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Measuring the effects of structural reforms in Malta

By Brian MICALLEF †

Abstract. Structural reforms are crucial to boost an economy's long-term growth potential, enhance its resilienceand increase its flexibility to adjust to adverse shocks. Malta has implemented a number of reforms in recent years, both to its labour and product market, which could in part explain its stellar growth performance after the crisis. Furthermore, EU membership has facilitated the inflow of foreign labour that helped to address critical labour and skill shortages. This paper quantifies the macroeconomic effects of structural reforms in labour and product markets using EAGLE, a large scale multi-country DSGE model, calibrated for the Maltese economy, as a small and open economy in a monetary union. The results show that a 10 percentage point reduction in product and labour mark-ups raises GDP by more than 5% in the long-run. The implementation of the reforms in isolation is associated with adjustment costs but the joint implementation of reforms can, to a large extent, soften the transition costs associated with the reforms. The results are robust to varying levels of mark-ups and different parameterization of the model. A key driver behind this finding is the adjustment in the labour market. This calls for policies to further reduce skill mismatches and for incentives that attract and retain more people in the labour market.
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JEL. C53, E27, F41, F47.

1. Introduction

There is a broad consensus among policymakers that structural reforms are needed to raise an economy's long-run potential growth and increase its flexibility to adjust to adverse shocks. In Europe, the implementation of these reforms, especially in product and labour markets, has become more urgent in the aftermath of the 2009 financial crisis and the 2012 European sovereign debt crisis, which had a persistent adverse effect on the potential growth in a number of EU countries. These effects can be exacerbated by prospects of an ageing population that are expected to reduce the labour force in the coming decades.

Structural reforms have long been identified as key ingredients to unlock Malta's growth potential. Located in the Mediterranean Sea, Malta is the smallest and one the most open member of the euro area, with a population of around 475,000 inhabitants. The economy's potential growth rate almost halved in the 2000s compared to the 1990s (Grech & Micallef, 2015; Micallef & Ellul, 2017). However, a process of economic

† Research Department, Central Bank of Malta, Malta.
☎. +923341369578 ✉. micallefb@centralbankmalta.org

diversification, mostly as a result of EU membership, and numerous structural reforms have led to a sharp rebound in potential output and increased the flexibility and resilience of the Maltese economy to foreign disturbances (Grech, 2015; Grech *et al.*, 2018). As a result, Malta registered one of the best performances among EU countries after the crisis, with real GDP growth averaging 7.2% between 2013 and 2018. At the end of 2018, real GDP stood at more than 60% above its pre-crisis level in 2008.

This growth momentum was underpinned by a number of reforms. In the energy sector, the authorities took bold reforms to diversify the island's energy mix and increase the efficiency of its electricity production, including the installation of an interconnector linking Malta's energy grid to Italy's and the conversion of one of the country's power stations from heavy fuel oil to gas (Rapa, 2017). In tourism, a traditional economic pillar of the Maltese economy, the introduction of low cost airlines in the late 2000s has dramatically increased the connectivity of the island to mainland Europe (Attard, 2019). Labour market reforms have played an important role in raising the country's supply potential (Micallef, 2017a, 2017b). Since the mid-2000s, Malta registered the largest increase in the female participation rate among EU countries as a result of numerous initiatives intended to attract more females to the labour market, including tax incentives and free child care centers (Micallef, 2018). EU membership facilitated the inflow of foreign labour, which was critical to address labour and skill shortages (Grech, 2017). The share of foreign workers in Malta increased from less than 3% at the time of EU membership in 2004 to 22% in 2018. While nowadays these foreign workers can be found in almost all sectors, they remain especially concentrated in both ends of the skill spectrum. Furthermore, the authorities also introduced a number of targeted training schemes to strengthen the employability prospects of certain target groups, while otherinitiatives were taken to reduce the reliance of long-term unemployed on the unemployment benefits and facilitate their integration in the labour market.

Against this background, this paper presents a unifying framework to quantify the impact of structural reforms aimed at increasing competition in Malta's product and labour markets using a dynamic stochastic general equilibrium (DSGE) model. In recent years, DSGEs have become the benchmark models in the literature to evaluate the impact of structural reforms and are regularly used both by academia and policy institutions. In this study, I use a calibrated version of EAGLE model, a multi-country dynamic general equilibrium model (Gomes *et al.*, 2010).[2] The key setting is the monopolistic competitive framework in product and labour markets, through which the effectiveness of structural reforms can be assessed on the basis of the reduction in mark-ups on prices and wages brought about by the increased competition in these markets.

[2]EAGLE stands for Euro Area and Global Economy model.

The rest of the paper is structured as follows. Section 2 provides a brief literature review, while Section 3 presents an overview of the EAGLE model. Section 4 documents the calibration of EAGLE for the Maltese economy and Section 5 simulates the model to assess the effects of structural reforms in the product and labour markets. Section 6 concludes. Appendix A provides additional details on the calibration of the model.

2. Literature review

This study is related to the extensive and growing literature on the macroeconomic effects of structural reforms using DSGE models (Forni *et al.*, 2010; IMF, 2016; Andres *et al.*, 2017). On the basis of existing OECD empirical studies, Bouis & Duval (2012) document that structural reforms – which is a broad 'catch-all' phrase that captures everything from product market regulation, employment protection legislation, unemployment benefits system to labour taxes – are associated with long-run gains in output, productivity and employment.

Blanchard & Giavazzi (2003) study the effects of product and labour market deregulation using a DSGE model with rents and bargaining, with the intention of proposing an 'optimal timing' of reforms. Bayoumi *et al.*, (2004) analyse the effects of increasing competition in the euro area using a 2-country version of the IMF's Global Economy Model (GEM). However, they do not focus on country-specific reforms and do not make a distinction between reforms in the tradable and non-tradable sectors of the economy.

Everaert & Schule (2007) use a similar version of GEM but focus on various sectors and international spillovers. Using a DSGE model for a small and open economy in a monetary union, Almeida *et al.* (2008) find that a reduction in non-tradable goods prices and wage mark-ups has non-negligible positive impact on economic activity, consumption and hours worked, reflecting an improvement in the country's international competitiveness. Similar studies for larger euro area countries, such as Forni *et al.* (2010) for Italy, reach similar conclusions.

This study is mostly related to Gomes *et al.* (2011), who use EAGLE to study the impact of structural reforms in product and labour markets. Given its multi-country setting, Gomes *et al.* (2011) find that cross-country coordination of reforms produces larger and more evenly distributed positive effects for a monetary union than if pursued by a single country. This study does not address which specific reforms will achieve the desired level of competition. Another concern is that the impact of structural reforms on mark-ups is not easily measurable and requires a detailed assessment of the specific reform in question. International comparisons are not very helpful either, since the effects of a particular reform depend on country-specific characteristics, such as the design and enforcement of the reform, existing institutions and legal framework and the size and openness of the economy.

