Fiscal Policy in Open Economies*

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Abstract

We argue that the significance of the exchange rate regime for the effectiveness of fiscal policy in small open economies has been exaggerated in the literature. Using the New Keynesian (NK) open economy model we demonstrate that the form of the domestic policy rule pursued under flexible rates and the degree of international capital mobility play a more important role. We investigate the effects of government spending shocks in 21 countries using a VAR identification scheme suggested by Fatás and Mihov, 2002. Consistent with the NK theory (and in contradiction to the IS-LM predictions), we find that the size of the fiscal multiplier does not vary systematically with the exchange rate regime. The degree of capital mobility and trade openness also seem to exert limited influence.

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1 Introduction

The closed economy IS-LM model has well known implications for the effects of fiscal policy on economic activity. A fiscal expansion (whether in the form of a budget deficit or balanced budget) increases output, employment and consumption, while crowding out private investment through the resulting increase in real interest rates. The total effect on output is a multiple of the initial change in government spending (the fiscal multiplier is greater than one).

The effects of fiscal actions become more ambiguous once the links with the rest of the world have been taken into account. Under a flexible exchange rate regime, a fiscal expansion raises real interest rates and leads to a nominal currency appreciation. Given nominal price sluggishness, this translates into a real exchange rate appreciation and a loss in international competitiveness. The trade balance deteriorates, and this restraints the expansionary effects of the higher government spending. If the economy is sufficiently small and capital is internationally mobile then the resulting reduction in net exports completely offsets the fiscal expansion. In other words, the fiscal multiplier becomes zero. On the other hand, if the exchange rate were fixed, monetary policy would have to loosen up in order to prevent the real interest rate increase and hence the currency appreciation, amplifying the effects of the initial fiscal expansion. The multiplier becomes greater than what it would have been in a closed economy. Furthermore, like the fiscal multiplier, the change in the terms of trade and in net exports as well as their persistence depends on the exchange rate regime, the degree of capital mobility and the size of the economy.

There is a large literature dealing with the effects of fiscal shocks in open economies. But this literature has yet to take advantage of recent advances in the time series methods for identifying fiscal shocks[1]. We return to this issue later in the literature review. Moreover, to the best of our knowledge, there exists no empirical work that attempts to link the size of the fiscal multiplier to the key macroeconomic features identified in the IS–LM model: the exchange rate regime in place, the degree of openness and the degree of capital mobility. The "closed" economy literature, on the other hand, uses more up-to-date methods for identifying fiscal shocks but does not pay much attention to the open economy features mentioned above (see Fatás and Mihov [6], Galí, Lopez-Salido and Valles [7], Mountford and Uhlig [10], Perotti [11]).

The goal of our study is twofold. First, to establish the nature of the theoretical rela-

[1]Using wars in order to identify fiscal shocks does not require any special econometric methodology (see Ahmed [1]). But this approach has its limitations due to data availability as well as to the fact that wars have other special features.

tionship between government spending and macroeconomic activity as a function of the key characteristics of an open economy within the context of the new Keynesian (NK) model. Remarkably, this is an issue that has not been studied in the NK literature. In particular, we investigate whether the three factors mentioned above (exchange rate regime, degree of capital mobility and degree of openness) play the same clear and strong role as in the IS-LM model. And second, to use cross country information in order to examine how the effects of fiscal shocks relate to these open economy characteristics. We study 21 countries over the last two decades employing the VAR scheme suggested by Fatás and Mihov to identify government spending shocks. We compute the fiscal effects in individual countries over various time horizons and we relate cross country differences in these effects to variation in the exchange rate regime, the degree of capital mobility and degree of openness.

Our key findings can be summarized as follows. At the theoretical front, we find that the fiscal implications of the open economy, new Keynesian model are very different from those associated with IS-LM analysis. In particular, running a flexible exchange rate system does not limit the effectiveness of fiscal policy. The fiscal multipliers can even be greater under flexible exchange rates than under a peg as long as monetary policy does not act to counter the fiscal expansion (as it would be the case under a standard Henderson-McKibbin-Taylor interest rule). Capital mobility and, to a smaller extent, trade openness exert a positive effect on the size of the fiscal output multiplier. The effect of fiscal policy on the trade balance is always negative while that on the terms of trade tends to be ambiguous.

At the empirical front, we find that the size of the fiscal multiplier is not systematically related to the degree of exchange rate flexibility. This finding seems consistent with the NK model to the extent that there is some variation in domestic monetary policy procedures across countries and/or capital mobility is high. Consistent with theory, capital mobility and trade openness are found to empower fiscal policy but the effects are statistically insiginificant. We also find an ambiguous sign for the response of the terms of trade, which again is consistent with the theory. The main discrepancy between theory and empirical evidence regards the response of the trade balance. It is unambiguously negative in theory (following a positive shock to the government spending). But there many cases of a positive response in the data. Nonetheless, in spite of its shortcomings, the NK model is much more successful when confronted with the data than its IS-LM predecessor.

The rest of the paper is organized as follows. Section 1 presents the model. Section 2 derives the implications of the model for macroeconomic activity as a function of the

exchange rate regime, the degree of capital mobility and degree of openness. Section 3 presents the econometric methodology and section 4 the main results. A detailed list of the data used can be found in the appendix.

2 The model

The economy under consideration is a small, open one. In this economy there are two types of firms. The first type produces final goods and the second intermediate goods.

2.1 Final sector firms

Following standard practice in the literature we assume that the domestic final good y is produced by perfectly competitive domestic firms by combining domestic (x^{D}) and imported (x^{M}) intermediate goods. Final good production is described by the following CES function

$$y_t = \left(\omega^{1-\rho}\left(x_t^{\mathrm{D}}\right)^{\rho} + (1-\omega)^{1-\rho}\left(x_t^{\mathrm{M}}\right)^{\rho}\right)^{\frac{1}{\rho}} \tag{1}$$

where $\omega \in (0,1)$ and $\rho \in (-\infty, 1)$. Minimization of total expenditures, $P_{x,t}x_t^{\mathrm{D}} + P_{m,t}x_t^{\mathrm{M}}$, where $P_{x,t}$ and $P_{m,t}$ denote the price of the domestic and the foreign bundle of goods in domestic currency results in the standard demand equations:[2]

$$x_t^{\mathrm{D}} = \left(\frac{P_{x,t}}{P_t}\right)^{\frac{1}{\rho-1}} \omega y_t \tag{2}$$

$$x_t^{\mathrm{M}} = \left(\frac{P_{m,t}}{P_t}\right)^{\frac{1}{\rho-1}} (1-\omega) y_t \tag{3}$$

where P_t is the domestic CPI, given by

$$P_t = \left(\omega P_{x,t}^{\frac{\rho}{\rho-1}} + (1-\omega) {P_{m,t}}^{\frac{\rho}{\rho-1}}\right)^{\frac{\rho-1}{\rho}} . \tag{4}$$

We assume producer currency pricing and purchasing power parity for traded goods. That is, $P_{m,t} = s_t P_t^{\star}$ where s_t is the nominal exchange rate and a $\star$ denotes foreign currency price.

x_t^{D} and x_t^{F} are themselves combinations of the domestic and foreign intermediate goods according to

$$x_t^{\mathrm{D}} = \left(\int_0^1 x_t^{\mathrm{D}}(i)^{\theta} \mathrm{d}i\right)^{\frac{1}{\theta}} \text{ and } x_t^{\mathrm{M}} = \left(\int_0^1 x_t^{\mathrm{M}}(i)^{\theta} \mathrm{d}i\right)^{\frac{1}{\theta}} \tag{5}$$

[2]The demand for the domestic good by the rest of the world is $x_t^{\mathrm{D}\star} = \left(\frac{P_{x,t}}{e_t P_t^{\star}}\right)^{\frac{1}{\rho-1}} (1-\omega^{\star}) y_t^{\star}$.

where $\theta \in (-\infty, 1)$. Note that ρ determines the elasticity of substitution between the foreign and the domestic bundle of goods, while θ determines the elasticity of substitution between goods in the domestic and foreign bundles.

2.2 The domestic intermediate goods firms

Each domestic intermediate goods firm $i \in [0, 1]$ produces an intermediate good $x(i)$ using physical capital $k(i)$ and labor $h(i)$ according to a constant return-to-scale technology ($\alpha_k, \alpha_h \in [0, 1]$, $\alpha_k + \alpha_h = 1$) represented by the production function

$$x_t(i) = \mathcal{A}_t k_t(i)^{\alpha_k} h_t(i)^{\alpha_h} \tag{6}$$

where $\mathcal{A}_t$ is an exogenous stationary stochastic technological shock.

Assuming that each firm i operates under perfect competition in the input markets, the production plan is determined by minimizing total cost, $W_t h_t(i) + P_t z_t k_t(i)$, where z_t is the real rental of capital, and W_t is the nominal wage, subject to the production function (6). The input demand functions are given by (dropping i)

$$\alpha_k \psi_t x_t = z_t k_t \tag{7}$$

$$\alpha_h \psi_t P_t x_t = W_t h_t \tag{8}$$

where the real marginal cost, ψ_t is given by $\psi_t = \frac{z_t^{\alpha_k} (W_t/P_t)^{\alpha_h}}{\mathcal{A}_t \varsigma}$ and $\varsigma = w^{\alpha_h} z^{\alpha_k}$ with $w = W/P$.

Intermediate goods producers are monopolistically competitive. Therefore, they set prices for the good they produce. We introduce price stickiness by assuming that it is costly to change prices. In particular, firms face an adjustment cost when they change their prices relative to some benchmark rate of inflation. Their profit maximization problem is given by

$$\max_{P_{x,t}(i)} \left\{ \mathbb{E}_t \sum_{n=0}^{\infty} D_{t,t+n} \Pi_{x,t+n}(i) \right\}. \tag{9}$$

The discount factor, $D_{t,t+n}$, $n = 0, 1, 2, \ldots$, in equation (9) is defined as $D_{t,t} = 1$ and $D_{t,t+n} = \beta \frac{\Lambda_{t+n}(j)}{\Lambda_t(j)}$, for $n = 1, 2, \ldots$, where the $\Lambda_{t+n}(j)$ come from the optimization problem of the household.

