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MACROECONOMIC EFFECTS OF GREATER COMPETITION IN THE SERVICE SECTOR: THE CASE OF ITALY

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In this paper we assess the effects of increasing competition in the service sector in one country of the euro area. We focus on Italy, which, based on cross-country comparisons, stands out as the country with the highest markups in nonmanufacturing industries among the OECD countries. We propose a two-region (Italy and the rest of the euro area) dynamic stochastic general equilibrium model where we introduce nontradable goods as a proxy for services and we allow for monopolistic competition in labor, manufacturing, and services markets. We then use the model to simulate the macroeconomic and spillover effects of increasing the degree of competition in the Italian services sector. According to the results, reducing the markups in services to the levels prevailing in the rest of the euro area induces in the long run an increase in Italian GDP equal to 11% and an increase in welfare (measured in terms of steady state consumption equivalents) of about 3.5%. Half of the GDP increase would be realized in the first three years. The spillover effects to the rest of the euro area are limited: consumption, investment, and GDP increases are relatively small.

Keywords: Competition, Markups, Monetary Policy

1. INTRODUCTION

The economic agendas of many European countries include policies to increase the degree of competition in product markets. Especially in service sectors, competition is often limited by regulation, which provides for entry barriers, restrictions on prices and limitations on the forms of business. Excessive regulation can give firms market power and allows them to charge high markups over costs, limiting output and material wealth. As recommended by several international economic institutions, increasing competition in markets is a crucial policy goal.

In this paper we assess the macroeconomic and spillover effects of increasing competition in the service sector in one country of the euro area. We focus on

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Italy. Based on cross-country comparisons, Italy stands out as the country with the highest markups in nonmanufacturing industries among the OECD countries.[1] Italy has also experienced more than a decade of sluggish growth compared to its main partner countries,[2] and one of the leading explanations for this development points to the lack of flexibility in the services sectors (mainly distribution, utilities, and banking), in both absolute and relative terms.

A large literature has analyzed the effects of regulation, especially in service sectors, on the performance of the regulated sector and found that regulation reduces the level of output, investment, and employment. For example, Alesina et al. (2005) show that regulatory reforms in sectors that are traditionally sheltered from competition (transport, communications, and energy) have had a significant positive impact on their investment levels. Also, the effect of service regulation on downstream industries, typically manufacturing, has been recently stressed. For example, Barone and Cingano (2008) show—using a large sample of sectors and countries—that lower service regulation has non-negligible positive effects on sectors that use services intensively in terms of value added and average labor productivity. Overall, these analyses point to relevant effects from deregulation in the service sectors, both on the same sector and on manufacturing production. These papers, however, do not tackle the issue of the macroeconomic and general equilibrium effects of deregulation, which is the main focus of this paper. Specifically, we develop a quantitative model of the Italian economy to measure the macroeconomic implications of greater competition in the Italian services sector.[3]

We use a two-region currency union model, calibrated to Italy and to the rest of the euro area.[4] The model is akin to the Global Economy Model (GEM) developed at the IMF.[5] It is a dynamic stochastic general equilibrium (DSGE) model, where we introduce nontradable goods as a proxy for services and we allow for monopolistic competition in labor, manufacturing, and services markets. Imperfect competition is introduced through imperfect substitution between varieties, so that monopolistic firms (households in the case of labor) are able to set a markup over costs (marginal rate of substitution between consumption and labor). The lower the degree of substitutability, the higher are markups and the lower is output (labor supply). Therefore, by modifying the parameter governing the degree of substitutability, we can simulate the impact of structural reforms that increase competition.[6] The model also includes real and nominal frictions to match the persistence usually found in the data as well as a feedback rule for the central bank.

The aim of the paper is to give a quantitative assessment of the macroeconomic implications of greater competition in key sectors of the Italian economy. It does not address the issue of which reform strategies would allow to achieve such an increased level of competition.

We use the model to run several simulations. We first calibrate the markups to empirically plausible values, using data from manufacturing and service prices in Italy and the rest of the euro area. We then investigate the long-run (steady-state) effects on the Italian economy and on the rest of the euro area of reforms

that permanently reduce the Italian markups in the service sector to the euro area average level. For each reform scenario we compute the new steady state of macroeconomic variables as well as the welfare gains that accrue to the reforming country, both including and excluding short-run gains coming from the transition phase. To check our results for the service sectors, we compare them with alternative scenarios in which reforms foster competition only in the labor markets, or in both the labor and the service sectors simultaneously. We also compute the effects of synchronized reforms in Italy and in the rest of the euro area. We do not limit the analysis to the long run, but also study the adjustments from one steady state to the other. Finally, we perform several robustness checks, varying key preference and technology parameters.

We find the following results. First, reforms in services markets have sizable long-run effects on output: the reduction of (gross) markup on services prices to the level prevailing in the rest of the euro area (i.e., from 1.61 to 1.35; the reader is referred to Section 2.2 for a description of how we calibrate mark-up) allows a permanent increase in Italian GDP of 10.8% and an increase in welfare (measured in consumption equivalent units) of about 3.5%.[7] For comparison, a similar reform in the labor market is worth 9.1% of GDP and above 2% in terms of welfare. Second, the spillovers of such reforms to the rest of the euro area are modest, given that the rest of the euro area is a relatively closed economy.[8] Third, when both reforms are jointly implemented, the effects are essentially additive (for example, GDP increases by roughly 21% in the long-run). Fourth, looking at the transition dynamics, while the labor supply rises fairly quickly after both reforms, the behavior of real wages is different: they rise gradually after a service sector reform, while dropping rapidly, although by a smaller amount, after a labor market reform. Fifth, and consequently, the main policy implication from these results is that a joint implementation of both reforms is likely to soften the negative effect on real wages associated with a labor market reform. This policy prescription resembles a point made by Blanchard and Giavazzi (2003), who argue in favor of starting reforms with product market deregulation in order to raise employment and real wages and thus lower resistance to subsequent labor market reforms. Finally, experiments varying the values of key parameters indicate that the quantitative estimated impact of reforms on the Italian economy is relatively robust.

The paper is structured as follows. Section 2 provides a brief description of the model, the calibration, and the simulated scenarios. Section 3 presents the results of increasing competition in labor and services markets, in terms of both steady state effects and transition dynamics. Section 4 provides a sensitivity analysis, and Section 5 concludes.

2. THE MODEL

In this section we briefly illustrate the model setup, the calibration, and the simulation exercises.[9]

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2.1. The Setup

We use a simplified version of the Italian and euro area Economy Model (IdEA), a medium-scale new-Keynesian model of Italy's economy developed at the Bank of Italy Research Department and incorporating economic linkages with the rest of the Euro area. The model merges microeconomic foundations with nominal price and wage rigidities, trade, and international financial markets. Hence, it is well suited to analyzing the domestic and international impact of structural changes due to changes in the degree of competition.

There are two regions, Italy and the rest of the euro area, having different sizes and sharing the currency and the central bank. In each region there are households and firms. Each household consumes a final composite good made of nontradable, domestic tradable, and imported intermediate goods from the rest of the area. Households have access to financial markets and smooth consumption by trading a short-term nominal riskless bond. They also own domestic firms and capital stock, which is rented to domestic firms in a perfectly competitive market. Households supply differentiated labor services to domestic firms and act as wage setters in monopolistically competitive markets by charging a markup over their marginal rate of substitution.

On the production side, there are perfectly competitive firms that produce the final goods and monopolistic firms that produce the intermediate goods. The three final goods (a private consumption, a private investment, and a public consumption good) are produced by combining all available intermediate goods in a constant-elasticity-of-substitution matter. Tradable and nontradable intermediate goods are produced by combining capital and labor in the same way. Tradable intermediate goods are split into domestically consumed and export goods. Because intermediate goods are differentiated, firms have market power and restrict output to create excess profits. We assume that Italy and rest of the euro area are segmented markets and the law of one price for tradables does not hold.[10] Hence, each firm producing a tradable good sets two prices, one for the domestic market and the other for the export market. Because the firm faces the same marginal costs regardless of the scale of production in each market, the different price-setting problems are independent of each other.

We introduce public expenditure into the model for calibration purposes, as government consumption is part of overall domestic demand. We assume that the fiscal authority consumes final nontraded goods, financed through lump-sum exogenous taxes. Hence, in each period the public sector budget constraint is balanced and public expenditure is constant.

To capture the empirical persistence of the aggregate data and generate realistic dynamics, we include adjustment costs on real and nominal variables, ensuring that, in response to a shock, consumption and production do not immediately jump to a new long-term equilibrium. On the real side, we assume habit in consumption and quadratic adjustment cost on investment change. On the nominal side, quadratic costs [Rotemberg (1982)] make wages and prices sticky; wages and

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prices are indexed to the previous-period corresponding sector-specific inflation rate.[11]

Imperfect competition in product and labor markets is reflected in markups over marginal costs. The elasticity of substitution between products of different firms determines the market power of each profit-maximizing firm. The setup in the labor market is similar. Each worker offers a differentiated kind of labor services that is an imperfect substitute for services offered by other workers. The lower the degree of substitutability, for example because of skill differences or anticompetitive regulation, the higher the markup and the lower employment in terms of hours. Hence, markups are modeled by a single parameter that can be appropriately modified to simulate the impact of structural reforms raising competition in product and labor markets.

2.2. Calibration

We calibrate the model on a quarterly basis to match steady-state great ratios and consistently with the existing DSGE modeling literature on the euro area.[12] In particular, given the focus of this paper, we try to match the share of value added produced in the nontradable sector. We assume that the services produced in the following sectors are largely nontradable: retail, transport and communications, finance, insurance, construction, electricity, gas, water, and hotels and restaurants. We do not include services produced by the public administration, as we model market services. Based on national account data on value added by sector in Italy and in the euro area, nontradable goods are about 50% of GDP. This number is in line with the value computed by Stockman and Tesar (1995) for the United States and it is consistent with the values of the utility weight of nontradable goods used by Corsetti et al. (2008) to match a share of nontradables in the U.S. consumption basket of 53% (average over the period 1967–2002).