The EAGLE model has been used extensively for policy work and research projects in recent years. ECB (2012) focuses on the international dimension of the model to analyse imbalances and competitiveness issues. Taking advantage of its fiscal rich environment, Gomes *et al.* (2010) apply the model to analyse the use of temporary fiscal policy stimulus to overcome the zero lower bound, while Kilponen et al. (2019) studies the fiscal consolidation multipliers for a number of EU countries. Kolasa (2010) and Brzoza-Brzezina *et al.* (2010) use EAGLE to analyse convergence problems within the euro area and in accessing countries. In Alves *et al.* (2009), EAGLE is used to analyse the mechanics of adjustment inside the euro area by simulating both common and country-specific shocks hitting the monetary union.

3. The EAGLE model

3.1. Theoretical framework

The theoretical framework of EAGLE builds on the ECB's New Area Wide Model (Christoffel *et al.*, 2008) and the IMF's GEM (Laxton & Pesenti, 2003). It is based on the open economy version of the new Keynesian paradigm, designed to analyse the interdependencies arising from trade in goods and financial assets, including the transmission of both domestic and external shocks. This is a relevant topic in a monetary union, where monetary policy is conducted taking into consideration euro area-wide performance while other policies, such as fiscal and structural, are mainly conducted at a national level.

EAGLE covers four regions of the world economy, two of which inside a monetary union and thus share a common monetary and exchange rate policy. The model is thus well-suited to assess the implications of the common monetary policy and country-specific characteristics for the transmission of country-specific or common shocks in the euro area. The two non-monetary union blocks – the US and the rest of the world – allow for the analysis of the role of the euro exchange rate and extra-euro area trade in the transmission of shocks outside the euro area. With few exceptions, each region is modelled in a symmetric fashion. The regions are linked by bilateral trade relations and international financial markets, which are assumed to be incomplete, thus allowing only for imperfect risk sharing across countries. In addition to fiscal and monetary policy, the model also incorporates a rich set of nominal and real rigidities.

On the supply side, the model distinguishes between two types of firms, those producing intermediate-goods and those producing final-goods. Intermediate-goods firms produce tradable and non-tradable goods. Final-goods producing firms operate in a perfectly competitive market and take the prices of intermediate goods as given to produce three different goods: a private consumption good, a private investment good and a public consumption good. Final-goods are bundled using intermediate domestic goods and imports.

Intermediate-goods firms operate in a monopolistically competitive environment. The degree of market power depends on the price elasticity of demand, which determines the degree of competition in the intermediate goods market. Mark-ups are inversely related to the degree of substitutability between the different varieties and therefore, to the degree of competition in the respective sectors.

Price contracts are staggered a la Calvo to introduce sluggish price adjustment. In their pricing, firms distinguish between the domestic and the foreign markets. In particular, export prices are set in the currency of the destination market, better known as local currency pricing. Together with sticky prices, this setup limits the degree of nominal exchange rate pass-through to import prices in the short-to-medium run.

In addition, the model features adjustment costs, bothto investment and imports, as well as habit formation to capture the degree of persistence observed in aggregate data and to generate realistic dynamics.

Turning to households, the model distinguishes between two types, Ricardian ones (labelled I-type households) and those that are liquidity constrained (labelled J-type households). Optimizing households have access to financial markets and smooth consumption by trading two types of riskless nominal bonds. One type of bond is denominated in euro and traded across the euro area while the other one is denominated in foreign currency (US dollar) and traded internationally. The uncovered interest rate parity condition holds and determines the exchange rate between the euro and the worldwide core currency (assumed to be the US dollar) subject to an endogenous risk premium depending on the net foreign asset position. Optimizing households also accumulate physical capital and rent their services to firms and hold money for transaction purposes. Liquidity constrained households cannot trade in financial and physical assets. In each period, they consume their disposable income and their only source of income is the labour supplied to domestic firms. These households allow for Keynesian effects of public expenditure in EAGLE since Ricardian equivalence does not hold for them.

Both types of households supply differentiated labour to domestic intermediate-good firms in a monopolistic manner, thereby exerting limited bargaining power and charge mark-ups over the marginal rate of substitution between consumption and leisure. Wages are assumed to be sticky a la Calvo with indexation.

There is a monetary and a fiscal authority in each country although, in the case of the two euro area countries, they share a single common monetary authority. Monetary policy is conducted by a Taylor-type interest rate rule specified in terms of annual CPI inflation and quarterly output growth. In the monetary union, the single central bank targets a weighted (by regional size) average of the regional macroeconomic variables. Regions in the monetary union share both a nominal interest rate and a nominal exchange rate against non-euro area countries.

The fiscal authority purchases a public good, which is fully biased towards non-tradable intermediate goods, and finances its expenditure by issuing bonds and levying taxes. Taxes can be either lump-sum or distortionary. In the latter case, the model distinguishes between taxes on consumption purchases, labour income, capital income and dividends. In addition, the fiscal authority makes transfers to households and earns seigniorage on outstanding money holdings. A fiscal rule guarantees the stability of public debt. In the case of the two countries belonging to the monetary union, fiscal policies are region-specific.

3.2. The role of mark-ups in product and labour markets

The key mechanism to assess the impact of structural reforms in a general equilibrium framework is the monopolistic competitive setup in the intermediate goods and labour market.

In a perfectly competitive environment, prices are equal to the marginal costs of production. In a monopolistic competitive environment, however, since there are a number of firms that offer different products that are imperfect substitutes, firms are able to introduce a mark-up between prices and marginal costs. In EAGLE, the elasticity of substitution between products of different firms determines the degree of market power. The first order condition for price setting in the steady state is the following:

$$P_Y = \frac{\theta_Y}{(\theta_Y - 1)} MC, \;\; \theta_Y > 1$$

where P_Y is the price of the intermediate good Y and MC is the marginal cost of producing Y. The mark-up is $\frac{\theta_Y}{\theta_Y - 1}$ and depends negatively on the elasticity of substitution between different products, θ_Y. For example, a low elasticity of substitution, say 3, will imply a mark-up of 50%, whereas a higher elasticity of substitution, say 9, will imply a mark-up of 12.5%. Thus, the higher the degree of substitutability, the lower the implied mark-up and the higher the production level for a given price.