Profits in period t are given by

$$\Pi_{x,t}(i) = (P_{x,t}(i) - P_t \psi_t) x_t(i) - \frac{\xi_x}{2} \left(\frac{P_{x,t}(i)}{P_{x,t-1}(i)} - \pi_x \right)^2 P_t y_t \tag{10}$$

The last element represents the cost of changing prices relative to some benchmark rate of inflation, expressed in units of the final good. The first-order condition with regard

to the choice of price, $P_{x,t}(i)$, is

$$\frac{\theta}{\theta-1}x_t(i) - \frac{P_t\psi_t}{\theta-1}\frac{1}{P_{x,t}(i)}x_t(i) - \frac{1}{P_{x,t-1}(i)}\xi_x\left(\frac{P_{x,t}(i)}{P_{xt-1}(i)} - \pi_x\right)P_t y_t + \mathbb{E}_t D_{t,t+1}\frac{P_{x,t+1}(i)}{P_{x,t}(i)^2}\xi_x\left(\frac{P_{x,t+1}(i)}{P_{x,t}(i)} - \pi_x\right)P_{t+1}y_{t+1} = 0. \quad (11)$$

2.3 The Household

There exists a continuum of identical households. The preferences of the representative household are given by

$$\mathbb{E}_t \sum_{\tau=0}^{\infty} \beta^{t+\tau}\left[\frac{\nu^c}{1-\sigma_c}c_{t+\tau}^{1-\sigma_c} - \frac{\nu^h}{1+\sigma_h}h_{t+\tau}^{1+\sigma_h}\right] \quad (12)$$

where $0 < \beta < 1$ is a constant discount factor, c_t denotes consumption and h_t is the quantity of hours supplied by the household. ν^h and ν^c are constants.

In period t the representative household faces the budget constraint

$$B_{t+1}^{\mathrm{D}} + s_t B_{t+1}^{\mathrm{F}} + M_t + P_t(1+\eta(v_t,\zeta_t))c_t + P_t I_t + T_t + W_t h_t = R_{t-1}B_t^{\mathrm{D}} + R_{t-1}^{\mathrm{F}} s_t B_t^{\mathrm{F}} + P_t z_t k_t + W_t h_t + M_{t-1} + N_t + \Pi_t \quad (13)$$

where B_t^{D} and B_t^{F} are domestic and foreign currency bonds. The foreigners do not hold any domestic bonds so aggregate $B_t^{\mathrm{D}} = 0$. W_t is the nominal wage; P_t is the nominal price of the domestic final good; c_t is consumption and I_t is investment expenditure; k_t is the amount of physical capital owned by the household and leased to the firms at the real rental rate z_t. M_{t-1} is the amount of money that the household brings into period t, M_t is the end of period t money and N_t is a nominal lump–sum transfer received from the monetary authority; T_t is the lump-sum taxes paid to the government and used to finance government consumption. Π_t denotes the profits distributed to the household by the firms. $\eta(v_t;\zeta_t)$ is a proportional transaction cost that depends on the household's money–to–nominal consumption ratio

$$v_t = \frac{P_t C_t}{M_t}$$

The specification of the function η is borrowed from Schmitt-Grohe and Uribe [15]:

$$\eta(v_t,\zeta) = \zeta\left(Av_t + \frac{B}{v_t} - 2\sqrt{AB}\right) \quad (14)$$

where ζ is a constant.

Capital accumulates according to

$$k_{t+1} = I_t - \frac{\varphi}{2}\left(\frac{I_t}{k_t} - \kappa\right)^2 k_t + (1-\delta)k_t \tag{15}$$

where $\delta \in [0,1]$ denotes the rate of depreciation. $\kappa > 0$ is a constant. The capital adjustment costs are assumed to be zero in the steady state.

The household then determines consumption/saving and money holdings maximizing (12) subject to (13) and (15).

2.4 Financial Markets

The nominal interest rate on foreign bonds includes a risk premium

$$\frac{R_t^{\mathrm{F}}}{\pi^\star} = \frac{R_t^\star}{\pi^\star} - \varrho\left(\frac{B_{t+1}^{\mathrm{F}}}{P_t^\star}\right) \tag{16}$$

where ϱ is a strictly increasing function of the aggregate level of real foreign debt. $R_t^\star$ is the world nominal interest rate, and $\pi^\star$ and $P_t^\star$ are the foreign inflation rate and price level respectively.

2.5 The government

The government finances government expenditure on the domestic final good using lump sum taxes. The stationary component of government expenditures is assumed to follow an exogenous stochastic process, whose properties will be defined below.

2.6 Monetary policy

We study two international monetary arrangements: A flexible system and a unilateral peg. In the latter case, the monetary authorities in the small open economy keep the nominal exchange rate vis a vis the rest of the world perfectly constant.

Under a flexible exchange rate system, monetary policy is assumed to be conducted according to one of two rules. A money supply rule which sets an exogenous rate of growth in the money supply

$$\frac{M_t - M_{t-1}}{M_{t-1}} = \mu \tag{17}$$

or, a standard interest rate rule

$$R_t = \rho R_{t-1} + (1-\rho)\left(k_\pi(\pi_t - \pi) + k_y(y_t - y)\right) \tag{18}$$

where R_t is the nominal interest rate, π_t is the inflation rate in period t, π is the inflation target (equal to the steady state rate of inflation), y_t is period t output and y is the output target (equal to the steady state value of output).

3 Calibration

We are mostly interested in investigating the effects of fiscal policy for a generic rather than for a particular, real world economy. Hence, we use parameter values that are commonly used in the open economy literature. The benchmark parameters are reported in table 1. We assume a degree of price stickiness that is higher than that typically used in the literature in order to make the differences across regimes sharper. Consequently, the reported differences probably represent an upper bound.

Table 1: Benchmark Parameter Values

Transactions cost	A	0.0111
Transactions cost	B	0.0752
Money demand	ζ	1.0000
Production	α_k	0.2268
Production	α_h	0.7732
Utility	σ_h	1.0000
Utility	σ_c	1.5000
Capital adjustment	φ	10.0000
Price adjustment	ξ_x	100.0000
SS capital target $\frac{i}{k}$	κ	0.0250
Trade elasticity	ρ	0.8000
Mark up	θ	0.8000
Openness	ω	0.8500
Discount factor	β	0.9900
Preferences	ν^c	1.0000
Preferences	ν^h	8.4342
Depreciation	δ	0.0250
Steady state gross inflation	π	1.0000
Working time	h	0.3100
Risk premium	ϱ	0.0100
Inflation coefficient in policy rule	k_p	1.500
Output gap coefficient in policy rule	k_y	0.150
Persistence in interest rate rule	ρ	0.00
Share of government spending	g/y	0.250
Fiscal shock: persistence	ρ_g	0.90

The fiscal shock is the only one in the model. The log of government spending is assumed

to follow an AR(1) processes with an autoregressive coefficient of 0.9.

4 The theoretical results

The model is solved after taking a first-order log approximation around the deterministic steady state. Tables 2 to 7 present the results. In each table, we report the cumulative effect (multiplier) on output, the trade balance and the the terms of trade at various time horizons of an increase in government spending by one unit. This is done for fixed and flexible exchange rates. In the latter case we report results mostly under the assumption that the monetary authorities target the money supply. In the main cases of interest we also report results corresponding to an interest rate rule.

We start by presenting the case of perfectly flexible prices (see Table 2). A positive government spending shock has a negative wealth effect, which induces households to increase their effort. Output and inflation go up while consumption decreases. Consumption is smoothed by running a trade deficit. The domestic currency depreciates but the domestic terms of trade improve as the real interest effect dominates the higher demand for imports effect (for this parametrization). There is a output multiplier.

Table 3 reports the results in the case that, in our view, corresponds closely to the textbook IS-LM analysis. An open economy ($\omega = 0.7$) that produces goods that are perfect substitutes for those abroad ($\rho = 0.999$) and operates under conditions of perfect capital mobility ($\varrho = 0.00001$). Two results stand out. First, unlike the IS-LM model, the exchange rate regime does not make any difference for the size of the multiplier. And second, in contrast again to the IS-LM model, the multiplier under flexible rates is increasing in the time horizon for quite a long time.

Table 4 reports the fiscal multipliers under the benchmark specification while Figure 1 plots the corresponding impulse responses. The key result is that fiscal policy is more effective under flexible than under fixed exchange rates, and this obtains even in the medium-longer term (the antithesis of the IS-LM model). This is due to the fact that the fiscal shock leads to a domestic currency *depreciation*. In order to support a fixed exchange rate, the monetary authority must follow contractionary monetary policy, which offsets some of the fiscal stimulus. The smaller increase in domestic output under a peg also means a larger increase in the domestic demand for imports and foreign borrowing in order to support consumption. Hence, the trade balance worsens more under a peg. The stronger demand for imports also leads to a deterioration in the terms of trade.

The picture is reversed when the monetary authorities pursue an interest rate policy

rule under flexible exchange rates. In this case, the inflationary pressures of the fiscal expansion are met by contractionary monetary policy. To the extent that this monetary contraction is more severe than that motivated from the desire to stabilize the exchange rate, the multiplier will be smaller under a flexible regime.

The preceding analysis thus indicates that in a cross country study of the effects of fiscal policy, it is unlikely to find a systematic relationship between the degree of flexibility of the exchange rate and the size of the multiplier unless the degree of capital mobility is limited and one also conditions on the type of domestic monetary policy rule. Given the difficulties associated with the identification of the policy rule, this type of conditioning does not seem feasible in the cross section. Note, though, that the prediction of the model that the fiscal multiplier would decrease if the monetary authorities replaced a money targeting rule with a Henderson-McKibbin-Taylor type of interest rate rule could provide an explanation for an interesting empirical finding documented by Perotti [11]. Namely, the decline in the effects of government spending on GDP in the post 1980 relative to the pre 1980 period. This could have arisen[3] from the adoption of a policy rule that paid more attention to inflation and the output gap and less attention to money supply targets.

We now turn to the examination of the role of other key features of the model. Tables 5 and 7 give information on the role played by openness, the elasticity of substitution between domestic and foreign traded goods and the size of the risk premium (capital mobility). For the flexible exchange rate system, we report results for the case of monetary targeting as similar patterns obtain under an interest rate rule (note, though, that as in the benchmark case, the multipliers are lower under a flexible system with an interest rate rule relative to the peg). As can be seen, variation in the parameter values for these features matters little for the size of the multiplier under a flexible exchange rate regime[4], with the exception of the degree of capital mobility. But these features, and specially capital mobility, matter much more under a fixed regime. In general, higher trade openness and capital mobility imply larger values for the multiplier.