In Table 1 we report values of markups for Italy and the rest of the euro area. The markups for tradables (nontradables) in Italy and in the rest of the euro area were computed on the basis of estimated markups in the manufacturing (service)

TABLE 1. Price and wage markups (base-case parameters)

Parameter	Italy	Rest of the euro area
Tradables (manufacturing)		
Markup $\theta_T/(\theta_T - 1)$	1.17	1.17
θ_T	7.00	7.00
Nontradables (services)		
Markup $\theta_N/(\theta_N - 1)$	1.61	1.35
θ_N	2.65	3.90
Wages		
Markup $\psi/(\psi - 1)$	1.61	1.35
ψ	2.65	3.90

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sector as reported in OECD (2005a, 2005b).[13] In general, although there is some heterogeneity among different service sectors, markups in services tend to be uniformly higher than in manufacturing. On the other hand, we were not able to find data on Italian and rest of the euro area wage markups. Hence, mainly for symmetry, we calibrated it to the same level as for the service sector; we will perform robustness on this parameter in the robustness section. The numbers in the table are gross markups over marginal costs and are related to the demand elasticity parameter θ by the following steady-state relationship for goods and services:

$$\text{Price} = \text{markup} * \text{marginal cost} \quad \text{or} \quad p = \theta/(\theta - 1) * \text{mc},$$

and, for wages:

$$\text{wage} = \text{markup} * \text{marg. rate of subst.} \quad \text{or} \quad w = \theta_W/(\theta_W - 1) * \lambda^{-1} L^{\tau - 1},$$

where L represents labor hours and λ the marginal utility of consumption. For example, the value of 1.61 reported in the table for the Italian nontradables markup means that in the service sector prices are on average 61% higher that their "perfect competition" counterparts. Looking at the table, we see that in each region markups in the manufacturing sector are lower than in the services and labor markets. Moreover, Italian markups in the labor and services sectors are higher than their euro area counterparts, by approximately 25 percentage points. In Table 2 we report other parameters. Discount factors and elasticities of substitution have the same value across the two regions. The discount factor β is set to 0.9926, so that the steady state annualized real interest rate is equal to 3.0%.[14] The intertemporal elasticity of substitution, $1/\sigma$, is set to 1; the habit parameter, h, to 0.7. The parameter $\tau (1/(\tau - 1)$ is the labor Frisch elasticity) is set to 1.5. The depreciation rate of capital is set to 0.025. The elasticity of substitution between capital and labor is set to 0.92 in the production functions of tradables and nontradables. The biases toward capital in the production functions are set to match the private investment–to–GDP ratios. In the final consumption and investment composite baskets, the elasticity of substitution between domestic and imported tradables is set to 1.5, whereas the elasticity of substitution between tradables and nontradables is set to 0.5 as is standard in the GEM calibration. As these elasticities are crucial for cross-region spillovers of the structural reforms, we also conduct sensitivity tests with respect to these parameters. The bias for the Italian-produced (vis-à-vis the rest of the euro area) tradable good and that for tradable (vis-à-vis nontradable) goods are chosen to match the bilateral (Italy–euro area) import and export shares to GDP. The size of the Italian population is set to 0.17. We set to the same value the number of Italian firms operating in each of the two intermediate sectors. Table 3 contains parameters that affect the dynamics. Quadratic adjustment costs on investment change are set to 4.5. The adjustment costs on prices and wages are set to levels that imply, at the prereform values of markup parameters, an average frequency of price and wage adjustment equal to seven quarters. We have chosen this value to get responses to a monetary policy shock similar to those obtained

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TABLE 2. Parameterization of Italy and the rest of the euro area (base-case parameters)

Parameter	Italy	Rest of the euro area
Rate of time preference $(1/\beta^4 - 1) \times 100$	3.02	3.02
Depreciation rate δ	0.025	0.025
Intertemporal elasticity of substitution $1/\sigma$	1.00	1.00
Habit h	0.70	0.70
Frisch elasticity of labor $1/(\tau - 1)$	2.00	2.00
Tradable intermediate goods		
Substitution between factors of production ξ_T	0.92	0.92
Bias toward capital α_T	0.50	0.50
Nontradable intermediate goods		
Substitution between factors of production ξ_N	0.92	0.92
Bias toward capital α_N	0.45	0.45
Final consumption goods		
Substitution between domestic and imported goods ϕ_A	1.50	1.50
Bias toward Italian tradable goods a_H	0.40	0.35
Substitution between domestic tradables and nontradables ρ_A	0.50	0.50
Bias toward tradable goods a_T	0.51	0.51
Final investment goods		
Substitution between domestic and imported goods ϕ_E	1.50	1.50
Bias toward Italian tradable goods v_H	0.40	0.35
Substitution between domestic tradables and nontradables ρ_E	0.50	0.50
Bias toward tradable goods v_T	0.51	0.51
Population size s	0.17	0.83

in GEM. In the sensitivity analysis we consider the effect of lowering the degree of nominal rigidities. The parameter regulating the degree of indexation to the previous-period sector-specific inflation is set to 0.5 for both wages and prices.

Parameterization of the systematic feedback rule followed by the monetary authority is reported in Table 4. The short-term nominal interest reacts to its value in the previous period, the euro area–wide CPI inflation rate, and the GDP growth rate.[15] We have experimented also with a Taylor rule targeting one year ahead yearly inflation and output gap. The modification does not change the results in any significant way.

Table 5 reports the model-based and actual steady-state great ratios. Given the chosen calibration, the private consumption–to–GDP ratio is 59% in Italy (57% in the rest of the area), in line with the data, which are averages from national accounts statistics over the period 1999–2006. Investment-to-GDP ratios are respectively

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TABLE 3. Real and nominal adjustment costs (base-case parameters)

Parameter (* refers to the rest of the euro area)	Italy	Rest of the euro area
Real adjustment costs		
Italian net foreign asset position		
Short-run dynamics ϕ_{B1}	0.05	
Short-run dynamics ϕ_{B2}	0.1	
Investment change ϕ_I, ϕ_I^*	4.5	4.5
Nominal adjustment costs		
Price of nontradables κ_N, κ_N^*	19.25	19.25
Price of domestically produced tradables κ_H, k_F^*	70.44	70.44
Price of imported intermediate goods κ_F, κ_H^*	70.44	70.44
Wages κ_W, κ_W^*	19.25	19.25
Indexation		
Prices $\text{ind}_i, \text{ind}_i^*$ $i = H, F, N$	0.8	0.8
Wages $\text{ind}_W, \text{ind}_W^*$	0.8	0.8

21 and 23% in Italy and in the rest of the area (21% in the data). Italian bilateral imports and exports with the rest of the euro area are both set to 26% of Italian GDP (26% for both flows, in the data). Public consumption expenditure share (which is exogenously given) is set equal to 20% in Italy and in the Euro area, essentially as in the data.

2.3. Scenarios

We consider fully credible and fully anticipated reforms. The way the reform scenario is implemented substantially follows Everaert and Schule (2008): we assume it is announced at time one and phased in gradually over five years. We compare reductions in the markups of several sizes.

The reforms are evaluated along two dimensions. First, we look at the long-run effects by comparing steady state equilibria that differ in terms of markup values. Next, we study the transitional dynamics from one long-run equilibrium to the other.

We also report two measures of welfare: the first one (steady state) is simply a comparison of the level of utility in the prereform and past-reform steady states. The second one expresses utility in present discounted value terms (using the

TABLE 4. Euro area monetary rule

Parameter	Value
Lagged interest rate at $(t-1)\rho_i$	0.9
Inflation ρ_Π	1.7
GDP growth ρ_{GDP}	0.4

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TABLE 5. Steady-state national accounts decomposition (base-case parameters)

	Italy		Rest of the euro area	
Ratio of GDP	Data	Model	Data	Model
Total consumption	78.9	79.2	77.3	77.3
Private C	59.7	59.2	57.1	57.3
Public G	19.2	20.0	20.2	20.0
Private investment $P_E I$	20.7	20.8	21.1	22.7
Export EXP	25.8	26.2	—	—
Imports IM	25.9	26.2	—	—
Share of nontradables in value added		50.1		55.2
Labor income share		47.0		50.0
Net foreign asset position B	0.0	0.0		
Share of euro area GDP (percent)	17.0	18.0	83.0	82.0

Data source: National account data for the macroeconomic variables (1999–2006 averages).

agents' discount factor) and also includes the transition phase to the new steady state; it is computed in lifetime consumption equivalent units, that is, as the constant percentage change x of the initial steady state level of consumption that would deliver the same utility as achieved in the reform scenario:[16]

$$x \quad \text{s.t.} \quad \sum_{i=1}^{\infty} \beta^i U(xC_{ss1}, L_{ss1}) = \sum_{i=1}^{\infty} \beta^i U(C_i, L_i).$$

3. RESULTS

In this section we report the results of the scenarios we simulated. We start by showing the long-run macroeconomic implications of the reforms. Next, we comment on the dynamics of transition from one long-run equilibrium to the other.

3.1. Long-Run Effects

In what follow we describe the domestic and spillover effects of greater competition in Italian services. As a check, we also present results for similar simulations regarding the labor market. We initially consider increasing competition separately in each market. We then compare these outcomes with those of increasing competition simultaneously in both markets in Italy, and simultaneously in both regions.[17]

The impact of changing services sector markups on the long-run (steady-state) levels of economic activity are shown in Table 6. We show the percentage changes of main variables when the markup is reduced from its actual estimated value (1.61, as reported in Table 1) to one of the values reported in the first row of the table. All other parameters are set to their baseline values. A lower markup implies an increase in domestic GDP and consumption. As a reference point,

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TABLE 6. Long-run effects of different Italian service price markups (base-case parameters)

	Service price markup			
	1.55	1.45	1.35	1.25
Italy long-run effects				
GDP	2.1	6.3	10.8	15.7
Consumption	1.6	4.6	7.7	11.1
Investment	3.5	10.4	18.2	27.1
Labor	1.6	4.6	7.9	11.6
Real wages	2.4	6.9	11.9	17.4
Export volume	1.4	4.0	6.9	9.9
Import volume	0.4	1.0	1.7	2.5
Real exchange rate	2.5	7.1	12.3	18.0
Terms of trade	1.0	2.9	5.0	7.3
Welfare steady state	0.8	2.2	3.5	4.7
Welfare transition	0.5	1.2	1.8	2.3
Rest of the euro area long-run effects				
GDP	0.2	0.5	0.9	1.3
Consumption	0.2	0.6	1.0	1.4
Investment	0.2	0.5	0.8	1.2
Labor	0.0	0.0	0.0	0.0
Real wages	0.2	0.6	0.9	1.4

consider the third column of Table 6, corresponding to the case of a reduction of the Italian markup to the level prevailing in the Euro area (1.35). The increases in GDP, consumption, and investment are respectively equal to 10.8, 7.7, and 18.2%. Hours worked also increase, by 7.9%. The rise in the capital stock triggers higher real wages, which increase by 11.9% as labor becomes relatively scarce. So the effects of the reform are substantial in this scenario, mainly because the starting level of competition of the Italian economy is particularly low, and thus the reform implies a sizeable 40% markup reduction. A decrease of the markup to a level even lower than that prevailing in the euro area (1.25) would produce an even bigger increase of GDP, equal to 15.7% with consumption and investment increasing, respectively, by 11.1 and 27.1%.