Imperfect competition in the labour market is modelled in a similar fashion. Each household offers a specific kind of labour service that is an imperfect substitute with the services offered by the other households and sets wages in order to maximize utility. Lower degree of substitutability can be due to skill differences or anti-competitive labour market regulation. The elasticity of substitution between the different labour bundles determines the market power of households to set wages. In EAGLE, the first order condition for labour supply L in the flexible-price equilibrium is:

$$\frac{W}{P} = \frac{\theta_L}{(\theta_L - 1)} \lambda^{-1} L_t^{\tau}, \;\; \theta_L > 1$$

where W/P is the real wage expressed in units of domestic consumption, λ is the marginal utility of consumption and τ is the inverse of the Frisch

elasticity of labour supply. The latter elasticity refers to the elasticity of hours worked to changes in the real wage, holding the marginal utility of consumption constant. The mark-up is $\frac{\theta_L}{\theta_L - 1}$ and depends negatively on the elasticity of substitution between the different labour varieties θ_L.

4. Calibration

The calibration of the model for the Maltese economy captures crucial differences with respect to Germany, the monetary union country in the original calibration of EAGLE in Gomes *et al.,* (2010). These refer mainly to the size of the economy, its openness, the geographical structure of trade, taxation and the weight of the tradable and non-tradable sectors.

In general, the calibration strategy can be divided in two parts. First, a subset of parameters governing key steady-state ratios is calibrated using their empirical counterparts. Next, I calibrate the remaining parameters of the model drawing heavily on the original version of EAGLE, which in turn can be traced back to the parameterization of NAWM and GEM. Unless otherwise stated, the calibration for the remaining three regions is left unchanged from the original version.

4.1. Steady-state values

The relative size of each economy is calibrated to reflect its GDP share in the world economy. The calibration ensures that Malta is an extremely small fraction of the euro area economy and that domestic developments have no impact on the other economies.[3] For the steady state ratios, data for Malta corresponds to the average of the period 2000-2015 and is derived from the National Accounts statistics in Eurostat. The share of private consumption in Malta is calibrated at 65% of GDP, which is higher than the corresponding ratio for the euro area. On the contrary, the shares of investment and public expenditure are lower than in the euro area, averaging 19.5% and 20%, respectively. Given these values, the trade balance is broadly in balance, reflecting a period of trade deficits in the 2000s and surpluses in more recent years.

In view of Malta's changing trade patterns, the total import shares of each region were averaged over a shorter period of time. Bilateral imports to Malta were carefully calibrated to match the country's bilateral export structure, which in EAGLE is endogenously calculated. In particular, the calibration closely captures the asymmetry in Malta's trade structure, with more than half of Malta's imports coming from the euro area but only around a third of its exports being directed towards it. Further details are available in Appendix A.

[3] Since the numerical algorithm to compute the steady state equilibrium requires a non-zero entry, the size of Malta in the global economy had to be artificially increased. This feature does not have any impact on the dynamics of the model. More importantly, developments in Malta do not have any impact on the rest of the euro area or the rest of the world.

The quasi-shares of non-tradables in final consumption and investment goods were calculated from Lombardo and Ravenna (2010). This study shows that the tradable component of consumption and investment in small open economies is higher than that of larger economies. The calibration ensures that Malta's tradable sector, which comprises not only primary commodities and manufacturing but also tradable industries in the services sector, is higher than the tradable sector of the three other regions in EAGLE and consistent with the calibrated import-to-GDP ratio.

4.2. Mark-ups

Studies on the empirical estimates of mark-ups in Malta are scarce. Borg (2009) estimates and compares mark-ups in products markets among 22 European countries, including Malta, for the period 1995-2005. According to this study, the average markup in Malta's product market is estimated at 1.32 (i.e. 32%), the sixth highest among the countries considered. Mark-ups are found to be heterogenous among sectors, being higher in the services sector compared to the manufacturing industries. Sectors that are characterised by strong network effects, such as retail, wholesale and the electricity, gas and water sectors, tend to display higher markups. For services industries, the mean mark-up is estimated at 1.5 and the median at 1.4, while for the manufacturing sector, the mean and median mark-ups are estimated at 1.3 and 1.2, respectively. In ECB (2011), retail sector regulation in Malta turned out to be relatively high compared to most other European countries, thus confirming the findings by Borg (2009) in this respect.

In the baseline calibration, the elasticity of substitution between different product varieties in the non-tradable sector in Malta is set at 3, which implies a mark-up of 50%. For the tradable sector, the elasticity of substitution is set at 6, which implies a mark-up of 20%.

Empirical estimates of labour mark-ups for Malta are not available. In the literature, estimates of wage mark-ups usually rely on inter-industry wage differentials in OECD countries (Jean and Nicoletti, 2002). Anecdotal evidence however suggests that mismatches between the demand and supply for particular skills, especially for jobs in high value added sectors, are present in Malta's labour market. For instance, education attainment statistics, such as the number of people with only a compulsory level of education and early school leavers, rank Malta at the lower end of the tables when compared with other EU countries. Shortages in specific segments of the labour market are evident by the inflow of foreign workers in Malta. In the baseline calibration, the elasticity of substitution between different labour varieties is set at 4.33 in line with Gomes *et al.* (2011), which implies a mark-up of 30%.

Mark-up values for the other countries were left unchanged from the original version of EAGLE. Mark-ups in the euro area are calibrated at 20% in the tradable sector, 30% in the labour market and 50% in the non-tradable sector. In the US and rest of the world, the corresponding mark-

ups are set at 20%, 16% and 30%, respectively.[4] Thus, mark-ups in the non-tradable sector and the labour market in Malta and the euro area are higher than the corresponding values in the US and the rest of the world, implying a lower degree of competition in these markets.

4.3. Other parameters

The tradable sector is assumed to be more capital intensive than the non-tradable sector. In addition, the capital share in Malta's production functions – both in the tradable and non-tradable sectors – is calibrated at a higher value (40% and 35%, respectively) compared to the other regions (35% and 30%, respectively). This is broadly in line with the evidence that Malta's share of compensation per employee to Gross Value Added over the past decade is lower than the equivalent euro area average. It also ensures that the share of labour in GDP is around 54%, which is broadly equivalent to the share of compensation of employees in gross value added over the past decade (Grech & Micallef, 2016).

