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**A MODEL-BASED
ASSESSMENT**

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A MODEL-BASED ASSESSMENT¹

by Sandra Gomes², Pascal Jacquinot³,
Matthias Mohr⁴ and Massimiliano Pisani⁵



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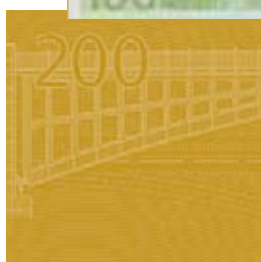
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² Bank of Portugal, Economic Research Department, Av. Almirante Reis 71, 1150-012 Lisbon, Portugal; phone number: +351-21-313-0719; e-mail: sandra.cristina.gomes@bportugal.pt and ISEG-TULisbon.

³ European Central Bank, Directorate General of Research, Kaiserstrasse 29, D-60311, Frankfurt am Main, Germany; phone number: +49-69-1344-8018; e-mail: pascal.jacquinot@ecb.europa.eu

⁴ European Central Bank, Directorate General of Economics, Kaiserstrasse 29, D-60311, Frankfurt am Main, Germany; phone number: +49-69-1344-8436 e-mail: matthias.mohr@ecb.europa.eu

⁵ Bank of Italy, Research Department, Via Nazionale 91, 00184 Rome, Italy; phone number: +39-06-4792-3452; e-mail: massimiliano.pisani@bancaditalia.it



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Address

Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address

Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone

+49 69 1344 0

Internet

<http://www.ecb.europa.eu>

Fax

+49 69 1344 6000

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Abstract

We quantitatively assess the macroeconomic effects of country-specific supply-side reforms in the euro area by simulating EAGLE, a multi-country dynamic general equilibrium model. We consider reforms in the labor and services markets of Germany (or, alternatively, Portugal) and the rest of the euro area. Our main results are as follows. First, there are benefits from implementing unilateral structural reforms. A reduction of markup by 15 percentage points in the German (Portuguese) labor and services market would induce an increase in the long-run German (Portuguese) output equal to 8.8 (7.8) percent. As reforms are implemented gradually over a period of five years, output would smoothly reach its new long-run level in seven years. Second, cross-country coordination of reforms would add extra benefits to each region in the euro area, by limiting the deterioration of relative prices and purchasing power that a country faces when implementing reforms unilaterally. This is true in particular for a small and open economy such as Portugal. Specifically, in the long run German output would increase by 9.2 percent, Portuguese output by 8.6 percent. Third, cross-country coordination would make the macroeconomic performance of the different regions belonging to the euro area more homogeneous, both in terms of price competitiveness and real activity. Overall, our results suggest that reforms implemented apart by each country in the euro area produce positive effects, cross-country coordination produces larger and more evenly distributed (positive) effects.

JEL Classification Numbers: *C53; E52; F47*.

Keywords: *Economic policy, structural reforms, dynamic general equilibrium modeling, competition, markups, monetary policy*.

Non-technical Summary

The recent financial crisis is likely to have produced persistent and large negative effects not only on the short-run economic activity but also on the long-run potential output of the industrialized countries. This has contributed to renew the interest in understanding the macroeconomic impact of competition-friendly structural reforms, aimed at increasing the economic efficiency and, as such, the maximum amount of output an economy can produce.

This is true in particular for European and euro area countries, notoriously characterized by relatively low potential output and degree of competition in national services and labor markets. The macroeconomic effects of augmenting the degree of competition in the labor and services markets are clear from the perspective of the euro area as a whole. However, the multi-country dimension of the euro area, the higher degree of economic integration and the fact that reforms are mainly decided at country level raise two issues. First, structural increases in the supply of goods and services in only one country could benefit the main trade partners by favorable movements in international relative prices (terms of trade and real exchange rate). However, symmetrically, these changes in relative prices would at least partially counterbalance the positive effects of reforms in the implementing country, by reducing households' purchasing power. Second, from the euro area perspective, asynchronous reforms can limit the degree of homogeneity in macroeconomic performance across euro area regions. As such, a country in the euro area may have a stronger incentive to implement reforms when other countries do it and, moreover, coordination can contribute to make euro area more homogeneous. The latter point is also stressed in the Europe 2020 Strategy, that emphasizes the relevance of cross-country coordination to achieve better and even supply-side performance in Europe and in the euro area. The risk is that divergent economic patterns can put strains on the single currency through different channels, for example through (increasing) differences in the sustainability of public finances and trade competitiveness.

Consistently with the above points, in this paper we adopt a multilateral perspective and systematically assess the domestic and cross-country macroeconomic implications of competition-enhancing reforms implemented in the euro area regional services and labor markets. Specifically, we simulate EAGLE (Euro Area and Global Economy model, see Gomes et al., 2010), a large scale new-Keynesian dynamic general equilibrium model of the euro area and the world economy. The euro area is a two-region monetary union having a common monetary policy and nominal exchange rate against the US and the (overall) rest of the world. The presence of the US and the rest of the world allows for a full characterization of the euro area international trade flows and relative prices. The model features monopolistic competition in product and labor markets. There is a markup between the marginal cost (marginal rate of substitution between consumption and leisure) and prices (wages). The markups reflect imperfect competition in product and labor markets, being inversely related to the degree of substitutability between goods or labor varieties. By permanently modifying these elasticity parameters we can simulate the impact of structural reforms that modify the degree of competition in the considered market. In particular, the higher

the elasticity of substitution between varieties, the lower the markup and the closer the market is to perfect competition.

We consider the domestic and international effects of reforms implemented only in one region of the euro area or coordinated across the two euro area regions. Specifically, we calibrate the euro area to Germany and the rest of the euro area and, alternatively, to Portugal and the rest of the euro area. We take Germany as it is the largest economy of the euro area (its gross domestic product is around 30 percent of the euro area-wide product) and, as such, spillovers to the rest of the euro area are potentially sizeable. We take the case of Portugal as it is a small country in the euro area and it also presents a considerable degree of openness, namely to intra-euro area trade. Finally, we perform some sensitivity analysis along key dimensions for international spillovers.

Our main results are as follows. First, there are benefits from implementing unilateral structural reforms. A reduction of markup by 15 percentage points in the German (Portuguese) labor and services market would induce an increase in the long-run German (Portuguese) output equal to 8.8 (7.8) percent. As reforms are implemented gradually over a period of five years, output would smoothly reach its new long-run level in seven years. Second, cross-country coordination of reforms in the euro area would add extra benefits to each region, by limiting the deterioration of relative prices and purchasing power that a country faces when implementing reforms unilaterally. This is true in particular for a small and open economy such as Portugal. Specifically, in the long run German output would increase by 9.2 percent, Portuguese output by 8.6 percent. Third, cross-country coordination would make the macroeconomic performance of the different regions belonging to the euro area more homogeneous, both in terms of prices and real activity. Overall, results suggest that reforms implemented apart by each country in the euro area produce positive effects, cross-country coordination produces larger and more evenly distributed (positive) effects.

1 Introduction

The recent financial crisis is likely to have produced persistent and large negative effects not only on the short-run economic activity but also on the long-run potential output of the industrialized countries. This has contributed to renew the interest in understanding the macroeconomic impact of competition-friendly structural reforms, aimed at increasing the economic efficiency and, as such, the maximum amount of output an economy can produce.

This is true in particular for European and euro area countries, notoriously characterized by relatively low potential output. A leading explanation of the issue is that the bad supply-side performance is mainly due to insufficient degree of competition in the labor and services markets. With this respect, several policy proposals have been suggested and implemented in the recent past. The most well known is the European Council's Lisbon Strategy for Growth and Jobs that has been followed by the Europe 2020 Strategy.¹ The latter is the Agenda that the European Union and its Member States have decided to "help Europe recover from the crisis and come out stronger, both internally and at the international level".² The Agenda sets five headline targets for the European Union in 2020 in terms of employment, research and development, energy, education and poverty. To achieve the targets, a large array of policy measures should be implemented over time at national and European-wide levels in the common market, fiscal sector, financial sector and external trade. In particular, the Agenda puts large emphasis on structural reforms in the labor and services markets. The reason is straightforward. The two markets are over-regulated and not directly subject, given their nontradable dimension, to the competitive forces originating from the European common markets. The lack of flexibility implies a low growth rate of productivity and employment in the long run and thereby does not support the growth of potential output.

The macroeconomic effects of augmenting the degree of competition in the labor and services markets are clear from the perspective of the euro area as a whole. However, the multi-country dimension of the euro area, the higher degree of economic integration and the fact that reforms are mainly decided at country level raise two issues. First, structural increases in the supply of goods and services in only one country could benefit the main trade partners by favorable movements in international relative prices (terms of trade and real exchange rate). However, symmetrically, these changes in relative prices would at least partially counterbalance the positive effects of reforms in the implementing country, by reducing households' purchasing power. Second, from an euro area perspective, asynchronous reforms can limit the degree of homogeneity in macroeconomic performance across euro area regions. As such, a country in the euro area may have a stronger incentive to implement reforms when other countries do it and, moreover, coordination can contribute to make euro area more homogeneous. The latter point is also stressed in the Europe 2020 Strategy, that emphasizes the relevance of cross-country coordina-

¹See, among others, European Commission (2002, 2005a, 2005b, 2010). See also International Monetary Fund (2004), Organization for Economic Co-operation and Development (1997, 2003, 2006).

²See European Council (2010).

tion to achieve better and even supply-side performance in Europe and in the euro area. The risk is that divergent economic patterns can put strains on the single currency through different channels, for example through (increasing) differences in the sustainability of public finances and trade competitiveness.³

Consistently with the above points, in this paper we adopt a multilateral perspective and systematically assess the domestic and cross-country macroeconomic implications of competition-enhancing reforms implemented in the euro area regional services and labor markets. Specifically, we simulate EAGLE (Euro Area and Global Economy model, see Gomes et al. 2010), a large scale new-Keynesian dynamic general equilibrium model of the euro area and the world economy. The euro area is a two-region monetary union having a common monetary policy and nominal exchange rate against the US and the (overall) rest of the world (each of the latter two regions has its own monetary policy and currency). The model features monopolistic competition in product and labor markets. There is a markup between the marginal cost (marginal rate of substitution between consumption and leisure) and prices (wages). Consistently with the monopolistic competition framework, the markups are inversely related to the degree of substitutability across product and labor varieties, and hence the underlying level of competition. Given the presence of nontradables in EAGLE, we can analyze the effect of increasing the degree of competition in the services sectors, traditionally considered as mainly nontradable. As we assume that monopolistic competition holds not only in the goods and services sectors but also in the labor market, we can compare the effects of deregulating each of these markets at a time as well as analyze the impact of coordinating reforms across sectors. Finally, the presence of the US and the rest of the world allows for a full characterization of the euro area international trade flows.

We consider the domestic and international effects of reforms implemented only in one region of the euro area or coordinated across the two euro area regions. Specifically, we calibrate the euro area to Germany and the rest of the euro area and, alternatively, to Portugal and the rest of the euro area. We take Germany as it is the largest economy of the euro area (its gross domestic product is around 30 percent of the euro area-wide product) and, as such, spillovers to the rest of the euro area are potentially sizeable.⁴ We take the case of Portugal as it a small country in the euro area and it presents a considerable degree of openness, namely to intra-euro area trade. Finally, we perform some sensitivity analysis along key dimensions for international spillovers such as the degree of substitutability between tradables.

We simulate the model assuming that competition-enhancing structural reforms are implemented in a gradual fashion along a period of five years. Given the assumption of perfect

³See European Commission (2010).

⁴It is also worth noticing that, over the last decade, the employment rate of the population at working age has significantly increased in Germany, to the extend of reducing the gap with the US (close to 73% in 2007). This evolution can partly be attributed to the deregulation implemented in the German labor market in the second half of the nineties and more notably in the 2002-2005 period (the latter being usually referred to as Hartz reforms). For details, see Ebbinghaus and Eichhorst (2006) and Jacobi and Kluve (2006) that give a comprehensive overview of the German employment policies and their effect. Nevertheless, our simulations should not be interpreted as an ex post evaluation of these reforms.

foresight, reforms are fully credible, there is no uncertainty and agents anticipate the overall transition path and the final equilibrium. We analyze both the long-run (steady state) effects and the transitional dynamics.

Our main results are as follows. First, there are benefits from implementing unilateral structural reforms. A reduction of markup by 15 percentage points in the German (Portuguese) labor and services market would induce an increase in the long-run German (Portuguese) output equal to 8.8 (7.8) percent. As reforms are implemented gradually over a period of five years, the output would smoothly reach its new long-run level in seven years. Second, cross-country coordination of reforms in the euro area would add extra benefits to each region, by limiting the deterioration of relative prices and purchasing power that a country faces when implementing reforms unilaterally. This is true in particular for a small and open economy such as Portugal. Specifically, in the long run German output would increase by 9.2 percent, Portuguese output by 8.6 percent. Third, cross-country coordination would make the macroeconomic performance of the different regions belonging to the euro area more homogeneous, both in terms of prices and real activity. Overall, results suggest that reforms implemented apart by each country in the euro area produce positive effects, cross-country coordination produces larger and more evenly distributed (positive) effects.⁵

Our paper is related to several contributions analyzing the macroeconomic implications of structural reforms. Bayoumi et al. (2004) analyze the effects of greater competition in the euro area. However, they do not focus neither on country-specific reforms nor distinguish between manufacturing and services sectors. Jonsson (2006, 2007) analyzes the macroeconomic implications of imperfect competition in the product and labor market using a closed economy dynamic general equilibrium model parameterized to fit the euro area and the US, respectively.⁶ Benigno and Thoenissen (2003) assess the implications of market reforms for the case of the UK calibrating a two-country DSGE model. Everaert and Schule (2008) compute a similar analysis focusing on the effects of synchronized structural reforms in the euro area. Differently from them, we can fully assess international spillovers and the impact of coordination because we calibrate EAGLE to the world economy. Forni et al. (2010a) analyze the role of greater competition in the Italian services sector in a two country model of the euro area. They do not consider spillovers related to trade with third-countries.

The paper has the following structure. The next section briefly presents the theoretical background of the model. Section 3 contains an overview of the calibration. Section 4 reports results. Section 5 concludes.

⁵Our results are robust to calibrating the model, alternatively, to France and Italy as they are similar to Germany in terms of the economic dimensions that the model is able to catch. To save on space we report only results for the case of Germany and Portugal.

⁶Several recent contributions have also focused on the macroeconomic effects of fiscal (tax- and public spending-based) reforms in the euro area (see, among the others, Coenen et al., 2008b, and Forni et al., 2010b) and of reforms aimed at reducing worldwide protectionism (see Faruqee et al., 2008).

2 Model setup

2.1 General features

We simulate the Euro Area and Global Economy (EAGLE) model, a multi-country dynamic general equilibrium model of the euro area.⁷ In EAGLE the world economy is composed of four blocs. Two out of four are members of the euro area, which is formalized as a monetary union. The two countries have a common nominal exchange rate and a common nominal interest rate. Each of the remaining two countries has its own nominal interest rate and nominal exchange rate. Similarly to the European Central Bank New Area Wide model (NAWM) and the International Monetary Fund Global Economy Model (GEM), EAGLE is microfounded and features nominal price and wage rigidities, capital accumulation, international trade in goods and bonds.⁸ Explicit microfoundations allow to clearly identify structural parameters and to properly analyze the impact of structural changes. The general equilibrium framework allows to appropriately take into account the effects of households' and firms' behavior.

In each country there are three types of agents: households, firms and a public sector. Each household is infinitely lived. Households consume a final good and decide how to allocate their time between work and leisure. They supply differentiated labor to domestic firms in a monopolistic manner, thus exerting limited bargaining power and charging markups over the marginal rate of substitution between labor and consumption. So they supply a lower amount of labor than under perfect competition. Households own the portfolio of domestic firms and the domestic capital stock, which they rent to domestic firms. The market for capital is competitive, and capital accumulation is subject to standard investment adjustment costs. Labor and physical capital are immobile internationally. Households also buy and sell two bonds: a domestic bond denominated in domestic currency and an international bond issued in zero net supply worldwide. When households undertake positions on the international bond they pay a premium to financial intermediaries, whose size is a function of the aggregate net asset position of the country. Households residing in the monetary union trade also a bond denominated in the common currency.