International spillovers are due to changes in the amounts of exports and imports and in relative prices. The excess supply in the Italian services sector induces a depreciation of the Italian real exchange rate. The implied effects are two: Italian tradables become cheaper and the purchasing power of foreign households increases. Both effects favor an increase in Italian exports.[18] Italian imports increase because of higher domestic demand, notwithstanding the worsening of the Italian terms of trade. The terms-of-trade deterioration is lower than the real–exchange rate depreciation. The reason is that the increase in the price of Italian tradables partially counterbalances the real–exchange rate depreciation. The increase in the price of Italian tradables (expressed in Italian consumption units) has two sources.

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TABLE 7. Long-run effects of different Italian wage markups (base-case parameters)

	Wage markup			
	1.55	1.45	1.35	1.25
Italy long-run effects				
GDP	1.8	5.3	9.1	12.9
Consumption	1.8	5.2	8.9	12.7
Investment	1.9	5.5	9.5	13.6
Labor	2.4	7.1	12.4	17.7
Real wages	−0.6	−1.7	−2.9	−4.1
Export volume	2.0	6.0	10.3	14.7
Import volume	0.5	1.5	2.6	3.7
Real exchange rate	0.9	2.7	4.7	6.6
Terms of trade	1.5	4.4	7.5	10.7
Welfare steady state	0.5	1.5	2.3	3.1
Welfare transition	0.4	0.9	1.3	1.7
Rest of the euro area long-run effects				
GDP	0.3	0.8	1.4	1.9
Consumption	0.3	0.8	1.4	2.0
Investment	0.2	0.7	1.2	1.7
Labor	0.0	0.0	0.0	0.0
Real wages	0.3	0.8	1.4	2.0

First, tradables and services are complements, hence higher demand for the latter drives up demand for the former. Second, higher demand for Italian inputs (labor and capital) also drives up marginal cost in the manufacturing sector, which is not subject to any markup-reducing reform.

Overall, the increases in GDP, consumption, investment, and labor hours in the rest of the euro area are relatively small, which is to be expected on account of the relatively small degree of openness of the rest of the euro area.

For comparison, Table 7 reports results from a scenario where the reforms only impact the labor markets. More specifically, the Italian wage markup is reduced by the same amount as in the case of the services sector reform. The effects on Italian GDP, consumption, investment, and welfare are still substantial, although slightly smaller than those obtained from a similar reduction in the services markup. In particular, when Italian wage markups are reduced to the euro area level (1.35), GDP increases by 9.1% whereas consumption, investment, and labor hours increase respectively by 8.9, 9.5, and 12.4%. The result depends on the share of labor and the elasticity of substitution between labor and capital in the production function. In the sensitivity analysis we show that the effect on GDP when implementing service sector reforms can become slightly lower.

The terms-of-trade deterioration is now stronger than the real–exchange rate depreciation because higher labor supply also stimulates the supply of Italian

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TABLE 8. Long-run effects of stand-alone and synchronized reforms (base-case parameters)

	Reforms in Italy			Reforms in Italy and the euro area		
	Wages	Services	Services and wages	Wages	Services	Services and wages
			Italy long-run effects			
GDP	9.1	10.8	20.8	10.5	11.9	23.7
Consumption	8.9	7.7	17.3	10.4	8.9	20.2
Investment	9.5	18.2	29.4	10.8	19.3	32.3
Labor	12.4	7.9	21.2	12.4	7.9	21.2
Real wages	−2.9	11.9	8.5	−1.6	13.1	11.2
Export volume	10.3	6.9	17.8	11.2	7.6	19.6
Import volume	2.6	1.7	4.4	6.8	5.1	12.3
Real exchange rate	4.7	12.3	17.4	2.6	6.1	8.8
Terms of trade	7.5	5.0	12.9	4.1	2.3	6.5
Welfare steady state	2.3	3.5	5.1	3.7	4.7	7.7
Welfare transition	1.3	1.8	2.4	2.6	2.8	4.6
			Rest of the euro area long-run effects			
GDP	1.4	0.9	2.3	6.1	6.9	13.4
Consumption	1.4	1.0	2.4	6.1	5.3	11.7
Investment	1.2	0.8	2.0	6.0	10.8	17.5
Labor	0.0	0.0	0.0	5.3	4.0	9.5
Real wages	1.4	0.9	2.4	0.8	7.4	8.2

tradables, differently from the case of reforms in the services sector. Net exports now increase to a greater extent (compared to the case of reforms in the services sector).

We now consider the case of simultaneously decreasing markups in Italian labor and services markets [Table 8, column (3)] to a level equal to 1.35. The main insight from this exercise is that the long-run gains from implementing both reforms are essentially equal to the sum of the effects from each individual reform. GDP increases by 20.8%, consumption and investment, respectively, by 17.3 and 29.4%, whereas hours worked increase by 21.2%. All these increases are only slightly higher then those obtained when reforms are separately implemented. This scenario is also useful to answer another question. What happens in the labor markets, given that in this scenario the effects on real wages of the two reforms tend to offset each other? The overall effect on real wages is an increase of 8.5% in the long run (slightly below the simple sum of the two separate effects) and hence the positive (and bigger) impact from the service reform more than offsets the negative one coming from the labor market reform. This result might be connected to a general point about the "optimal" timing of reforms made by Blanchard and Giavazzi (2003), who argue that structural reforms should generally start from the

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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). Our simulations suggest that the two reforms, when implemented at exactly the same time, imply that real wages increase overall, although during the transition they initially drop because the service reform leads to a slightly delayed increase in real wages.[19] Obviously, the two reforms together imply stronger movements in international relative prices (the real exchange rate and terms of trade deteriorate), exported and imported volumes (which increase), and spillovers (GDP, consumption, and investment increase in the rest of the euro area).

Finally, we consider the case of permanently and simultaneously reducing markups not only in Italy, but also in the rest of the euro area. This scenario sheds light on the effect of movements in international prices in the baseline case. Remember that, when a reform is implemented in one country, the relative abundance of its products increases and therefore international relative prices tend to move against the reforming country. This effect tend to disappear when both regions are undergoing the structural reforms at the same time. In columns (4)–(6) of Table 8 we consider the case in which markups are also reduced in the rest of the euro area from 1.35 to 1.25. Terms of trade and real exchange rate still deteriorate (essentially because the size of the reform in the euro area is smaller), but to a lesser extent. The smaller real–exchange rate depreciation (compared to the benchmark) has a positive income effect on Italian households and stimulates GDP (which increases by 23.7% in the scenario where markups are reduced in both services and labor markets), consumption and investment (that increase respectively by 20.2 and 32.3%). Also, the welfare gains for Italy when the rest of the euro area is joining into the reform effort are significantly superior to the ones in the benchmark case. In the case of both reforms in both regions [Table 8, column (6)], the labor market is again the place where the combined effects are more interesting. Now hours worked in Italy increase but the extra effect coming from reforms in the euro area is zero, because now Italian households substitute imported for domestic goods, whose supply strongly increases. The increase in Italian export is also relatively small, because households in the rest of the euro area have a smaller incentive, given the less favorable movement in international relative prices, to substitute Italian goods for domestic ones.

3.2. Transition Dynamics

In this section we look at the dynamics of transition from one long-run equilibrium to the other. As said above, we run perfect-foresight simulations in which a fully credible (and fully anticipated) reform is implemented starting from the beginning of the simulation via a gradual (over a five-year horizon) and permanent reduction in the correspondent markup. We then study the adjustment paths of endogenous variables toward their new steady state level. Variables do not jump immediately to the new steady state for two reasons. First, reforms are gradually implemented. Second, habit in consumption and adjustment costs on investment, prices, and wages, introduced to get a realistic dynamics, slow the adjustment.

Figures 1a and 1b report the transition dynamics when the Italian services markup is reduced to the euro area level gradually over five years. Time is in quarters, and variables are expressed as percentage deviations with respect to the prereform steady state values. Reforms in the services sector imply that most of the long-run change in GDP and investment takes place in the first twenty quarters whereas, in the same time span, consumption variation is equal to 25% of its long-run change. Consumption drops on impact for two reasons. First, there is an increase in the real interest rate (see Figure 1b), due in turn to the fall in inflation in the presence of a slightly higher nominal rate at the euro area level. Second, lower consumption makes it possible to make room for accumulating capital, to maximize the foreseen higher future positive effects of reforms on output. Employment and investment increase gradually over time.

Production in the services sector rises significantly, accompanied by a sizable fall in the price of services relative to that of domestic composite (domestic and imported) tradables. The real marginal cost in the services sector also increases, because of the increase in both real wages and the rental rate of capital (the latter, not shown in the figures, starts dropping after about twenty quarters, contributing to the flattening of the marginal cost). The drop in service prices leads to an increase in import prices relative to the CPI (the weight of services in the consumption bundle is relatively high). The Italian real exchange rate and the terms of trade deteriorate. Italian export quantities increase more than imports do, given the depreciation of the Italian real exchange rate and the related shift of the euro area demand.