We have also computed the effects of fiscal shocks on the trade balance and the terms of trade. Three patterns emerge (see Tables 2 to 6). First, a positive fiscal shock almost invariably decreases net exports (the only exception regards an economy with a flexible exchange rate that faces very large risk premia). Second, the effect of a fiscal shock on

[3] As it will be seen below, some of the other explanations that are based on the IS-LM model which Perotti rules out on empirical ground can be ruled out also on theoretical grounds based on our analysis.

[4] This seems consistent with Perotti's finding and argument that the increase in the degree of openness during the last two decades – a period *of flexible exchange rates* for the countries he considers– cannot account for the reduction in the size of the multiplier.

the trade balance is increasing in the degree of openness, capital mobility and elasticity of substitution between domestic and foreign goods amplify (the effect is rather small, though). This prediction is similar to that arising in the IS-LM model. And third, the sign and size of the effect on the terms of trade depends on the exchange rate system in place as well as on the other features of the model.

To summarize the main empirical implications of the model.

(a) The relationship between the degree of flexibility and the size of the fiscal multiplier is ambiguous, depending on the type of monetary policy rule followed under a flexible system.

(b) In a flexible exchange rate regime, the "effectiveness" of fiscal policy does not vary substantially with the degree of openness and the elasticity of substitution between domestic and foreign goods but it is influenced significantly by capital mobility. Under a fixed, there is more variation, with greater openness, capital mobility and substitutability between domestic and foreign goods contributing to a larger multiplier (as in the IS-LM model). From (a) and (b) one may not expect the data to show any systematic relationship between the fiscal multiplier and the exchange rate regime, but to find a positive relationship between the size of the fiscal effects and the degree of openness and capital mobility.

(c) The trade balance reacts negatively to a positive fiscal shock. The relationship between the size of the impact and exchange rate flexibility is ambiguous, depending again on the type of monetary policy pursued under a flexible system. The fiscal effect on the trade balance is larger the more open the economy, the greater capital mobility and the higher the elasticity of substitution.

(d) The relationship between the sign of the fiscal impact on the terms of trade and the exchange rate regime in place is ambiguous. And, greater openness makes the effect of the fiscal shock less negative (a positive relationship) while higher capital mobility makes this effect more negative (a negative relationship).

5 Methodology

5.1 Review of the literature

A key difficulty in the analysis of the effects of fiscal policy is the identification of fiscal shocks. For instance, some of government spending is due to automatic stabilizers and

cannot be used in the determination of the causal effect of spending on macroeconomic activity. Another part represents an adjustment to past tax changes. And so on. Two alternative methods have been proposed in the literature.[5]

The first is the *narrative* or event-study approach. It identifies historical events which have led to unusually large military build-ups and then asks whether this increased military spending stimulated aggregate demand and output. The event-study approach hinges upon a reliable identification of country-specific historical episodes. Moreover, it assumes that these episodes are entirely unanticipated and do not coincide with different types of fiscal shocks. Two prominent examples of this approach are Ramey and Shapiro [13] and Burnside et al. [5].

The *structural VAR* approach, on the other hand, rests on one of two assumptions. Either that current government expenditures do not automatically react within the period to changes in economic conditions, an institutional feature of the budget process which seems to be shared by a wide range of countries and political systems. It follows that shocks to government spending can be taken as predetermined with respect to all other structural shocks in a VAR. Two prominent examples of the approach are Blanchard and Perotti [4] and Fatás and Mihov [6]. Or, that fiscal shocks can be identified by using sign restrictions on the impulse responses and by imposing orthogonality to business cycle shocks and monetary policy shocks (Mountford and Uhlig [10]). An advantage of the latter approach is that it overcomes the difficulty that changes in fiscal policy may manifest themselves in variables other than fiscal variables first and that fiscal variables may also respond "automatically" to business cycle conditions.

On US data, both the narrative and the structural VAR approach have led to the same conclusions regarding output and employment: the two variables increase in response to a positive government spending shock. They produce, however, conflicting evidence regarding the response of private consumption and real wage: while Ramey and Shapiro [13] and Burnside et al. [5] report that real wage and private consumption fall, Blanchard and Perotti [4] and Fatás and Mihov [6] find that the same variables rise, while Mountford and Uhlig find no effect.

[5] A third method proposed in the literature is the use of deficit measures (such as the full-employment deficit or a cyclically-adjusted fiscal balance) as an indicator of fiscal stance. This method, however, does not allow us to discriminate between spending increases and tax cuts.

5.2 Econometric framework

In this paper we follow the semi-structural approach proposed by Fatás and Mihov [6] and Blanchard and Perotti [4] to identify fiscal shocks. Consider for this purpose the multidimensional stochastic process $\{X_t\}$ which consists of $X_t = (G_t, Y_t, \pi_t, T_t, R_t, TOT_t)'$ where G_t, Y_t, π_t, T_t, R_t, and TOT_t denote the logarithm of real government consumption, the logarithm of real GDP, the inflation rate computed with respect to the GDP deflator, the logarithm of tax revenues deflated by the GDP deflator, the long term interest rate, and the logarithm of the terms of trade (defined as import prices over export prices), respectively. When we are also interested in the effects on net exports (NX), we replace the variable TOT_t by NX_t.[6] This is, with the exception of the terms-of-trade or net exports, basically the set of variables proposed by Fatás and Mihov [6] and Blanchard and Perotti [4]. We assume that $\{X_t\}$ can be approximated by a VAR model of order p, including a constant and a linear time trend:

$$X_t = c_0 + c_1 t + \Phi_1 X_{t-1} + \ldots + \Phi_p X_{t-p} + Z_t \tag{19}$$

where $\{Z_t\} \sim \mathrm{WN}(0, \Sigma)$ and where c_0 and c_1 denote vectors of constants. As in Fatás and Mihov we assume that the reduced form shock Z_t is a linear combination of the structural shock $V_t = (v_t^{(g)}, v_t^{(y)}, v_t^{(\pi)}, v_t^{(T)}, v_t^{(r)}, v_t^{(tot)})'$ such that

$$BZ_t = CV_t \tag{20}$$

where $\{V_t\} \sim \mathrm{WN}(0, \Omega)$ and where B and C are 6×6 matrices. Assuming as usual that the structural shocks are contemporaneously uncorrelated, this implies that Ω is a diagonal matrix with the variances of the structural shocks on the diagonal. As we are only interested in the effect of shocks to real government consumption, $v_t^{(g)}$, we do not assign any interpretation to the other structural shocks nor do we make any attempt to identify them. The government consumption shock $v_t^{(g)}$ is identified by restricting B to be equal to $\mathbf{I}_6$ and by setting the diagonal elements of C equal to one. In addition, and most importantly, we assume that real government consumption does not react within the period to any other shock nor to any other variable. Although this assumption may be criticized, it has the advantage in comparison to Blanchard and Perotti [4] and Perotti [11], that it does not require the estimation of nuisance elasticities. Given the ordering of the variables in X_t, the fiscal shock is then identified through the Cholesky decomposition of Σ.

Although several arguments can be made in favor of a specification in growth rates, we stick to the less restrictive log-level specification. This presents several advantages:

[6] For some countries we had to use a slightly different set of variables (see Appendix).

(a) It makes comparisons with the benchmark studies by Fatás and Mihov [6], Blanchard and Perotti [4] and Perotti [11] easier.

(b) We avoid the usage of unit-root tests in the specification search which sometimes lead to unreliable conclusions. See the discussion in Ashley and Verbrugge [2], and, with respect to confidence intervals for impulse response functions, Kilian [8] and Pesavento and Rossi [12]).

6 Results

After estimating the VARs of order 2 we use the impulse responses to compute the fiscal multipliers (the cumulative effect up to period t, t=1, 4, 12, and 20). Their values, together with the corresponding standard deviations, at various time horizons are given in Table 8. Two properties stand out. First, the impact effects are positive on average, and for many countries significantly so. This is encouraging because there is no theory that can justify a negative fiscal effect on impact. But then as the time horizon increases, some of them become negative. A negative multiplier may be is possible when the increased government spending is financed initially with debt which is then repaid pretty quickly using distortionary taxes (see Baxter and King [3]).[7] And second, the size of the multiplier tends to increase in absolute terms with the time horizon.

In Figure 2 we relate the estimated fiscal effects over the various time horizons to the the exchange rate regime in place. To highlight this relation we regressed the corresponding multiplier against Reinhart and Rogoff's [14] measure of exchange rate flexibility. In order to account for noisiness of the data, we rely on the results from a robust regression in Table 9, but report also the OLS estimates in Table 10. Both lead to the same conclusions. As argued above, to the extent that there is some variation in *domestic* monetary practices across countries one should not expect to find a systematic relationship between the degree of exchange rate flexibility and the size of the fiscal multiplier. This is precisely the pattern exhibited in these graphs and tables. Note that this is in sharp contrast to the predictions of the IS-LM model, at least for the longer time horizons.

Figures 3 and 4 repeat the same exercise, but with the degree of capital mobility, as measured by Miniane [9], and openness to trade, as measured by the sum of nominal exports and imports over nominal GDP, in place of the degree of exchange rate flexibility. Recall that the theory predicts a positive relationship between these two factors and fiscal

[7] Negative values for the fiscal multipliers are often reported in the literature, see for instance, Perotti [11].

policy effectiveness. The observed relationships are positive, and thus consistent with our model. However, they are not statistically significant.

We now turn to the examination of the fiscal effects on the trade balance and the terms of trade. This issue has received less attention in the literature. Figures 5 to 10 plot the fiscal effect on these variables as a function of the degree of exchange rate flexibility, trade openness and the degree of capital mobility. In general, none of these factors seems to matter[8] significantly for the size of the fiscal effects with the exception of the influence of trade openness on net exports. In this case more openness implies a larger fiscal effect as predicted by our theoretical model. A major problem is that many of the effects on the trade balance are positive, while theory almost uniformly predicts a negative effect.

7 Summary and Conclusions

We have derived the implications of the popular NK open economy model for fiscal policy. These implications are quite different from those obtained in the IS-LM model, which predicts strong differences in fiscal effects across exchange rate regimes, degrees of openness, capital mobility and so on. The NK model, on the other hand, predicts small if any differences across regimes and it also downplays the role of the other features of the open economy (with the exception of capital mobility). It seems thus that the debate on the effectiveness of fiscal policy in open economies has long been misled by its adherence to the IS-LM model.