On the production side, firms produce the nontradable final goods, an array of differentiated intermediate goods, and provide intermediation services. There are two nontradable final goods — a consumption good and an investment good — produced by perfectly competitive firms using all available intermediate goods, combined accordingly to a constant elasticity of substitution (CES) technology.

There are many varieties of intermediate goods, each produced by a single firm under conditions of monopolistic competition. The market power implies that firms set nominal prices charging a markup over marginal costs and produce an amount of goods which is lower than in the case of perfect competition. Each intermediate good is produced using domestic labor inputs

⁷The EAGLE model code was developed in both TROLL and DYNARE. For a detailed description of EAGLE, see Gomes et al. (2010).

⁸On GEM see Bayoumi (2004) and Pesenti (2008). On the NAWM see Coenen et al. (2008a).

and domestic capital. They are combined according to a Cobb-Douglas technology. Intermediate goods are either nontraded or traded internationally. There is international price discrimination as firms set prices in the currency of the importing country (as such, goods markets are segmented).

The government purchases nontraded intermediate goods and finances its expenditures with public debt and various taxes on the domestic private sector. A standard fiscal rule ensures model stability by appropriately adjusting lump-sum taxes.⁹ As for the monetary authority, the central bank sets the national short-term nominal interest rate according to a standard Taylor-type rule, by reacting to increases in consumer price index (CPI from now on) inflation and real activity. The interest rate rule is specified as follows for each region:

$$(R_t^4 - \bar{R}^4) = \rho_R (R_{t-1}^4 - \bar{R}^4) + (1 - \rho_R) \rho_\pi (\pi_{4,t} - \bar{\pi}_4) + \rho_y \left(\frac{gdp_t}{gdp_{t-1}} - 1 \right) \quad (1)$$

where R is the (quarterly) nominal interest rate, \bar{R} its steady state value, π_4 is the year-on-year CPI inflation rate, $\bar{\pi}_4$ is the central bank CPI inflation target (assumed to be constant), gdp is the gross domestic product. To capture inertia in the conduct of monetary policy, we assume that the current period policy rate reacts to its one period-lagged value. In the euro area, π is defined as the average of two region-specific CPI inflation rates and gdp as the sum of the regional gross domestic products. Note that in the euro area region-specific inflation rates determine the region-specific real interest rates, because the nominal interest rate is common and set by the central bank of the monetary union.

The model uses standard functional forms, which allows firms and consumers to be aggregated as if they were a representative entity. Adjustment costs for real variables and nominal rigidities enable EAGLE to mimic the typical hump-shaped reaction of macroeconomic variables to shocks observed in more empirically oriented models of the euro area such as the estimated version of the NAWM (see Christofell et al., 2008 and Smets and Wouters, 2003). There are investment and import adjustment costs and external habit formation in consumption. All (intermediate goods) prices and wages are sticky (Calvo, 1983) and indexed to a weighted average of previous period CPI inflation rate and current period central bank's inflation target.

2.2 Markups in labor and product markets

The monopolistic competition framework in the intermediate goods and labor markets is a crucial feature for the type of analysis we perform. As such we will describe it in more detail in what follows. Let's consider the labor market setup first. Each household offers a specific kind of labor services that is an imperfect substitute for services offered by other households and set its wage to maximize utility. The elasticity of substitution between labor varieties determines the related market power. The first order condition for labor supply, L , in the (flexible-price symmetric)

⁹Results are not affected by the presence of the fiscal items.



steady-state equilibrium is:¹⁰

$$\frac{W}{P} = \frac{\theta_L}{\theta_L - 1} \lambda^{-1} L^\tau, \theta_L > 1 \quad (2)$$

where W/P is the real wage (expressed in units of domestic consumption), λ is the marginal utility of consumption. The parameter τ is the inverse of the Frisch elasticity of labor supply. The markup is $\theta_L/(\theta_L - 1)$ and depends negatively on the elasticity of substitution between labor varieties, θ_L . So, the higher the degree of substitutability, the lower the implied markup and the higher employment in terms of hours, for a given wage. As such, the markup reflects imperfect competition in the labor market.

In the intermediate goods market, imperfect competition is introduced in a similar way. There is a large number of firms offering a continuum of different products that are imperfect substitutes. Each product is made by one monopolistic firm, which sets prices to maximize profits. The elasticity of substitution between products of different firms determines the market power of each firm. In steady state, in each sector (tradables and services sectors) a first order condition for price setting like the following one holds:

$$\frac{P_Y}{P} = \frac{\theta_Y}{\theta_Y - 1} \frac{MC}{P}, \theta_Y > 1 \quad (3)$$

where P_Y/P is the relative price of the generic intermediate good Y and MC/P is the real marginal cost of producing Y . The markup is $\theta_Y/(\theta_Y - 1)$ and depends negatively on the elasticity of substitution between different products, θ_Y . So, the higher the degree of substitutability, the lower the implied markup and the higher the production level, for a given price. As such, the markup reflects imperfect competition.

Summing up, in EAGLE markups are modeled by a single parameter in each national market (labor, tradable intermediate good, nontradable intermediate good), consistently with other similar models based on the monopolistic competition framework. By permanently modifying the elasticity parameters we can simulate the impact of structural reforms and modify the degree of competition in the considered market. The higher the elasticity of substitution between varieties, the lower the markup and the closer the market is to perfect competition.

¹⁰We assume that the generic household i gains utility from consumption ($C_{i,t}$) and disutility from working ($L_{i,t}$). In particular, we assume external habit formation, which means that its utility depends positively on the difference between the current level of individual consumption, $C_{i,t}$, and the lagged average aggregate consumption level, $C_{I,t-1}$. Household i lifetime expected utility function is then:

$$E_t \left[\sum_{s=0}^{\infty} \beta^s \left(\frac{1-\kappa}{1-\sigma} \left(\frac{C_{i,t+s} - \kappa C_{I,t+s-1}}{1-\kappa} \right)^{1-\sigma} - \frac{1}{1+\tau} (L_{i,t+s})^{1+\tau} \right) \right]$$

where β is the discount factor, σ denotes the inverse of the intertemporal elasticity of substitution and τ is the inverse of the elasticity of work effort with respect to the real wage. The parameter κ measures the degree of external habit formation in consumption.

3 Calibration

We summarize in Tables 1 to 6 the (quarterly) calibration of the model. We illustrate the markup values for labor, manufacturing and services, the values of parameters affecting the relevant steady state great ratios and the dynamics. They are set according to the empirical evidence or existing literature on the NAWM and the GEM.

We calibrate the model to Germany (DE), the rest of the euro area (REA), the United States (US) and the rest of the world (RW). We choose Germany because it is the largest economy of the euro area. Alternatively, we calibrate the two euro area regions to Portugal (PT) and the rest of the euro area. The calibration of the model to the Portuguese economy captures crucial differences with respect to Germany, such as size, trade shares and weight of nontradables. We report in Table 1 the implied great ratios for Germany and Portugal.¹¹ In the other tables we report only the German case to save on space.¹²

3.1 Markup values

We report in Table 2 initial markup values. We identify the nontradable and tradable intermediate sectors in the model with the services and manufacturing sectors in the data, respectively. Markups in the euro area services and labor markets are higher than the corresponding values in the US and the rest of the world. In each region the markup in the nontradable sector is higher than that in the labor market. For the euro area, the latter is higher than the markup in the manufacturing sector. In other terms, in the euro area the degree of competition is particularly low in the services sector. Specifically, the (net) price markup in Germany and the rest of the euro area is set to 50, 30, 20 percent in the services, labor and manufacturing sectors, respectively. In the US and in the rest of the world the corresponding markups are set to 28, 16, 20 percent. Our values are in line with other existing similar studies, such as Bayoumi et al. (2004), Faruquee et al. (2007), Everaert and Schule (2008). Many, if not all, of these studies refer to Jean and Nicoletti (2002), Oliveira Martins et al. (1996) and Oliveira Martins and Scarpetta (1999) for estimates of markups on the basis of data from Organization of Economic Co-operation and Development. Some additional empirical evidence for the euro area is provided by Christophoulou and Vermeulen (2008). Their estimates suggest that the markup in the German services sector is similar to the corresponding value for the euro area and that the markup in German manufacturing sector is relatively low with respect to that in the German services sector.

¹¹National accounts data are from the European Commission AMECO database and from the Statistics Portugal.

¹²Tables for Portugal are available from the authors upon request. We assume that elasticities of substitution and parameters regulating the dynamics are the same as in Germany, consistently with common practice in calibrating multi-country models and so as to make results more easily comparable. We also set the same values for markups given the lack of estimates for Portugal in the literature.

3.2 Other parameters

We report in Table 3 preference and technology parameters. Preferences are the same across households of different regions. We set the discount factor so that the steady-state annualized real interest rate is about 3 percent, the habit persistence parameter to 0.70, the intertemporal elasticity of substitution to 1.5 and the Frisch elasticity to 0.50. We set the quarterly depreciation rate of capital to 0.025, consistently with an annual depreciation rate of 10 percent.

For the production side, there is a bias toward capital of 0.3 in the Cobb-Douglas production functions of both tradable and nontradable intermediate goods. As for the final goods baskets, the degree of substitutability between domestic and imported tradables is higher than that between tradables and nontradables, consistent with existing literature. In particular, we set the (long-run) elasticity of substitution between tradables and nontradables to 0.5 while the elasticity between domestic and imported tradables to 2.5.¹³ The biases toward the tradable bundle in the consumption and investment baskets are equal respectively to 0.45 and 0.75 in each region of the euro area, respectively to 0.35 and 0.75 in the US and the rest of the world. The weight of domestic tradable goods in the consumption and investment tradable baskets is different across countries, to be coherent with multilateral import-to-GDP ratios.

In Table 4 we report nominal and real rigidities. We set Calvo price parameters in the domestic tradables and nontradables sector to 0.92 (on average, firms adjust prices optimally every 12.5 quarters) in the euro area, consistently with estimates by Christoffel et al. (2008) and Smets and Wouters (2003).¹⁴ Corresponding nominal rigidities outside the euro area are equal to 0.75, implying an average frequency of adjustment equal to 4 quarters, in line with Faruqee et al. (2007). Calvo wage parameters and price parameters in the export sector are equal to 0.75 in all the regions. The indexation parameters on prices and wages are equal respectively to 0.50 and 0.75, so to get sufficiently hump-shaped response of wages and prices. For real rigidities, we set the parameters of the adjustment costs on investment changes to 6 in the euro area and to 4 in the case of the US and the rest of the world; and adjustment costs on consumption and investment imports to 2 and 1, respectively. We set weights of bilateral imports to match the trade matrix reported in Table 5 (for details see Gomes et al., 2010).¹⁵ In particular, it's interesting to note that intra-euro area trade represents a significant share of total trade in the two euro area regions. We calibrate the net foreign asset position of each economy (as a ratio to GDP) to match the corresponding data. Given the calibrated import shares, net foreign asset position and international interest rate, the steady-state trade-balance ratio (to GDP) is exogenously pinned-down, while export and import quantities as well as international relative prices consistently adjust.¹⁶

¹³Note that the short-run elasticity for imported goods is lower than its long-run value because of adjustment costs on imports. Numbers are consistent with Bayoumi et al. (2004).

¹⁴In fact, given that we assume indexation, prices (and wages) change every period.

¹⁵The trade matrix covers intra and extra euro area flows of goods and services. Numbers are computed by the authors using AMECO and Eurostat data.

¹⁶The indeterminacy of steady state net foreign asset position and trade balance is standard in open economy models with representative households and incomplete international financial markets. See, for example, Pesenti

Finally, in Table 6 we report parameters in the monetary policy rules, where the (annualized) interest rate reacts to the its lagged value (inertial component of the monetary policy), annual inflation and quarterly output growth (see equation 1).

4 Results

In this section we report the results of our simulations. We analyze the macroeconomic effects of structural reforms in the euro area labor and services markets. We assume that reforms are implemented in a gradual way over a period of five years (consistently, markups are reduced gradually to a permanently lower value). We also assume that households and firms have perfect foresight, thus eliminating any uncertainty about the credibility of the reforms.¹⁷ We report both long-run (steady-state) values of the variables and the related transition dynamics. To stress the role of cross-region coordination, we compare results when reforms are implemented in Germany in isolation and simultaneously in both regions of the euro area. To make our results more general, we also report the case of reforms implemented in Portugal. Finally, we perform sensitivity analysis by appropriately changing the values of some key parameters.

4.1 Unilateral reforms in Germany

In this section we initially report results of the reform in the German services sector. Subsequently, we show results when the reform is implemented in the German labor market. Finally, we consider the case of simultaneous reforms in German services and labor markets.

4.1.1 Services sector

In Table 7 we report the long-run results of reducing the (gross) markup in the German services sector by 5, 10, 15 percentage points. Overall, the macroeconomic impact of the reforms is sizable. In the case of a 15 percentage points markup reduction (the gross markup is permanently reduced to 1.35), German output rises by 4.4 percent.¹⁸ The increase is driven by higher investment (7.1 percent) and consumption (1.8 percent). Firms increase demand for capital and labor. In particular, hours worked and real wage increase by 3.1 and 7.5 percent, respectively.

As for international trade, the excess supply of German services induces a depreciation of the (multilateral) real exchange rate and a deterioration of the (multilateral) terms of trade, as the relative price of nontradables becomes lower.¹⁹ In the case of a 15 percentage points markup

(2008). To the opposite, along the transition dynamics the trade balance and the net foreign asset position endogenously adjust to the given shock. For this reason, we include the dynamics of the trade balance in the charts reporting the transitional equilibrium.

¹⁷As in other large scale dynamic general equilibrium models, abstracting from aggregate uncertainty simplifies computation. See for example Ferrero (2010).

¹⁸Gross domestic product and its components are evaluated in real terms, i.e. using the initial (pre-reform) fixed steady state prices (see Faruqee et al., 2007).

¹⁹The real exchange rate of a region is defined as the ratio of the foreign to the domestic CPI indices, both expressed in the domestic currency. An increase represents a depreciation. The terms of trade of a region is the

reduction, German exports increase by 1.1 percent favored by the depreciation. German imports increase as well, by 0.6 percent, driven by higher German aggregate demand.²⁰

Spillovers to the rest of the euro area are positive but small. Output, consumption and investment in the rest of the euro area increase in a negligible way. This is not surprising, given that services are nontradables and that the size of Germany in the world economy is relatively small. Both rest of the euro area exports and imports respectively to and from Germany (not reported) increase. Exports increase because of higher German aggregate demand. Imports increase to a bigger extent, because German tradables are now cheaper. For the same reason, rest of euro area exports to the US and to the rest of the world (not reported) decline, as world demand shifts toward cheaper German tradables. Given the German real exchange rate depreciation and the deterioration in the German terms of trade, the purchasing power of households resident outside Germany improves, in particular those residing in the rest of the euro area because of higher trade linkages. Welfare effects on German and rest of the euro area households (measured in terms of consumption equivalents) are positive and, in the case of German households, sizeable.²¹

Finally, spillovers to the rest of the world and the US output are negligible.