A number of parameters are assumed to be the same across the four regions and broadly consistent with the original version of EAGLE. Calvo probabilities on the labour and domestic product markets are set at 0.75 for all regions, implying an average time between wage and price re-optimization of four quarters. For Malta, this is broadly consistent with the findings of the Wage Dynamics Network (Micallef & Caruana, 2017). For the euro area, this value is consistent with the findings of the Inflation Persistence Network but on the low side of estimates of price stickiness from estimated DSGE models, such as Smets & Wouters (2003) and Christoffel *et al.,* (2008). 5 Price and wage indexation were set at 0.5 and 0.75, respectively. The degree of substitutability between domestic and imported tradables is higher than that between tradables and non-tradables, consistent with existing literature. In particular, the elasticity of substitution between tradables and non-tradables is set at 0.5, while the elasticity between domestic and imported tradables in Malta is calibrated at 1.5. The latter elasticity is lower than the calibrated value of 2.5 set for the other three regions to account for the fact that as a small and open economy, the choices of Maltese households and firms between consuming/investing domestic and imported goods are rather limited.

In the absence of data, the calibrated parameters related to households were largely left unchanged from the original version of EAGLE. The share of non-Ricardian households is calibrated at 25% and habit formation is set at 0.6. The discount factor, the intertemporal elasticity of substitution and

[4] These values are in line with other existing similar studies in the literature, such as Gomes *et al.,* (2011), Bayoumi *et al.,* (2004), Farquee *et al.,* (2007) and Everaert & Schule (2008).

[5] Gomes *et al.,* (2010, 2011) calibrate the Calvo price parameter at 0.92, which implies that prices are changed on average every 2.5 years. This calibration is derived from Smets & Wouters (2003) and Christoffel *et al.,* (2008) but is in contrast with micro evidence. Christoffel *et al.,* (2008) explain that such a high estimate is reflective of a flat Phillips Curve rather than an extremely high degree of nominal rigidity.

the Frisch elasticity were set respectively for all regions at 0.9926 (implying a steady-state annualized real interest rate of about 3%), 1 and 0.5. The quarterly depreciation rate of capital is set at 0.025 for all regions, consistent with an annual depreciation rate of 10%.

The adjustment cost parameters are taken directly from the original version of EAGLE. The only difference is the lower import adjustment parameter of consumption goods in Malta, which reflects the country's higher import content and reliance on imported goods.

Turning to monetary policy, the response to inflation and output growth is calibrated at 1.7 and 0.1, respectively, while the interest rate smoothing parameter is set to 0.87. Long-run inflation targets are set equal across all regions at 2% per annum.

As for the fiscal parameters, the response of the share of lump-sum taxes in nominal output to deviation of the public debt-to-output ratio (60% on an annual basis) is set at 0.1, in line with the original version of EAGLE. I also maintain the original version of EAGLE assumption on asymmetric distribution of lump sum transfers and taxes across the two types of households, favouring those with limited access to capital markets in the proportion of 3 to 1.VAT and income tax are broadly similar between Malta and the euro area but social security contributions are substantially lower in Malta. In line with the evidence from 'Taxation Trends in the European Union', the contribution of Maltese employees and employers to SSC is set at around two thirds and one third of the euro area average, respectively.[6]

5. Model simulations

The re-calibrated version of EAGLE is used to assess the macroeconomic impact of reforms aimed at increasing competition in the Maltese non-tradable goods and labour markets.

The setup of the simulation builds on Gomes *et al.*, (2011). In the baseline version, the respective elasticities of substitution are set as exogenous parameters but are endogenized for the purposes of the simulation. The impact of the structural reforms is assessed by permanently increasing the parameters governing the elasticity of substitution between product and labour varieties, thereby increasing competition in these markets. The shocks are modelled as AR(1) processes and the persistence parameter determines the time it takes for the elasticities of substitution to converge to the new equilibrium value. In all simulations, the persistence parameter is set at 0.7, which implies that the reforms are implemented gradually over a period of around four years. It is assumed from the outset that households and firms have perfect foresight, thereby eliminating any uncertainty concerning the credibility of the reforms.[7]

[6] The steady-state tax rates refer to the tax wedges published by the OECD. The figures for the euro area are taken from Coenen, McAdam & Straub (2008).

[7] Similar assumptions are common in the literature, especially when the simulations involve large scale models, since they simplify the computation. See for instance Gomes *et al.*, (2011) and Almeida *et al.*, (2008)

For each simulation, I report the long-run (steady state) values of the main macroeconomic variables and the transition dynamics from the initial steady state to the new one following a 10 percentage point reduction in mark-ups. The results are reported both when the reforms are implemented in isolation, jointly and in conjunction with the rest of the euro area. Finally, I assess the robustness of the results by performing a sensitivity analysis by changing the values of some key parameters.

Table 1 summarizes the main results.

Table 1. *Long run effects of reforms: 10 p.p. reduction in mark-ups (percent deviations from baseline)*

	NT	W	NT+W	Spillovers
Real activity				
GDP	2.1	3.3	5.5	6.0
Consumption	1.1	3.1	4.2	5.7
Investment	3.2	1.5	4.8	6.1
Exports	0.8	4.0	4.7	5.4
Imports	0.5	2.3	2.7	4.4
Labour market				
Hours	0.9	3.4	4.3	4.2
Real wage	3.5	-1.6	1.9	3.0
International relative prices				
REER	2.8	0.7	3.6	1.7
Terms of trade	0.3	1.6	1.9	1.8
Spillovers to EA				
GDP	0.0	0.0	0.0	-

Note: NT refers to Non-Tradable Sector, W to the Labour reform, NT+W to the simultaneous non-tradable and labour market reforms. Spillovers refer to the additional gains if reforms are implemented simultaneously in the rest of the euro area as well.

5.1. Non-tradable sector reforms

The first column of Table 1 shows the long-run results of reducing the mark-up in the Maltese non-tradable sector by 10 percentage points i.e. from 50% to 40%. In line with other studies in the literature, the overall macroeconomic impact of the reforms is sizeable.

In the long-run, GDP increases by 2.1% compared to the baseline case of no reforms. The increase is driven mainly by investment and to a lesser extent, consumption and exports. Anticipating higher future demand, firms increase the demand for capital and labour, triggering an increase in hours worked and wages as labour becomes relatively scarce. Real wages and hours worked increase by 3.5% and 0.9%, respectively. The excess supply of Maltese services leads to a depreciation of the real effective exchange rate. The deterioration in the terms of trade is however less pronounced due to the increase in the prices of domestic tradable goods. The two channels that lead to higher prices of domestic tradable goods are the following. First, the increased demand for factor inputs raises marginal costs in the tradable sector which is not subject to lower mark-ups. Second, since tradable and non-tradable goods and services are complements, higher demand for non-tradables will also exert an upward pressure on the demand for tradable goods and therefore, higher prices. Higher aggregate

demand drives up imports, which increase by 0.5% in the long run. In light of the small size of the Maltese economy, spillovers to the rest of the euro area and the world are negligible.

