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DERIVE CONSUMPTION ALLOCATION AND PRICE LEVEL WITH CONSUMPTION TAX IN DSGE MODEL

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Abstract: *In this paper we are looking to derive Consumption Allocation and Price Level with Impose Consumption Tax in a small open-economy dynamic stochastic general equilibrium (DSGE) model. The domestic economy has access to foreign goods through import and domestic households undertake final consumption of domestic and foreign goods. There exists a continuum of households in the domestic economy. However, for the goal of deriving the optimality conditions, the focus stays on a single representative household. The derived optimality conditions hold analogously for the whole continuum.The household's consumption bundle is a combination of a domestic consumption bundle and foreign consumption bundle . Furthermore, the domestic and foreign consumption bundles are themselves combinations of domestic produced goods and foreign produced goods.*

The government imposes a tax on the consumption of domestic and foreign goods. We consider this taxation on houshold behavior. For this purpose, we describes households' behavior with regard to consumption spending and utility maximization. this decision problem consists of two parts. First, a repersentative household decides about allocation of expenditures between domestic and foreign goods. It maximizes the total consumption subject to its expenditure constaint. Second, household tries to minimize the costs of buying the composite consumption good. and finally it maximize their lifetime utility depending on consumption, money holdings and leisure.

Keywords: *Optimization, Consumption Tax, Price Level ,Small Open Economy, Dynamic Stochastic General Equilibrium*

1. INTRODUCTION

In most developed countries the level of taxes rose steadily over the course of the twentieth century: an increase from about 5%-10% of gross domestic product (GDP) at the turn of the century to 30% - 40% at the end is typical.

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Such significant increases raise serious questions about the effect taxation has upon economic.

DSGE models are powerful tools that provide a coherent framework for policy discussion and analysis. In principle, they can help to identify sources of fluctuations; answer questions about structural changes; forecast and predict the effect of policy changes,(such as tax policy) and perform counterfactual experiments. They also allow to establish a link between structural features of the economy and reduced form parameters, something that was not always possible with large-scale macroeconomic models.

household behavior played a crucial role in macroeconomic models. This paper provides an structure to calculation of the household s optimizing behavior. The household s optimizing behavior analysis focuses on the presence of consumption tax within a small open economy framework in the context of an dynamic stochastic general equilibrium.

Some countries, particularly developing countries, for reasons such as revenue or protect of domestic industries from foreign competition and also to create a steady demand in the home market for domestic goods imposed tariffs on foreign Foreign goods, including imported consumer goods.

To describe all Considerable relationship in an economy it is not possible to concentrate only on the behavior within the economy. A relationship with the foreign economies could be in some respects important. The participation gives some benefits. According to Bhagwati, Panagariya and Srinivasan (1998), there can be higher welfare especially due to a possibility of international trade in open economies.

The previous word can be supported with the situation of the Iran economy as a small open economy. The import or export ratio to GDP is relatively high (but comparable with similar countries). If we want to analyze behavior of the Iran economy it is necessary and inevitable to take the foreign sector into account.

In dynamic stochastic general equilibrium models, the first step to make a model is usually to make a closed economy model. These models use a condition of a closed economy with no connection to the rest of the world. They are able to describe some basic characteristic of the economy where is more detailed analysis of the behavior and the model indicates a suitable approximation. but considering it as open , allows to cover a connection to outside of the economy.

2. PREVIOUS RESEARCH

Households preferences display habit persistence in consumption, and the utility function is separable in terms of consumption, leisure and real money balances. Fiscal policy is usually restricted to a Ricardian setting, while monetary policy is conducted through an interest rate feedback rule, in which the interest rate is set in response to deviations from an inflation target and some measure of economic activity (eg output gap). Furthermore, some degree of interest rate smoothing is often assumed.

This basic model is enriched with a stochastic structure associated with different types of shocks such as supply side shocks (productivity and labour supply), demand side shocks (preference, investment specific, government spending), cost-push or mark-up shocks (price mark-up, wage mark-up, risk premium) and monetary shocks (interest rate or on other target variables). These shocks are often assumed to follow a first-order autoregressive process.

Over the last 20 years, Dynamic Stochastic General Equilibrium (DSGE) models became the cornerstone of policy analysis and forecast.

An advantage of DSGE models lies in their microeconomic fundations, their ability to model agents' behaviour, fact that doesn't make them subject to Lucas' critique. Another advantage lies in the fact that DSGE models are able to identify deep structural parameters and their link to reduced form estimated parameters.

Dynamic Stochastic General Equilibrium models have their origins in the Real Business Cycle (RBC) theory of Kydland and Prescott (1982). Their model substitutes aggregate behavioral equations describing macroeconomic relationships with first order condtions of firms and households. However, their model doesn't leave any role for money and monetary policy, and assumes that the source of all aggregate fluctuations is technology shocks.

Latter, New Keynesian Economists2 added some extensions to the classical RBC model: monopolistic competition that implies price stickyness (Calvo, 1983).