The transitional dynamics for the case of a reduction in the labor markup are shown in Figures 2a and 2b. In this case also, most of the effects of the reforms seem to accrue in the first twenty quarters. Real wages drop severely during this initial period (to a level below their new steady state) and then slowly rise. Meanwhile employment increases accordingly. Investment, production, and consumption rise substantially (between 30 and 40% of the long-run increase in the first ten quarters). The latter, differently from the case of services reform, always increases because the increase in Italian real interest rate is now much lower. The relative price of services vs tradables drops, mainly due to the higher share of labor input in the service sector as compared to the tradable sector, together with the decrease in real wages. The terms of trade and the real exchange rate deteriorate, given the greater availability of Italian tradable and nontradable goods. Given the behavior of Italian international relative prices, reforms in the Italian labor market imply that Italian exported quantities increase more than imported ones, as in the case of the services sector reform.

4. SENSITIVITY ANALYSIS

We now investigate the robustness of our long-run results against changes in the values of key parameters. We first report results from increasing the competition in the service sector, assuming a value for the markup in the labor market lower

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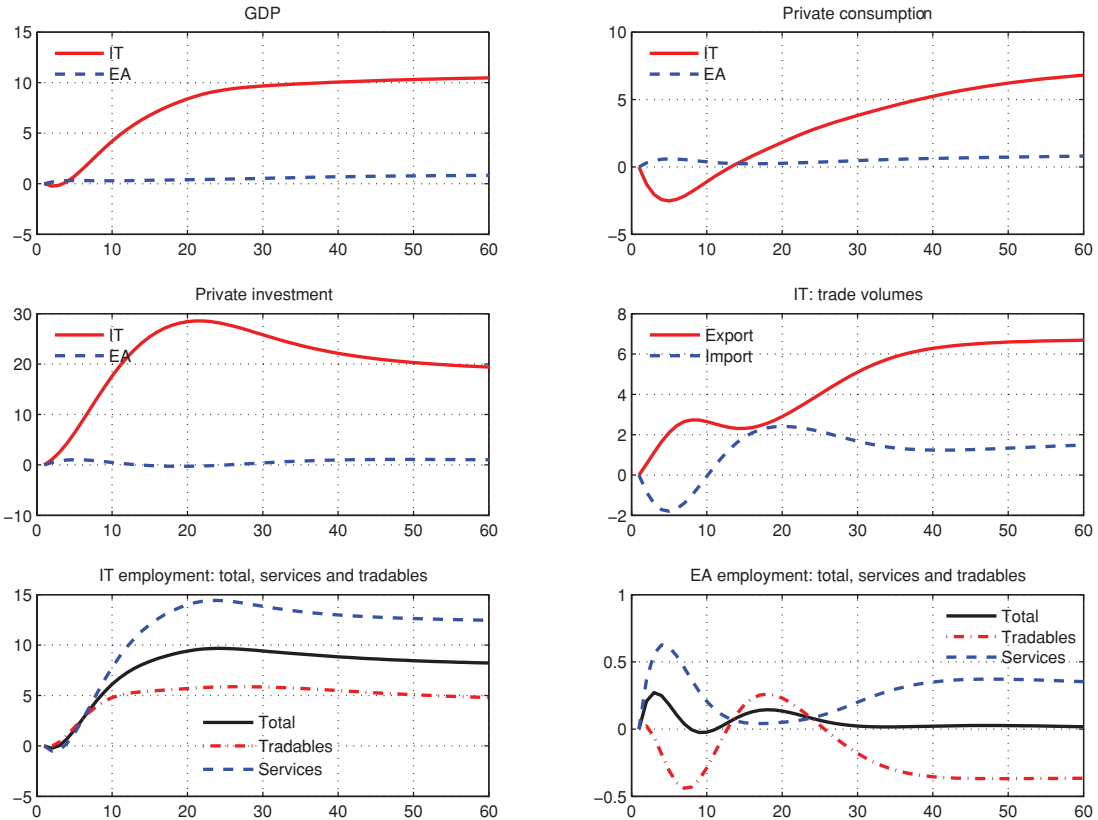

FIGURE 1A. Reduction in the services sector markup (quantities).

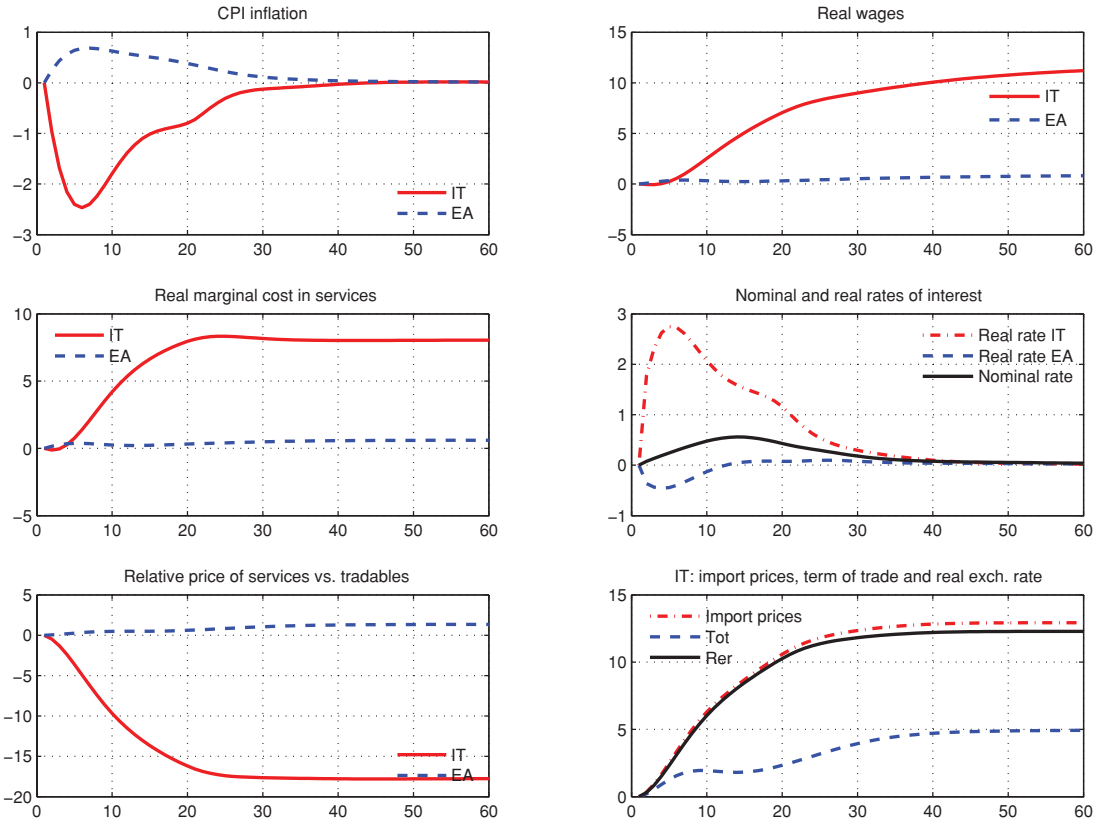

FIGURE 1B. Reduction in the services sector markup (prices).

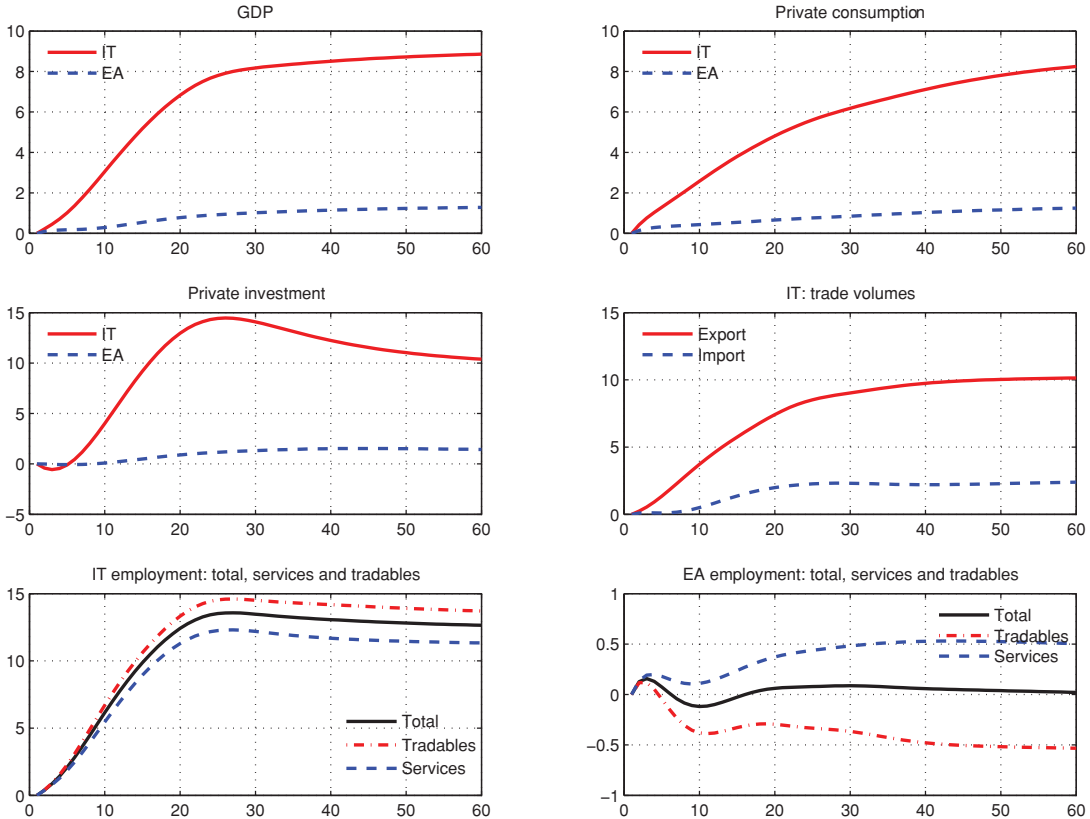

FIGURE 2A. Reduction in the labor market markup (quantities).