We have used data from a large number of countries in structural VARs to investigate the role of these open economy features for fiscal policy. Our main findings are that, consistent with the NK but contrary to the IS-LM model, the choice of the degree of flexibility of the exchange rate does not make any significant difference for the effects of fiscal policy. While the degree of openness or capital mobility seems to matter a bit more (with more trade and capital mobility empowering fiscal policy) neither effect is found to be statistically significant.

A fruitful path for future research could be the repetition of the analysis using alternative government spending identification schemes. This could serve to check the robustness of our findings. Moreover, the development of models that can account for negative fiscal effects at short horizons should also be a high priority for future research.

[8]This is not entirely surprising as the open economy empirical literature has not been particularly successful in accounting for the the behaviour of the trade balance and the terms of trade.

A Data

The empirical part of our study involves the 21 OECD and Non-OECD countries listed in Table 8. We use two categories of data. The first one is utilized to estimate the fiscal multipliers at various horizons. The following quarterly series over the period 1982:1 - 2004:3 are taken from either the Main Economics Indicators (MEI) or the International Financial Statistics (IFS) database: real GDP, implicit GDP deflator, real government consumption, nominal tax revenue, long-term interest rate, import price and export price deflator.[9] If the variable tax revenue is contained in neither the MEI nor the IFS database, we use the series government revenue instead, taken from the Oxford Economic Forecasting (OEF) database. And when the import price and export price deflators are missing, then we proxy the terms of trade by the real effective exchange rate. Most series are seasonally adjusted by the original source; if not, we apply the Census X12 filter.

The second category of data are used to get measures of the three open economy characteristics: The exchange rate regime in place,the degree of capital mobility, and trade openness. To classify a country's exchange rate regime, we utilize the Reinhart and Rogoff [14] classification.[10] From their annual classification we compute for each country the arithmetic mean over the period 1988 to 2001. To measure a country's capital account restrictions we use the dummy provided by Miniane [9], which is based on information from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions.[11] The trade openness variable is constructed from the Penn World Table (the sum of nominal imports and nominal exports over nominal GDP). Miniane's measure and the trade openness variables have an annual frequency. For both series we compute the arithmetic mean over 1988 to the year of the latest available observation (2001 in the case of Miniane, 2000 in the case of the Penn World Table).

References

[1] S. Ahmed, *Temporary and Permanent Government Spending in an Open Economy*, Journal of Monetary Economics, 17 (1986), pp. 197–224.

[2] R. A. Ashley and R. J. Verbrugge, *To Difference or Not To Difference: A Monte Carlo Investigation of Inference in Vector Autoregressive Models*. VPI Eco-

[9] For Denmark (DNK), Hong Kong (HKG), New Zealand (NZL), and Portugal (PRT) the sample periods only start in 1988:4, 1986:4, 1988:1, amd 1987:1, respectively

[10] The Reinhart and Rogoff classification allows for 14 categories of exchange rate regimes, ranging from no separate legal tender to a hyperfloat.

[11] Miniane's dummy ranges from 0 to 1, where 0 means no restrictions.

nomics Department Working Paper E99-15, 2001.

[3] Baxter and King, *Fiscal policy in general equilibrium*, AER, 83 (1993), pp. 315–334.

[4] O. Blanchard and R. Perotti, *An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output*, Quarterly Journal of Economics, 117 (2002), pp. 1329–1368.

[5] M. E. Burnside, Craig and J. D. Fisher, *Assessing the Effects of Fiscal Shocks*. NBER Working Paper 7459, 2000.

[6] A. Fatás and I. Mihov, *The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence*. Mimeo, 2001.

[7] J. D. L.-S. Gali, Jordi and J. Valles, *Understanding the Effects of Government Spending on Consumption*. ECB Working Paper Series No. 339 (April), 2004.

[8] L. Kilian, *Small-Sample Confidence Intervals for Impulse Response Functions*, Review of Economics and Statistics, 80 (1998), pp. 218–230.

[9] J. Miniane, *A New Set of Measures on Capital Account Restrictions*. IMF Staff Papers Volume 51, Number 2, 2004.

[10] A. Mountford and H. Uhlig, *What are the Effects of Fiscal Policy Shocks?* CEPR, 2002.

[11] R. Perotti, *Estimating the Effects of Fiscal Policy in OECD Countries*. CEPR Discussion Paper no. 4842, 2005.

[12] E. Pesavento and B. Rossi, *Small Sample Confidence Intervals for Multivariate Impulse Response Functions at Long Horizons*. Mimeo, 2004.

[13] V. A. Ramey and M. D. Shapiro, *Costly Capital Reallocation and the Effects of Government Spending*, Carnegie-Rochester Coference Series on Public Policy, 48 (1998), pp. 145–194.

[14] C. M. Reinhart and K. S. Rogoff, *The Modern History of Exchange Rate Arrangements: A Reinterpretation*, Quarterly Journal of Economics, 119 (2004), pp. 1–48.

[15] S. Schmnitt-Grohé and M. Uribe, *Optimal Fiscal and Monatery Policy Under Sticky Prices*, Journal of Economic Theory, 114 (2004), pp. 198–230.

Table 2: Response to a Fiscal Shock: Flexible Prices

	Cumulative Fiscal Effect (Multiplier) at Horizon					
	1	4	8	12	20	40
				Peg		
Output	0.17	0.57	0.91	1.10	1.24	1.17
TB	-0.04	-0.13	-0.19	-0.21	-0.17	-0.04
ToT	-0.04	-0.13	-0.17	-0.17	-0.11	0.07
				Flexible, M-targeting		
Output	0.17	0.57	0.91	1.10	1.25	1.17
TB	-0.04	-0.13	-0.19	-0.21	-0.17	-0.04
ToT	-0.04	-0.13	-0.17	-0.17	-0.10	0.07

Table 3: Response to a Fiscal Shock: A Special Case

	Cumulative Fiscal Effect (Multiplier) at Horizon					
	1	4	8	12	20	40
				Peg		
Output	0.24	0.84	1.39	1.74	2.10	2.27
TB	-0.12	-0.43	-0.70	-0.86	-0.99	-0.89
ToT	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
				Flexible, M-targeting		
Output	0.24	0.84	1.39	1.74	2.11	2.28
TB	-0.02	-0.33	-0.60	-0.77	-0.91	-0.82
ToT	0.00	-0.00	-0.00	-0.00	-0.00	-0.00

Note: ρ=0.999, ω= 0.7, ϱ=0.00001.

Table 4: Response to a Fiscal Shock: The Benchmark Case

	Cumulative Fiscal Effect (Multiplier) at Horizon					
	1	4	8	12	20	40
				Peg		
Output	0.20	0.65	1.00	1.20	1.34	1.28
TB	-0.02	-0.10	-0.16	-0.18	-0.16	-0.04
ToT	-0.01	-0.06	-0.11	-0.12	-0.08	0.09
				Flexible, M-targeting		
Output	0.25	0.76	1.14	1.35	1.52	1.49
TB	-0.00	-0.06	-0.12	-0.15	-0.14	-0.04
ToT	0.02	0.00	-0.04	-0.06	-0.02	0.11
				Flexible, R-rule		
Output	0.09	0.28	0.44	0.53	0.60	0.55
TB	-0.04	-0.14	-0.21	-0.24	-0.21	-0.06
ToT	-0.05	-0.17	-0.26	-0.28	-0.24	-0.03

Note: ρ=0.8, ω= 0.85, ϱ=0.01.

Table 5: Response to a Fiscal Shock and Trade Openness

	Cumulative Fiscal Effect (Multiplier) at Horizon					
	1	4	8	12	20	40
				ω=0.95		
				Peg		
Output	0.22	0.67	1.00	1.19	1.34	1.33
TB	-0.01	-0.04	-0.08	-0.10	-0.10	-0.04
ToT	-0.02	-0.12	-0.24	-0.30	-0.29	-0.05
				Flexible, M-targeting		
Output	0.25	0.75	1.10	1.30	1.47	1.48
TB	-0.00	-0.03	-0.07	-0.09	-0.09	-0.04
ToT	0.00	-0.06	-0.18	-0.24	-0.24	-0.01
				ω=0.75		
				Peg		
Output	0.20	0.65	1.00	1.19	1.33	1.24
TB	-0.03	-0.13	-0.20	-0.22	-0.18	-0.03
ToT	-0.00	-0.04	-0.06	-0.05	-0.00	0.12
				Flexible, M-targeting		
Output	0.24	0.76	1.15	1.36	1.52	1.47
TB	-0.00	-0.07	-0.15	-0.18	-0.16	-0.03
ToT	0.02	0.02	0.00	0.00	0.04	0.15

Table 6: Response to a Fiscal Shock and Substitutability

	Cumulative Fiscal Effect (Multiplier) at Horizon					
	1	4	8	12	20	40
				ρ=0.3		
				Peg		
Output	0.21	0.65	0.99	1.17	1.31	1.26
TB	-0.01	-0.06	-0.10	-0.12	-0.12	-0.05
ToT	-0.01	-0.09	-0.16	-0.17	-0.07	0.35
				Flexible, M-targeting		
Output	0.25	0.75	1.12	1.31	1.47	1.43
TB	-0.01	-0.06	-0.09	-0.11	-0.11	-0.05
ToT	0.02	0.00	-0.04	-0.04	0.06	0.48
				ρ=-0.5		
				Peg		
Output	0.19	0.59	0.90	1.06	1.16	1.04
TB	-0.01	-0.05	-0.07	-0.08	-0.09	-0.05
ToT	-0.00	-0.04	-0.04	0.03	0.35	1.45
				Flexible, M-targeting		
Output	0.24	0.73	1.07	1.24	1.36	1.23
TB	-0.01	-0.05	-0.08	-0.09	-0.09	-0.06
ToT	0.06	0.15	0.25	0.39	0.81	2.09

Table 7: Response to a Fiscal Shock and Capital Mobility

	Cumulative Fiscal Effect (Multiplier) at Horizon					
	1	4	8	12	20	40
				ϱ=0.1		
				Peg		
Output	0.16	0.50	0.76	0.90	1.01	1.01
TB	-0.01	-0.04	-0.05	-0.05	-0.02	0.00
ToT	-0.00	-0.00	0.00	0.03	0.08	0.12
				Flexible, M-targeting		
Output	0.24	0.72	1.06	1.23	1.37	1.38
TB	0.00	-0.01	-0.03	-0.03	-0.02	0.00
ToT	0.03	0.07	0.07	0.09	0.13	0.16
				ϱ=0.00001		
				Peg		
Output	0.24	0.79	1.23	1.51	1.80	1.92
TB	-0.03	-0.15	-0.29	-0.39	-0.47	-0.45
ToT	-0.02	-0.13	-0.28	-0.38	-0.47	-0.43
				Flexible, M-targeting		
Output	0.25	0.79	1.24	1.52	1.81	1.94
TB	-0.03	-0.15	-0.29	-0.38	-0.47	-0.45
ToT	-0.01	-0.12	-0.27	-0.37	-0.46	-0.42