(without any monopolistical power, firms that aren't able to adjust their prices will lose their sales); following sticky price framework, Erceg et al. (2000) introduce wages stickiness; Christiano et al. (2005) introduce the concept of variable capacity utilization rate (variable capital utilization) and investment adjustment costs. However, all these models were developed for closed economies, and could not account for all the shocks that matter in an open economy (given the fact that, in practice, monetary policy is conducted in open economies). This lack has encouraged the work of New Open Economy Macroeconomist (NOEM), who extend closed economy DSGE models to incorporate open economy features, like Gali and Monacelli (2002).

Since developed countries apply lower import tariffs on foreign goods, including imported consumer goods, there is a lack of studies concerning the transmission effects of an import consumption tax in the economy with the dynamic stochastic general equilibrium (DSGE) modeling. Studies that examine the macroeconomic effects of fiscal policy on international trade mostly focus on government spending (e.g., Clarida and Findlay, 1992; Anwar, 1995 and 2001; Müller, 2008). Most research on the effects of tax policy on trade has been theoretical (e.g., Helpman, 1976; Baxter, 1992; Frenkel, Razin, and Sadka, 1991).

The literature has been growing rapidly, as more and more researchers are seeking a superior alternative to the Mundell-Fleming-Dornbusch model. There are at least two survey articles available (Lane 1999 and Sarno 2000), which give one a good idea of this new modeling approach for open economies. The main characteristic of the recent literature is that the models are dynamic general equilibrium models with well-specified microfoundations. Furthermore, sticky prices and imperfect competition play a crucial role in these models.

3. HOUSEHOLD S OPTIMIZING BEHAVIOR

The government imposes a tax on the consumption of domestic and foreign goods. We consider this taxation on houshold behavior. For this purpose, we describes households' behavior with regard to consumption spending and utility maximization. this decision problem consists of tree parts. First, a repersentative household decides about allocation of expenditures between domestic and foreign goods. It maximizes the total consumption subject to its expenditure constaint. Second, household tries to minimize the costs of buying the composite consumption good and finally it maximize their lifetime utility depending on consumption, money holdings and leisure

3.1 Household Optimal Allocation of Expenditures on domestic goods

A representative household decides about optimal allocation of expenditures between domestic and foreign goods. Because the economy is open, the household can consume not only domestic produced consumption goods $C_{d,t}$ but the imported foreign consumption goods $C_{m,t}$ as well. Following Monacelli (2003) household's consumption is a bundle of domestic and imported consumption goods and the total consumption every period $C_{T,t}$is is assumed to be given by a CES index of domestically produced and imported goods according to:

$$C_{T,t} \equiv \left[(1-\alpha_c)^{\frac{1}{\mu_c}}\left(C_{d,t}\right)^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}\left(C_{m,t}\right)^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}} \tag{1}$$

where and are consumption of the domestic and imported good, respectively. μ_c is the elasticity of substitution between domestic and imported consumption goods and α_c si the share of imported consumption goods in total consumption. Besides deciding how much to consume, households must divide their consumption expenditure between two types of goods. household maximizes the total consumption expressed by the equation (1), subject to its expenditure constraint:

$$P^c_{T,t}C_{T,t} = \left(1+\tau^c_{d,t}\right)P_{D,t}C_{d,t} + \left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}C_{m,t} \tag{2}$$

Where $P_{D,t}$ and $P^c_{m,t}$are domestic and foreign prices indices . $\tau^c_{d,t}$ is tax rate on domestic consumption goods and $\tau^c_{m,t}$ is tax rate on imported consumption goods.

The Lagrangian and its partial derivatives take the following forms (with a multiplier ϖ_t):

$$\mathcal{L}_t\left(C_{d,t}, C_{m,t}, \varpi_t\right) = \left[(1-\alpha_c)^{\frac{1}{\mu_c}}C_{d,t}{}^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}C_{m,t}{}^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}} + \tag{3}$$

$$\varpi_t\left(P^c_{T,t}C_{T,t} - \left(1+\tau^c_{d,t}\right)P_{D,t}C_{d,t} - \left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}C_{m,t}\right)$$

Taking the first order condition

$$FOC_{C_{d,t}} = \frac{\mu_c}{\mu_c-1}\left[(1-\alpha_c)^{\frac{1}{\mu_c}}C_{d,t}{}^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}C_{m,t}{}^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}-1}. \tag{4}$$

$$(1-\alpha_c)^{\frac{1}{\mu_c}}\,\frac{\mu_c-1}{\mu_c}\,C_{d,t}{}^{\frac{\mu_c-1}{\mu_c}-1} - \varpi_t\left(1+\tau^c_{d,t}\right)P_{D,t} = 0$$

$$FOC_{C_{m,t}} = \frac{\mu_c}{\mu_c-1}\left[(1-\alpha_c)^{\frac{1}{\mu_c}}C_{d,t}{}^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}C_{m,t}{}^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}-1}. \tag{5}$$

$$\alpha_c{}^{\frac{1}{\mu_c}}\,\frac{\mu_c-1}{\mu_c}\,C_{m,t}{}^{\frac{\mu_c-1}{\mu_c}-1} - \varpi_t\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t} = 0$$

$$FOC_{\varpi_t}\ P^c_{T,t}C_{T,t} - \left(1+\tau^c_{d,t}\right)P_{D,t}C_{d,t} - \left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}C_{m,t} = 0 \tag{6}$$