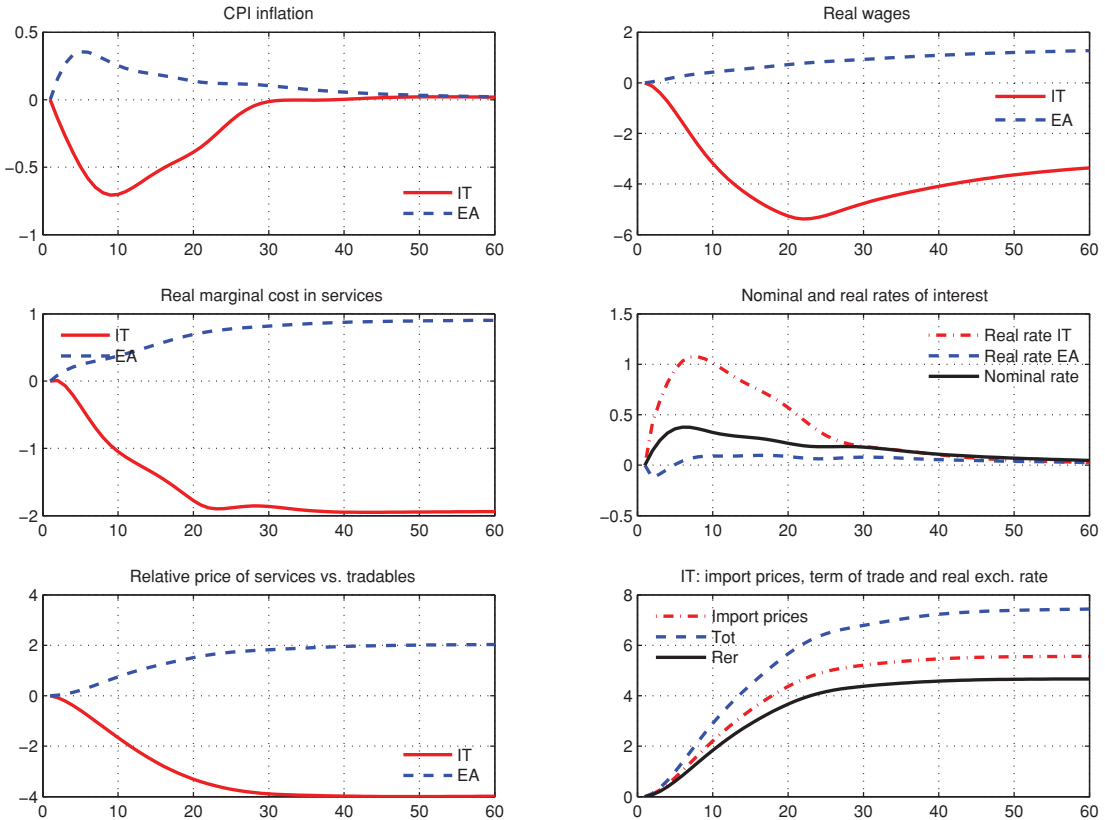

FIGURE 2B. Reduction in the labor market (prices).

TABLE 9. Long-run effects of different Italian service price markups (lower wage markup)

	Service price markup			
	1.55	1.45	1.35	1.25
Italy long-run effects				
GDP	2.1	6.2	10.7	15.6
Consumption	1.6	4.5	7.7	11.0
Investment	3.5	10.3	18.0	26.9
Labor	1.5	4.5	7.8	11.5
Real wages	2.4	6.9	11.8	17.2
Export volume	1.4	4.0	6.8	9.8
Import volume	0.4	1.0	1.7	2.4
Real exchange rate	2.4	7.1	12.2	17.8
Terms of trade	1.0	2.9	5.0	7.2
Welfare steady state	0.7	1.8	2.8	3.6
Welfare transition	0.3	0.8	1.1	1.2
Rest of the euro area long-run effects				
GDP	0.2	0.5	0.9	1.3
Consumption	0.2	0.6	1.0	1.4
Investment	0.2	0.5	0.8	1.2
Labor	0.0	0.0	0.0	0.0
Real wages	0.2	0.6	1.0	1.4

than in the baseline. We then consider changes in some important parameters. Finally, we perform some robustness exercises on the parameters of price and wage rigidities, which contribute to determining the speed of adjustment toward the new steady state.

In the baseline simulation we have assumed a wage markup of 1.61, mainly for symmetry with the value calibrated for the service markup, as we were not able to find reliable estimates for this parameter. Table 9 shows the results assuming a wage markup equal to 1.35. The results are only marginally different for all the variables except for the welfare level. When wage markups are lower, the welfare from increasing competition in the service sector increases by a smaller amount, as the starting level of utility is higher.

Tables 10 and 11 report results of reducing the markup in the service sector (Table 10) and in the labor market (Table 11) to 1.35 by moving one parameter at a time in both regions. The elasticity of intratemporal substitution between domestic and imported tradable goods (ϕ) is changed from 1.5 to 3; the elasticity of substitution between tradable on nontradable goods (ρ) from 0.5 to 1.1; the intertemporal elasticity of substitution ($1/\sigma$) from 1 to 2; the parameter of the labor Frisch elasticity (τ) from 1.5 to 3; the elasticity of substitution between labor and capital (ξ) from 0.92 to 0.8; the capital weight in the production function (α) from

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TABLE 10. Long-run effects of different Italian service price markups: robustness

		Parameter						
	Baseline	ϕ	ρ	σ	τ	ξ	s	α
		Italy long-run effects						
GDP	10.8	11.2	9.0	13.6	7.6	8.5	9.9	6.9
Consumption	7.7	8.3	7.1	10.5	4.7	6.9	7.1	5.8
Investment	18.2	18.2	13.2	21.2	14.7	14.7	16.3	13.9
Labor	7.9	7.5	5.3	11.5	3.8	7.0	7.0	5.8
Real wages	11.9	12.3	9.9	11.0	12.9	10.6	10.8	8.8
Export volume	6.9	5.9	1.6	9.9	3.5	4.4	5.8	3.2
Import volume	1.7	3.6	0.5	3.0	0.9	1.1	1.2	0.8
Real exchange rate	12.3	10.0	7.3	13.3	10.6	11.2	10.9	9.8
Terms of trade	5.0	2.3	1.1	6.7	2.5	3.3	4.5	2.4
Welfare steady state	3.5	4.3	4.1	4.5	2.7	3.0	3.4	2.5
Welfare transition	1.8	2.5	2.8	2.3	1.3	2.1	1.8	1.8
		Rest of the euro area long-run effects						
GDP	0.9	0.3	0.2	1.9	0.5	0.5	1.0	0.4
Consumption	1.0	0.3	0.2	2.0	0.5	0.5	1.1	0.4
Investment	0.8	0.3	0.2	1.8	0.4	0.4	0.9	0.3
Labor	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0
Real wages	0.9	0.3	0.2	1.3	0.5	0.5	1.1	0.4

Note: The table reports results of reducing the markup in the service sector to 1.35 by moving one parameter at a time. The elasticity of intratemporal substitution between domestic and imported tradable goods (ϕ) is changed from 1.5 to 3; the elasticity of substitution between tradable on nontradable goods (ρ) from 0.5 to 1.1; the intertemporal elasticity of substitution ($1/\sigma$) from 1 to 2; the labor Frisch elasticity $[1/(\tau - 1)]$ from 2 to 0.5; the elasticity of substitution between labor and capital (ξ) from 0.92 to 0.8; the capital weight in the production function (α) from 0.45 to 0.2 for nontradables and from 0.5 to 0.2 for tradables; the relative size of Italy (s) from 0.17 to 0.5.

0.45 to 0.2 in the nontradables sectors and from 0.5 to 0.2 in the tradable sectors. Finally, the relative size of Italy (s) is increased from 0.17 to 0.5.

Compared to the baseline case, the main effect of the higher substitutability between domestic and imported tradable goods is to induce, for a given reduction of price or wage markup, a stronger increase in Italian GDP and consumption and a lower depreciation of real exchange rate and terms of trade. Higher Italian demand implies a stronger increase in volume imports while exported quantities, because of the smaller deterioration of terms of trade, increase by a lower extent. Spillover to the rest of the euro area decreases—increases in GDP, consumption, and investment are smaller—given the smaller increase in Italian real exchange rate and terms of trade.

Increasing the elasticity of substitution between tradable and nontradable goods has significant effects in case of a reduction in nontradable sector markups. The higher substitution induces a decrease in demand for tradable goods, reducing the need to increase capital and labor supply at the economywide level. Hence the overall effect on GDP is reduced. Changes in markup in the labor market,

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TABLE 11. Long-run effects of different Italian wage markups: robustness

		Parameter						
	Baseline	ϕ	ρ	σ	τ	ξ	s	α
		Italy long-run effects						
GDP	9.1	10.5	8.9	12.6	4.4	9.4	9.5	9.2
Consumption	8.9	10.3	8.8	12.4	4.4	9.2	9.4	9.2
Investment	9.5	10.7	9.2	13.1	4.6	10.1	10.0	9.5
Labor	12.4	12.4	12.3	16.9	6.0	12.4	12.4	12.4
Real wages	−2.9	−1.7	−3.1	−3.6	−1.5	−2.7	−2.5	−2.7
Export volume	10.3	9.2	9.3	14.1	5.0	10.8	9.7	10.9
Import volume	2.6	5.5	2.8	4.2	1.3	2.6	2.0	2.6
Real exchange rate	4.7	2.1	3.4	5.9	2.3	4.9	4.7	4.5
Terms of trade	7.5	3.5	6.3	9.5	3.7	8.0	7.5	8.1
Welfare steady state	2.3	3.6	1.9	3.4	1.1	2.1	2.6	1.7
Welfare transition	1.3	2.5	1.0	2.0	0.7	1.5	1.6	1.3
		Rest of the euro area long-run effects						
GDP	1.4	0.5	1.3	2.7	0.7	1.2	1.7	1.3
Consumption	1.4	0.5	1.3	2.8	0.7	1.3	1.8	1.3
Investment	1.2	0.4	1.2	2.5	0.6	0.9	1.5	1.2
Labor	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0
Real wages	1.4	0.5	1.3	1.8	0.7	1.3	1.8	1.3

Note: The table reports results of reducing the markup in the service sector to 1.35 by moving one parameter at a time. The elasticity of intratemporal substitution between domestic and imported tradable goods (ϕ) is changed from 1.5 to 3; the elasticity of substitution between tradable on nontradable goods (ρ) from 0.5 to 1.1; the intertemporal elasticity of substitution ($1/\sigma$) from 1 to 2; the labor Frisch elasticity $[1/(\tau - 1)]$ from 2 to 0.5; the elasticity of substitution between labor and capital (ξ) from 0.92 to 0.8; the capital weight in the production function (α) from 0.45 to 0.2 for nontradables and from 0.5 to 0.2 for tradables; the relative size of Italy (s) from 0.17 to 0.5.

on the other hand, have a similar effect on both tradable and nontradable sectors, and therefore results are not particularly sensitive to changes in the elasticity of substitution between the two. Spillovers are lower than in the benchmark, given the lower deterioration in Italian relative prices.