Table 8: Fiscal Multipliers on Output at Horizons 1, 4, 12 and 20

Country	Horizon			
	1	4	12	20
Australia	0.11	0.45	0.38	0.27
	(0.05)	(0.33)	(1.27)	(2.62)
Belgium	0.08	1.15	0.89	-0.82
	(0.09)	(0.29)	(1.76)	(3.68)
Canada	0.08	0.29	0.91	-0.63
	(0.07)	(0.49)	(2.50)	(5.61)
Denmark	0.11	0.76	0.55	-1.01
	(0.20)	(0.92)	(4.08)	(13.45)
Finland	0.16	-0.01	-0.09	-0.15
	(0.13)	(0.78)	(4.84)	(10.97)
France	0.23	-0.30	-2.90	-3.52
	(0.11)	(0.68)	(3.19)	(5.67)
Great Britain	0.03	0.04	-0.78	-2.93
	(0.05)	(0.31)	(1.75)	(4.45)
Greece	-0.12	-0.10	0.60	1.81
	(0.06)	(0.18)	(0.56)	(1.10)
Hong Kong	-0.01	0.52	3.48	4.84
	(0.05)	(0.35)	(1.93)	(5.17)
Italy	0.19	0.75	3.98	2.47
	(0.24)	(1.26)	(5.33)	(13.40)
Japan	-0.05	-0.35	-1.33	-3.53
	(0.11)	(0.58)	(3.72)	(9.59)
Mexico	0.01	0.35	-0.52	-0.98
	(0.07)	(0.40)	(1.59)	(2.63)
Netherlands	0.02	-0.43	-2.71	-4.13
	(0.11)	(0.54)	(2.08)	(4.01)
New Zealand	0.08	0.18	-0.71	-1.02
	(0.05)	(0.24)	(1.12)	(2.35)
Norway	0.13	0.32	0.95	1.97
	(0.09)	(0.43)	(2.27)	(5.14)
Portugal	0.03	0.06	-4.00	-8.35
	(0.23)	(0.97)	(3.48)	(7.55)
Spain	0.28	1.02	-1.17	-5.04
	(0.08)	(0.37)	(1.83)	(3.88)
Sweden	0.01	-0.68	-2.95	-5.70
	(0.11)	(0.46)	(1.92)	(3.83)
Switzerland	0.13	1.13	3.14	1.82
	(0.09)	(0.60)	(2.80)	(5.11)
United States	0.19	1.01	2.63	1.14
	(0.08)	(0.49)	(1.95)	(3.56)
South Africa	-0.03	-0.11	-1.17	-2.34
	(0.03)	(0.23)	(0.77)	(1.33)

Note: The impulse responses to Cholesky (d.f. adjusted) one S.D. innovations are accumulated up to horizons 1, 4, and 12 and 20, respectively. Standard errors in parenthesis. To make the findings comparable across countries, the multipliers are divided by the estimated country-specific standard deviation of the fiscal shock. Frequency and time period: quarterly, 1982:1 - 2004:3.

Table 9: Explaining the fiscal multiplier on output at different horizons (robust regression)

Regressor	Coefficients											
	Horizon 1			Horizon 4			Horizon 12			Horizon 20		
Intercept	0.096	0.052	0.110	0.378	0.110	0.177	-0.183	-1.763	-1.072	-1.339	-2.942	-2.526
	(0.058)	(0.073)	(0.039)	(0.329)	(0.399)	(0.224)	(1.418)	(1.551)	(0.894)	(1.845)	(2.230)	(1.186)
Exchange rate regime	-0.002			-0.009			0.21			0.028		
	(0.007)			(0.038)			(0.165)			(0.215)		
Capital mobility		0.044			0.310			3.061			3.010	
		(0.116)			(0.638)			(2.475)			(3.559)	
Openness to trade			-0.000			0.002			0.015			0.021
			(0.001)			(0.003)			(0.011)			(0.014)

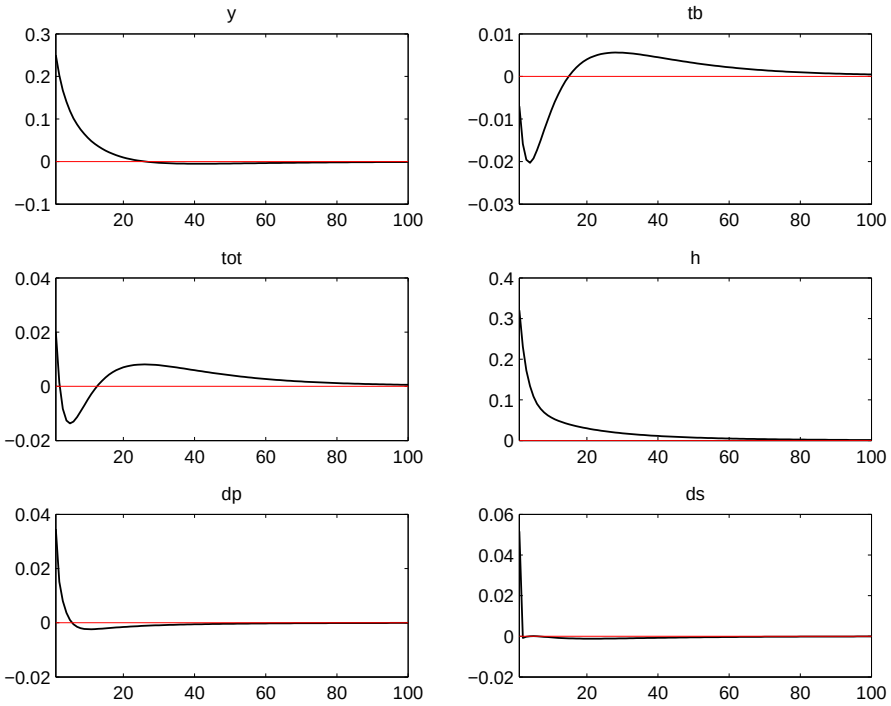
Note: Estimated standard errors in parenthesis. The following proxies are used: Reinhart and Rogoff's [14] exchange rate regime classification (the higher the value, the more flexible the exchange rate), Miniane's [9] measures on capital account restrictions (the higher the value, the more restrictions are in place), and the variable openness in current prices from the Penn World Table (the higher the value, the higher the degree of openness). For details refer to the Appendix.

Table 10: Explaining the fiscal multiplier on output at different horizons (OLS regression)

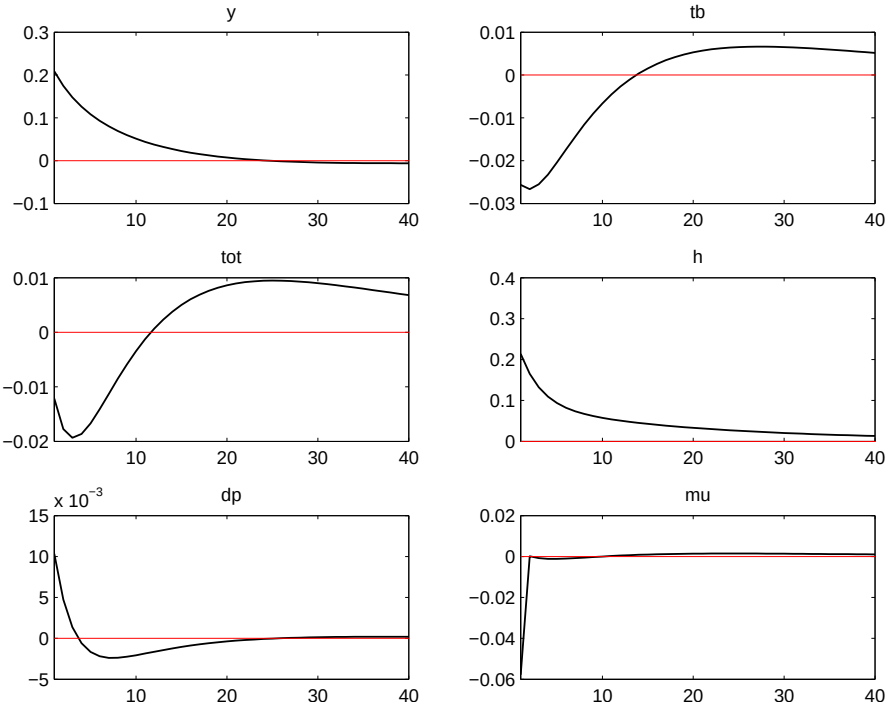
Regressor	Coefficients											
	Horizon 1			Horizon 4			Horizon 12			Horizon 20		
Intercept	0.098	0.057	0.108	0.383	0.121	0.187	-0.119	-1.807	-0.829	-1.318	-3.196	-2.646
	(0.055)	(0.069)	(0.037)	(0.303)	(0.372)	(0.205)	(1.235)	(1.441)	(0.806)	(1.794)	(2.138)	(1.141)
Exchange rate regime	-0.002			-0.010			0.018			0.018		
	(0.006)			(0.035)			(0.144)			(0.210)		
Capital mobility		0.037			0.295			3.056			3.317	
		(0.110)			(0.593)			(2.300)			(3.406)	
Openness to trade			-0.000			0.002			0.012			0.021
			(0.000)			(0.003)			(0.010)			(0.014)

Note: Estimated standard errors in parenthesis. The following proxies are used: Reinhart and Rogoff's [14] exchange rate regime classification (the higher the value, the more flexible the exchange rate), Miniane's [9] measures on capital account restrictions (the higher the value, the more restrictions are in place), and the variable openness in current prices from the Penn World Table (the higher the value, the higher the degree of openness). For details refer to the Appendix.