From equation (5) and (6) obtain ϖ_t:

$$\varpi_t = \frac{1}{\left(1+\tau^c_{d,t}\right)P_{D,t}}\frac{\mu_c}{\mu_c-1}\left[(1-\alpha_c)^{\frac{1}{\mu_c}}C_{d,t}{}^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}C_{m,t}{}^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{1}{\mu_c-1}} \tag{7}$$

$$(1-\alpha_c)^{\frac{1}{\mu_c}}\ \frac{\mu_c-1}{\mu_c}\ C_{d,t}{}^{-\frac{1}{\mu_c}}$$

$$\varpi_t = \frac{1}{\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}}\frac{\mu_c}{\mu_c-1}\left[(1-\alpha_c)^{\frac{1}{\mu_c}}C_{d,t}{}^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}C_{m,t}{}^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{1}{\mu_c-1}} \tag{8}$$

$$\alpha_c{}^{\frac{1}{\mu_c}}\ \frac{\mu_c-1}{\mu_c}\ C_{m,t}{}^{-\frac{1}{\mu_c}}$$

Then we equal both equation (7) and (8).which yields:

$$\alpha_c{}^{\frac{1}{\mu_c}}\ C_{mt}{}^{-\frac{1}{\mu_c}}\frac{1}{\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}} = (1-\alpha_c)^{\frac{1}{\mu_c}}C_{d,t}{}^{-\frac{1}{\mu_c}}\frac{1}{\left(1+\tau^c_{d,t}\right)P_{D,t}}$$

$$\frac{\left(1+\tau^c_{d,t}\right)P_{D,t}}{\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}} = \frac{\alpha_c{}^{-\frac{1}{\mu_c}}C_{d,t}{}^{-\frac{1}{\mu_c}}}{(1-\alpha_c)^{-\frac{1}{\mu_c}}C_{mt}{}^{-\frac{1}{\mu_c}}}$$

$$\left(\frac{P_{D,t}}{\left(1+\tau^c_{m,t}\right)P^c_{m,t}}\right)^{-\mu_c} = \frac{\alpha_c C_{d,t}}{(1-\alpha_c)C_{mt}} \tag{9}$$

Obtains $C_{m,t}$from equation (2):

$$C_{mt} = \frac{P^c_{T,t}C_{T,t} - \left(1+\tau^c_{d,t}\right)P_{D,t}C_{d,t}}{\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}} \tag{10}$$

Put $C_{m,t}$ value from equation (10) into equation (9):

$$\left(\frac{P_{D,t}}{\left(1+\tau^c_{m,t}\right)P^c_{m,t}}\right)^{-\mu_c} = \frac{\alpha_c C_{d,t}}{(1-\alpha_c)\frac{P^c_{T,t}C_{T,t}-\left(1+\tau^c_{d,t}\right)P_{D,t}C_{d,t}}{\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}}}$$

$$\left(\frac{P_{D,t}}{\left(1+\tau^c_{m,t}\right)P^c_{m,t}}\right)^{-\mu_c} = \frac{\alpha_c C_{d,t}\left(\left(1+\tau^c_{d,t}\right)\left(1+\tau^c_{m,t}\right)\right)P^c_{m,t}}{(1-\alpha_c)\left[P^c_{T,t}C_{T,t}-\left(1+\tau^c_{d,t}\right)P_{D,t}C_{d,t}\right]}$$

$$\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}(1-\alpha_c)\left[P_{T,t}^c C_{T,t}-(1+\tau_{d,t}^c)P_{D,t}C_{d,t}\right]=\alpha_c C_{d,t}$$

$$\left((1+\tau_{d,t}^c)(1+\tau_{m,t}^c)\right)P_{m,t}^c$$

$$\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}(1-\alpha_c)P_{T,t}^c C_{T,t}=\alpha_c C_{d,t}\left((1+\tau_{d,t}^c)(1+\tau_{m,t}^c)\right)P_{m,t}^c+\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}(1-\alpha_c)(1+\tau_{d,t}^c)P_{D,t}C_{d,t}$$

$$\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}(1-\alpha_c)P_{T,t}^c C_{T,t}=C_{d,t}\left[\alpha_c(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c+(1-\alpha_c)\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}(1+\tau_{d,t}^c)P_{D,t}\right]$$

$$C_{d,t}=\frac{(1-\alpha_c)P_{T,t}^c C_{T,t}\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}}{\alpha_c(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c+(1-\alpha_c)\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}(1+\tau_{d,t}^c)P_{D,t}} \tag{11}$$

Multiply the right side of equation (11) in the $\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}$

$$C_{d,t}=\frac{(1-\alpha_c)\frac{P_{T,t}^c C_{T,t}}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{-\mu_c}}{\alpha_c+(1-\alpha_c)\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{1-\mu_c}} \tag{12}$$

From overall consumer price index, we have:

$$\left(P_{T,t}^c\right)^{1-\mu_c}=(1-\alpha_c)\left((1+\tau_{d,t}^c)P_{D,t}\right)^{1-\mu_c}+\alpha_c\left((1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c\right)^{1-\mu_c} \tag{13}$$