Figure 1 illustrates the transition dynamics from the initial to the new steady state. Compared to the long-run, there are short-term costs associated with the reforms. In particular, the non-constrained households anticipate that services will be cheaper in the future and thereby postpone consumption to future periods. On the other hand, consumption by the liquidity constrained households increases immediately. Given the larger share of the non-constrained households, overall consumption is temporarily lower, lasting for around two to three years. Firms gradually start to increase demand for capital in order to raise their stock of capital in anticipation of higher future production. The increased demand for labour leads to a gradual increase in the real wage and hours worked, although the latter reacts sluggishly in the first few quarters after the start of the reforms. Higher competition in the non-tradable sector leads to lower price pressures, driving inflation below equilibrium in the short to medium term. With unchanged nominal interest rates, this leads to temporary higher real interest rates, further encouraging the non-constrained households to postpone consumption.

The gradual increase in output towards its new long-run level is mainly driven by higher production of non-tradables. Higher real wages in both the tradable and non-tradable sector exert upward pressures on export prices, while at the same time, exports do not benefit from an increase in foreign demand as spillovers to the rest of the world are negligible. As a result, I observe a slight appreciation of the terms of trade, which explains the sluggish performance of exports. Imports also decline temporarily given the initial decline in consumption. The trade balance initially improves as domestic demand declines in the first few quarters after the reform but subsequently deteriorates over the medium term as domestic demand picks up while exports remain sluggish for a longer period of time.

5.2. Labour market reforms

The second column of Table 1 shows the long-run results of reducing mark-ups in the Maltese labour market from 30% to 20%. There are noticeable differences in terms of the effects of this reform from the previous one on the main macroeconomic variables.

Focusing first on the long-run results, the increase in GDP is more pronounced with labour market reforms as compared to the product market reforms. GDP increases by 3.3% compared to the baseline scenario of no-reform, driven mainly by exports and consumption, which increase by 4.0% and 3.1%, respectively. The main differences are found in the labour market. In particular, labour market reforms lead to an increase in hours worked and a reduction in real wages, due to the increased supply of labour. This contrasts with the reform in the non-tradable sector but is in line with similar studies in the literature (Blanchard and Giavazzi, 2003;

Gomes *et al.*, 2011). Hours worked also increase more rapidly since firms have a stronger incentive to use labour input given the decline in the real wage. The deterioration in the terms of trade is stronger than the real effective exchange rate since the decline in the prices of non-tradables is less pronounced. Lower real wages also translate in lower marginal costs for firms, thereby pushing down export prices. The higher price competitiveness stimulates exports, which become the main driver of growth.

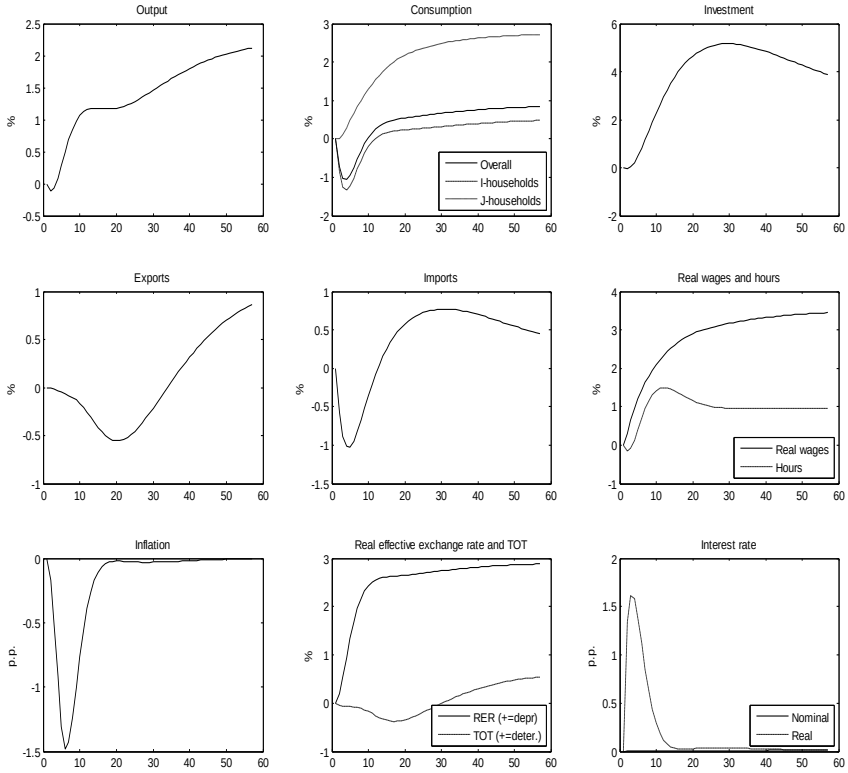

Figure 1. *Product market reform – Transition dynamics*

Imports increase more as well, given the increase in aggregate demand and lower real exchange rate depreciation. As in the other simulation, spillovers to the rest of the euro area are negligible.

Figure 2 illustrates the effects of reforms in Malta's labour market along the transition path to the new steady state. As firms anticipate that labour costs will be lower in the future and that the labour supply will increase, they start to adjust the capital stock, inducing an increase in investment and labour demand. Real wages decline for around two years, after which they settle to the new, albeit lower, equilibrium. The decline in wages lowers firms' marginal costs, pushing inflation below its equilibrium level in the short to medium run. Consistently, Malta's terms of trade deteriorate to a greater extent. Nominal interest rates remain unchanged as the euro area variables are not affected by the Maltese reforms. Higher labour income in response to the increase in hours worked boosts consumption by

both types of households, though it is partially offset by lower wages and an increase in the real interest rate. Exports benefit from the depreciation of the real effective exchange rate, as the increase in the supply of labour translates into excess supply in the goods market. Imports also increase given the higher aggregate demand.