In Figures 1-4 we show the domestic and cross-country effects of reforms in the German services sector along the transition from the initial to the new steady-state (we report results obtained in the case of a 10 percentage point reduction in the markup). In Figure 1 we report the domestic effects. German households anticipate that services will be cheaper in the future, when their supply will be higher. As such, given its high services content, households postpone consumption to future periods, when it will be cheaper. Consumption drops in the first two years and then starts to increase but stays below the initial steady state level for around 5 years, roughly the amount of time needed to fully implement reforms. Simultaneously, firms gradually increase demand for physical capital, so to have a higher stock of capital when the production level has to be increased (in correspondence of higher competition). The increase in investment drives up demand for domestic tradables. Similarly, the real wage follows an increasing path, given that firms gradually increase labor demand, as the price markup becomes lower. After roughly one year from the beginning of the reform, German output starts to monotonically increase toward its new long-run level, driven to a great extent by higher production of nontradables. The German-specific real interest rate increases over time, as the nominal interest rate, set taking into account of euro area-wide variables, hardly moves while German inflation decreases. The higher German real interest rate further stimulates German households to postpone consumption.

ratio of import to export prices, both expressed in domestic currency. An increase corresponds to a deterioration. For the details on the construction of the multilateral index, see Gomes et al. (2010).

²⁰German bilateral export and imports (not reported in the table) increase respectively toward and from all other regions.

²¹Denoting L_0 as the initial steady state level of labor effort, and C_{FIN} and L_{FIN} as the final steady-state levels of consumption and labor, i.e. after the markup change, the consumption equivalent CE is defined implicitly by:

$$W(CE, L_0) = W(C_{FIN}, L_{FIN}).$$

The CE is a measure of the permanent change in consumption required to achieve the new level of utility holding labor effort constant at its original (steady-state) value. Following Bayoumi et al. (2004), this welfare measure is independent of habit persistence parameter.

The trade balance initially rises, as German demand decreases. In the medium run it stays persistently below its equilibrium level, as aggregate demand increases. The German real exchange rate depreciates over time, so as to absorb the increasing excess supply. The terms of trade deteriorate only slightly, as the real exchange rate depreciation is partially compensated by the increase in the relative price of German tradables.²²

In Figure 2 we report the short-to-medium run spillovers to the rest of the euro area. Spillovers are positive. Regarding real activity, they are larger in the short run than in the medium run. Cheaper imports from Germany and higher exports to the rest of the world and the US (see below) have a positive effect on rest of the euro area production and income. The related increase in regional inflation drives down the real interest rate in the rest of the euro area, given also the smoothed reaction of the nominal interest rate. This further stimulates consumption and hence aggregate demand for tradables and nontradables.

Higher aggregate demand stimulates imports, in particular from Germany. Overall, the rest of the euro area trade balance initially falls, as domestic aggregate demand increases and the world demand shifts toward cheaper German goods. In the medium run it improves, as German aggregate demand gradually increases. The rest of the euro area terms of trade slightly improve and the real exchange rate appreciates in the medium run, consistently with the relatively scarcity of rest of the euro area goods (or, equivalently, the excess supply of German goods).

German exports increase toward all countries, while German imports from all countries decrease in the short run, driven by lower German aggregate demand in the initial periods (Figure 3). On impact the German bilateral real exchange rates against US and rest of the world currencies depreciate to a bigger extent than the real exchange rate against the rest of the euro area, as the euro area *nominal* exchange rate depreciates (the depreciation of the German *vis-à-vis* rest of the euro area bilateral *real* exchange rate is smooth, as it reflects the inflation differential only). Consistently with the local currency pricing assumption, German terms of trade slightly improve in the short-run (firms set nominal prices in the currency of the destination market and, as such, there is incomplete short-run pass-through of nominal exchange rate into import prices).

We report in Figure 4 the trade variables for the rest of the euro area. Rest of the euro area exports toward the US and the rest of the world decrease in the medium run, as German tradables become more competitive. International relative prices against the rest of the world and the US deteriorate on impact, reflecting the fact that higher aggregate demand in the euro area as a whole stimulates production relatively more in the rest of the euro area than in the US and the rest of the world. As such, the improvement in rest of the euro area international relative prices is driven by the bilateral relative prices against Germany.

Summing up, German-specific services reforms produce positive effects domestically, even if the German international relative prices deteriorate, partially limiting the increase in the purchasing power of German households. Spillover effects to the rest of the euro area are positive

²²Reform in the services sector induces an increase in real wages and hence in the production costs of both tradables and nontradables.

as well, along the transition and in the long run. However they are relatively small when compared with German domestic effects implying that the macroeconomic performance across the two regions is rather different.

4.1.2 Labor market

We show in Table 8 the long-run effects of reducing markups in the German labor market. There are several differences in terms of the effects of the reform on the main economic variables compared to the services sector reform.

For the domestic effects, the following results arise. First, hours worked increase while real wages decrease. In contrast, in the case of services reform of similar size real wages increase because of the higher competition in the services market (it pushes up labor demand and drives down consumption prices). Second, employment increases relatively more since firms have a stronger incentive to use labor input as real wages decrease. Third, exports increase more as well, because the lower real wage translates into a lower marginal cost in the whole economy and hence in lower prices of both tradables and nontradables. Consistently, the German terms of trade deteriorate to a greater extent. To the opposite, the German real exchange depreciates less because the relative price of services, which is a large share of the consumption bundle, decreases to a lower extent. Finally, imports increase more as well. This is so due to the lower real exchange rate depreciation and the stronger increase in consumption, that represents a large share of aggregate demand though having a lower import content than investment.

Spillovers to the rest of the euro area are positive and bigger than in the case of reforms in the services sector, as the rest of the euro area now benefits from more favorable terms of trade movements. The effect stimulates consumption and investment in the rest of the euro area. Real output increases, while rest of euro area exports to the US and to the rest of the world (not reported) decline (German tradables are cheaper). Also in this case welfare effects in Germany and the rest of the euro area are positive.

Spillovers to the rest of the world are also bigger than in the case of reforms in the services sector. As for the rest of the euro area, the stimulating effect is due to the combination of higher exports of the rest of the world toward Germany and the improvement in the rest of the world terms of trade. Spillovers to the US are negligible, as in the case of the services sector reform (as previously said, the US mainly trades with the rest of the world).

In Figures 5-8 we show the domestic and cross-country effects of reforms in the German labor market along the transition path (10 percentage point reduction in the markup). In Figure 5 we show the domestic effects. German firms foresee that labor will be cheaper in the future and that labor supply will increase. They immediately start to adjust the stock of capital, that will make labor more productive, inducing an immediate increase in investment. To produce more capital goods, firms increase labor demand as well. Given that labor supply is relatively low, real wages initially increase, and then decrease over time. Higher demand for investment goods drives up production and inflation. Consumption smoothly and monotonically increases (toward the new

steady state level), benefiting from higher labor income given higher hours worked. The same is true for output. In addition, the real interest rate in Germany initially falls. Subsequently, it increases as German inflation increases to a lower extent and eventually declines. The German real exchange rate depreciates and the terms of trade deteriorate over time, as the increase in German supply of labor gradually translates into excess supply in the goods market. The trade balance initially drops below its steady state level and then moves slightly above, as the excess supply kicks in and makes German tradables more competitive.

In Figure 6 we report spillovers to the rest of the euro area. They are positive and, on real activity, larger in the short run than in the long run. Higher German imports favor economic activity in the rest of the euro area. The initial increase in rest of the euro area inflation rate is only partially counterbalanced by the higher nominal interest rate, as the latter reacts in a smooth way. As such rest of the euro area-specific real interest rate falls, stimulating consumption, investment and, hence, total output. Hours worked increase mainly on impact. The rest of the euro area real exchange rate depreciates on impact, while in the long run it appreciates, consistently with the gradual increase in German (and euro area) supply of goods. For the same reason rest of the euro area terms of trade show a lasting improvement. The trade balance is overall balanced. As shown in Figures 7 and 8, higher imports from Germany are counterbalanced by (a) the improvement in international relative prices and (b) the increase in exports of the rest of the euro area toward Germany, that counterbalances the shift in world demand towards German tradables.

Overall, as in the case of services reform, the increase in competition in the German labor market produces positive domestic effects.²³ Spillover effects to the rest of the euro area are positive as well, along the transition and in the long run. Moreover, they are somehow larger than in the case of services reforms, as the rest of the euro area benefits from cheaper German tradable goods and the consumption-driven increase in German aggregate demand. Also in this case German households face a deterioration in international relative prices and the economic performance across euro area regions is uneven.

4.1.3 Services sector and labor market

In the previous exercises we focused on reforms being carried out separately. The next step is to quantify how beneficial it would be to implement reforms simultaneously in both markets. In Table 9 we show results of simultaneously lowering markups in both German labor and services markets, starting from the corresponding initial values. The effects of individual reforms are more or less additive. In particular, real wages increase, given that the increase in labor demand more than counterbalances the increase in labor supply. The former is associated with the reform in services sector. The latter with the reform in the labor market.²⁴ This result relates to a general point about the “optimal timing” of reforms made by Blanchard and Giavazzi (2003),

²³The results for Portugal are similar as shown below and are also in line with the findings of Forni et al. (2010a) for Italy.

²⁴Results for the real wage are conditional on the relative size of the reforms.

who argue that structural reforms should generally start from the service sector because the ensuing increase in real wages helps to generate support for subsequent reforms in the labor market (which instead are going to decrease the real wages). Both exports and imports increase, favored by the real exchange rate depreciation. Spillovers to the rest of the euro area are positive. They are qualitatively similar to those obtained when labor and services reforms are implemented in an isolated manner. Welfare improves in both Germany and the rest of the euro area.

In Figures 9-12 we show the domestic and cross-country effects of reforms in the German services sector and labor market along the transition path. We consider the case of a 10 percentage point reduction in the corresponding markup values. In Figure 9 we show the effects in the German economy. Results are similar to those obtained when implementing services market reform in a stand alone fashion. In particular the real wage monotonically increases over time, even though reforms in the labor market are implemented. Spillovers to the rest of the euro area are positive and slightly larger than those obtained when reforms are implemented solely in one sector (Figure 10). For trade variables, German exports increase toward all regions (Figure 11). To the opposite, exports of the rest of the euro area decrease in the medium run, given that German tradable sector gradually becomes more competitive (Figure 12).

4.2 Simultaneous reforms across euro area regions

In the previous section we have shown that the German economy benefits from domestic structural reforms, even if international relative prices deteriorate. Moreover, spillovers to the rest of the euro area are relatively small. Higher German aggregate demand and cheaper German tradable goods favor the increase in rest of the euro economic activity, consumption and investment, but only to a small extent. As such, when reforms are implemented in one country only, the macroeconomic performance across euro area regions is rather different in both the short and the long run.

In this section we assess the impact of implementing reforms simultaneously in Germany and the rest of the euro area. We assume that both regions reduce markups by the same amount in the labor and services markets, that the reduction is gradual (over a period of five years) and fully anticipated.

In Table 10 we show the long-run results of the simultaneous reforms in the two euro area regions. German multilateral international relative prices deteriorate to a lower extent than in the case of German unilateral reforms because Germany benefits from cheaper imports as aggregate supply in the rest of the euro area increases. Moreover, the increase in economy activity is more evenly spread across the two regions. In each region, output rises by more than 9 percent in the case of a simultaneous reduction of markups by 15 percentage points. Regional welfare increases in both euro area regions, consistently with the lower degree of monopolistic distortions.

Spillovers to the rest of the world are now stronger namely given the higher weight in the world economy of the regions carrying out the reforms. The rest of the world benefits from the improvement in international relative prices. Consistently, imports from Germany and the rest

of the euro area increase. Spillovers to the US are positive as well, albeit relatively small, as the trade linkages with the euro area are more limited than in the case of the rest of the world.

In Figures 13-16 we show the effects of reforms in the euro area services sector and labor market along the transition path. We consider the case of a 10 percentage point reduction in the corresponding markup values. In Figures 13 and 14 we show the transition path for Germany and the rest of the euro area, respectively. Differently from the case of unilateral implementation of reforms, the two euro area regions have rather similar macroeconomic performances in the short and medium run. There is an initial reduction in consumption in both regions. Resources are initially exploited for increasing investment, so as to sustain the higher level of production in the future. The decrease in consumption is limited by the initial decrease of the real interest rate, given the relatively quick increase in the inflation rate and the smoothed response of the nominal interest rate. For the trade balance (as a percentage of GDP), in each region it initially shows a surplus as both regions postpone consumption. Subsequently, as reforms gradually kick in and the euro area aggregate demand increases, the trade balance in each region moves below its equilibrium level. In each region the real exchange rate depreciates. In the case of Germany, its relative prices deteriorate to a lower extent than in the case of unilaterally implemented reforms.

In Figures 15 and 16 we show bilateral trade variables for Germany and the rest of the euro area, respectively. They react in a rather symmetric way. Differently from the case of German unilateral reforms, rest of the euro area exports now increase. The increase in aggregate supply is now symmetric among the two euro area regions, implying that the international competitiveness of both regions (not only of Germany) increases. A larger depreciation of German and rest of the euro area bilateral real exchange rates against the US and the rest of the world is associated with the euro area-wide reforms.²⁵

Overall, cross-country simultaneous reforms have rather large and positive effects on the euro area macroeconomic performance, in the short and long run. Compared to the case of unilateral reforms they imply a similar macroeconomic performance across the euro area regions and a lower deterioration in international relative prices for each region.

4.3 Reforms in a small economy: the case of Portugal

To assess if our results are robust to the size and openness of a country, we consider the case of reforms implemented in Portugal, which is among the smallest euro area countries and is relatively open to trade, namely with other euro area countries. Table 11 shows the long-run effects of lowering markup by 15 percentage points in Portuguese labor and services markets, starting from the corresponding initial values. As for the case of Germany, reforms are gradually implemented over a period of five years and perfectly anticipated by households.²⁶ We report the

²⁵As previously said, the German multilateral real exchange rate depreciates to a lower extent than in the case of unilateral reforms, given that aggregate supply increases in the rest of the euro area as well.

²⁶To save on space, we do not report results for the transition dynamics. They are broadly similar to the case of Germany and are available from the authors upon request.

effects of reforms in the services market, in the labor market, in both markets and coordinated with the rest of the euro area.

Reforms implemented unilaterally produce positive domestic effects, as they reduce the distortions existing in the economy. Compared to the case of Germany, the effect on output is relatively low, as Portugal is more open than Germany (imports have a higher weight in the domestic demand). Spillover effects to rest of the euro area are smaller than in the case of German reforms. The simulations also show that the movement in relative prices, as in the case of Germany, is not beneficial for the region implementing reforms as the Portuguese terms of trade deteriorate and real exchange rate depreciates. In the case of Portugal the exchange rate depreciation has a larger negative impact on households' consumption, because the latter is more biased toward imported goods. As such, consumption in Portugal increases to a lower extent than in the case of Germany. This is true in particular when reforms are implemented in the services sector, as the real exchange rate depreciates to a bigger extent than in the case of labor market reforms. In the latter case, instead, there is a stronger incentive to substitute domestic for imported tradables, as the price of the domestic tradables decreases in relative terms thanks to the reduction in real wages (consistently, the Portuguese terms of trade deteriorate to a larger extent than in the case of services reform).

As in the case of Germany, reforms simultaneously implemented with the rest of the euro area produce large benefits for Portugal and make the macroeconomic performance of the two regions rather similar. Output would increase by 8.6 percent in Portugal. Moreover, compared to the case of Germany, cross-country simultaneous reforms would imply that the Portuguese exports increase relatively more than in the case of the country-specific reforms. For two reasons. First, its considerable openness to intra-euro area trade. Second, Portuguese isolated reforms induce a lower stimulating effect on the rest of the euro area than that of German isolated reform. Hence, Portugal benefits from the larger (than in the case of Germany) increase in aggregate demand in the rest of the euro area when reforms are coordinated across countries.

Overall, results suggest that reforms are beneficial for a small economy such as Portugal. They are particularly so if reforms are implemented simultaneously in the euro area, given the degree of openness of the Portuguese economy.

4.4 Sensitivity analysis

Finally, in Table 12 we report the long-run effects of both German and euro area-wide coordinated reforms in the labor and services sectors for alternative values of key parameters (considering a 15 percentage points a reduction of markups). We show the effects on Germany and the rest of the euro area. In particular, the table reports the case of lower and higher intertemporal elasticity of substitution (set respectively to 1 and 3 instead of 1.5 as in the baseline calibration), lower and higher Frisch labor elasticity (set to 0.33 and 0.99 instead of 0.5) and lower and higher elasticity of substitution between domestic and imported tradable goods (set to 1.5 and 5 instead of 2).