We divided both sides of equation (13) on $\left((1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c\right)^{1-\mu_c}$

$$\left(\frac{P_{T,t}^c}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{1-\mu_c}=(1-\alpha_c)\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{1-\mu_c}+\alpha_c$$

$$(1-\alpha_c)\left(\frac{P_{D,t}}{(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{1-\mu_c}=\left(\frac{P_{T,t}^c}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{1-\mu_c}-\alpha_c$$

$$\left(\frac{P_{D,t}}{(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{1-\mu_c} = \frac{1}{(1-\alpha_c)}\left[\left(\frac{P^{c}_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{1-\mu_c} - \alpha_c\right] \tag{14}$$

Put $\left(\frac{P_{D,t}}{(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{1-\mu_c}$ value from equation (14) into equation (12) :

$$C_{d,t} = \frac{(1-\alpha_c)\frac{P^{c}_{T,t}C_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\left(\frac{P_{D,t}}{(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{-\mu_c}}{\alpha_c+(1-\alpha_c)\frac{1}{(1-\alpha_c)}\left[\left(\frac{P^{c}_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{1-\mu_c}-\alpha_c\right]}$$

$$C_{d,t} = \frac{(1-\alpha_c)\frac{P^{c}_{T,t}C_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\left(\frac{P_{D,t}}{(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{-\mu_c}}{\left(\frac{P^{c}_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{1-\mu_c}}$$

$$C_{d,t} = (1-\alpha_c)\frac{P^{c}_{T,t}C_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\left(\frac{P_{D,t}}{(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{-\mu_c} \cdot \left(\frac{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}{P^{c}_{T,t}}\right)^{1-\mu_c}$$

$$C_{d,t} = (1-\alpha_c)\frac{P^{c}_{T,t}C_{T,t}}{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}\left(\frac{P_{D,t}}{(1+\tau^{c}_{m,t})P^{c}_{m,t}}\right)^{-\mu_c}\left(\frac{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}{P^{c}_{T,t}}\right)^{-\mu_c}\frac{(1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})P^{c}_{m,t}}{P^{c}_{T,t}}$$

Which yields optimal allocation of expenditures on domestic goods:

$$C_{d,t} = (1-\alpha_c)\left(\frac{(1+\tau^{c}_{d,t})P_{D,t}}{P^{c}_{T,t}}\right)^{-\mu_c} C_{T,t} \tag{15}$$

3.2 Household Optimal Allocation of Expenditures on foreign goods

Obtains $C_{d,t}$ from equation (2):

$$C_{d,t} = \frac{P^{c}_{T,t}C_{T,t}-\left((1+\tau^{c}_{d,t})(1+\tau^{c}_{m,t})\right)P^{c}_{m,t}}{(1+\tau^{c}_{d,t})P_{D,t}} \tag{16}$$

Put $C_{d,t}$ value from equation (16) into equation (9):

$$\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{-\mu_c} = \frac{\alpha_c \frac{P^c_{T,t}C_{T,t}-\left((1+\tau^c_{d,t})(1+\tau^c_{m,t})\right)P^c_{m,t}}{(1+\tau^c_{d,t})P_{D,t}}}{(1-\alpha_c)C_{mt}}$$

$$\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{-\mu_c} = \frac{\alpha_c\left[P^c_{T,t}C_{T,t}-\left((1+\tau^c_{d,t})(1+\tau^c_{m,t})\right)P^c_{m,t}C_{m,t}\right]}{(1-\alpha_c)(1+\tau^c_{d,t})P_{D,t}C_{m,t}}$$

$$\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{-\mu_c}(1-\alpha_c)(1+\tau^c_{d,t})P_{D,t}C_{m,t}$$

$$= \alpha_c\left(P^c_{T,t}C_{T,t}-\left((1+\tau^c_{d,t})(1+\tau^c_{m,t})\right)P^c_{m,t}C_{m,t}\right)$$

$$\left[\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{-\mu_c}(1-\alpha_c)(1+\tau^c_{d,t})P_{D,t}+\alpha_c(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}\right]$$

$$C_{m,t} = \alpha_c P^c_{T,t}C_{T,t}$$

$$C_{m,t} = \frac{\alpha_c P^c_{T,t}C_{T,t}}{\left[\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{-\mu_c}(1-\alpha_c)(1+\tau^c_{d,t})P_{D,t}+\alpha_c(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}\right]} \tag{17}$$

We multiply the right side of equation (17) in the $\frac{(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}}{(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}}$

$$C_{m,t} = \frac{\alpha_c\frac{P^c_{T,t}C_{T,t}}{(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}}}{\alpha_c+(1-\alpha_c)\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{1-\mu_c}} \tag{18}$$

Put $\left(\frac{P_{D,t}}{(1+\tau^c_{m,t})P^c_{m,t}}\right)^{1-\mu_c}$ value from equation (14) into equation (18) :

$$C_{m,t} = \frac{\alpha_c\frac{P^c_{T,t}C_{T,t}}{(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}}}{\alpha_c+(1-\alpha_c)\frac{1}{(1-\alpha_c)}\left[\left(\frac{P^c_{T,t}}{(1+\tau^c_{d,t})(1+\tau^c_{m,t})P^c_{m,t}}\right)^{1-\mu_c}-\alpha_c\right]}$$

$$C_{m,t} = \frac{\alpha_c \frac{P_{T,t}^c C_{T,t}}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}}{\left(\frac{P_{T,t}^c}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}\right)^{1-\mu_c}}$$

$$C_{m,t} = \alpha_c \frac{P_{T,t}^c C_{T,t}}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c} \left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{1-\mu_c}$$

$$C_{m,t} = \alpha_c \frac{P_{T,t}^c C_{T,t}}{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c} \left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{-\mu_c} . \frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}$$