Higher intertemporal elasticity of substitution increases, through the labor supply schedule, the response of hours worked, favoring a stronger response of all variables for reduction in markups both in the nontradable sector and in the labor market. GDP and consumption now reach a level 40% higher than in the baseline; there is a relatively higher response of investment compared to hours when competition in services increases, while hours increase in line with investment when reforms involve the labor market. Spillovers are now stronger, given the higher depreciation of Italian real exchange rate

Compared to the baseline case, a less elastic labor supply decreases the impact of changes in the wage or services markup on both domestic and foreign variables. Both quantities and relative prices increase less than in the baseline case, with the exception of real wages when markups are changed in the service sector.

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Reducing the elasticity of substitution between labor and capital in both Italy and the rest of the euro area, in the case of services sector deregulation, limits the increase in services supply and hence, in equilibrium, the increase in consumption, investment, labor hours, and real wage is reduced. As a consequence, also, the real GDP increase is lower. The real exchange rate and the terms of trade depreciate less than in the baseline and spillovers to the rest of the euro area are smaller. In the case of labor market liberalization, the labor supply increase is the same under the two alternative values of the elasticity, whereas the decrease in the real wage is reduced. The stronger complementarity between labor and capital now favors a stronger increase in investment and hence capital accumulation. GDP and consumption increases are also higher. The stronger increase in supply favors a greater deterioration of terms of trade and real exchange rate. In the rest of the area aggregate quantities and real wage increase less in the low-elasticity case, given that the stronger deterioration of the Italian terms of trade favors a shift of world demand toward the Italian tradable goods.

As for the size of the country, domestic variables are not very sensitive to changes in this dimension (as the spillover effects in our baseline simulation are limited); however, the spillovers are now more significant.

These results suggest that changing key parameters in the model generally does not alter the qualitative message emerging from the base-case scenario, and in particular the size of domestic and cross-region effects of changes in competition in the Italian economy, given that changes in markups have a first-order effect that tends to dominate.

Finally, we performed a robustness check with respect to the parameters of wage and price stickiness. In the baseline simulation we set to seven quarters the frequency of price adjustment in the three markets (tradables, nontradables, and wages). Setting these parameters to different levels alters only the speed of adjustment toward the new steady state. If we set all prices and wage rigidities so that the frequency of adjustments is about one year, about 70% of the effects on GDP would be realized in the first two years (instead of about 25% in the baseline).

5. CONCLUSIONS

We have developed and simulated a DSGE model of the Italian economy to quantitatively address the macroeconomic implications of competitive-enhancing reforms in the Italian services sector. Our simulations produce plausible effects of structural polices aimed at improving competition. Changes in services (and wage) markups significantly affect the economy. The long-run spillover effects of reforms to the rest of the euro area are limited because the increase in the Italian potential output is matched almost one to one in the long run by rises in domestic demand and because the rest of the euro area is a relatively closed economy.

Benefits are relatively stronger when there are concurrent reforms in both labor and services markets. There is also a qualitative difference between implementing the reforms in isolation and jointly, given the different responses of real wages and

labor supply to the different reforms. Hence, reforms in the services sector can be used to generate support for labor market reform, a point recently emphasized by Blanchard and Giavazzi (2003). Synchronization of reforms between Italy and the euro area would add further benefits to the Italian economy, stimulating production while at the same time limiting the deterioration of international relative prices.

NOTES

1. For markup estimates for different sectors and countries, see OECD (2005a, 2005b) and Christopoulou and Vermeulen (2008). Also, according to the IMF (2007), "Italy has the most highly regulated product markets in the EU-15, and various cross-country reviews identify excessive regulation as a continuing problem in key sectors, accounting also for Italy's undersized services sector and high energy prices. In part due to these problems, Italy's ranking in cross-country surveys of the business environment is poor (and worsening). Significant labor market rigidities (notwithstanding important progress) also inhibit growth by slowing labor reallocation."

2. The GDP average annual growth rate in Italy over the period 1996–2006 is equal to 1.4%, compared to 1.5% in Germany and 2.3% in France. Estimates of Italian potential output growth have declined from around 3.6% in the early 1970s to about 1.3–1.4% currently. Over the same period the German potential growth rate has decreased from 2.9 to 1.5%. In France it has decreased from 3.0 to 1.8%.

3. For an analysis of the implications of enhancing competition and productivity in the Italian services sector see also OECD (2007).

4. The choice of modeling Italy as a part of the euro area makes it possible to properly take into account the role of the common monetary policy and the spillovers from (and to) the rest of the area.

5. See Bayoumi (2004) and Pesenti (2008) for a description of the GEM. Several central banks have developed DSGE models for policy anlysis. Among others, the Fed has developed SIGMA [see Erceg et al. (2006)], and the European Central Bank the New Euro Area Wide Model [see Coenen et al. Straub (2007)].

6. In most macroeconomic applications of monopolistic competition it is assumed that there is no entry or exit of firms, even though profits are positive, and that the substitution elasticity between goods is also a measure of competition. However, Ebell and Haefke (2003), for example, show that in many cases it is equivalent to vary competition by varying the degree of substitution between goods or by varying the numbers of firms in the industry. More firms means that the number of substitutes increases, which makes each firm's demand more elastic. This is also the approach followed, among others, by Blanchard and Giavazzi (2003), Bayoumi et al. (2004), Everaert and Schule (2006), and Jonsson (2007).

7. When we modify the parameter of markup in the service sector, we keep all other parameters unchanged. As pointed out above, there is an empirical literature [Barone and Cingano (2008) among others] on the effects of liberalizations that has shown how more competition in the service sectors can increase productivity. Such an effect, which our model does not capture, would reinforce and augment our quantitative results.

8. Similar results were obtained by Everaert and Schule (2008), who conduct a similar experiment for France and Belgium relative to the rest of the euro area. Jonsson (2007) analyzes the welfare costs of imperfect competition in the United States using a similar model, although in a closed economy; he also shows how these costs increase markedly once one takes into account the presence of distortionary taxation.

9. The main equations are reported in the Appendix.

10. Fabiani et al. (2005) provide some empirical support for pricing-to-market in the euro area.

11. We have experimented introducing a share (35% of the population in each region) of liquidity-constrained agents. These have been modeled assuming they consume their current disposable income and take the wage rate in the labor market as given, as in Forni et al. (2009). Under these assumptions,

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the long-run effects are hardly affected. The short-run dynamics is slightly amplified, but the effects are small.

12. Specifically, we set parameters to values in the range used to calibrate the euro area block of the IMF's GEM model. See Bayoumi et al. (2004), Batini et al. (2005), Cova et al. (2008), Everaert and Schule (2008), and Cova et al. (in press).

13. Christopoulou and Vermeulen (2008) have recently produced new estimates of sectoral markups using the EUKLEMS data set. On the average of their sample period (1981–2004) their estimated values are in line for the Manufacturing and Construction aggregate (1.18 and 1.23 in the euro area and Italy, respectively), but substantially higher for the market services sector (1.56 and 1.87, respectively, in the euro area and Italy). In our baseline calibration we use the more conservative values (1.35 and 1.61, respectively, in the euro area and Italy) estimated by the OECD. As the percentage reductions in markup (when moving from the Italian level to the euro area one) are similar for both estimates, results would not be substantially different if we used these more extreme values.

14. For simplicity we assume that in steady state the gross CPI inflation rate is one, there is no technology trend, and the net asset position of Italy against the rest of the euro area is zero.

15. The euro area–wide CPI inflation rate is a weighted (by the size of each region) geometric average of regional inflation rates. The euro area–wide GDP is the sum of regional GDPs, denominated in terms of Italian consumption.

16. Following Bayoumi et al. (2004), when we compute consumer welfare we abstract from habit persistence in consumption.

17. In this section each reform acts independent of the other in the sense that, even when both are implemented at the same time, the model does not have a role for interaction effects. For an empirical assessment of the importance of such effects see Jean and Nicoletti (2002).

18. The Italian real exchange rate (RER) is defined as the ratio of the Euro area CPI to that of Italy. Hence, an increase corresponds to a depreciation. The Italian terms of trade (TOT) are defined as the Italian import prices (P_{IMP})–to–Italian export prices (P_{EXP}) ratio, both expressed in Italian consumption units; that is,

$$\mathrm{TOT} \equiv \frac{P_{\mathrm{IMP}}}{\mathrm{RER} \times P_{\mathrm{EXP}}}.$$

Hence a depreciation in the Italian real exchange rate favors, to some extent, a deterioration of the Italian terms of trade.

19. It follows that, if the service reforms were allowed to start earlier, as Blanchard and Giavazzi (2003) suggest, a scenario could be implemented in which real wages on not only in the final outcome, but also all along the transition path.

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APPENDIX

In what follows we illustrate the Home economy (Italy). The structure of the Foreign economy (the rest of the euro area) is similar, and to save on space, we do not report it.

A.1. FINAL CONSUMPTION AND INVESTMENT GOODS

There is a continuum of symmetric Home firms producing Home final nontradable consumption under perfect competition. Each firm producing the consumption good is indexed by $x \in (0, s]$, where the parameter $0 < s < 1$ is a measure of country size. Foreign firms producing the Foreign final consumption goods are indexed by $x^* \in (s, 1]$ (the size of the monetary union is normalized to 1). The CES production technology used by firm x is

$$A_t(x) = \left\{ \begin{array}{l} a_T^{1/\rho_A} \Big[a_H^{1/\phi_A} Q_{HA,t}(x)^{(\phi_A-1)/\phi_A} + (1-a_H)^{1/\phi_A} \\ \times Q_{FA,t}(x)^{(\phi_A-1)/\phi_A} \Big]^{\phi_A/(\phi_A-1)(\rho_A-1)/\rho_A} \\ + (1-a_T)^{1/\rho_A} Q_{NA,t}(x)^{(\rho_A-1)/\rho_A} \end{array} \right\}^{\rho_A/(\rho_A-1)}, \tag{A.1}$$

where Q_H, Q_F, and Q_N are bundles of, respectively, Home tradable, Foreign tradable, and Home nontradable intermediate goods, $\phi > 0$ is the elasticity of substitution between tradables, and $\rho > 0$ is the elasticity of substitution between tradable and nontradable goods. The parameter a_H $(0 < a_H < 1)$ is the weight of domestic tradable, and a_T $(0 < a_T < 1)$ is the weight of tradable goods.