The main message is that baseline results are quite robust to changes in the considered parameters. Compared to the benchmark scenario (Tables 9 and 10), the economic expansion in the euro area continues to be sizeable and broadly similar across regions. The impact of reforms on welfare remains positive and considerable. The value of the elasticities affect the relative size of responses of prices and quantities. In the case of low values, quantities are less responsive to changes in relative prices and hence aggregate demand increase to a lower extent than in the benchmark scenario. As such, the increase in output is lower as well. Similar considerations hold for the case of relatively large values of the elasticities but in the opposite direction. The impact of the alternative parameters on the overall results is not particularly strong except, to some extent, in the case of the lower (respectively higher) Frisch elasticity that implies a smaller (bigger) increase in employment and, correspondingly, in GDP.

5 Conclusions

We have quantitatively analyzed the macroeconomic implications of greater competition in euro area labor markets and services sectors by simulating a multi-country microfounded general equilibrium model of Germany (alternatively Portugal) and the rest of the euro area. The monetary union dimension of the model allowed us to assess cross-regional spillovers and the implications of coordination of reforms across countries. Because of the presence of two regions not belonging to the euro area we have been able to clearly distinguish the impact of the reforms on intra-euro area trade and extra-euro area trade variables. Our analysis stresses two points. First, isolated increases in the levels of competition in one country produce large positive domestic effects, while spillovers to the other regions are positive but relatively small. This introduces cross-country heterogeneity in the macroeconomic performance in both the short and the long run. Second, cross-country coordination of reforms would produce larger positive effects in comparison to the case of isolated country-specific reforms. Each country would benefit from the economic activity expansion in the partner's economy. Moreover, from the perspective of the euro area as whole, the macroeconomic performance would be more uniform across regions. Overall, our results suggest that competition-oriented reforms in the euro area produce benefits, in particular if they are coordinated across regions.

The analysis of macroeconomic effects of structural reforms can be extended along several lines. First, competition-friendly reforms and fiscal reforms in euro area regions can interact in the context of a policy strategy aimed simultaneously at consolidating public finance and increasing potential output in the euro area. For example reforms can limit the need to increase taxes by stimulating activity in the euro area, further contributing to limit distortions in the euro area economy. Second, we can assess the impact of reforms when households differ in terms of access to financial markets (implying differences across households in terms of consumption smoothing and international risk-sharing). From this point of view, coordination of reforms with appropriate social spending measures (one of the main items of the European Union balance)

becomes crucial to limit an uneven distribution of costs and benefits inside and across euro area (and more generally, European Union) regions.²⁷ Third, and finally, we can analyze if and to what extent regional fiscal policy can contribute to efficiently stabilize in the short run the economy of a country of the euro area that unilaterally implements structural reforms. All these points stress the relevance of the cross-regional dimension of the euro area for appropriately designing structural and stabilization policies. We leave them for future research.

²⁷For a model-based assessment of the Cohesion Policy expenditure in the European Union, see Varga and in't Veld (2010).

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Table 1: Steady-State National Accounts (percentage of GDP).

	DE	REA	US	RW	PT
Private consumption	60.9	59.6	63.2	64.5	53.4
Private investment	20.0	20.0	20.0	20.0	19.7
Public expenditure	20.0	20.0	16.0	16.0	21.0
Imports	27.6	23.8	11.5	14.9	32.9
Consumption goods	18.4	20.1	7.3	8.6	17.0
Investment goods	9.2	3.6	4.2	6.3	15.9
Public debt (%yearly GDP)	60.0	60.0	60.0	60.0	60.0
Share of services sector	60.6	61.7	63.1	62.5	52.5
Share of world GDP	6.9	16.2	30.5	46.4	0.20

DE=Germany; REA=Rest of euro area; US=United States; RW=Rest of the world; PT=Portugal.

Table 2: (Gross) Price and Wage Markups.

	DE	REA	US	RW
Manufacturing (tradables) price markup	1.20	1.20	1.20	1.20
Services (nontradables) price markup	1.50	1.50	1.28	1.28
Wage markup	1.30	1.30	1.16	1.16

DE=Germany; REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 3: Households and Firms Behavior.

	DE	REA	US	RW
Households				
Subjective discount factor	$1.03^{-0.25}$	$1.03^{-0.25}$	$1.03^{-0.25}$	$1.03^{-0.25}$
Depreciation rate	0.025	0.025	0.025	0.025
Intertemporal elasticity of substitution	1.5	1.5	1.5	1.5
Habit persistence	0.70	0.70	0.70	0.70
Inverse of the Frisch elasticity of labor	2.00	2.00	2.00	2.00
Tradable Intermediate Goods				
Bias toward capital	0.30	0.30	0.30	0.30
Nontradable Intermediate Goods				
Bias toward capital	0.30	0.30	0.30	0.30
Final consumption goods				
Substitution btw domestic and imp. goods	2.50	2.50	2.50	2.50
Bias toward domestic goods	0.31	0.21	0.65	0.58
Substitution btw tradables and nontrad.	0.50	0.50	0.50	0.50
Bias toward tradable goods	0.45	0.45	0.35	0.35
Final investment goods				
Substitution btw domestic and imp. goods	2.50	2.50	2.50	2.50
Bias toward domestic goods	0.42	0.80	0.70	0.55
Substitution btw tradables and nontr.	0.50	0.50	0.50	0.50
Bias toward tradable goods	0.75	0.75	0.75	0.75

DE=Germany; REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 4: Real and Nominal Rigidities.

	DE	REA	US	RW
Real Rigidities				
Investment adjustment	6.00	6.00	4.00	4.00
Import adjustment (consumption)	2.00	2.00	2.00	2.00
Import adjustment (investment)	1.00	1.00	1.00	1.00
Nominal Rigidities				
<i>Households</i>				
Wage stickiness	0.75	0.75	0.75	0.75
Wage indexation	0.75	0.75	0.75	0.75
<i>Manufacturing</i>				
Price stickiness (domestically produced goods)	0.92	0.92	0.75	0.75
Price indexation (domestically produced goods)	0.50	0.50	0.50	0.50
Price stickiness (imported goods)	0.75	0.75	0.75	0.75
Price indexation (imported goods)	0.50	0.50	0.50	0.50
<i>Services</i>				
Price stickiness	0.92	0.92	0.75	0.75
Indexation	0.50	0.50	0.50	0.50

DE=Germany; REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 5: International Linkages (percentage of GDP).

	DE	REA	US	RW
Substitution between consumption imports	2.50	2.50	2.50	2.50
Imported consumption goods from				
DE	...	3.1	0.3	1.1
REA	8.7	...	0.8	3.5
US	1.2	0.5	...	4.0
RW	8.5	16.6	6.2	...
Substitution between investment imports	2.50	2.50	2.50	2.50
Imported investment goods from				
DE	...	2.2	0.2	0.7
REA	4.4	...	0.4	2.2
US	0.6	0.7	...	3.4
RW	4.3	0.8	3.6	...
Trade balance (%yearly GDP)	-0.23	0.09	0.19	-0.12
Net foreign assets (%yearly GDP)	10	-3.75	-15	10
Financial intermediation cost function	0.01	0.01	0.01	0.01

DE=Germany; REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 6: Monetary Policy.

	EA	US	RW
Inflation target	1.02	1.02	1.02
Interest rate inertia	0.87	0.87	0.87
Interest rate sensitivity to inflation gap	1.70	1.70	1.70
Interest rate sensitivity to output growth	0.10	0.10	0.10

EA=euro area; US=United States; RW=Rest of the world

Table 7 - Long-Run Effects of Reducing Services Markups in Germany
(percent deviations from baseline)

Markup Level	1.45	1.40	1.35
Domestic Effects			
Real GDP	1.28	2.87	4.39
Consumption	0.54	1.18	1.76
Investment	2.04	4.62	7.14
Hours worked	0.88	1.99	3.07
Real wage	2.14	4.84	7.47
Exports	0.32	0.72	1.08
Imports	0.17	0.37	0.56
Real exchange rate	1.92	4.35	6.70
Terms of trade	0.14	0.30	0.45
Welfare (CE)	0.17	0.32	0.42
Spillovers to the REA			
Real GDP	0.01	0.02	0.03
Consumption	0.02	0.04	0.06
Investment	0.02	0.05	0.08
Hours worked	0.00	0.00	0.01
Real wage	0.02	0.03	0.05
Exports	0.02	0.05	0.08
Imports	0.06	0.13	0.19
Real exchange rate	-0.41	-0.90	-1.38
Terms of trade	-0.03	-0.06	-0.09
Welfare (CE)	0.02	0.04	0.06
Spillovers to the RW			
Real GDP	0.00	0.00	0.00
Spillovers to the US			
Real GDP	0.00	0.01	0.01

REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 8: Long-Run Effects of Reducing Labor Markups in Germany
(percent deviations from baseline)

Markup Level	1.25	1.20	1.15
Domestic Effects			
Real GDP	1.35	2.77	4.27
Consumption	1.18	2.43	3.74
Investment	1.12	2.30	3.55
Hours worked	1.46	3.00	4.63
Real wage	-0.26	-0.52	-0.79
Exports	1.22	2.50	3.85
Imports	0.69	1.42	2.18
Real exchange rate	0.34	0.69	1.06
Terms of trade	0.51	1.04	1.60
Welfare (CE)	0.56	1.11	1.66
Spillovers to the REA			
Real GDP	0.03	0.07	0.11
Consumption	0.07	0.14	0.21
Investment	0.09	0.19	0.29
Hours worked	0.01	0.01	0.02
Real wage	0.06	0.12	0.18
Exports	0.09	0.19	0.29
Imports	0.22	0.46	0.71
Real exchange rate	-0.03	-0.07	-0.11
Terms of trade	-0.10	-0.20	-0.31
Welfare (CE)	0.06	0.13	0.20
Spillovers to the RW			
Real GDP	0.01	0.02	0.03
Spillovers to the US			
Real GDP	0.00	0.00	0.01

REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 9: Long-Run Effects of Reducing Labor and Services Markups in Germany
(percent deviations from baseline)

Markup reduction (pp)	5	10	15
Domestic Effects			
Real GDP	2.64	5.71	8.83
Consumption	1.73	3.64	5.56
Investment	3.19	7.03	10.92
Hours worked	2.36	5.05	7.83
Real wage	1.88	4.29	6.60
Exports	1.55	3.23	4.97
Imports	0.86	1.79	2.74
Real exchange rate	2.27	5.06	7.81
Terms of trade	0.65	1.34	2.06
Welfare (CE)	0.71	1.36	1.91
Spillovers to the REA			
Real GDP	0.04	0.09	0.14
Consumption	0.09	0.18	0.27
Investment	0.12	0.24	0.37
Hours worked	0.01	0.02	0.03
Real wage	0.07	0.15	0.24
Exports	0.11	0.24	0.37
Imports	0.28	0.59	0.91
Real exchange rate	-0.44	-0.98	-1.51
Terms of trade	-0.13	-0.26	-0.41
Welfare (CE)	0.08	0.17	0.26
Spillovers to the RW			
Real GDP	0.01	0.02	0.04
Spillovers to the US			
Real GDP	0.00	0.00	0.01

REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 10: Long-Run Effects of Reducing Labor and Services Markups in Germany and the Rest of the Euro Area (percent deviations)

Markup reduction (pp)	5	10	15
German Effects			
Real GDP	2.87	5.93	9.19
Consumption	2.00	4.10	6.28
Investment	3.66	7.62	11.87
Hours worked	2.46	5.10	7.91
Real wage	2.27	4.70	7.25
Exports	1.79	3.67	5.65
Imports	1.47	3.01	4.63
Real exchange rate	1.41	2.89	4.43
Terms of trade	0.33	0.67	1.02
Welfare (CE)	0.93	1.79	2.57
REA Effects			
Real GDP	2.88	5.95	9.22
Consumption	1.98	4.04	6.20
Investment	3.73	7.76	12.09
Hours worked	2.45	5.06	7.85
Real wage	2.22	4.59	7.07
Exports	1.41	2.87	4.40
Imports	1.00	2.04	3.13
Real exchange rate	1.85	3.81	5.84
Terms of trade	0.46	0.92	1.40
Welfare (CE)	0.88	1.70	2.43
Spillovers to the RW			
Real GDP	0.05	0.09	0.14
Spillovers to the US			
Real GDP	0.01	0.01	0.02

REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 11: Long-Run Effects of Reducing Markups in Portugal by 15 pp
(percent deviations from baseline)

Market	Services	Labor	Both markets	EA wide
Portuguese Effects				
Real GDP	3.62	4.02	7.77	8.59
Consumption	1.47	3.52	5.04	6.39
Investment	4.81	2.79	7.71	9.97
Hours worked	2.55	4.59	7.26	7.40
Real wage	6.20	-0.99	5.12	6.32
Exports	0.86	3.84	4.73	5.71
Imports	1.01	2.25	3.28	6.06
Real exchange rate	5.87	1.03	6.95	1.80
Terms of trade	0.35	1.52	1.87	0.26
Welfare (CE)	0.09	0.96	0.87	2.10
REA Effects				
Real GDP	0.00	0.00	0.01	9.22
Consumption	0.00	0.01	0.01	6.23
Investment	0.00	0.01	0.02	12.01
Hours worked	0.00	0.00	0.00	7.82
Real wage	0.00	0.01	0.01	7.04
Exports	0.01	0.02	0.03	3.52
Imports	0.01	0.05	0.07	1.98
Real exchange rate	-0.08	-0.02	-0.11	7.22
Terms of trade	-0.01	-0.04	-0.05	1.47
Welfare (CE)	0.00	0.01	0.01	2.58
Spillovers to the RW				
Real GDP	0.00	0.00	0.00	0.09
Spillovers to the US				
Real GDP	0.00	0.00	0.00	0.02

EA: euro area; REA=Rest of euro area; US=United States; RW=Rest of the world.