Figure 1: Impulse responses to a positive fiscal shock



(a) Flexible Exchange Rates



(b) Fixed Exchange Rates

Figure 2: Fiscal Multiplier on Output at different horizons and Exchange Rate Flexibility

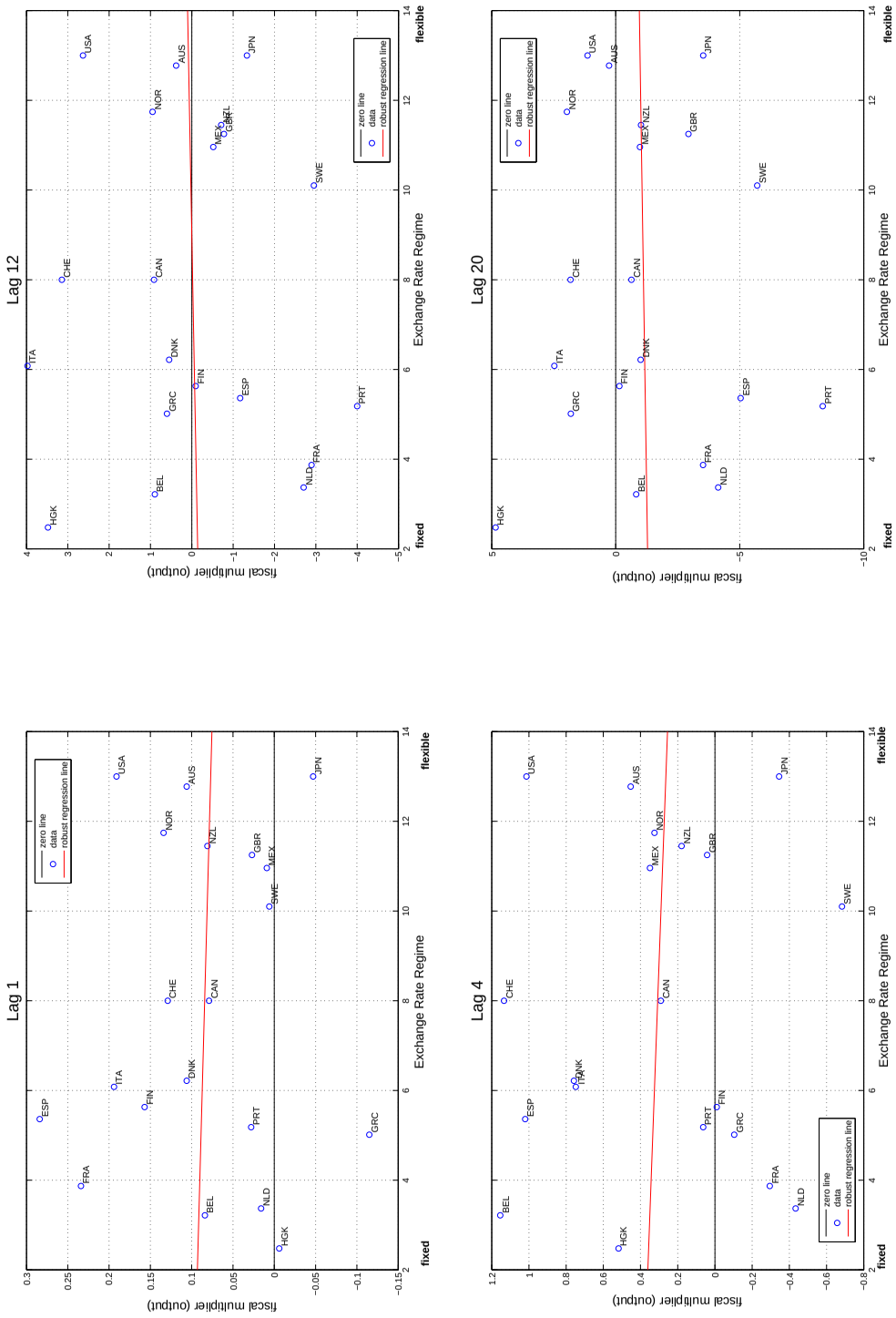


Figure 3: Fiscal Multiplier on Output at different horizons and Capital Mobility

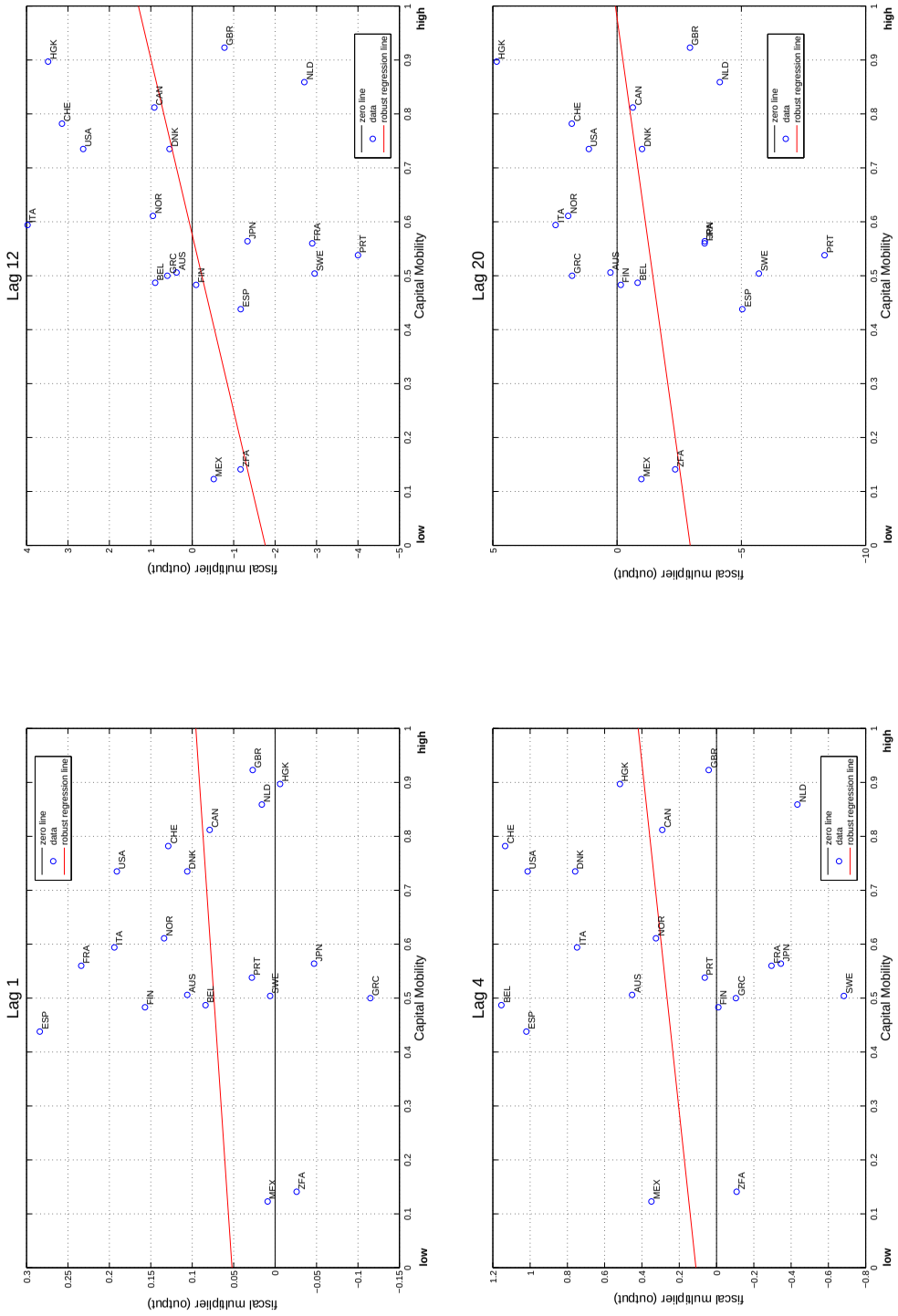


Figure 4: Fiscal Multiplier on Output at different horizons and Openness

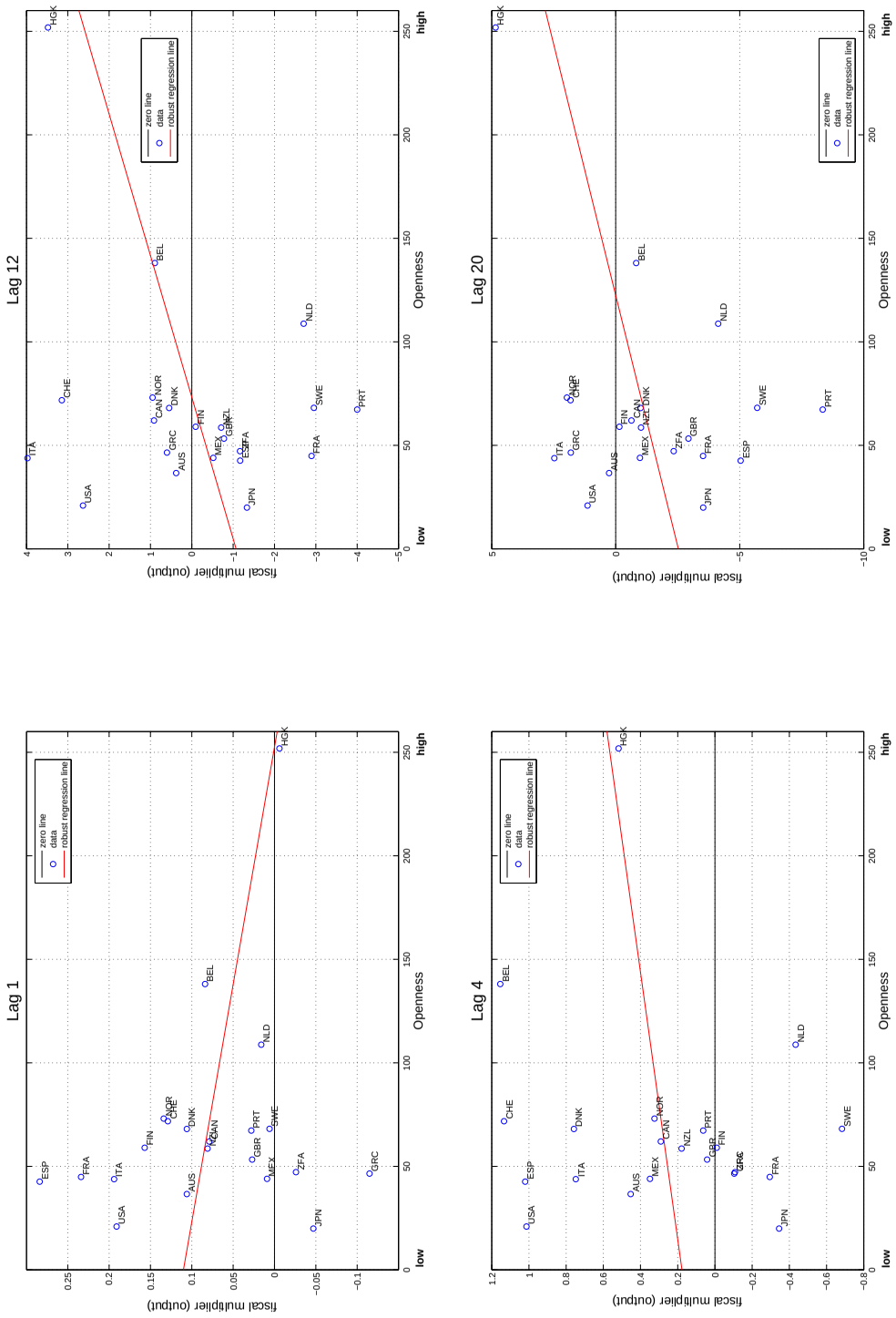


Figure 5: Fiscal Multiplier on Net Exports at different horizons and Exchange Rate Flexibility