The production of investment goods is similar. There are symmetric Home firms under perfect competition indexed by $y \in (0, s]$, and symmetric Foreign firms by $y^* \in (s, 1]$. The output of Home firm y is

$$E_t(y) = \left\{ \begin{array}{l} v_T^{1/\rho_E} \Big[v_H^{1/\phi_E} Q_{HE,t}(y)^{(\phi_E-1)/\phi_E} + (1-v_H)^{1/\phi_E} \\ \times Q_{FE,t}(y)^{(\phi_E-1)/\phi_E} \Big]^{[\phi_E/(\phi_E-1)][(\rho_E-1)/\rho_E]} \\ + (1-v_T)^{1/\rho_E} Q_{NE,t}(y)^{(\rho_E-1)/\rho_E} \end{array} \right\}^{\rho_E/(\rho_E-1)}. \tag{A.2}$$

Finally, we assume that public expenditure G has the same composition as private consumption.

A.2. INTERMEDIATE GOODS

Bundles used to produce the final consumption goods are CES indices of differentiated intermediate goods, each produced by a single firm under conditions of monopolistic competition,

$$Q_{HA}(x) = \left[\left(\frac{1}{s} \right)^{\theta_T} \int_0^s Q(h,x)^{(\theta_T-1)/\theta_T} dh \right]^{\theta_T/(\theta_T-1)},$$

$$Q_{FA}(x^*) = \left[\left(\frac{1}{1-s} \right)^{\theta_T} \int_s^1 Q(f,x)^{(\theta_T-1)/\theta_T} df \right]^{\theta_T/(\theta_T-1)}, \tag{A.3}$$

$$Q_{NA}(x) = \left[\left(\frac{1}{s} \right)^{\theta_N} \int_0^s Q(n,x)^{(\theta_N-1)/\theta_N} dn \right]^{\theta_N/(\theta_T-1)}, \tag{A.4}$$

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where firms in the Home tradable and nontradable intermediate sectors and in the Foreign intermediate tradable sector are respectively indexed by $h \in (0, s)$, $n \in (0, s)$, $f \in (s, 1]$. Parameters θ_T, $\theta_N > 1$ are respectively the elasticity of substitution between brands in the tradable and nontradable sector. The prices of the nontradable intermediate goods are denoted $p(n)$. Each firm x takes these prices as given when minimizing production costs of the final good. The resulting demand of nontradable intermediate input n is

$$Q_{A,t}(n, x) = \left(\frac{1}{s}\right)\left[\frac{P_t(n)}{P_{N,t}}\right]^{-\theta_N} Q_{NA,t}(x), \tag{A.5}$$

where $P_{N,t}$ is the cost-minimizing price of one basket of local intermediates:

$$P_{N,t} = \left[\int_0^s P_t(n)^{1-\theta_N} dn\right]^{1/(1-\theta_N)}. \tag{A.6}$$

We can derive $Q_A(h, x)$, $Q_A(f, x)$, $G_A(h, x)$, $G_A(f, x)$, P_H, and P_F in a similar way. Firms y producing the final investment goods have similar demand curves. Aggregating over x and y, it can be shown that total demand of intermediate nontradable good n is

$$\int_0^s Q_{A,t}(n, x)\, dx + \int_0^s Q_{E,t}(n, y)\, dy + \int_0^s G_t(n, x)\, dx = \left[\frac{P_t(n)}{P_{N,t}}\right]^{-\theta_N} (Q_{NA,t} + Q_{NE,t} + G_{N,t}), \tag{A.7}$$

where G_N is the nontradable component of the public sector consumption. Home demands for Home and Foreign tradable intermediate goods can be derived in a similar way.

The supply of each Home nontradable intermediate good n is denoted by $N^S(n)$:

$$N_t^S(n) = \left[(1-\alpha_N)^{1/\xi_N} L_{N,t}(n)^{(\xi_N-1)/\xi_N} + \alpha^{1/\xi_N} K_{N,t}(h)^{(\xi_N-1)/\xi_N}\right]^{\xi_N/(\xi_N-1)}. \tag{A.8}$$

Firm n uses labor $L_N(n)$ and capital $K_N(n)$ with constant elasticity of input substitution $\xi_N > 0$ and capital weight $0 < \alpha_N < 1$. Firms producing intermediate goods take the prices of labor inputs and capital as given. Denoting by W the nominal wage index and by R^K the nominal rental price of capital, cost minimization implies

$$L_{N,t}(n) = (1-\alpha_N)\left[\frac{W_t}{MC_{N,t}(n)}\right]^{-\xi_N} N_t^S(n),\ K_{N,t}(n) = \alpha\left[\frac{R_t^K}{MC_{N,t}(n)}\right]^{-\xi_N} N_t^S(n), \tag{A.9}$$

where MC_N is the nominal marginal cost:

$$MC_{N,t}(n) = \left[(1-\alpha)\, W_t^{1-\xi_N} + \alpha\left(R_t^K\right)^{1-\xi_N}\right]^{1/(1-\xi_N)}. \tag{A.10}$$

The production of each Home tradable good, $T^S(h)$, is similarly characterized.

Consider now profit maximization in the Home country's nontradable intermediate sector. Each firm n sets the price $p_t(n)$ by maximizing the present discounted value of profits subject to demand constraint (A.7) and the quadratic adjustment costs:

$$AC_{N,t}^p(n) \equiv \frac{\kappa_N^p}{2}\left[\frac{P_t(n)/P_{t-1}(n)}{(P_{N,t-1}/P_{N,t-2})^{\text{ind}_N}} - 1\right]^2 Q_{N,t} \quad \kappa_N^p \geq 0,$$

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paid in unit of sectorial product $Q_{N,t}$ and where κ_N^p measures the degree of price stickiness, whereas $0 \leq \text{ind}_N \leq 1$ is the degree of price indexation to previous-period sector-specific inflation. The resulting first-order condition, expressed in terms of domestic consumption, is

$$p_t(n) = \frac{\theta_N}{\theta_N - 1}\text{mc}_t(n) - \frac{A_t(n)}{\theta_N - 1}, \tag{A.11}$$

where $\text{mc}_t(n)$ is the real marginal cost and $A(n)$ contains terms related to the presence of price adjustment costs. The above equations clarify the link between imperfect competition and nominal rigidities. As emphasized by Bayoumi et al. (2004), when the elasticity of substitution θ_N is very large and hence the competition in the sector is high, prices closely follow marginal costs, even though adjustment costs are large. On the contrary, it may be optimal to maintain stable prices and accommodate changes in demand through supply adjustments when the average markup over marginal costs is relatively high. If prices were flexible, optimal pricing would collapse to the standard pricing rule of constant markup over marginal costs:

$$p_t(n) = \frac{\theta_N}{\theta_N - 1}\text{mc}_{N,t}(n). \tag{A.12}$$

We simulate structural reforms in the services sector by permanently changing the value of θ_N (nontradables are considered as proxy of services). Greater competition and lower long-run (steady-state) markup correspond to permanently higher values of θ_N. A similar strategy, as illustrated below, is adopted to implement the labor market reforms.

Firms operating in the intermediate tradable sector solve a similar problem. We assume that there is market segmentation. Hence the firm producing the brand h chooses $p_t(h)$ in the Home market and $p_t^*(h)$ in the Foreign market to maximize the expected flow of profits (in terms of domestic consumption units):

$$E_t \sum_{\tau=t}^{\infty} \Lambda_{t,\tau}[p_\tau(h)\, y_\tau(h) + p_\tau^*(h)\, y_\tau^*(h)\, \text{rer}_\tau - \text{mc}_{H,\tau}(h)(y_\tau(h) + y_\tau^*(h))],$$

subject to quadratic price adjustment costs similar to those considered for nontradables and standard demand constraints. The term E_t denotes the expectation operator conditional on the information set at time t, $\Lambda_{t,\tau}$ is the appropriate discount rate, and $\text{mc}_H(h)$ is the marginal cost. The term rer is the Italian real exchange rate, defined as the euro area CPI–to–Italian CPI ratio. The first-order conditions with respect to $p_t(h)$ and $p_t^*(h)$ are

$$p_t(h) = \frac{\theta_T}{\theta_T - 1}\text{mc}_t(h) - \frac{A_t(h)}{\theta_T - 1}, \tag{A.13}$$

$$p_t^*(h) = \frac{\theta_T^*}{\theta_T^* - 1}\text{mc}_t(h)/\text{rer}_t - \frac{A_t^*(h)}{\theta_T^* - 1}, \tag{A.14}$$

where θ_T^* is the elasticity of substitution of tradable intermediate goods in the Foreign country, whereas $A(h)$ and $A^*(h)$ involve terms related to the presence of price adjustment costs $AC_{H,t}^p(h)$ and $AC_{H,t}^{p*}(h)$:

$$AC_{H,t}^p(h) \equiv \frac{\kappa_H^p}{2}\left[\frac{P_t(h)/P_{t-1}(h)}{(P_{H,t-1}/P_{H,t-2})^{\text{ind}_H}} - 1\right]^2 Q_{H,t}, \quad \kappa_H^p \geq 0,$$