Table 12: Sensitivity. Long-Run Effects of Reducing Markups in the German Services and Labor Markets by 15 pp
(percent deviations from baseline)

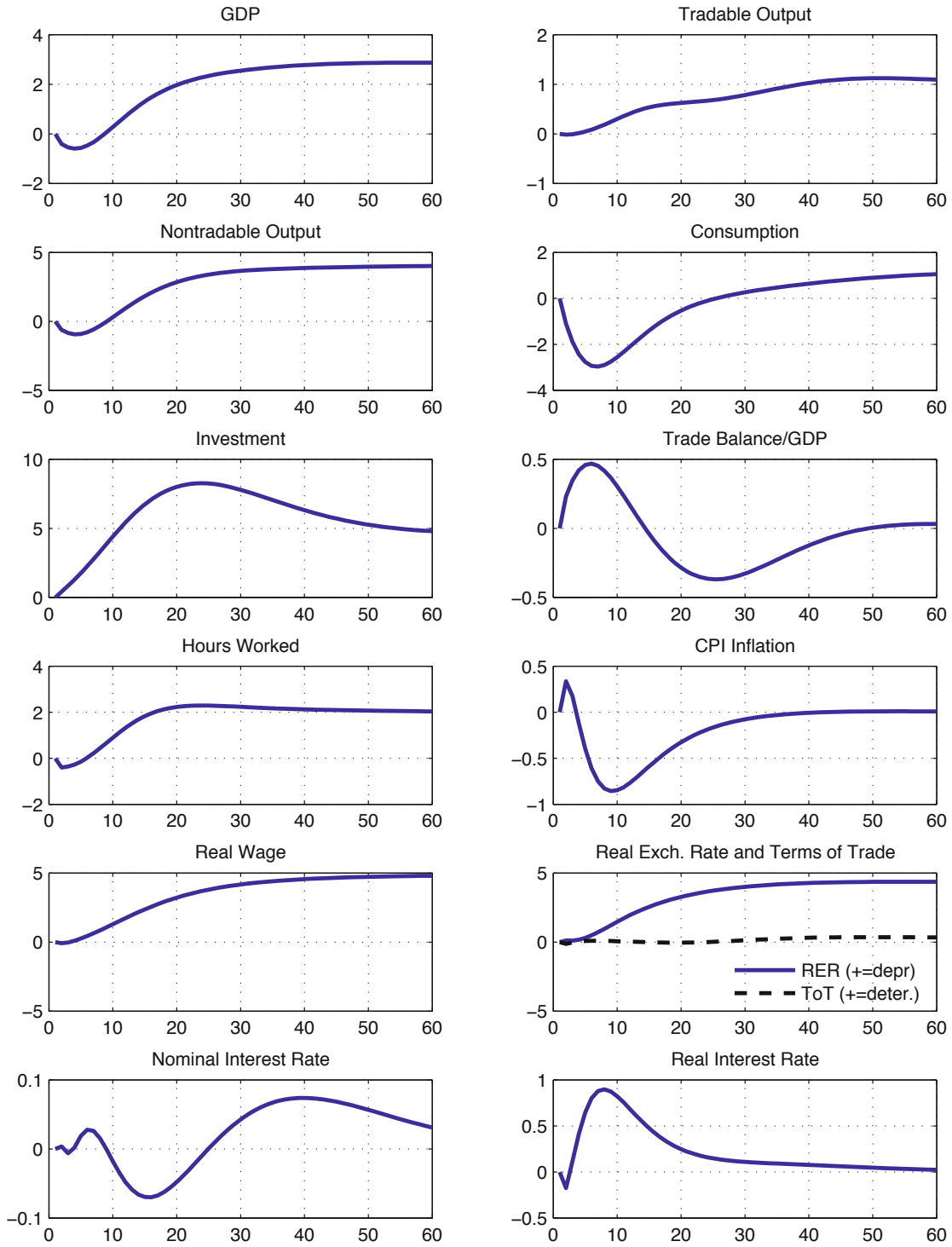
German price and wage markups														
	Benchmark		Intertemp. elast. substitution			Frisch labor elasticity			Elast. subst. btw tradables					
	DE	REA	Lower (1)	Higher (3)	Lower (0.33)	Higher (0.99)	Lower (1.5)	Higher (5)	DE	REA	DE	REA		
Real GDP	8.83	0.14	8.21	0.10	9.59	0.00	6.81	0.08	13.26	0.26	8.72	0.16	9.00	0.10
Consumption	5.56	0.27	5.02	0.23	6.23	0.34	3.83	0.17	9.36	0.51	5.34	0.33	5.90	0.19
Investment	10.92	0.37	10.41	0.30	11.56	0.46	9.20	0.23	14.70	0.68	10.62	0.44	11.37	0.26
Hours worked	7.83	0.03	7.19	0.00	8.63	0.07	5.66	0.01	12.59	0.08	7.80	0.03	7.87	0.02
Real wage	6.60	0.24	6.70	0.22	6.48	0.26	6.98	0.15	5.81	0.42	6.40	0.28	6.90	0.16
Exports	4.97	0.37	4.44	0.31	5.62	0.44	3.20	0.23	8.83	0.66	5.53	0.19	4.08	0.61
Imports	2.74	0.91	2.42	0.80	3.13	1.05	1.75	0.58	4.89	1.63	2.90	0.84	2.47	0.99
Real exch. Rate	7.81	-1.51	7.66	-1.50	7.99	-1.52	7.29	-1.45	8.90	-1.61	8.05	-1.56	0.00	-1.42
Terms of trade	2.06	-0.41	1.84	-0.38	2.31	-0.44	1.33	-0.27	3.61	-0.66	2.43	-0.51	0.00	-0.25
Welfare (CE)	1.91	0.26	1.65	0.23	2.21	0.31	0.64	0.16	3.47	0.48	1.70	0.31	0.00	0.18

Euro area price and wage markups

	Benchmark		Intertemp. elast. substitution			Frisch labor elasticity			Elast. subst. btw tradables				
	DE	REA	Lower (1)	Higher (3)	Lower (0.33)	Higher (0.99)	Lower (1.5)	Higher (5)	DE	REA	DE	REA	
Real GDP	9.19	9.22	8.47	10.11	10.13	7.03	7.06	13.99	14.02	9.16	9.19	9.24	9.27
Consumption	6.28	6.20	5.59	7.15	7.00	4.28	4.32	10.74	10.33	6.21	6.03	6.39	6.39
Investment	11.87	12.09	11.19	12.74	13.00	9.80	9.92	16.48	16.89	11.78	12.03	12.01	12.18
Hours worked	7.91	7.85	7.18	8.83	8.76	5.70	5.67	12.82	12.68	7.90	7.83	7.92	7.87
Real wage	7.25	7.07	7.28	7.13	7.19	6.99	7.40	7.33	6.92	7.18	6.92	7.34	7.24
Exports	5.65	4.40	4.99	3.74	6.50	5.24	3.64	2.40	10.13	8.85	5.91	4.70	5.20
Imports	4.63	3.13	4.05	2.66	3.72	2.95	1.79	8.37	6.11	4.75	3.09	4.39	3.11
Real exch. rate	4.43	5.84	4.31	5.68	4.57	6.04	4.06	5.39	5.24	6.83	4.57	6.04	4.21
Terms of trade	1.02	1.40	0.89	1.18	1.68	1.68	0.64	0.73	1.87	2.89	1.16	1.75	0.80
Welfare (CE)	2.57	2.43	2.22	2.12	3.02	2.81	1.06	1.05	4.70	4.23	2.50	2.27	2.68

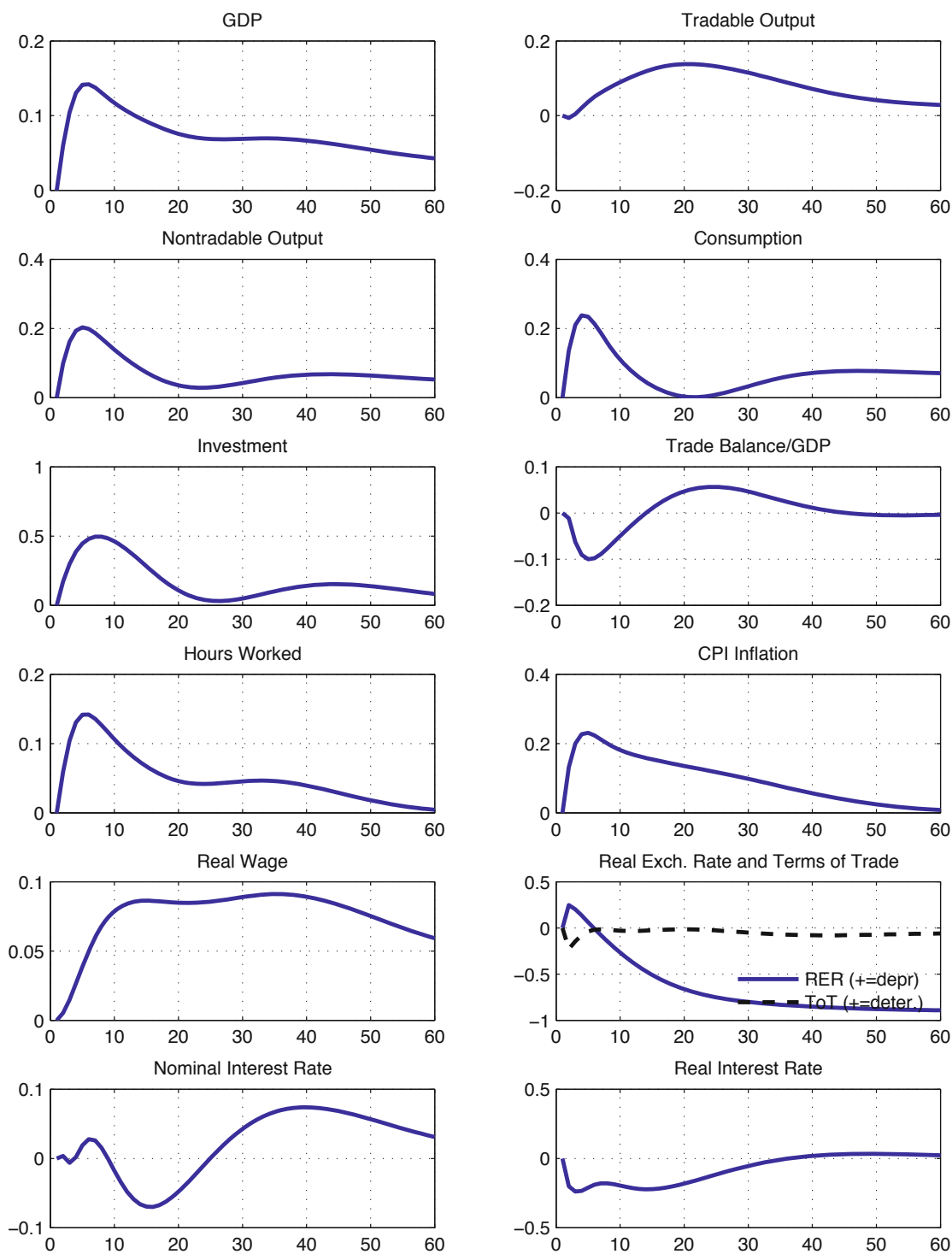
DE=Germany; REA=Rest of euro area.

Figure 1. Services Market Reforms in Germany (domestic effects).



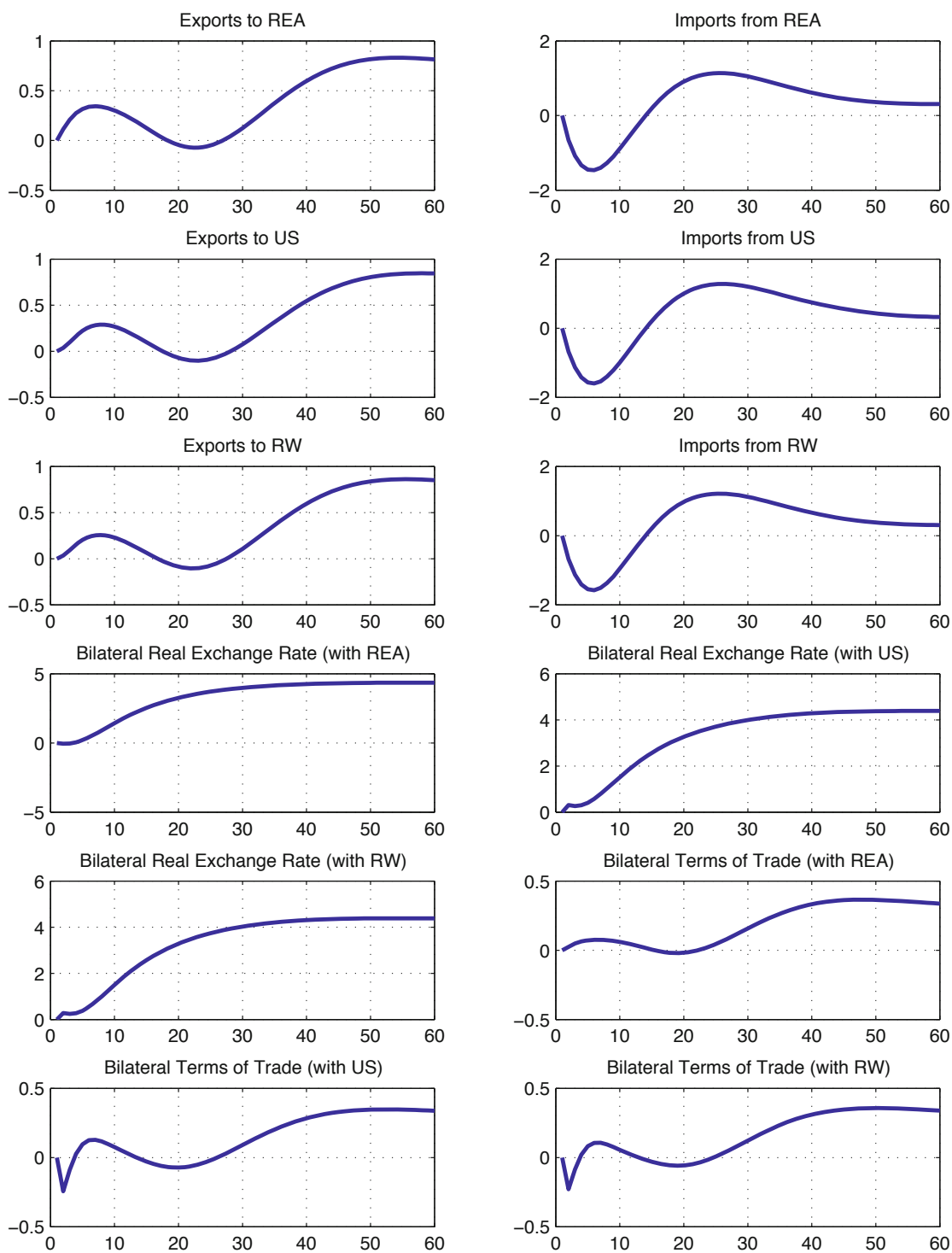
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 2. Services Market Reforms in Germany (spillovers to rest of euro area).



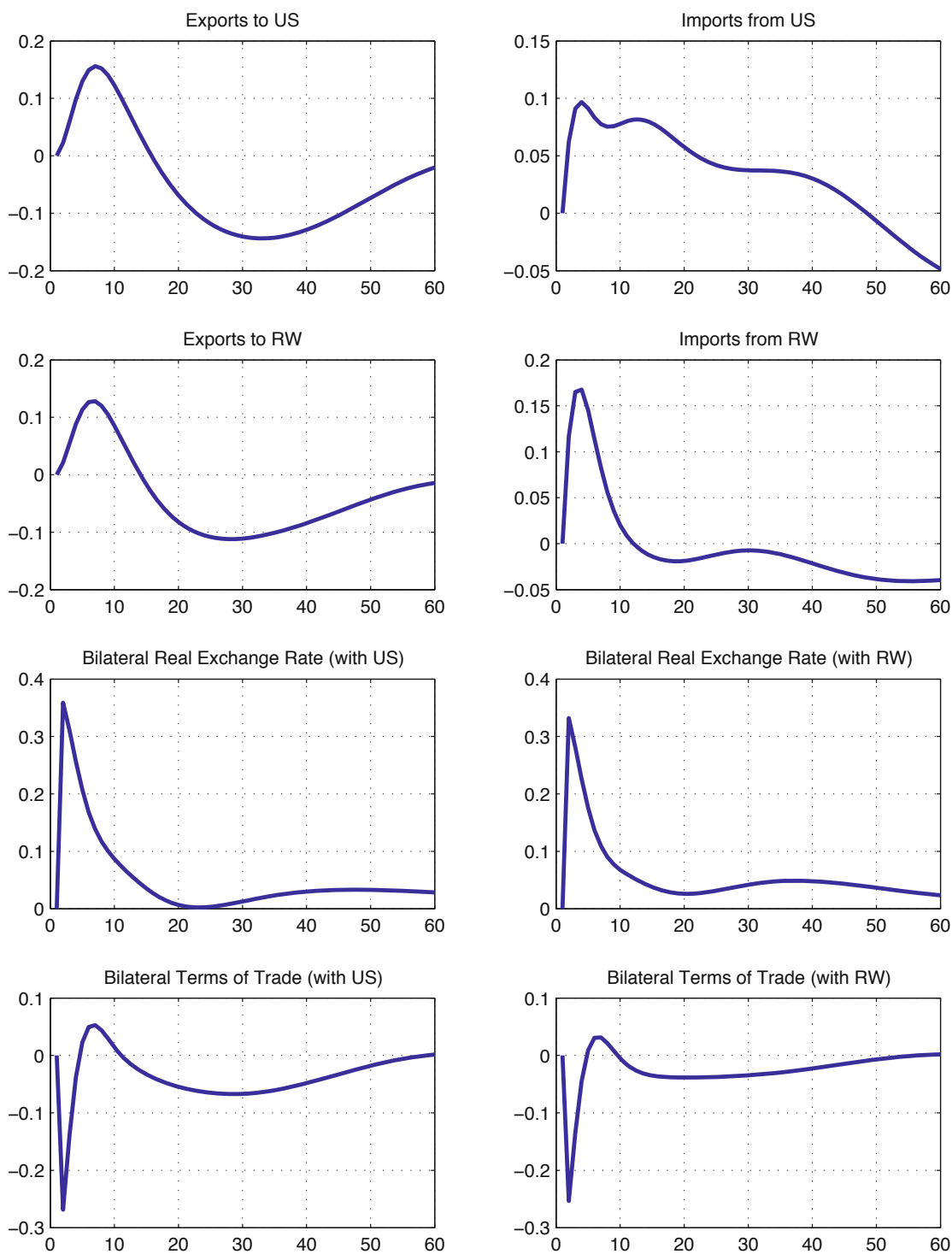
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 3. Services Market Reforms in Germany (effects on German trade variables).



