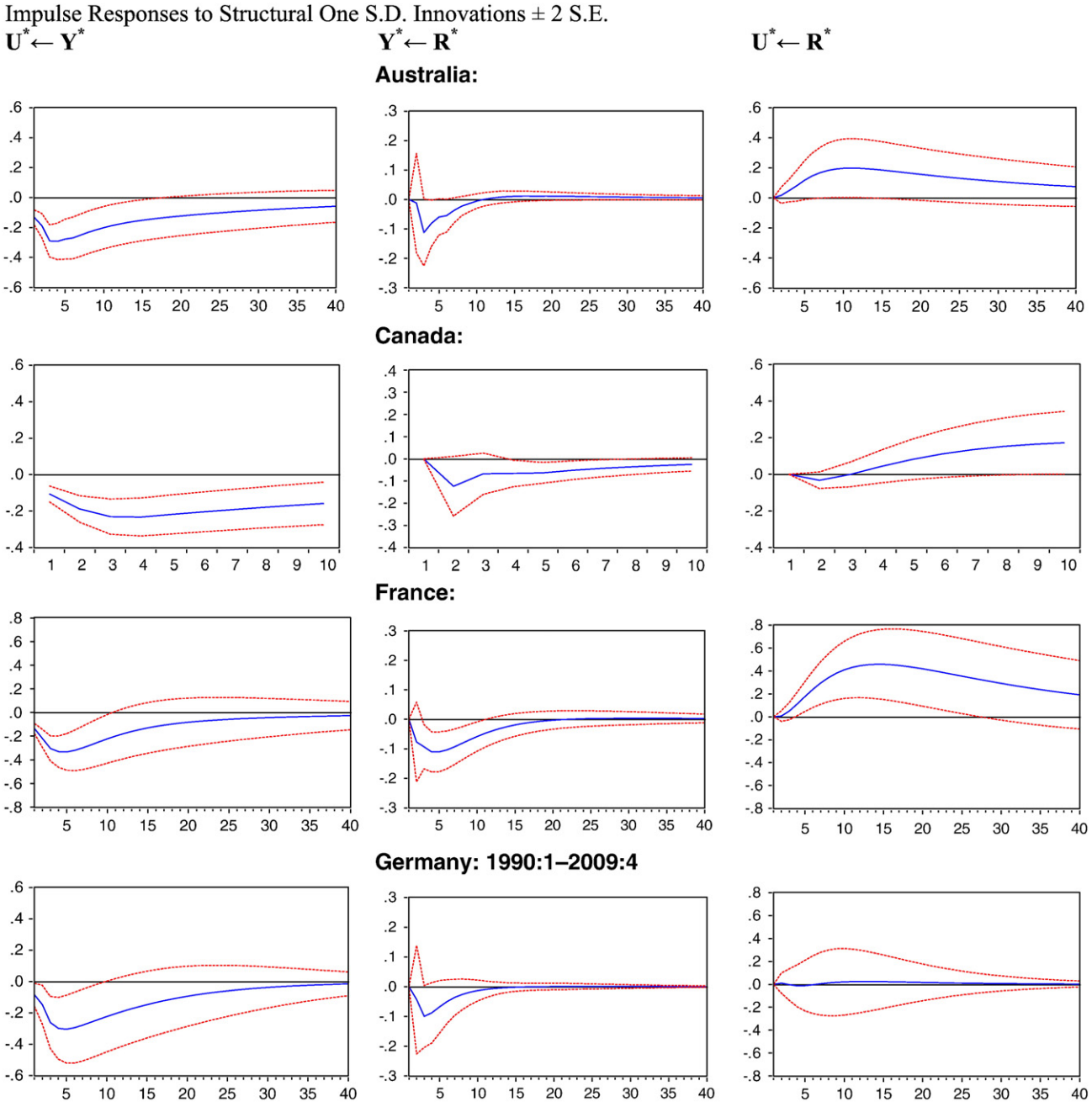


Fig. 9. Impulse responses of differential output growth and differential unemployment rate.