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$$AC_{H,t}^{p*}(h) \equiv \frac{\kappa_H^{p*}}{2}\left[\frac{P_t^*(h)/P_{t-1}^*(h)}{(P_{H,t-1}^*/P_{H,t-2}^*)^{\text{ind}_H^*}} - 1\right]^2 Q_{H,t}^*, \quad \kappa_H^{p*} \geq 0,$$

where $\kappa_H^p > 0$ ($\kappa_H^{p*} > 0$) measure the degree of nominal rigidity in the Home (Foreign) country and $0 \leq \text{ind}(\text{ind}_H^*) \leq 1$ is the degree of indexation to previous period sector-specific inflation. If nominal rigidities in the (domestic) export market are highly relevant (that is, if κ_H^{p*} is relatively large), the degree of inertia of Home goods prices in the Foreign market will be high. If prices were flexible ($\kappa_H^p = \kappa_H^{p*} = 0$) and $\theta_T = \theta_T^*$, then optimal price setting is consistent with the cross-border law of one price:

$$p_t(h) = \frac{\theta_T}{\theta_T - 1}\text{mc}_t(h) = p_t^*(h)\,\text{rer}_t. \tag{A.15}$$

A.3. LABOR MARKET

In the case of firms in the nontradable intermediate sector, the labor input $L_N(n)$ is a CES combination of differentiated labor inputs supplied by domestic agents and defined over a continuum of mass equal to the country size ($j \in [0, s]$, $j^* \in (s, 1]$):

$$L_{N,t}(n) = \left(\frac{1}{s}\right)^{1/\psi}\left[\int_0^s L_t(n, j)^{(\psi-1)/\psi}\,dj\right]^{\psi/(\psi-1)}, \tag{A.16}$$

where $L(n, j)$ is the demand of the labor input of type j by the producer of good n and $\psi > 1$ is the elasticity of substitution among labor inputs. Cost minimization implies that

$$L_t(n, j) = \left(\frac{1}{s}\right)\left[\frac{W_t(j)}{W_t}\right]^{-\psi} L_{N,t}(j), \tag{A.17}$$

where $W(j)$ is the nominal wage of labor input j and the wage index W is

$$W_t = \left[\left(\frac{1}{s}\right)\int_0^s W_t(j)^{1-\psi}\,dj\right]^{1/(1-\psi)}. \tag{A.18}$$

Similar equations hold for firms producing intermediate tradable goods. Each household is the monopolistic supplier of a labor input j and sets the nominal wage facing a downward-sloping demand, obtained by aggregating demand across Home firms. The wage adjustment is sluggish because of quadratic costs paid [see Kim (2000)]:

$$\text{AC}_t^W \equiv \frac{\kappa_W}{2}\left[\frac{W_t(j)/W_{t-1}(j)}{(W_{t-1}/W_{t-2})^{\text{ind}_W}} - 1\right]^2 L_t, \tag{A.19}$$

where the parameter $\kappa_W > 0$ measures the degree of nominal wage rigidity and L is the total amount of labor in the Home economy, while $0 \leq \text{ind}_W \leq 1$ represents the parameter of indexation to previous period wage inflation in the overall economy.

A.4. HOUSEHOLDS' OPTIMIZATION

In each country there is a continuum of symmetric households. Home households are indexed by $j \in [0; s]$ and Foreign households by $j \in (s; 1]$, the same indexes of labor

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inputs. Households' preferences are additively separable in consumption and labor effort. Households receive utility from consuming and disutility from working L_t hours. The expected value of household j lifetime utility is given by

$$E_0\left\{\sum_{t=0}^{\infty}\beta^t\left[\frac{(C_t(j)-hC_{t-1})^{1-\sigma}}{(1-\sigma)}-\frac{1}{\tau}L_t(j)^{\tau}\right]\right\},$$

where E_0 denotes the expectation conditional on information set at date 0, β is the discount factor ($0<\beta<1$), $1/\sigma$ is the elasticity of intertemporal substitution ($\sigma>0$), $1/(\tau-1)$ is the labor Frisch elasticity ($\tau>0$), and b ($0\le h\le 1$) is the parameter of external habit.

The budget constraint of agent j is

$$\frac{B_t(j)}{(1+i_t)\mu_t}-B_{t-1}(j)\le\Pi_t^P(j)+R_t^K K_{t-1}(j)+W_t(j)L_t(j)-P_tC_t(j)-P_tI_t(j)$$
$$-AC_t^W(j)-TAX_t(j).$$

Home agents hold a bond, B, denominated in the currency of the monetary union. The short-term nominal rate i_t is paid at the beginning of period t and is known at time t. It is directly controlled by the monetary authority. The bond is traded with Foreign agents. A financial friction μ_t is introduced to guarantee that net asset positions follow a stationary process and the economy converge to a steady state. The variable μ_t is defined as

$$\phi_{B1}\frac{\exp(\phi_{B2}B_t/GDP_t)-1}{\exp(\phi_{B2}B_t/GDP_t)+1}.$$

Revenue from financial intermediation is rebated in a lump-sum way to Foreign agents [see Benigno (2001)]. Home agents accumulate physical capital, which they rent to Home firms at the nominal rate R^k. The law of motion is

$$K_t(j)=(1-\delta)K_{t-1}(j)+\left[1-AC_t^I(j)\right]I_t(j),$$

where δ is the depreciation rate. Investment growth is subject to adjustment costs:

$$AC_t^I(j)=\frac{\phi_I}{2}\left[\frac{I_t(j)}{I_{t-1}(j)}-1\right]^2.$$

Home agents own all Home firms and there is no international trade in claims on firms' profits. The variable $\Pi^P(j)$ includes profits accruing to Home households. Finally, Home agents pay lump-sum (nondistortionary) net taxes $\mathrm{TAX}_t(j)$. Similar relations hold in the Foreign country, with the exception of the intermediation frictions in the financial market. The Home household j chooses bond holdings, capital, investment, consumption, and wage paths to maximize its expected lifetime utility subject to budget constraint, the capital accumulation law, and the demand for labor by firms. The resulting Euler equation for consumption is

$$\lambda_t(j)=(1+i_t)\beta E_t\lambda_{t+1}(j)\frac{P_t}{P_{t+1}}, \tag{A.20}$$

where

$$\lambda_t(j)=[C_t(j)-bC_{t-1}]^{-\sigma} \tag{A.21}$$

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is the Lagrangean multiplier of the budget constraint. The first-order conditions with respect to $I_t(j)$ and $K_t(j)$ are standard. The first-order condition with respect to $W_t(j)$ involves terms related to the presence of wage adjustment costs. Absent these costs, the real (in units of domestic consumption) wage would be equal to a constant markup, $\theta_W/(\theta_W - 1)$, proportional to the elasticity of substitution between labor varieties θ_W, over the marginal rate of substitution between consumption and labor:

$$\frac{W_t(j)}{P_t} = \frac{\theta_W}{(\theta_W - 1)} L_t^{\tau-1}(j)\,\lambda_t^{-1}(j).$$

As for services, we simulate structural reforms in the labor market by permanently changing the value of θ_W. Greater competition and lower long-run (steady-state) markup correspond to permanently higher values of θ_W.

A.5. PUBLIC SECTOR

We assume that aggregate public expenditure G consists of consumption goods and is financed through net lump-sum taxes $\mathrm{TAX}_t(j)$. For simplicity we assume that there is no public debt. The budget constraint of the Home government is

$$P_t G_t = \int_0^s \mathrm{TAX}_t(j)\,dj. \tag{A.22}$$

The monetary authority controls the short-term rate according to a Taylor rule of the form

$$\left(\frac{1+i_t}{1+i}\right) = \left(\frac{1+i_t}{1+i}\right)^{\rho_i} (\Pi_{MU,t})^{(1-\rho_i)\rho_\pi} \left(\frac{\mathrm{GDP}_{MU,t}}{\mathrm{GDP}_{MU,t-1}}\right)^{(1-\rho_i)\rho_{\mathrm{GDP}}}. \tag{A.23}$$

The parameter ρ_i $(0 < \rho_i < 1)$ captures inertia in interest rate setting, whereas the parameters ρ_π and ρ_{GDP} are respectively the weights of the currency union's CPI inflation rate $\Pi_{MU,t}$ and GDP $\mathrm{GDP}_{MU,t}$. The CPI inflation rate is a geometric average of CPI inflation rates in the Home and Foreign country (respectively Π_t and Π_t^*) with weights equal to the correspondent country size:

$$\Pi_{MU,t} \equiv (\Pi_t)^s (\Pi_t^*)^{1-s}. \tag{A.24}$$

The unionwide GDP is the sum of the Home and Foreign GDPs (respectively GDP_t and GDP_t^*), expressed in terms of Italian consumption units:

$$\mathrm{GDP}_{MU,t} \equiv \mathrm{GDP}_t + \mathrm{GDP}_t^* \mathrm{rer}_t. \tag{A.25}$$

A.6. MARKET CLEARING

The model is closed by imposing the following resource constraints and market clearing conditions. The resource constraint for the Home nontradable final consumption good is

$$\int_0^s A_t(x)\,dx \geq \int_0^s C_t(j)\,dj + G_t. \tag{A.26}$$

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The resource constraint for the Home nontradable final investment good is

$$\int_0^s E_t(x)\,dx \geq \int_0^s I_t(j)\,dj. \tag{A.27}$$

The resource constraint for good n is

$$N_t^S(n) \geq \int_0^s Q_t(n,x)\,dx. \tag{A.28}$$

The Home tradable h can be used by Home firms or imported by Foreign firms:

$$T_t^S(h) \geq \int_0^s Q_t(h,x)\,dx + \int_s^1 Q_t(h,x^*)\,dx^*. \tag{A.29}$$

The resource constraints for factor market are

$$\int_0^s L_t(j)\,dj \geq \int_0^s L_t(n)\,dn + \int_0^s L_t(h)\,dh, \tag{A.30}$$

$$\int_0^s K_{t-1}(j)\,dj \geq \int_0^s K_t(n)\,dn + \int_0^s K_t(h)\,dh. \tag{A.31}$$

The bond market clearing condition is

$$\int_0^s B_t(j)\,dj + \int_s^1 B_t(j^*).dj^* = 0. \tag{A.32}$$

A.7. THE EQUILIBRIUM

We find a symmetric equilibrium of the model. In each country there is a representative agent and four representative sectorial firms (in the intermediate tradable sector, intermediate nontradable sector, consumption production sector, and investment production sector). The equilibrium is a sequence of allocations and prices such that, given initial conditions and the sequence of exogenous shocks, each private agent and firm satisfy the corresponding first-order conditions, and the private and public sector budget constraints and market clearing conditions for goods, labor, capital, and bonds hold.

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