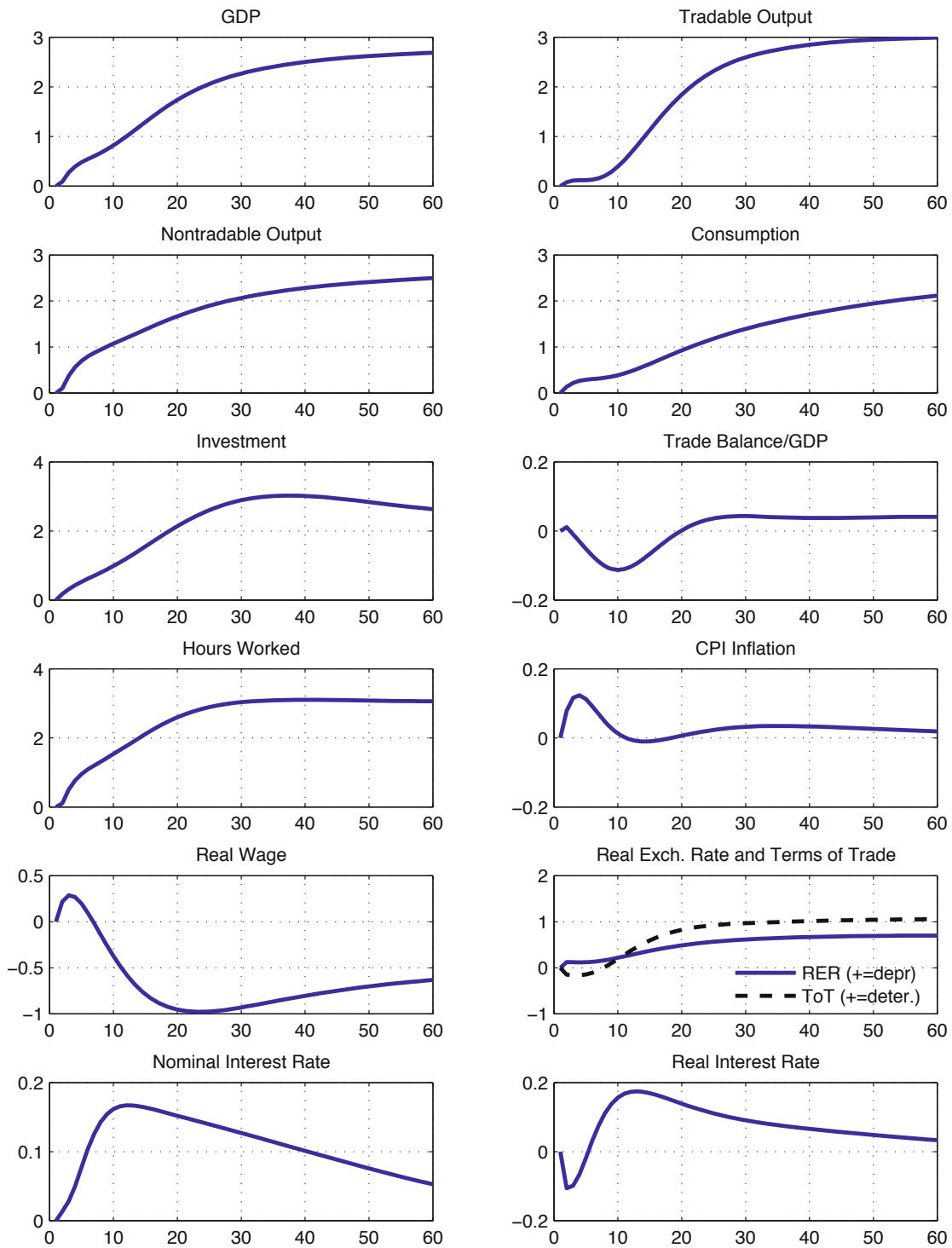
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 4. Services Market Reforms in Germany (effects on rest of euro area trade variables).



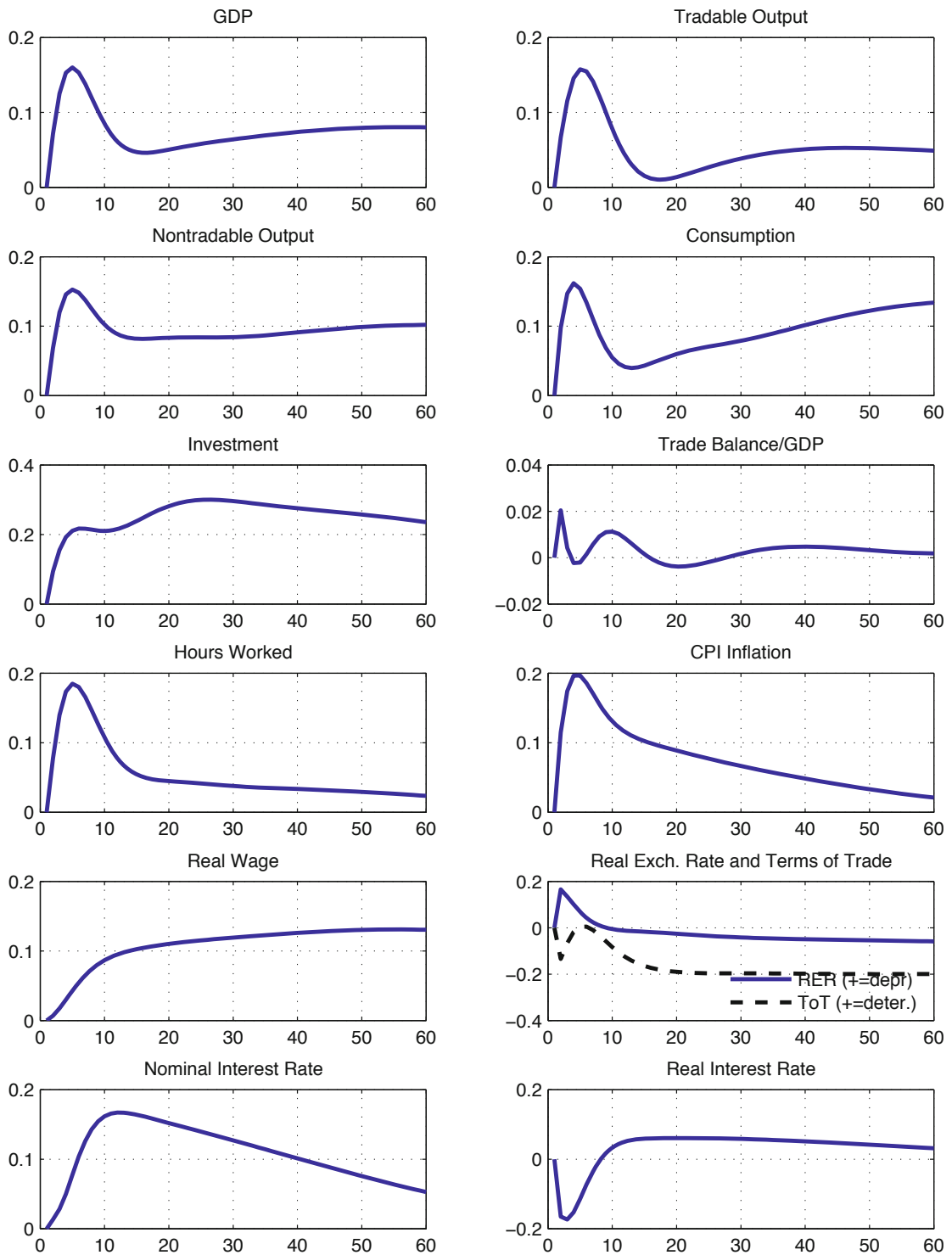
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 5. Labor Market Reforms in Germany (domestic effects).



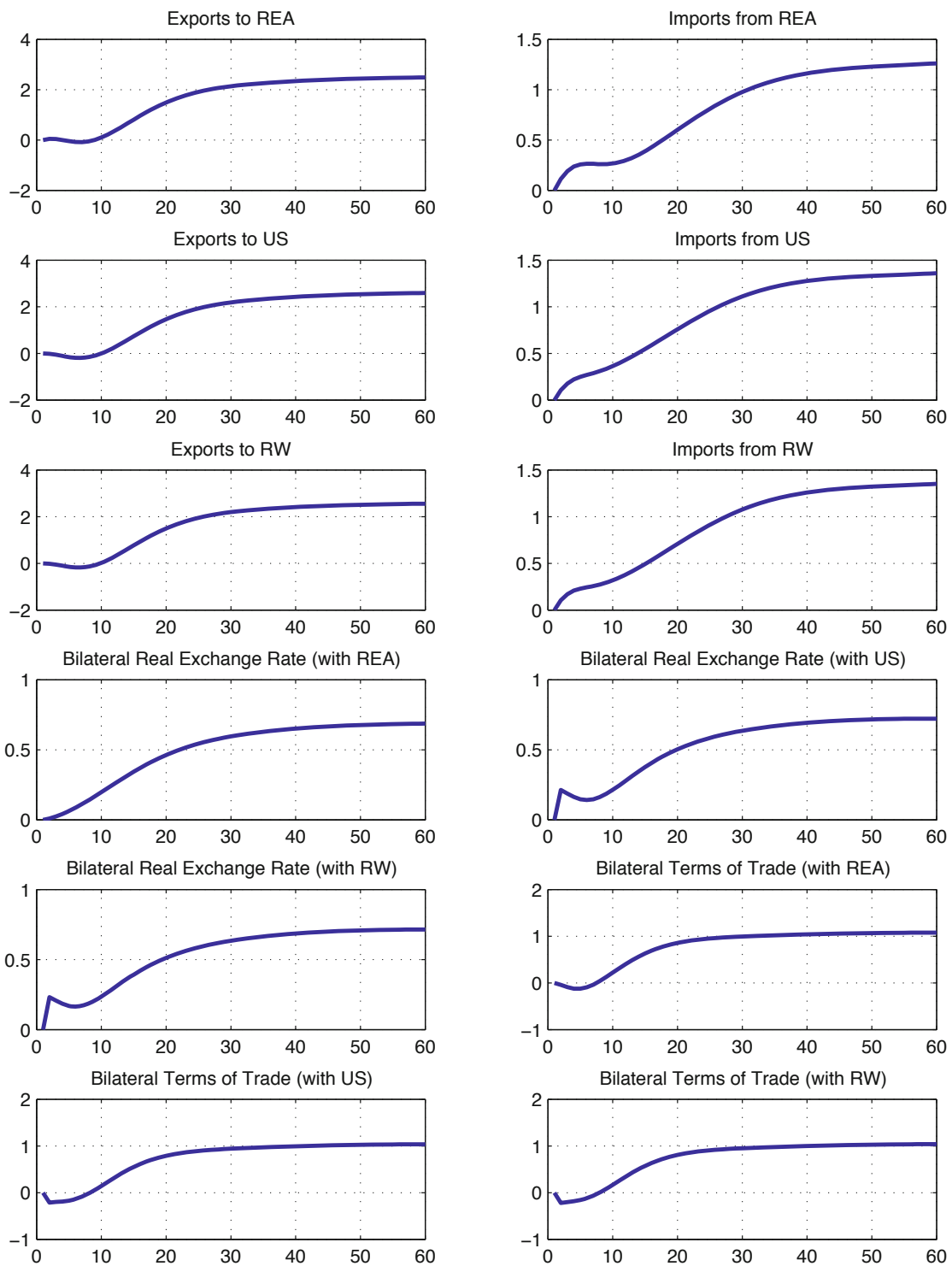
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 6. Labor Market Reforms in Germany (spillovers to rest of euro area).



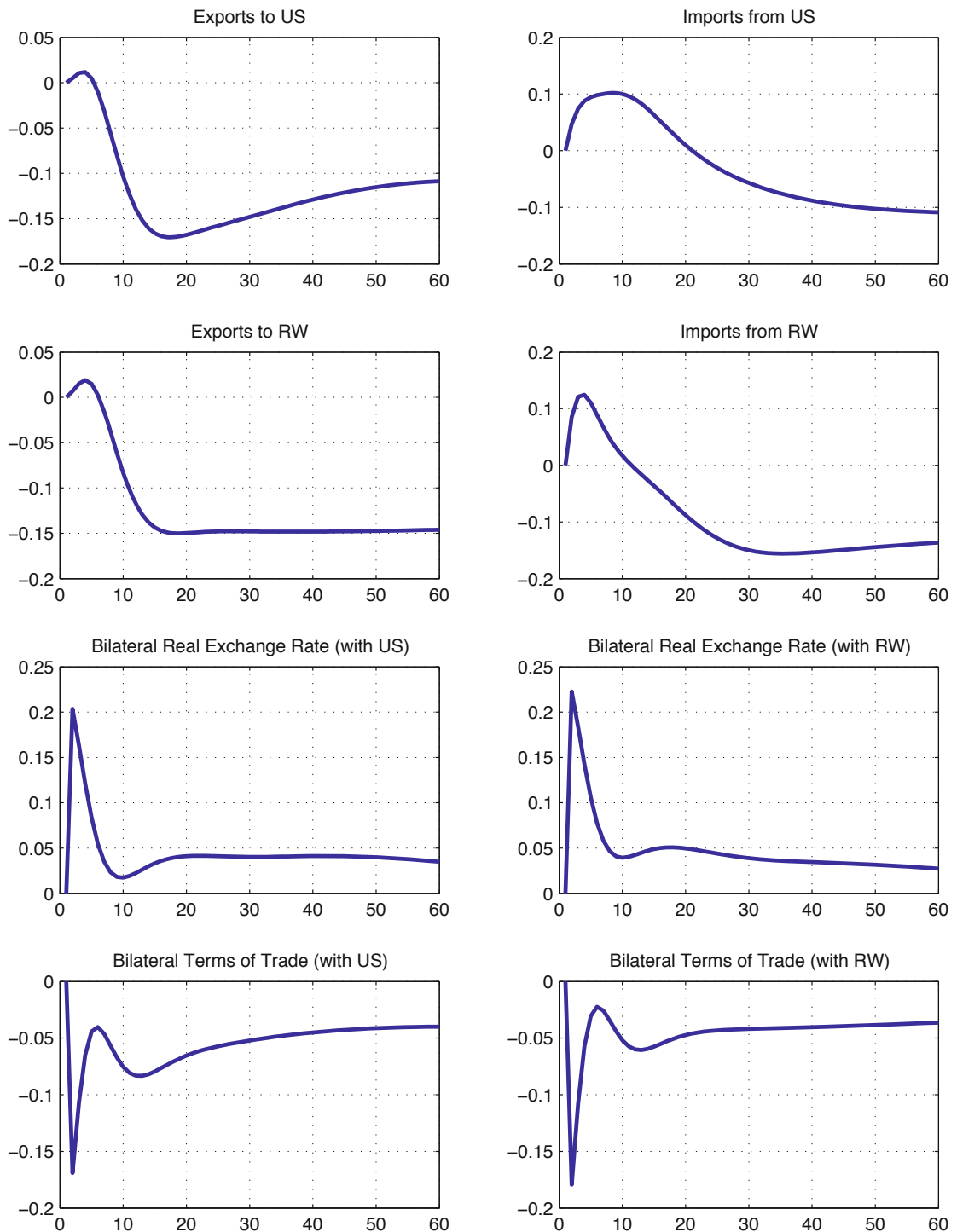
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 7. Labor Market Reforms in Germany (effects on German trade variables).