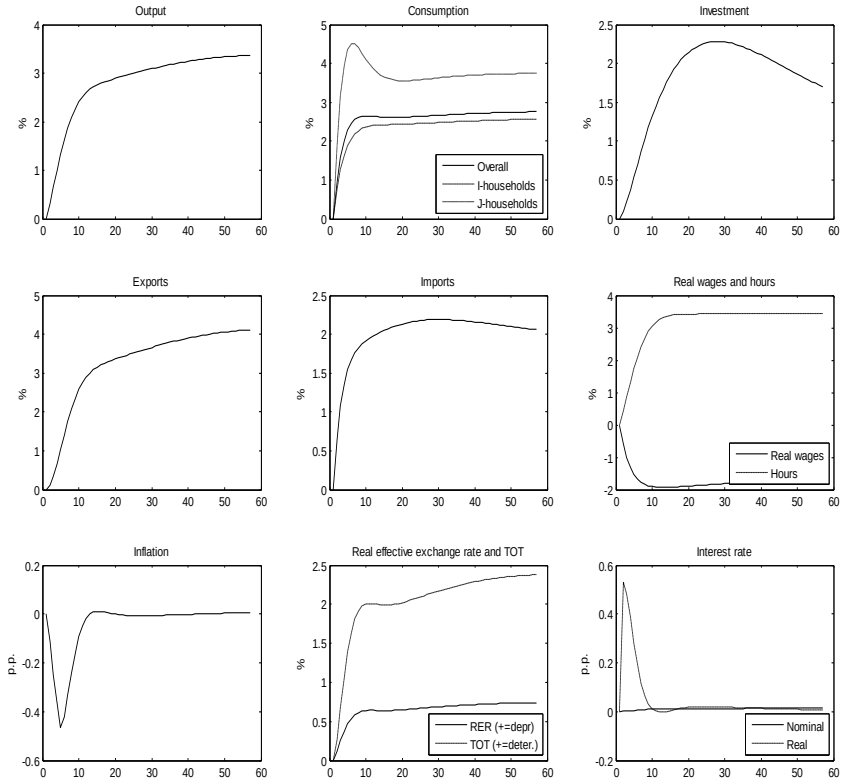

Figure 2. *Labour market reform – Transition dynamics*

5.3. Non-tradable and labour market reform

The previous simulations focused on the two reforms being carried out separately. The third column of Table 1 reports on the long-run effects of the two reforms being implemented simultaneously. The results are more or less additive since the non-tradable mark-up and the wage mark-up are uncorrelated in the model. In general, one would typically also expect that higher competition will also induce productivity gains, for example, through the transfer of resources from inefficient production units to more efficient ones or due to foreign direct investment (Jean & Nicoletti, 2002). If this is indeed the case, the long-run gains reported in Table 1 are likely to be on the low side of what should be expected from the implementation of structural reforms.

The simultaneous implementation of the two reforms will raise real GDP by 5.5% in the long-run compared to the no-reform baseline scenario. All components of aggregate demand increase, with consumption, investment and exports increasing by 4% to 5% in the long run. Real wages

rise as well, as the increase in demand for labour, associated with the reforms in the non-tradables sector, offsets the increase in the supply of labour associated with the labour market reform. Again, spillovers to the rest of the euro area are negligible.

Figure 3 describes the transition dynamics to the new equilibrium. In general, the dynamics are similar to the average of the two reforms implemented separately. The simultaneous implementation of both reforms can soften, to a large extent, the transition costs associated primarily with the decline in consumption and exports (in the non-tradable sector reform) and the real wage (in the labour market reform). This time, the decline in the real wage is less pronounced and temporary, and wages start to increase after around two years, even though the labour market reforms are still being implemented. The short to medium term drops in consumption and exports associated with the reform in the non-tradable sector are outweighed by the effects of the labour market reform, pushing up these variables on impact.

Overall, the main conclusion is that the joint implementation of services and labour market reforms, though potentially challenging for policy makers, could limit the transition costs associated with pursuing one reform in isolation, in particular, by softening the decline in the real wages following labour market reforms. This conclusion is somewhat related to the 'optimal' timing policy prescription put forward by Blanchard and Giavazzi (2003), who suggested that reforms in the services sector should precede those in the labour market since the increase in the real wage associated with the former will help to generate support for the labour market reform (which is associated with a decline in real wages).

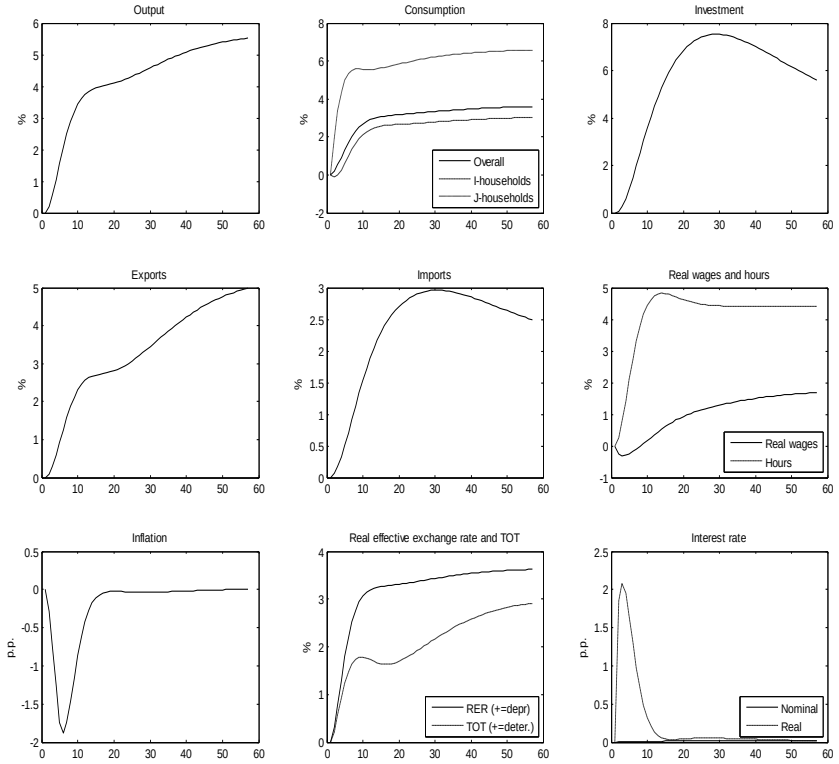

Figure 3. *Non-tradable and labour market reforms – Transitional dynamics*

5.4. Spillovers from euro area reforms

The previous section showed that Malta stands to benefit from domestic structural reforms but spillovers to the rest of the euro area are insignificant, given the small size of the Maltese economy. However, reforms implemented in the euro area are likely to have positive spillovers on the Maltese economy, given the size of the euro area and trade linkages between the two economies. The fourth column of Table 2 illustrates the results when both reforms are implemented simultaneously in Malta and in the euro area.

As expected, there are positive spillovers on GDP and all components of aggregate demand. A 10 p.p. reduction in product and labour market mark-ups in both regions of the monetary union raises Malta's GDP by 6% in the long run, 0.5 p.p. higher than if the reforms are implemented only in Malta. Spillovers are greater when labour market reforms are implemented, since the increase in production in the services reform is primarily concentrated in the non-tradable sector. Consumption and investment in Malta increase by more than 1 p.p., respectively, compared to the benchmark scenario. Hours worked remain broadly unchanged as Maltese households substitute domestic for imported goods, whose supply increases strongly. Exports benefits from a buoyant foreign demand but are weighed down by a less pronounced depreciation of the real effective exchange rate since the increase in aggregate supply also pushes down

prices in the euro area. In addition, imports are strongly boosted by the increase in the import-intensive domestic demand components.