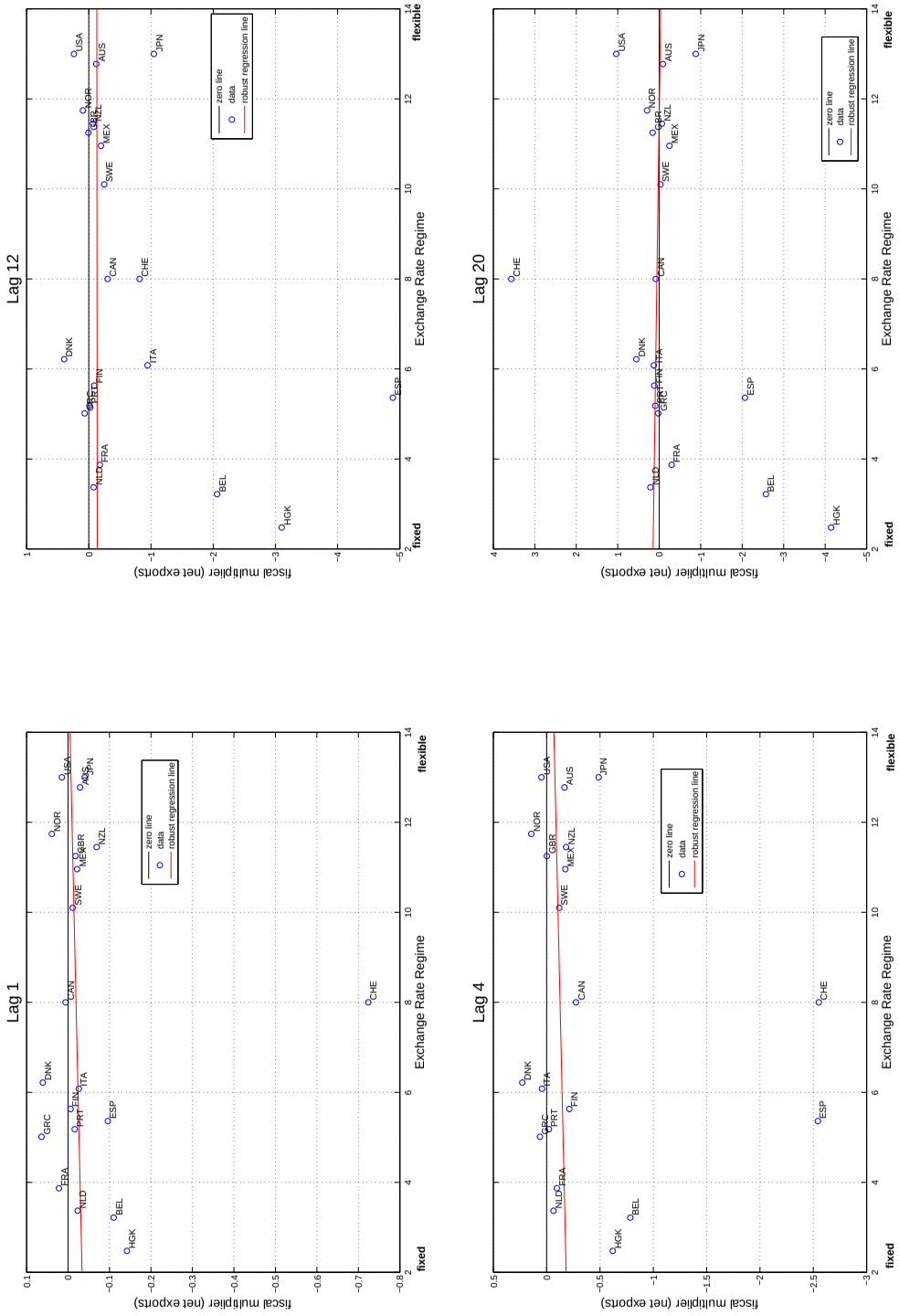


Figure 6: Fiscal Multiplier on Net Exports at different horizons and Capital Mobility