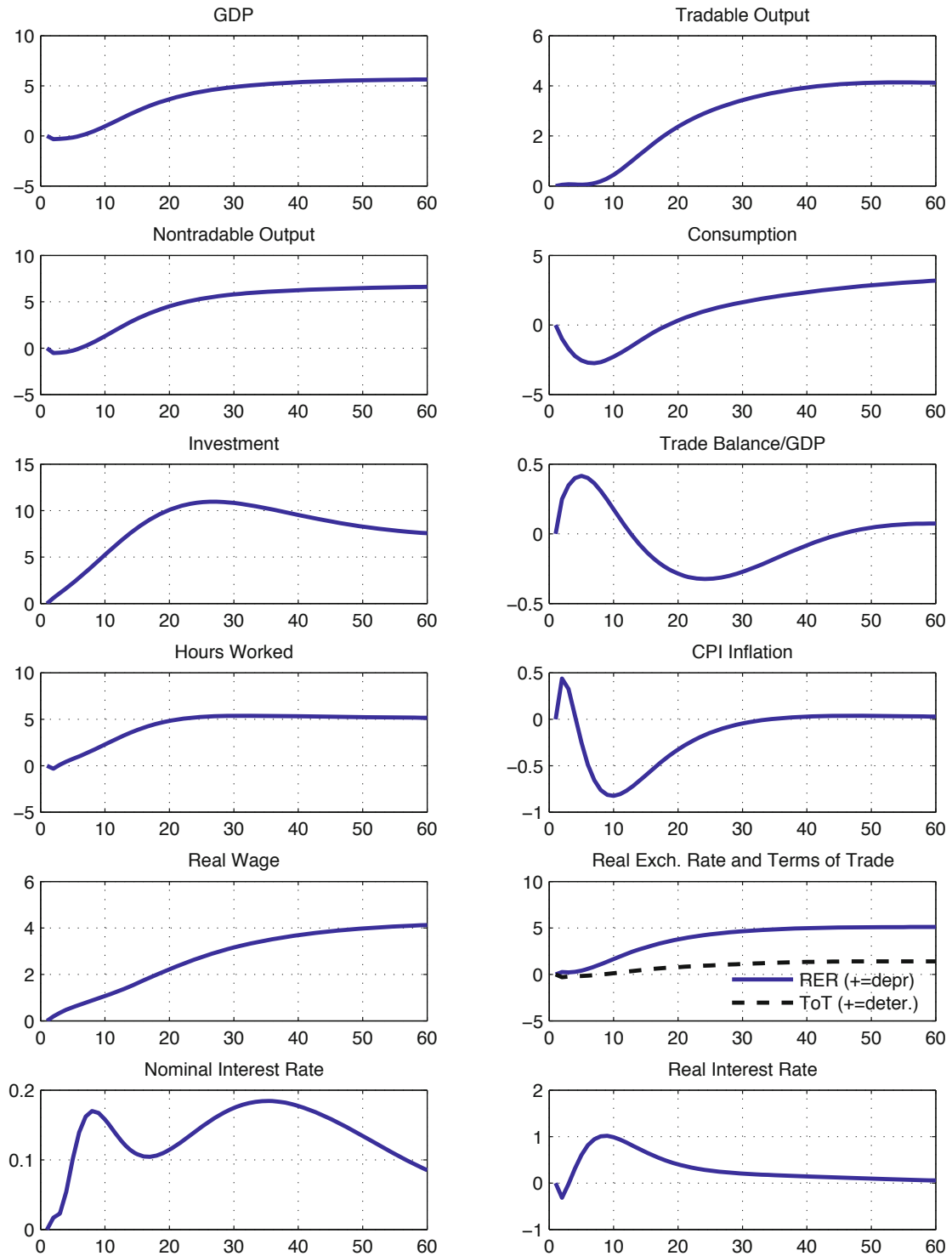
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 8. Labor Market Reforms in Germany (effects on rest of euro area trade variables).



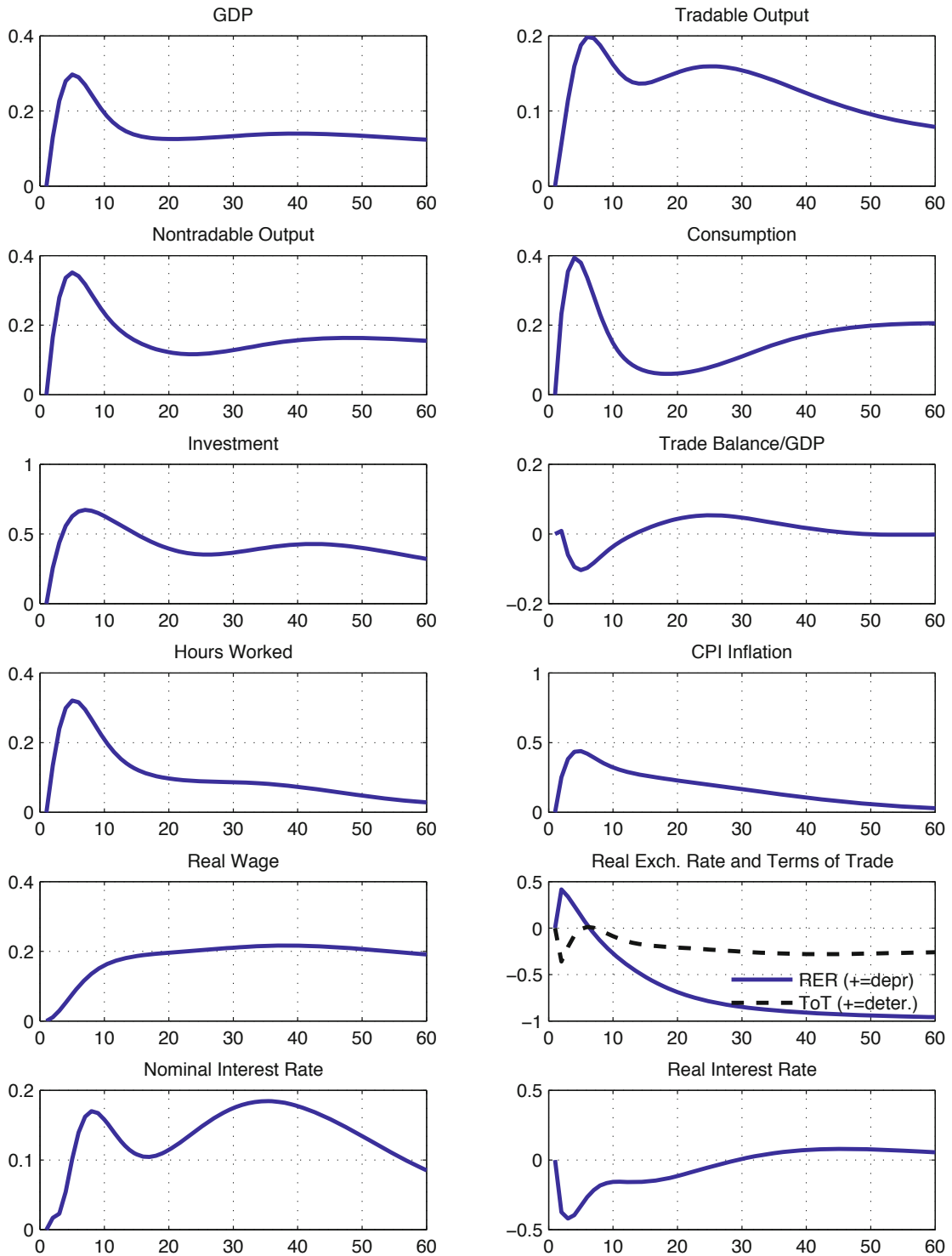
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 9. Labor and Services Reforms in Germany (domestic effects).



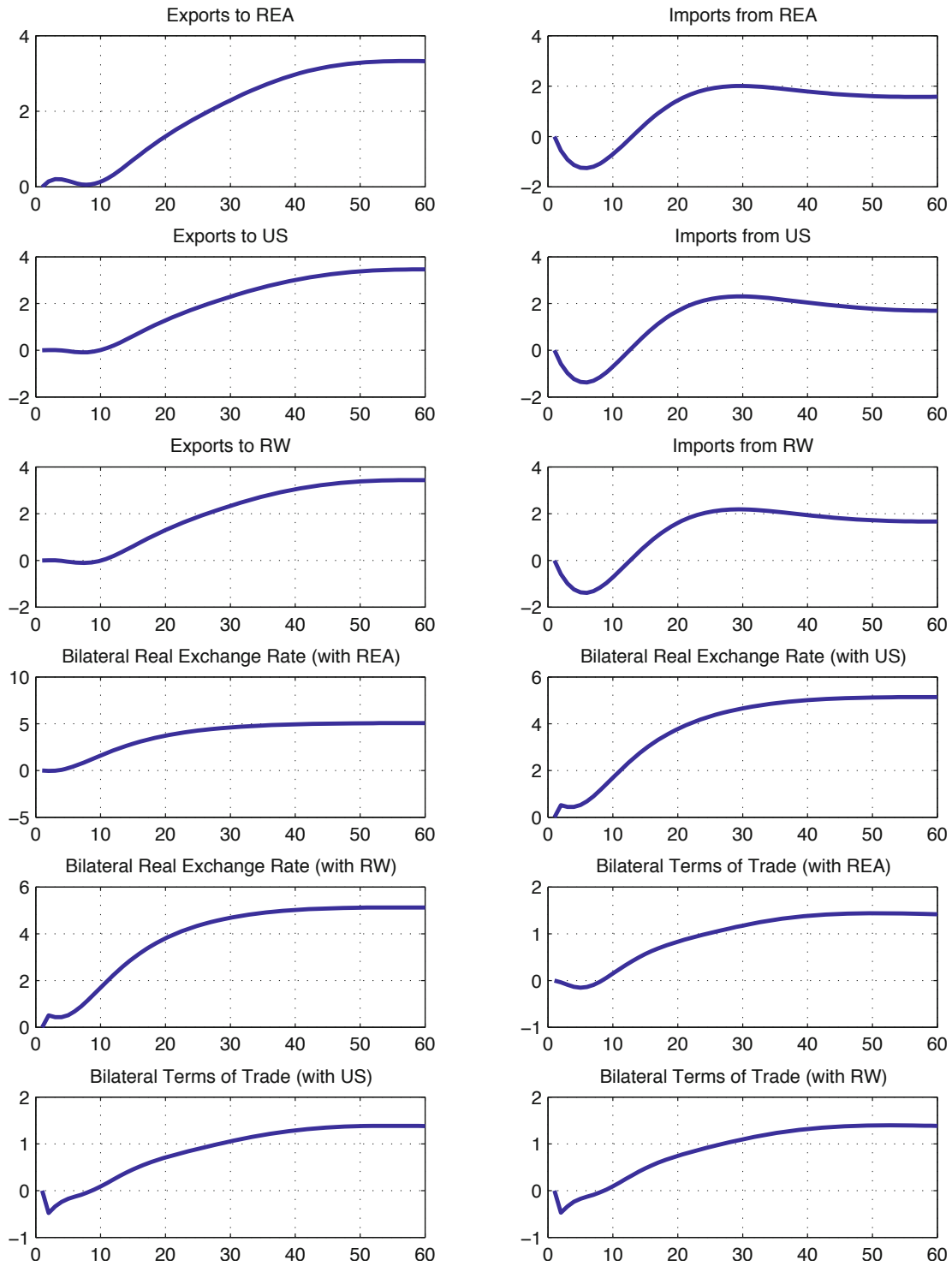
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 10. Labor and Services Reforms in Germany (spillovers to rest of euro area).



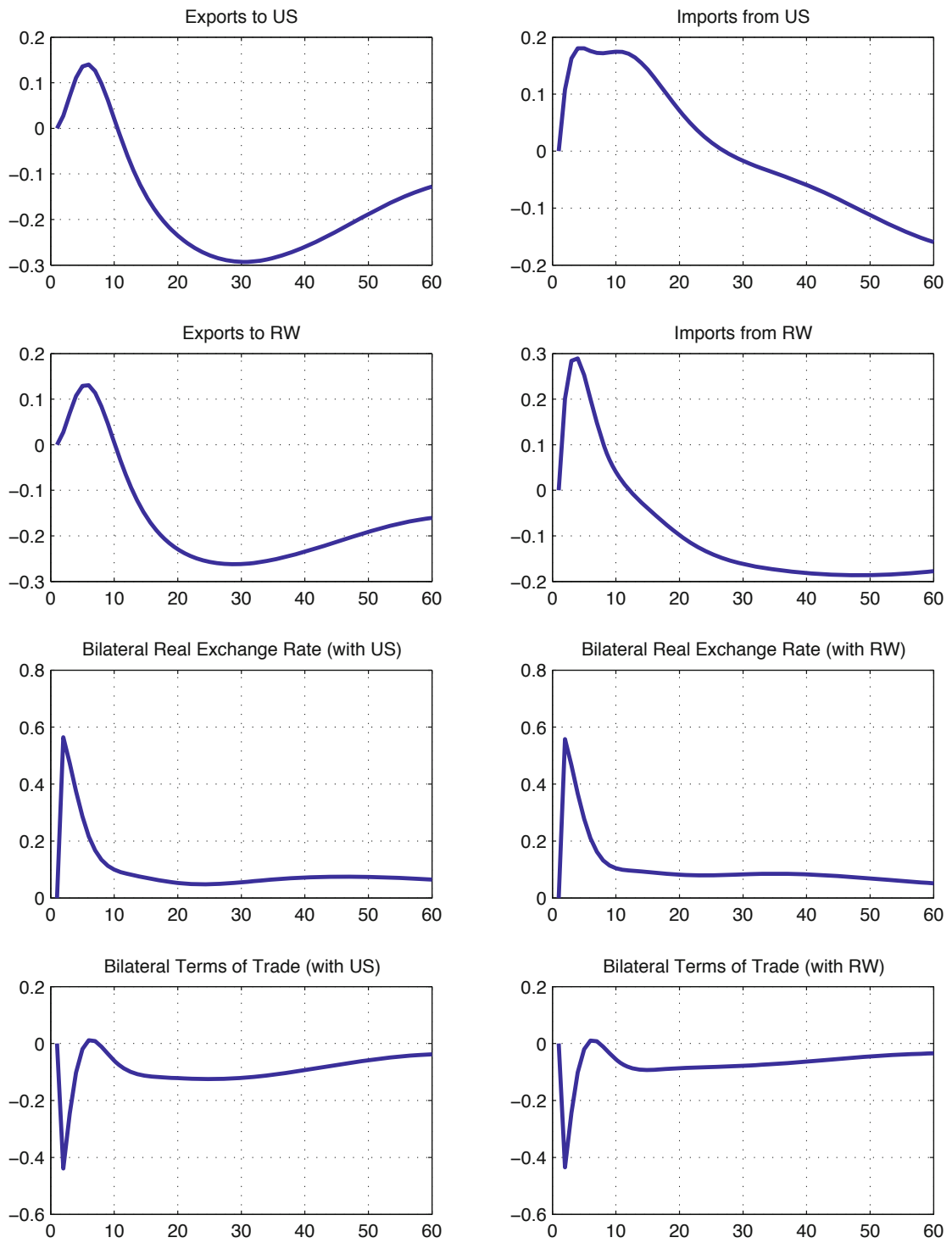
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 11. Labor and Services Reforms in Germany (effects on German trade variables).