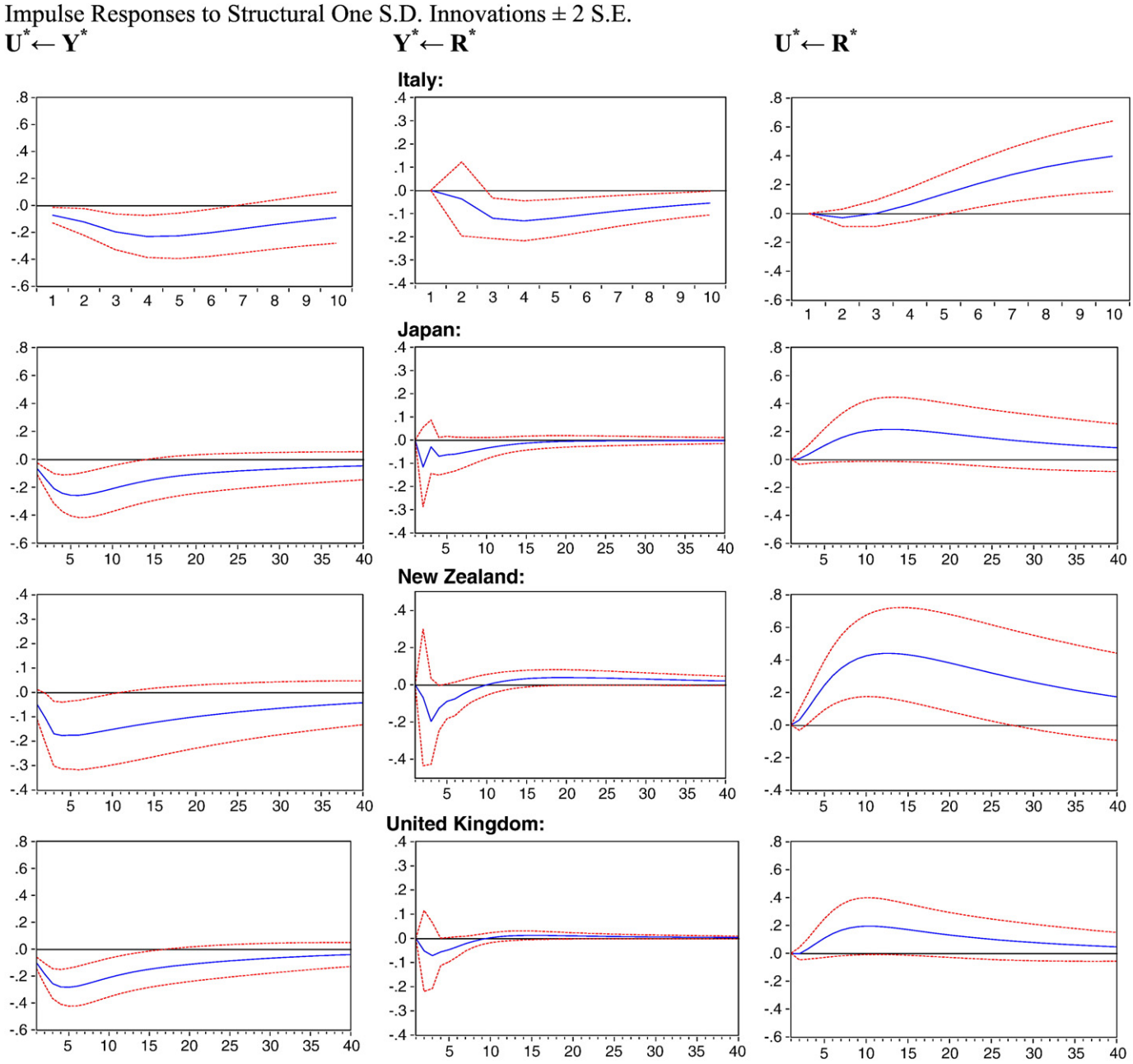


Fig. 9 (*continued*).

fund rate, but the housing market in Canada and the financial sector did not collapse, simply because of the stiff rules in place while inflation was being targeted around 2%. Also, as the findings of the paper show, a higher inflation rate target in most OECD countries would have increased the differential unemployment rate further as a result of increase short-term interest rate differential with the US, holding other factors constant.

4. Conclusion

There is an ongoing debate as to whether monetary policy can be destabilizing if low inflation is targeted blindly without taking into consideration the possibility that a tradeoff with unemployment might exist in the long-run. Using cointegration analysis and bivariate SVARs to compare major OECD countries with the US, this paper has made a valuable contribution to the literature in focusing directly on the relationship between short-term interest rate and unemployment rate differentials. The results suggest that there is indeed a long-run relationship in terms of interest rate linkages of the countries with the US, which has become weaker starting the 1990s and the price these countries have paid (with the exception of Japan) for the deviation from US monetary policy is higher unemployment rate at home. The correlation between differential real interest rate response to inflation shock and differential unemployment rate response to real interest

Table 3
Dynamic panel data estimation results.

	U^*			Y^*
$U^*(t-1)$	1.307 (0.056)	0.990 (0.003)	0.990 (0.004)	
$U^*(t-2)$	−0.323 (0.054)			
R^*	−0.006 (0.002)		−0.016 (0.004)	0.01 (0.02)
$R^*(t-1)$	0.012 (0.007)		0.033 (0.011)	−0.012 (0.01)
$R^*(t-2)$	0.013 (0.004)			−0.033 (0.011)
Y^*		−0.046 (0.011)	−0.044 (0.011)	
$Y^*(t-1)$		−0.051 (0.013)	−0.056 (0.013)	−0.054 (0.030)
$Y^*(t-2)$				
i^*		−0.036 (0.012)		
$i^*(t-1)$		0.050 (0.015)		

U^*, R^*, Y^*, and i^* are differential unemployment rate, real interest rate, output growth, and nominal interest rate, respectively. Standard errors are in parenthesis. For all models with U^* as the dependent variable, all coefficients are statistically significant at the 5% level.

rate shock is statistically significant and positive for all countries but France, suggesting that other factors such as immigration policies, labor unrest, unionization, and fiscal distortions may explain the persistence of unemployment rate in this particular country. Two-way Granger causality tests further confirm that the responses of differential unemployment rate to interest rate shock are tributary to the stance of the country on inflation. Moreover, we have found that in the very short-run, interest rate differentials with the US do not seem to matter for most countries and also we could not confirm the vertical long-run Phillips curve for most countries. When it comes to assessing the origin of the financial crisis, this paper lends support to the view that lax mortgage rules and financial deregulations in the US as opposed to low-inflation-targeting monetary policy were the main factors responsible for the crisis.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.econmod.2012.09.042.

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