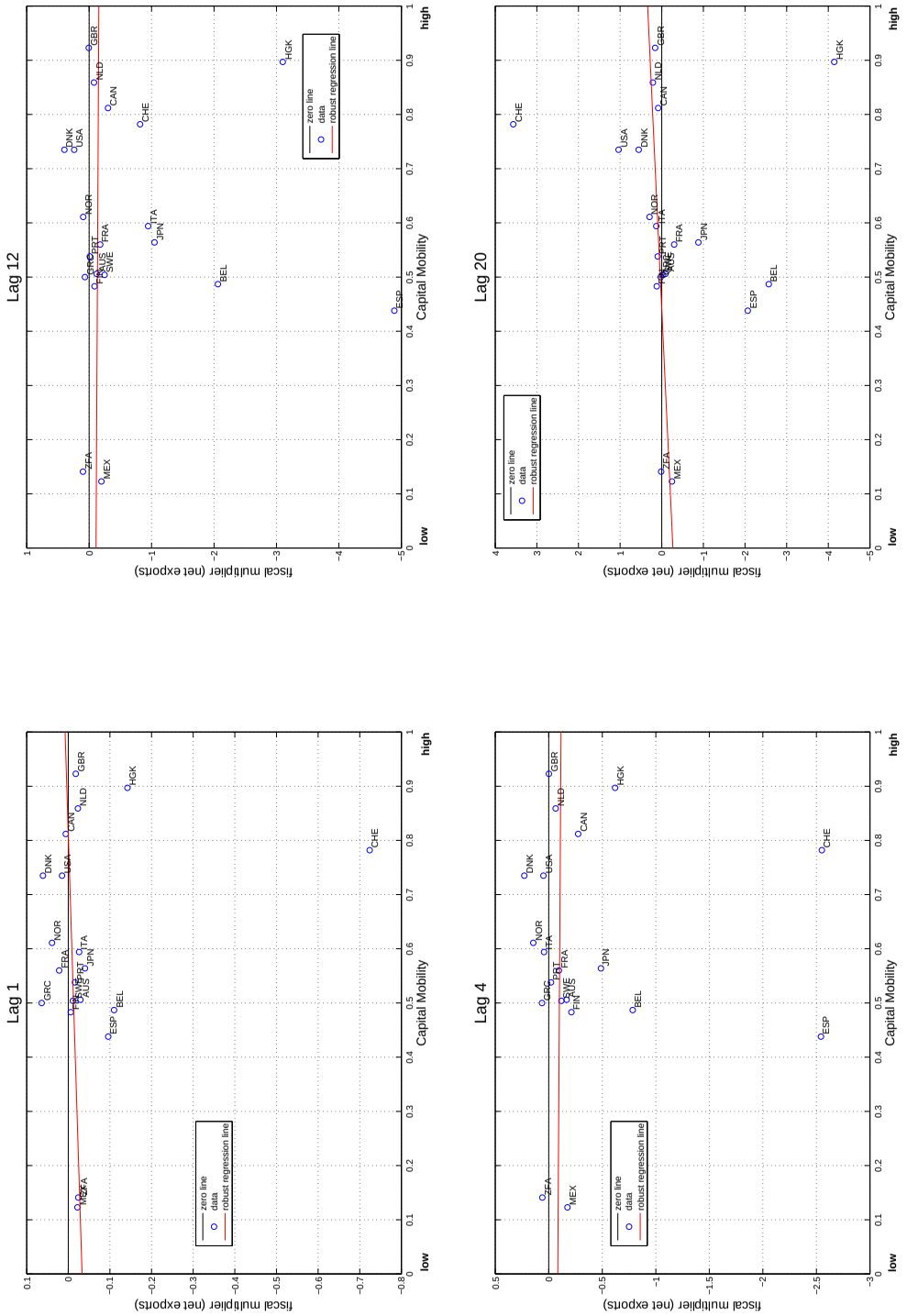


Figure 7: Fiscal Multiplier on Net Exports at different horizons and Openness

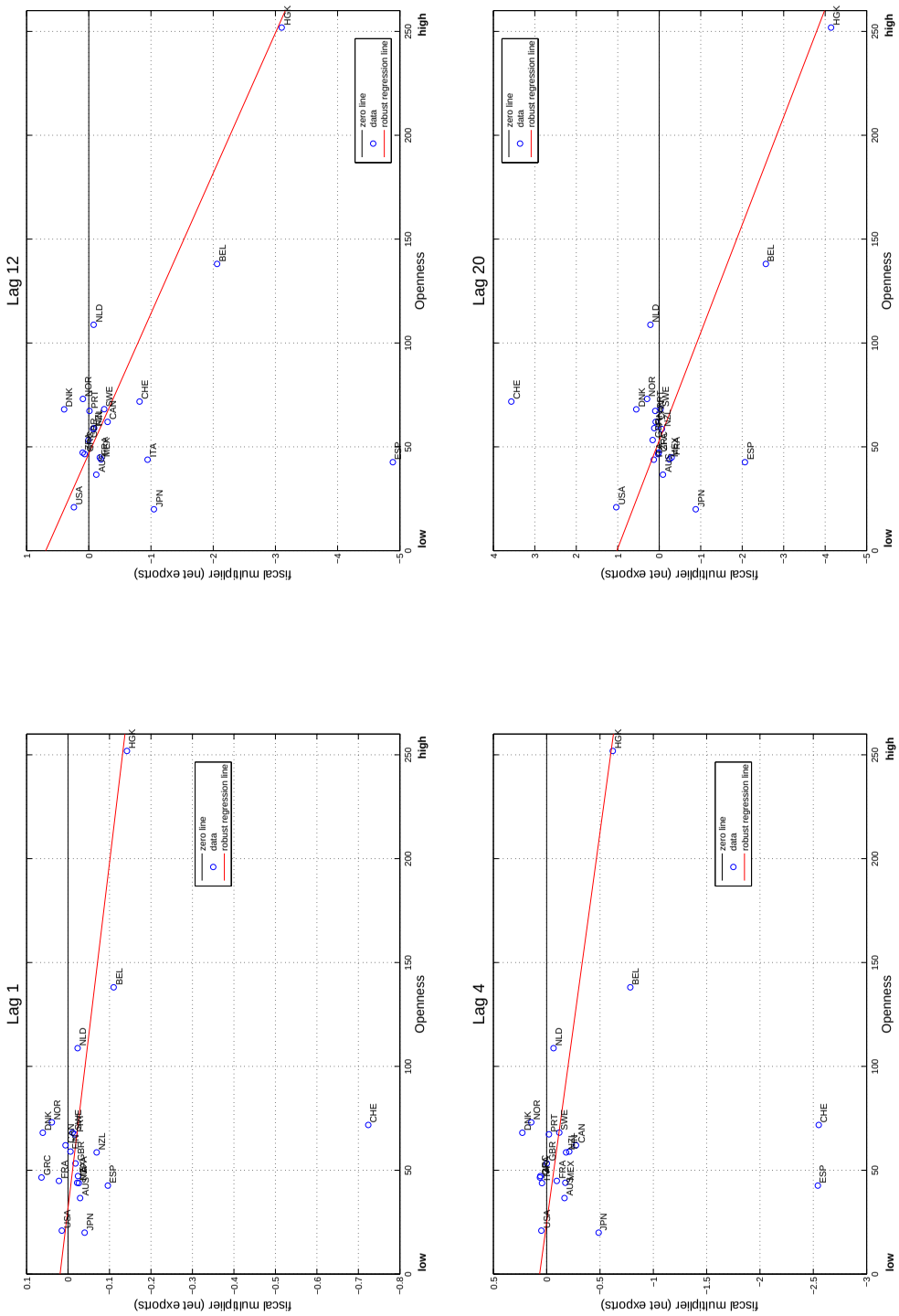


Figure 8: Fiscal Multiplier on Terms-of-Trade at different horizons and Exchange Rate Flexibility

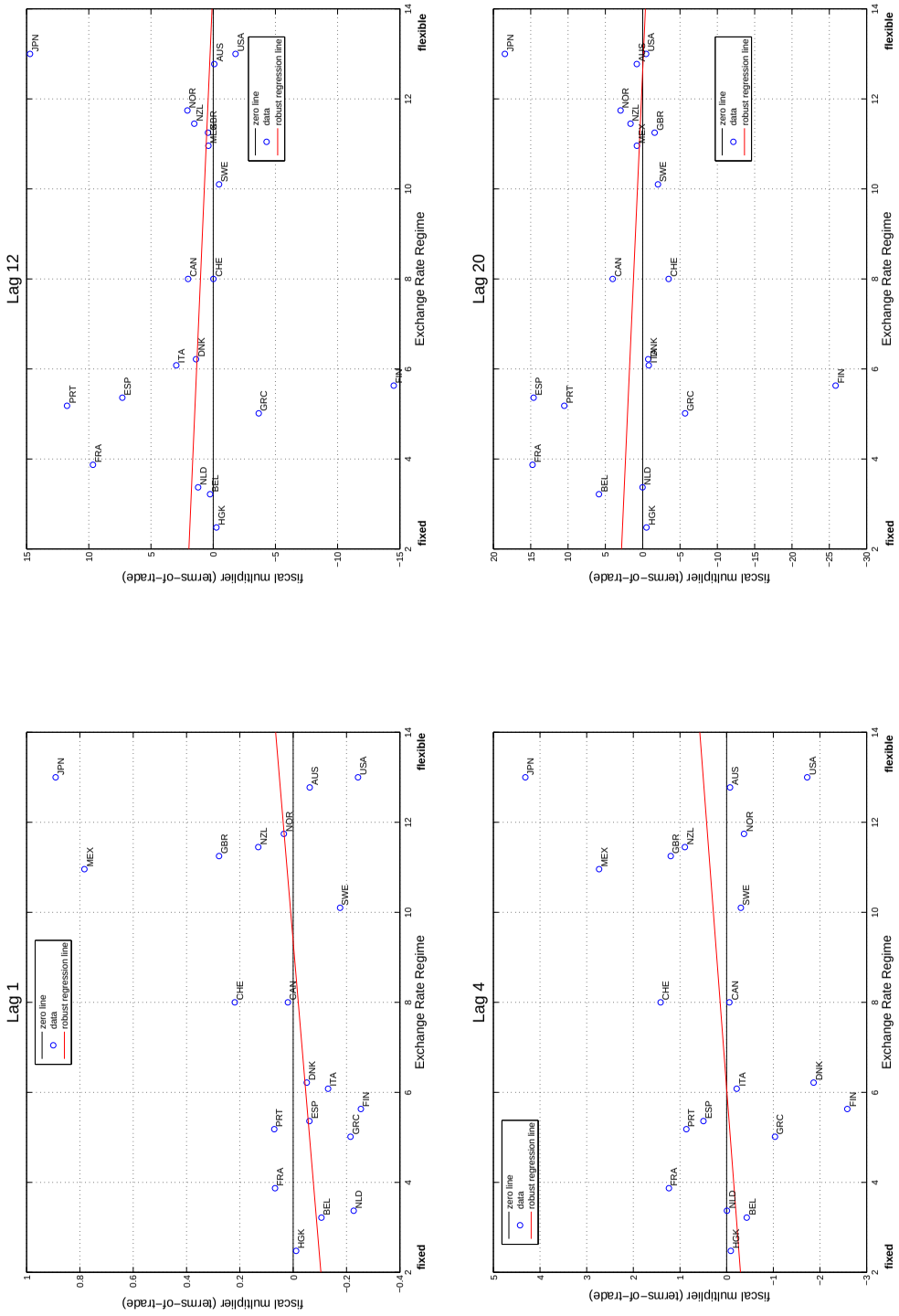


Figure 9: Fiscal Multiplier on Terms-of-Trade at different horizons and Capital Mobility

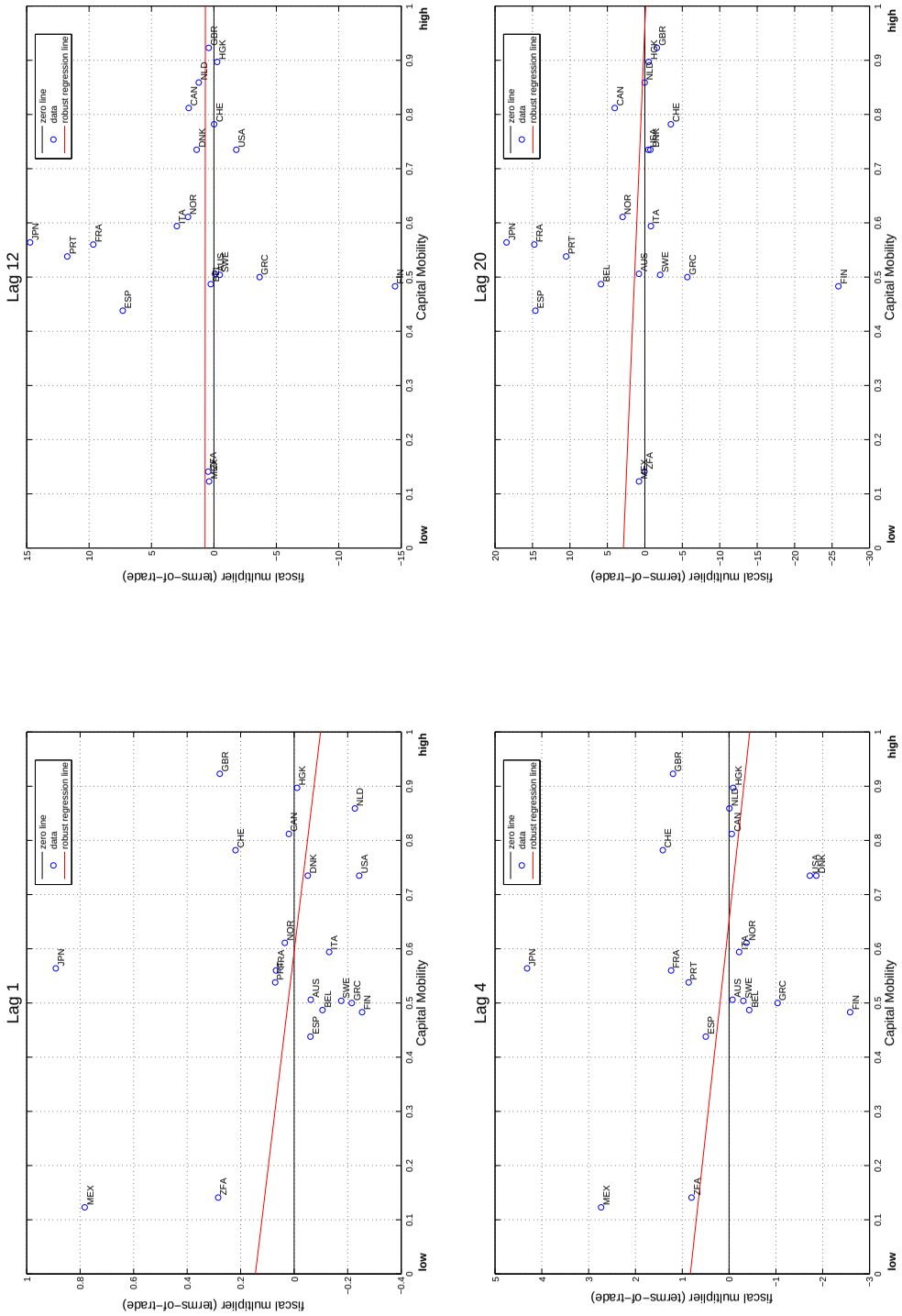


Figure 10: Fiscal Multiplier on Terms-of-Trade at different horizons and Openness