Which yields optimal allocation of expenditures on foreign goods:

$$C_{m,t} = \alpha_c \left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{-\mu_c} C_{T,t} \tag{19}$$

3.3 Demand Function for domestic consumtion good

We suppose a continuum of domestic products and aggregate domestic consumption are given by:

$$C_{d,t} \equiv \left[\int_0^1 C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}} di\right]^{\frac{\upsilon}{\upsilon-1}} \quad , \quad \upsilon > 0 \tag{20}$$

Where $C_{d,t}(i)$ are is domestic households consumption levels of home i^{th} good, with $i \in [0,1]$. It is also assumed that parameter, υ is the elasticity of intratemporal substitution among goods.

A representative household optimizes its behavior. It tries to minimize its expenditure for consumption of the domestic goods:

$$\int_0^1 (1 + \tau_{d,t}^c) P_{D,t}(i)\, C_{d,t}(i) di \tag{21}$$

Where $P_{D,t}(i)$ is prices of domestic good i.

Subject to its constraint that expressed in equation (20). The lagrangian function is in the following form and Δ_t is a lagrangian multiplier:

$$\Gamma_t\left(C_{d,t}(i), \Delta_t\right) = \int_0^1 (1 + \tau_{d,t}^c) P_{D,t}(i)\, C_{d,t}(i) di$$

$$-\Delta_t \left\{\left[\int_0^1 C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}} di\right]^{\frac{\upsilon}{\upsilon-1}} - C_{d,t}\right\} \tag{22}$$

Taking the first order condition

$$FOC_{C_{d,t}(i)} \tag{23}$$

$$= \left(1+\tau^{c}_{d,t}\right)P_{D,t}(i)$$

$$-\Delta_t \left\{\frac{v}{v-1}\left[\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right]^{\frac{v}{v-1}-1} . \frac{v-1}{v} C_{d,t}(i)^{\frac{v-1}{v}-1} = 0\right\}$$

$$FOC_{C_{d,t}(i)} = \left(1+\tau^{c}_{d,t}\right)P_{D,t}(i) - \Delta_t \left(\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{d,t}(i)^{-\frac{1}{v}} = 0$$

$$\left(1+\tau^{c}_{d,t}\right)P_{D,t}(i) = \Delta_t \left(\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{d,t}(i)^{-\frac{1}{v}} \tag{24}$$

Multiply the both side of equation (24) in $C_{d,t}(i)$

$$\left(1+\tau^{c}_{d,t}\right)P_{D,t}(i)C_{d,t}(i) = \Delta_t \left(\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{d,t}(i)^{-\frac{1}{v}} C_{d,t}(i)$$

$$\left(1+\tau^{c}_{d,t}\right)P_{D,t}(i)C_{d,t}(i) = \Delta_t \left(\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{d,t}(i)^{\frac{v-1}{v}} \tag{25}$$

$$\int_0^1 \left(1+\tau^{c}_{d,t}\right)P_{D,t}(i)C_{d,t}(i)di = \int_0^1 \Delta_t \left(\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{d,t}(i)^{\frac{v-1}{v}} di$$

first order condition for lagrangian multiplier:

$$FOC_{\Delta_t} = C_{d,t} - \left[\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right]^{\frac{v}{v-1}} = 0 \tag{26}$$

From equation (26) we can derive :

$$C_{d,t}{}^{\frac{1}{v}} = \left(\int_0^1 C_{d,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} \tag{27}$$

Put $C_{d,t}{}^{\frac{1}{v}}$ value from equation (27) into equation (20):

$$\left(1+\tau^{c}_{d,t}\right)\int_0^1 P_{D,t}(i)C_{d,t}(i)di = \int_0^1 \Delta_t C_{d,t}{}^{\frac{1}{v}} C_{d,t}(i)^{\frac{v-1}{v}} di$$

$$\left(1+\tau_{d,t}^{c}\right)P_{D,t}C_{d,t} = \Delta_t C_{d,t}^{\frac{1}{\upsilon}} \int_0^1 C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}} di$$

$$\left(1+\tau_{d,t}^{c}\right)P_{D,t}C_{d,t} = \Delta_t C_{d,t}^{\frac{1}{\upsilon}} C_{d,t}^{\frac{\upsilon-1}{\upsilon}}$$

$$\left(1+\tau_{d,t}^{c}\right)P_{D,t}C_{d,t} = \Delta_t C_{d,t}$$

$$\left(1+\tau_{d,t}^{c}\right)P_{D,t} = \Delta_t \tag{28}$$

From equation (28) and equation (25) we have:

$$\left(1+\tau_{d,t}^{c}\right)P_{D,t}(i)C_{d,t}(i) = \left(1+\tau_{d,t}^{c}\right)P_{D,t}\left(\int_0^1 C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}} di\right)^{\frac{1}{\upsilon-1}} C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}}$$