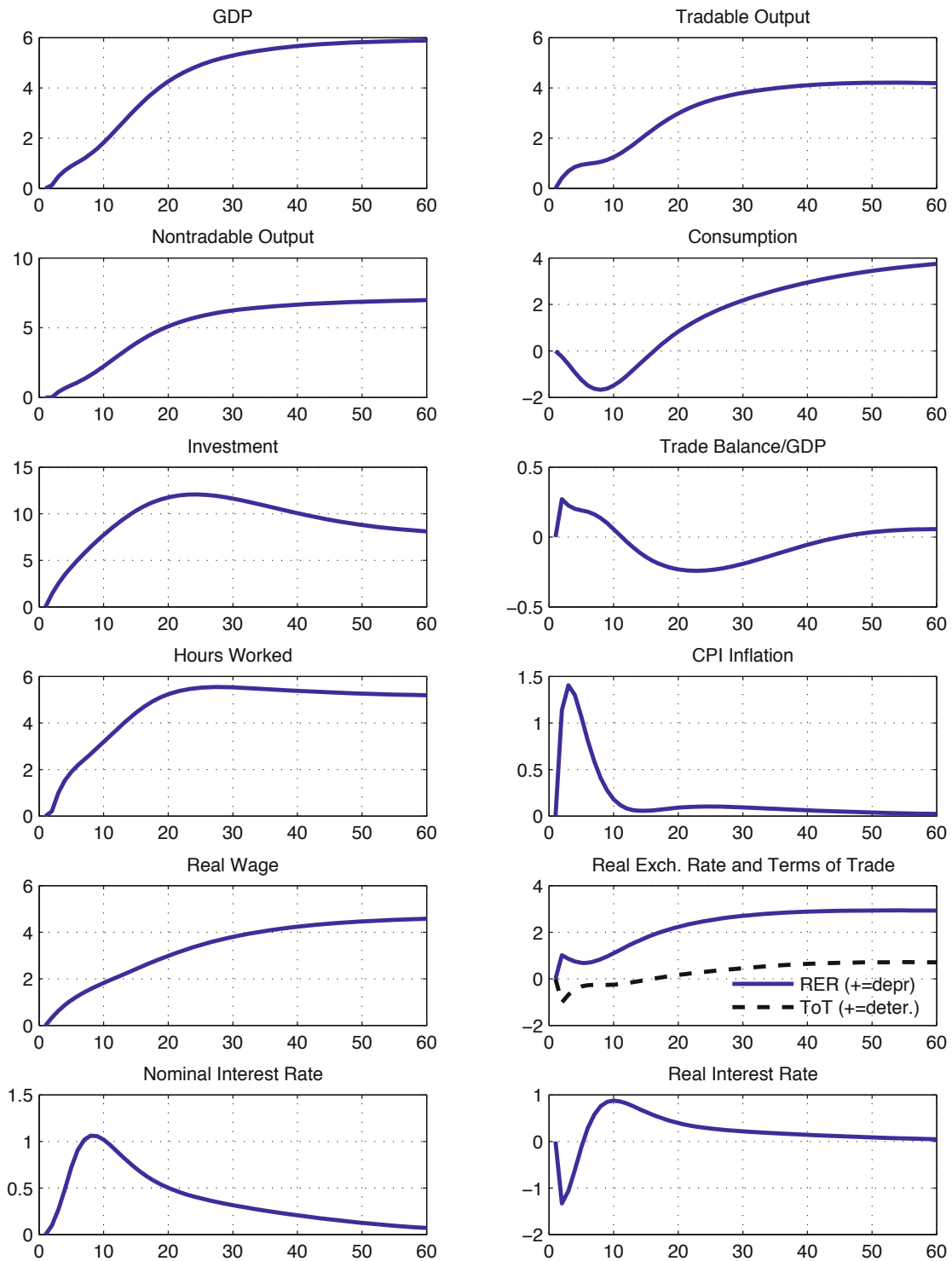
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 12. Labor and Services Reforms in Germany (effects on rest of euro area trade variables).



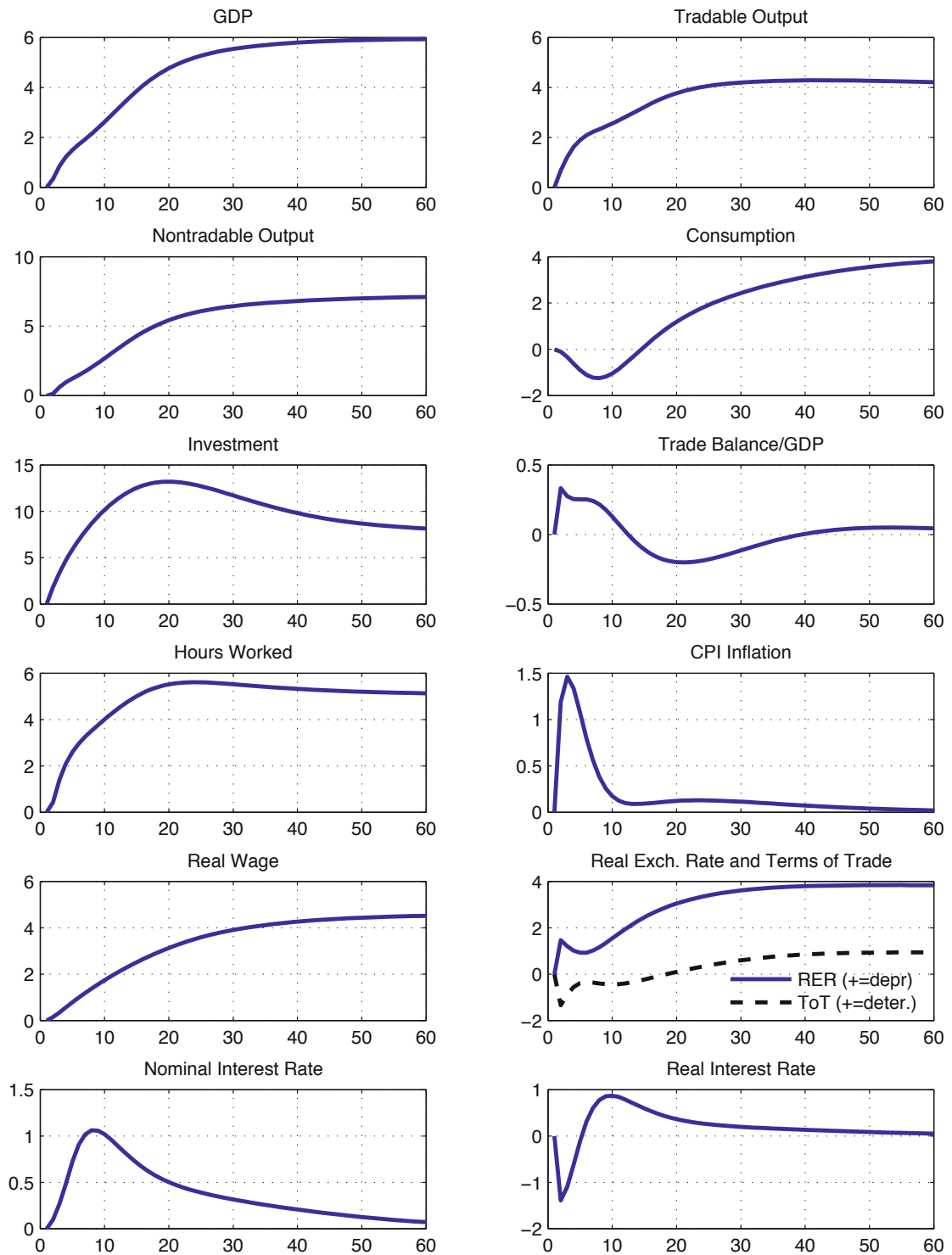
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 13. Labor and Services Reforms in the euro area (German effects).



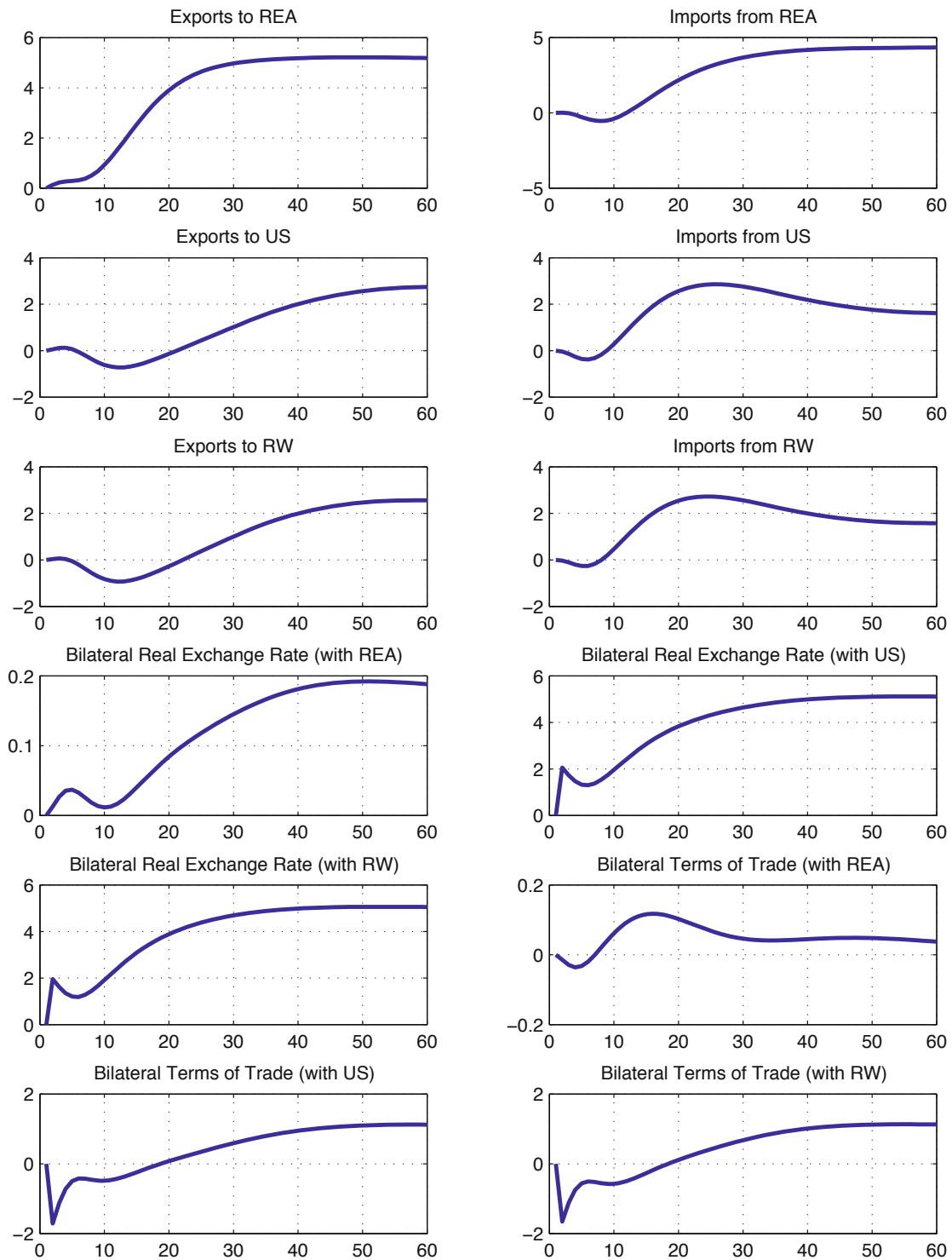
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 14. Labor and Services Reforms in the euro area (rest of euro area effects).



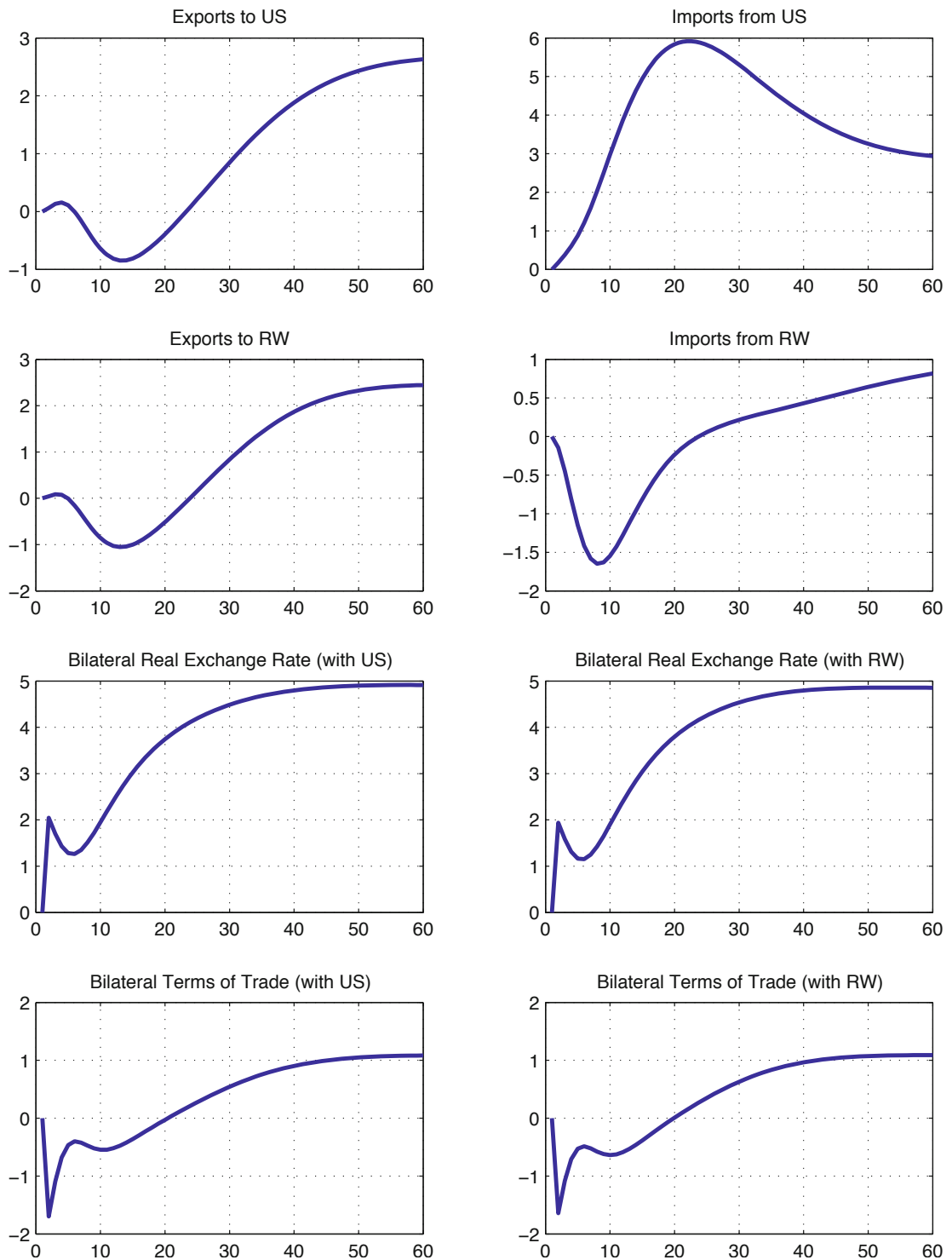
Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline, except for inflation and interest rates (annualized percentage-point deviations), and the trade balance-to-GDP ratio (percentage-point deviations). GDP and its components are reported in real terms.

Figure 15. Labor and Services Reforms in the euro area (effects on German trade variables).



Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

Figure 16. Labor and Services Reforms in the euro area (effects on rest of euro area trade variables).



Horizontal axis: quarters. Vertical axis: percentage deviations from the baseline.