5.5. Sensitivity analysis

Given the uncertainty surrounding the different parameter estimates, this section provides a sensitivity analysis to assess the robustness of the results to (i) changes in the level of mark-ups and (ii) changes in key parameters governing the transmission mechanism.

Table 2 presents a sensitivity analysis of the long-run estimates to varying mark-up levels. The baseline product market mark-up of 50% is at the upper bound of the range of values commonly found in the literature. In addition, the empirical estimates of Borg (2009) for the period 1995-2005 may overestimate the actual level of product market mark-ups in Malta for two reasons. First, the output of the different sectors is measured at base prices i.e. including subsidies, which may lead to higher mark-up values. Second, the estimates refer mainly to the pre-EU accession period and the dismantling of levies following Malta's EU membership in 2004 may have exerted downward pressure on mark-ups. Similarly, I also test the sensitivity of the results to different labour market mark-ups since no direct estimates are available for Malta.

The sensitivity of the baseline results is assessed both through variations in the level of the mark-up and to the size of the shocks. The first two columns of Table 3 present the results of a 10 p.p. reduction in product market mark-up, with the initial mark-ups standing at 40% ($\theta_Y = 3.5$) and 30% ($\theta_Y = 4.33$) respectively instead of 50% as in the baseline calibration. The last two columns present the result of a 5 p.p. reduction in labour mark-ups, again starting from lower levels (25% and 20% instead of 30%). The smaller size of the shock in the case of labour market reforms is intended to assess the effects of possible non-linearities on the results to shocks of different magnitudes.

Two findings are noteworthy. First, the results are broadly robust to varying levels of mark-ups, though lower levels of mark-ups lead to slightly higher increases in GDP.[8] This feature stems mainly from the fact that the same percentage point reduction in the mark-up represents a larger percentage decline in prices and wages as the level of the mark-up decreases. Second, despite the non-linear properties of the model, the impact on the main economic variables stemming from shocks of different magnitudes can broadly be approximated linearly. For instance, the 1.7% increase in GDP from a 5 p.p. reduction in labour market mark-up is approximately half the baseline estimate of 3.3% following a 10 p.p. reduction in wage mark-ups.

[8] Similar results were also reported in Bayoumi *et al.* (2004).

Table 2. *Sensitivity analysis to level varying mark-ups (percent deviations from baseline)*

	Product market 10 p.p. reduction		Labour market 5 p.p. reduction	
	40%	30%	25%	20%
Real activity				
GDP	2.3	2.5	1.7	1.8
Consumption	1.1	1.1	1.6	1.7
Investment	3.5	3.7	0.8	0.8
Exports	0.8	0.8	2.0	2.1
Imports	0.5	0.5	1.2	1.2
Labour Market				
Hours	1.0	1.1	1.7	1.8
Real wage	3.8	4.0	-0.8	-0.9
International relative prices				
REER	3.0	3.2	0.4	0.4
TOT	0.3	0.3	0.8	0.9

Table 3 presents a sensitivity analysis of the results to changes in key parameters. The table reports four different scenarios that are benchmarked against the baseline results as reported in Table 1 (when both reforms are implemented simultaneously). The second column in Table 3 reports the case of a higher inverse Frisch elasticity, which governs the sensitivity of hours worked to a change in the real wage (while keeping the marginal utility of consumption constant). In the sensitivity exercise, the inverse of the Frisch elasticity is increased from 2 to 3, thereby reducing the sensitivity of hours worked to changes in the real wage. This means that, given a 1% increase in real wages, hours worked will increase by 0.33% compared to 0.5% in the baseline scenario. The third column reports the results when the intertemporal elasticity of substitution is increased from 1 to 1.5. A higher (lower) intertemporal elasticity of substitution raises (lowers) the sensitivity of consumption to the real interest rate. Column 4 increases the elasticity of substitution between domestic tradables and imported goods from 1.5 to 2.5, moving it closer to the values typically found in microeconomic studies (ECB, 2012). Finally, the fifth column reports the result if the share of liquidity constrained households is increased from 25% to 40%, in line with the estimates of Castro (2006) and the calibration in Almeida *et al.*, (2009) for the Portuguese economy.

The main conclusion is that the results are robust to changes in the considered parameters. In particular, the gains in output continue to be sizeable, with the long-run impact on GDP ranging between 4.6% to 5.5% for a 10 p.p. reduction in the non-tradable and labour market mark-ups. Similar conclusions hold for the components of aggregate demand. In three out of the four cases considered, an important channel driving the result is a smaller increase in hours worked, which in turn affects consumption through lower disposable income in the long run. The only exception is the case of higher elasticity of substitution between domestic tradables and imports, the results of which are very similar to the baseline figures, with the exception of some slight changes in international relative prices.

Table 3. *Sensitivity analysis: Long-run effects of reducing mark-ups by 10 p.p. (percent deviations from baseline)*

	Baseline	Inverse Frisch elasticity	Intertemp. Elasticity of substitution	Elasticity of substitution btw tradables	Liquidity constrained households
		$\tau = 3$	$\sigma = 1.5$	$\mu_{TC}=\mu_{TI}=2.5$	J = 0.4
Real activity					
GDP	5.5	4.7	4.9	5.5	4.6
Consumption	4.2	3.5	3.7	4.2	3.4
Investment	4.8	4.4	4.5	4.8	4.4
Exports	4.7	3.8	4.0	4.7	3.7
Imports	2.7	2.2	2.3	2.7	2.1
Labour Market					
Hours	4.3	3.5	3.7	4.3	3.4
Real wage	1.9	2.2	2.1	1.9	2.3
International relative prices					
REER	3.6	3.4	3.4	3.5	3.4
TOT	1.9	1.5	1.6	1.8	1.5

6. Conclusion

This paper has quantitatively analysed the macroeconomic implications of structural reforms in product and labour markets by simulating a calibrated version of EAGLE for Malta. Better functioning of these markets is widely recognised as a precondition to boost the economy's growth potential, especially in the face of an ageing population.

The analysis shows that there are sizeable long-run positive effects associated with the implementation of structural reforms, which implies that these reforms have played an important role in boosting Malta's growth potential after the crisis. Furthermore, if these reforms stimulate productivity gains, for instance, by attracting foreign direct investment or shifting resources towards more productive enterprises, the long-run benefits could be even more pronounced than those reported in this paper. The country also stands to benefit from positive spillover effects if structural reforms are pursued by the rest of the monetary union, given the resultant economic expansion and Malta's trade linkages with the rest of the euro area.