$$P_{D,t}(i)C_{d,t}(i) = P_{D,t}\left(\int_0^1 C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}} di\right)^{\frac{1}{\upsilon-1}} C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}}$$

$$P_{D,t}(i)C_{d,t}(i) = P_{D,t}C_{d,t}^{\frac{1}{\upsilon}} C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}}$$

$$P_{D,t}(i)C_{d,t}^{-\frac{1}{\upsilon}} = P_{D,t}C_{d,t}(i)^{-1} C_{d,t}(i)^{\frac{\upsilon-1}{\upsilon}} \rightarrow P_{D,t}(i)C_{d,t}^{-\frac{1}{\upsilon}} = P_{D,t}C_{d,t}(i)^{-\frac{1}{\upsilon}}$$

After simplification

$$C_{d,t}(i) = \left(\frac{P_{D,t}(i)}{P_{D,t}}\right)^{-\upsilon} C_{d,t} \tag{29}$$

The equation is the representative household s demand function for domestic produced consumption goods.

3.4 Demand Function for foreign consumtion good

we suppose a continuum of foreign products and aggregate foreign consumption are given by:

$$C_{m,t} \equiv \left[\int_0^1 C_{dm,t}(i)^{\frac{\upsilon-1}{\upsilon}} di\right]^{\frac{\upsilon}{\upsilon-1}} \quad , \quad \upsilon > 0 \tag{30}$$

Where $C_{m,t}(i)$ are is foreign households consumption levels of foreign i^{th} good, with $i \in [0,1]$. It is also assumed that parameter, υ is the elasticity of intratemporal substitution among goods.

A representative household optimizes its behavior. It tries to minimize its expenditure for consumption of the foreign goods:

$$\int_0^1 (1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c(i)\,C_{m,t}(i)di \tag{31}$$

Where $P_{m,t}^c(i)$ is prices of imported good i.

Subject to its constraint that expressed in equation (31). The lagrangian function is in the following form and Δ_t is a lagrangian multiplier:

$$\Xi_t(C_{m,t}(i),\Omega_t) = \int_0^1 (1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c(i)\,C_{m,t}(i)di - \tag{32}$$

$$\Omega_t\left\{\left[\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}\,di\right]^{\frac{\upsilon}{\upsilon-1}} - C_{m,t}\right\}$$

Taking the first order condition

$$FOC_{C_{m,t}(i)} = (1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c(i) \tag{33}$$

$$-\Omega_t\left\{\frac{\upsilon}{\upsilon-1}\left[\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}\,di\right]^{\frac{\upsilon}{\upsilon-1}-1}.\frac{\upsilon-1}{\upsilon}C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}-1} = 0\right\}$$

$$FOC_{C_{m,t}(i)} = (1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c(i)$$

$$-\Omega_t\left(\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}\,di\right)^{\frac{1}{\upsilon-1}} C_{m,t}(i)^{-\frac{1}{\upsilon}} = 0$$

$$(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c(i) = \Omega_t\left(\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}\,di\right)^{\frac{1}{\upsilon-1}} C_{m,t}(i)^{-\frac{1}{\upsilon}} \tag{34}$$

Multiply the both side of equation (34))in $C_{m,t}(i)$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}(i)C_{m,t}(i)$$
$$=\Omega_t\left(\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di\right)^{\frac{1}{\upsilon-1}}C_{m,t}(i)^{-\frac{1}{\upsilon}}C_{m,t}(i)$$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}(i)C_{m,t}(i)=\Omega_t\left(\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di\right)^{\frac{1}{\upsilon-1}}C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}} \tag{35}$$

$$\int_0^1\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}(i)C_{m,t}(i)di \tag{36}$$
$$=\int_0^1\Omega_t\left(\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di\right)^{\frac{1}{\upsilon-1}}C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di$$

first order condition for lagrangian multiplier (Ω_t) :

$$FOC_{\Omega_t}=C_{m,t}-\left[\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di\right]^{\frac{\upsilon}{\upsilon-1}}=0 \tag{37}$$

From equation (26) we can derive :

$$C_{m,t}{}^{\frac{1}{\upsilon}}=\left(\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di\right)^{\frac{1}{\upsilon-1}} \tag{38}$$

Put $C_{m,t}{}^{\frac{1}{\upsilon}}$ value from equation (38) into equation (36):

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)\int_0^1 P_{m,t}^{c}(i)C_{m,t}(i)di=\int_0^1\Omega_t C_{m,t}{}^{\frac{1}{\upsilon}}C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di$$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}C_{m,t}=\Omega_t C_{m,t}{}^{\frac{1}{\upsilon}}\int_0^1 C_{m,t}(i)^{\frac{\upsilon-1}{\upsilon}}di$$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}C_{m,t}=\Omega_t C_{m,t}{}^{\frac{1}{\upsilon}}C_{m,t}{}^{\frac{\upsilon-1}{\upsilon}}$$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}C_{m,t}=\Omega_t C_{m,t}$$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}=\Omega_{t} \tag{39}$$

From equation (39) and equation (35) we have:

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}(i)C_{m,t}(i) =$$

$$\left(1+\tau_{d,t}^{c}\right)\left(1+\tau_{m,t}^{c}\right)P_{m,t}^{c}\left(\int_0^1 C_{m,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{m,t}(i)^{\frac{v-1}{v}}$$

$$P_{m,t}^{c}(i)C_{m,t}(i) = P_{m,t}^{c}\left(\int_0^1 C_{m,t}(i)^{\frac{v-1}{v}}\,di\right)^{\frac{1}{v-1}} C_{m,t}(i)^{\frac{v-1}{v}}$$

$$P_{m,t}^{c}(i)C_{m,t}(i) = P_{m,t}^{c}{C_{m,t}}^{\frac{1}{v}}C_{m,t}(i)^{\frac{v-1}{v}}$$

$$P_{m,t}^{c}(i){C_{m,t}}^{-\frac{1}{v}} = P_{m,t}^{c}C_{m,t}(i)^{-1}C_{m,t}(i)^{\frac{v-1}{v}} \rightarrow P_{m,t}^{c}(i){C_{m,t}}^{-\frac{1}{v}} = P_{m,t}^{c}C_{m,t}(i)^{-\frac{1}{v}}$$

After simplification

$$C_{m,t}(i)=\left(\frac{P_{m,t}^{c}(i)}{P_{m,t}^{c}}\right)^{-v} C_{d,t} \tag{40}$$

The equation is the representative household s demand function for foreign produced consumption goods.

3.5 Price Index of Home Produced Goods

From equation (20) and equation (29) we have:

$$C_{d,t} = \left[\int_0^1 \left(\left(\frac{P_{D,t}(i)}{P_{D,t}}\right)^{-v} C_{d,t}\right)^{\frac{v-1}{v}} di\right]^{\frac{v}{v-1}}$$

$$C_{d,t} = C_{d,t}\cdot\frac{1}{{P_{D,t}}^{-v}}\left[\int_0^1 \left(P_{D,t}(i)\right)^{1-v} di\right]^{\frac{v}{v-1}}$$

$${P_{D,t}}^{-v} = \left[\int_0^1 \left(P_{D,t}(i)\right)^{1-v} di\right]^{\frac{v}{v-1}} \rightarrow P_{D,t} = \left[\int_0^1 \left(P_{D,t}(i)\right)^{1-v} di\right]^{1-v} \tag{41}$$

Equation (41) shows price index of home produced goods. from equation (29) and equation (21) we have:

$$\int_0^1 (1+\tau_{d,t}^c) P_{D,t}(i) \left(\frac{P_{D,t}(i)}{P_{D,t}}\right)^{-\upsilon} C_{d,t} di = (1+\tau_{d,t}^c).\frac{C_{d,t}}{{P_{D,t}}^{-\upsilon}} \int_0^1 \left(P_{D,t}(i)\right)^{1-\upsilon} di \tag{42}$$

From equation (41) obtain:

$${P_{D,t}}^{1-\upsilon} = \int_0^1 P_{D,t}(i)^{1-\upsilon} di \tag{43}$$

Use this relation into equation (42):

$$\int_0^1 (1+\tau_{d,t}^c) P_{D,t}(i)\, C_{d,t}(i) di = (1+\tau_{d,t}^c).\frac{C_{d,t}}{{P_{D,t}}^{-\upsilon}} {P_{D,t}}^{1-\upsilon} = (1+\tau_{d,t}^c).C_{d,t} P_{D,t}$$

The last equation shows household expenditure on a continuous set of domestic goods.

3.6 Price Index of Foreign Produced Goods

From equation (30) and equation (40) we have:

$$C_{m,t} = \left[\int_0^1 \left(\left(\frac{P_{m,t}^c(i)}{P_{m,t}^c}\right)^{-\upsilon} C_{m,t}\right)^{\frac{\upsilon-1}{\upsilon}} di\right]^{\frac{\upsilon}{\upsilon-1}}$$

$$C_{m,t} = C_{md,t}.\frac{1}{{P_{m,t}^c}^{-\upsilon}} \left[\int_0^1 \left(P_{m,t}^c(i)\right)^{1-\upsilon} di\right]^{\frac{\upsilon}{\upsilon-1}}$$

$${P_{m,t}^c}^{-\upsilon} = \left[\int_0^1 \left(P_{m,t}^c(i)\right)^{1-\upsilon} di\right]^{\frac{\upsilon}{\upsilon-1}} \rightarrow P_{m,t}^c = \left[\int_0^1 \left(P_{m,t}^c(i)\right)^{1-\upsilon} di\right]^{1-\upsilon} \tag{44}$$

Equation (44) shows price index of foreign produced goods. from equation (40) and equation (31) we have:

$$\int_0^1 (1+\tau_{d,t}^c)(1+\tau_{m,t}^c) P_{m,t}^c(i) \left(\frac{P_{m,t}^c(i)}{P_{m,t}^c}\right)^{-\upsilon} C_{m,t}\, di = (1+\tau_{d,t}^c)$$
$$(1+\tau_{m,t}^c) \frac{C_{m,t}}{{P_{m,t}^c}^{-\upsilon}} \int_0^1 \left(P_{m,t}^c(i)^{1-\upsilon}\right) di \tag{45}$$

From equation (44) obtain:

$$\left(P_{m,t}^c\right)^{1-\upsilon} = \int_0^1 \left(P_{m,t}^c(i)\right)^{1-\upsilon} di \tag{46}$$

Use this relation into equation (45):

$$\int_0^1 (1+\tau_{d,t}^c) P_{D,t}(i)\, C_{d,t}(i) di = (1+\tau_{d,t}^c)(1+\tau_{m,t}^c) \frac{C_{m,t}}{{P_{m,t}^c}^{-\upsilon}} {P_{m,t}^c}^{1-\upsilon}$$

$$= (1+\tau_{d,t}^c)(1+\tau_{m,t}^c). C_{m,t} P_{m,t}^c$$

The last equation shows household expenditure on a continuous set of foreign goods.

3.7 Consumer Price Index

We have known that the representative household has following optimal allocation functions:

$$C_{d,t} = (1-\alpha_c)\left(\frac{(1+\tau_{d,t}^c)P_{D,t}}{P_{T,t}^c}\right)^{-\mu_c} C_{T,t}$$

$$C_{m,t} = \alpha_c \left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{-\mu_c} C_{T,t}$$

And the total consumption of the household consists of the domestic and foreign produced goods described according to this relationship:

$$C_{T,t} \equiv \left[(1-\alpha_c)^{\frac{1}{\mu_c}}\left(C_{d,t}\right)^{\frac{\mu_c-1}{\mu_c}} + (\alpha_c)^{\frac{1}{\mu_c}}\left(C_{m,t}\right)^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}}$$

We combine these 3 equation together to yield the overall Consumer Price Index:

$$C_{T,t} = \left[(1-\alpha_c)^{\frac{1}{\mu_c}}\left((1-\alpha_c)\left(\frac{(1+\tau_{d,t}^c)P_{D,t}}{P_{T,t}^c}\right)^{-\mu_c} C_{T,t}\right)^{\frac{\mu_c-1}{\mu_c}} + \right.$$

$$\left.(\alpha_c)^{\frac{1}{\mu_c}}\left(\alpha_c\left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{-\mu_c} C_{T,t}\right)^{\frac{\mu_c-1}{\mu_c}}\right]^{\frac{\mu_c}{\mu_c-1}}$$

$$C_{T,t} = (1-\alpha_c)^{\frac{1}{\mu_c}}(1-\alpha_c)^{\frac{\mu_c-1}{\mu_c}}\left(\frac{(1+\tau_{d,t}^c)P_{D,t}}{P_{T,t}^c}\right)^{-\mu_c.\frac{\mu_c-1}{\mu_c}} {C_{T,t}}^{\frac{\mu_c-1}{\mu_c}} +$$

$${\alpha_c}^{\frac{1}{\mu_c}}{\alpha_c}^{\frac{\mu_c-1}{\mu_c}}\left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{-\mu_c.\frac{\mu_c-1}{\mu_c}} {C_{T,t}}^{\frac{\mu_c-1}{\mu_c}}$$

$$C_{T,t}{}^{\frac{\mu_c-1}{\mu_c}} = (1-\alpha_c)\left(\frac{(1+\tau_{d,t}^c)P_{D,t}}{P_{T,t}^c}\right)^{1-\mu_c} C_{T,t}{}^{\frac{\mu_c-1}{\mu_c}} + \alpha_c\left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{1-\mu_c} C_{T,t}{}^{\frac{\mu_c-1}{\mu_c}}$$

$$1 \equiv (1-\alpha_c)\left(\frac{(1+\tau_{d,t}^c)P_{D,t}}{P_{T,t}^c}\right)^{1-\mu_c} + \alpha_c\left(\frac{(1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c}{P_{T,t}^c}\right)^{1-\mu_c}$$

$$\left(P_{T,t}^c\right)^{1-\mu_c} \equiv (1-\alpha_c)\left((1+\tau_{d,t}^c)P_{D,t}\right)^{1-\mu_c} + \alpha_c\left((1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c\right)^{1-\mu_c}$$

$$P_{T,t}^c \equiv \left[(1-\alpha_c)\left((1+\tau_{d,t}^c)P_{D,t}\right)^{1-\mu_c} + \alpha_c\left((1+\tau_{d,t}^c)(1+\tau_{m,t}^c)P_{m,t}^c\right)^{1-\mu_c}\right]^{\frac{1}{1-\mu_c}}$$

The last equation shows overall Consumer Price Index (CPI).

4 CONCLUSION

In most developed countries the level of taxes rose steadily over the course of the twentieth century: an increase from about 5%-10% of gross domestic product (GDP) at the turn of the century to 30% - 40% at the end is typical. Such significant increases raise serious questions about the effect taxation has upon economic. DSGE models are powerful tools for policy analysis.

household behavior played a crucial role in macroeconomic models. This paper provides an structure to calculation of the household s optimizing behavior. The household s optimizing behavior analysis focuses on the presence of consumption tax. We consider this taxation on houshold behavior. For this purpose, we describes households' behavior with regard to consumption spending and utility maximization. this decision problem consists of two parts. First, a repersentative household decides about allocation of expenditures between domestic and foreign goods. It maximizes the total consumption subject to its expenditure constaint. Second, household tries to minimize the costs of buying the composite consumption good.

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