The simulations point to qualitative differences in the impact on the main macroeconomic variables if the reforms are implemented in isolation or jointly. Both reforms are associated with short to medium term adjustment costs if implemented in isolation. This result suggests that coordination of the reforms is beneficial since it will soften, to a large extent, the adjustment costs associated with the implementation of the reforms in isolation, especially the decline in real wages.

It is encouraging that the sensitivity analysis showed that the findings are robust to varying levels of mark-ups and different parameterization of the model. In general, rather than focusing on point estimates, the results should be interpreted to suggest that there are non-trivial long-run positive

effects associated with the implementation of structural reforms. As the long-run effects seem to be more pronounced as more people are attracted to the labour market, this calls for the continuation of policies that reduce skills mismatches and labour shortages, and to make labour more inclusive so that more people are attracted in the labour force. The sharp increase in the labour supply in recent years – driven by the increase in the female participation rate and the inflow of foreign workers – may have played this important role.

Appendix

Appendix A: Steady State Values and Calibration of the Model

Table A1. *Steady-State National Accounts (Ratio to GDP, percent)*

	MT	EA	US	RW
Share in world GDP	0.2	22.8	28.0	49.0
Domestic Demand				
Private consumption	65	58	66	64
Public consumption	20	21	15	16
Private investment	19.5	21	19	20
Trade				
Imports (excl. intermediate imports)	50	24	11	15
Imports of consumption goods	36	20	7	9
Imports of investment goods	14	5	4	6
Trade balance	-2	0	0	0
Production				
Tradables	50	40	35	35
Non-tradables	50	60	65	65
Labour	54	54	57	57

Table A2. *Implied Trade Linkages*

Exports				
% of total	MT	EA	RW	US
MT	-	35	49	16
EA	0	-	87	12
RW	0	45	-	55
US	0	17	89	-
Imports				
% of total				
MT	-	51	41	8
EA	0	-	86	14
RW	0	50	-	50
US	0	6	94	-

Table A3. *Price and Wage Mark-ups (Implied Elasticities of Substitution)*

	Tradables (θ_T)	Non-Tradables (θ_N)	Wages (η_I=η_J)
MT	1.20 (6.0)	1.50 (3.0)	1.30 (4.3)
EA	1.20 (6.0)	1.50 (3.0)	1.30 (4.3)
US	1.20 (6.0)	1.28 (4.6)	1.16 (7.3)
RW	1.20 (6.0)	1.28 (4.6)	1.16 (7.3)

Table A4. *Final Goods*

	MT	EA	US	RW
Share of tradables in final consumption good (υ_C)	0.60	0.45	0.35	0.35
Share of tradables in final investment good (υ_I)	0.75	0.75	0.75	0.75
Quasi-share of domestic tradables in tradable consumption bundle (υ_{TC})	0.55	0.55	0.75	0.75
Quasi-share of domestic tradables in tradable investment bundle (υ_{TI})	0.55	0.55	0.70	0.65
Elasticity of substitution between tradable and non-tradable goods (μ_C and μ_I)	0.50	0.50	0.50	0.50
Elasticity of substitution between domestic goods and imports (consumption and investment goods) (μ_{IMC} and μ_{IMI})	1.50	2.50	2.50	2.50
Elasticity of substitution between imported goods (μ_{TC} and μ_{TI})	2.50	2.50	2.50	2.50

Table A5. *Intermediate Goods*

	MT	EA	US	RW
Capital share in non-tradable production (α_{NT})	0.35	0.30	0.30	0.30
Capital share in tradable production (α_T)	0.40	0.35	0.35	0.35
Fixed costs in tradable production (ψ_T)	0.20	0.20	0.20	0.20
Fixed costs in non-tradable production (ψ_{NT})	0.28	0.28	0.08	0.08
Calvo probability for goods sold domestically (ξ_H and ξ_N)	0.75	0.75	0.75	0.75
Calvo probability for exported goods (ξ_X)	0.75	0.75	0.75	0.75
Price indexation (χ_H, χ_N and χ_X)	0.50	0.50	0.50	0.50

Table A6. *Households*

	MT	EA	US	RW
Share of J-type households (ω)	0.25	0.25	0.25	0.25
Inverse of the intertemporal elasticity of substitution (σ^{-1})	1.00	1.00	1.00	1.00
Habit formation (κ)	0.60	0.60	0.60	0.60
Inverse elasticity of labour supply (ζ)	2.00	2.00	2.00	2.00
Calvo probability for wages (ξ_I and ξ_J)	0.75	0.75	0.75	0.75
Wage indexation (χ_I and χ_J)	0.75	0.75	0.75	0.75
Depreciation rate (δ)	0.025	0.025	0.025	0.025
Discount factor (β)	0.9926	0.9926	0.9926	0.9926

Table 7. *Fiscal authorities*

	MT	EA	US	RW
Target government debt-to-output ratio ($\overline{B_Y}$)	2.40	2.40	2.40	2.40
Sensitivity of lump-sum taxes to debt-to-output ratio ($\emptyset_{BY}$)	0.10	0.10	0.10	0.10
Consumption tax rate (τ^C)	0.18	0.183	0.077	0.077
Personal income tax rate (τ^N)	0.122	0.122	0.154	0.154
Social security contribution paid by firms (τ^{Wf})	0.079	0.219	0.071	0.071
Social security contribution paid by employees (τ^{Wh})	0.072	0.119	0.071	0.071

Table A8. *Monetary Policy*

	EA	US	RW
Inflation target ($\overline{\Pi^4}$)	1.02	1.02	1.02
Interest rate smoothing ($\emptyset_R$)	0.87	0.87	0.87
Interest rate sensitivity to inflation gap ($\emptyset_\pi$)	1.70	1.70	1.70
Interest rate sensitivity to output growth ($\emptyset_Y$)	0.10	0.10	0.10

Table A9. *Adjustment costs*

	MT	EA	US	RW
Capacity utilisation cost (γ_{u2})	2000	2000	2000	2000
Investment adjustment cost (γ_I)	6.0	6.0	4.0	4.0
Import adjustment cost for consumption good (γ_{IMC})	1.0	2.0	2.0	2.0
Import adjustment cost for investment good (γ_{IMI})	1.0	1.0	1.0	1.0
Transaction cost function (γ_{v1})	0.0267	0.0267	0.0267	0.0267
Transaction cost function (γ_{v2})	0.1284	0.1284	0.1284	0.1284
Intermediation cost function (γ_{B^*})	0.01	0.01	-	0.01

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